## ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Baku – Tbilisi – Ceyhan Oil Pipeline Azerbaijan

**Prepared for BP** 

By AETC Ltd / ERM

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# **GENERAL NOTES**

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Where field investigations have been carried out these have been restricted to a le detail required to achieve the stated objectives of the work.	evelof
This work has been undertaken in accordance with the Quality Management Syste AETC.	∍m of

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#### EXECUTIVE SUMMARY 1

#### 1.1 INTRODUCTION

There are significant oil and gas reserves in the Azerbaijan sector of the Caspian Sea. However, the land-locked geography of the Caspian region currently limits the ability of Azerbaijan to fully exploit these reserves, due to difficulties with transportation to international markets. The Baku-Tbilisi-Ceyhan (BTC) project has been designed to help resolve some of these transportation issues by building a dedicated pipeline system to deliver up to one million barrels per day of crude oil from Sangachal terminal near Baku in Azerbaijan, through Georgia, to a new marine terminal at Ceyhan in Turkey, on the Mediterranean coast. Tankers will then ship the oil to international markets. The 1,760km pipeline, of which 442km are in Azerbaijan, is currently scheduled to be operational by late 2004.

The owners of the BTC pipeline comprise a set of oil companies who, from mid 2002, will be known as BTC Co. BP is the largest stakeholder in the project and is leading the design and construction phase of the project. Other companies that will form BTC Co. currently include the State Oil Company of the Azerbaijan Republic (SOCAR), Unocal, Statoil, TPAO, Itochu, Delta Hess and ENI. Negotiations are currently under way with other companies about possible involvement in BTC Co. BTC Co will be responsible for construction and operation of the proposed pipeline in both Azerbaijan and Georgia, with construction in Turkey falling under the control of the State Company BOTAS.

This document summarises the Environmental and Social Impact Assessment (ESIA) of the BTC pipeline project in Azerbaijan. The analysis covers impacts for the lifetime of the project, i.e. construction, operation and decommissioning.

The ESIA has been conducted to meet international standards and guidelines (including those of the World Bank Group), Azerbaijani legislation, and BP corporate policies. It also fulfils the requirement in the Host Government Agreement, for the development of an EIA. Figure 1-1 illustrates the ESIA process followed for BTC.

#### 1.2 CONSULTATION AND PARTICIPATION

As can be seen from the flow diagram below, consultation and participation have been central elements during each phase of the ESIA process. This has involved the following groups during both baseline data collection and the development of mitigation measures:

- Communities along the route
- Government departments ٠
- Academics
- International and national non-governmental organizations (NGOs)

Representatives of all communities within 2km of the pipeline route and additional facilities have been consulted. A Public Consultation and Disclosure Plan has been developed that

includes further information on the past and future consultation activities, and stakeholders consulted.

This draft of the ESIA document has been prepared specifically for public disclosure and comment. The report will be widely disseminated and will be available for comment for a period of 60 days. Following the 60-day disclosure period all comments received will be incorporated as appropriate into the ESIA, prior to formal submission to the Government.

Figure 1-1 The BTC ESIA process



### **1.3 PROJECT ALTERNATIVES**

The decision to progress development of BTC was reached following an assessment of alternative oil export options, which included an exhaustive routing assessment.

One major environmental benefit of the BTC pipeline is that it will make it possible to export significant additional volumes of Caspian oil, without increasing volumes shipped through the Bosphorus Straits.

When refining the pipeline route within Azerbaijan, first to a 10km wide corridor, and subsequently by a staged approach to a 44m wide construction corridor, a number of issues had to be considered, including:

- Environmental risk
- Designated areas
- Social impacts and proximity to settlements
- Constructability and engineering constraints
- Security
- Proximity to other projects such as the existing Western Route Export Pipeline (WREP)
- Use of existing infrastructure corridors

As a result, a shared route for BTC and a new gas pipeline (the Southern Caucasus Pipeline or SCP) has been selected, which runs parallel to the WREP for most of its route through Azerbaijan. Where significant deviations from the WREP route occur these have often been incorporated to reduce the environmental impact of the project. This is reflected in route changes in the Gobustan Desert region, and in re-routes to avoid the Korchay and Shamkir State Forbidden Areas.

As part of the process of assessing alternatives to the project, the option of "no-development" was considered. However, the potential positive socio-economic benefits of the pipeline (including government revenue and local employment opportunities) and associated environmental risks of not developing the project (including development of other pipelines that may require onward transport of Caspian crude through the Bosphorus) were considered to outweigh the potential negative environmental and social impacts that will result from the construction and operation of the BTC pipeline.

## **1.4 PROJECT DESCRIPTION**

The complete BTC pipeline, which will be buried for its entire length, will total 1750 km in length, divided as follows:

- Azerbaijan = 442km
- Georgia = 248km
- Turkey = 1060km

Within Azerbaijan, the BTC pipeline system will also include:

- One intermediate pigging station (IPS) to be further developed to include a pump station
- Two additional IPSs
- Valve stations
- A cathodic protection (CP) system
- A fibre optic communications system
- A computer-based control system

The pipeline route is illustrated in Figure 1-2.



### Schedule

Key milestones for the BTC project in Azerbaijan are shown in the table below.

MILESTONE	APPROXIMATE TIMING
Award of construction contract	3Q 2002
Start upgrade of pipe storage yards	3Q 2002
Start of pipelay	1Q 2003
Finish of pipelay	2Q 2004
Oil fill	4Q 2004

### 1.4.1 Construction

An experienced international contractor, under close supervision of the BTC Co. management team, will carry out construction of the pipeline.

The contractor will use one or more conventional construction spreads for normal pipeline installation, and one or more special section crews for river crossings and other specialised pipe segment installations.

Initially the pipeline construction corridor will be marked, prior to clearing and levelling. Generally topsoil is stripped and stored to one side of the corridor, and separately from subsoil.

The pipeline trench will be excavated to approximately 2.2m, allowing the pipeline to be buried with a minimum depth of cover of 1m. Deeper burial may be required at river, road, rail and other crossings.

Pipe sections will be transported to the construction corridor by truck and laid end-to-end alongside the open trench. The pre-coated pipe sections are then welded together and a further protective coating applied to the welded joints. The coating is tested to ensure it will provide adequate corrosion protection before the pipe is lowered into the trench.

The trench is then filled with the material taken from the trench, in the reverse order to which it was excavated. The cover material is compacted to reduce the risk of future settlement and erosion.

The construction corridor and all other project areas will be reinstated, either fully or using interim measures if required for imminent gas pipeline construction. Reinstatement will include erosion control measures and re-vegetation.

The integrity of the pipeline is tested by filling discrete sections with water and increasing the pressure.

The construction of the pipeline will also require a number of temporary facilities, including construction camps for workers and pipe storage yards.

### **1.4.2 Operation and maintenance**

The pipeline system has been designed to require minimal operational and maintenance intervention. Safety of employees, customers and the general public, and environmental performance will remain priorities during this phase. A system of regular inspection and maintenance will be developed and implemented for the pipeline and associated facilities.

Training programmes will be developed for all operations staff.

### 1.4.3 Decommissioning

As part of decommissioning all hydrocarbon products will be removed from the line. Once cleaned, it is generally preferable to leave the abandoned line in place as this avoids the environmental disturbance associated with removal. It may be necessary to maintain the cathodic protection system to prevent corrosion of the pipeline, which could lead to subsidence.

The option of using the pipeline for the local/national distribution of low-pressure gas, the transportation of water or as a conduit for services such as telecommunications cables, may also be considered.

## 1.5 BASELINE DESCRIPTION

### **1.5.1** Environmental baseline and identification of issues

The environmental characterisation of the pipeline route has included analysis of the following issues:

- Ecology (flora, fauna and biodiversity)
- Water resources (surface and groundwater)
- Geology and geomorphology
- Landscape and land use
- Climate and meteorology
- Archaeology and cultural heritage

- Traffic and transportation infrastructure
- Air quality
- Noise
- Contamination
- Soil erosion

The sections below summarise the key findings for each of the above issues.

#### Ecology

The proposed route is characterised by very diverse ecological conditions and by abundant biodiversity. The key issues relating to habitats, flora and fauna along the pipeline route are:

- Artemisia and Salsola deserts of the proposed Gobustan National Park
- Potential presence of the red data book listed plant *Iris acutiloba* in desert habitats
- Potential presence of the red data book listed plant *Merendera trigyna* in desert habitats
- Presence of the IUCN classified Mediterranean tortoise, *Testudo graeca*, in many locations
- Presence of several ground nesting birds of conservation importance at various locations

### Water Resources

The proposed route crosses 21 major rivers and a number of important canals.

Key issues relating to hydrology along the route of the pipeline are:

- The two crossings of the Kura River, the major river in Azerbaijan
- The highly seasonal flow regime of many of the rivers crossed
- The high sediment load of many rivers crossed
- Poor channel stability of rivers such as the Djeyrankechmes, Shamkirchay and Kura East
- Ecological value of certain rivers, particularly the Kura, Korchay and Hasansu

#### Geology and Geomorphology

The pipeline route in Azerbaijan is located in a depression (the Kura River Valley) within the southern extension of the Great Caucasus mountain range. The regional structure is dominated by compressed sedimentary rock.

The route is also close to areas of land instability and the region generally exhibits high seismic activity. These geohazards have been fully considered in the route selection process and therefore only minor instances actually affect the current route.

Key issues in terms of geology and geohazards along the pipeline route are as follows:

- The majority of the pipeline route is underlain with relatively soft sediments that ٠ can be easily excavated
- Azerbaijan is situated in the seismically active Caucasus region and experiences frequent earthquakes. However the pipeline route itself is situated mainly within the less seismically active Kura River plain
- The pipeline route crosses four seismically active fault zones
- The pipeline route crosses an area in the vicinity of active mud volcanoes

World-renowned specialists have advised on how the risks from these geohazards should be mitigated in the pipeline design.

#### Landscape and land use

Landscape and land use along the BTC pipeline route are mainly determined by the combination of relief, climate, geology, topography soils and hydrology.

A number of distinct regions can be identified along the route, including the arid, desert regions at the east of the route, and the fertile agricultural lands of the Kura Plain.

The value of the landscape varies according to the degree of human impact, which has resulted in degraded landscapes in many regions. Activities impacting upon visual amenity include civil and industrial construction, military activities, power infrastructure, mining, waste disposal, and deforestation.

#### Climate and meteorology

Numerous climatic types are found in Azerbaijan, depending on altitude and distance from the Caspian. Dry subtropical climate is typical in the Kura river valley where the majority of the BTC pipeline route is located. The highest air temperatures occur at the eastern end of the pipeline and along the Caspian coastline. In this region average July temperatures are more than 25°C, whilst during the winter temperatures rarely fall below freezing. The average annual temperature is 15°C. Average rainfall is 200-400mm per year but can be as little as 150-200mm in semi-desert areas such as Gobustan.

The weather is cooler and wetter in the west, towards the border with Georgia.

### Archaeology and cultural heritage

Azerbaijan is rich in evidence of previous occupation. Most stages of human development have been encountered at archaeological sites in the country. The proposed BTC pipeline route crosses several areas of archaeological interest and areas where potential additional finds could occur during excavation works.

Field studies have identified areas of particular interest and a series of pre-construction archaeological surveys will be conducted to further define the archaeology of these areas.

The pipeline route also crosses the north-eastern edge of the Gobustan Cultural Reserve, for a total distance of 900m. However, the pipeline will have no impact upon any of the rock art that the Reserve is designated to protect.

#### Traffic and transportation infrastructure

The road network in Azerbaijan has suffered from a lack of investment, with many roads in a poor condition. Many roads also have poor signage, limited lighting, a lack of markings, crash barriers and other safety infrastructure. The key issue associated with the BTC project will be the increase in traffic and therefore in traffic safety risks in some areas.

#### Air quality

Information on air quality along the route was generated by desk based assessment of historical data from various locations. This data was supplemented by on-site monitoring of air quality, and subsequent modelling of emissions, at the proposed pump station location.

The results of this assessment show that baseline air quality in these areas is good, and is likely to be typical of the rural and urban areas encountered on the pipeline route.

#### Noise

The BTC pipeline is routed almost entirely through quiet desert, semi-desert and rural areas where ambient noise levels, particularly at night, can be expected to be low or very low (typically less than 20 dB(A) at night). However, background noise levels can be significantly higher during periods of strong winds, with levels typically in the range of 45-55 dB(A).

Background noise surveys have been undertaken in the vicinity of the proposed pump station and at Sangachal Terminal.

At the pump station daytime noise levels were found to range between 29 to 39 dB(A). The noise environment was dominated by local activity, agricultural machinery and at positions close to roads, by individual traffic movements. Measured night-time background noise levels range 22 to 35 dB(A). These background noise levels were considered to be typical of a rural/agricultural area during the night.

A background noise survey undertaken in 1996 in the Sangachal area, prior to the construction of the existing terminal facilities, revealed generally high noise levels of up to 55 dB(A). The levels measured are considered typical of a windy coastal location near to road traffic in Azerbaijan.

#### Contamination

Areas of visible contamination have been identified along the pipeline route. Sites that currently fall within the proposed construction corridor include instances of waste dumping, some asbestos tiles, minor areas of oil staining and scrap metal.

From the BTC project perspective the key baseline contamination issues are:

- Minimising risks to worker health and safety, particularly during construction
- How to treat and/or dispose of contaminated material from the pipeline corridor.
- Clearly documenting pre-existing contamination so that the BTC project is not assumed to be responsible for contamination that in fact pre dates the project

#### Soil erosion

While much of the BTC pipeline route is in areas that have little tendency for soil erosion there are a number of areas that are prone to high levels of soil erosion. Soils with a high clay and silt content are particularly prone to erosion.

### **1.5.2 Socio-economic baseline and identification of issues**

Baseline socio-economic information for the ESIA was collected in consultation with members of communities within 2km of the pipeline route, and covers both existing conditions and attitudes to the BTC pipeline. Communities within 5km of major facilities and 2km of pipe yards were also consulted. A total of 73 interviews were held with community leaders and 814 with community members.

#### Population and area of study

A total of 83 communities have been identified as being located within (or partly encroaching into) a 4km corridor centred on the route, or are close to a potential construction camp or pipe yard. The total population of all the communities surveyed is 257,223, of whom just over 96% are permanent residents, 0.3% temporary residents, and 3.3% IDPs and refugees. Communities are, in general, ethnically and religiously homogenous (Azerbaijani muslim).

### Infrastructure

Access to reliable sources of energy is a major concern for these communities. 84% of communities stated that they receive infrequent electricity supply, and 58 communities are currently receiving no gas supply.

Water supplies are problematic for all surveyed districts. 73% of communities in the survey area have no communal piped water supply and obtain their water mainly from canals. Water is also essential in most areas for agricultural irrigation.

There are almost no active refuse or sewerage systems in the surveyed communities.

Many services, such as fire departments and banks are virtually non-existent along the route, while other services such as police services and health clinics have suffered from a lack of investment.

### Land Tenure

The majority of people rely on the land for subsistence, particularly as industrial activity along the route has dwindled. Land is used mainly for crop cultivation and grazing of livestock. 86% of communities are engaged in vegetable cultivation, 57% in growing grain and almost all of them in small amounts of animal husbandry. Many households own one or two cows and a small number of sheep and poultry for subsistence purposes (wool, milk and meat). During the winter season, municipal and state land is also used by migratory sheep-herders for grazing their animals.

The land privatization process began in late 1996 and has progressed rapidly. 95% of people interviewed have direct ownership or use of land. IDPs and refugees tend to use State or municipal land.

#### Employment

There is generally a high level of unemployment along the route. All communities surveyed stated that they had members who would be available for temporary work. Communities ako reported that there were members of their community with skills they felt would be of interest to the project, eg engineers, drivers and welders. Communities close to potential construction camps also reported the availability of workers experienced in catering, laundry, cleaning, food production, etc.

In 2000, the national average income was 203,400 manats per month (US\$46). In rural communities along the pipeline route incomes are considerably lower than this national average.

Crops and animal husbandry are the main sources of cash income along the pipeline corridor. This income is supported by the following sources:

- State sector employment, eg teachers, doctors, and government posts
- Material aid provided by international NGOs and the State
- Social transfers state pensions, benefits, etc
- Hunting, fishing and gathering
- Trade including local shops and businesses (70% of communities have at least one shop or market)

Attitudes to the BTC Pipeline

Nearly 80% of the communities surveyed have previous experience of the construction process for either the Azerigaz pipeline or WREP and therefore have some idea of what to expect from the BTC project. In general, the overall attitude to the project was positive but cautious, with 94% indicating that they thought the construction and operation of the pipeline would be beneficial. Employment was by far the most important perceived benefit. All respondents felt strongly that local people should be offered first refusal for jobs for which they were qualified.

### **1.6 MANAGEMENT OF IMPACTS**

### **1.6.1 Management of environmental impacts**

An assessment has been made of both generic and location specific environmental impacts, as defined below.

**Generic impacts** are defined as those that could occur at any geographical location, as they are related to the activity rather than being dependent upon the environment.

**Location specific impacts** are defined as those that could occur in one specific geographic location, due to a particular sensitivity at that location.

Mitigation measures have been developed for each type of impact. The likelihood and significance of each impact occurring, after mitigation, has been determined.

The most effective mitigation measure for a pipeline project is to ensure that the route is selected to minimise environmental impact. For the BTC pipeline project this has involved rerouting to avoid sensitive areas, protected areas, archaeological sites and geohazards, and the sensitive siting of facilities.

Knowledge of environmental constraints has also enabled the engineering team to select the most suitable construction techniques and design features to further minimise impacts.

Finally, a quantified environmental risk assessment has been used to look at the likelihood of a leakage of oil from the pipeline and to assess the potential impacts upon different environmental sensitivities. This has directly influenced the project design, for example in the spacing and location of isolation valves.

The table below provides an outline of the mitigation measures that will be applied to manage the environmental impacts associated with:

- General construction and operation activities
- Construction camps and storage yards
- Construction of crossings
- Testing and commissioning

Environmental Mitigation Measures		
General Construction and Operation Activities		
Procurement		
Environmental issues will be considered during the procurement of goods and equipment		
Responsible use of materials (eg recycling and re-use) to minimise waste		
Habitat Loss		
Sites & routes have been selected to avoid protected areas and ecologically sensitive areas wherever practical		
Pre-clearance surveys will be undertaken to identify, transplant or otherwise manage rare and endangered botanical species that are likely to be affected by the construction operations		
There will be clear demarcation of workspace boundaries through sensitive areas		
Construction traffic will be restricted to approved access roads and the ROW		
Ecologicaly sensitive areas will be reinstated as soon as practical after construction		
Introduction of competitive species		
Information on this issue will be provided in workforce and visitor induction training		
Invasive species assessments will be included in the project construction environmental monitoring programme		
<u>Visual impact</u>		
Site selection for permanent facilities has taken visual impact into consideration		
A planting scheme for the pump station will be implemented and maintained		
The perimeter wall at the pump station will help to screen low level equipment		
Good housekeeping will be employed at all facilities to ensure a tidy and well maintained appearance		
Hazardous materials management		
There will be no storage of hazardous materials in active floodplains or within 30m of a watercourse Storage in areas of known groundwater vulnerability will be minimised		
Hazardous materials will only be stored within designated storage areas and using appropriate procedures (eg, bunding, impermeable surfaces, secure drainage, limited access, labelling)		
A record will be kept of all hazardous materials on-site and Material Safety Data Sheets (MSDS) maintained		
Potentially reactive materials will be segregated		
Personnel will be trained in safe use & handling of hazardous materials		
Spill response equipment (absorbents etc) will be available and emergency response training provided		
Solid waste management		
A strict duty of care will be enforced on the project managers and the contractors		
Secure waste storage sites will be established, in defined areas away from watercourses and drains, and secure from vermin		
There will be a prohibition on uncontrolled burning or burial of waste		
There is a requirements for the environmental review of potential landfill & incinerator sites including site selection & proposed mode of operation		
Monitoring and suditing of waste management practices will be carried out during construction and		

Monitoring and auditing of waste management practices will be carried out during construction and operation

#### BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA

Environmental Mitigation Measures
Liquid waste management
Water quality will be monitored prior to discharge
There will be a prohibition on the discharge of contaminated wastewater to the environment
Sewage treatment facilities have been incorporated into the design of construction camps and the pump station
Wherever practical there will be no disposal of liquid wastes in vulnerable groundwater areas
There will be brief environmental assessment of disposal options and locations
A routine wastewater monitoring programme will be developed and implemented
A waste water treatment facility has been included at the pump station
Traffic management
Project speed limits will be strictly enforced
Driver will receive safety and environmental awareness training, and be subject to assessments and monitoring
Construction traffic will be restricted to approved access roads and the ROW
Vehicles will be maintained to minimise emissions and fuel consumption
Warning signs will be placed at road crossings and other appropriate locations as required
Temporary traffic control will be established where necessary at road crossings and junctions
A local community safety awareness programme will be implemented and communities will be discouraged from use of the ROW as a road
Soil structure
Soil storage areas will be protected from vehicle movements
The subsoil beneath the vehicle running track will be broken up prior to reinstatement
Appropriate use of load bearing materials (eg, mats, straw, geotextile membrane) in areas of particularly soft ground
Topsoil and subsoil will be stored separately to maintain seed bank viability and soil structure
Dust generation
Wetting of the ROW will be carried out to reduce dust generation
Areas of particularly sensitive crops or animals eg cotton and bees, will be identified and consultations held with the owners
<u>Air Emissions</u>
Equipment and vehicles will be maintained in line with manufacturer's recommendations to meet relevant international standards
Vehicle emissions will be monitored periodically
A monitoring and maintenance programme will be developed to ensure emissions from plant meet required standards

#### BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA

Environmental Mitigation Measures		
Noise Emissions		
Equipment and vehicles will be maintained in line with manufacturer's recommendations to meet relevant standards		
Noise abatement equipment will be used where appropriate		
Most work will be limited to defined, daylight, working hours		
Vehicles will be used responsibly, eg machines will not be left idling for long periods if they are not in use		
Local residents will receive prior notification of particularly noisy activities		
Noise emissions will be monitored against noise control targets		
A monitoring and maintenance programme will be developed to ensure emissions from plant meet required standards		
Irrigation canals		
Where possible flow will be maintained in active drainage or irrigation systems during construction work through use of measures such as pumping, channel diversions and fluming		
Any disrupted drainage or irrigation systems will be reinstated to a standard at least equal to the original conditions upon completion of construction work		
<u>Archaeological management</u>		
The pipeline has been routed to avoid known or potential archaeological sites where practical		
A Cultural Heritage Management Plan has been developed and is being implemented. This addresses pre-construction and construction phase activities		
Pre-construction work will be undertaken to evaluate & record suspected archaeological sites		
There will be specialist archaeological surveillance present during the clearance of the ROW and facility sites		
Issues of archaeological awareness (such as ownership of finds, notification of finds and protection of archaeological sites) will be included in induction training		
Sediment control		
Sediment fencing, drainage channels & trench barriers will be installed where appropriate		
Water will be discharged through a filtering medium as necessary		
Contamination		
Avoid construction in areas of known or suspected contamination as far as is practical (N.B. the pipeline has been routed to avoid many areas of known or potential contamination and a baseline contamination survey has been carried out.)		
Known contamination within the construction corridor will be cleared prior to construction to at least a standard that ensures worker health and safety		
Ensure segregation of contaminated soil from uncontaminated materials		
Containment measures (ditches, impermeable base membranes, covers) will be provided to minimise run-off from any contaminated soil piles		
Where offsite disposal or long-term storage of contaminated material is required it will be undertaken in accordance with the provisions set out in the project Waste Management Plan		
Construction Camps and Storage Yards		

#### BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA

Environmental Mitigation Measures
Abstraction of Groundwater
Vulnerable water bodies, wetlands & groundwater sources have been identified and recorded
Sampling and analysis of water from existing boreholes will be carried out to determine existing contamination levels
All new abstractions for use by the project will be subject to environmental review
The project will adhere to national and local licensing policy for abstractions
Test-pumping of New abstractions will be subject to test pumping and of impacts on the flow rates of existing abstractions will be monitored
Construction of Crossings
Roads
Trenchless crossing techniques will be utilised for many major roads
Minimise duration of closure of roads and provide temporary access where necessary
Steel plates will be lain across the trench to maintain access where practical
Communities will be consulted prior to any temporary closure of roads
Rivers
Open cut of fish spawning rivers (eg the West Kura and the Hasansu) will be avoided between early October and late June
Environmental considerations will play a significant role in the selection of crossing design and choice of methodology
Where possible, existing river flows will be maintained during construction work (including the use of measures such as trenchless crossings, pumping, channel diversions and fluming)
The duration of any necessary flow interruptions will be minimised
Horizontal directional drill
Extensive geotechnical survey work has been conducted during project design
Storage of drilling muds will only be permitted in a bunded area
The use of toxic chemicals in drilling fluids will be avoided
Testing and Commissioning
<u>Hydrotest water</u>
Use of chemical additives in hydrotest water will be minimised
Discharge of hydrotest water will be controlled to reduce soil erosion
Water will be tested and treated as necessary before discharge to ensure it meets agreed standards

## **1.6.2 Management of socio-economic impacts**

Socio-economic impacts that have been identified relate not only to fact - the aspects of the project - but also to individual and community perceptions and attitudes towards these aspects, gleaned through the ESIA consultation process. The addition of perception and community attitudes towards the issues means that the impact will vary according to the individuals or communities involved. As a result, assessment of the likely magnitude of an impact involves a degree of subjective, albeit professional judgement.

Construction

Four categories of socio-economic issue related to project construction activities have been identified. These are as follows:

- Local employment and procurement opportunities
- Land acquisition and land-based livelihoods
- Local infrastructure, services and natural resources
- Community relations, management of construction workers and camps

The table below summarises the mitigation measures developed to address each of these issues.

SOCIO-ECONOMIC MITIGATION MEASURES
Employment and local sourcing opportunities
BTC Co and the contractor will agree a plan for local labour content
Preference will be given to suitably qualified and experienced applicants from communities local to the pipeline route
Recruitment procedures will be developed that will be transparent and fair
Contractor will develop and implement training programme for local workers
Contractor will develop and implement a plan to maximise local sourcing opportunities
Land and Land Based Livelihoods
A fair and transparent compensation process has been developed for land owners and land users
Prior consultation on land acquisition, entitlements and compensation has been held with land owners and users along the route
Grievance procedures have been drawn up to aid in the resolution of disputes
Procedures have been developed to manage crossings of irrigation canals and other infrastructure and services to minimise damage and disturbance.
Land owners and users will be allowed continued access (with minor restrictions) to the pipeline corridor after construction
Infrastructure and Resources
There will be upgrade of some existing roads and construction of some new access roads
Roads used by the project will be maintained during construction and any damage to roads caused by the project will be rectified
All roads will be restored to a condition at least as good as that existing before the project
The quality of roads prior to and after project will be documented
Development of and adherence to Transport Management Plan, including focus upon community safety
All other infrastructure eg irrigation canals and fences, to be documented prior to construction and restored to at least their pre-existing condition after construction

#### SOCIO-ECONOMIC MITIGATION MEASURES

#### **Construction Workers and Community Relations**

Development and implementation of Community Liaison Management Plan and Construction Camp Management Plan

Establishment of community Liaison team to facilitate relationships with communities during the construction phase

Development of a code of conduct for camp workers, camp rules and disciplinary procedures

All workers will receive cultural sensitivity and health awareness training

#### Pipeline Operation

There are few significant socio-economic impacts associated with the operation of the BTC pipeline. These can be identified as follows:

- Direct employment of approximately 100 operational staff
- Skills enhancement from long term employment opportunities
- Minor restrictions on the use of land on the ROW (eg no deep rooting plants directly above the pipeline, no new buildings, no deep ploughing or use of explosives)

Mitigation measures for negative impacts during the operational phase are consistent with those drawn up for the construction phase.

An additional major issue identified during ESIA consultation was community expectations of improved access to energy as a result of the project. Given this is not a direct impact of the project, but an outstanding community concern, it has been dealt with under Residual Impacts below.

### **1.7 RESIDUAL IMPACTS**

### **1.7.1 Environmental residual impacts**

There will be a number of positive residual environmental impacts associated with the BTC project. These include:

- Development and implementation of environmental investment programmes focused on maintenance of biodiversity along the pipeline corridor
- Benefits of an increased knowledge base of the Azerbaijan environment as a function of the BTC project baseline studies the data collected will be shared with the academic community and made public
- Benefits resulting from the contaminated land survey and clean up of identified areas of 3<sup>rd</sup> party, pre-existing contamination
- Skills transfer between international and national environmental consultancies and scientists eg in survey techniques and national ecological knowledge
- Investigations before and during construction will result in an increased knowledge of archaeological features along the route, thereby increasing the national archaeological record

• Raising public awareness of environmental issues in Azerbaijan, on an international, national and community level, through the publication of documents and consultation

#### Air Quality and Climate

Given the extent of spatial and temporal distribution of emissions to atmosphere no significant residual impacts will be associated with construction activities. However it is recognised that there is likely to be generation and deposition of significant quantities of dust in the immediate vicinity of the construction works.

Greenhouse gas emissions from the project are negligible when considered on a regional or national scale. Appropriate stack design and project emission limits will fully mitigate any potential for deterioration of air quality during operation.

#### Noise

Noise associated with pipeline construction will be short term at any one stationary receptor but cannot be fully mitigated. Therefore residual noise impacts during construction are recognised.

#### Soils

Proposals for handling and storage of soils, and for soils re-instatement, will minimise erosion and therefore no significant residual impacts are expected.

With regard to soil quality the mitigation measures will minimise, but not eliminate, the potential for the reduction of diversity and viability of the seedbank. The significance of this impact is however low considering the small incidence of the disturbed land compared with the overall occurrence of the subject soils.

#### Ecology

The BTC pipeline route will cross several ecologically sensitive areas resulting in a number of residual impacts.

The main impacts will be associated with the disturbance to the sensitive Gobustan desert area, where it is estimated that it will take approximately 10 to 12 years for complete habitat recovery on the construction corridor following reinstatement.

#### Landscape

The visual impact of pipeline construction operations will be short term for most stationary receptors. Longer term impacts will be minimised by the implementation of appropriate reinstatement measures along the ROW. There is likely to be a residual visual impact from:

- The upgrade of an existing access road in the Gobustan desert area
- Construction of the pipeline along narrow ridges in the Gobustan (Mud Volcano Ridge), Tovuz and Hasansu areas

The above ground facilities associated with the pipeline will form part of the landscape and therefore will cause a residual impact. The magnitude of the visual intrusion will however reduce in time as the plants used for landscaping the sites grow to maturity.

## 1.7.2 Socio-economic residual impacts

There are a number of positive residual socio-economic impacts associated with the BTC project in Azerbaijan, related to both the construction and operation of the pipeline. These include:

- Additional cash injected into communities
- Wide distribution of economic benefits
- Enhanced local experience and employability
- Economic benefit of indirect employment opportunities:
  - o Road-side stalls
  - Local purchase of diesel
  - Local purchase of bottled water
  - Local purchase of aggregate
- Enhanced capacity to tender for contracts
- New roads / improvements to roads
- Improved health awareness
- Access to new cultures and international attitudes

The main residual negative social impacts associated with the construction and operation of the BTC pipeline in Azerbaijan are addressed below.

#### Access to energy

During preliminary consultation, many communities with poor energy supply clearly associated the construction of pipelines with potential provision of energy to their houses, primarily during pipeline operation. While the project will not draw energy from community sources either during construction or operation, nor will it provide them directly with any additional energy.

#### Employment expectations

There was clear evidence that communities have the expectation that the number of jobs that will be created, and the duration of the employment, are larger and longer than they will actually be. It is therefore important to provide accurate information on this topic in order to avoid potential disappointment.

The employment strategy developed should ensure that local employment levels are maximised as far as practical and community consultation has sought to clearly outline the level of employment that is expected during both construction and operation of the pipeline.

Accidents involving community members

Accidents to community members, while potentially serious on an individual basis, are expected to be rare given the strong emphasis placed by BTC Co. on health and safety issues. Although all practical steps will be taken to ensure that no accidents occur any incident that harms a person will have a high significance residual impact in terms of diminishing quality of life for that person, negatively impacting them or their household livelihood, and potentially creating tension between the local community and the project team.

#### Local infrastructure, services and natural resources

Damage to roads from construction traffic and the depletion of community access to power are key concerns for local communities.

The project will build some new roads which will be a beneficial impact for local communities. Mitigation should also ensure that roads remain in a safe and reasonable condition, although residual community resentment may be generated if the high standards that follow the initial upgrades are not maintained.

On the basis of the current design the power draw from local sources for the project in both construction and operational phases should be minimal.

#### Managing community relations

Despite the positive attitude towards the pipeline found during consultation, it is possible that tensions between communities and the pipeline project will rise during construction, for example in relation to nuisance and disturbance, or in regard to opportunities for employment.

Therefore the approach to management of community relations is one of the most crucial mitigation measures.

Impacts on communities will be considerably reduced in the operation phase of the pipeline, however an on-going community relations programme will ensure that community concerns continue to be understood and addressed as appropriate.

### **1.8 CUMULATIVE IMPACTS**

The cumulative effects of the project are considered at three geographical levels: regional, national and route level. At a regional level the effects of BTC have been evaluated in combination with the other oil and gas development in the regions, including the upstream activities that will generate the crude oil to fill the BTC pipeline, and other oil and gas developments in the Caspian region. In this context, the contribution of BTC in Azerbaijan, to the overall environmental impacts associated with these activities is negligible.

At a national level, the project has been assessed in conjunction with other activities that could benefit from the development of the crude oil pipeline or that could have a negative interaction with the project.

At the route level the project's main interaction is clearly with the SCP gas pipeline with which BTC shares a common corridor. The main route level cumulative impacts are outlined below.

#### Longer duration of the construction project

The construction of two large diameter pipelines along the same corridor will have a longer duration than construction of a single pipeline. Therefore there will be additional disturbance to the local populations eg through dust and noise generation, and additional vehicular traffic along access routes.

#### Land take and subsequent habitat loss

The combined construction corridor for the two pipelines is 44m wide. Were the two pipelines to be built in separate corridors the overall width of land disturbed would be much greater (approximately 64m) in addition to having opened a secondary pipeline corridor through the country. There is a significant positive cumulative impact of the two pipelines sharing a common corridor.

#### Delayed reinstatement of the ROW

The co-existence of the two projects in the same corridor may lead to a delay in the start of full reinstatement of some sections of the ROW. This could have the following negative impacts:

- The landscape value of certain sections of the ROW will be reduced for an extended period of time
- Prolonged topsoil storage may lead to impoverishment of the seed bank and a reduction in the germination rate of the surviving seeds
- The delayed permanent restoration of the ROW could facilitate the onset of erosive processes with associated negative impacts to the soils

The reinstatement plan has been developed to address these issues and states that interim measures will be adopted in areas where full reinstatement is delayed, with the primary objective of preventing erosion.

#### Air emissions

The potential for occurrence of a cumulative impact to human health from the simultaneous operation of closely located project facilities has been assessed and is not considered significant, as potential impacts posed by harmful emissions associated with each facility are fully mitigated through appropriate design of stacks and compliance with project standards.

Green house gas emissions associated with project activities have also been estimated and assessed, and regarded as of relatively minor significance when considered within a national, regional and global context.

Economic Benefits and Livelihoods

The cumulative socio-economic impacts resulting from the BTC, SCP and any other industrial development projects will, if well managed, provide an overall increase in wealth and livelihoods of the national population. The main national level benefit is increased government revenues from transit of oil and gas and from taxes. Increased government revenues could contribute to an increased standard of living for the national population.

The combined effect of the two pipeline projects will be to double the inflow of cash into the local economies along the pipeline corridor, through doubling:

- Length of and number of opportunities for employment for unskilled and semiskilled labour
- Opportunities for the provision of goods and services
- The knock-on effect of having salaried workers living in the local villages.

#### Skills Base

Both BTC and SCP projects will develop and implement training programmes. The cumulative impact of BTC and SCP will be to double the scale and impact of the training. As a result of the BTC training programme, the SCP project may be able to achieve a higher proportion of local employment than BTC. The combined impact of the projects will be to increase the pool of labour in Azerbiajan with experience in major international construction projects.

#### Disruption of Land Use

Cumulative impacts of SCP and BTC pipeline in terms of land are complicated. On the one hand, the effect of planning the two projects in parallel will result in reduced impacts had the alternative been to run the two pipelines independently of one another. On the other hand, the effect of constructing SCP after BTC pipeline will result in some of the land being out of production for at least one, if not two or three seasons longer than would have otherwise have been the case. This will result in longer-term impacts for individuals affected by the temporary land take. However the land compensation process should effectively mitigate this impact.

### 1.9 ENVIRONMENT AND COMMUNITY INVESTMENT PROGRAMMES

In addition to the above direct mitigation and management measures, an Environmental Investment Programme (EIP) and a Community Investment Programme (CIP) are being developed in order to go beyond direct mitigation and to help meet environmental and community needs and offset remaining residual impacts.

## **1.9.1 Environment Investment Programme (EIP)**

#### **Objectives of Environmental Investment Programme**

In recognition of the importance of the regions biodiversity, the aim of the EIP is to enhance biodiversity management and/or protection primarily through investments in offset projects.

### Types of Environmental Investment

Although still in the development stage, it is likely that the EIP will focus on the following themes:

- Protected areas and species
- Areas of high ecological significance outside protected areas
- Capacity building for biodiversity management

#### Timeframe

The development of the EIP is being undertaken through consultation with stakeholders to gain an understanding of where involvement would be most beneficial. The intention is that potential programmes or projects are developed and implemented in conjunction with relevant stakeholder bodies. Identification of potential partners is underway.

Implementation of the EIP will follow BP's business processes and control procedures for managing project performance and cost.

The programme will be publicised in more detail later in 2002, once feedback on the ESIA has been received and further consultation with authorities, NGOs and affected communities has taken place. It is expected that actual investments will begin in late 2002 or early 2003.

### 1.9.2 Community Investment Programme (CIP)

The objective of the CIP is to have a positive impact on communities most affected by construction activities by providing direct benefits, and by engaging with and adding value, to local communities in a sustainable way. The CIP will go beyond the social impact mitigation measures described in the ESIA and move towards BP's goal of having a positive influence in the areas in which BP operates.

There will be two types of community investment projects:

**Sustainable Development Projects**, which will be larger scale and longer term in duration, and will take place primarily in communities that are directly affected by pipeline activities but may be extended to nearby towns or villages

Local Community Projects, which are relatively small in scale and duration but respond to an immediate need in those communities that are directly affected by the construction activities

Potential projects will be developed through discussions with the communities themselves, NGOs, international development agencies and government. These discussions will ensure that the BTC project is not duplicating effort, and gains from the experience of NGOs and other potential implementation partners. Potential projects will be selected on the basis of criteria drawn from international community investment best practice and local experience.

### **1.10MANAGEMENT AND MONITORING**

BP's approach to Environmental and Social Management is to apply the key principles of environmental and social protection to all activities for which it is the Operator.

These principles include:

- Prior assessment of environmental and social impact
- Minimisation of potential impact through design and other mitigation controls
- Monitoring of effectiveness of controls
- Auditing of performance

The principal tool that will be employed to coordinate and review the environmental and social performance of the project will be the BTC Environmental Management System (EMS). Social issues will also be addressed within the EMS.

For the construction phase, the EMS will provide an umbrella for the implementation of requirements specified in a series of management plans addressing specific issues. Adherence to these plans will be assessed through a regular programme of monitoring and auditing, and the EMS will be subject to regular review and amendment as necessary.

A project specific operational phase EMS will be developed, in line with the requirements of ISO14001. The EMS will be certified to the ISO standard within 9 months of becoming operational.

### 1.110VERALL PROJECT ASSESSMENT

The ESIA process has identified those BTC project activities that could result in impacts to existing environmental and social conditions, and has provided an evaluation as to the significance of those impacts. Mitigation plans have been developed for each of the impacts

to accentuate any positive benefits and to minimise or remove any negative impacts. The most valuable tool in this process has been analysis of the extensive environmental and social surveys and consultations undertaken over the last two years.

### 1.11.1 Environmental project assessment

The assessment shows that the majority of the impacts will be associated with the construction phase. Potential construction impacts will be mitigated through the implementation of good construction practice, adherence to management plans, and through the application of localised measures to protect specific or sensitive receptors.

The operation of the pipeline will result in limited localised impacts. The most significant direct impact of operation will be the generation of noise and visual intrusion at the location of the pump station and, to a lesser extent, at the other AGIs and permanent access roads.

The potential for unplanned events and the potential consequence of such events on the habitats, rivers and groundwater resources crossed by the pipeline have also been analyzed. The assessment shows that the likelihood of any event occurring and the risk of significant impacts resulting, are very bw. In the unlikely event an incident were to occur the impact could be significant dependant upon the scale of the event, geographical location of the event site, and the local metrological, geographical and hydrological conditions.

Mitigation measures have been adopted to counter the risk of an oil spill on three fronts. Firstly, the design basis of the project includes many features to prevent a leak occurring, including routing around geohazards where possible, increased burial depth and wall thickness in certain locations and pipeline surveillance. Secondly the design also includes many features for early identification of a spill event, including a leak detection system, selected groundwater monitoring and surveillance. Finally, an Oil Spill Response Plan will be developed which will identify resources, responsibilities and equipment necessary for responding to a spill event, in the unlikely event it should occur.

The mitigation measures implemented through construction and operations will be monitored and reviewed on a regular basis to ensure they are effective. Alternative measures will be applied if necessary. To ensure that the mitigation measures are implemented in the field requirements have been included within the construction invitation to tender documents. Assessment of contractors approach to mitigation will form a significant component of the bid review process.

### 1.11.2 Socio-economic project assessment

Consultation revealed that most communities are generally positive towards the BTC project, as their perception is that any disruption will be temporary and offset by potential economic benefits both to their community and to Azerbaijan.

There will be a number of socio-economic benefits associated with the BTC project. These include:

• Development of a CIP focused on communities adjacent to the pipeline corridor

and associated facilities

- Direct employment there will be a limited number of opportunities for direct employment on the project, primarily short term jobs during construction, with fewer, longer term, vacancies during operation
- Opportunity for provision of goods and services to the project
- Skills development and training, increasing the employment chances of people after the pipeline construction period
- Enterprise development, a transfer of business knowledge and skills eg internationally recognized standards of HSE, technical, commercial, accountancy, IT etc
- Infrastructure improvement including temporary and permanent upgrade of some roads
- Benefit of the increased knowledge basis of the Azerbaijan social and economic conditions along the pipeline route, through the BTC project baseline studies the data collected will be shared with the academic, aid agency and NGO communities
- Skills transfer between international and national consultancies, eg in social data gathering and survey techniques
- Increased public awareness of socio-economic issues in Azerbaijan, on an international, national and community level, through publication of documents and consultation
- Utilisation in-country of international best practice in relation to land acquisition and compensation

Two of these positive aspects were particularly prominent during consultation, firstly in relation to possible employment opportunities, and secondly in relation to possible expenditure on local goods and services by construction workers.

There was clear evidence, however, of the communities having some expectations which will not be realized as a direct result of the project. It is therefore important to provide accurate information **m** these topics in order to avoid potential disappointment. Firstly, the level of anticipated employment is higher in terms both of numbers of jobs to be created and length of employment.

Secondly, villagers living in communities with poor energy supply dearly associated the construction of energy pipelines with immediate provision of energy to their houses, which is not possible from high pressure export pipelines.

After more than a year of regular consultation these expectations have since been reduced, but will still require careful management in the future.

To conclude, although there are a few residual concerns relating to the construction of the pipeline which need to be carefully managed through the mitigation measures set out in the ESIA document, it is generally anticipated that both the construction and operation of the BTC pipeline will bring a series of short and long term benefits to the communities. These are particularly relevant in relation to employment, provision of goods and services and community investment which will provide longer term benefits to many communities thereby helping to off-set any short term negative impacts.

ESIA is an iterative process. Therefore there will be continual effort to increase and further refine knowledge of the environmental and social issues associated with the BTC pipeline throughout construction and operation.

## **GLOSSARY AND LATIN NAMES**

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# 2 GLOSSARY AND LATIN NAMES

### 2.1 GLOSSARY OF TERMS

AAQC	Ambient Air Quality Criteria
AC	Alternating Current
ACG	Azeri, Chirag, Gunashli offshore oilfield, Caspian Sea
Acheulian	A stratigraphic stage name based on an early Palaeolithic culture, for part of the European Lower Pleistocene
AETC	The company Azerbaijan Environment and Technology Centre - RSK's sister company in Baku
AGI	Above Ground Installation
AGT	Azerbaijan Georgia Turkey pipelines project - BTC and SCP combined
AIOC	Azerbaijan International Operating Company
AIDS	The disease - Auto Immune Deficiency Syndrome
Aksakal	Elderly respected people in communities
Alluvium	Fine grained soil consisting of mud, silt and sand deposited by
	flowing water
Alternative pipeline route	A previously considered pipeline route that deviates from the existing proposed route
Ambient noise	Totally encompassing sound in a given situation in a given time. Usually composed of sound from many sources near and
	far
Anti-scour devices	Impermeable barriers built around downhill pipeline sections to prevent erosion
API	American Petroleum Institute
ASCE	Azerbaijan State Committee for Ecology and Nature
	Resources Utilisation. Recently incorporated into the Ministry of the Environment
ASME	American Society of Mechanical Engineers
Aspect (environmental)	A generic term describing activities or an element of the
	project that may interact with the natural environment (see also impact, below)
ASTM	American Society for Testing and Materials
Averaging time	The period of time over which measurements are averaged
A-weighting	A-weighting most closely matches the sensitivity of the human ear to the sound frequency spectrum
Backfill crew	The crew that replaces subsoil in the trench after the pipeline has been laid
Backhoes	Excavators
BACT	Best Available Control Technology
Barg	A Unit of Pressure
Baseline	Existing Conditions
Baseline studies	Environmental or socio-economic studies establishing the existing environmental or socio-economic conditions
BATNEEC	Best Available Technique Not Entailing Excessive Cost
BCM	Billion Cubic Metres (10 <sup>9</sup> )
Berms	An engineered (earth) bank forming secondary containment
	around tanks or a screening mound or stockpile
BG	British Gas
Biodiversity	Range of animals and plant species present in a region
Block valve	Device for stopping flow and isolating the pipeline into distinct
	sections
Blowdown	Release of pressure from a vessel or effluent resulting from purging of process vessels

BOD₅ Bopd BOTAS BP BPEO Breccias Bronze Age	5 day Biological Oxygen Demand Barrels of oil per day Lump sum contractors for Turkish section of the BTC pipeline International energy group currently leading work on the BTC and SCP projects Best Practicable Environmental Option Rock (concreted) consisting of angular fragments embedded in a finer matrix Technological stage between the Stone and Iron Ages, beginning in the Middle East about 4500 BC and lasting in Europe from 2000 500 BC
BS	British Standard
BSI	British standard institute
BTEX	Baku-Tollisi-Ceynan Oli Pipeline Benzene, Toluene, Ethylbenzene and Xylene
BU	Business Unit
Bunding	A form of secondary containment, eg around tanks
C4	Hydrocarbons with 4 carbon atoms
C5+ gasoline	Hydrocarbons with more than 5 carbon atoms
Caravanserai	An inn surrounding a courtyard where caravans rest at night
CCTV	Close Circuit Television
Cenozoic	An era of geologic time, from the beginning of the Tertiary
	period to the present. The Cenozoic is considered to have
CEP	Degun about 65 million years ago Caspian Environment Programme
CH <sub>4</sub>	Methane
CITES	Convention on International Trade of Endangered Species as per 12-4
CLO	Community Liaison Officer
co	Carbon monoxide
COD	Carbon doxide Chemical Oxygen Demand
Consequences	A result or effect of an action or impact
CP	Cathodic Protection - anti-corrosion system based on physical
0	principle of ion exchange
Cretaceous	I he final period of the Mesozoic era (after the Jurassic and before the Tertiary period of the Cenozoic era) thought to
	have covered the span of time between 135 and 65 million
	years ago
CRM	Community Relations Manager
CTP	Caspian Regional Thematic Centre Crude Topping Unit
Cumulative Impact	An impact resulting from the combined effects and interactions
-	of past, present or future projects or activities
	Calorific Value
dB(A)	scale, which compensates for the specific sensitivities of the
	human ear (compared to a normal, unselective microphone)
DBA	The sound pressure level of a signal which has been passed
	though an "A" filter whereby both low and high frequency
Decibel (dB)	Units used to measure the intensity of sound. It can be
	specifically defined as the logarithmic ratio of a sound
	pressure relative to a reference level of 20 micro-Newtons per
Directional drilling	square metre
	pipeline beneath obstructions (road, river, railway, canal, tree

	belt, etc)
DIV	Dutch Intervention Values
DLN	Dry Low NOx Emissions
DPI	Dye Penetrant Inspection
Duration	The length of time that something lasts or continues
DWG	Deep Water Gunashli
Dwt	Deadweight ton
E&P	Exploration and Production
EAQG	European Air Quality Guidelines
EAP	Environmental Action Plan
EA-UK	Environment Agency - United Kingdom
EBRD	The European Bank of Reconstruction and Development
EC	European Community, now more commonly known as the
	European Union
ECA	Export Credit Agency
Effect	Something produced, either positive or negative, by a cause or
	agent
EIA	Environmental Impact Assessment - the process of collecting
	data, consulting with interested parties, assessing significant
	environmental impacts (positive and negative) and defining
	mitigation measures
Eminent Domain	The ability to involuntarily acquire land from private land
	owners
EMS	Environmental Management System
Eneolithic	5 ,
Eocene	An epoch of the early Tertiary period, after the Palaeocene
	and before the Oligocene; also, the corresponding worldwide
	series of rocks (53 to 37 million years ago)
EOP	Early Oil Project (Chirag field)
EPCM Contractor	Engineering, Procurement, Construction and Management
	Contractor
EQE International	
ERA	Environmental Risk Assessment
ERM	The company Environmental Resources Management Ltd
ERP	Emergency Response Plan
ES	Environmental Statement
ESD	Emergency Shutdown
ESIA	Environmental and Social Impact Assessment
EU	European Union
Extent	The range over which something extends
FBF	Fusion Bonded Epoxy pipe coating for corrosion prevention
FCI-ROW	Facilities. Construction and Installation Right of Way.
-	commonly referred to as the ROW in this FSIA
FEED	Front End Engineering and Design
FFD	Full Field Development
Field walking	An archaeological survey technique comprising the systematic
	recovery of artefacts from the surface of ploughed fields
Flagging	Demarcation of site/ services of particular interest or sensitivity
Flare	Equipment for burning waste gas
Frequency	The number of times that an event occurs within a given
	period (single event or continuous)
FSU	Former Soviet Union
Fugitives (emissions)	Discontinuous, diffuse, usually accidental. emissions to
,	atmosphere
FWL	Fire Water Lagoon
Gabion	A stone / earth filled open wire mesh container used to
	strengthen river banks, steep slopes and foundations
Gauging pig	A device which can be passed through a pipe to assess its
	dimensions
GCM GCV	General Circulation Models Gross Calorific Value
-------------------------------	--
GDP	Gross Domestic Product
GHG	Greenhouse gases
GIOC	Georgian International Oil Company
GIS	Geographical Information System - a digital process of
GLC	Ground Level Concentration
GPS	Global Positioning System
GT	Gas Turbine
GWP	Global Warming Potential
На	Hectare
Hazard	An exposure or vulnerability to injury
	Hydro-Chlorofluorocarbon
	Horizontal Directional Drilling
HE	Hydrogen Eluoride
HFC	Hydro-Fluorocarbon
HGA	Host Government Agreement
HGL	-
HIV	Virus responsible for the illness AIDS
HP	High Pressure
	Human Resources
	Heating Ventilation and Air Conditioning
Hvdrotest	The process of testing the integrity of a pipeline prior to
	commissioning with water under pressure for an extended
	period
Hydrotest fluids	Fluids used in hydrostatic testing (e.g. water, possibly with
	biocides, oxygen scavengers, antifreeze, corrosion inhibitors
	and dyes)
IEC	International Finance Corporation a member of the World
	Bank Group
IFI	International Finance Institution
IFI guidelines	International Finance Institutions guidelines
IGA	Inter Governmental Agreement
IGE	The Institute of Gas Engineers
ILU Impact (onvironmontal)	A positive or pogetive change to the environment that results
	wholly or partially from project activities
Incident	An occurrence or event
Inspection crew	The crew that radiographically or ultrasonically inspects the
	condition of the pipeline and welds prior to pipe wrapping
IP	The Institute of Petroleum
IPS Iron Ago	Intermediate Pigging Station
ISO	International Standards Organisation
ISO 14001	The International Standards Organisation's Standard for
	Environmental Management Systems
IT	Information Technology
ITT	Invitation to Tender
	International Union for the Conservation of Nature
JUIASSIC K	Energy class relating to earthquake severity
KP	Kilometre point is distance from the start point of the pipeline
14	measured in kilometres
kPa	
KPIs	Key Performance Indicators

KV	Kilovolt
KW	Kilowatt
L <sub>Æq</sub> dB	A measure of "average" sound level (over a specified time period). The constant level of noise that would have provided the same acoustic energy as the actual fluctuating sound during the same period
L <sub>Æq,</sub> T	Equivalent continuous A-weighted sound pressure level (SPL). The value of the A-weighted SPL in dB of continuous steady sound that within a specified time interval 'T' has the same
Leachate test	A test to determine the potential for contaminants to dissociate from soils
Likelihood	The chance or probability of something happening
	Light Non-Aqueous Phase Liquid
LF M <sup>3</sup>	Cubic metre
Magnitude	The relative size or extent of an event or impact
Mamsl	Metres above mean sea level (Baltic Datum)
Manats	Azeri currency
MAOP Mb	Millihar
mbd	Thousand barrels per day
MCR	Maximum Continuous Rating
Measurement time interval	The total time over which measurements are taken (e.g. this
- T <sub>m</sub>	may consist of the sum of a number of non-contiguous, short -
Medieval period	An archaeological time period lasting approximately 800 AD to
MENR	Ministry for Ecology and Natural Resources
Mesolithic	The archaeological period between the Palaeolithic and the
	Neolithic (12,000-3,000 BC)
Mesozoic	An era of geological time, from the end of the Palaeozoic to
	the beginning of the Cenozoic, of from about 225 to 65 million vears and
MG/L	Milligram per litre
μr hr <sup>-1</sup>	Micro roentgen per hour
	Unit commonly used in the Soviet system for the
	the following formula
	$1 \mu r hr -1 = 0.01 m Sv hr -1$
MIGA Miacana	Multilateral Investment Guarantee Agency
MIOCEIIE	before the Pliocene: also, the corresponding worldwide series
	of rocks (23 to 5 million years ago)
Mitigation	Measures that may reduce the severity of potentially
M 1	significant adverse environmental impacts
MLAS	Multilateral Lending Agencies
MMB/D MMbd better	Million barrels per day
MMSCF/D MMscfd	Million standard cubic feet per day
MMSCM/H	Million standard cubic meters of gas per hour
	Magnetic Particle Inspection
MSS	Manufacture Standardisation Society
MSSOP	Maximum steady state operating pressure
MT	Million tonnes
IVI VV Maar	Megawatt Magnituda of corthquaka covority
N <sub>2</sub> O	Nitrous oxide
-	

NACE Nappes	The National Association of Corrosion Engineers Large-scale horizontal displacement of rocks (either folded or
NDT	undisturbed)
NDT	Non-Destructive Lesting
NEAP	National Environmental Action Plan of Azerbaijan
Neogene	Pliocene of the Tertiary period
Neolithic	The period characterised by primitive farming and the use of polished stone and flint tools and weapons
NGO	Non Governmental Organisation
NO <sub>2</sub>	Nitrogen dioxide
NORM	Naturally Occurring Radioactive Material (e.g. radon)
NO <sub>x</sub>	Nitrogen oxides
NREP	Northern Route Export Pipeline
NRPB	National Radiological Protection Board
NSPS	New Source Performance Standards (of the US EPA)
O <sub>2</sub>	Oxygen
O <sub>3</sub>	Ozone
OECD	Organisation for Economic Co-operation and Development
OIEC	Oil Industries Engineering & Construction
Oligocene	An epoch of the early Tertiary period, after the Eocene and
	before the Miocene; corresponding worldwide series of rocks
Onen eut ense els	(37 to 23 million years ago)
Open cut crossing	Standard trenching technique for crossing a water body or
OPIC	1080 Oversees Drivets Investment Corporation
OFIC	Mountain huilding process
	A A A A A A A A A A A A A A A A A A A
OWS	Oil Spill Response Plan Oily Water Separator
Owg Oxygen scavengers	Chemicals that convert available oxygen into an unreactive
oxygen stavengers	form
P&ID	Process and instrumentation drawings
PAH	Poly Aromatic Hydrocarbons
Palaeocene	An epoch of the early Tertiary period, after the Cretaceous
	period and before the Eocene: corresponding to all rock aged
	65 to 53 million years. This started right after the dinosaurs
	died away
Palaeogene	An interval of geologic time incorporating the Palaeocene,
	Eocene, and Oligocene of the earlier Tertiary
Palaeolithic	Period of the emergence of primitive man, approximately 2.5
	to 3 million years ago
Pathway	Chain of reactions associated with a particular metabolic
	process
PCB	Polychlorinated biphenyl
PCDP	Public Consultation and Disclosure Plan
PCE	Lype of Chlorinated Solvent
	Programme Coordination Unit
	Polential Evapotranspiration
	FILLESS NOW DIAVIAN Measure of acidity / alkalinity
Pia	Pipeline Integrity Gauge
Pigging	
	The process of cleaning or measuring internally the pipeline
	The process of cleaning or measuring internally the pipeline whereby a gauge is sent though the line to scour /measure the
	The process of cleaning or measuring internally the pipeline whereby a gauge is sent though the line to scour /measure the inside of the pipeline
PIN	The process of cleaning or measuring internally the pipeline whereby a gauge is sent though the line to scour /measure the inside of the pipeline Inlet pressure
P <sub>IN</sub> PIP	The process of cleaning or measuring internally the pipeline whereby a gauge is sent though the line to scour /measure the inside of the pipeline Inlet pressure Priority Investments Portfolio
P <sub>IN</sub> PIP Pipe yard	The process of cleaning or measuring internally the pipeline whereby a gauge is sent though the line to scour /measure the inside of the pipeline Inlet pressure Priority Investments Portfolio The area used to store pipes prior to being transported to the
P <sub>IN</sub> PIP Pipe yard	The process of cleaning or measuring internally the pipeline whereby a gauge is sent though the line to scour /measure the inside of the pipeline Inlet pressure Priority Investments Portfolio The area used to store pipes prior to being transported to the spread
P <sub>IN</sub> PIP Pipe yard Pleistocene	The process of cleaning or measuring internally the pipeline whereby a gauge is sent though the line to scour /measure the inside of the pipeline Inlet pressure Priority Investments Portfolio The area used to store pipes prior to being transported to the spread An epoch of the Quaternary period, after the Pliocene of the

	Tertiary and before the Holocene; corresponding to all rocks aged 1.6 million years ago to 10,000 years
Pliocene	An epoch of the Tertiary period, after the Miocene and before
	the Pleistocene; also, the corresponding worldwide series of
PM	Particulate Matter
PM <sub>40</sub>	Particulate matter of less than 10 um aerodynamic diameter
	Outlet pressure
PPAH`	Pollution Prevention and Abatement Handbook (World Bank
	Publication)
ррb	Parts per billion $(10^3)$
ppm	Parts per million (10°)
ppmv: pPDB	Parts per million by volume
PRS	Pressure Reduction Station
PSA	Production Sharing Agreement
QA	Quality Assurance
QRA	Quantified Risk Assessment
Quarternary	The second period of the Cenozoic era, following the Tertiary;
	also the corresponding system of rocks. It began 2 to 3 million
DAD	years ago and extends to the present
KAP	Tuesday seems this is evolving to LARAP2 Land Acquisition
	and Resettlement, etc
RDB	Red Data Book
Receptor	The receiver of an input or stimulus
Reference time interval - T <sub>r</sub>	The specified interval over which an equivalent continuous A-
	weighted SPL is determined
Reinstatement crew	The crew that replaces topsoil, vegetation, tences etc. once
Reinstatement NB One	The process of restoring the area to its prior state after
word	pipeline laying
Residual impact	Potential impacts remaining after mitigation measures have
	been adopted into a project
Residual noise	The ambient noise remaining at given position in a given
	situation when the specific hoise source is suppressed to a
RH	Relative Humidity
Richter scale	A logarithmic scale for expressing the magnitude of an
	earthquake, ranging from 0 to 8
Rip-rap	Large stones blocks from a quarry and which are placed on a
	river bank to prevent erosion. The stones are sometimes
Biek	embedded in concrete
IT ISK	dangerous conditions or materials
ROW	The strip of land in which the pipeline will be laid. Sometimes
	used (incorrectly) to refer to the working width, the area
	cleared for pipeline construction and subsequently reinstated,
	which includes the ROW
RSK	The company RSK Environment Ltd
	Kemote Lest Unit
Sconing	The process of identifying the key environmental and social
	issues associated with a project and seeking agreement with
	interested parties about how these are to be addressed in the
	EIA and SIA process
SCP	South Caucasus Pipeline (previously termed Shah Deniz Gas
25	Pipeline)
20	Shan Deniz

Sensitivity SIA	The level of response to a received stimuli Social Impact Assessment - the process of collecting data, consulting with interested parties, assessing significant social impacts and defining mitigation measures
Sm <sup>3</sup>	Standard Cubic Metre
	Sulphur dioxide
SOCAR	State Oil Company of Azerbaijan Republic
Source	The point or place from which something originates
SOx	
Specific noise level - L <sub>aeq,Tr</sub>	The equivalent continuous A-weighted SPL in dB at the measurement position produced by the specific noise source
Specific noise source	over a given reference time interval, in integer units The noise source under investigation for assessing the likelihood of complaints
Spent catalyst	Waste catalyst in which the active component has been fully
	consumed
SPL	Sound Pressure Level
Spread	All the personnel and equipment necessary to carry out all stages of construction
Spread technique	The system whereby several different sequential construction
-p	phases are in process at one time along the pipeline length
SSC	Suspended Sediment Concentration
SSL	Suspended Sediment Load
SSM	Start-ups/Shutdown/Malfunction
STD	Sexually Transmitted Disease
Steady noise	Noise that gives fluctuations over a range not more than 5 dB
-	on a sound level meter set to frequency weighting "A" and time weighting "S"
Stone Age	
STP Stringing grow	Sewage treatment package
Stringing crew	them out along the Right Of Way ready for welding
Survey crew	The crew that undertakes the initial topographical and
	alignment surveys of the pipeline route
Suspended solids	Solid material held in suspension by the energy of water in a
Sweet network and	stream, river or discharge
Sweet natural gas	Natural gas which has a low sulphur content Social Assessment Company based in Baku
TACIS	The Tacis Programme (launched by the EC in 1991) provides
	grant-financed technical assistance to 13 countries of Eastern
	Europe and Central Asia, including Azerbaijan
	Type of Chlorinated Solvent
TCN	Type of Chiofinated Solveni Third Country National – someone from outside Azerbaijan or
	the nationality of a contracting company
TDS	Total Dissolved Solids
TEG	Thermo electric generators
Telecoms	Telecommunications
TMP	Traffic Management Plan
TOC	Total Organic Carbon
ТРАО	Turkish Petroleum Anonim Ortaglygy
ТРН	Total Petroleum Hydrocarbons
TRACECA	EU-funded transport corridor project linking Europe to Asia
Transformer rectifiers	Equipment to transform high voltage AC to lower voltage DC
Trenching crew	The crew that excavates the trench for the pipeline

тv	Television
TSS	Total Suspended Solids
UAE	United Arab Emirates
UHC	Unburned Hydrocarbons
UK	United Kingdom
UN	United Nations
UNAIDS	Joint United Nations program on AIDS/HIV
UNDP	United Nations Development Programme
UNHCR	United Nations High Commission on Refugees
UNICEF	United Nations Children's Fund
UPS	Uninterrupted Power Supply
URS Dames and Moore	The company URS Dames and Moore Ltd, the UK operating
	company of the URS Corporation of San Francisco
USA	United States of America
US\$	United States Dollar
US EPA	United States Environmental Protection Agency
US Ex Im	United States Export Import Bank
UV	Ultra-Violet
VLCC	Very Large Crude Carriers
VOCs	Volatile organic compounds
WBG	World Bank Group
Welding crew	The crew that welds the pipeline sections together
WHO	World Health Organization
WMP	Waste Management Plan
Wobbe index	The Wobbe-index reflects the gas/air relationship and
	combustion characteristics that express the heat impact which
	a burner is exposed to during combustion
Working width	The area within which the pipeline installation takes place,
	including topsoil and subsoil storage
Wrapping crew	The crew that wraps the pipeline (normally at joints) with anti-
	corrosion tape, FBE epoxy or other surface coating prior to
	testing and acceptance
WREP	The existing Western Route Export Pipeline oil pipeline
	operated by AIOC between Baku, Azerbaijan and Supsa,
	Georgia
ZVI	Zone of visual influence

### 2.2 GLOSSARY OF AZERBAIJANI PLACE NAMES

Agdash Agdjaqovak Akhindjachay Akstafa Akstafachay Agsu Canal Alabashli Aly Bayramly Alikend Alimerdanli Alpout Alyat Amirarckh Amirarh **Anatolian Plateau Anver Memmedhanly** Apsheron Araks Aran Arazli Arshaly Asaqy Leky Ashagi Mulkulu Ashagy Agasybeyli Ashagy Garhun Ashagy Kesamanly Azimkend Azizbeyov Azraildag Baku Barda **Bashirly Bayramly Big Harami range** Borsunlu **Boyuk Kesik Bumchav** Chaparhy Chirag, Azeri and Gunashli Chivny Chokhranly Daghkesemen Dallar-Tovuz **Dellyar Dashbulak** Dellercirdaxan Dallyar Djeir Dalimamedli Deller Dellercirdaxan Djeyrankechmes Djingir Durandar

Town and District Village Tributary of the Tovuschay Town and district River River, canalised at crossing point. (crossed at KP 111.2) Pipe vard/railway sidings Village Village Village A village in Udjar Town, location of meteorological station Oil exploration field Village Plain area Village District and also a peninsula River Village and location of refugee camp River Village Village Village Village Village Village Village Village Archaeological site Capital city of Azerbaijan Republic Village Village Village Mountain range east of Shirvan plain Village Village Tributary of Turianchay Village Oil fields in the AIOC contract area Village Village Village Hydrocarbon exploration field Village Village Village Hydrocarbon exploration field Village and pipe yard Village Wadi (crossed at KP 9.3) Archaeological site Range of mountains and mud volcanoes towards eastern end Duzdak Duz Kirikli Dzegamchay Erevanly Eyvazlilar Farhraly Fizuli Ganja Ganjachay Gancachav Garaarh Garaberk Garadaq Garagemirly Geokchay Giragkasaman Gashgarachay Gobustan Goran Geranbov Geychay Goranchay **Great Caucasus** Gurudere Gulabend Gurbanzade Guvekend Hadgiqabul Harami Hanitlu Hasansu Hodjaly Indjasu River Jandar Jinli Boluslu Jingirdag Kadily Karabakh Karabach canal **Karabach Plain** Karadagly Karadaq Karadjally Karasu Karayazi Karrar **Karrar Station** Kasum Ismailov Kazakh Kazambulak Kazi-Magomed Kazyan Kechily Kechvely Khanlor Khatunli

of the WREP Village Village River Village Village Village Village District and city River (crossed at KP 296) River (crossed at KP 298.4) Village Village District Village River (crossed at KP 171.3) Hydrocarbon exploration field River (crossed at KP 316.7) Area to east of pipeline route, some of which is proposed for designation as a National Park. Railway Station Town and district Village River (crossed at KP 257.8) Region of high earthquake density River Village Village Village Town/District Exploration drilling field (north of Kazi-Magomed) Village River (crossed at KP 397.8) Village River Lake Village Archaeological site Village Region Canal and location of one of the key archaeological sites (crossed at KP 245.1). Plain from Kura River to Goran railway station near Goranboy Larger village Pipe yard/sidings and archaeological site Village and exploration drilling field River (crossed at KP 320.9) / Village Wetland area and Nature Reserve Village Village Village Region to the south-west of the WREP Village Town (the old name for Hadgigabul) Village Village Village Village Hydrocarbon exploration field

Khatinly Village (also Khatynly) Village Kirikli Kirah Kesemen Village Koch Nohur Archaeological site Kolkhozkend Village Korchay River (crossed at KP 292) **Koshkarchay River** River River (crossed at KP 223.6 & 411) Kura Kurudera River (crossed at KP 422.3) Kurekchav River (crossed at KP 276.5) Kurdemir District and Town Kurzan Location of hydrological station on the Kura Village and location of proposed pipe yard Leki Lyak Village Mahmudlu Village Oil exploration field Miaidjik Mingechaur Town and location of major water reservoir Mugan Village Muzdurlar Village Nadirkend Village Nakhichevan Region of Azerbaijan separated from the rest of the country by Armenia. Naftalan Town Narimanabad Village Neymatabad Village Otman Bozdag Mud volcano, NW of Sangachal Terminal Padar Village and exploration drilling field Pirsaat Village Wadi (crossed at KP 42.1) Pirsagat Village and station. Location of 2nd crossing of Kura river. Poylu Possible location of construction camp Puta Village, location of meteorological station Qarasu Village Ramal Village Randibar Village Ranzbarilar Village Sabirabad Village Sadixly Village on the Azerbaijan / Georgian border adjacent to the pipeline crossing point. Village Salakhly Salaxli Village Saloglu Village Sametobad Village Samukh District Sangachal Town south of Baku and location of AIOC oil receiving terminal. Origin of WREP, NREP and SDGP. Sarov Village Sarysu River (crossed at KP 316.1) Sary Tepe Village Sevidlyar Village Shabran Town Shahlig Village Shak Gaya Tie-in point of pipeline from Sangachal with existing Baku-Akstafa products line. Town/District Shamkir Shamkirchay River (crossed at KP 332) Sheki Village in the Great Caucasus Shemaka Village in the Great Caucasus, subject to high seismic activity/District.

Shilyan	Lake
Shirvan	City/ Region
Shirvan Plain	Plain from Ranjbar to Kura River
Sigirly	Village
Small Caucasus Plain and	Geomorphological section between Goran railway station and
Lowland	border.
Small Harami	Hydrocarbon exploration field
Solakhay	Hydrocarbon exploration field
Soyuk Bulak	Village
Sumgayit	City
Talish	Village
Taza Shilyan	Village
Terkblaga	River
Tourgay	Oil exploration field
Tovuz	Region
Tovuzchay	River (crossed at KP 377.1)
Transcaucasia	Area in the Caucasus Region
Turagay	Hydrocarbon exploration field and mud volcano
Turianchay	River (crossed at KP 193.5)
Ujar	Town/District
Usubvurulan	Sites of pottery – village
Villa Petrolea	BP Emergency Response Centre.
Yaharchi Gazahlar	Village
Yaldily	Village
Varvara	State Hunting Area
Yeni Shiximly	Village
Yevlakh	Town and Administrative region
Yolpak	Village
Zardob	District/City
Zeyem	Village and proposed pipe yard location
Zayamchay	River (crossed at KP 357)
Zelimhan	Village
Zurnobad	Village

# 2.3 LATIN NAMES

Table 24 Latin Names for Flora

Latin Name for Flora	Common English Name (where	Azeri Name	Russian Name
	appropriate)		
	Lower Plant	S	
Amblystegium serpens*		と さ と さ と さ	<i>¿¿¿</i>
Brachythecium mildeanum*		<b>さこここ</b>	<i>¿¿¿</i>
Campylium chrysophyllum*		<i>とことこと</i>	<i>żżż</i>
Fissidens taxifolius*		22222 2222222242 2	غغغغغغغغغغ غغغ
	Higher Plan	S	
Alhagi pseudoalhagi	camel prickle	<i><b>さ</b>ここととととととととととととととととととという。</i>	222222222 2222222
Allium rubellum	onion spp.	22222 22222 22222	¿¿¿¿¿¿¿¿¿¿¿
Alyssum desertorum	alisons spp.	<i><b>さとこととととと さんしと</b></i>	22222222222222
Artemisia fragrans	mugwort spp.	さ ううううう ううううう	<i>     \black \lambda \</i>
Atriplex tatarica	orache spp.	22222 22222	غغنغن غنغنغنغ
Bolboschoenus maritimus	sea club-rush	<i><b>さええええ えんしん</b></i>	222222222222222222222222222222222222222
Bromus japonicus	thunberg's brome	<i><b>は</b>えんえんえん えんえん</i>	خنخنخن خنخنخن
Calamagrostis	small reed spp.	<i><i><i><b>よ</b>よよよよよよよよよよよよ</i></i></i>	\$
pseudophragmites			
Capparis spinosa	spineless caper	<i><b>よよよよよよ よよよよよ</b></i>	333333 3333333
Carpinus caucasica	caucasian hornbeam	555555 555555	3333 333333333
Cichorium intybus	chicory	ا ئ ئائائانىڭ ئا ئا ئ	<i>     \diababbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb</i>
Clematis vitalba	travellers joy /old mans beard	<b>さささささ</b>	خنخنخنخنا للكنا للمناها للمناها للمناه المستحد المستحد المستحد المستحد المستحد المستحد المستحد المستح المستحد المستحم المستحد المستحد المستحد المستحد المستحد المستحد المستحم المستحد ال
Crataegus spp	hawthorn spp.	とんとんとん しょうしょう	22222272722222222222222222222222222222
Cynanchum acutum	stranglewart	<i>2 22 222222222</i>	<i>     \distantial \distantia \distantial \distantia \distanti \distantia \distantia \distantia \distantia \distantia \distant</i>
Cynodon dactylon	bermuda-grass	<i><b>はしとしと ととしとしとしとし</b></i>	خذذذذذذ ذذذذذذ ذذذذذذذ
Cyperus longus	galingale	<i>خۇخۇخۇخۇخ ئورىكە ئورىكە ئورىكە ئورىكە ئورىكە ئورىكە ئۇرۇپۇ ئۇرۇپۇ ئۇرۇپۇ ئۇرۇپۇ ئۇرۇپۇ ئۇرۇپۇ ئۇرۇپۇ ئۇ ئۇ ئۇ ئ</i>	222 di la calendaria di la
Datura stramonium	thorn-apple	<i>ذذذذذذ المحالية المحالي</i>	<i>¿¿¿¿¿¿</i>
Elaeagnus angustifolia	oleaster spp.	222222222222	333 333333333 3
Elaeagnus spp	oleaster spp.	5555	3333 3333
Eleocharis palustris	common spike rush	2222225	22222222
Elymus repens	common couch	ننن خنذ خنذ	ننننن ننننننن غننند ننننن

じんしんしんしんしんしん しんしんしんしん كككككككككك ككككككككككككك 7777777777 777777777777777777777777 **Russian Name** كككككككك ككككككككك 7 77777 77777777777777777777777777 **2222 2222222222222** ととととならならる シフククシアクタクク فكككككككك كككككككك كمك しととととととと ととととととし ととととととととと とととととと 77777 77777777777777777 2222222 222222 7777777 7777777 22222 22222 222222 222222 2222 2222 *ここここ い* **222 222 2222222222** Azeri Name 22222 よるう ううううう うくうち うくろう 22222 222222 2222222 22222222 22222 2222222 222222 2 22222 22222222222222222 22222 22222 *さここここここここここ* 2222 よ×よよ よよよよよ 222222 222 222222 22222 <u>ن ۲۲۲۲۲۲۲۲۲۲۲۲ ۲</u> 2222 2222222 222222222222 ひょう シックショング 2222 2222 *ここここにいいい* 222 2222 22222 2222222222 *ننن ننن* 22222222222 0000000 ととととと 202 **Common English Name (where** appropriate) common or black mulberry tree perfoliate pepperwort glabrose liquorice purple loosestrife sea lavender spp. sea lavender spp caucasian orchid water-milfoil spp. water cress spp. sun spurge spp. wall barley spp. sea buckthorn common privet rye grass spp. common reed plantain spp. jointed rush bur-medick grass spp. grass spp. mint spp. ephedra ash spp. iris spp ivy ī Latin Name for Flora Halocnemum strobilaceum Hippophae rhamnoides Eremopyrum orientale Euphorbia helioscopia Eremopyrum triticeum Lepidium perfoliatum Phragmites australis Hordeum leporinum Karthamus glaucus Kalidium caspicum Limonium spicatum Merendera trigyna Glycyrrhiza glabra Juncus articulatus Ligustrum vulgare Medicago minima Noaea mucronata Plantago praecox Limonium meyerii Myriophyllum spp Lythrum salicaria Orchis caucasica Ephedra procera Nasturtium spp Lolium rigidum Fraxinus spp Iris acutiloba Hedera helix Morus nigra Mentha spp

Latin Name for Flora	Common English Name (where appropriate)	Azeri Name	Russian Name
Poa bulbosa	bulbous meadow-grass	222222222222222222222222222222222222222	11111111111111111111111111111111111111
Polygonum hydropiper	water-pepper	22222222	¿¿¿¿¿¿ ¿¿¿¿¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿
Populus canescens	grey poplar	222222222	11111111111111111111111111111111111111
Populus nigra	black poplar	2222	<i>\$</i>
Populus spp	poplar spp.	2222	<i>333333 3333</i>
Potamogeton spp	pondweed spp.	55555555	<i>\$</i>
Pulicaria uliginosa	fleabane spp.	11111111111111111111111111111111111111	33333333 33333333
Punica granatum	pomegranite	٤٤٤ ٤٤٤	<i>\$</i>
Quercus longipes	vardim oak	<i>خخخخخخ</i> فخخخخ	<i>ذذذ ذذذذذذذذذذذ ذذذ ذذذ ذذذ</i>
Quercus pedunculiflora	oak spp.	22222	555 ST
Quercus robur	pedunculate oak	2225	غغغغ غنغ غنغ غني المستحد المستح المستحد المستحد
Ranunculus spp	buttercup spp.	222222222	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Rosa spp	rose spp.	555555	5555 5555 5555 5555 5555 5555 5555 5555 5555
Rubus sanguineus	bramble spp.	\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$	2222222 222222
Rubus spp	bramble spp.	222222222222222222222222222222222222222	¿¿¿¿ ¿¿¿¿¿¿¿
Salicornia europaea	common glasswort	111111 111111 111111	111111 1111111111111
Salix australis	willow spp.	5 2222 22222	ﻧﻨﻨ ﻧﻨﻨﻨﻨ
Salix spp	willow spp.	<i>خخخخخ خخخخ</i>	غغغ غغغغ
Salsola crassa	saltwort spp.	غغغغ غغغغ	<i>خۇخۇخۇخۇخۇخۇخۇخۇخۇخۇخۇخۇخۇخۇخۇخۇخۇخۇخۇ</i>
Salsola dendroides	saltwort spp.	<i><b>よよよよよ よよよよよよよ</b></i>	¿¿¿¿¿¿¿¿¿ ¿¿¿¿¿¿ ¿¿ ¿¿¿¿¿ ¿ ¿ ¿ ¿ ¿ ¿
Salsola ericoides	saltwort spp.	222222 22222	222222222222222222222222222222222222222
Salsola nodulosa	saltwort spp.	22225	<i>ئڈڈڈڈ ڈڈڈڈڈڈ ڈڈڈڈڈڈ</i>
Salsola paulsenii	saltwort spp.	<i><b>よよよよよよ よよよよよよ</b></i>	11111111111111111111111111111111111111
Sambucus nigra	elder	ندندن دورورورورورورورورورورورورورورورورورورور	<i>¿¿¿¿¿ ¿¿¿¿¿¿ `````````````````````````</i>
Silybum marianum	milk thistle	22222	<i><i><i><b>111</b></i></i></i>
Smilax excelsa	greenbriar spp.	333333 333333	<i>3333333 3333333</i>
Stipa szowitsiana	needle grass spp.	ن <i>خذخذ خذخذ خ</i>	ننننن ننننن نننند نندند

Latin Name for Flora	Common English Name (where appropriate)	Azeri Name	Russian Name
Suaeda altissima	sea blight spp.	٤،،،، ،، ،، ،، ،، ،، ،، ،، ،، ،، ،، ،، ،	<i>     \black \lambda \</i>
Suaeda confusa	sea blight spp.	<i><b>さええええ えんえんえん</b></i>	<i>\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\</i>
Suaeda dendroides	sea blight spp.	2222 222	<i>¿¿¿¿¿¿¿¿¿¿¿¿¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ </i>
Suaeda microphylla	sea blight spp.	2222222222222	<i>¿¿¿¿¿¿¿¿¿¿¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ </i>
Suaeda australis	sea blight spp.	<i>としとし</i>	<i>とととと</i>
Tamarix ramosissima	tamarisk spp.	<i><b>3333333333</b>33 3333333</i>	<i>ᲐᲐᲐᲐᲐᲐᲐᲐ ᲐᲐᲐᲐᲐᲐᲐᲐᲐᲐ</i>
Torularia contortuplicata	-	222222 222222	<i><i><i>iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii</i></i></i>
Typha latifolia	bulrush	33333333333 333333	<i><i><i><i>ააააა აააააააააააა</i></i></i></i>
Typha spp	bulrush spp.	<i>خخخخخخخخ خخخخخ</i>	<i>しししし しょうし しょうし しょうし しょうし しょうし しょうし しょうし</i>
Ulmus carpinifolia	smooth elm	555555	<i>333 3333333333</i>
Ulmus foliacea	smooth-leaved elm	222222	<i><i><i><i>i</i> i i i i i i i i</i> </i></i>
Vitis sylvestris	woodland grape	٤ ۵ ۵ ۵ ۵ ۵ ۵ ۵ ۵ ۵ ۵ ۵ ۵ ۵ ۵ ۵ ۵ ۵ ۵ ۵	11111111111111111111111111111111111111
Xanthium spinosum	cocklebur spp.	222222 222222	<i><i><i><b>よししししし</b></i></i></i>
Zerna rubens	brome spp.	<i><b>3333333</b>33333333333333333333333333333</i>	<i>4444444444444444444444444444444444444</i>

Note: \* These lower plants have no Azeri and Russian names.

**Table 2-2 Latin Names for Fauna** 

Latin name for Fauna	Common English name ( where appropriate )	Azen Name	Kussian Name
	Inverte	brates	
Anchylocheria salomoni	beetle spp.	<i><b>えんしんしんしんしん しんしんしん</b></i>	<i>     \black bblack bbl</i>
Anthophora nigriceps	bee spp.	<i>ししし</i>	<i>22225</i>
Astacus pyzołwi	crayfish	غغذ غذار المعلم الم المعلم المعلم	غغغغ غنغنغة
Bombus argillaceous	bumble -bee spp.	غغغغ المنافع المستحد مستحد مست	2222
Bombus daghestanicus	daghestan bumble bee	خدخذذ خذذذذذ فذذذذذ فذذذذذذ	11111 11111111111111111111111111111111
Bombus lagsus	bumble bee spp.	<i>ذذذ ذذذذذ المحمد ال</i>	<i>ここととし、</i>
Bombus muscorum	bumble bee spp.	غ <i>ذ</i> ذ المراجع ال	2225
Bombus persicus	bumble-bee spp.	22222 22222 2222	222222222222
Coenonympha saad	heath spp. of butterfly	222222 2222	خذذذذذذذ المراسبين
Colias aurorina	clouded yellow spp.	2222222 222222	122111 122 122 122 122 122 122 122 122
Daphnis nerii	oleander hawkmoth	<i>ذذذ ذ ذذذذذ</i>	2222222 2222222222
Iphiclides podalirius	scarce swallowtail	222222	2222222
Manduca atropos	death's-head hawkmoth	222 2222 2222	خدخدخد خاخانا المرابع ممرابع الممرابع المرابع المرابع المرابع المرابع المرابع المرابع
Megacephalus euphraticus	beetle spp.	غۇغىغە ئەرمەر بىلىكە ئەرمەر بىلىكە ئەرلىكە ئەرلىكە ئەرلىكە ئەرلىكە ئەرلىكە ئەرلىكە ئەرلىكە ئەرلىكە ئەرلىكە ئەر مەربىيە ئەرلىكە	<i>¿¿¿¿¿????????????????????????????????</i>
Melitturga clavicorris	bee spp.	<i>ذذذذذ ذذذذذ فذذذذذ</i>	<i>ئۇنۇنۇنى ئ</i>
Papillo machaon	swallowtail	<i>しししし</i>	22222
Tomares romanovi	hairstreak spp.	<i><b>ししししししし しししししし</b></i>	<i>33333333 33333333</i>
Xylocopa valga	bee spp.	غذذ ذذذذذذ المراجع الم المراجع المراجع	¿¿¿¿¿¿¿¿¿
	H	sh	
Abramis brama orientalis	caspian bream	<i>しししし</i>	111 111 111 111 111 111 111 111 111 11
Abramis sapa bergi	white-eyed bream	<i>ししし</i>	<i>\$</i>
Acanthalburnus microlepis	blackbrow	<i>ذذذذذذ</i>	
Acipenser nudiventris	sturgeon spp.	<i>し</i> んしんしん	نننن نننن در المعلم المعلم المعلم المعلم
Barbus brachycephalus	barbel spp.	<i>¿¿¿¿¿¿ ¿¿¿¿¿ ¿ ¿¿¿¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ ¿ </i>	نئئنئنئن نئنئن فننك
Barbus capito	chanari barbel	222222	2222-22222
Barbus mursa	murtsa barbel	<i>し</i> ししし	المالمان المالية الم
Caspiomyzon wagneri	caspian lamprey	22222 222222222	222222 222222222
Cyprinus carpio	common carp	<i>し</i> しし しょうしょう しょうしょ しょうしょう しょうしょ しょうしょ しょう しょう	22222

Latin name for Fauna	Common English name ( where appropriate )	Azeri Name	Russian Name
Leuciscus cephalus	chub	222222	222222
Pelecus cultratus	ziege	とととととととく ひょうしょう ひょうしん しょうしん しょうしん しょうしょう しょう	<i>とことととし</i>
Rutilus rutilus caspicus	caspian roach	<i>と</i> よ <i>と</i> よ	<i>     \black b b b b b b b b b b b b b b b b b b b</i>
Salmo trutta	brown trout	よよよよよ よよよよよよよよよ	<i><i><i><i>ააააა ააააააააა</i></i></i></i>
	Amph	ibians	
Bufo bufo	common toad	2222 2222 2222	ن <i>خان خانخانخان</i> انان کارز کارز کارز کارز کارز کارز کارز کارز
Bufo viridis	green toad	خذذذذ ذذذذ ذذذذ ذذذذ	2222222
Hyla arborea	european tree frog	غغغ غغغان غنغنغ غنغن غني المعلم ال	<i>خۇخۇخەن خەرەپەرەپەرەپەرىيا بارىيا بارىي</i>
Pelobates syriacus	eastern spadefoot toad	222222 2222222222222222222222222222222	<i>¿¿¿¿¿????????????????????????????????</i>
Rana ridibunda	marsh frog	<i>خخخ</i> ئەرەر ئەرەر ئەرەپ ئەرە ئەرەپ ئەرەپ ئەر	$\dot{c}$
	Generation	tiles	
Agama caucasica	caucasian agama	غغغغغ غنغغة المستحدة ا	نغنغنغ غنغنغنغ
Clemmys caspica	freshwater terrapin spp.	<i>     \black b b b b b b b b b b b b b b b b b b b</i>	<i>\$</i>
Coluber schmidti	schmidt's whipsnake	<i>よよよよよ よよよよよ</i>	22222 222222
Cyrtopodion caspicus			
Elaphe hohonackeri	ladder snake spp.	<i><i><i><b>よよよよよよよよ よよよよよよよ</b></i></i></i>	<i><i><i><i>ააააა ააააააააააა</i></i> <i></i></i></i>
Emys orbicularis	european pond terrapin	<i><i><i><b>よよよよよよよ よよよよよよよ</b></i></i></i>	<i><i>~~~~~~~~~~~~~</i></i>
Eremias velox	rapid fringe-toed lizard	ፊ ፊፊፊ ፊፊፊፊፊፊፊፊፊፊፊፊ ፊፊፊ ፊ	<i>333333 333333</i>
Eryx jaculus	caucasian sand boa	<i>خخخخ خان خان خان خان خان خان خان خان خان</i>	<i><b>ՆՆՆՆՆՆՆ ՆՆՆՆՆՆ</b></i>
Eumeces schneideri	long-legged skink	<i><b>ئئئئنگن ئ</b>ۇنگن</i>	<i>     \displaystyle \displayst</i>
Gymnodactylus caspius	gecko	<i>\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\</i>	<i><i>~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~</i></i>
Lacerta agilis	sand lizard	<i>خۇخۇچەر ئەرەپەرەرەرى يارىيا بارىيا بارىل</i>	<i>しょうこうこう ひょうひょう</i>
Lacerta saxicola	rock lizard	خذذذذذذ ذذذذذذ ذذذذذذ	<i>ذذذذذذ ذذذذذذ ذذذذذ</i>
Lacerta saxicola raddei	Azerbaijan rock lizard	<i>~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~</i>	<i><i><i><i><i>iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii</i></i></i></i></i>
Lacerta strigata	caspian green lizard	ﺧﯘﺧﯘﺧﯘﺧﯘﺧﯘﺧﯘﺧﯘﺧ	<i>ذذذذذذ ذذذذذ ذذذذذ</i>
Lacerta trilineata	balkan green lizard	<i>خخخخخخخ</i> مع المعالي ال	<i>     \black \lambda \</i>
Malpolon monspessulanus	montpellier snake	<i>33333 33333</i>	<i>2222 22 222222</i>
Natrix natrix	european grass snake	<b>333 3333333</b>	22 22222222222
Natrix tesselata	water grass snake	222222	22 2222222
Ophisops elegans	snakeeyed lizard	<i>~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~</i>	<i>~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~</i>

**Russian Name** 22222 22222 5666 66666666 6 ふっっ っっっ いっつううううううう *ننننن منننن* さささささ さささささ (よよよよよ) よよよよよ) 2222 22222222222 *よよよよよよ よよよよ* 222222222222 22222 22222 2222 222222 *ここここ ここここ* 222222222 ,22222 222222 52525 222225 22222 2222 2222 Azeri Name فككككك فكككك فكككك فككفك كمك فككف فككف **ここここう こここここ** ففففف ففففففف さささささささ さささ 222 22222222 *ننذن ذذ ذذذ*ذ とととととと ととと **2222 22222** 22222222222  $\frac{1}{2}$ 222222222 22222222 222222222 222222 2222 222 222 222 22222222 さささ さささ *iii ii* 222222 000000 22222 22222 222 Birds Common English name ( where appropriate ) lesser short-toed lark spur-thighed tortoise long-legged buzzard lesser spotted eagle white-tailed plover blunt-nosed viper squacco heron sociable plover golden eagle steppe eagle long-tailed tit stone curlew carrion crow tawny eagle grey heron hen harrier black stork white stork little egret kinafisher buzzard nightiar mallard chukar bittern neron egret roller quail rook Latin name for Fauna Caprimulgus europaeus Burhinus oedicnemus Calandrella lufescens Aegithalos caudatus Anas platyrhynchos Chettusia gregaria Aquila chrvsaet us Chettusia leucura Corvus frugilegus Coracias garrulus Aquila nipalensis Botaurus stellaris Coturnix coturnix Ardeola ralloides Aquila pomarina Egretta garzetta Alectoris chukar Testudo graeca Ciconia ciconia Circus cyaneus Vipera lebetina Corvus corone Ardea cinerea Ciconia nigra Alcedo atthis Buteo rufinus Aquila rapax Buteo buteo Egretta spp Ardea spp

**Russian Name** 22222 22222 22222 *čičičiči i čičičiči i* لكككك كككككك لمككك *პპპპპ პპპპპპპპპპპპ* 222222 2222222222 فففففف ففقفففف 22222 2222222222222 222222222222 222222 *とししししし しししししし* 222222 222222 *ذذذذذ-ذذذذذ* 222222222222 よよよよ よよよよ 222222 とととととと 222227 22222 22222 22225 20000 *とととととと とととととととととととと* Azeri Name 77777777 77777 77777 7777777 じんしんしん しんしんしんしん ふふふ ふうううううううううう 2222222 2222222 ككككككك كككككك 2 22272 22272 222727 22222222222222 2 22222 222222 2 <u>22 22 2222222222222</u> **~~~~~~~~~~~~**~~ *٤ ٤٤٤٤٤٤ ٤٤٤* 2222 2222222 277 777777777777 *よ*よよ よ よ よ よ よ よ よ よ よ *333 333333333333* 222 22222 22222222222 222 22225 2222222222 222222 いいいいい 200000 22222 Common English name ( where appropriate ) black-winged pratincole collared pratincole blue-cheeked bee-eater red-crested pochard isabelline wheatear white-tailed eagle northern wheatear black-winged stilt finsch's wheatear egyptian vulture blue rock thrush eurasian kestrel house sparrow black francolin oystercatcher great bustard lesser kestrel white wagtail calandra lark night heron crested lark little bittern herring gull black kite bee-eater great tit blue tit osprey crane coot gull jay Latin name for Fauna Melanocorypha calandra Himantopus himantopus Haematopus ostralegus Neophron percnopterus Francolinus francolinus Merops superciliosus Nycticorax nycticorax Oenanthe isabellina Oenanthe oenanthe Garrulus glandarius <u>Glareola nordmanni</u> Glareola pratincola Ixobrychus minutus Monticola solitarius Passer domesticus Haliaeetus albicilla Pandion haliaetus Oenanthe finschii Falco tinnunculus Galerida cristata Larus argentatus **Werops** apiaster Parus coeruleus <sup>c</sup>alco naumanni Milvus migrans Motacilla alba Parus major Netta rufina Fulica atra Grus grus arus spp Otis tetrax

Russian Name ننننننن نننننن よううううううう マクククク 2222222 22222222 とくくていい ママクシアクト 222222 2222222 2222222222 222222 22 222222222222222 222 222222222222 2222222 22222 さささささ さささささ *よよよよよ よよよよよ* 2222 22222222 *こここと こここ*こ 222222222222 *とことととといい* じるさるさるる 277777777777 2 2222227 22222222 22222 2 222' 2 2221 2222 ﺧﺪﻙ ﺧﺪﺩﺩﺩﺩﻩ ﺧﺪﻩ ﺧﺪﻩ ﺧﺪﻩﻩ ﺧﺪﻩﺩﻩ Azeri Name 77777 777777777777777 222222 222222 2222 22222222222222222 22222 22222222222 222222222222222 *はしはし しししし* 22222 22222 22222 22222 *ن ن ن ن ننننن*نن ذذذذذذذذ فرذذذ 222222 222 222 222222 2222222222 22222222 *さこここことここ* 0000000 0000 222222222 とことこここと 2222222 22222 22222 Mammals Common English name long-tailed white-toothed shrew ( where appropriate ) eastern european hedgehog common wood mouse mountain asian jerboa striped field mouse desert serotine bat pygmy cormorant forest dormouse honey buzzard purple gallinule ruddy shelduck barbastelle bat grey partridge grey hamster golden jackal tree sparrow little bustard small jerboa wild field cat sand martin water vole glossy ibis cormorant blackbird water rail red deer magpie reed cat starling wolf Latin name for Fauna Phalacrocorax pygmeus Barbastella barbastellus Cricetulus migratorius Crocidura guldenstaedti Apodemus sylvaticus Phalacrocorax carbo Porphyrio porphyrio Apodemus agrarius Tadorna ferruginea Plegadis facinellus Erinaceus concolor Allactaga williamsi Arvicola terrestris Dryomys nitedula Passer montanus Eptesicus bottae Rallus aquaticus Sturnus vulgaris Pernis apivorus Allactaga elater Cervus elaphus Riparia riparia Turdus merula Perdix perdix Canis aureus Fetrax tetrax Canis lupus Felis chaus Felis lybica Pica pica

	Common English name ( where appropriate )	Azeri Name	Russian Name
wild cat	5355	ﺧ ﺧ ﺧ ﺧ ﺧ ﺧ ﺧ	22222 222222
goitered gazelle	んし しょうしょう しんしょう しんしょ しんしょ	ذذذ	222222
edible, fat or squirrel-taile	d dormouse   ????	<i>と</i> よ よ よ よ よ よ よ よ よ よ よ よ よ よ よ よ	2222-22222
long-eared desert hedgeh	og/ear shrew	1111 IIII	111111 July 200
striped hyaena	5225	222	2222
porcupine spp.	2222	<i>53 33333333</i>	22222222 22222222222222222222222222222
brown hare	525	222222	5555-55555
eurasian otter	, ¿¿¿	ととととと	22222
eurasian badger	<b>さささ</b>	٤٤٤	22225
red-tailed sanderling	ا المراجعة	11111111111111111111111111111111111111	<i>\$</i>
brandt's hamster	5225	15 25225 222 222222	3333333 33333333333
gunther's vole	よ る る る る る る る る る る る	ささささ さささ さんさん	<i>خذخذخذ خذخ خذخان خذخان</i> المنافع المنافحة
vole spp.	よ る る る る る る る る る る る	· ??????	222222
schreiber's bat	555	22222222	222222222222222222222222222222222222222
house mouse	555	22222	2222 222222
coypu	2222	2222	22222
whiskered bat	5255	<b>ひひ ひひひひひ ひひ</b>	<i>3333333 333333</i>
shelkovnikov's water shr	.ew 5.5	11111111111111111111111111111111111111	
kuhl's pipistrelle	2222	ﻧ ﺧﻨﺨﻨﺨﻨﺨﺨ	22222222 2222
brown rat	5 222	<b>うシラシララ</b>	22222 22222
greater horseshoe bat	ندندن	ii iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii	
lesser horseshoe bat	5225	222222222	<i>     \black b b b b b b b b b b b b b b b b b b b</i>
wild boar	<b>さささ</b>	، ئەتەتەت	55555
pygmy white-toothed shree shre	ew/etruscan ???	، ٢٢٢، ٢٢٢، ٢٢٢،	333333333 3333333333
marbled polecat	5555	くくく	22222222
red fox	خذذذ	52	333333

# **INTRODUCTION**

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# 3 INTRODUCTION

The Baku-Tbilisi-Ceyhan (BTC) pipeline will be constructed to export crude oil reserves from the Caspian region to world markets.

This section introduces the BTC pipeline, and the Environmental and Social Impact Assessment (ESIA) work that has been conducted in relation to the project.

Azerbaijan Environment and Technology Centre (AETC) has been responsible for the production of this ESIA on behalf of BP/the BTC CO. URS Dames & Moore has produced an equivalent document for Georgia; and BOTAS / Environmental Resources Management Ltd (ERM) have produced the same document for Turkey. ERM has also contributed to the Social Impact Assessment (SIA) for all three countries.

### 3.1 THE BTC OWNERS AND BTC PIPELINE COMPANY

In October 2000, eight companies, lead by BP, formed a sponsor group to develop the BTC crude oil export pipeline as the base case option for the export of their future production – primarily from the Azeri, Chirag and Deepwater portion of the Gunashli (ACG) field (see Figure 3.1). These companies are known as the BTC Owners.

BOTAS, under the terms of a Lump Sum Turnkey Agreement (LSTKA) have been contracted to deliver the Turkish section of BTC, including the marine terminal at Ceyhan, on behalf of the BTC Owners.

In mid 2002 the BTC Owners will form a company that will be known as the BTC Pipeline Company or BTC Co.

BTC Co will be responsible for construction and operation of the proposed pipeline in both Georgia and Azerbaijan, with construction in Turkey falling under the control of the State Company BOTAS.



Figure 3-1 Location of the Azeri-Chirag-Gunashli (ACG) oil fields in the Caspian

BP has been nominated by the BTC Owners to lead the engineering design work for the project on behalf of the BTC Owners which currently includes the State Oil Company of the Azerbaijan Republic (SOCAR), Unocal, Statoil, TPAO, Itochu, Delta Hess and ENI (see Figure 3-2). Negotiations are currently under way with other companies about possible involvement in the project. BP is also taking the lead in managing the environmental and social issues associated with the developments, and it has been agreed that BP Health, Safety and Environmental (HSE) Policy will be adopted by BTC Co.

Figure 3-2 The BTC owner group



Throughout this document reference will be made to BTC Co as the organisation responsible for construction and operation of the pipeline in Azerbaijan and Georgia, and therefore responsible for implementation of the commitments made in this ESIA.

During the design phases of the BTC project several international engineering firms have been contracted to provide expertise and resources to support the development of the project. Fluor Daniel conducted early engineering work. Bechtel has undertaken the detailed engineering work for the BTC pipeline system. Bechtel and John Brown Hydrocarbons (the lead engineers for the proposed Southern Caucasus gas pipeline (SCP)) have been jointly responsible for all pipeline corridor and right of way (ROW) issues.

A bid process to select contractors to carry out the construction of the pipeline and associated above ground installations (AGIs) is under way, with contractors expected to be appointed sometime in the middle of 2002.

### 3.2 PROJECT RATIONALE

The Caspian region has abundant oil and gas reserves. The domestic demand for oil in the Caucasus and Central Asia is low and unlikely to grow in the near future. Most of the expansion in production will therefore be available for export. This export potential is severely constrained due to the land-locked geography of the Caspian and the very limited pipeline and rail networks serving the region. Oil exported from the Caspian is currently

transported by rail and/or pipeline to ports located on the east coast of Black Sea. From here the product is either transported to other ports on the Black Sea for further distribution within Central and Eastern Europe, or shipped via the Bosphorous Straits to the Mediterranean Sea and then onwards to world markets.

The BTC pipeline is being constructed in order to overcome the limited capacity of existing export options. At full capacity the pipeline will export one million barrels per day of crude oil from the existing Sangachal Terminal near Baku in Azerbaijan, through Georgia to Ceyhan in Turkey, where a new marine terminal is to be constructed. The pipeline will be buried for its entire length and has been selected to ensure that no communities will need to be re-settled. Initially the BTC pipeline will transport oil from the Azeri, Chirag and Gunashli (ACG) Phase 1 Full Field Development (see Figure 3-1), followed at a later date by crude oil from other phases of the ACG development as well as other regional crude oil streams.

The BTC pipeline is considered to be the most suitable method to transport crude oil from the Azerbaijan sector of the Caspian to world markets when environmental, economic and political factors are taken into consideration, as discussed further in Section 4, Alternatives.

One of the key benefits of the BTC project is that it enables Caspian oil to be exported to the open market without an incremental increase in the volumes of oil shipped through the Bosphorus Straits.

### 3.3 **PROJECT ALTERNATIVES**

During preliminary work relating to the BTC project, alternative options for the transportation of oil were considered. These options included road, rail and pipeline options, including the expansion of the existing Northern Route Export Pipeline (NREP), and/or expansion of the existing Western Route Export Pipeline (WREP).

Detailed investigations into the possibility of building a new pipeline were carried out, and on the basis of these considerations it was confirmed that the concept of transporting crude oil by pipeline from the Caspian to the Mediterranean, via Azerbaijan, Georgia and Turkey could be realised. In particular the project was considered to be a commercially viable and environmentally acceptable solution that was not contrary to the policies of either the host Governments or the Governments of the BTC Owners. A key consideration in arriving at this decision was the lower environmental risk associated with shipping through the Mediterranean rather than via the Bosphorous Straits.

A comprehensive route selection process was also followed to determine the optimum route for the line, considering political, environmental, social and engineering issues. The proposed route of the BTC pipeline across Azerbaijan, Georgia and Turkey is shown schematically in Figure 3-3.

A detailed analysis of project alternatives, including route selection, can be found in Section 4 of this document.



Figure 3-3 Map of BTC pipeline route

### 3.4 PROJECT DESCRIPTION

The proposed BTC pipeline will be approximately 1750km long and buried for its entire length. The 42" (1,066.8mm) diameter BTC pipeline originates at the Sangachal Terminal near Baku in Azerbaijan. Within Azerbaijan the new pipeline will, for the majority of its length, be constructed parallel to the existing Western Route Export Pipeline (WREP) operated by the Azerbaijan International Operating Company (AIOC). On reaching Georgia, the pipeline converts to 46" (1,168.4mm) diameter and runs west towards Turkey. Within Turkey, the pipeline reverts to 42" diameter and heads south to the Mediterranean port of Ceyhan

Construction is currently scheduled to start in the spring of 2003 and to be completed by the end of 2004.

Design of the BTC pipeline is being carried out at the same time as, and in alignment with, the design work for the SCP, which will transport gas from Azerbaijan to the Georgian-Turkish border. The proposed SCP will be approximately 690km long and will run parallel to the BTC pipeline between the Sangachal Terminal and the Georgian-Turkish border near Akhaltsikhe. The SCP has a planned completion date of one year after the BTC pipeline and is addressed in detail in a separate ESIA report.

Figure 3-4 provides an overview of the routes of the WREP, NREP, SCP and BTC pipeline.



Figure 3-4 Overview map of WREP, NREP, SCP and BTC pipeline

Detailed pipeline routing and engineering design is an interactive and ongoing process. This ESIA is based on the information currently available. As the engineering design develops more information will become available and will be subject to environmental review.

### 3.5 SCOPE OF THIS ESIA

### 3.5.1 Geographical extent

The subject of this ESIA report is the onshore section of the BTC pipeline within the territory of Azerbaijan. This is defined as the pipeline, and all associated facilities, between the fenceline of the Sangachal Terminal and the Azerbaijan-Georgian border.

In addition to the pipeline itself permanent facilities within Azerbaijan necessary for the first stage of the BTC development will include:

- An initial intermediate pigging station (to be further developed to include a pump station)
- Two additional intermediate pigging stations
- 21 valve stations
- A cathodic protection (CP) system
- A fibre optic cable
- A computer-based control system

A detailed description of the BTC project in Azerbaijan can be found in Section 5.

### 3.5.2 Project phasing

This ESIA describes the impacts that the BTC project that could potentially have upon the existing environmental and social conditions along the pipeline corridor in Azerbaijan, and

how these impacts will be mitigated. However, environmental and social assessment has also fed into every stage of the project design process, significantly influencing how the project will be developed, as shown in Figure 3.5. Therefore many of the potential impacts of the project will never be realized as steps have already been taken to avoid the impact occurring.

Table 3-1 below outlines the level of environmental and social analysis for each stage of the project design process.

BP Internal Phase	Project Phase	Degree of Environmental and Social Analysis
Appraise	Preliminary Engineering	Screening
Select	Basic Engineering	Scoping
Define	Detailed Engineering	Environmental and Social Impact Assessment (ESIA)
Execute	Construction	Environmental and Social Management Plan
Evaluate	Operations	Environmental and Social Management Systems

 Table 3-1 Inter-relationship of environmental and social assessment with the engineering and construction process

A comprehensive Environmental and Social Scoping Study document was produced during the basic engineering phase and provided to key stakeholders in Azerbaijan and Georgia. This highlighted the key environmental and social issues associated with the BTC project, and provided the basis of the full ESIA to be undertaken during the detailed engineering phase. This document details that ESIA process.

The ESIA assesses the impacts of all phases of the BTC project development, from the start of construction, through commissioning, operation and eventual abandonment of the facilities.

### 3.6 OBJECTIVES OF THE BTC PIPELINE ESIA

The overall objective of the BTC pipeline ESIA process is to ensure that any potential adverse environmental or social impacts arising from pipeline construction and operation are identified, and where possible eliminated or minimized through early recognition of, and response to, these issues. Another important objective of the ESIA process is to provide a mechanism for community participation and information dissemination.

The main issues considered during the preparation of this ESIA are listed below:

- Identification, quantification and assessment of environmental and social impacts
- Comprehensive integration of environmental and social considerations and constraints into the project planning and design activities
- Demonstration that environmental and social issues will figure prominently at all stages of the project
- Thorough consideration of company policy and legal requirements
- Consultation with all stakeholders and consideration of their concerns

Figure 3-5: Index of potential environmental impact



Where it is not possible to eliminate or minimize impact through design, the ESIA details those environmental and social mitigation measures which have been identified in conjunction with engineering teams and stakeholders and will be implemented by the BTC Co (Sections 10 and 11). Further more, where appropriate, additional environmental and community investment programmes will be developed, and are discussed in the ESIA.

Potential impacts of all stages of the project have been evaluated against applicable environmental standards, regulations and guidelines, existing environmental conditions and issues raised by stakeholders (see Section 6, Legal and Policy Framework, and Section 16, Consultation).

In addition to these primary objectives, a guiding principle for the BTC pipeline ESIA process has been to build upon experience gained during the production of previous ESIA reports in the region, and to improve upon these earlier studies where possible.

The following issues have been given additional consideration during the BTC pipeline ESIA process, as a result of experience gained during production of the WREP EIA:

- Consideration of alternatives to the proposed pipeline and alternative export routes
- A greater emphasis on socio-economic impacts and opportunities for community investment and maximizing community benefits
- A comprehensive public consultation programme including a 60-day period for responses prior to finalization of the report
- The involvement of stakeholders from outside Baku
- Greater emphasis on geohazards (eg seismic and geotechnical risk)
- Planning of ecological surveys involving local scientists to address seasonal aspects (dormant plants, animal migration and hibernation etc)
- Reviewing methods for facilitating independent review of reports
- Issuing a scoping report and inviting feedback

### 3.7 CURRENT STATUS OF THE ESIA

This draft of the ESIA document has been prepared specifically for public disclosure and comment. The report will be widely disseminated and will be available for comment for a period of 60 days. Following the 60-day disclosure period all comments received will be incorporated as appropriate into the ESIA, prior to formal submission to the Government.

### 3.8 STRUCTURE OF THE ESIA REPORT

This ESIA document comprises three volumes: the ESIA report itself, a volume of Environmental and Social Route Maps and a volume of Appendices (Technical Appendices and Environmental and Social Baseline Reports).

The structure of this ESIA has been developed by BTC Co in order to adhere to International Financing Institution (IFI) requirements, to meet the national host government requirements as defined in the Host Government Agreements (HGAs), and to provide alignment with ISO standards for Environmental Management Systems (EMS).

This ESIA report is divided into 18 Sections, as detailed in Table 3-2.

### Table 3-2 ESIA report structure

Section Number	Section Title
1	Executive Summary
2	Glossary and Latin Names
3	Introduction
4	Project Alternatives
5	Project Description
6	Legislation and Policy Framework
7	Environmental and Social Impact Assessment Methodology
8	Environmental Baseline
9	Socio-Economic Baseline
10	Environmental Impacts and Mitigation
11	Social Impacts and Mitigation
12	Residual Impacts
13	Cumulative Impacts
14	Management and Monitoring
15	Overall Project Assessment
16	Consultation
17	ESIA Contributors
18	References and Bibliography

The Appendix volume accompanying this document, comprises the following:

### **Technical Appendices**

- 1. Project codes and standards
- 2. Regulatory review of environmental and social issues
- 3. Technical inventories
- 4. Pump Station Atmospheric Dispersion Modelling Study
- 5. Summary of Reinstatement Plan
- 6. Oil spill modelling results
- 7. Oil Spill Response Plan Framework
- 8. Public Consultation and Disclosure Plan BTC and SCP Pipeline Projects, Azerbaijan

### **Environmental and Socio-economic Baseline Reports**

- 1. Ecological Baseline
- 2. Cultural Heritage Management Plan and Archaeological Baseline Data
- 3. Hydrogeology Baseline
- 4. Traffic Assessment
- 5. River Corridor Survey
- 6. Contaminated Land
- 7. Geohazards
- 8. Geology and Soils
- 9. Climate and Meteorology
- 10. Hydrology
- 11. Socio-economic Baseline
- 12. Baseline Air Quality Report for Pump Station
- 13. Background Noise Survey for Pump Station
- 14. Landscape and Visual Impact Pump Station PS-A2

Copies of the full ESIA report and a Non-Technical Executive Summary will be made widely available, with copies in Azerbaijani, English and Russian.

Where possible, the structure of this report has been developed in such a way as to allow direct comparison between the ESIAs produced for Azerbaijan and for Georgia. A number of the sections are common to both countries, and have therefore been reproduced in the same form in the two documents. A common impact identification and assessment methodology has been applied. However, within some sections, particularly Section 10, Environmental Impacts and Mitigation, there are differences in the presentation of information, which reflect the level of analysis required for specific subjects in each country.

# 3.9 ASSOCIATED ESIAS AND SUPPORTING DOCUMENTS

Environmental and social issues along the BTC pipeline route are covered in three separate ESIA documents, subdivided as detailed below:

- BTC ESIA Azerbaijan 442km of pipeline, from the Sangachal Terminal to the Azerbaijan-Georgian border (this document)
- BTC ESIA Georgia 248km from the Azerbaijan-Georgia border to the Georgian-Turkish border
- BTC ESIA Turkey 1060km from the Georgian-Turkish border to the Ceyhan Terminal on the Mediterranean Coast

A Grand Executive Summary has also been produced to summarize all three ESIAs in a single volume.

Separate ESIA reports will or have also been produced covering the following related projects:

- Shah Deniz (SD) Gas Field Development and Production (offshore development, sub sea pipeline and onshore terminal)
- SCP gas export project in Azerbaijan
- SCP gas export project in Georgia
- ACG Phase 1 Upstream Ol Project (offshore development, sub sea pipeline and onshore terminal)

Finally, a regional assessment entitled "Environmental, Social and Economic Review of ACG Full Field Development and Export in a Regional Context" has been prepared.

# **PROJECT ALTERNATIVES**

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# 4 **PROJECT ALTERNATIVES**

### 4.1 INTRODUCTION

The BTC crude oil export pipeline project, as described in Section 5 of this report, represents the results of a process of assessment of alternative options for the export of oil produced from the ACG field in the Azerbaijan sector of the Caspian to world markets. This process has taken more than five years. This Project Alternatives section describes the process that has led to the adoption of the BTC project as described in Section 5.

The assessment of alternative export options was a phased process, starting with a review of the best method for transportation of the oil, followed by a comprehensive assessment of the best corridor for a pipeline and then looking in great detail at the exact route alignment within that corridor. This process is described in detail in Section 4.3, Transportation Method and Section 4.4, Routing, below.

The options for transporting line-pipe and equipment to the host countries, and onward to the project construction areas have also been the subject to a detailed assessment. This review of logistics options has also included a consideration of access roads, construction camps and line-pipe storage areas that could be utilized for the project. The assessment of alternatives for these issues is dealt with in Section 4.5, Logistics Options.

Considerable effort has also gone in to optimizing the design of the pipeline system to maximise its operability, minimise its cost and minimise environmental impact where practical. The assessment of alternative design options is described in detail in Section 4.6, Design Options.

However, before embarking on a detailed study to assess the relative merits of various export options it was necessary to consider the impacts of the "No Development Option", that is what would be the results of not developing any additional export capacity for Azerbaijan oil. In this way an informed decision on the merits of pursuing an export solution could be made.

### 4.2 NO DEVELOPMENT OPTION

No development of the BTC project would remove all potential environmental and social impacts due to construction and operation.

A number of potential negative effects were identified should the project not proceed, including the financial benefits to Azerbaijan of the export of oil from the ACG field (this is estimated to be particularly significant between 2007 and 2017) not being realized. The ACG reservoir has greater production potential than the current export capacity for ACG oil. This potential can only be monetised if additional export capacity can be provided. Much of this revenue would go directly to the Government, so no development would result in denying Azerbaijan the opportunity to benefit from the ACG export earnings which could (with careful management) end government budget deficits and lead to positive social and environmental change.

If the BTC project was not to be progressed either alternative export options would need to be found or the development of the ACG fields would not be viable.

If the ACG field is not developed, not only would this remove a valuable source of revenue it would also deprive Azerbaijan of a fuel supply in the form of gas from the ACG fields that

would be associated with the oil. This gas would then not feed into the domestic gas grid, or be available for power generation, therefore increasing reliance upon fuel oil, imported gas or informal sources of energy, eg timber.

The no development option would also mean that specific environmental and social benefits that may accrue as a result of the BTC project, such as increased employment opportunities, and other community benefits would not occur.

If the BTC pipeline were not developed this would increase the demand for alternative export solutions from the Caspian and may lead to other projects being proposed that entail a greater degree of environmental risk, for example proposals that require:

- Shipping of oil through the Bosphorous strait
- Alternative pipeline routes through areas of higher risk (terrain and security)

The no development option was therefore discounted on financial, environmental and social grounds, and the decision made to identify the most suitable export option for Azerbaijani oil.

### 4.3 TRANSPORTATION METHOD

Once it had been determined that it was appropriate to assess methods for exporting Azerbaijani oil to world markets the primary transportation method required assessment. A number of transportation options were considered, including:

- Road
- Rail
- Pipeline
- Shipping
- A combination of the above

Various routes and final destinations for these transportation options were assessed. Two key environmental studies were carried out to investigate the relative environmental risks and benefits of these options:

- 1. An analysis of key environmental issues associated with exporting ACG volumes from the Caspian, completed in 1997. This desktop report examined and summarized the major environmental sensitivities along each of the potential export routes.
- 2. The second study, a semi-quantitative Environmental Risk Assessment (ERA), studied the relative risk of oil spills associated with transportation by pipeline and shipping, for the following options, to a common point in the Mediterranean:
  - Baku to Supsa
  - Baku to Supsa with a by-pass of the Bosphorus
  - Baku to Novorossiysk
  - Baku to Novorossiysk with a by-pass of the Bosphorus
  - Baku-Tbilisi-Ceyhan

The study concluded that Baku-Tbilisi-Ceyhan was the lowest environmental risk option. Rail and road transportation options were discounted, as part of an earlier screening study, in part owing to high relative spill risk, and in part owing to the logistical difficulties and social and environmental impacts in transporting the large volumes required by these methods.

As a contingency a study was also commissioned that looked at alternative export options that would enable 450 - 500mbd of oil to be exported from the Caspian by end 2004, so securing an export route for at least the early ACG Phase 1 development volumes.

The options considered in the latter study included various scenarios for the expansion of the existing oil export lines from the Azerbaijan sector of the Caspian, the WREP and NREP. Screening of all potential expansion options identified three that were subject to more detailed assessment:

- Expansion of the existing NREP through upgrade of the pump stations to 200mbd capacity
- Expansion of the NREP to 350mbd through upgrade of the pump stations and addition of a looped 700mm (28") line from the Sangachal Terminal
- Expansion of the WREP to 300mbd accomplished by a new pipeline within Azerbaijan and upgrade of pump stations in Georgia

Environmental and social assessments (including baseline studies and risk assessments) were conducted for all of these expansion options. These highlighted that, while feasible, they all involved onward transportation of oil through the Bosphorus from Supsa (WREP) or Novorossiysk (NREP). The options for expansion were all also limited in terms of the volumes that could be transported and therefore did not represent long term export solutions.

Development of a new pipeline, from Baku to Ceyhan was therefore considered the most acceptable transportation method for the Azerbaijan oil as it has the lowest environmental risk associated with it. Pipelines are universally considered to be the safest, most cost effective and environmentally sound method of transporting hydrocarbons.

### 4.4 ROUTING

### 4.4.1 Regional routing

The BTC pipeline route delivers a major environmental benefit enabling Caspian ACG crude volumes to be exported from the land-locked Caspian, to open market, without an incremental increase in volumes shipped through the Bosphorus Straits. Turkey was selected as the most suitable export destination, as it is the nearest country to Azerbaijan with access to the Mediterranean Sea, which provides the nearest open market point of delivery. Georgia was selected as the intermediate transit country. See Figure 3-3 for a regional geographical overview.

Azerbaijan does not share a common border with Turkey. Routing options from Azerbaijan to Turkey included transiting via Iran, Armenia or Georgia.

When considering the use of Armenia as a possible transit country, the wishes of the BTC primary Host Government, BTC Co and owner of the ACG crude to be transported, Azerbaijan, have to be respected. Despite the ceasefire with Armenia in 1994, it has still not been possible for Azerbaijan and Armenia to reach settlement over the Ngorno Karabach issue. Therefore, due to the ongoing political uncertainty over this issue, allied with the terrain and engineering constraints that this route would pose, it was decided not to pursue the possibility of BTC pipeline construction through Armenia.
Due to continued sanctions against Iran, the involvement of US investors and partners in the ACG Production Sharing Agreement (PSA) and BTC project precluded the use of Iran as a transit country.

Options to export via Russia were also considered but discounted due to the commercial implication of the distance to the Mediterranean Sea and need to ship oil via the sensitive Bosphorus Straits.

Therefore the route through Georgia was selected based on the willingness and support offered by Georgia and Turkey to be transit countries; subsequently this support was enacted into leading-edge transit and investor protection laws. The routes through Georgia and Turkey were found to be commercially competitive.

### 4.4.2 National routing

### 4.4.2.1 The process

After deciding upon Baku to Ceyhan via Georgia as the most suitable route for a new pipeline, an intensive study was carried out to look at all the routing options across the three concerned countries. The option evaluation process took into account issues such as terrain, environmental and social constraints, security, safety, constructability, cost, schedule, and operational issues.

For linear developments such as pipelines, the key process for managing potential negative environmental and social impacts is to identify the least sensitive route. It is obviously preferable to avoid creating a potential impact in the first instance. Therefore a great deal of work has gone into ensuring that the route selected for the BTC pipeline minimises environmental and social impact by re-routing, where possible, away from constraints.

A Geographical Information System (GIS) was used as a tool to manage, interrogate and interpret all data collected during the above-mentioned studies. The GIS was then used to develop a series of constraints maps and to evaluate various route options at a regional level.

This process initially involved the designation of constraint areas which should be avoided wherever practical and some areas, for example security zones, that had to be avoided. Primary importance was placed on the selection of a route that could be constructed and operated with a minimum of risk to personnel and infrastructure owing to third party interference. Following this, significant constraints were evaluated in terms of their potential to affect the construction and operation of the pipeline. Constraints considered included environmental, terrain (geohazard), construction, social, security, cost and access issues.

In order to ensure that geotechnical risks were fed into the routing process a desktop study based on satellite imagery was undertaken to identify primary geomorphological terrain units. This was validated by "ground truthing" and the results fed into the constraint mapping.

The importance of a robust and thorough route selection process was recognized as being the key to avoiding and managing potential environmental and social impacts. The following basic principles were adopted:

- Use of multi-disciplinary teams with recognized expertise in pipeline route development
- Avoidance where practical of known designated sensitive areas
- Constant verification of the route through field surveys and reviews
- Avoidance of densely populated areas and areas of known or potential future development as defined by the requirements of ASME 31.8

- Avoidance of known cultural monuments where practical
- Avoidance of known geohazards
- Avoidance of high risk security areas or areas of regional instability
- Minimization of spill risk
- Minimizing land-take
- Maximizing reinstatement potential

#### 4.4.2.2 Corridor selection & narrowing

The BTC HGAs define the route corridor optimisation process that is common to all three countries, as described in Sections 4.4.3 - 4.4.5.

### 4.4.3 10km "Corridor of Interest"

During the year 2000, multi-disciplinary studies were conducted to identify a 10km wide "Corridor of Interest" through the BTC host countries, in accordance with the HGAs. A common corridor was selected for both the BTC oil and Shah Deniz or SCP gas lines, reducing substantially the potential social and environmental impacts should both projects proceed, in line with the project's Environmental and Social Goals (Section 6), as follows:

- Reduction in total area of land clearance; habitat and agricultural land bst
- Reduction in number of temporary facilities (camps, pipe storage yards, access roads etc) required
- Provision of BTC pipeline pump facilities with access to SCP gas, so allowing pumps to be driven on gas, rather than crude (contingent upon SCP approval)

In Azerbaijan, the studies focused on confirming the suitability of the existing WREP corridor as a common alignment for the BTC and SCP lines, thus avoiding opening a second or third energy transportation corridor, and minimizing land-take. This route also followed the main infrastructure corridor of road and railways to Tbilisi and avoided environmentally-sensitive areas.

The WREP was built along a route previously identified by Soviet engineers. The BTC project has been able to draw upon much of the experience and knowledge gained during WREP construction in the routing of the BTC pipeline.

Specifically, several environmentally or socially sensitive areas were avoided or the route through them was minimised from the outset of this project by the following measures:

- Shortening of the route by approximately 12km through the sensitive Gobustan semidesert habitat
- Avoiding the Korchay State Forbidden Area (KP 285-295), which is crossed by the WREP
- Avoiding the Shamkir State Forbidden Area (KP 330-370), which is crossed by the WREP
- Avoiding resettlement of people or movement of buildings and minimizing disruption to settlements, and public buildings such as schools

Re-routes to avoid the Karayazi Aquifer (KP 410-442) were considered in detail, but have been discounted owing to the other constraints present in the region (a full report on this issue has been prepared and issued to the Ministry for Ecology and Natural Resources (MENR)).

These and other detailed routing issues in Azerbaijan are discussed in Section 4.4.7 below.

Adoption of a common "energy corridor" within Azerbaijan will minimize the environmental and social disturbance associated with the construction of the three separate pipelines (WREP, SCP and BTC pipeline). This is discussed further in Section 13, Cumulative Impacts.

Following the route of the existing WREP also maximized the advantages of constructing the pipeline in the Kura River valley, which:

- Provides the obvious natural corridor for a pipeline to the west given the topography of the country (ie Greater Caucasus mountains to the north and Lesser Caucasus mountains to the south)
- Is low lying and largely flat (with the exception of the initial section through Gobustan and some of the river valleys)
- Is an established pipeline and infrastructure corridor
- Allows significant synergies in terms of land acquisition and pipeline operations as it is near an existing BP operated pipeline
- Does not pass directly through any major settlements

The 10km Corridor of Interest for BTC pipeline and SCP was submitted to the Azerbaijan Government in November 2000. The Government provided comments on the 10km corridor in January 2001.

### 4.4.4 500m "Preferred Corridor"

The comments from the Government of Azerbaijan on the 10km Corridor of Interest were used in conjunction with further detailed desk and field environmental, social and engineering studies to identify a 500m "Preferred Corridor" within the 10km Corridor of Interest.

The 500m corridor was presented to the Government in April 2001. Within Azerbaijan the key environmental issue raised by the Government on the 500m submission was the potential interaction of the pipelines with sensitive groundwater resources.

### 4.4.5 100m "Specified Corridor"

Further work, predominantly field-based, was undertaken to identify specific terrain (geohazard), environmental, social, and constructability issues that needed to be resolved. These surveys included:

- Detailed geotechnical surveys of geohazards
- Acquisition and analysis of ortho-rectified aerial photographs
- Detailed topographic surveys of the pipeline corridor and identification of third party services crossing the route.
- Detailed survey of all rivers, including engineering, environmental and geomorphological assessments.
- Detailed assessment of dry gorges and the identification of potential mudslide areas
- Detailed seismic survey locating active fault lines with surface eruptions
- Detailed CP survey, including soil resitivity data acquisition and identification of other adjacent structures which potentially provide AC induction
- Surveys of access roads and other logistics infrastructure
- Detailed assessment of all planned crossings

- Identification of dwellings, isolated farms and buildings through analysis of orthorectified aerial photographs
- Botanical surveys
- Zoological surveys
- Archaeological desk and field studies

This information was used to generate a 100m corridor that was presented to the Government of Azerbaijan in September 2001.

### 4.4.6 The "Construction Corridor"

Additional work was undertaken to further refine the 100m Corridor to produce a 44m "Construction Corridor".

This stage of the route refinement process comprised the following key activities:

- Detailed re-instatement survey, including the classification of potential erosion areas and existing flora requiring re-instatement. Specific attention was paid to the highly erodable soils found in Gobustan and the impact snow melt and heavy rainfall has on the erosion of non-re-instated soils
- Assessment by environmental specialists including botanists and zoologists to identify sensitive receptors
- Detailed assessment of archaeological sites
- Assessment by social specialists of communities adjacent to the corridor
- Further detailed geotechnical surveys of landslide areas and other geohazards
- Use of aerial photographs to carry out population studies as part of the risk assessment process
- Further detailed topographic surveys to incorporate minor route changes
- Further detailed survey of major river crossings including the Kura and Shamkirchay, including the collection of river bed sediment samples to assist with the calculation of river scour depths and the completion of topographical cross sections at 500m centres up and down stream of the crossing
- Final refinement of seismic survey data to locate the pipeline fault crossing locations
- Refinement of access roads and other logistics infrastructure requirements

Most of the pipeline construction activities will be restricted to the construction corridor, although some limited work outside of this area will be undertaken, typically including:

- Construction of AGI's
- Construction at crossings where deeper open-cut excavation may be required
- Horizontal Directional Drilling (HDD) header installations
- Other areas where construction work cannot be retained within the ROW due to Health and Safety reasons

The works will also comprise some pipeline construction related activities off the construction corridor, including:

- Construction of new, and upgrade, of existing access roads
- Construction and re-instatement of camp facilities
- Construction and re-instatement of line-pipe storage areas and rail spurs

### 4.4.7 Local routing issues

As stated above, the base-case for the route of the line in Azerbaijan was to parallel the existing WREP wherever practical. However, experience of the WREP construction and the detailed field surveys described above indicated that a number of environmental and other constraints meant that diversions away from the WREP in certain sections would be required. Additionally, the requirements of western pipeline codes adopt different pipeline proximity criteria from the Russian codes used to design the WREP, hence short deviations in route.

The more significant deviations are discussed below.

### 4.4.7.1 Gobustan Desert Area (KP 0– KP15)

The WREP runs north from the Sangachal Terminal before turning to the south-west and rejoining the proposed route of the BTC line at approximately KP15. The decision was taken not to follow the WREP in this area and to run the BTC line due west out of Sangachal terminal. This has the advantage of shortening the length of the BTC pipeline by 12km compared to the WREP.

As well as having financial benefits in terms of reduced capital outlay this also decreases the length of line to be constructed in the sensitive Gobustan semi-desert habitat that has a long botanical recovery rate. In addition, it reduces the length of BTC line that crosses the proposed Gobustan NationalPark. The area is proposed as a National Park primarily for its desert habitat and botanical interest, although it has been severely degraded by anthropogenic activity.

Routing the BTC pipeline in this way does mean that the line crosses the Gobustan Cultural Reserve for 900m. It has not been possible to avoid the Reserve completely due primarily to terrain constraints to the north and restrictions on the location for crossing the Djeyrankechmes river immediately to east. However, every effort has been made to minimize the length of the Reserve crossed. See Figure 4-2.

The Gobustan Cultural Reserve is designated primarily to protect the numerous examples of rock art that are found on the rocky outcrops in the area. The pipeline route is approximately 1km from the nearest rock outcrop depicting art and therefore does not impact upon any of these features.

# 4.4.7.2 Shamkir and Korchay State Forbidden Areas (KP285 - 295 and KP330 - 370)

At the outset of the routing process a decision was made to avoid areas designated for nature conservation wherever practical. The boundaries of all known Reserves were therefore incorporated into the GIS and used in the definition of the 10km corridor of interest. The existing WREP crosses the edge of two areas designated for nature protection, the Shamkir and Korchay State Forbidden Areas. The route of the WREP was pre-determined by Soviet engineers prior to AIOC taking over and upgrading the pipeline.

Field teams comprised of engineers and environmental specialists identified a route for the BTC pipeline that avoided both of these areas, by routing further to the south, as shown in Figure 4-3.

### 4.4.7.3 Kura East River Crossing (KP223.5)

The route of the BTC pipeline has been changed slightly from that taken by the WREP in the vicinity of the east Kura river crossing. The WREP crosses a number of cut-off meanders of the

river (ox-bow lakes) that are of some ecological interest. The BTC pipeline has been routed to avoid all of these features, as shown in Figure 4-4.

### 4.4.7.4 Karayazi Aquifer (KP411 – 442)

It is known that one of the key environmental sensitivities along the proposed pipeline corridor are the groundwater resources in the western half of the corridor, particularly those termed the Karayazi aquifer to the north of the Kura river adjacent to the Georgian border.

A study was carried out to determine whether there were potential routes in the Azerbaijan – Georgia border area that avoided the aquifer region as defined. Routes to the south and the north of Lake Jandar, and to the south of the Kura river were explored. However, it was found that a number of additional constraints ruled out any of these alternative routes. These constraints included:



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Figure 4-2 BTC pipeline route in the Gobustan Region

Figure 4-3 BTC pipeline route in relation to Shamkir and Korchay State Forbidden Area





Figure 4-4 BTC pipeline route at the Kura East river crossing

- Terrain constraints (highly erodable gullies and hills) to the north of lake Jandar
- Military constraints and concerns over safety in the area to the east of lake Jandar
- Security concerns in the area to the south of the Kura river owing to the proximity to disputed regions
- Environmental constraints, particularly the fact that lake Jandar is a proposed Ramsar site. Consequently there was a desire to maximize the distance from the lake and to maintain the pipeline to the south, and therefore downslope, of the lake
- Construction constraints in terms of access of vehicles and equipment to the area to the north of the lake

Allied with the benefits described earlier of maintaining one common corridor wherever possible, and avoiding the opening up of another corridor, it was felt appropriate to align the BTC pipeline with the WREP in this region, as shown in Figure 4-5.

However, as described in Section 10, Environmental Impacts and Mitigation, a number of mitigation measures will be adopted to protect the groundwater resources.

### 4.4.8 Avoiding social impact

The route of the BTC pipeline has been carefully selected to minimize impact upon the communities along the route. Consultations and discussions have been held with all communities within 2km of the route to determine their key areas of concern. This has fed directly into the project design process (see Section 11, Social Impacts and Mitigation).

It is currently envisaged that no one will be required to move from their homes or communities as a direct result of the project. However, a full Resettlement Action Plan is being produced to fully describe the land acquisition and compensation process, and to address economic displacement issues.

The route of the pipeline has also been selected to minimize disruption to sensitive crops such as vineyards, orchards and cotton plantations.

# 4.5 LOGISTICS OPTIONS

### 4.5.1 Transport of pipe and equipment to storage areas

A number of modes of transport have been assessed for the transport of line pipe, materials and other large equipment to the host countries, and within the host countries to the project areas. Options considered have included:

- Sea
- Land
- Rail
- Road
- Air
- A combination of the above

The determination of the most suitable transport method has included consideration of issues such as safety, the quantities of pipe and material that could be transported, delivery schedules, environmental impact and cost.



Figure 4-5 BTC pipeline route in the vicinity of the Azerbaijan – Georgia border

Based on assessment of the above it was determined that transport by ship was the most appropriate primary method of delivering line-pipe and large equipment for the project.

The only viable routes into the project host countries by ship are through the Black Sea and the Volga Don canal. The Volga Don is blocked to traffic for periods of the year by ice, and therefore not a reliable transport alternative for the ongoing delivery of line-pipe. Therefore it was decided to bring all line pipe into Georgia, via existing ports on the Black Sea coast. These ports, eg Poti and Batumi, generally have adequate or improvable facilities with good road and rail connections for onward transport of equipment.

From the port facilities it is necessary to move pipe and equipment to the project area. Three options were considered for this onward transport, road, rail and air.

#### 4.5.1.1 Road, rail and air

Rail transport is generally much safer than road transport as an option for transporting line pipe, materials and other equipment, as there is less interaction with other users. It also provides a more fuel efficient transport option, and has less negative environmental and social impact in terms of emissions, noise and general nuisance. In addition, in Azerbaijan the rail network is generally well aligned with the proposed pipeline corridor meaning that transportation distances from the rail network to the pipeline construction corridor are not too great.

The road network is generally in a bad state of repair, would require a high degree of upgrade, and does not generally conform to the pipeline route. Therefore to transport line-pipe, materials and other equipment from the ports in Georgia to storage areas by road would result in a greater impact on the local population in terms of noise, dust and interference.

Air is by far the most expensive of the options for moving line pipe, materials and equipment. However, the safety record of air transport is superior to road transport. There is a problem with the availability of resources of an appropriate standard in-country, both in terms of airplanes and air-fields. Therefore if air transport were to be used for moving line pipe, materials and equipment it would be necessary to construct new facilities. As a result air transport is being considered only for rapid evacuation or emergency response scenarios as opposed to transport of equipment or pipe.

For these reasons rail transport is preferred as the primary mode of transporting line pipe and equipment to project laydown areas where it will be transferred to truck for onward movement to the workfront. Some upgrade of existing rail spurs will be required to improve the available infrastructure, and provide access to identified storage areas.

# 4.5.2 Construction camps, pipe yards and associated access roads

Field surveys have identified a number of potential locations for construction camps, pipe yards and the associated access roads from these locations to the pipeline ROW. These potential locations have been subject to environmental and social assessment, and focused consultation has been conducted in communities adjacent to these areas.

It is the responsibility of the construction contractor to determine which of these alternative locations will be adopted, based on the construction strategy and schedule.

If the construction contractor proposes any previously unidentified camps or storage yards then the contractor must undertake environmental and social assessments of these locations.

A number of criteria were used in the determination of these potential sites, as described below.

### 4.5.2.1 Construction camps

Criteria used to determine the potential construction camp locations included:

- No adverse impact upon environmental sensitivities
- Located sufficiently far from settlements as to not cause a nuisance but without removing the opportunity for positive social interaction (eg supply of goods and services)
- Ability for transport to and from the site to the project areas to meet the HSE objectives ie no night driving
- Provide room for expansion if required
- Proximity to the ROW
- Proximity to reliable local utilities services eg electricity and water

### 4.5.2.2 Line-pipe storage yards

Criteria used to determine the potential line-pipe storage yard locations included:

- No adverse impact upon environmental sensitivities
- Located sufficiently far from settlements as to not cause a nuisance
- Proximity to exiting or upgradeable rail spur access
- Ability for transport to and from the site to the project areas to meet the HSE objectives, ie no night driving
- Proximity to the ROW
- Proximity to reliable local utilities services, e.g. electricity and water

### 4.5.2.3 Access roads

The route of the temporary access roads from the camps and line-pipe storage areas to the ROW is dependent upon the location of these facilities in relation to the ROW. Existing roads, some of which will require upgrade, will be used wherever possible. The ROW will also be used as a running track for the movement of line pipe to the construction spread.

### 4.6 **DESIGN OPTIONS**

The engineering design of the pipeline is an iterative process, with increasing definition being added to the base-case design as more information becomes available, as more studies are completed, or as external circumstances change eg political and commercial requirements.

This section describes some of the key design decisions that have been necessary, and explains how these have been arrived at. It also places the preferred base-case project design described in Section 5 in a wider context.

Key engineering decisions described in more detail below include:

- Use of same or separate corridors for BTC and SCP pipelines
- Selection of design contractors

- Pipeline diameter
- Pipeline wall thickness
- Number and location of block valves
- Number and location of pump stations
- Pump driver selection
- Operational power and fuel requirements for pump drivers

### 4.6.1 Use of same corridor for BTC pipeline and SCP

It is proposed that the BTC pipeline and the SCP share the same corridor through Azerbaijan. From an environmental and social perspective this has the following benefits:

- It reduces the total area of clearance and therefore temporary habitat and agricultural land-loss
- It reduces the number of temporary facilities (camps, pipe storage yard etc) established within Azerbaijan during the proposed construction periods
- It provides BTC facilities with future access to SCP gas with the minimum additional infrastructure development. Future operation of BTC facilities using SCP gas will provide a number of environmental benefits (discussed below)
- Joint use of a corridor carefully selected to minimize environmental and social impacts where practical (see Section 4.4 above).

Cumulative impacts posed by pipeline construction within same corridor are discussed in Section 13.

### 4.6.2 Selection of design contractors

A competitive tender process was used to select the contractor company to conduct the engineering design for the BTC pipeline project. Retaining the correct contractor was considered to be an essential aspect of optimizing project design and ensuring overall success of the project.

The successful contractor was selected after review of bids against a number of criteria, including:

- Relevant experience (projects and regional)
- Experience of personnel
- Cost
- Environmental and social performance
- Health and safety performance
- Schedule

Following the tender review process, Bechtel were selected as the lead engineers for the BTC project. Bechtel and John Brown Hydrocarbons, lead engineers for the SCP gas line, share responsibility for pipeline corridor and ROW issues.

### 4.6.3 **Pipeline diameter**

Pipeline diameters of 1219.2mm (48"), 1168.4mm (46"), 1066.8mm (42") and 914.4mm (36") were considered. A decision to use 42" diameter pipeline in Azerbaijan was taken following consideration of factors including:

- Pipeline hydraulics and the ability to remove one pump station in Georgia if 42" pipeline was adopted through Azerbaijan and 46" pipeline was used in Georgia
- The relative environmental and social impact of constructing various diameter pipelines ie larger diameter pipelines generally require a wider construction corridor
- Relative capital and operational costs associated with different diameter pipelines
- Ability to transport and deliver different size pipe sections to the project area
- Required export capacity based on the ultimate throughput of the system, including ACG full field development and potential export of other Caspian reserves

### 4.6.4 Pipeline wall thickness

The selection of the material properties and the wall thickness of the linepipe to be used for each section of the BTC pipeline has been determined by the engineering teams on the basis of:

- International standards and design guidelines
- The loads that will be applied to the pipe, ie the internal pressures
- Local environmental and social sensitivities, including seismic zones, river crossings, proximity to existing communities and their likelihood for future expansion
- Manufacturers' standard production specifications
- Limiting factors associated with the constructability of the BTC pipeline (eg ease of welding) and the robustness of the linepipe during construction operations.

As a result of engineering analysis, it is anticipated that the minimum pipewall thickness will be 12.7mm.

### 4.6.5 Number and location of block valves

Block valves are to be installed on the pipeline to provide the capability to isolate sections of the line in case of accidental leakage or damage and for maintenance or repair purposes.

A comprehensive environmental risk assessment has been carried out, the results of which were used to refine the placement of pipeline valves. Section 10.4 explains the results of this process.

Valve placement has therefore been determined to a large degree by the environmental sensitivity of the surrounding environment and a desire to minimize the volume of any potential spill on sensitive receptors.

### 4.6.6 **Power generation**

Provision of a reliable local supply of electrical power is not always possible within Azerbaijan, and remotely-generating electricity was not technically preferred or economically feasible.

Power requirements for each facility have been studied and assessed in the context of a Best Practical Environmental Option (BPEO) Study. The facilities covered by the BPEO are as follows:

- Main facilities
- The remote block valve stations
- The construction camps
- Pipe storage yards

### 4.6.6.1 Main facilities (pump stations)

During basic engineering a preliminary design for the pipeline was prepared based on five pump stations in Azerbaijan and Georgia and a pipeline diameter of 42" throughout.

A further review of pipeline hydraulics was conducted during the detailed engineering phase. This hydraulic analysis was conducted in a number of phases, with each phase reducing the number of options being considered, with remaining options being considered in increasing detail.

Initially the base case of five pump stations from the basic engineering phase was compared against ten other possible system designs. This was narrowed down to six options for the second pass, and three options for the third pass.

Finally, a preferred option of a total of four pump stations in Azerbaijan and Georgia, with a dual diameter pipeline system of 42" in Azerbaijan and 46" in Georgia was selected.

Selection of preferred option was made on the basis of:

- Capital and operating costs
- Environmental impact, including emissions, land-take and visual impact
- Location of pump station and flexibility in location
- Number of pump stations
- Pipeline diameters (consistent generally considered to be preferable to dual diameter)

A key aspect of the preferred option was that it entailed one less pump station in Georgia with the corresponding benefits in terms of environmental impact (less emissions and reduced visual impact) and capital and operational costs. Pump station emissions in Azerbaijan are discussed in Section 10, Environmental Impacts and Mitigation.

This option also has the added benefit of allowing the construction of the intermediate pump station in Azerbaijan (KP 243) to be deferred for a period of approximately three years.

#### Pump driver selection

Mainline crude oil pumps within Azerbaijan will be mechanically driven due to the need for a reliable, stand-alone energy supply.

At an early engineering stage, reciprocating engines and gas turbine drivers were considered and subject to a selection study. The gas turbine driver proved to be the preferred option on the basis that it provided significant environmental benefit from lower emissions.

In order that the driver systems are operated efficiently, a programme of installation of several smaller units will be undertaken rather than meet the required duty with a single large unit over the project lifetime.

#### Operational power / fuel requirements for pump drivers

Reduction in the quantity of emissions to air has been a key objective of the engineering design team throughout the various phases of the project development. The main source of emissions associated with the operational phase of the project is the pump drivers at the pump stations. Therefore selection of pump drivers has been a key component of the emissions reduction programme. The power requirement of major plant (ie the mainline oil pumps) has been studied and assessed in the context of the preferred environmental option. At peak export, mainline crude oil pumps will be required to provide approximately 32MW of hydraulic power at two pump station sites. Therefore these sites will demand a significant and reliable fuel supply, and the following options were considered:

- Gas, available from the proposed SCP in the its operational phase
- Crude oil (from the mainline)
- Distillate (derived from the mainline crude by a crude topping plant)
- Diesel

Given the environmental requirements for emissions, it was decided that systems would not operate on mainline crude, as the emissions would not meet the required standards. Currently, local reliable supplies of natural gas are not available. Therefore the preferred environmental option for early export would be to operate on a liquid fuel (similar to diesel) generated from the mainline crude. Based on the characteristics of the crude this liquid fuel is expected to have a lower sulphur content than diesel fuels commercially available within Azerbaijan.

Operation of combustion plant on natural gas provides a number of environmental benefits, particularly in terms of operational emissions. Therefore turbine drivers will be 'duel fuelled', that is, capable of operating on either natural gas or liquid fuels. The turbines would operate on Shah Deniz gas as soon as practicable after the installation of the proposed SCP.

The key design changes relating to pipeline diameter and pump driver selection, and the high level impact on emissions especially those of carbon dioxide and nitrogen oxides, are summarized for the entire BTC pipeline in Table 4-1 below.

PROJECT PHASE	CHANGE	IMPA Emissk And	CT ON DNS (CO <sub>2</sub> NO <sub>x</sub> )
Basic Engineering	Base case in Azerbaijan and Georgia changed from crude burning reciprocating engines to gas turbines on SCP gas, with crude fuelled drivers as back-up	Reduction	Reduction
Detailed Engineering	Pipe diameter in Georgia increased to facilitate removal of a pump station in a remote and sensitive part of Georgia	Reduction	Reduction
	SCP programme altered requiring BTC pipeline to rely on crude to fuel drivers	Increase	Increase

Table 4-1 Impacts on emissions due to changes in design

A cost benefit analysis was undertaken of other options for increasing the efficiency of the pipeline system and reducing emissions, and considered:

- Provision of centralized power at each facility
- Use of combined heat and power where and if appropriate

This cost benefit analysis, conducted using the BP Environmental Performance Guidelines, concluded that direct coupling of the drivers to the pumps was the best solution.

### 4.6.6.2 Remote block valve stations

There are several options for producing the power output required to drive the remotely actuated block valve stations. 5.5kW and 7.0kW are required respectively for each standalone and each co-located (SCP and BTC pipeline) site. The following options were considered for the project:

#### Solar power generation system

This option offers a clean and cost effective method of producing power. However, the system necessitates the use of large panels, in the order of  $25m \times 3m$  for every kilowatt. Hence, the footprint needed to generate the required power is prohibitive.

#### Wind power generation system

This option offers a clean, cost-effective method of producing power. However, the system necessitates a sweeping area of  $4.0m^2$  for every kilowatt. Hence, the electrical loads required for each block valve station are prohibitive.

#### Closed cycle vapour turbogenerators (CCVT) powered on natural gas

This method of producing the required power is relatively clean. However, this system necessitates a pressure reduction station, which includes inherent safety problems with the number of connections and fittings. Furthermore, the footprint size of the plot would need to be  $8.0m \times 5.0m \times 6m$  high, which prohibits this method due to the associated land-take and security issues.

#### CCVT powered on diesel

This method is inefficient and the footprint size required is larger than for natural gas power generation. Hence, this option has not been selected.

#### Thermo-electric generators (TEG's) powered on natural gas

This system necessitates a pressure reduction facility, which includes inherent safety problems with the number of connections and fittings. The maximum size of a TEG unit is 500W, which is not practical when the outputs required are considered. Furthermore, TEGs require consistent load when operating which may not be achieved as the loads may start and stop as required.

#### Microturbine system powered on natural gas

This system necessitates a pressure reduction facility, which includes inherent safety problems with the number of connections and fittings. Furthermore microturbine systems have not yet been proven on similar gas export systems. Hence, this option was not considered in detail.

#### Gas engine generator powered on natural gas

This system necessitates a pressure reduction facility, which includes inherent safety problems with the number of connections and fittings. Furthermore, these types of generators are limited to 2.5kW for each unit. Hence, this option was not considered in detail.

#### Diesel electric generator

Diesel generators will be used as emergency back up supplies at the remotely-activated Block Valve stations.

#### Incoming reliable overhead lines

This option is the preferred option, as it provides a reliable constant power supply.

### 4.6.6.3 Construction camps

Diesel generators are the preferred option for power generation at the construction camps. Low emissions and low noise generation have been specified to minimise the environmental impacts of this option.

### 4.6.6.4 Pipe storage yards

The supply of power to the railway system is one of the most reliable supplies in Azerbaijan. Therefore it is envisaged that power will be drawn from the railway network to supply the rail spurs and line-pipe storage areas. There will be a need for diesel generators as a back-up.

### 4.7 CONSTRUCTION

### 4.7.1 Selection of construction contractors

A competitive tender process is under way to select contractor companies to construct the pipeline and associated facilities.

It is recognized that selection of a qualified and experienced contractor, and ensuring that the appropriate requirements are incorporated into the contract, is an integral component of achieving the commitments set out in this ESIA report.

Therefore both environmental and social issues were afforded a high degree of priority in the invitation to tender documents. Requirements to implement the mitigation measures set out in this ESIA are set out in the invitation to tender documents and will be further addressed in precontract award negotiations.

The successful contractor/s will be selected after bid review, on the basis of a number of criteria, including how they have addressed environmental and social concerns.

Specifically, from an environmental and social perspective, the bids will be reviewed against:

- Training plans for HSE issues
- Proposals for managing environmental and social issues, eg maximizing local employment and management of wastes
- Adherence to the project environmental goals and project social objectives
- Compliance with relevant standards, policies and regulations
- Demonstrated awareness of relevant environmental and social issues
- Responses to an environmental and social questionnaire
- Proposed resources and structure for managing environmental and social issues

The selected contractor is required to develop and environmental and social management plan outlining how the commitments made in their bid will be implemented during construction.

## 4.8 BASE CASE PROJECT DESIGN

This section has summarized some of the key project alternatives and options that have been assessed which have a significant bearing on the overall environmental and social impact of the BTC project. This continual process of environmental and social input to the project design has contributed to the adoption of a base case for the BTC project in Azerbaijan. This base case design is described in detail in Section 5, Project Description.

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# 5 **PROJECT DESCRIPTION**

This Section presents a description of the project and addresses those engineering aspects relevant to the Azerbaijan section of the BTC pipeline, covering the following areas:

- Basis of design, including the technical and performance requirements, and codes and standards used
- Description of the pipeline and facilities required
- Description of the construction activities involved
- Description of testing of the pipeline and facilities (including hydrotesting and pigging)
- Commissioning of the BTC pipeline and facilities
- BTC system operation and maintenance
- Decommissioning and abandonment

Where appropriate, this Section presents details of the project in a wider sense (ie, beyond the confines of Azerbaijan). Where kilometre points (KPs) are noted for Azerbaijan, KP0 represents the point at which the BTC pipeline emerges from the Sangachal Terminal and KP442 is the Azerbaijan-Georgian border.

### 5.1 **Project Overview**

The BTC overall pipeline route is presented in Figure 3-3 (see Section 3, Introduction) and the Azerbaijani section is illustrated in detail in Figures 51. Each of the principal features of the system in Azerbaijan is described in greater detail within this Project Description.

With respect to the environmental and social impact of the project, the key features of the pipeline system design are as follows:

- The pipeline will be buried throughout the route
- The pipeline route has been selected with the aim of minimising impact on socially or environmentally sensitive areas
- As a result of careful pipeline route and facilities site selection, it is not anticipated that any permanent resettlement of people will be required
- The system will be built, operated and decommissioned in line with international standards

When fully operational and running at its design capacity, the BTC pipeline is to have the capability to export 50 million tonnes of crude oil per year from the Sangachal Terminal on theAzerbaijani Caspian coast, near Baku, through Azerbaijan, Georgia and Turkey to the Ceyhan Terminal on the Turkish Mediterranean coast. Initially the BTC pipeline will transport oil from the Azeri, Chirag and Gunashli (ACG) Phase 1 Full Field Development, followed at a later date by crude from other phases of the ACG development as well as other regional crude oil and condensate streams.

It is anticipated that the construction and commissioning of the system will be carried out in phases determined by the required transportation capacity and that the first phase will be

completed by late 2004. The pipeline has been designed on the basis of a 40-year operational life.

The entire BTC pipeline system will be approximately 1750km in length, sub-divided between the three countries as follows:

- Azerbaijan 442km
- Georgia 248km
- Turkey 1,060km

A comprehensive route evaluation process was undertaken to determine the optimum pipeline alignment (see Section 4, Project Alternatives). The preferred route for the proposed pipeline reflects a number of critical constraints, including:

- Terrain
- Safety
- Proximity and suitability of existing infrastructure within Azerbaijan
- Environmental impact (see Section 10, Environmental Impacts and Mitigation)
- Social impact (see Section 11, Socio-economic Impacts and Mitigation)

Figures 5-1 present the proposed pipeline route in Azerbaijan topographically, superimposed on satellite imagery, and as an altimetric profile. The figure also presents the locations of facilities (ie, pump stations and pigging stations) and other above ground installations (ie, block valves) associated with the BTC pipeline – each of which is discussed later in this Section.

The Azerbaijan section of the BTC pipeline will have an external diameter of 42" and has generally been routed parallel to the existing Western Route Export Pipeline (WREP), operated by Azerbaijan International Oil Company (AIOC).

There are planned to be two pump stations within Azerbaijan. One will be within the Sangachal Terminal complex<sup>1</sup>. The second pump station (PS A2) will be approximately midway between the Terminal and the Georgian border.

The BTC pipeline system will also include two dedicated intermediate pigging stations in Azerbaijan, pigging facilities integrated within the pump stations, a number of valve stations, a cathodic protection (CP) system, an optical fibre communications system, a leak detection system, and a computer-based Integrated Control and Safety System (ICSS). The system design has been based on fully automatic operation, however, some equipment at the pump station (PS A2) will require routine manual intervention. The Sangachal Terminal and the intermediate pump stations will be permanently manned.

The basis for overall BTC pipeline control is centralized control from the control room at the Sangachal Terminal communicating with Process Control Units (PCUs) at pump stations, block valves and metering facilities. Flow rate control will be carried out by adjusting the numbers and speeds of the pumps operating at the Sangachal Terminal and at the intermediate pump station.

<sup>&</sup>lt;sup>1</sup> The environmental and social review of the BTC Sangachal Terminal facilities is outside the scope of this study and it is covered by a separate assessment (Azerbaijani, Chirag & Gunashli Full Field Development Phase 1 ESIA, URS Corp, 2002).





Figure 5-1b



Figure 5-1c



Figure 5-1d



Figure 5-1e



Figure 5-1f



Figure 5-1g



Figure 5-1h



Figure 5-1i



#### An overview of project features is presented in Table 5-1.

Table 5-1 Development s	summary
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Total pipeline length (Sangachal to Ceyhan)	Approximately 1,750km
Pipeline length in Azerbaijan	Approximately 442km
Pipeline diameter	42"
Pipeline material	High grade steel pipe with a 3-layer polyethylene anti-corrosive coating
Normal pipeline burial depth	1m from top of pipe
Operating pressure range (at 1,000mbd)	76-142 barg
Number of pumps stations in Azerbaijan	When fully operational - 2 (including the 1 at the Sangachal Terminal)
Block valves	18 block valves, 3 check valves, with additional block valves at intermediate pigging stations and pump stations
Other AGIs in Azerbaijan	2 Intermediate pigging stations (IPS)
Peak oil export	~1,000mbd

The control room at the Sangachal Terminal will be shared with AIOC, ACG, SCP and SD Upstream project though the control systems will be independent.

### 5.2 PROJECT DEVELOPMENT

The project details and scope presented in this Section are correct at this stage of the project development. Some of these details are likely to change as the project design becomes refined and more detailed over time. Nonetheless, the current level of detail is sufficient to enable potential environmental impacts to be determined and assessed, and appropriate mitigation measures

developed. Where possible, these mitigations have already been incorporated into the design premise.

In accordance with BP policies and international best practice (as described in Section 6, Legal and Policy Framework), the BTC project's social and environmental impact has been subject to assessment and review. As a result, environmental and social considerations have been implicit in each element of the project's development, including conceptual design, front-end engineering design and detailed design. The importance of environmental and social considerations is reflected in the project management commitment to world-class performance, and in the pipeline and facility design as described in the remainder of this Section.

Several specific measures have been implemented to ensure that appropriate consideration has been given to environmental and social issues. These measures include:

- The inclusion of a team of environmental and social experts in the project management team, with dedicated personnel located in the United Kingdom, Azerbaijan, Georgia and Turkey
- The inclusion of environmental engineers and environmental management professionals within the engineering design teams
- Incorporation of clauses into the contracts for the main engineering design contractors to ensure that the design would involve environmental expertise, commensurate with host government agreement requirements, BP's policy, and the scale and nature of the BTC project
- Routine involvement of environmental specialists in project design and management meetings
- The involvement of locally and internationally respected environmental and social consultants in all key phases of the project (including conceptual review, goal setting, scoping, routing, engineering design and environmental/social assessment)
- The involvement of environmental and social experts to conduct peer reviews of the environmental/social aspects of the project
- The collection and assessment of extensive environmental and social data for the proposed pipeline route
- An ongoing programme of benchmarking against similar projects conducted elsewhere in the region and around the world
- The inclusion of environmental and social requirements within the tender documentation for the pipeline and facilities construction contracts
- The requirement for all contractors to develop environmental protection plans prior to the commencement of work on any aspect of the project
- Ongoing liaison with stakeholder groups including the Azerbaijan Government, the project partners, local stakeholders, IFIs and Non-governmental Organisations (NGOs).

# 5.3 **PROJECT SCHEDULE**

The design and preliminary survey work required for the BTC pipeline commenced in 2000 and is ongoing. It is anticipated that the main BTC construction contract(s) will be awarded in mid 2002 with the aim of the main construction work commencing in Spring 2003. The pipeline construction period in Azerbaijan is likely to last for approximately 15 months. Filling and commissioning of the pipeline is dependent on the completion of associated projects in Azerbaijan, Georgia and Turkey and is programmed to commence in mid 2004.

Some preparatory construction works are intended to commence in late 2002, and it is intended that all construction works will be completed by mid 2004. Cleaning and testing of the pipeline

system is scheduled to take place in mid 2004, and oil fill in late 2004. It is anticipated that the entire BTC pipeline system will become operational by early 2005.

The period between the award of the construction contract and the commencement of the pipeline construction work will be used by the project management team and the pipeline and facility construction contractors for various enabling and preparatory works including:

- Staff mobilisation and training
- Detailed design and procurement
- Clearance and establishment of temporary facilities (construction camps, pipe yards, temporary roads etc)
- Field verification of identified environmental and social receptors
- Stockpiling of materials
- Upgrading of infrastructure (eg, roads, railways etc)

It is currently anticipated that the construction of the SCP will commence immediately following the completion of the BTC pipeline. The relationship between the construction and commissioning programmes for the two pipelines is discussed in greater detail in Section 13, Cumulative Impacts.

Figure 5-2 presents a schematic summary of the anticipated project schedule including the key events associated with the completion of the BTC project.

#### Figure 5-2 Anticipated project schedule and key events



## 5.4 **PROJECT PHASES**

The BTC pipeline project is a phased development focused on the following targets:

- The BTC Phase 1 Development will enable the BTC pipeline system to transport approximately 500 thousand barrels per day (mbd) of crude oil.
- The BTC Phase 2 Development will increase the capacity of the BTC pipeline system from approximately 500mbd to 1,011mbd and will include expansion of certain facilities developed during the Phase 1 Development.

With respect to the Azerbaijani sections of the project, Phase 1 Development will include the establishment of the following permanent components:

- The pipeline, along with all associated block and check valves, communications systems, access roads and other basic infrastructure
- Head pump station (PS-A1) located within Sangachal Terminal
- Intermediate pigging station (IPS A1)
- Intermediate pump station (PS A2) with provision of minimum plant and equipment to enable the facility to initially operate as an intermediate pigging station
- Intermediate pigging station (IPS A2)

The Azerbaijan Phase 2 Development will involve the establishment of the following additional facilities:

- Additional crude oil pumping units at PS A1
- Expansion of the intermediate pump station facility (PS A2) to include provision of a complete pump station with a dedicated Crude Topping Plant Unit (if required) and supporting utilities

### 5.5 PROJECT DESIGN BASIS

The following Sections are applicable to the whole BTC pipeline except where otherwise stated.

### 5.5.1 Design life

The proposed BTC pipeline has a 40-year design life. Facilities (ie, pump stations, pigging stations) and other AGIs will be designed for a 30-year design life, with the exception of the mainline oil pumps and drivers that will have a design life of 20 years.

Routine maintenance measures will be applied during these periods to ensure that all facilities operate as designed for their intended lifetime.

# 5.5.2 Crude oil characteristics

The basic physical characteristics of the ACG crude oil as supplied to the BTC pipeline from the Sangachal Terminal are anticipated to be as follows:

- Density:  $861 \text{kg/m}^3 @ 5^{\circ}\text{C}$ ,  $852 \text{kg/m}^3$  at  $15^{\circ}\text{C}$
- Reid Vapour Pressure: 69kPa
- True Vapour Pressure: 100kPa at pipeline input temperature
- Specific Heat Capacity: 1.8 kJ/kgK at 0°C, 1.9 kJ/kgK at 20°C
- Pour Point: -6°C
- Wax Appearance Temperature: 37.7°C

The majority of the hydraulic modelling work carried out during the design process has been based on these physical properties. Additional work has been carried out to assess the implications of variations to this base case data. Given the density stated above, the planned operational flow of 50Mt/a equates to a peak hydraulic design capacity of 1,011mbd, which in turn is equivalent to  $6,697m^3/h$ .

Whilst the intention is that the BTC pipeline will transport predominantly ACG crude, provision has been made for the transport of other crudes originating in the Caspian region and condensate from local natural gas production activities. The physical and chemical characteristics of differing crude oil and condensate blends will vary slightly from those of pure ACG crude. The degree of divergence will be dependent on the characteristics of each blended material and the proportions in which they are blended. It is not anticipated that the potential variations in the physical characteristics of the transported material will materially affect the operation or safety of the BTC pipeline.

### 5.5.3 Codes and standards

The BTC oil pipeline and associated system components will be designed, fabricated, constructed, tested and commissioned in accordance with the requirements of ASME 31.4 and 31.3 (1999) supplemented by other selected international standards (eg, American Petroleum Institute (API), British Standards Institute (BSI), International Standards Organisation (ISO), the Institute of Petroleum (IP), Manufacture Standardisation Society (MSS) and the National Association of Corrosion Engineers (NACE)). A list of the Codes and Standards adopted for the project is provided in Part 1 of Technical Appendices.

### 5.5.4 Design safety factors

In the context of engineering design, the term 'safety factor' is understood to mean a multiplier that is used to ensure that the maximum design load or capacity falls below the maximum value that could be sustained by a pipeline system component or structure without failure. Such factors are used to ensure that a design is conservative. In accordance with normal engineering practice, and the requirements of the engineering standards adopted for the project, safety factors have been incorporated in each element of the engineering design for the BTC pipeline.

Where required by the applicable design standards or considered appropriate by the engineering teams, additional safety factors have been incorporated into the design to reflect key sensitivities. As a result, more conservative design factors have been applied for BTC pipeline sections close to:

- Areas of geotechnical (potential subsidence or settling) and seismic (earthquake and landslip) sensitivity where aspects of design (eg, trench configuration, material, welding) increase flexibility and limit the influences of external forces
- Road and rail crossings where the design also includes additional cover to alleviate excessive loads on the pipeline

### 5.5.5 Design pressures and temperatures

The design pressure of the BTC pipeline system in Azerbaijan will be 125bar gauge (barg), with a maximum operating pressure of approximately 120barg. As with the use of safety factors in the design process, the adoption of an operating pressure lower than the design pressure reflects a conservative approach to the design of the BTC pipeline system. Pressure control systems will be provided so that the pressure in the BTC pipeline system does not exceed a safe level.

The operating pressure of the pipeline will vary along the pipeline route due to changes in elevation, hydraulic losses and pump inputs. This necessitates changes in wall thickness along the route.

The BTC pipeline has been designed for an external temperature range of minus  $24^{\circ}$ C to plus  $43^{\circ}$ C.

### 5.5.6 Pipeline diameter

The pipeline diameter selected for each major route section for the entire BTC export system has been designed upon the basis of:

- Export crude volume
- Crude physical properties (particularly viscosity and density)
- Optimisation of the modelled hydraulic conditions that may be encountered along the pipeline route under various steady state and transient flow regimes
- The placement and rating of pumping stations to provide positive crude pressure at discrete locations along the proposed route

In Azerbaijan this has resulted in the selection of a 42" diameter pipeline.

### 5.5.7 BTC pipeline capacity

The BTC pipeline system has been designed to accommodate a flow rate of 50Mt/a, which equates to 1,011mbd of ACG crude. The principal sources of the crude are anticipated to be:

- Existing Early Oil Project (EOP) crude production at the Chirag oil field in the Azerbaijani sector of the Caspian
- The proposed development of the ACG oil fields in the Azerbaijani sector of the Caspian for crude production
- Condensate production from the Shah Deniz gas field

As illustrated in Figure 5-3, the pipeline flowrates are projected to start at around 200mbd in year one, increasing to 1,011mbd by the end of year three.

Figure 5-3 Projected flow profile



# 5.5.8 Hydraulic design

The engineering design team has conducted a detailed analysis of the hydraulic conditions that may be encountered along the BTC pipeline route for various flow regimes and design assumptions. This analysis has been used to support the selection of the final design (eg, number and location of pump stations, pipeline diameter and pipe wall thickness, etc) of the BTC pipeline system.

As described above, hydraulic modelling has been conducted to assess the implications of potential variations in the crude oil supplied to the pipeline.

Figure 5-4 presents the hydraulic profile at maximum throughput and steady state conditions.


#### Figure 5-4 Diagrammatic representation of hydraulic model

On the basis of flow capacity, hydraulic modelling, design pressures and generally available pipeline materials, a BTC pipeline diameter of 42" has been adopted in Azerbaijan.

In order to accommodate the full 50Mt/a flow capacity at a pressure of not more than 95barg it has been determined that two pump stations will be required within Azerbaijan. The proposed locations of these pump stations are:

- Within the Sangachal Terminal complex
- In Central Azerbaijan, near to the village of Yardili (ca KP244)

The hydraulic analysis has indicated that the installation of the pump station near Yardili can be deferred from BTC Phase 1 Development (ie, the initial export phase). This pump station is likely to be built in 2004 or 2005.

### 5.5.9 BTC pipeline material

The selection of the material properties and the wall thickness of the line pipe to be used for each section of the BTC pipeline have been determined by the engineering teams on the basis of:

- International standards and design guidelines
- The anticipated loads that will be applied to the pipe, including those associated with potential seismic events
- Hydraulic optimisation
- Local environmental and social conditions
- Manufacturers' standard production specifications supplemented by specific project requirements to ensure/improve quality
- Limiting factors associated with the constructability of the BTC pipeline (eg, ease of welding) and the robustness of the line pipe during construction operations

As a result of the engineering and constructability analysis, and based on using API 5L Grade X70 grade steel, it is currently anticipated that five standard pipe wall thicknesses (12.7, 13.5, 14.3, 15.9 and 19.1mm) will be used for the project in Azerbaijan.

Approximately 442km of 42" diameter pipe will be required for the Azerbaijan portion of the pipeline, comprising approximately 37,000 pipe sections each just under 12m long. All pipe sections will be externally coated (prior to delivery) with a high-integrity three-layer polyethylene system. Welded joints will have a similar coating applied during construction. In each instance the coatings will be designed to protect the pipe from corrosion and damage.

## 5.6 OUTLINE OF THE BTC PIPELINE AND ASSOCIATED FACILITIES

## 5.6.1 The BTC pipeline

### 5.6.1.1 BTC pipeline route

The BTC pipeline route has been carefully selected to take account of social, engineering, geotechnical and environmental constraints. The route selection process and the alternatives considered are described in Section 4, Project Alternatives. The BTC pipeline route and the location of the key facilities/AGIs are illustrated in Figure 5-5.

### 5.6.1.2 Corrosion protection

The BTC pipeline system will be protected from external corrosion by a combination of a highintegrity three-layer polyethylene coating system and an impressed current cathodic protection (CP) system. Sacrificial anodes will be used as necessary in addition to the impressed current system.

Permanent pipeline cathodic protection will be provided by transformer rectifiers and shallow horizontal groundbeds located at the intermediate pump station (PS A2) and selected block valve sites.

Following commissioning, regular monitoring activities will be carried out to ensure that adequate protection potentials are being achieved and that power sources are operating within their intended limits.

### 5.6.1.3 Leak detection

A modern leak detection system will be installed. It will operate by comparing actual profiles of flow, pressure, temperature and density with modelled profiles of the same parameters. Excessive differences between the real-time measurements and the modelled profiles indicate possible pipe failure and leakage. The time taken to detect a leak will be therefore dependent on the size of the leak and the accuracy of the flow measurement instrumentation.

The leak detection system will be designed in accordance with the requirements of API 1130 Computational Pipeline Monitoring (Oct 1995) and API 1155 Evaluation Methodology for Software Based Leak Detection Systems.

Figure 5-5 Locations of key facilities and AGIs

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The leak detection algorithm will be designed with the aim of identifying any leaks in excess of 1.0% of the flow rate being measured (from start-up through full flow). The system may also be able to identify smaller leaks over a longer period of time.

The leak detection system will be designed to accommodate routine (steady-state) pipeline operating conditions, as well as transient conditions (eg, pigging runs) and slack flow. Potential suppliers of the leak detection system are required to demonstrate the capabilities of their system in respect of the detailed requirements contained within the relevant specification.

### 5.6.1.4 BTC pipeline location identification

Low level marker posts will be provided at all station sites, CP test stations, road, track, rail and water crossings, AGI/facility fences, and any other locations deemed necessary to ensure identification of the BTC pipeline route. Each marker will be in line of sight contact with adjacent markers, to the greatest extent possible. Marker posts will be provided with identification plates that will include telephone contact numbers to be used in the event of a pipeline incident.

Aerial markers will be installed at significant changes in direction and every 1km along the route to assist in aerial surveillance.

## 5.6.2 Sangachal Terminal complex

As previously mentioned, the environmental and social review of the BTC Sangachal Terminal facilities is outside the scope of this study and it is covered by a separate environmental and social assessment (Azeri, Chirag & Gunashli Full Field Development Phase 1 ESIA, URS Corp, 2002). The following information is included to provide a more complete picture of the setting of the BTC pipeline development and to aid the assessment of cumulative impacts (see Section 13, Cumulative Impacts).

BTC pipeline facilities will occupy a dedicated portion of the Sangachal Terminal Complex, alongside the existing AIOC, ACG, Shah Deniz and SCP facilities.

The BTC facilities within the Sangachal Terminal complex will comprise:

- Control/telecommunications systems
- Control room shared with other terminal operators
- Custody transfer metering
- Mainline pumps and variable speed electric drivers
- Pig launcher
- Shared utilities (power generation, potable water, air, open and closed drain systems etc as required)
- Shared offices, laboratory and maintenance support facilities (warehouse, workshops etc)

### 5.6.3 **Pump stations**

At present, it is planned that pump station PS A2 will be constructed on an area of agricultural land adjacent to the pipeline at approximately KP244.

An alternative location for the pump station is currently being assessed. The new location is a parcel of municipal land to the west of the site discussed in this report, and to the east of the road that runs parallel to the Karabakh Canal. It is likely that the environmental factors associated with alternative location will be similar to, or less than, those assessed for the current location.

However, specific environmental assessments will be conducted for the new site should the engineering studies indicate that re-siting would constitute a preferable option.

One of the key reasons for assessing the possibility of locating the Pump Station in the area of municipal land is to reduce impacts upon agricultural land in the vicinity of the current location.

As previously discussed, PS A2 will not be required during Phase 1 of the BTC pipeline development. It is anticipated that the whole site will be secured during the initial project execution phase, although only the pigging station facilities and certain project critical elements of the pump station infrastructure (eg, shutdown valves) will be constructed at that time. It is planned that the remainder of the pump station will be constructed during Phase 2 of the project development.

### 5.6.3.1 General description of pump station facilities

The future pump station, PS A2, is expected to occupy an area of approximately 8 to 9 hectares and will include the following facilities:

- Four mainline pumps with turbine drivers in parallel (three would operate at 80% capacity or greater, with a fourth on standby)
- Station bypass piping
- Fuel storage facility with bunding
- Utilities (including potable water, nitrogen, air, open and closed drain systems etc)
- Wastewater treatment facilities
- Firewater system including fire ring main, jockey pumps, an electrically driven fire pump, two diesel driven fire pumps, fire monitors, foam monitors, a deluge system within the pump house, sprinkler systems within all buildings, and a retention pond
- Three diesel/natural gas fuelled generators to provide on-site power generation
- Gas conditioning (including pressure control, filtering, heating etc) and metering facilities (provided by the SCP facilities) in the event that the pump turbine and generator drivers are gas fuelled
- Local control room, controls and telecommunications system with an uninterruptible power supply (UPS), offices, warehousing, workshops, accommodation and a security gate house
- Lighting:
  - 400W high pressure sodium lamps mounted on 10m permanently erected columns for area lighting
  - 250W high pressure sodium lamps mounted on 10m permanently erected columns for perimeter/security lighting and at the entrance of the main gate
  - 2x40W high efficiency fluorescent lights as supplementary lighting at outdoor pumps and packages
- An emergency helicopter landing and takeoff pad (external to the site)
- Permanent accommodation (mess hall and single rooms with en-suite facilities) for up to ten operators
- Security gate-house
- Remotely operated Emergency Shutdown (ESD) valves at the inlet and outlet of the facility
- Pipeline inlet/outlet flow measurement
- Pig receiver and launcher suitable for accommodating intelligent and other pigs
- A Crude Topping Plant (CTP) designed to produce diesel range fuel (only required for later stages in the absence of available gas from the SCP)
- Wax handling and disposal system

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For illustrative purposes only, Figure 5-6 presents the typical layout of a pump station. The pump station configuration is further illustrated in the photomontages included in Part 14 of Baseline Reports (Appendices).



Figure 5-6 Indicative pump station configuration

### 5.6.3.2 Mainline oil pumps

It is proposed that four 33% load pump units will be installed in parallel, and housed within a dedicated building.

### 5.6.3.3 Mainline oil pump drivers

Studies have been carried out to identify efficient pump drivers for the pump station PS A2. On the basis of the current design, it is anticipated that there will be three pumps plus an additional pump on standby. Evaluation of fuel options has also been undertaken, however the choice of fuel for the pumps is largely dependent on the available fuel supplies and consequently dependent on the status of the SCP project. The preferred fuelling option will be to use of natural gas supplied from SCP, however the system has been designed to allow the use of diesel should natural gas be unavailable by the time of commissioning.

In order to use gas from the SCP for the pump drivers, a gas metering and pressure regulating station will be necessary at the pump station. If the diesel option is adopted, a crude oil off take and a crude oil topping plant will be necessary to provide diesel supplies for the pump drivers.

All emissions from turbine exhausts will be vented to atmosphere via stacks, the height of which has been determined on the basis of detailed air dispersion modelling. It is currently anticipated that the stacks will be at least 25m above prevailing ground level (see Section 10, Environmental Impacts and Mitigation). For further details on the emissions modelling process conducted for the pump drivers, see Part 4 of the Technical Appendices.

For safety and performance maintenance, the turbines will have the ability to shutdown via the plant Emergency Shut Down (ESD) system.

### 5.6.3.4 Emergency shut down valves

During Phase 1 of the development, ESD valves will be installed at the perimeter of the pump station site. The valves will be full bore, hydraulically actuated, suitable for pigging operations, and will fail to the closed position.

Shut down of the BTC pipeline system will be initiated manually in response to an ESD situation or predetermined abnormal operating conditions.

### 5.6.3.5 Facilities power generation

Power generation at pump station sites will be achieved by 3 diesel generators, each providing 50% (1.2 MW) of the sites power requirements. At any one time, two generators will operate while the remaining one generator provides a back-up. Exhaust gases from the generator engines will be emitted to atmosphere via appropriately designed vents. Emergency and essential power will be provided for instruments and telecoms.

#### 5.6.3.6 Site storage tanks

A number of storage tanks will be included within the pump stations. The principal tankage will be as follows:

- Fire water storage tank
- Crude surge relief tank
- Storage tank for pump driver diesel supplies (contingent on the adoption of diesel fuel alternative for the pump drivers)
- Naptha/residue buffer tank (contingent on the adoption of diesel fuel alternative for the pump drivers)

All hydrocarbon storage tanks will be provided with secondary containment designed to minimise environmental impact in the event of a spill.

### 5.6.3.7 Crude topping plant (if required)

The crude topping distillate fuel will be compositionally and physically similar to diesel and is therefore referred to as diesel throughout this document. The distillation process would be undertaken at a purpose designed and built CTP located within the PS A2 pump station facility.

A summary of the key features of the CTP is presented below:

- The topping plant would be capable of producing up to 248m<sup>3</sup>/day of diesel
- Of the crude taken from the pipeline, approximately 30% will be converted into diesel fuel with the residual 70% that is unsuitable for use as diesel being re-introduced into the pipeline crude stream
- Sulphur content of the diesel is expected to be less than 0.1% by weight (based upon the sulphur content of the most common blend of exported crude)
- The processed diesel will be stored in a dedicated storage tank located within the pump station facility

Emissions to the atmosphere from the CTP would be vented through an appropriately designed flare stack.

### 5.6.3.8 Buildings

Table 5-2 lists the main buildings that will be present at the pump station.

Building title	Approximate Height (m)	Approximate Plan Area (m <sup>2</sup> )	Remarks
Gate house	4	20	
Pump station control building	5	400	Includes ICSS, telecoms and offices Mast for antenna adjacent to this building
Sub-station	7	180	Bottom entry cable feed
Pump shelter	10	2200	Deferred until expansion into pump station
Warehouse and maintenance area	6	600	
Fire water pump house	5	150	Deferred until expansion into pump station
Pig launcher/receiver shelters	5	100	Two shelters
Strainers maintenance shelter	5	500	Deferred until expansion into pump station
Accommodation	4	600	Deferred until expansion into pump station

Table	5-2	Building	list	for	PS	A2
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## 5.6.4 Metering stations

Within Azerbaijan, a fiscal metering station will be installed at the Sangachal Terminal on the upstream side of the main line oil pumps. The next fiscal metering station along the BTC pipeline will be at the first Georgian pumping station, located just west of the Azerbaijan/Georgian border. These metering stations are considered in the ESIAs for Sangachal Terminal and Georgia respectively and they are not therefore considered further in this document. They do, however, contribute to the leak detection system for the pipeline in Azerbaijan.

Operational metering systems, based around ultrasonic testing devices, will be provided at the pump station to support the management of the pipeline system.

## 5.6.5 Pigging facilities

A pipeline integrity gauge (PIG) is a device that is used for internally monitoring and cleaning pipelines. All pigging operations require a means of loading pigs into the pipeline and retrieving them from it. These locations are respectively referred to as pig launchers and pig receivers or collectively as pigging facilities. The BTC pipeline has been designed to facilitate the use of cleaning and inspection pigs.

Pigging operations will be controlled locally and will be performed for:

- Commissioning
- Cleaning, including wax and debris removal (to maintain pipeline efficiency)
- Corrosion control
- Pipeline inspections (eg, intelligent pigging) for integrity management

Intelligent pigging will be carried out periodically (approximately every five to ten years) to check the integrity of the BTC pipeline. This is achieved by recording any changes in the BTC pipeline thickness and shape, and by inspecting for defects and cracks. Cleaning pigging will be undertaken more regularly, with the frequency being determined principally by the rate of wax build-up in the BTC pipeline. It is anticipated that such pigging will occur as frequently as once or twice a week for the duration of the BTC pipeline operation.

Three pigging facilities are proposed for the Azerbaijan section of the BTC pipeline, at the locations shown in Figure 5-5. Of these, one will be within the pump station (PS A2), and other two will be stand-alone facilities. In addition, a pig launching facility will be present within the Sangachal Terminal. The number of pigging stations has been determined based on:

- Wax deposition rate(s) for the produced crude
- Degree of wax removal during pigging exercises
- Pigging frequency studies with and without intermediate pigging stations

The intermediate pigging stations will include the following features:

- Onsite power generation (two diesel fuelled engine driven generator sets)
- Wax/crude transfer pump (for re-injection back into the pipeline from closed/open drain tanks or to road tankers for offsite disposal)
- Pig handling equipment, including cranage
- Pig launcher/receiver
- Open and closed drain system
- Lighting
- Buildings, the most significant of which will be:
  - A security gatehouse (22m<sup>2</sup>)
  - Administration/maintenance/warehouse building (300m<sup>2</sup>)
  - Pig launcher  $(100m^2)$
  - Maintenance shelter (100m<sup>2</sup>)
  - Telecoms, ICSS and Power generation (60m<sup>2</sup>)

The pigging stations will be self-sufficient in power (derived from diesel fuelled generating sets) and will be provided with uninterruptible power supply facilities to ensure essential and emergency supplies for instrumentation and telecommunications systems.

## 5.6.6 Pipeline valves

Valve stations will be located along the BTC pipeline route to facilitate maintenance and to isolate sections of the BTC pipeline in the event of accidental leakage. In each instance the valve bodies will be buried in-line with the pipeline.

Two forms of valve station are proposed:

- Block valve stations, housing valves that can be remotely operated (actuated) or can be closed manually (ie, by operatives working at the valve site) to restrict or stop pipeline flow
- Check valve stations, housing simpler valve devices that rely on gravity/reverse flow to close automatically when the pipeline flow is interrupted. These valves cannot be manually or remotely closed. Check valve stations involve a minimal land-take and require no additional power to operate the valve

A quantified risk assessment (QRA), which included environmental sensitivity risk factors, and a block valve spacing study were conducted to support the selection and locations of valves. Environmental sensitivity risk information included:

- Major water courses including rivers or canals
- Lakes and reservoirs
- Wetlands
- Nature reserves and parks
- Features that channel water to underground aquifers
- Geohazards (eg, landslides, geological faults)
- Areas of high population density or settlements considered to be particularly sensitive to disruption

The QRA process is discussed in more detail in Section 10, Environmental Impacts and Mitigation.

The provisional locations for the valve stations are listed in Table 5-3 and illustrated on Figure 5-5. Check valves have been located at specific sites to prevent backflow into environmentally sensitive areas in the event of a spill. To ensure check valve effectiveness, the valves are located such that adequate back-pressure will be generated to shut the valve. The final locations of these facilities will be defined through the ongoing detailed engineering design process.

Approxiamte KP	BTC AGI/FACILITY	AGI Name	Co-Located SCP AGI
0	Pump Station	PS A1	
9	CHECK valve	AC01	
40	BLOCK valve	*AB02	
79	BLOCK valve	*AB03	SD BVR A1
111	BLOCK valve	AB04	
125	Pigging Station	IPA1	
152	BLOCK valve	*AB05	SD BVR A2
171	BLOCK valve	AB06	
220	BLOCK valve	AB07	
227	BLOCK valve	AB08	SD BVR A3
244	Pump Station	PS A2	
259	CHECK valve	AC09	
290	BLOCK valve	AB10	
298	BLOCK valve	AB11	SD BVR A4
314	BLOCK valve	*AB12	
325	BLOCK valve	AB13	
333	BLOCK valve	AB14	
346	Pigging Station	IPA2	
358	BLOCK valve	AB15	
387	BLOCK valve	*AB16	SD BVR A5
398	BLOCK valve	AB17	
410	BLOCK valve	AB18	
412	CHECK valve	AC19	
422	BLOCK valve	AB20	
436	BLOCK valve	AB21	

 Table 5-3 Preliminary pipeline valve & facility locations

NOTES:

This table reflects the revised fourth issue of AGI locations issued by the engineering design team on the 27<sup>th</sup> of March 2002.

the 27<sup>th</sup> of March 2002. \* Locations where further field verification expected (eg, utility verification).

The block valves used for the remotely operated sites will be inline, full-bore and fully welded. They will be suitable for pigging operations and designed to fail in the 'as is' position (ie, the position in which they are at the time of failure). Each block valve station will be located within a compound measuring approximately 25m by 25m.

At the block valve sites, the valves themselves will be located underground with the valve actuator mechanism located above ground within a concrete structure. Each site will include an equipment room, which will also be within a concrete structure. A welded mesh wire fence with thin section steel posts will define the perimeter of each site. The typical layout of a block valve is illustrated in Figure 5-7.



#### Figure 5-7 Indicative representation of a block valve station

Power supplies for the block valve sites will be provided primarily from the Azerbaijan national grid (including national railway supplies), via overhead electrical cables. Each block valve site will be provided with a back-up generator capable of providing the full power requirements for that site. Electrical power will be used at the sites both for the operation of the pumps associated with the hydraulic valve actuation mechanisms and for ancillary activities such as lighting, heating/ventilation/air conditioning (HVAC), PCUs, telecommunications and security system operation. Essential and emergency loads will be powered from an uninterruptible power supply.

No power supply is currently envisaged at the check valve sites. Full valve opening during intelligent pigging operations will be achieved using a manually operated device which will be an integral component to each valve unit. Manual check valve opening will not be required for routine 'maintenance' pigging activities.

Valve stations will not be manned under routine operating conditions. The communications system (described in detail in Section 5.6.7) will transmit data about block valve status, operating conditions (including temperature and pressure) and security to the Sangachal and Ceyhan control centres.

## 5.6.7 Control/telecommunication systems

The basis of the control philosophy is for a manned, centralised control room at the Sangachal Terminal. Full back-up (alternate) control will be provided via the control room at the Ceyhan Terminal in Turkey. Remotely operated equipment will be installed at the block valve sites,

metering, pump and intermediate pigging stations. These control units will contain the field interface instrumentation equipment for control, monitoring, supervision, shutdown and fire detection at the facilities.

An optical fibre system will be installed to provide inter-site communications along the BTC pipeline route. The optical fibre cable will be installed concurrently with the BTC pipeline in the same trench. The network will support a wide range of communications services including:

- Telephone and facsimile
- ICSS data communications
- Information technology data communications
- Closed circuit TV signals for security and surveillance
- Other miscellaneous traffic or signals

The telecommunications optical fibre system has been designed such that no single failure will cause loss of ICSS communications to any of the stations or the main operating areas at Sangachal or Ceyhan. This will be achieved by using a system configuration that has self-healing characteristics and is designed with an integral level of redundancy for the primary communications system and through the provision of a satellite back-up link.

If multiple simultaneous failures occur, communications could be lost to any stations between the failure points, but the operation and safety of the isolated sections of the pipeline system will be maintained under control of the local station ICSS. When operating under these conditions of isolation, the station is termed as being in 'local mode'.

In the event of single or multiple failures of the communication system, satellite links will be available to provide essential voice co-ordination between operating personnel at strategic locations. Telephone/facsimile co-ordination of these strategic stations, operating in local mode, is expected to be an adequate contingency until primary communications are restored. The strategic stations will include all pump stations and the main control centres at Sangachal and Ceyhan.

## 5.7 OUTLINE OF PIPELINE SYSTEM CONSTRUCTION

## 5.7.1 Construction overview

Construction of the pipeline and associated facilities will be undertaken by a contractor, or multiple contractors, experienced in major pipeline construction, who will be contractually obliged to complete the works in accordance with applicable government regulations and requirements, project permits and authorisations and BP policies, plans and specifications.

Pipeline construction is a sequential process and comprises a number of distinct operations, undertaken by a large range of specialised and general crews (teams of workers and the necessary plant and equipment collectively referred to as the construction spread). Pipeline construction will use one or more conventional construction spreads to accomplish pipeline installation, and one or more special section crews to accomplish watercourse crossings and other specialized pipe installations.

The construction of the pipeline will require a number of temporary facilities, which will include worker construction camps and pipe storage yards. Each of these facilities is described in more detail below.

It is anticipated that the range of average pipeline lay rates will be between 680 and 720m/day/spread. Lay rates are, however, highly dependent on site specific factors (eg, ground conditions, topography, hydrology, the presence of restricted areas and the presence of preexisting infrastructure) and weather conditions. The sequencing of the construction activities and the direction of construction will be at the construction contractors discretion.

The construction programme will be conducted in accordance with the HGA and applicable government regulations, contractual requirements, applicable permits and authorisations, and company-approved drawings, plans, procedures and specifications. However, within this regulatory framework, the selection of many of the detailed construction methodologies and plant for the BTC pipeline project will be the responsibility of the successful construction contractor(s). As such, much of the more detailed approach in terms of construction methodologies has yet to be defined. This Section aims to present an indicative outline of the approaches that are likely to be adopted by the contractor, recognising that some details may change at a later stage of the project.

Prior to the commencement of each element of the construction programme, the construction contractor(s) will develop detailed designs, drawings and method statements for the work to be performed. These documents will incorporate the reasonable requirements of landowners and occupiers, the mitigation measures outlined in this ESIA and the requirements of the regulatory authorities in Azerbaijan.

# 5.7.2 Pipeline right of way

The Right of Way (ROW) as referred to throughout this ESIA, is however, more correctly known as the Facilities Construction and Installation Right of Way (FCI ROW). The FCI ROW is the corridor that is required for the pipeline construction and installation activities and is generally 32m wide. The FCI ROW is also referred to in the glossary.

Where the proposed BTC pipeline route intersects particular environmentally sensitive areas, public roads and other elements of infrastructure, the ROW may be less than 32m, as illustrated in Figure 5-8. It should be noted that a reduced working width can only be achieved for a limited distance without seriously impeding construction activities, and that reduction of the working width can lead to other impacts such as additional access road construction. In such situations, an optimized construction technique will be selected with the aim of balancing all considerations and constraints.

At certain areas, particularly crossings (eg, other pipelines, roads, watercourses, etc), additional temporary workspaces will be necessary to manage the additional spoil, plant areas and materials. These areas will be clearly identified along the ROW and approved prior to their use.

#### Figure 5-8 Anticipated right of way and clearance schedule



Figure:54a INDICATIVE STANDARD LAYOUT OF FIGHT OF WAY DURING CONSTRUCTION

Figure 3-86 INDICATIVE STANDARD LAYOUT OF RIGHT OF WAY (THROUGH RESTRICTED AREAS) DURING CONSTRUCTION Stage 1 Installation of STC Pipeline



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## 5.7.3 Pre-construction works

All pipeline construction activities will be undertaken within a demarcated strip of land known as the 'working width', which will generally be 32m wide. It should be noted however that a wider working width may be necessary at some locations, particularly where non-standard construction procedures are required (eg, service and river crossings, the ends of hydrostatic test sections). All facilities and AGI construction activities will be conducted within defined areas, on the basis of the facility design and the construction contractors method statements.

Before construction begins the route will be surveyed and marked. This will establish precise route alignment particularly in relation to important environmentally, archaeologically or socially sensitive sites. As far as practicable, the route has been chosen to avoid and/or minimise direct impacts on known resources.

## 5.7.4 Access roads

The road conditions in a number of areas of Azerbaijan are poor, with defects ranging from minor cracking of surface materials to significant potholing, and, in some cases, complete washout. To give adequate and safe access for equipment, materials and personnel to the construction sites and permanent facilities a number of existing roads and tracks will need to be upgraded and the construction of some new access roads will be required (Figure 5-9). Preference will be given to upgrading and/or widening existing routes rather than constructing new roads.

The details of any new permanent roads will be agreed in advance with the relevant authorities. Typically, a temporary access road will consist of a layer of crushed stone which can be removed when no longer necessary. Permanent road repair/upgrade will be in accordance with approved plans and specifications and will typically be achieved using a combination of asphalt, concrete and aggregate.

The engineering design team has identified a number of potential access routes, which will be investigated by the construction contractor(s) in terms of suitability for the logistical requirements of that contractor. Table 5-4 summarizes an estimate of new and existing roads to be used for the project. It also includes an estimate of the structures (principally bridges) that will require upgrade to allow them to sustain the anticipated traffic volumes and loads. These estimates are subject to ongoing review and verification.



Figure 5-9 Potential locations for access roads and associated construction facilities

#### BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA



Road for Access to:	No	Upgrade		ew	
	Upgrade		Permane Temporar		Temporary
			nt (to		(to Reinstate)
			4m	6m	
Primary Access Routes (*1)	510	-	-	-	-
Access to ROW	-	37.5	-	-	-
AGIs	-	26.3	26.7	1.58	-
Pipe Yards	-	13.6			-
Camps	-	13.7			-
Quarries and Asphalt Plants	-	6.8	1.80		-
Total	510	60	29	1.6	-
Structures	NA	16	-	-	1
NOTEO					

Fable 5-4	Potential	roads and	structures	for use	by the	project in	Azerbaijan
					~ ,	F	J

NOTES:

All lengths are quoted in km

Indicates no anticipated requirement

NA Indicates information that has either not been assessed or is not relevant

(\*1) Estimate of existing roads and main arterial routes attracting significant construction traffic during the course of the project

## 5.7.5 Pipe and equipment transport to the ROW

An important aspect of the construction process is the transport of pipe sections, plant and other equipment to the construction areas, dedicated storage areas and construction camps. For the Azerbaijani section of the project, it is anticipated that the majority of such transportation will be accomplished through the **u**se of the existing infrastructure in Azerbaijan (road and rail) and Georgia (port and rail). A description of the existing infrastructure within Azerbaijan is presented in Section 8, Environmental Baseline.

Line pipe delivery will represent the majority of movements associated with the construction phase. It is anticipated that the BTC pipeline sections will be transported from the pipe fabricating/pipe coating factories into Georgia via the port of Poti on the Black Sea coast and then onwards to Azerbaijan.

Pipe will normally be offloaded directly onto rail cars at the port and secured with dunnage and strapping to prevent damage to the pipe coating during transit. The rail systems of Georgia and Azerbaijan will then be used to transport the pipe sections to the pipe yards established for the project.

Mobile cranes will be used to offload pipe sections from the railcars to storage areas or pipe trucks at the pipe yard rail sidings. Although some of the pipe sections will be transported directly to the ROW, it is likely that most will be stored initially in the pipe yards. From the pipe yards, pipe sections will be transported to the ROW on trucks that will travel along approved access routes. It is anticipated that there will usually be three pipes on each truck, resulting in approximately 12,000 - 13,000 truck movements to take pipe from the pipe yards to the ROW. The contractor may propose to weld 'double joint sections' (ie, two lengths of standard pipe joined together) at the pipe yards to take advantage of a controlled welding environment. This may reduce the number of vehicle movements significantly, but will substantially increase the load and length of the trucks.

It is anticipated that the majority of the equipment needed for the pipeline construction programme, for construction support facilities and for the permanent installations will also be

imported and transported by a mixture of rail and road haulage to site. Individual items of equipment (eg, pump drivers, mainline valves) will be of considerable size and weight and may necessitate special measures (such as bridge strengthening) to enable their safe delivery.

# 5.7.6 Temporary construction facilities

Temporary facilities comprise pipe storage yards, warehousing, temporary project offices and construction camps. Earlier surveys have identified a number of suitable sites, however the final location and number of sites will be determined by the construction contractors and agreed with the BTC Management Team. The construction contractors will not be limited to the potential sites discussed in this Section, however the construction contractor will be required to assess the environmental/social sensitivity of any additional or alternative sites prior to their approval for adoption.

The identified potential locations for temporary facilities and temporary roads are presented in Figure 59. The characteristics of the anticipated temporary facilities are discussed in further detail in the following Sections.

### 5.7.6.1 Pipe and materials storage yards

#### Locations

The appointed construction contractor will decide which locations are to be used for pipe storage. Ten provisional locations have been identified following field surveys and environmental assessments. These are at roughly 40km intervals with an average area of approximately 23,000m<sup>2</sup>.

Potential sites for pipe storage yards have been identified in earlier surveys based upon the following criteria:

- Availability of adequate rail siding or spur lines
- Sufficient ground for pipe storage to meet anticipated quantities
- Reasonable road access/egress
- Proximity and access to the ROW
- Communications (landline/mobile systems)
- HSE requirements, in particular those relating to transportation
- Availability of local labour force
- Route maintenance
- The duration of occupancy required for BTC/SCP

#### Facilities

It is anticipated that the pipe yards will include the following facilities:

- Fabrication and pre-test area
- Double joint yard
- Pipe carrier turning circle
- Workshop
- Tyre bay area
- Inspection facility
- Electrical generators
- Diesel fuel storage tanks with secondary containment
- Accommodation area
- Medical facilities
- Canteen facilities
- Soak away areas
- Offices
- Communications including radio and mobile systems
- Waste material storage and handling
- Equipment storage areas
- Concrete coating and fabrication shop
- Security equipment and facilities

It is anticipated that electrical power for the pipe yards will be generated locally by diesel generator sets, however the contractor may, subject to approval by BTC Co, adopt alternative sources such as supply from the Azerbaijani railway system or national grid. A diesel powered emergency generator will also be provided to maintain an uninterruptible electrical supply. As the pipe storage yards will be manned, wastewater and sewage collection and treatment will be provided. The system and the method of disposal will comply with the project HSE policy and waste management strategy.

### 5.7.6.2 Construction camps

#### Locations

Potential sites for construction camps have been identified in earlier surveys based on the following criteria:

- Location
- Suitability of ground
- Communications (landline/mobile systems)
- HSE requirements, in particular those relating to transportation
- Access and egress, routes to ROW and national road system
- Availability of local resources, including labour force
- Their required period of occupation
- Proximity to proposed AGI locations
- Previous use as construction camp locations

A number of construction camps will be erected in Azerbaijan. The final locations of the camps are to be decided by the construction contractor, however, the locations which have been identified by preliminary assessments carried out by the project team in Azerbaijan are indicated in Figure 5-9. It is considered very likely that the contractor will choose to adopt two or more of these locations as their construction camps.

#### Facilities

It is anticipated that each camp will measure at least 500m by 500m and include the following facilities:

- Accommodation and offices
- All relevant utilities water supply and treatment, electricity,
- Medical suite
- Site security security hut at gate
- Helipad/airlift facilities (if deemed necessary as a result of the development of the project Emergency Response Plan)
- Maintenance building
- Warehousing
- Kitchens, canteens and cold storage
- All communications telephone, data and postal services, pay phones
- Paved roads and hard standing for lorries and car parking (concrete or asphalt)
- Boundary fences/walls
- External lighting to roads and walkways
- Storm water drainage
- A prayer room or mosque and other necessary worship facilities
- Fuel storage
- Waste storage and incineration facilities
- Sewage treatment and disposal
- Recreation facilities
- Laundry
- Equipment storage
- Welding gas storage
- Radiographic equipment storage

All power supplies necessary for the camps will be generated locally by diesel generator sets. Wastewater and sewage collection and treatment will also be undertaken at the camp site. The system and the method of disposal, although currently under development, will comply with the project HSE policy and project waste management strategy.

## 5.7.7 Construction procedures

### 5.7.7.1 Setting out/staking of the pipeline route

The initial activity associated with BTC pipeline construction is the final surveying and setting out or staking of the ROW and any additional temporary workspaces. This may include flagging to indicate the construction workspace boundaries. Environmental compliance personnel will participate in the pre-construction identification (eg, flagging) of environmental resources to be protected during the construction process. Examples of such resources include:

- Identified cultural resources (eg, archaeological and monument sites)
- Identified ecological resources (eg, tree or plant specimens to be protected)
- Watercourses, setbacks/buffer zones, and wetlands
- Key faunal populations



Figure 5-10 illustrates some typical activities associated with the preparation of the ROW.

Figure 5-10 Preparation of the construction corridor

Environmental activities may also comprise additional data collection, rare plant translocation, and pre-construction surveys for rare or protected wildlife. Other activities such as the location and exposure of existing pipelines and other services will also be conducted at this time.

### 5.7.7.2 Surface preparation and grading

The BTC pipeline route will need to be cleared and graded to permit the safe installation of the BTC pipeline and associated facilities/AGIs. This process will include the levelling and 'benching' (ie, the establishment of flat areas or terraces) of the terrain, stripping of cultivated areas and the removal of scrub, trees and shrubs. Clearance work will be undertaken using hand tools, construction vehicles and earth-moving plant.

To ensure that the ROW can be properly reinstated and to allow the re-growth of vegetation, the topsoil and subsoil will be removed as required and stored separately. Surfaced roads and paved areas that are subject to open trench crossings will be prepared by removing material only directly over the width of the pipe trench. This material will be kept separate from other stripped or excavated material.

Watercourse bank and bed material will be stored separately and will not be placed where flow or drainage will be obstructed.

The topsoil will be stripped across the working width by appropriate earth moving equipment and stored on the ROW. The topsoil stacks will not exceed 2m in height and will be kept free from disturbance to reduce the risk of physical damage and compaction. Generally, vehicle movements will be confined to a running track established on the underlying subsoil.

Where necessary, measures will be taken to maintain the flow capacity of watercourses including ditches and drainage channels that cross the ROW, whilst ensuring a continuous running track for construction vehicles. The measures to be implemented (eg, bridging, fluming, fording) will be selected by the construction contractors in consultation with the project management team.

# 5.7.8 Pipe stringing and bending

Pipe sections will be transported to the ROW, and laid end to end along side the trenchline. The pipe will be strung in a manner to minimise joint overlap and accumulation of pipe and to leave gaps for crossings and for access where necessary for pedestrians, livestock and wildlife. The pipe will not typically be strung on the ROW more than 5km in advance of the mainline welding. Figure 5-11 illustrates the stringing and welding process.



Figure 5-11 Stringing and welding of the BTC pipeline

Factory manufactured bends will be used for acute changes of pipe direction or elevation along the route. Where less severe bends are required these will be constructed using pipe-bending machines in the field. The quality of the bends will be controlled through the use of approved bending procedures, by witnessing trial field bends before production and by inspection of completed field bends.

## 5.7.9 Pipe welding and inspection

Following stringing and bending, the pipe sections will be elevated onto wooden blocks to the correct height to allow proper alignment of the sections and safe welding. Internal line-up clamps will be used to align pipe lengths.

Welded pipe will be inspected to ASME, ASTM, and BSI. Welds will initially be visually inspected, then subject to one or a combination of the following non-destructive testing (NDT) techniques:

- Radiography
- Ultrasonic testing
- Magnetic Particle Inspection (MPI)
- Dye Penetrant Inspection (DPI)

NDT inspectors will be suitably qualified (ie, to level II of the relevant PCN standard or ASTM-TC-1A standard).

Rejected welds will be repaired and re-inspected or replaced, as necessary. To minimise the number of tie-in welds below ground level, the pipe will be welded into the longest practicable strings. These strings will take into account third party access requirements across the working width.

# 5.7.10 Field coating

The BTC line pipe will be supplied with a factory-applied three-layer polyethylene coating. Field coating will be applied to all welds, fittings and areas where the factory coating has been damaged to provide a continuous coating along the pipeline. Following welding, the joint area will be gritblasted and a primer coat applied. Finally, a polyurethane pipe coating will be applied. The coating will be tested for continuity by means of spark testing.

## 5.7.11 Trenching

The first step of trenching is the staking and marking of the trench centreline. Where possible, existing third-party services (eg, underground cables, pipelines, drainage systems) will also be located and marked prior to the commencement of excavation work. Warning posts and bunting will be erected for overhead cables, and temporary crossing points will be indicated.

The trench will be dug to a depth that allows BTC pipeline installation with a minimum of 1m of cover from the top of the pipe to the pre-existing ground surface. The presence of sub-surface structures (such as other pipelines) and surface features (such as hills, rivers or irrigation channels) may require deeper installation of the BTC pipeline in some areas.

The trenching operation will be undertaken using methods to suit the local terrain and ground conditions. It is expected that trenching equipment will include backhoes and trenching machines. It is not anticipated that rock saws, explosives or rock hammers will be required for the excavation of the pipe trench in Azerbaijan. In confined areas, such as areas adjacent to existing pipes, a combination of backhoes and hand tools will be used to open and reinstate the trench.

In open rural areas of Azerbaijan, up to 15km of continuous trench may be open at any one time. Where the ROW is near settlements, measures will be taken to limit public access to the ROW or excavated trench.

Where ground conditions dictate, trench dewatering will be undertaken. When discharge velocities have the potential to create erosion, energy dissipaters will be used to establish sheet flow. Trenches will be dewatered in such a manner that no heavily silt-laden water flows into any wetland or waterbody. All trench water will be discharged away from water bodies, and onto stable surfaces to minimise erosion. In addition to implementing the erosion and sedimentation control measures for trench dewatering, the construction contractor will ensure that all other necessary measures are taken to prevent pollutants from reaching a wetland or waterbody. The use of filter bags, detention pits, or similar method may be employed as and when appropriate.

A typical approach to the trenching process is illustrated in Figure 5-12.



#### Figure 5-12 Typical approach to trenching activities

At locations where it is necessary to provide public access across the trench, safe trench crossings will be constructed. Warning signs and barricades will be erected around the trench, and adequate warning lights will be provided during the hours of darkness.

## 5.7.12 Lowering-in and backfilling

Prior to lowering-in, the BTC pipeline trench will be prepared to accept the pipe. Rocks or debris that could damage the pipe coating will be removed from the trench. Where needed, imported materials, screened to remove rocks, will be placed in the bottom of the trench. Where excavated material is unsuitable for backfilling, suitable materials with the appropriate characteristics may be sourced from commercial sources or 'borrow pits' (although the establishment of borrow pits is not anticipated to be necessary for the project in Azerbaijan).

After pipe joint coating and testing, sideboom tractors and backhoes will be used to lift the pipe section and lower it into the trench. Several sidebooms and backhoes are typically used simultaneously to accomplish the lowering-in procedure (as illustrated in Figure 513). Once lowered into the trench, each pipe section will be welded onto the preceding or adjacent sections.

Where the BTC pipeline crosses watercourses or where the water table is high, the BTC pipeline will be either concrete coated (to achieve negative buoyancy), or secured using ground anchors.

The trench will be backfilled with the material taken from the trench, in the reverse order to which it was excavated. The material will be consolidated by tamping or rolling. This process ensures that appropriate compaction of the material in the backfilled trench is achieved and reduces the risk of future settlement, washout and erosion. Care will be taken to eliminate organic debris, such as branches and chips, from bedding, padding and backfill materials.

In sloping terrain (usually 15 degrees and above), trench breakers (eg, bags filled with solid material, inert polyurethane foam, or similar material) will be installed across the width of the trench at suitable intervals and to within 100mm of the existing ground level. These act as barriers to subsurface water flows that could channel through the pipe trench, washout the backfill material and potentially expose the pipeline.

Any surplus material from trench excavations will normally be spread within the working width and within zones that exh**b**it similar subsoil types. The spreading work will be carried out in a manner that avoids the mixing of soil types to the greatest extent possible. Care will be taken to ensure that the trench spoil is spread beneath the topsoil and is not left on the surface. Where offsite disposal is necessary, it will be disposed of in compliance with project environmental requirements. Where necessary, land drains will be restored as part of the backfilling operation.

Figures 513 and 514 respectively illustrate the pipe lowering procedure and the backfilling process.



Figure 5-13 Lowering-in of the BTC pi peline

Figure 5-14 Backfilling activities



## 5.7.13 BTC pipeline crossings

Crossings are defined as the intersection between the proposed BTC pipeline route and preexisting features such as:

- Rivers and other watercourses
- Public roads and tracks
- Rail tracks
- Underground services
- Geohazards (eg, faults, mud volcanoes)

Crossing techniques for each of the above are discussed below.

#### 5.7.13.1 Watercourse crossings

With respect to crossings, watercourses include canals, aqueducts, drainage ditches, and natural streams and rivers. Table 5-5 presents a summary of the main watercourse crossings along the pipeline route:

Table 5-5 Wajor watercourse crossings					
River	Approximate KP				
Djerankechmes	9.3				
Pisgarat	42.1				
Girdmanchay/ Agsu	111.2				
Canal					
Geokchay	171.3				
Turianchay River	193.5				
Kura (east crossing)	223.6				
Karabach Canal	245.1				
Goranchay	257.8				
Kurekchay	276.5				

Table 5-5 Major watercourse crossings

River	Approximate KP
Korchay	292
Ganjachay	296
Sarysu	316.1
Gashgarachay	316.7
Karasu	320.9
Shamkirchay	332
Zayamchay	357
Tovuzchay	377.1
Hasansu	397.8
Kura (west crossing)	411
Kuradera	422.3

The route also crosses a number of intermittent watercourses that may be dry at the time of construction. Plans will be developed to address the potential for the watercourse to become active during construction, however, these are normally seasonal watercourses and construction will normally be scheduled for the dry periods. Additionally, marshy areas and areas with high water tables may call for similar construction methodologies to those adopted for watercourses. A detailed hydrological assessment has determined where river bed scour may occur and each river crossing design will reflect this through the depth of burial and the need for additional protective features.

Special construction crews and equipment will typically be utilised for the installation of pipeline sections at watercourse crossings. A variety of techniques are available for the crossing of watercourses and it is likely that several of them will be employed for the BTC project in Azerbaijan. A selection of common crossing methods is described in more detail below. On the basis of the current site survey work for the BTC pipeline route, it is anticipated that most crossings will be open-cut but that some watercourses will require HDD.

It should be noted that all of the construction techniques described will be subject to suitable ground conditions, site investigation borehole surveys, an agreed method statement for each crossing and the applicable environmental compliance requirements.

#### **Open Cut Crossings**

River and stream crossings will generally be constructed using the conventional open cut methodologies as outlined below. All methodologies assume flowing water, or the immediate potential for flowing water during construction. The open cut trench technique will typically be used in conjunction with weighted (usually concrete coated) pipe. The purpose of the concrete coating is to ensure negative buoyancy of the pipeline and to provide additional mechanical protection. If concrete-coated pipe is not used, a concrete slab, or concrete filled bags, may be buried in the pipeline trench above the BTC pipeline.

In order to avoid interruption of the flow of the watercourse, open cut crossings usually use wettrenching or flumed water crossing techniques. Where appropriate and advantageous, seasonal constraints on construction activities may be imposed to ensure that crossings are built during low flow conditions.

Pipe to be installed in the crossing is welded, inspected and coated at a site near the crossing. When the complete pipe section has been successfully assembled and inspected, it is lowered into place. Trench breakers are then installed in the trench near to the watercourse banks to prevent subsurface flow.

For the BTC project, the disturbed portion of the watercourse bed and banks associated with any open cut crossings will be returned to pre-construction dimensions, where possible. The trenching of the watercourse banks and bed will normally be undertaken immediately prior to installing the pipeline section of pipeline and the trench will typically be back-filled as soon as possible following BTC pipeline installation. This will minimise environmental impacts to the watercourse. The material placed over the pipeline as backfill will be at least as erosion-resistant as the original bed material. In addition, where the riverbanks have been disturbed, these areas will generally be stabilised within two days of pipeline installation, and restored to their original condition and contours. Where this is not possible, site-specific plans will be installed and maintained until the area has stabilised and vegetation is sufficiently re-established (as discussed in Section 10, Environmental Impacts and Mitigation). Sediment interception techniques may be used and could include filter berms, silt fences and straw bale barriers.

#### Method 1 (Dry open-cut - flumed)

In this method, water flow is maintained using temporary 'flume' pipes installed in the bed of the watercourse:

- The trenchline-only is prepared by stripping the topsoil from the watercourse banks and ramping them down to allow the safe installation of the pipeline
- Suitably sized flume pipes (eg, flow does not exceed 80% of the flume pipe(s) capacity) are installed
- The upstream end of the crossing is then dammed, forcing the flow through the flume pipes
- The downstream end is then dammed to prevent backflow into the open trench
- Where appropriate, fish and other aquatic life caught between the dams are transferred downstream of the crossing
- The pipe trench is then excavated below the flume pipes. De-watering and/or trench supports may be used to facilitate safe excavation. If pumps are used, the discharge hose is typically directed to an upland area that is well vegetated or through a filtering medium to reduce silt loads, before the pumped water is allowed to percolate back into the watercourse
- The pipeline is installed in the trench and the trench is then backfilled, initially with subsoil and then with the stored river bed materials
- The riverbanks are then reformed and profiled in accordance with the project Reinstatement Plan and erosion control measures (eg, silt fencing erosion control fabric) are installed

• The downstream dam, the upstream dam, and the flume pipe(s) are removed in that sequence

#### Method 2 (Dry open-cut - dammed)

This method is similar to that described under Method 1 above, except the water pumped around the trench:

- The site will be prepared as for Method 1 and a dam constructed upstream of the crossing and within the approved ROW
- Pumps, intake hoses, and discharge hoses are installed to pump the water around to the downstream side of the pipe crossing. Pumps will be fitted with grills to prevent fish entering them where necessary and will be provided with secondary containment to prevent fuel spills into the watercourse
- Energy dissipaters are typically used to prevent erosion/scour at the downstream discharge point
- Once the pumps have begun diverting water, a downstream dam is installed to prevent water from flowing back into the working area
- Where appropriate, fish and other aquatic life caught between the dams is transferred to a point downstream of the crossing
- The trench is then excavated in a manner similar to Method 1
- The pipe is installed, the trench backfilled and the whole area reinstated as for Method 1

#### Method 3 (Wet open-cut)

These are crossings using 'wet' installation by means of an open-cut trench. It is anticipated that this method will only be used where ditches are either generally dry or very small. The typical procedure will be as follows:

- The site is prepared as for Method 1
- The river bed material is then excavated (potentially through the running water) and stored separately
- The pipe is installed and the trench is backfilled
- The pipe is protected and the whole re-instated as for Method 1

#### Trenchless crossings

Where the size and design of a watercourse is such that an open cut crossing is impractical, or will result in too much environmental disruption, trenchless techniques may be used. A range of techniques is available, as described below. It should be noted that many of these techniques, including auger bores and pipe jacks, require deep excavations on either side of the crossing to achieve the installation of the pipeline. De-watering, sheet piling and other techniques may be required to enable excavations and construction techniques to be carried out in accordance with health and safety regulations.

The applicability of trenchless crossings is highly dependent on local geotechnical conditions and the techniques will typically require the utilisation of an area of land wider than the normal ROW at either end of the boring. The principal advantage of the techniques over open cut excavations is that they can facilitate the crossing of sensitive or inaccessible features (eg, gorges, rivers, railway lines, canals) with minimal disruption to those features.

#### Horizontal directional drill (HDD)

HDD is a large-scale operation that utilises lubricated hollow drilling rods to tunnel under a feature. The first stage of HDD is to drill a pilot hole using a string of drilling rods. As the drilling proceeds, a drilling fluid, commonly known as 'mud', comprising of water and bentonite (a

naturally occurring clay mineral) is pumped down the centre of the hollow drill rods to the drilling face. This lubricates the drilling rods and picks up cuttings before returning to the surface via the drill hole. The drill fluid is then filtered to remove the cuttings and returned to temporary storage tanks where it is held for re-use. The position and progress of the drill head is monitored and controlled from the surface using electromagnetic detection equipment.

It is possible that the drill may encounter groundwater as it progresses. The pressure under which the drilling fluid or mud is pumped down the borehole will be monitored to prevent migration into the groundwater and vice versa. Similarly, HDD may be affected by voids or solids within the substrate through which drilling is occurring. Drill fluid usage will be monitored at the surface to confirm no significant losses are occurring. As it is non-toxic, bentonite mud is normally used for drilling in areas where groundwater is likely to be encountered.

After the pilot hole is drilled, reaming devices are attached and pulled back through the borehole to enlarge it to the required diameter. A pre-prepared section of pipe will then be pulled through the borehole in one continuous action. This minimises the risk of it becoming stuck during the pull. Bentonite is injected around the reamer to coat the borehole, and support the sides of the hole as the pipe is pulled through.

The plant associated with directional drilling typically includes an HDD rig, two power units mounted on skids, bentonite storage and mixing tanks, a filter for separating cuttings from the drilling mud and a control cab. The pipe is usually 'strung' on temporary roller supports for fabrication and then winched into position.

Drilling and pull back operations are typically continuous, 24-hour operations lasting for up to three weeks. Once the section has been completed, the drilling rig and associated plant are removed. The drilling mud is usually sampled, analysed and disposed of offsite to a licensed waste disposal facility.

#### Auger boring

A pit is excavated on one side of the crossing large enough to take the auger head and a full length of pipe, approximately 12m long. A smaller receiving pit is excavated on the opposite side of the crossing. A 'cutting head' is fixed to the auger drill at the front of the pipe. Power is transmitted to the auger drill via a power unit that is temporarily fastened to the top and to the rear of the pipe. This assembly is then lowered into the sending pit and is supported by cranes or side boom tractors. Engineers then align and level the pipe to ensure it is installed in the correct location and at the correct depth.

A combination of rotation of the auger drill within the pipe and a winch located on the front of the power unit installs the first pipe section with the excavated material being drawn from the cutting head, down the auger drill flutes before exiting from the rear of the pipe. Additional work areas are required on both sides of the crossing to accommodate the additional excavated material from the pits and the auger boring equipment.

Once the first section of pipe is augured into the ground, the second pipe length is lowered into the pit and welded to the first. The auger is then restarted. This process of lowering, welding and auguring is repeated until the crossing is complete.

#### Pipe jack (carrier pipe)

This construction method is generally used on large diameter pipes and involves the carrier pipe itself being installed behind a protective shield using a combination of normal mining techniques and hydraulic jacks to drive the pipe forward, with the excavated material being removed via the

exposed end of the pipe. As each pipe progresses forward then another is welded on; by repeating this cycle the pipe is installed.

#### Microtunnelling

Microtunnelling could be employed for some of the crossings. This method involves placing precast concrete jacking pipes on the carrier pipe behind a microtunnelling machine with the excavated material being removed mechanically via the tunnel entrance.

The cutting head is lubricated with water and bentonite may also be used to reduce friction. The drill fluid is returned to the surface where it will be filtered to remove the cuttings and returned to temporary mud storage tanks for re-use.

Equipment associated with microtunnelling will include a power unit, one or two storage tanks for cuttings, separation plant and an operation board.

Used drilling fluids will be sampled, analysed and recycled or disposed offsite to a suitable waste disposal facility.

### 5.7.13.2 Road and rail crossings

Minor road crossings are likely to be accomplished by open trenching of one-half of the road at a time, with steel plates used to maintain one lane of through traffic at all times. Smaller rural roads may be closed to through traffic, following consultation with local officials and residents. Appropriate signs, barricades, and other traffic management measures, will be used to minimise road user inconvenience and promote safety during temporary closure of roads. The pipe to be installed in the crossing will be welded, inspected, and coated nearby. The completed fabrication will be lowered into the BTC trench during a low traffic period, and one-half of the trench covered with steel plates to restore traffic. The trench will be backfilled in one-half of the road at a time, using a lean-mix concrete or other readily compacted fill.

Rail crossings and major road crossings may be constructed using trenchless techniques similar to those described above for watercourse crossings.

## 5.7.14 Block valve station construction

Following initial site grading activities, equipment foundations will be constructed. Equipment will then be installed, involving the mechanical assembly and connection of the valve components, the cathodic protection, the telemetry repeater and facility piping and wiring. The site will then be surfaced and fenced.

## 5.7.15 Outline of facilities construction

The main pipeline facilities (ie, intermediate pigging stations and pump station) will be constructed under a separate contract to the main pipeline/block valve construction. The work will be conducted sequentially at each facility, however it is likely that the contractors will choose to work on a number of separate facilities in parallel.

At each facility, the construction programme is likely follow the same typical sequence:

- Site surveying to determine the geotechnical, geophysical and topographical features of each proposed facility site
- Locating, marking and isolating pre-existing underground services
- Raising or diverting existing overhead services such as power and telephone lines

- Perimeter demarcation and setting out
- Establishment of temporary fences and gates
- Establishment of access roads and internal facility roads
- Site clearance and preliminary grading
- Establishment of construction facilities (eg, materials stores, laydown areas, offices etc)
- Completion of detailed geotechnical assessments as required to support the detailed design of foundations for plant and buildings
- Soil improvement and slope stabilisation, if required
- Site excavation and placement to achieve the required cut and fill profile for the facility
- Installation of underground piping, drainage systems, utility lines and chambers
- Construction of retention ponds (as necessary)
- Installation of cathodic protection groundbeds
- Installation of building and equipment foundations
- Placement of ground slabs to support each building and key item of equipment
- Placement of equipment and construction of buildings
- Connection of the facility to the pipeline
- Installation of all above ground utilities and services (including security, lighting, fire fighting, process control and telecommunications systems)
- Installation of high security fencing and gates
- Installation of outer security wall and the provision of gates to suit
- Placing of granular surfacing to all unpaved plant areas
- Landscaping (as necessary) including the supply, planting and establishment trees and other appropriate plant species
- Reinstatement of temporary and permanent roads, paving, construction facilities, overhead services and other items that have been damaged as a consequence of the work

## 5.8 TESTING AND COMMISSIONING

### 5.8.1 Hydrostatic testing

#### 5.8.1.1 Testing procedures

The entire pipeline will be subjected to hydrostatic pressure testing to prove the strength and integrity of the pipeline system, in accordance with the relevant standard (ASME B31.4). Hydrostatic testing of the BTC pipeline will involve filling sections with water and raising the pressure to a minimum of 1.25 times the maximum allowable operating pressure (equivalent to 90% of the specified minimum yield strength of the material). (Note: although the governing engineering standard ASME B31.4 calls for an eight-hour test period a more rigorous test period of up to 24 hours may be adopted for this project).

The pipeline will be tested in sections to:

- Limit the volume of test water needed at one time
- Limit elevation changes, allowing the test pressure to be maintained between the minimum required test pressure and maximum pressure which the pipeline will safely withstand
- Suit availability of water sources and the projects waste minimisation objectives
- Accommodate the maximum stress criteria for each wall thickness

Hydrostatic testing activities will be carried out in sequence and will include the following:

- Welding of certified test ends onto each end of the pipeline test section
- Internal cleaning of pipeline sections using air or water-driven cleaning and gauging pigs to remove construction debris
- Gauging pig run to confirm the internal geometry is within specified limits
- Controlled filling of pipeline sections with water
- A temperature stabilisation period to allow the water and line pipe steel temperature to stabilise
- Pressurisation of the pipeline test section
- A test pressure hold period (ie, commencement of up to 24 hour strength and leak test)
- De-pressurisation of the pipeline test section
- Controlled dewatering of the pipeline test section
- Swabbing of the pipeline test section to remove as much water as practicable
- Removal of test ends

The displaced hydrostatic test water may be transferred to another section of pipe or discharged at a suitable location. Filters and break tanks will be used to remove any solids and control the rate of discharge. Discharge locations and rates will be agreed in advance with the relevant authorities. If chemical additives have been used, the water will be tested and treated, as required, to ensure all discharges are in compliance with applicable environmental requirements. During discharging operations, samples for water quality analysis will be taken and stored for reference.

Following successful hydrostatic testing and dewatering of two consecutive test sections a tie-in closing weld will be carried out to link the two sections together.

#### 5.8.1.2 Hydrotest water supply

Water for hydrostatic testing will be clean, contain the minimum achievable concentrations of contaminants (eg, sediment, bacteria) and be non-corrosive. Water abstraction sources will be selected to suit the geographical location of the pipeline and will be of sufficient quantity and quality to facilitate filling of the pipeline test sections without any detrimental effect to the surrounding ecology and downstream consumers.

The number of hydrotest sections, their volume and the amount of water that can be reused for more than one section will not be known until the completion of the construction contractors detailed plans for construction and commissioning. Based on the information currently available, it is likely that the Azerbaijan section of the BTC pipeline will be tested in at least four, and more probably in eight to ten sections.

Hydrotest water will be abstracted from surface water bodies located in close proximity to the BTC pipeline. The preferred source will be from one of the larger rivers crossed by the BTC pipeline such as the River Kura. Hydrotest water will only be taken from and disposed of at preapproved locations. It is likely that the testing programme will require continuous water abstraction for periods of several days at each abstraction point.

Prior to the commencement of the testing programme, the construction contractor will prepare, and submit for approval, a Hydrostatic Test and Monitoring Plan. The plan will detail methods to be used for water quality analysis for pipeline filling and discharge, and the environmental controls to be implemented to prevent or minimise the following potential impacts:

- Erosion at intake location (eg, by using a buoy intake)
- Erosion /scour protection at the discharge location
- Fish entrainment into the pump (ie, in identified fish habitats )

- Fuel spillage (eg, secondary containment of pump)
- Inadequate reinstatement of disturbed lands.

Potential hydrotest water abstraction points identified by the construction contractor(s) will be subject to an environmental review by the project team prior to their adoption. All necessary permits required for water abstraction and disposal will be obtained from the owner/occupier/local authorities and will be in accordance with project environmental requirements. The test water will be analysed to check quality before and after use; the use of chemicals will be minimised but it may be necessary to add corrosion inhibitors, oxygen scavengers or biocides.

## 5.8.2 Pre-commissioning

Pre-commissioning of the pipe will ensure the pipeline system has been constructed in accordance with the project design drawings and specifications. Unlike hydrostatic testing, precommissioning activities will be carried out over entire sections of the pipeline (eg, from launching pig trap to receiving pig trap). All tie-in welds and mainline equipment will have been installed and the pipeline system will be mechanically complete.

For the pipeline, pre-commissioning activities will be carried out in sequence and will include the following activities:

- Final internal cleaning of the pipeline using cleaning pigs
- Geometric survey using a specialist calliper pig to confirm the internal geometry of the pipeline
- Drying of the pipeline using dry air
- Dry lay up of the pipeline

Pre-commissioning of the pump stations, pigging stations and block valve stations will include the following activities:

- Internal cleaning of pipework by flushing with water
- Hydrostatic testing of pipework
- Internal inspection of pipework
- Drying of pipework using either vacuum drying or dry air

## 5.8.3 Pipeline lay up

The project team will aim to minimise the period between introduction of hydrotest water and the commissioning/ start-up (introduction of hydrocarbons) of the system. Where the period between the introduction of hydrotest water and commissioning exceeds 30 days then a lay-up procedure will be carried out as an integral part of the hydrotest and pre-commissioning procedures.

The system will be completely drained and free of all standing water. The system will be dried to a dew point of minus ten degrees centigrade or less at all exit points by blowing super dry air through the system and pushing foam pigs through the sections between pigging stations. The pig will be weighed at the beginning and end of the runs and the weights will be graphed to demonstrate the rate of reduction of water content in the line. When the dew point of  $-10^{\circ}$ C is reached at the exit points, the pigging process will cease. The system will then be shut-in for not less than 12 hours to allow it to come to equilibrium with the dry air. Exit dew points will then be measured and, if found to be above  $-1^{\circ}$ C, the drying procedure will be repeated. Once appropriate exit dew points have been reached then the pipeline system will be shut-in with a positive pressure until it is ready for commissioning and start-up.

## 5.8.4 Commissioning

Commissioning of the pipeline, block valves and associated above-ground installations will ensure that the pipeline system has been constructed in accordance with the design and that the system is ready for operation. Commissioning will also ensure that there are no defects in the pipeline system, which could cause problems during start-up (introduction of crude oil) or during operation.

Commissioning activities for the pipeline and block valves will be carried out in sequence and will include the following:

- Checking the opening, closing, sealing and operation of mainline block valves
- Operational checks on all instrumentation
- Operational checks on all ICSS and control equipment
- Operational checks on all metering
- Checking the operation of all pressure protection systems
- Checking the operation and settings of all pumping and associated equipment (eg, block valves, filters, pre-heaters)
- Checking the operation of other facilities (eg, generators)
- Checking the CP system to ensure that it is operating
- Undertaking integrity surveys to confirm continuity of pipeline coating

The minimum requirement for the commissioning of the BTC pipeline facilities will typically comprise the following:

- Start up and limited operation of permanent items of equipment and utilities by system (eg, firewater, power generation, communications and control systems)
- Nitrogen and helium leak-testing integrity checks (including in-line critical valve leak testing) of hydrocarbon systems at the designated operating pressures of the plant
- Purging of plant systems prior to the introduction of hydrocarbons
- Closed-loop running of process plant and equipment utilising appropriate test mediums to prove system integrity and correct functioning
- Plant performance trials conducted in accordance with specified performance criteria

The duration of performance trials and acceptance criteria will be based on the following considerations:

- Capacity of pipeline and facilities
- Methods to determine stock levels at start and finish
- Sample collection points
- Methods of measurement
- Adequacy of flow monitoring devices
- Consumption of raw materials
- Quality of finished product
- Reliability aspects
- Consumption of utilities
- Quantity and composition of effluent discharged
- Temperatures and pressures
- Flows and levels
- Product specification requirements
- Mass and energy balances

Following the successful completion of all required testing of the BTC pipeline and its associated facilities, and the implementation of all necessary management/contingency plans, it will be brought into commission by filling with crude oil from Sangachal Terminal. All hydrocarbon vessels and pipelines associated with the facilities will be purged with nitrogen prior to plant start up.

# 5.9 REINSTATEMENT AND EROSION CONTROL

## 5.9.1 Introduction

Prior to the commencement of the construction programme the construction contractors will be required to develop a project-specific Reinstatement Plan based on the project Reinstatement Specification. The full width of the ROW and all other project areas will be re-instated in accordance with the Reinstatement Plan on completion of the works. The contractor will also be required to incorporate reinstatement measures in their method statements for each critical element of the construction programme (eg, watercourse crossings, site clearance, re-grading). Additional details of the project reinstatement plans are provided in the Summary of Reinstatement Plan (Part 5 of Technical Appendices).

The key areas that may require reinstatement are as follows:

- The ROW
- Construction camps
- Pipe and materials storage yards
- Maintenance areas
- Temporary roads and transport facilities
- Waste management and disposal sites

The following Sections provide a summary of the reinstatement works that will be required for the BTC pipeline and are based on a reinstatement specification being developed by the project team.

## 5.9.2 Reinstatement philosophy

The project reinstatement specification is based on the following principles:

- Disturbed areas will be reinstated to pre-construction conditions (eg, contours) to the greatest practicable extent
- Disturbed areas will be stabilised to protect the integrity of the pipeline and minimise potential impacts associated with erosion, transportation and sedimentation of material from disturbed areas
- Disturbed areas will be re-vegetated to achieve conditions similar b those that exist immediately adjacent to the ROW
- Regular monitoring of all reinstated areas will be undertaken until environmental requirements and goals are achieved

## 5.9.3 Erosion control

An assessment of the route has been undertaken to identify areas of potential erosion and to support the development of appropriate erosion control measures for such areas. On the basis of
the erosion assessment and the technical objectives of the project, the following goals have been set:

- No risk of the depth of cover above the BTC pipeline being reduced
- Very low risk of offsite pollution and sedimentation
- Low risk of damage to bio-restoration by erosion of soils containing seedbank resources, vegetative material and plants

Further details of the erosion assessment and the classification of the soils along the route are provided in Part 5 of the Technical Appendices

# 5.9.4 Timing of reinstatement

Reinstatement of the ROW and facilities will be undertaken on a sequential basis dependent on the completion of construction and hydrostatic testing activities in each area. Where practicable, the ROW will be cleared of any residual construction debris, construction signs, and equipment prior to the successful completion of hydrostatic testing. Reinstatement of the construction corridor will then be started. Following successful hydrostatic testing, all other areas will be cleared and reinstatement started.

Should the proposed SCP construction follow directly from the BTC pipeline construction, full reinstatement will only be carried out as part of the BTC project on sections that will not be disturbed by SCP construction activities. Interim reinstatement and erosion control measures will be undertaken over the remaining portion of the ROW with final reinstatement of those areas being undertaken under the SCP project.

If there is a delay of more than 12 months between the completion of interim reinstatement and the start of construction of SCP for a route section subject to erosion control, then full erosion control measures and reinstatement will be performed over the whole of the disturbed area.

River crossings will typically be reinstated as soon as practicable given the BTC project constraints and regardless of the SCP construction schedule.

# 5.9.5 Site cleanup

Prior to demobilisation of construction personnel and equipment, cleanup activities will be conducted in accordance with environmental standards and industry best practice. Cleanup activities will consist of the removal and/or disposal of temporary buildings, equipment, tools, and excess material brought onsite or generated during the construction and commissioning programme.

# 5.9.6 Interim reinstatement

In areas that are expected to be disturbed within 12 months by the installation of the SCP, interim reinstatement measures will be implemented. The construction contractors will prepare a detailed method statement that identifies appropriate measures for each section of the pipeline according to the erosion potential of that section.

# 5.9.7 Permanent reinstatement

Permanent reinstatement will be undertaken on completion of the BTC pipeline hydrostatic testing in those areas that will not be subjected to disturbance by SCP-related activities and those

deemed unsuitable for interim reinstatement. Elsewhere it will be undertaken after completion of installation and testing of the SCP.

The first stage of the reinstatement programme will comprise the regrading of all working areas to achieve a final surface that is sympathetic to the natural landform contours where practical. Any required permanent erosion control measures (eg, diversion berms) will also be installed at this time.

To facilitate natural re-vegetation of the ROW, the separately stockpiled topsoil and vegetation debris will be spread over the surface of the ROW following completion of grading, as appropriate. The contractor will be required to comply with all requirements for the reinstatement of environmentally and ecologically sensitive areas, and will be required to submit a reinstatement schedule and methodology which, as a minimum, complies with the project Reinstatement Specification and the ESIA requirements (see Section10). In some instances, areas of sensitive natural habitats or high erosion potential may be seeded with a mixture of native plant species to facilitate re-vegetation. If deemed necessary by the project management team, additional surface stabilisation measures may be adopted in areas of high erosion potential.

The key reinstatement principles are summarised below:

- Minimise reduction in soil quality and structure through predetermined stripping, handling and storage procedures
- Use of appropriate temporary erosion control measures (including erosion matting, sediment traps, silt fences, and filter berms)
- Use of permanent erosion control (including diverter berms, and trench breakers)
- Reinstate all third party assets affected by project activities in accordance with pre-entry agreements
- Reinstate all redundant spoil and waste disposal sites. These will be closed, capped and landscaped in accordance with the relevant requirements of the project Reinstatement Specification and waste management strategy
- Reinstate certain locations such as environmentally sensitive areas, watercourses and locations prone to erosion, as soon as practicable after installation of the pipeline. Any development (including roads, tracks, bridges, construction camps etc) made to facilitate construction at these locations will also be re-instated to original condition as soon as practicable
- Undertake joint inspections of all reinstated areas (ie, involving contractors reinstatement personnel and BTC Co representatives) to ensure that all necessary measures have been undertaken
- Reinstatement of uncultivated areas to facilitate re-establishment of natural (pre-existing) vegetation communities (including, as appropriate, final grading, ripping, cultivating, reseeding and planting of trees and shrubs). Agricultural land will be tilled and left for reseeding by land users
- A target minimum cover of pre-existing ground vegetation established within one year of final reinstatement will be set for each reinstated area, on the basis of the floral composition and environmental sensitivity of the area
- An aftercare, monitoring and corrective action programme will be developed and implemented based on examining the bio-restoration process periodically after reinstatement

Any fences, services, structures, roads, tracks, pavements or other facility affected by the works connected with BTC will be repaired or replaced to a condition that is at least as good as that found prior to construction.

# 5.9.8 River bank reinstatement

Upon completion of construction works at a crossing, the banks and a surrounding buffer area will be reinstated in a manner that reflects the local environmental conditions. The construction contractor will produce method statements incorporating plans for erosion control, sediment control and reinstatement, prior to the commencement of work at the crossings. As a minimum the method statements will include information on the following:

- Recording of the original channel width, depth and slope prior to disturbance to allow reinstatement as near to the original as is practicable
- Construction of stable platforms designed to prevent changes in channel shape where vehicles need to regularly cross the river
- Re-contouring of banks to match surrounding slopes
- Environmental and engineering review of potential bank and bed stabilisation methods
- Replacement of the channel substrate
- Replacement of the bank topsoil
- Reseeding of the banks

The contractor will be required to submit a contract-specific Soil Erosion and Sediment Control Plan, relating to areas subject to washout. Measures to be used in such areas may include the provision of riprap, gabions or impervious membranes.

# 5.10 OPERATION, CONTROL AND MAINTENANCE

# 5.10.1 General

The pipeline system has been designed for minimal operational and maintenance intervention. The operating and maintenance requirements for the pipeline system have been developed to achieve the following objectives:

- Safety of operation for operations employees, customers and third parties
- Environmental compliance in accordance with HGAs, permits and authorisations, BP company policy, and project plans, specifications, and requirements
- Continuity of supply within design criteria
- Minimised operational expenditure consistent with meeting contractual obligations and sustaining the design life of the system
- Maintenance of the system's technical integrity and performance over its design life
- Full compliance with statutory and regulatory obligations
- Maintenance of the security of the system
- To demonstrate 'fitness for purpose' of the BTC pipeline for the length of its design life allowing it to operate at optimum condition during this period
- Centralisation and integration of operations and maintenance activities

The main Control Room will be located within the Sangachal Terminal. As an emergency response centre, a high-level communication network (telephone/e-mail) will be established between the Sangachal Terminal and the existing Emergency Response Centre in BP's offices in Baku.

The pipeline will be operated in accordance with international codes and standards. These codes place stringent requirements upon the operating company to ensure that:

- The pipeline is operated safely
- Staff are appropriately trained
- A thorough programme of preventive maintenance is implemented
- The pipeline is regularly surveyed

# 5.10.2 Operation and maintenance organisation

It is anticipated that the operation of the BTC pipeline will be managed by a dedicated team based across the three countries of operation.

It is anticipated that maintenance resources will be based at remote locations along the BTC pipeline route and the Sangachal Terminal. Each facility will be responsible for a part of the BTC pipeline within its geographical area, including associated block valves, pumping and metering stations. The requirements for these facilities will be determined with regard to required maintenance frequencies, personnel mobility and safety, communications, required speed of response etc.

The potential for sharing maintenance facilities with the SCP will be considered during detailed design.

# 5.10.3 Pipeline control

There will be a manned centralised control centre at the Sangachal Terminal Complex with remote control units at pumping and metering stations, intermediate pigging stations and block valves. The remote control units contain the field interface instrumentation equipment for control, monitoring, supervision, shutdown, fire detection, mechanical packages and supporting utilities.

The filling and emptying of the crude oil storage tanks at Sangachal will be controlled from the Sangachal Terminal. Selected information on the upstream supply infrastructure/plant status including tank levels and booster pump status will be provided to the BTC Crude Pipeline Operator by the terminal management system.

Under normal conditions pipeline throughput will be achieved by controlling the number and speed of the main oil line pumps at the pump station within Sangachal Terminal to achieve the required flow.

# 5.10.4 Pipeline maintenance

The pipeline system will be monitored and maintained to ensure that the system, as designed, constructed and tested, remains 'fit for purpose' throughout the BTC pipeline's design life. In general, BTC pipeline surveillance, function checks and condition monitoring will be used to anticipate system problems and allow them to be rectified in a timely manner. Planned maintenance will be implemented with the objective of minimising any risks associated with long-term plant and equipment operations. The incorporation of planned maintenance has been a fundamental element of the project development to date and it will be implemented throughout the operation of the BTC system.

BTC pipeline inspection and maintenance activities during operation will include the following tasks:

- Pipeline monitoring and surveillance
- Special crossing inspections
- Monitoring of population and third-party activities in close proximity to the BTC pipeline
- CP system monitoring
- Inventory monitoring surveys
- Functional operational checks and verification of plant and equipment
- Routine maintenance of plant and equipment at pre-defined intervals

Maintenance procedures for the BTC facilities will be developed and scheduled utilising a computerised maintenance management database. Maintenance procedures will provide the necessary instructions and technical information to support operational and maintenance activities that are necessary to satisfactorily maintain day to day plant operation, including:

- Stage by stage inspection, care and maintenance instructions
- Essential manufacturers maintenance instructions and references
- Isolation and permit to work requirements
- Previous historical reading/results etc

# 5.10.5 Wax removal

Below a temperature of approximately 38°C, waxes entrained in the crude oil start to solidify and form lumps within the fluid. Provided that the fluid does not stop flowing, these lumps will predominantly remain suspended in the crude and pass through the system.

Maintenance pigs will be used to remove or re-entrain wax that collects within the BTC pipeline or block valves. Following each pigging run the contents of the pig receiver will be drained to facilitate the removal of any residual wax collected by the pig. Collected wax will be pumped back into the BTC pipeline upstream of the main line pumps. Alternatively, the oil may be warmed or pressurised to keep the wax entrained in the crude oil as it passes through the receiver. As a result of these measures, it is not anticipated that significant offsite disposal of waste waxes will be required in Azerbaijan.

Final removal of the wax from the BTC pipeline system will occur at the Ceyhan Terminal where it will either be left in situ within the exported crude or removed and taken offsite for appropriate disposal.

# 5.10.6 Export system monitoring and pipeline surveillance

BTC pipeline surveillance will include the following activities:

- Patrolling
- Aerial survey
- Vantage point survey
- Leakage survey
- Liaison with owners/occupiers, tenants and authorities
- Coating defects survey
- CP system monitoring
- Online intelligent pigging

The surveillance programme will monitor the entire BTC pipeline length, however particular attention will be given to sensitive locations such as:

- Settlements
- Watercourse crossings
- Rail and road crossings
- Minor and major course deviations
- AGIs/facilities

The design of the surveillance programme will also take into account experience gained through the operation of the NREP and WREP in Azerbaijan.

In addition to the pipeline surveillance measures described above, closed circuit television (CCTV) and intruder alarm systems will be provided at each facility and ball valve site.

# 5.10.7 Training provision

During project development BTC Co will develop a comprehensive training programme for all BTC operation and maintenance personnel. The programme will deliver operations, maintenance and safety training requirements as well as ongoing development of personnel skills.

Skills will be regularly assessed, and a system maintained for recording and ensuring that all personnel working on the BTC pipeline system are fully trained and competent to perform their assigned duties.

Similar standards of training and competence will also be required of all of the contractors' personnel who may be required to work within such facilities during operation.

# 5.10.8 Helicopters

Provision will be made for the use of helicopters to support normal operations. In particular, they may be used to facilitate routine surveillance of the BTC pipeline corridor.

The strategic locations and the minimum requirements to facilitate helicopter services will be developed during the detailed design.

# 5.11 Decommissioning and Abandonment Plans

# 5.11.1 Legal basis

The HGA continues to be effective for a primary term of 40 years from the date of first shipment of oil. The BTC pipeline is therefore being built with an initial design life of 40 years. Some of the associated facilities, for example the pump stations, are being designed for an initial life of 20-30 years, maintainable for a longer operational period in line with the BTC pipeline design life.

Should the HGA be terminated for any reason during the period of BTC Co ownership of the line then BTC Co or its successor(s) are required to provide to the Azerbaijan Government a written Abandonment Plan detailing:

- Removal of all surface installations
- Clearance of all equipment from waterways and marine areas that may pose a navigational hazard

- Drainage and disposal of any remaining oil in the facilities
- Disconnection of the pipelines from supply of oil, and abandonment in place or removal where abandonment causes a risk to the environment
- Filling all abandoned underwater pipelines with water or inert material and the sealing the ends
- Re-vegetation of the pipeline corridor consistent with the terrain features and other prevailing conditions

Within 30 days of termination of the agreement a plan must be prepared describing how this will be achieved. This Abandonment Plan will be subject to approval by the Government. An ESIA will be prepared prior to implementation of this plan, to assess and minimise potential environmental and social impacts arising from the abandonment operations. This abandonment ESIA will be submitted to the Government.

Upon completion of the abandonment operations an assessment of contaminated land will be prepared recording the final contamination status of the location of the project facilities. This assessment will be subject to governmental approval.

In the event of abandonment of the line during BTC Co ownership then BTC Co will carry out monitoring for a period of two years in order to identify (and if required remediate) any adverse environmental impacts related to pipeline activities that may subsequently become evident.

# 5.11.2 Technical solutions for abandonment

As stated above, exact details of how facilities will be abandoned will be determined prior to abandonment, and agreed with the Government. Therefore it is not possible to determine at this stage exactly what techniques will be used. However, these will be in accordance with recognised international standards.

Possible abandonment techniques might include:

- Removal of all surface facilities and appropriate reinstatement
- De-oiling of the BTC pipeline, and disposal or re-use of any waste oil
- Filling the pipeline with air or nitrogen to slightly over atmospheric pressure
- Maintaining a functional CP system to prevent corrosion, as corrosion could lead to subsidence
- Investigating any corrosion that does occur and excavating the BTC pipeline section if necessary
- In the event of a high risk of subsidence it may be necessary to fill sections of the BTC pipeline with concrete to prevent collapse

# 5.11.3 Handover of facilities

BTC is being designed and constructed as a 'Build-Operate-Transfer' project. This means that 20 years after first export of oil ownership will transfer from BTC Co to SOCAR. It is possible that the member companies of BTC Co will retain a small holding in the pipeline system after the transfer of ownership to SOCAR.

Therefore, whilst the design life of the BTC pipeline is 40 years the period of BTC Co ownership is 20 years prior to handover of ownership to SOCAR.

# 5.11.4 Health, safety and environmental management

Health, safety, environment, and social (HSES) management plans will be developed to ensure compliance during the operational phase of the project. Wherever possible, the BTC HSES management system will be integrated with both the pre-existing upstream and WREP systems and any systems that are to be developed for the SCP.

The HSES management procedures that will be adopted for the project are described in detail in Section 15, Management and Monitoring.

# 5.12 PROJECT RESOURCES, WASTES AND EMISSIONS

# 5.12.1 Labour

# 5.12.1.1 Construction

Although the size and composition of the workforce will be at the discretion of the construction contractors, (subject to BTC Co approval), it is anticipated that construction will involve approximately 2,300 personnel. The workforce is likely to comprise approximately 1,600 personnel for the pipeline construction, 400 personnel for the facilities construction and 200 to 300 for the temporary facilities (ie, construction camps and pipe yards).

# 5.12.1.2 Operation

It is expected that pump station PS-A2 would be permanently manned by up to 10 personnel and that approximately 20 to 30 further staff will be employed along the pipeline. The intermediate pigging stations would not be permanently manned by technical staff, but would typically have a crew of five workers during a pigging run. It is anticipated that security personnel will be present at the pigging stations on a permanent basis. Block valve sites would not be staffed under normal operating conditions.

# 5.12.2 Construction equipment

The construction works will require the deployment of earth moving and specialist pipeline construction equipment. A summary of the estimated mobile and other related equipment required to accomplish the pipeline installation is presented in Table 5-6. It should be noted, however, that the precise type and number of equipment will be at the discretion of the construction contractors.

Plant Type	Estimated Number
Off highway tractors	50-100
Motor graders	10-50
Cranes	10-50
Pick ups	50-100
Dozers	50-100
Excavators	< 10
Sideboom	10-50
Pumps <50hp	10-50
Air compressors <50hp	10-50
Welders <50hp	50-100

Table 5-6 Major mobile plant summar y

Plant Type	Estimated Number
Rollers	< 10
Trenchers	< 10
Welding Rigs	10-50
Cement Mixers	10-50
Forklifts	< 10
Loaders/Backhoes	50-100
Agricultural Tractors	< 10
Dump Trucks	50-100
Off highway trucks	50-100
Generators <50 hp (350W)	< 10
Ambulances	< 10
People Cabs	10-50
Buses	50-100
Trailers	10-50

Major stationary plant anticipated for the construction phase is presented in Table 5-7 below.

		-
Location	Plant	Function
Construction camps (location and number to be decided by construction contractor)	Main power will be provided from diesel generators on site. Emergency diesel generator(s) would also be provided.	Main power and emergency power generation for construction camps
	Sewage treatment system Potable water system	Sewage treatment and provision of potable water
	Waste Incinerators	Waste management during the construction period
	Sewage treatment system Potable water system	Sewage treatment and provision of potable water
Pipe storage yards (location and number to be decided by construction contractor)	Main power would be provided from diesel generators on site. Emergency diesel generator(s) would also be provided.	Power generation and emergency power generation for pipe storage yards
	Sewage treatment system Potable water system	Sewage treatment and provision of potable water
	Waste incinerators	Waste management during the construction period

Table 5-7 Major stationary plant associated with pipeline construction

# 5.12.3 Construction materials

Estimates for consumption construction material are presented in Table 5-8 below. Amounts are estimates only.

Table 5-8 Estimated resource requirements for construction

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Resource Type	Estimated Amount	Units
Line pipe	154,300	Metric Tonnes
Aggregates (sand and gravel)	40,000	m
Concrete	23,000	m³
Cement (within concrete above)	8,000	Metric Tonnes
Asphalt/Tarmac	60,000	m <sup>2</sup>
Timber	3,200	m³
Fuel/Diesel	37,600,000	Litres
Structural Steel	3,000	Metric Tonnes
Welding gas	60,000	m³
Coating materials	1,505,000	m <sup>2</sup>
Fibre optic cable	445,000	Metres

# 5.12.4 Energy

## 5.12.4.1 Construction fuel consumption

Diesel fuels will be required for the operation of all mobile and stationary plant as presented above. It is estimated that 53,000 tonnes of diesel will be required for the entire construction period. These figures do not include shipping and rail transportation fuel consumption.

# 5.12.4.2 Operational Fuel Consumption

In the worst case from the emissions standpoint, combustion plant will operate on liquid fuels, predominately crude topped distillate. Consumption is estimated (for the programme of plant installation and operation as discussed earlier):

- 100 tonnes per year prior to construction of the pump station
- 132,000 tonnes per annum following construction and commissioning of PS A2

# 5.12.5 Water supplies for construction and operation

# 5.12.5.1 Construction

Raw water for sanitary and washing requirements at each of the construction camps and pipe yards will be sourced from one or more of the following:

- Purpose-designed and constructed boreholes
- Local civil or municipal supplies
- Springs
- Rivers
- Canals

These sources may also be used for potable water supplies if the water quality is shown to meet the World Health Organisation (WHO) drinking water guidelines. Should the water supplies fail to meet the guidelines, the following options will be considered:

- Installation and operation of a dedicated water treatment plant
- Use of bottled water transported to the site

#### 5.12.5.2 Operation

It is anticipated that water supplies for the pump station will be sourced from a deep borehole. located within the pump station site. Where necessary, water will be transported from pump stations to smaller facilities (eg, intermediate pigging stations) by tanker truck as required. Water treatment will be undertaken at each facility with the aim of providing supplies suitable for potable water use and, if necessary, service water use. The type and extent of treatment will be dependent on the size and nature of the facility being supplied, and the quality of the water supply.

The water treatment plant for pump station PSA2 will be designed to operate with the minimum of operator input. The design and operation of the plant will incorporate measures to minimise the use of chemicals and the production of liquid and solid wastes. Raw water supply at the site will be provided from a borehole drilled to a nominal depth of 100 m. If at the target depth of 100m no suitable water supply aquifer has been identified, the borehole will be progressed to greater depth or at a different location under the direction of a qualified hydrogeologist.

The borehole design will be prepared by the supervising hydrogeologist and will include features designed to minimise the potential for cross-contamination of aquifers and to avoid the migration of contaminants (including oil) from the surface to the aquifers.

The water treatment plant at the pump station will produce potable water that, at minimum, meets the WHO drinking water standards and BTC Co requirements.

The plant will be designed to produce an average of  $1m^3/h$  of potable water. It is anticipated that the treatment plant/process will include the following:

- Preliminary disinfection using hypochlorite (or similar)
- Filtration to remove solids
- Free chlorine removal through carbon filters
- A reverse osmosis unit
- Treated water disinfection with hypochlorite
- An ultra-violet (UV) sterilisation unit capable of processing 10m<sup>3</sup>/h of water. This plant may be located away from the main water treatment plant but will be directly linked with the potable water pumps
- Backwash accessories, tanks, pumps and reverse osmosis clean-in-place facilities

Each pigging station will be supplied with raw water by means of a water truck, or where necessary bottled potable water. An above ground service water storage tank will provide on-site water storage capacity. An anticipated peak flow water requirement of 5m<sup>3</sup> per hour is expected for the pigging stations

Each facility will be provided with a UV sterilisation unit suitable for the treatment of up to  $5 \text{ m}^3/\text{h}$ . The sterilisation unit will be designed and installed with the aim of ensuring that water is safe and free from bacterial or algal contamination at the point of use.

# 5.12.6 Wastes

#### 5.12.6.1 Introduction

The construction project will generate inert, non-hazardous and hazardous wastes over a period of up to three years. Operation of the BTC pipeline will result in continued generation of small

volumes of inert, non-hazardous and hazardous wastes for the remainder of the lifetime of the pipeline system.

# Figure 5-15 outlines the principal wastes that will be generated during the construction, commissioning and operation of the BTC pipeline.



#### Figure 5-15 Project activity waste summary

## 5.12.6.2 **Project waste management strategy**

A waste management strategy has been developed for construction, testing, commissioning and operation. The strategy was designed to address the needs of both the BTC and SCP projects and takes account of proposals made for waste management by the other oil industry projects in the region. It also provides for synergistic development of waste management strategies with these projects.

Prior to the commencement of the construction programme the BTC team will prepare a Project Waste Management Plan (WMP). The WMP will:

- Propose a minimisation/collection/storage/treatment/re-use/disposal route for each waste stream; identify potential third party re-users; propose incinerator types, duties and locations
- Describe possible locations of landfills or long-term storage sites
- State the method to properly managing (ie, training, storing, containerising, labelling, transporting, disposing) wastes
- Describe the transition of control from the construction contractors to the operator, including arrangements for wastes associated with commissioning

Relevant aspects of the WMP will be prepared in conjunction with the construction contractor and will be reflected in their own management plans for construction wastes.

#### 5.12.6.3 Project waste management principles

#### Standards

The BTC project will aim to adopt the standards specified in European Community (EC) directives and regulations on waste management.

#### Duty of Care

The principles of 'duty of care' (ie, the responsibility of a generator or owner of waste to ensure that it is handled, transported and disposed of in an appropriate manner) for wastes and waste ownership by the waste generator will be adopted by the BTC project throughout the construction, commissioning and operation of the pipeline. During construction and commissioning the construction contractor(s) will share the duty of care for those wastes generated by construction activities with BTC Co. During operation the duty holder will be BTC Co or their successors. The BTC Company, as the top-level managers of the project activities, have the ultimate duty of care for overall waste management.

#### Waste inventories and classification

Waste inventories will be created to quantify and characterise waste streams at each stage of the project. Separate inventories will be developed for construction wastes and for commissioning/operational wastes. As a minimum, wastes will be classified into four types, as follows:

Inert	Waste as defined in Article 2 of the Landfill directive 1999/31/EEC – essentially non-degradable, non-leaching and non-reactive materials.			
Hazardous Waste	Waste classified as hazardous according to Article 1(4) of Directive 91/689/EEC.			
Non Hazardous Waste	Waste that is neither inert, nor hazardous nor wastewater. It includes 'municipal waste' as defined in Article 2 of the Landfill Directive 1999/31/EEC.			
Waste Water	Fresh water that is contaminated as a result of project activity.			

Further subdivisions of these classifications may be developed and adopted on the basis of the treatment requirements (eg, incineration) and ultimate disposal point (eg, reuse, recycling, landfill) for each individual waste material.

The principal waste disposal options for each waste stream will be as follows:

#### Table 5-9 Waste disposal options

Waste Stream	Principal Disposal Options
Inert waste:	<ul> <li>Transfer to a third party for recycling or re-use</li> <li>Processed and used for construction and reinstatement purposes</li> <li>Burial in a landfill designed and operated in general accordance with the Landfill Directive (1999/31/EEC)</li> </ul>
Non-hazardous waste	<ul> <li>Transfer to a third party for recycling or re-use. A special case of this is to spread it on land for agricultural purposes. The waste, the land, and the spreading operation will be in general accordance with EC Directive 1986/278/EEC</li> <li>Burial in a landfill designed and operated generally according to the Landfill Directive (1999/31/EEC)</li> </ul>
Hazardous waste	Transfer to a third party for re-use

Waste Stream		Principal Disposal Options
	٠	Burial in a landfill designed and operated generally according to the Landfill Directive (1999/31/EEC)

The volumes of waste requiring ultimate disposal will be minimised both through the control of waste generation and through incineration. Inert and non-hazardous wastes that cannot be reused or recycled may be incinerated in an incinerator designed and operated in general accordance with EC Directive 89/369/EEC on Municipal Incinerators. Hazardous wastes may be incinerated in an incinerator designed and operated in general accordance with either EC Directive 1994/67/EC or EC Directive 89/369/EEC depending on the waste involved.

#### Hierarchy of Waste Management Practices

Each waste stream will be managed according to the following hierarchy of techniques, in which the technique chosen should be the first in the hierarchy that is safe and practicable:

- Eliminate or minimise the waste stream by choice of procedure or technology
- Re-use as a material
- Re-use as a fuel
- Process and re-use as a material
- Process and re-use as a fuel
- Incinerate and re-use or landfill the ash
- Landfill (not applicable to waste water)
- Discharge to a receiving water course (applicable only to wastewater)

#### Transfer of Waste to Third Parties

It is expected that there will be a wide variety of potential third parties that may receive wastes generated by the BTC project. These third parties will include commercial waste disposal contractors and entities (corporate or individual) that have the capacity to reuse or recycle individual waste materials.

In general, transfer of a waste to a third party for ultimate disposal will only be permitted if the part of their operation that is used for BTC project wastes meets specified EC standards. The disposal of waste timber and other reusable project wastes to the local population will, however, be permitted on the basis of a case-by-case review undertaken by the BTC Management Team.

#### Trans-boundary Waste Shipment

It is not anticipated that trans-boundary (international) shipment of wastes will be required for any element of the BTC project. Should the case arise where such shipments are found to be necessary, the shipments will comply with the relevant bilateral protocol and with the relevant requirements of the EC Regulation on the Supervision and Control of Shipments of Waste (Regulation 259/93).

#### 5.12.6.4 Construction and commissioning waste management

The construction contractors will be responsible for the management and disposal of wastes they generate during the construction and commissioning phases of the project. The contractual terms set for the construction programme require all waste operations and waste facilities to meet the requirements of the relevant EC legislation and guidelines. The adoption of EC standards is consistent with the stated project aim of meeting international standards and with the commitments made in the HGA for Azerbaijan.

BTC PIPELINE ESIA	
AZERBAIJAN	
FINAL ESIA	

 Table 5-10 presents an indicative and approximate estimate of the wastes that will be generated by the BTC construction project in Azerbaijan:

	Tatal		Tetel
	Total		Total
	(tonnes)		(tonnes)
SOLIDS		SLUDGES	
Activated carbon	7	Inorganic	Minor
Bricks & building materials eg, plaster	20	Organic	
Cement (dust)	1	- Grease	Minor
Clothing & PPE	15	- Paint	1
Concrete – cured	60	<ul> <li>Pipeline coating materials</li> </ul>	25
Paper and card	330	Sewage sludge	130
Plastic bottles, cans, drums & packing	330	LIQUIDS	
Plastic drums with pipe coating epoxy	50	Aqueous (Excluding Hydrotest V	Vater)
Water inlet filters	3	Blackwater (eg. sewage liquids)	45.000
Vehicle parts	1.1	Drum cleaning waste	950
Glass	390	Grevwater (eq. oily water, wash water)	105.000
Grease, rags & oil absorbents	40	Washdown water (pipeyards and camps)	315,000
Incinerator ash	460	Oilv	
Insulation	1	Diesel Waste	15
Light bulbs & tubes	0.2	Diesel generator – lube oil	35
Paint cans & brushes	0.05	Miscellaneous oils (incl. hydraulic)	3
Polystyrene products	15	Vehicle & equip. maintenance - lube oil	15
Stone & rock	None	MISCELLANEOUS WAS	TES
Tyres	15	Batteries and Electrical	
Cleared trees & branches	850	Dry battorios	1.4
Cleared undergrowth, shrubs, etc	80	Wet batteries	4
Waste timber	Minor	Misc electrical or electronic	
Packing crates & similar	170	Bulk electrical (switchgear fittings etc)	0.4
Concrete shuttering	40		0.4
Metals		Acids	Minor
Welding rods	8	Adhesives	0.4
Aerosol cans	2	Bitumen	130
Aluminium	Minor	General chemicals	150
Cans	65	Fire fighting foam	10
Sheeting	2	Glycol	Minor
Exhaust catalysts	0.2	Solvents	1
Copper (electrical wire, facilities services)	Minor	Radioactive (eq. testing sources)	Minor
Plastic-coated cables	0.4	Domestic	
Pipe-end protectors	20	Food	330
Steel (including stainless)	800	Clinical	0.7
		enniou.	

#### Table 5-10 Indicative construction waste breakdown

There are currently no waste disposal facilities in Azerbaijan that meet the minimum technical requirements set by the project. The principal waste disposal options available for the construction project are therefore:

- The creation of independent landfills and incinerators by the contractors specifically for project wastes
- Incorporation of the project needs into a regional waste facility development to cater for oil industry wastes from a number of sources including production and exploration activities in the Caspian

Given the project schedule and the current availability of waste disposal facilities in Azerbaijan, it is probable that the contractors will choose to establish at least one landfill facility and to employ at least two mobile/semi-mobile waste incinerators.

In order to achieve the timely establishment of a landfill, given the overall project schedule, it is likely that the construction contractor will prioritise siting studies and permitting approvals with the aim of initiating them soon after the award of the contract. Some wastes (principally hazardous materials) may require secure storage for an extended period whilst the ultimate waste disposal point is chosen and a landfill is established. Waste storage areas will be designed, constructed and operated in general compliance with internationally recognised standards, including the relevant requirements of EC Directive 75/442/EEC and 91/156/EEC.

It is proposed that most combustible construction wastes will be compacted at the pipe storage yards and construction camps prior to incineration. Various wastes generated at the ROW and camps will also be transported to incinerator sites for disposal. At this stage of project development, it is not possible to present details of waste incineration units that may be applied, however the chosen system(s) will be operated in general compliance with EC directives 89/369/EEC; 94/67/EEC; 91/689/EEC and COM (97) 604.

During commissioning a considerable quantity of waste will arise, mainly due to clean-up of construction wastes. It is planned that the construction landfill operators will be retained through commissioning until routine operation is established.

The contractors will be required to develop construction specific waste management plans prior to the start of the construction work. At the start of the construction contract, the contractors will undertake a waste minimisation/treatment/disposal study, guided by the project waste management strategy. The study will identify and quantify the expected wastes and describe:

- Proposals for reduction, treatment processing
- Third parties to whom waste will be transferred for re-use
- The locations of landfills or waste storage sites to be adopted or developed for use by the project

The findings of the study will be used in the development of the construction waste management plans. At a minimum, these plans will include:

- A consolidated summary of the applicable regulations and restrictions governing the generation, handling, treatment and disposal of wastes generated during the construction/commissioning phases of the project
- Any permitting requirements for waste treatment or disposal
- Detailed method statements for each element of the waste management handling, treatment and disposal process
- Any third party agreements for waste handling, transfer or disposal

After construction of each section of the route is completed, the waste handling/disposal facilities established under the construction programme will either be:

- Closed
- Retained for long-term pipeline operation
- Retained for use by the BTC project
- Transferred to a local operator for general use by the community

If a waste handling/disposal facility is closed, the construction contractor will be required to ensure it is appropriately de-commissioned (ie, including capping of any landfills), and the surface will be re-instated according to the project reinstatement strategy. If the facility is retained, it will be transferred to the operator or BTC contractor. Transfer to a local operator is most likely where the landfill is an extension of an existing site and it is not required for future company use.

#### 5.12.7 Construction waste and emissions inventories

# 5.12.7.1 Releases to the atmosphere

Atmospheric and effluent emissions associated with the construction activities were derived from the type and number of construction plant used and from the duration of each construction activity. These estimates are presented in Table 5-11, below.

Table 5-11 Assessment of combustion emissions arising from construction activities over the entire 15 month construction phase

Source	NO <sub>x</sub> <sup>(5)</sup>	СО	SO <sub>2</sub>	PM	VOC	CO <sub>2</sub>	CH₄
				Tonne	s		
Pipeline construction	2,096	960	170	197	249	150,000	15
Waste incineration <sup>(1)</sup>	4	1	4	29	No	2,000	No
					data <sup>(3)</sup>		data <sup>(4)</sup>
Power generation at	1,158	249	77	82	86	43,000	8
construction camps <sup>(2)</sup>							
Total	3,258	1,210	251	308	336	195,000	23

(1)Based on the total estimated volume of waste incinerated for all camps (2)

Based on total power requirement, for all camps, of 5.61MW

(3) No data was available to enable estimation of VOC emissions from waste incineration, however VOC emissions from this source are not expected to be significant.

(4) No data was available to enable estimation of methane emissions from waste incineration, however methane emissions from this source are expected to be negligible in comparison to CO<sub>2</sub> emissions. (5)

As NO<sub>2</sub>

## 5.12.7.2 Hydrotest Water Disposal

The maximum theoretical volume of hydrotest water would be equal to the entire pipeline capacity in Azerbaijan (ie, approximately 470,000 m<sup>3</sup>), however hydrotest water re-use will reduce this very considerably. Prior to the testing, the construction contractor will be responsible for the development of a hydrotest water supply, use and discharge strategy that incorporates measures to ensure efficient resource usage and ensures that abstraction and disposal of hydrotest water is appropriately managed.

Hydrotest water disposal procedures will be dependent on the quality of the water and the nature of any lay up (ie, temporary mothballing) period that has been undertaken. The contractors Hydrostatic Test and Monitoring Plan will include detailed method statements for all water disposal activities. The following sections outline the general procedures that will be applied.

To the greatest extent possible, Hydrotest water will be discharged, via break tanks and additional filters as appropriate, into the next section of pipeline to be tested. If necessary, additional water will be added to make-up any losses or differences in lengths of test section. If surplus water is encountered then it will be discharged at approved locations. Prior to the discharge of any hydrostatic testing waters to the environment, the water will be tested and the results known. Water will be discharged in a manner that prevents environmental impacts (eg, scouring, erosion) to land surfaces and/or watercourses.

It should be noted that all water discharged from a pipeline following hydrotesting would be discoloured/stained. Although visible, the levels of concentration are normally very low and as such can be safely discharged to the environment (ie, to vegetated ground and then indirectly to watercourse or directly to watercourses). The concentration of iron and other potential contaminants in the discharged water will be determined and, if found to be above approved water quality parameters, one of several options for appropriate disposal will be adopted:

- The hydrotest water will be diluted prior to discharge or the discharge rate will be reduced
- The water will be held in an approved holding area and allowed to evaporate off, the remaining iron residue will either be collected for proper disposal, or if concentrations are at or below acceptable limits, abandoned in place. Although this option will be retained for use should circumstances require, it should be noted that it is not currently anticipated that evaporation ponds will be used
- Chemicals (eg, manganese dioxide) will be added to neutralise the environmental effects of the iron

Hydrotest water that does not meet the water quality standards for direct disposal will not be discharged directly to the environment. After dewatering and disposal activities are complete, disturbed areas will be restored to their pre-construction conditions.

# 5.12.7.3 Waste management during pipeline operation

Upon completion of the commissioning phase, the project WMP will be re-formulated as an operational WMP. This plan will set out all necessary waste management procedures for routine and exceptional activities associated with the operation of the BTC pipeline. The operational WMP will be formulated with the aim of integrating the BTC waste management procedures into existing strategies and to maximise synergies with other projects in the region.

Given the limited range and extent of activities that will be undertaken on the BTC pipeline during operation, it is anticipated that the volume of waste produced will be very small, particularly during Phase 1 of the development (ie, prior to the commissioning of pump station PS A2).

It is expected that the operator will adopt some of the third party agreements made by the construction contractors as long-term disposal routes. It is also anticipated and that some or all of the waste handling/treatment/disposal facilities established during construction will be adopted for operational use.

# 5.12.8 Solid and non-aqueous waste

Solid and non-aqueous wastes for the operational phase of the project have been estimated by the engineering design team at approximately 21 tonnes per annum. It is anticipated that these materials will principally comprise domestic type wastes.

# 5.12.9 Waste water

## 5.12.9.1 General principles

Wastewater will be minimised by efficient use of raw water and water management schemes will be devised for both construction and operation. In order to minimise waste, the management

schemes will aim to ensure that water is re-used whenever practicable prior to treatment and disposal.

All wastewater, except for uncontaminated rainwater, will be treated prior to discharge. The standard of treatment, (ie, the limits in terms of concentration and/or flow of contaminants) will be location–specific and dependent on the conditions at the point of discharge to the environment. At a minimum, the relevant World Bank environmental performance guidelines will be complied with.

Run-off and dewatering from construction sites will be treated to remove suspended silt and other solid matter, as necessary. Other contaminated wastewater will be treated to the standards set out in the EC Directive on Urban Wastewater Treatment (1991/271/EEC). Where the Directive specifies different standards for different population ranges, the stricter standards will be chosen for the more sensitive receiving waters. Wastewater treatment facilities will be established at major construction camps and facilities. Other minor locations will use portable treatment equipment.

It is expected that water treatment plants will be established at the pumping station, the main construction camps and potentially at pigging facilities. These are likely to be capable of accepting a range of segregated wastewaters. Short-term camps are likely to have simpler facilities, such as packaged sewage treatment units and tanks to receive waste from chemical toilets.

If any wastewater is transferred to a third party for treatment, the requirements will be equivalent to those applying to third party landfill sites.

### 5.12.9.2 Operational Wastewater Streams and Treatment

The principal point of generation of wastewater under operational conditions will be pump station PS A2. Table 5-12 presents indicative estimates of the wastewater generation during the operational phase following the commissioning of pump station PS A2

Black	water	600 m <sup>3</sup>	
Grey w	200 m <sup>3</sup>		
Note:	Assumes worker numbers remain constant for entire export period.		

Table 5-12 Wastewater associated with total operational activities

A number of aqueous wastes would be generated at the proposed pump station sites, of several categories. Each would require different treatment schemes. The streams arising, and their outline treatment is presented in Table 5-13. Final design of wastewater treatment at pump station sites will achieve all project standards for water quality.

Table 5-13: (	Outline	wastewater	treatment
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Wastewater Stream	Outline Treatment
Domestic waste water including sewage	Sewage Treatment Package (STP)
Operational waste water from workshop	Oil-water separator (OWS)
facilities, process area and equipment washing	
(clean)	
Operational waste water from workshop	Held in sumps for either:
facilities, process area and equipment washing	Waste tanker collection
(contaminated)	Trickle feed to STP
	On/off site incineration
Rainwater runoff from roofs and undeveloped	Discharge to the environmental without

Wastewater Stream	Outline Treatment
areas	treatment
Rainwater runoff from process slabs and tank	OWS and any supplemental treatment to
Rainwater runoff from clean areas	Discharged to the environment without treatment
Firewater runoff from an incident triggering the deluge system process and storage areas	Held in firewater detention pond (FDP) for assessment of suitable treatment and disposal (possibly OWS, STP or tanker collection – to be decided for each incident)
Backwashings from water treatment filters and plant	OWS
Drainage from raw water, potable water or firewater tanks	Discharged to the environment without treatment

The likely treatment methods for each type of wastewater are described in more detail in the following sections.

#### Domestic wastewater

Domestic wastewater from the major AGIs and construction camps will be passed to a sewage treatment package (STP), specifically designed for the site throughput, to reduce suspended solids, chemical oxygen demand (COD) and biological oxygen demand (BOD). The construction contractor will determine the details of the STP design as part of their detailed design responsibilities.

The outflow from the plant will then be passed for offsite discharge.

#### Operational wastewater (clean)

Where there is minimal risk of oil contamination, such as domestic sinks, operational wastewater will be treated as domestic wastewater.

#### *Operational wastewater (potentially contaminated)*

There are several categories of potentially contaminated wastewater:

- Wash water from hosing equipment, vehicles or process slabs. This is to be treated by oilwater separation (OWS) equipment to remove solids and suspended oil droplets. Surfactants will not be used in the washing areas as their presence could potentially compromise the performance of the OWS
- Drainage of equipment coolant systems containing glycols and additives such as anti-corrosion reagents; this stream is unsuitable for treatment by an OWS, so must be collected either in drums or a dedicated water sump tank for later removal by an approved waste contractor. As suitably equipped waste contractors may be difficult to locate in Azerbaijan or Georgia, there are two further treatment options for this wastewater stream trickle-feed to the STP or incinerate using incinerators. These options are to be explored with equipment manufacturers
- Wash water from regular detergent washings of equipment. This stream is unsuitable for treatment by an OWS, so must be collected either in drums or a dedicated water sump tank for later removal by an approved waste contractor

#### Rainwater runoff (potentially oil contaminated)

Oil contaminated rainwater runoff could potentially arise from two main sources.

- 1. Water collecting in tank bunds, such as the diesel storage tank, where there is likely to be oil contamination. Such water should be manually pumped out to the OWS (via the firewater detention pond (FDP)). Such bunds will not be permanently connected to the FDP/OWS as there is the risk of flooding the unit with oil in the event of a leak
- 2. Rainwater falling on process areas that house equipment. The drains from these areas will be connected to the OWS. Likely areas to be connected in this way are those sited outside and having the risk of an oil spill, they include:
- Incinerator/waste compactor areas
- Pigging area
- Diesel generator package
- Firewater pumping area

#### *Rainwater runoff (clean)*

Clean rainwater runoff will arise from rainfall onto the gravelled areas of site and roofs of buildings. Since these areas are not expected to pick up any contamination, the water will be passed through site drainage to offsite discharge. In the event of an unexpected waste spill to the clean drains, the offsite outlet valve will be shut to allow a decision to be made on the treatment and disposal route. There will be the facility to sample and pump-out water held up in this way.

#### Firewater runoff

In the event of a fire in the pump station turbine house, the firewater deluge system will deliver up to large volumes of water at high flow rates. This water is potentially contaminated with oils, equipment coolants (glycols) and any chemicals stored within the building. In the event of a fire, process drainage from these buildings will be directed to an on site firewater retention pond. Any collected firewater runoff will be held in the pond until a treatment route is determined.

#### Back-washings from water treatment plant

In the train of water treatment equipment, there are water filters and potentially other plant items (sand filters or carbon adsorption units) that need cleaning or backwashing. It is likely that the liquid from backwashing would contain suspended solids that would be routed to the STP through the sewage drainage system.

#### Drainage from raw and firewater tanks

It is assumed that these tanks will need to be cleaned infrequently. The water should contain no contamination and may be safely routed to offsite discharge. When the firewater tank is cleaned, the offsite discharge valve will be closed to ensure that water is available should a fire arise during the cleaning process.

# 5.12.10 Atmospheric emissions

A range of atmospheric emissions will be generated by BTC project activities during operation. It is anticipated that the most significant components of such emissions from the environmental and social standpoint will be combustion gasses, specifically:

- Nitrogen oxides (NO<sub>x</sub>)
- Carbon monoxide (CO)
- Carbon dioxide (CO<sub>2</sub>)
- Sulphur dioxide (SO<sub>2</sub>)
- Particulate matter (PM)
- Methane (CH<sub>4</sub>)
- Volatile organic compounds (VOC)

Table 5-14 presents indicative estimates of the key operational emissions.

Source	NO <sub>x</sub> <sup>(2)</sup>	CO	SO <sub>2</sub>	PM	VOC		CH₄
			•	Tonnes/y	/r		
Pump driver turbines (PS A2) fired by liquid fuel	435	169	145	47	220	201,000	25
Pump driver turbines (PS A2) fired by gas fuel	359	184	0	14	24	173,000	615
Generators (PS A2) fired by liquid fuel	820	70	45	20	63	15,000	6
Generators (PS A2) fired by gas fuel	65	96	7	7	74	10,000	460
Firewater pumps	0.4	0.1	0.0	0.0	0.0	15	0
Generators (standalone IPSs)	119	26	8	8	9	4,000	1
Total – (gas available)	544	306	15	30	107	187,000	1,076
Total – (gas unavailable)	1374	265	198	76	292	220,000	32

Table 5-14 Assessment of annual combustion emissions arising from operational activities<sup>(1)</sup>

<sup>(1)</sup> Based on PS A2 operating at maximum capacity. <sup>(2)</sup> As NO<sub>2</sub>

As indicated in Table 5-14, the atmospheric emissions associated with operational activities were derived from the fuel requirements for the major thermal plant. Values presented do not reflect the operation of the crude topping plant, however such emissions are anticipated to be relatively insignificant compared to those associated with gas turbine operation. These values are summarised at the bottom of the Table according to the adopted fuel supply (ie, diesel or natural gas). It should also be noted that the emissions in Azerbaijan will be highly dependent on the phase of development of the project, the key features of which are as follows:

- Between 2004 and approximately 2006, no turbine drivers or other major plant will operate on the Azerbaijani section of the pipeline
- From year 2006 onwards, pump station PS-A2 will be operational
- In the worst case (from the point of view of atmospheric emissions), a crude topping plant would also be in operation at pump station PS A2

The subject of atmospheric emissions is discussed in greater detail in Section 10 of this ESIA.

# Legislation and Policy Framework

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# 6. LEGISLATION AND POLICY FRAMEWORK

This section of the ESIA outlines the legislation, standards and policies applicable to the BTC Project in Azerbaijan in two sub-sections. The first sets out the environmental legislative and policy framework and the second sets out the social legislative and policy framework.

# 6.1 ENVIRONMENTAL LEGISLATION AND POLICY FRAMEWORK

# 6.1.1 Introduction

The BTC Project will be designed, built and operated in a manner intended to conform with a number of legislative and regulatory requirements and other guidelines and policies, the main categories of which are set forth below:

- National legislation (including the Intergovernmental Agreement and Host Government Agreement the IGA and HGA, respectively which form a prevailing legal regime under domestic law in Azerbaijan)
- International Finance Institution (IFI) Policies
- International Conventions in force in Azerbaijan
- BP Corporate Policies

The standards set forth in international treaties (including the IGA and the HGA) are considered an integral part of Azerbaijan national legal system and override national legislation to the extent such rational legislation is inconsistent, with the exception of the Constitution of the Azerbaijan Republic and laws adopted by Referenda. Accordingly, the complete range of standards applicable to the BTC Project in Azerbaijan includes not only what is set forth in the IGA and the HGA, but also Azerbaijani environmental legislation and applicable international standards and guidelines to the extent that they are not inconsistent with the IGA and HGA. Finally, while the applicable national legislative and regulatory requirements together establish the minimum standards of performance below which the conduct of BTC Project Activities must not fall as a matter of law, the BTC Project will also be implemented in accordance with standards, practices and guidelines requiring conduct that will in many instances exceed those legal requirements. These include BP's corporate Health, Safety and Environment (HSE) policies and the requirements of various IFIs with which BTC agrees to comply as part of the BTC Project financing.

This section of the ESIA discusses the relevance of each of these to the BTC project. The descriptions of the IGA, HGA and other laws and documents included below are summaries only and are qualified by reference to the full text of the actual laws or documents.

# 6.1.2 National legislation

The national environmental legislation applicable to the BTC Project comprises the following sources of law listed hierarchically in accordance with the Constitution and other laws of the Azerbaijan Republic:

- The Constitution
- The IGA and the HGA
- The existing laws of Azerbaijan on environmental protection, safety and emergency situations, to the extent they do not conflict with the IGA and HGA

• Other regulatory requirements as set forth inter alia in various Presidential Decrees, to the extent they do not conflict with the IGA and HGA

The national environmental legislation applicable to the BTC Project, moreover, is covered by a covenant from the Government of Azerbaijan to the BTC Participants to restore the initial Economic Equilibrium in case of any negative change to the national legislation in force as of the Effective Date (See Section 7.2(x) of the HGA). Obviously, the policies of both BP and the IFIs will be applied to the BTC Project, as they exist from time to time regardless of this stability covenant.

Each of these pieces of legislation is reviewed below.

### 6.1.2.1 The Constitution

The Constitution is the governing law of the Azerbaijan Republic and prevails over any other national legislation or international agreements. It stipulates basic rights of people to live in the healthy environmental conditions [ART. 39.I.], have access to accurate information regarding environmental conditions and to receive compensation for damages suffered in relation with violations of environmental law by third parties [ART. 39.I.].

#### 6.1.2.2 The Inter-governmental and Host Government Agreement Framework

The BTC Project is being implemented within the framework of an Intergovernmental Agreement (IGA) among the three transit countries (the Azerbaijan Republic, Georgia and the Republic of Turkey) and is comprised of a package of documents including the IGA itself, three unexecuted forms of the Host Government Agreements (HGAs) and, with respect to the Republic of Turkey, unexecuted forms of the Lump Sum Turnkey Agreement (LSTK) and the Government Guarantee. Together, the IGA document package constitutes the binding international law and the controlling domestic law of Azerbaijan governing the BTC Project.

The foregoing IGA document package was ratified by each of the three Parliaments, and the last instrument of ratification was deposited with the depository in Ankara, Turkey, in June 2000. In October 2000, the BTC Participants executed one HGA with each of the three transit countries and, with respect b the Republic of Turkey, the LSTK and the Government Guarantee. Table 6.1 depicts the IGA and HGA Framework.

Table 6-1 IGA and	HGA Agreement I	Framework matrix	ζ.
AGREEMENT	AZERBAIJAN	GEORGIA	TURKEY
<b>IGA</b> Signed and ratified by Governments together with unexecuted forms of the three HGAs, the LSTK and the Government Guarantee appended thereto	~	~	~
<b>HGA</b> Signed by Government and the BTC Participants as private law contracts.	$\checkmark$	~	✓
LSTK Signed by BOTAS and BTC Participants as a private law contract.	n/a	n/a	✓

Table 6-1 IGA and	HGA Agreement I	Framework matrix	Σ.
AGREEMENT	AZERBAIJAN	GEORGIA	TURKEY
<b>Government Guarantee</b> Signed by Turkish Government and BTC Participants as a private law contract.	n/a	n/a	✓

# 6.1.2.3 The IGA

In an effort to ensure more uniform application of environmental, health, safety and technical standards across the three jurisdictions in which the BTC Project will be constructed and operated, Article IV of the IGA states that "[such standards will be] in accordance with international standards and practices within the Petroleum pipeline industry (which shall in no event be less stringent than those generally applied in the European Union)." This more general statement is subsequently elaborated in the relevant provisions of the HGA as described below.

## 6.1.2.4 The HGA

In addition to its role as an integral component of the IGA, the HGA is also a contract entered into between the Government of Azerbaijan and the BTC Participants. The HGA determines the following components of the regulatory framework for the conduct of BTC Project Activities:

- The overall regulatory framework within which the BTC Project will be constructed and subsequently operated including the technical and design standards
- The applicable foreign and international environmental standards and practices incorporated by reference into the national legislation by the HGA
- The regulatory requirements applicable to the BTC Project and the administrative responsibilities of different government departments for the BTC Project
- The liability of the BTC Participants to the State and to third parties for, inter alia, breaches of the national environmental legislation

Each of these components will be briefly summarised below.

#### The overall regulatory framework

Article 12 and Appendix 3 of the HGA detail the environmental, health and safety standards and practices applicable to the project. The main principles of Article 12 include the following:

- The environmental, health and safety standards are set forth in Appendix 3 and are applicable notwithstanding conflicting national standards and practices (12.1)
- If spillage occurs, the BTC Participants will take all necessary action as set forth in Appendix 3 (12.1)
- The applicable social impact standards are set forth in Appendix 3 (12.2)

The following is a brief summary of the matters covered in Appendix 3 of the HGA:

- Order of priority for actions shall be protection of life, environment and property (Clause 3.1)
- Environmental standards to be conformed with (Clause 3.1)
- Procedures to be followed in the event of an emergency (Clause 3.2)
- Enactment or promulgation of future environmental standards and practices by regional or intergovernmental authorities shall not apply to the extent they are different from, in addition to, or more stringent than the Environmental Standards applicable as of the Effective Date (Clause 3.3)
- Scoping study and risk assessment requirements (Clause 3.4)
- Contaminated land baseline study requirements (Clause 3.5)
- Environmental Impact Assessment procedures and requirements (Clause 3.6)
- Spill Response Plan procedures and requirements (Clause 3.7)
- General principles to be followed in the preparation of the scoping study, risk assessment, Baseline Study, EIA and Spill Response Plan (collectively termed the "Environmental Strategy Product") (Clauses 3.8 to 3.11)
- Procedures to be followed in the event of dispute as to the implementation of the Environmental Strategy Product (Clause 3.12)
- Liability for pre-existing environmental pollution, contamination or damage (Clause 3.13)
- Abandonment plan procedures and requirements (Clauses 3.14 to 3.16)

The general requirements described in Clauses 3.6 and 3.8 to 3.11 have formed the basis for the methodology and structure adopted in the environmental impact assessment for the project. For purposes of technical compliance, as well as for purposes of achieving compliance with the applicable environmental standards and practices, the HGA also sets forth the technical and design standards for the BTC Project.

Section 3.1 of Appendix 3 of the HGA is explicit in that the BTC Participants shall:

In conducting all activities involved in the [Pipeline Activities], the [BTC] Participants shall use Best Endeavours to minimise potential disturbances to the environment, including the surface, subsurface, sea, air, lakes, flora, fauna, other natural resources and property. The order of priority for actions shall be protection of life, environment and property.

#### HGA Environmental, Health and Safety regulatory process

The HGA also specifies that, *inter alia*, all environmental, health and safety approvals shall be provided on a priority basis within thirty (30) days but in no event later than sixty (60) days (subject to the provisions of Appendix 3). Appendix 3 of the HGA also details the regulatory requirements associated with the preparation, submission and publication of various components of the environmental strategy product including a scoping study, risk assessment, an environmental Baseline Study, the Environmental Impact Assessment and the Spill Response Plan.

#### HGA principles on environmental and other liabilities

In addition to the obligation imposed on the BTC Participants by Article 12 of the HGA, Sections 10.1 and 10.2 further set forth the principles of liability applicable to the BTC Participants in the event of a breach by them of the national environmental legislation. The BTC Participants shall be liable to the State Authorities for loss or damage arising from any

breach by them of the HGA or the national legislation of Azerbaijan. Moreover, the BTC Participants shall be liable to third parties for any breach of the standards set forth in the HGA or the national legislation, provided, however, that the BTC Participants shall not be liable to the State Authorities for punitive or consequential damages.

# 6.1.3 Existing national legal & administrative framework - environmental

Azerbaijan is divided into 78 administrative and territorial units (Districts) and the Nakhichevan Autonomous Republic. All central government bodies are located in Baku, the capital city. The principal administrative functions in each District are performed by Local Executive Bodies. A full description of the administrative structure is given in Section 10, Socio-Economic Baseline.

A variety of government bodies share responsibility for environmental and social issues. The following organisations are particularly significant:

- Ministry of Environment and Natural Resources (MENR)
- State Committee on Land and Cartography
- State Labour Committee
- Health Ministry
- State Committee for Architecture and Construction
- Municipalities and the Local Executive Authorities

Until May 2001 the national environmental regulatory body of Azerbaijan was the Azerbaijan State Committee of Ecology (ASCE). The ASCE had interdepartmental status and was directly subordinate to the President of the Azerbaijan Republic. The ASCE has now been replaced by the MENR.

The MENR was recently formed from the merger of four state organisations comprising the State Committee for Ecology, State Committee for Hydrometeorology, State Forestry Committee and the State Committee for Geology. The MENR is responsible for the following:

- Development of draft environmental legislation for submission to Supreme Soviet (Milli Mejlis)
- Implementation of environmental policy
- Enforcement of standards and requirements for environmental protection
- Suspension or termination of activities not meeting set standards
- Advising on environmental issues
- Expert review and approval of environmental documentation, including Environmental and Socio-economic Impact Assessment

Throughout this document, references are made to both of these regulatory bodies. This has been necessary, as many activities carried out in the early stages of the BTC project involved consultation with the ASCE. However, any future consultation will now be with the MENR. Further guidance on the ESIA process in Azerbaijan is given in:

- 1999 (June 8) Law on Environmental Protection
- 1999 (August 4) Law on Ecological Safety

• 1996 ASCE/UNDP Handbook for the Environmental Impact Assessment Process in the Republic of Azerbaijan

The ESIA Process is applied to all development proposals in principle. The extent and depth to which the ESIA Process is applied is dependent upon the severity of the expected environmental impacts. This decision is made by the MENR, in consultation with appropriate experts. After consultation with the MENR, the BTC Participants have agreed to undertake a full ESIA.

# 6.1.3.1 Protected Areas

The laws on Environmental Protection and Natural Areas and Objects of Special Protection include specific provisions concerning the status of Specially Protected Areas. Activities with a potential to have a negative impact upon the environment are not allowed in State Natural Reserves, National, Natural and Ecological Parks as well as the State Natural Forbidden Areas. With the exception of State Natural Reserves, which represent the highest protection category, operations that have no negative impact on the environment are allowed after approval by the MENR.

A network of Specially Protected Areas, with different levels of protection, has been established and now functions within the Republic of Azerbaijan. The Specially Protected Areas are grouped as follows:

- State Natural Reserves, including Biosphere Reserves
- National Parks
- Natural Parks
- Ecological Parks
- State Natural Forbidden Areas (Wildlife Sanctuaries)
- Natural Monuments
- Zoos
- Botanical Gardens and Arboretums
- Health Resorts
- Hunting Reserves

•

A key objective in routeing the pipeline has been to avoid protected areas. The proximity of the pipeline to protected areas is described in Section 8.

There are also currently 14 areas within Azerbaijan that are protected due to their cultural importance. These Cultural Reserves fall under the jurisdiction of the Ministry of Culture. The BTC pipeline route crosses the very northern tip of the Gobustan Cultural Reserve, but away from any of the features for which the Reserve is designated. It was not possible to route the pipeline to avoid the Reserve due to significant terrain constraints to the north.

Protection, use, and restoration of Reserve Areas are carried out on the basis of the "Law On Protection of Historical and Cultural Monuments" and the "Law On Culture", as well as on the basis of international conventions and recommendations [eg the Convention on Protection of World Cultural and Natural Heritage (Paris, 16.11.1972) and the European Convention on Protection of Archaeological Heritage (La Vilette, 16.01.1992)].

# 6.1.4 Other international agreements and conventions

A broad range of multilateral and regional agreements is relevant to the BTC Project and has been fully considered in the EIA and other environmental studies. Following the independence of Azerbaijan in 1991, the ASCE began to establish close contacts with international environmental organisations and various Government environmental departments.

The Government of Azerbaijan has ratified the following relevant international conventions:

- (1948) Universal Declaration of Human Rights
- The 7 core ILO Conventions<sup>1</sup>
- 1971 Convention of Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention), 1982 Protocol and 1987 Amendment to the Convention
- 1972 Convention concerning Protection of the World Cultural and Natural Heritage
- 1973 Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)
- 1979 Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)
- 1987 Montreal Protocol on Substances that Deplete the Ozone Layer
- 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
- 1991 Espoo Convention
- 1992 UNECE Conventions on the Protection and Use of Transboundary Watercourses and International Lakes
- 1992 Convention on Prevention of Marine Pollution
- 1992 Convention on Biodiversity
- 1992 United Nations Framework Convention on Climate Change
- 1994 Convention on Combating Desertification

In addition, Azerbaijan has acceded to the following conventions, which have not yet been ratified:

- 1951 International Convention for the Protection of Plants and Plant Products
- 1985 Vienna Convention on the Protection of the Ozone Layer
- 1998 Convention on Access to Information, to Public Participation in the Decisions Making Process and the Administration of Justice concerning Environmental Matters (Aarhus Convention)

# 6.1.5 International Finance Institution (IFIs) policies and guidelines

The BTC Project is currently negotiating financing with a number of IFIs. In connection with any financing, IFIs such as the International Finance Corporation, part of the World Bank Group, the European Bank for Reconstruction and Development (EBRD) and export credit agencies require compliance with specified environmental and social policies during the term of any financing provided by them.

<sup>&</sup>lt;sup>1</sup> Forced Labour (C29, 1970 & C105, 1957), Freedom of Association and Right to Organise (C87, 1948), Right to Organise & Collective Bargaining (C98, 1949, Discrimination (Employment & Occupation) C111, 1958, Equal Re-numeration (C100, 1951), Minimum Age (C138, 1973).

The BTC owners are also required by the provisions of the HGA to "conform to the environmental standards and practices ... generally observed by the international community with respect to Petroleum pipeline projects comparable to the Project" (Article 3, HGA). Thus, to satisfy the HGA, potential international lending agencies and to ensure good practice, all ESIA work for the BTC project is being carried out with regard to World Bank Group and EBRD policies.

These policies will include environmental standards applicable to the project as well as guidelines covering resettlement and other actions involved in project development and operation. The policies that will apply to the project will be set out in an environmental action plan that will be included in the project loan documentation. Tables 6-3 to 6-5 indicates the policies that may be deemed applicable, and have been considered in developing this ESIA.

oolicies considered
ind EBRD
Group a
rld Bank
IFC/W <sub>0</sub>
Table 6-2

Policy	Potential relevance to the BTC Project	Compliance by the BTC Project	ESIA Document Reference
ntal nt	Requirement for environmental assessment (EA) of projects proposed for financing.	Through the development of this ESIA report.	
998)	BTC project has been classified as a Category "A" project for the purpose of environmental screening. Projects are classified as Category A if they could have "adverse impacts that may be sensitive, irreversible, and diverse" (OD4.01).		
	The associated guidelines specify the stages of the EIA process, discuss their objectives and list requirements for each stage; including screening, scoping and development of terms of reference, preparing environmental assessment report, EA review and project appraisal, and project implementation.		
	EA for a Category A project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives and recommends any measures needed to prevent, minimise, mitigate, or compensate for adverse impacts and improve environmental performance.		
atural r 1998)	OP4.04 embodies the "no net loss" principle, Paragraphs 4 and 5 state: "The IFC will not invest in projects that significantly convert or degrade critical natural habitats or in projects that otherwise affect habitats supporting threatened or endangered species. They will also not invest in projects that significantly convert or degrade other natural habitats	The BTC project, and BP recognise the importance of protecting biological diversity, and in particular ensuring that protected natural habitats are avoided where at all possible through the route selection process. Where an overall project assessment indicates that this is unfeasible, and the overall benefits substantially outweigh the	See Section 8, Environmental Baseline, and Part 1 of Baseline Reports (Appendices) for a discussion of habitats and protected areas

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	Table 6-2 IFC/World Bank Gro	up and EBRD policies considered	
Policy	Potential relevance to the BTC Project	Compliance by the BTC Project	ESIA Document Reference
	unless careful and comprehensive review and analysis indicate that: 1, No feasible alternative exists for the project or it's sitting; 2. The projects overall benefits substantially outweigh its environmental costs; 3. Project plans include mitigation measures acceptable to IFC; and 4. Project sponsors have the ability to implement necessary conservation and mitigation measures or the project includes plans that are acceptable for developing this capacity.	environmental costs, direct mitigation measures have been developed and will be implemented to minimise the impact. Where a residual impact remains, the project will implement compensation plans and environmental investment projects to offset this impact and ensure that there is no net loss to biological diversity.	
OPN11.03 Management of Cultural Property (September 1986) 1986)	The World Bank Group's general policy regarding cultural properties is to assist in their preservation, and to seek to avoid their elimination. OPN11.03 states that the Bank normally declines to finance projects that will significantly damage non-replicable cultural property "Cultural Property" is defined as "sites having archaeological, palaeontological, historical, religious and unique natural values". Along the BTC pipeline route areas and sites have been identified that are important from an archaeological or cultural perspective.	The project has gathered detailed cultural heritage and archaeological information through literature searches and consultation with national and international experts. Extensive non-intrusive integrated baseline surveys involving teams of national and international experts have been completed and sites of potential importance avoided where possible through route selection. Remote sensing tools, including aerial photographs have been used to identify potential sites. Intrusive Phase 2 surveys will be undertaken to define the extent of any potential sites prior to construction, enabling further avoidance measures to be taken. Pre- excavation of sites will take place if no alternative route can be identified, and the overall project benefits outweigh any costs.	See Section 8, Environmental Baseline, and Part 2 of Baseline Reports (Appendices) for a discussion of important cultural Heritage features. A Cultural Heritage Management Plan is included in Part 2a of Baseline Reports (Appendices).

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Policy	Potential relevance to the BTC Project	Compliance by the BTC Project	ESIA Document Reference
		Direct site protection measures will be implemented during the construction phase. Archaeologists will be present to monitor any late finds during construction. Plans are being developed to manage, record and preserve finds. The Cultural Heritage Management Plans will be subject to regular review and revision to ensure that the Project Plans remain appropriate and effective.	
OD4.30	The principal World Bank instrument governing project	Project land acquisition and associated	See Section 11, Socio-
Involuntary	impacts resulting from land expropriation is World Bank	livelihood impacts will be addressed in	economic Aspects, Impacts and
Resettlement,	OD 4:30 Involuntary Resettlement <sup>2</sup> . World Bank OD 4:30	accordance with international good practice	Mitigation, of this ESIA for a
(June 1990)	Involuntary Resettlement is invoked where the	as embodied in the policies and guidelines of	discussion of the land
	involuntary taking of land results in people experiencing	the IFC/World Bank Group. Requirements	acquisition process. This
	economic or physical displacement through one or more	contained in Azerbaijan legislation and the	section outlines the principles
	of the following circumstances: (i) relocation or loss of	project HGA will also be complied with.	that are being followed to
	shelter; (ii) loss of assets or access to assets; (iii) loss of		address BTC project and
	income sources or means of livelihood, whether or not	The overarching goal of the BTC project is:	expropriation and associated
	the persons must move to another location; and, (iv) loss		physical and economic impacts
	of access or restriction of access to communal resources	To restore or enhance project affected	on land owners, users and
	and services. Projects entailing any of the foregoing	peoples' living standards, income earning	occupiers in Azerbaijan, and
	impacts are required to prepare a Resettlement Action	capacity and production to at least	outlines in more detail how the
	Plan.	without-project levels	above key issues will be
			addressed and compliance
	Through careful pipeline alignment and facilities siting,	In compliance with OD4.30, the BTC project is	achieved.
	the BTC Azerbaijan project will minimise impacts on	completing a Land Acquisition and	
	housing and the need to physically relocate households.	Resettlement Action Plan (LARAP). This	A full Land Acquisition and
	The project will also involve impacts on land, productive	document is currently under preparation using international specialists experienced in World	Resettlement Action Plan is also being prepared for the

Table 6-2 IFC/World Bank Group and EBRD policies considered

BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA <sup>22</sup> There are presently two involuntary resettlement policies in force within the World Bank Group. On advice of the World Bank Group, the project has adopted OD 4:30.

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ESIA Document Reference	project.	The BTC project consultation process is discussed in more detail in Section 16, Consultations. The full Public Consultation and Disclosure Plan is provided in Part 8 of the Technical Appendix.
Compliance by the BTC Project	Bank Group Policies and national land procedures. The LARAP will be prepared through consultation with project-affected people and will be publicly disclosed. The LARAP will also address the following key issues: Grievance mechanisms Valuation of land and compensation determination Liaison with communities Negotiations Documentation of land use and/or ownership Eligibility for compensation Land re-instatement Monitoring and evaluation	A Public Consultation and Disclosure Plan (PCDP) has been prepared for the BTC project in accordance with the World Bank Group policies. Public Consultation and Disclosure of information have been carried out through the design stages of the BTC project and will continue throughout construction and operations. A scoping report was completed in consultation with NGOs, scientists, academic
Potential relevance to the BTC Project	assets, and livelihood through (i) temporary use of land for construction purposes; (ii) permanent acquisition of land (or imposition of rights to construct and operate a pipeline under existing ownership) for the pipeline alignment and two permanent AGIs; and, (iii) imposition of restrictions on land use adjoining the pipeline. The project will impact privately owned land, municipal and state land, some of which is leased to private entities and individuals.	The World Bank Group requires consultation with project stakeholders including the potentially affected population, NGOs and other interested parties about the project's environmental and social aspects, and to take their views into account. The consultation should begin at an early stage of the project design. IFC's publication "Doing Better Business Through Effective Public Consultation and Disclosure – A Good Practice Guide" provides "step- by-step" practical guidance on how to prepare a constructive public consultation. Under the World Bank Group policies, the BTC project
Policv		Policy on Disclosure of Information (September 1998)

Table 6-2 IFC/World Bank Group and EBRD policies considered

BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA LEGISLATION AND POLCY FRAMEWORK DECEMBER 2002 6-12
	ESIA Document Reference	۵		Employment issues are addressed in Section 11, Socio-	economic Aspects, Impacts and Mitigation.	
Table 6-2 IFC/World Bank Group and EBRD policies considered	Compliance by the BTC Project	institutions, regulators and other interested stakeholders the early engineering design phase. The report was disclosed and comments taken into consideration during the execution of the ESIA baselines studies and impact assessment. Consultation continued during the ESIA preparation. The draft ESIAs will be disclosed in accordance with the HGA and World Bank	Group requirements.	The BTC Project or its contactors will not employ Child or Forced Labour.	The Invitations to Tender and Contracts contain appropriate clauses to address this.	m and FRPD anidelines considered
	Potential relevance to the BTC Project	must complete a Public Consultation and Disclosure Plan (PCDP).		<b>NOTE</b> * Consideration of this policy is a requirement for all World Bank Group investments and does not pre-	suppose that the Bank believes that the Project is involved in such practices.	ToNo 6.3 IFC/World Bank Crou
	Policy			IFC Policy Statement on	Child/Forced Labor (March 1998):	

BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA

	Table 6-3 IFC/World Bank Gro	oup and EBKD guidelines considered	
Guideline	Potential relevance to the BTC Project	Compliance by the BTC Project	ESIA Document Reference
World Bank	These Guidelines address onshore oil and gas	The BTC project has been designed taking	See Section 6.1 and 6.2 of this
and Gas	בארוסומנוסוו, מווווווא מוומ הוסמסנוסון סרפומנוסווא.	particular in the areas of air emissions, waste	ESIA report for a description of the application of IFI
Development		management and oil spill prevention.	requirements.
(Onshore) (July			-
1998)			A framework Oil Spill Response
			Plan has been included in Part
			7 of the Technical Appendix.

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# Table 6-3 IFC/World Bank Group and EBRD guidelines considered

uideline	Potential relevance to the BTC Project	Compliance by the BTC Project	ESIA Document Reference
			Section 5, Project Description, outlines the project design and how these standards have been achieved.
			Section 10, Environmental Aspects, Impacts and Mitigation

# Table 64 IFC/World Bank Group and EBRD procedures considered

Procedure	Potential relevance to the BTC Project	Compliance by the BTC Project	ESIA Document Reference
EBRD	EBRD Environmental Procedures (1996) detail the	The BTC Co have commissioned this ESIA to	
Environmental	environmental appraisal process and standards required	address the requirements of the EBRD's	
Procedures	of projects sponsored by the Bank. An EIA is required for	procedures.	
(1996)	all Category "A" projects, as listed in Annex 4 of the		
	procedures, including large diameter oil and gas	The Public Consultation and Disclosure Plan	
	pipelines.	(PCDP) developed (discussed above) details	
		the BTC project's consultation and disclosure	
	It is the responsibility of the project developer to	programme.	
	commission and conduct the necessary environmental		
	investigations to the satisfaction of the Bank.		
	EBRD operations are structured to meet national and		
	existing European (EU) environmental standards. Where		
	EU standards to no exist, national, World Bank standards		
	and international agreements apply where relevant.		
	EBRD encourages developers to comply with good		
	international practice and standards.		
	EDDD hollower that officiative mublic concutation is a work		
	בטעה מפוופעפט נוומן בוופטוועב מתמווט נטווטמוומו וט מ אמא		

LEGISLATION AND POLCY FRAMEWORK DECEMBER 2002 6-14

Table 6-4 IFC/World Bank Group and EBRD procedures considered

Procedure	Potential relevance to the BTC Project	Compliance by the BTC Project	ESIA Document Reference
	of improving the quality of operations. The EBRD		
	requires project sponsors to ensure that national		
	requirements for public consultation in the country of		
	operation be met and that these in turn meet the		
	procedures described in the "Banks Disclosure of		
	Information Policy". For Category "A" projects the EBRD		
	requires the project sponsors to provide the affected		
	public and interested NGOs with notification about the		
	nature of the operation. The EIA and Executive Summary		
	should be available to the public in the local language, in		
	accordance with relevant national legislation and allow		
	sufficient time for public comment.		

# 6.1.6 BP corporate policy

#### 6.1.6.1 Policy

BP corporate policy focuses on five areas: ethical conduct; employees; relationships; health, safety and environment; and control and finance. They apply equally to all BP activities worldwide. BP policy commitments are the foundation on which its business is built and carried out.

BP's corporate policy states that long-term relationships founded on trust and mutual advantage are vital to BP's business success. BP's commitment is to create mutual advantage in all relationships so that others will always prefer to do business with BP. This will be done by:

- Understanding the needs and aspirations of individuals, customers, contractors, suppliers, partners, communities, governments and non-government organizations
- Conducting activities in ways that bring benefits to all those with whom relationships are held
- Fulfilling obligations as a responsible member of the societies in which the company operates
- Demonstrating respect for human dignity and the rights of individuals

BP is committed to working to build long-term relationships founded upon:

- High performance standards
- Delivering on promises
- Openness and flexibility
- Learning from others
- Mutual interdependence
- Sharing success

The BTC owners have nominated BP HSE Policies as the basis on which the BTC Project is developed.

#### 6.1.6.2 HSE Policy commitment

BP's commitment to HSE performance in the Caspian region, and applicable to the BTC project, is outlined in Figure 6-1 overleaf.

BP expects to apply it's corporate policies above, and in particular on safety, health and the environment as long as it remains Operator of the project, and subject to the decisions made by Project Participants with respect to operation of the project. BP will apply these policies as in effect from time to time and the policies described in this ESIA are subject to change.

#### Figure 6-1 BP HSE Policy in the Caspian



2.

David Woodward Business Unit Leader BP Azerbaijan September, 2001

#### 6.1.6.3 HSE Management

BP manages HSE through the application of a set of Corporate HSE Elements and Expectations embodied in the BP document "*Getting HSE Right*" or GHSER. All aspects of environmental management are addressed including the requirements for risk assessment; environmental impact assessment; emergency preparedness and response; community relations, and reporting and disclosure of information.

The policy expectations under the BP HSE Management System Framework state that, in all activities and operations, BP will:

- Comply fully with all legal requirements and meet or exceed our HSE Expectations wherever we operate in the world
- Provide a secure working environment by protecting ourselves, our assets and our operations against risk of injury, loss or damage resulting from criminal or hostile acts
- Ensure that all BP employees, contractors and others are well informed, well trained, engaged in and committed to the HSE improvement process; we recognize that safe operations depend not only on technically sound plant and equipment but also on competent people and an active HSE culture, and that no activity is so important that it cannot be done safely
- Regularly provide assurance that the processes in place are working effectively; while all BP employees and contractors are responsible for HSE performance, line management is accountable for understanding and managing HSE risks
- Fully participate in hazard identification and risk assessments, Assurance Management System Assessments and reporting of HSE results
- Maintain public confidence in the integrity of our operations; we will openly report our performance and consult with people outside the company to improve our understanding of external and internal HSE issues associated with our operations
- Expect that all parties working on BP's behalf recognize that they can impact our operations and reputation, and must operate to our standards. We will assure ourselves that our contractors' and others' management systems are compatible with our Commitment to HSE Performance

#### 6.1.6.4 Environmental performance guidelines

Furthermore, BP has developed a set of environmental guidelines applicable to the development of new projects. The BP "*Upstream Environmental Performance Guidelines for New Projects and Developments*" apply to all new developments and major modifications undertaken by BP, including BTC project. They link the environmental assurance process with the engineering, commercial and business development processes. The guidelines require projects to use a zero damage philosophy as the starting point for project design and development. Any variations away from this basis must be evaluated against the following criteria:

- Technical feasibility
- Safety
- Legal Compliance
- Good Engineering Practice
- Environmental Damage Costs
- Expert Professional Judgment
- Remediation & Mitigation Options
- Reputation

The Environmental Performance Guidelines require the establishment of a set of project environmental goals, based on the concept of zero damage. These goals serve as the aspirational drivers for the project. Targets are set in line with these goals against which the environmental performance of the project design and implementation are measured.

The environmental goals established for the BTC project are:

- No combustion emissions
- No loading and offloading emissions
- Zero discharge to land or surface waters (eg oil, chemicals, wastes)
- Maximise efficiency of net energy exported
- Restoration of habitat and hydrogeological regime after construction of pipeline
- No permanent disruption to livelihood of local population
- No resettlement of inhabitants of local population
- No loss of containment of product
- No third-party damage to the pipeline
- No damage to protected ecological areas or archaeological sites
- No creation of access routes to otherwise inaccessible areas

#### 6.1.6.5 Corporate focus areas

BP has three publicly stated corporate environmental focus areas:

- Biodiversity
- Green House Gas Emissions Reduction
- ISO 14001 Environmental Management System Accreditation

#### Biodiversity

The BTC project recognises that it has the potential to have real and measurable impacts on biodiversity, both positive and negative as reflected by the Project Environmental Goals.

In his speech in 2000 at the BP Conservation Awards ceremony, Lord John Browne formalised BP's ongoing practical commitment to biodiversity through making specific external commitments to take action on biodiversity issues:

"We can have a real, measurable and positive impact on the biodiversity of the world. That is a high aspiration - but like our other aspirations we're determined to show that we can deliver."

And that BP were committed to achieve this by:

- "Working to understand the impact of our current activities....
- Ensuring that key staff monitor and manage conservation and biodiversity issues in their area of responsibility as part of their performance contracts....
- Expanding the area we manage for conservation....
- Integrating biodiversity considerations into our operating practices....
- Working with others local communities, partners and contractors so that our effort is part of a wider drive in the right direction....
- Undertaking a series of specific initiatives in the countries and areas where we Operate ....
- Measuring, reporting and auditing performance....

- Setting targets to drive the right behaviours, publish results and have them independently verified....
- Sharing our ecological data with the World Conservation Monitoring Centre (WCMC)"

BP has a strategy in place that sets out 5 elements for action:

- Responsible Operations understand impacts on biodiversity and demonstrate continual improvement in performance
- Public Policy contribute constructively to the public policy on biodiversity
- External Relations understand what is important to people; forming partnerships to develop solutions to biodiversity issues
- Conservation Projects create collaborative partnerships, fund and contribute to conservation activities aligned with local, national, regional and global priorities
- Research, Education and Awareness make a positive contribution to biodiversity research and education; raise awareness and understanding of employees, people BP works with and customers

At the BTC project implementation level, the BP Corporate Biodiversity Strategy is translated into:

- The need to comply with the commitments and spirit of International Treaties and Conventions to which Azerbaijan, Georgia and Turkey are signatories
- Integration of project plans with national and regional biodiversity action plans
- A robust route selection process including evaluation of biodiversity impact, resulting in the pipeline construction corridor that avoids the most sensitive areas, including IUCN Category I to IV sites
- An open and thorough public consultation process to identify sensitive areas, possible mitigation measures and achieve buy in and consensus on solutions
- Development of direct mitigation measures such as re-routes; reduced working width; seasonal constraints etc
- Incorporation of direct mitigation measures into pipeline construction Invitation to Tender (ITT) documents
- Evaluation of possible indirect mitigation measures, such as offset projects resulting in overall enhanced biodiversity or environmental additionality
- Identification of potential partners for implementation of offset projects
- Provision of baseline data to the World Conservation Monitoring Centre (WCMC) to enhance its worldwide ecological database, thus assisting with biodiversity planning

#### Greenhouse gas emissions reduction

BP is committed to maintaining brand distinction compared to market competitors through continued leadership on greenhouse gas (GHG) emissions reductions. To achieve this BP will look to continue to influence public policy on climate change. BP is well positioned to take advantage of the growing market for lower carbon energy and to build on value already created through energy savings, which have resulted from earlier initiatives. It is recognised that Carbon has already become, and will increase in importance as a real business issue / cost.

BP supports the view of the Intergovernmental Panel on Climate Change that:

- The global average surface temperature has increased during the 20th century by about 0. 6°C
- About three-quarters of the anthropogenic emissions of CO<sub>2</sub> to the atmosphere during the past 20 years is due to fossil fuel burning

- There is now new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities
- Future changes in atmospheric composition and climate are inevitable with increases in temperature and some extreme events, and regional increases and decreases in precipitation, leading to an increased risks of floods and droughts

In 1998, BP targeted a 10% reduction in internal GHG emissions from a 1990 baseline (90MT) by 2010. This target was achieved in 2001 with emissions of 80.5MT (9.5MT reduction). However, meeting the target is not the end of BP's commitment to tackling climate change.

Therefore BP has identified a number of further steps to address the climate change issue. These recognise the need for stabilisation of GHGs in the atmosphere, and include:

- Improved energy efficiency
- Use of lower carbon fuels
- CO<sub>2</sub> capture and storage in the medium term

Through application of skills, technology and business processes BP has set an internal target to hold our net emissions at 10% below 1990, through 2012, by a combination of:

- 10 15% improvement in operational energy efficiency by 2012
- Use of flexible mechanisms such as GHG emissions trading and carbon credits

This will be achieved by:

- Sharing knowledge and expertise on energy efficiency
- Producing and selling products with a lower carbon content
- Shifting the balance of our business in favour of lower carbon energy sources
- Working with others (eg Auto makers) to develop more energy efficient technologies
- Continuing our focus on growing our renewable energy portfolio

BP has established a pioneering internal emissions trading scheme, which will be used to help meet GHG emissions targets. Through making and selling lower carbon products, BP will be helping to create "carbon credits", which can be created when a change is made to a more efficient or lower carbon form of energy. BP is committed to working with others to advance emissions trading and emissions credits. We will work with others to quantify credits and apportion ownership.

BP is continuing to lead in the commercialisation of renewable energy technologies, and has one of the fastest growing renewable energy businesses in the world, BP Solar for example is expected to grow by 40% this year.

At the BTC project implementation level, the BP Corporate commitment to GHG emissions reduction is reflected in the developing emissions profile for the project.

#### ISO 14001 accreditation

To progress towards the BP Environmental Expectation that material activities and operations be managed in line with a recognised international Environmental Management System (EMS), specifically ISO 14001, the following target was established:

• By the end of 2001 (2002 for Arco heritage) all major facilities will have their EMSs certified to ISO 14001, and be producing regular verified site environment reports, available on the Internet

The BP Caspian Sea Business Unit achieved certification of its EMS in the year 2000, covering all existing operational units.

At the BTC project implementation level, the BP Corporate commitment to ISO 14001 certification is reflected in the requirement to achieve certification within 9 months of operations commencing. To aid this certification process this ESIA has been developed to be in line with the requirements of ISO 14001, including development of registers of legislation, aspects and impacts registers and monitoring and management plans. An EMS will be developed to manage activities during the construction phase, with certification to be achieved within 9 months of operations commencing.

# 6.2 SOCIAL LEGISLATION AND POLICY FRAMEWORK

# 6.2.1 Introduction

As with the environmental requirements, the social requirements set forth in the IGA and the HGA override national legislation to the extent such national legislation is inconsistent. Therefore, the BTC Project social legislation and regulatory framework in Azerbaijan includes not only what is set forth in the IGA and HGA, but also includes Azerbaijan national legislation to the extent that it is not inconsistent with the IGA and HGA. Additionally, the BTC Project will be implemented in accordance with applicable international conventions in force in Azerbaijan, IFI standards with which BTC agrees to comply as part of the BTC Project financing and BP project specific policies, which in many instances exceed the above mentioned legal requirements.

The descriptions of the IGA, HGA and other laws and documents included below are summaries only and are qualified by reference to the full text of the actual laws or documents.

# 6.2.2 Host Government Agreement (HGA)

Many of the requirements applicable to social assessment are set out in Article 12 of the Azerbaijan HGA. Article 12 references Appendix 3, which outlines the standards and principles for social impact assessment (SIA). The key requirements are:

- Use best endeavours to minimise potential disturbances to surrounding communities and the property of the inhabitants thereof (Clause 4.1 of Appendix 3)
- Complete a general review of social conditions in the general location of the pipeline and associated infrastructure, consisting of a scoping study and a risk assessment. These will together form the basis of the content and structure for a social impact assessment of project activities and associated operations, to be conducted by the BTC Participants (Clause 4.3 of Appendix 3)
- During the course of project activities, from time to time, to confer with the State Authorities as to the impact of ongoing project activities in light of the SIA (Clause 4.4 of Appendix 3)
- Maintain means of access and construct temporary crossings that may be reasonably required by affected landowners and occupiers. Following construction, private roads and footpaths will be reinstated to their original condition, and made available to landowners (subject to maintaining the security of project facilities) (Clause 5.3 of Appendix 3)

In addition to Article 12 and Appendix 3, Article 4.1 references Appendix 2, which further governs the social impact of the BTC Project. The key aspect is discussed below:

• The right to receive confirmation that each affected landowner and/or occupier has been made aware of and has consented and/or has been compensated under Azerbaijan Law

Finally, Article 18 of the Azerbaijan HGA details certain employment and procurement practices. The key aspects include:

- The BTC Participants and any contractor may select and determine the number of employees to be hired in connection with the project. All citizens of the State hired in respect of the project shall be hired under written employment contracts that specify the hours of work required of the employees and the compensation and benefits to be paid. All employment practices applicable to citizens of Azerbiajan working on the project in Azerbaijan must be at least as stringent as the requirements provided for in Azerbaijan labour legislation, subject to the condition that no Project Participant shall be required to follow any employment practices or standards that (i) exceed those international labour standards or practices which are customary in international oil transportation projects or (ii) are contrary to the goal of promoting an efficient and motivated workforce. These requirements include hours of work, leave, remuneration, fringe benefits and occupational health and safety standards (Section 18.2)
- For procurement of services, equipment, materials, machinery and tools, vehicles, spare parts, goods and supplies necessary for the proper conduct and achievement of Project Activities, the BTC Participants and any Contractor (including any Operating Company) shall give preference to Azerbaijan suppliers in those cases in which such Azerbaijan suppliers are in all material respects competitive in price, quality and availability with those available from other sources (Section 18.3)

# 6.2.3 Existing National Legal and Administrative Framework

Various Government Bodies share responsibility for most social issues, with the following groups playing a more pertinent role:

- State Committee on Land and Cartography
- State Labour Inspection
- Health Ministry
- Ministry for Ecology and Natural Resources
- State Committee for Architecture and Construction
- Municipalities and the Local Executive Authorities

#### 6.2.3.1 Land Legislation

The overall framework for the granting of Rights to Land by the Government to the BTC Participants is set forth in Articles 4 and 7 and Appendix 2 of the HGA. Section 4.1 of the HGA grants to the BTC Participants:

- The absolute and unrestricted right to carry out the Project and conduct Project Activities
- The exclusive and unrestricted Rights to Land as set forth in Appendix 2
- The exclusive right to use, possess, control and construct upon and/or under the Permanent Land

Section 7.2 of the HGA grants the BTC Participants the right to exercise the above mentioned Rights to Land by providing that the State Authorities shall:

- Exercise powers of taking, compulsory acquisition, eminent domain or other similar sovereign powers to allow the BTC Participants to receive and exercise the Right to Land in respect of the State Land
- Pay such compensation to Persons in the Territory as may be required by Azerbaijan Law to authorise the State Authorities to grant to and vest in each of the BTC Participants the rights obtained in accordance with the previous bullet point. Any such Non-State Land acquired shall be subject to the obligations that such Land be acquired at the lowest possible cost in accordance with the standards and procedures set forth in the Land Code of the Azerbaijan Republic, the Law of Azerbaijan Republic on Land Market and any Decrees of the President and/or the Cabinet of Ministers implementing such laws. In addition, the BTC Participants shall pay the State Authorities the amount of all verifiable costs to be incurred by State Authorities

Appendix 2, which is appended to the HGA by Section 4.1(iii), further governs the BTC Participants Rights to Land by providing that:

- The Rights to Land granted to or obtained by the BTC Participants shall be enforceable by the BTC Participants against all State Authorities and against all third parties
- The State Authorities will obtain, secure and grant to the BTC Participants, among other things, the following Rights to Land:
  - (1) The right to transport construction materials, plant and equipment without hindrance, including the right to construct and maintain roads
  - (2) Right to use and designate other areas of land
  - (3) Right to receive confirmation that each affected landowner and/or occupier has been made aware of and has consented to and/or has been compensated under Azerbaijan Law for the rights acquired by the BTC Participants through State Authorities
  - (4) Right to exclusive use, possession and control, and the right to construct upon and/or under, and peaceful enjoyment of, these Rights to Land without hindrance or interruption

#### 6.2.3.2 Public participation & consultation

In line with BP policies, public participation is expected to form a key role in the development of projects such as BTC. Public participation is linked with BP's commitment to sustainable development. To remain aligned with World Bank funding requirements, public participation is expected to be an integral part of the project. The 1993 document Public Involvement in Environmental Assessment: Requirements, Opportunities and Issues, in Environmental Assessment Sourcebook Update 5, lists the various forms of consultation that are recommended in the development of an EIA. Parties specifically requiring consultation would include the public and non governmental organisations. Consultation should be complete before construction begins.

In addition to World Bank requirements, the EBRD requires that project sponsors carry out monitoring to ensure that national requirements for public consultation be met and that the procedures described in the Banks Disclosure of Information Policy are adhered to.

The EIA "Handbook" contains provisions requiring the developer to inform the public about a proposed development and to utilise the ESIA process as an effective two-way feedback system,

with the ultimate aim of providing an opportunity for the public to provide input to the decisionmaking process.

Environmental Assessment in Azerbaijan is based upon the 1996 UNDP guidelines, which include requirements and systems for consulting the public. Although the guidelines are adopted in practice, they have no formal status in law, as they have not been through the procedure of Milli Mejlis (Parliament).

Present requirements have evolved through the system of Ecological Expertise. This is addressed under articles 50 and 58 of the 1999 Environmental Protection Act. Article 50 states that "Expertise is conducted by the relevant body of executive power and public organisations," while other articles focus on the role of the state and the power in law of the Expertise decision. Article 58 provides for independent involvement in the process. The Act also states that citizens have the right to participate in discussion of issues related to projects which may have a harmful impact on the environment.

The State Environmental Expertise authorities regulate compliance with the requirement for public participation.

Azerbaijan is also a signatory to the 1998 UN Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters.

#### 6.2.3.3 Labour Legislation

The Constitution, international conventions and the Labour Code of Azerbaijan, 1st February 1999 regulate labour relations of all workers and employees in the Republic of Azerbaijan. This sets out the principles and procedures ensuring the rights to employment rest and work under safety and health conditions and to other basic rights and freedoms as stipulated in the Constitution of the Republic of Azerbaijan. Public control over the provision of labour, social and economic rights of employees and employers, is governed by trade unions and representatives of employers' unions (Article 309 of the Labour Code).

Monitoring, implementation, and enforcement of these laws belong to the Office of the Public Prosecutor and also the State Office for Labour Inspection (Article 308 of the Labour Code). The latter operates under the regulation passed by Resolution No 20 on 9th February 2000.

Under the Law on the Legal Status of Foreign Citizens and Stateless Persons (1996) and the Law on Labor Migration (1999), foreign citizens and stateless persons have the right to work for a definite period in the Republic of Azerbaijan if certain legislative features are followed. These include registration with the relevant local authorities of the location of the foreign employee's residence as well as obtaining permission for employment.

The HGA provides Project Participants with the right to employ such Persons (including foreign citizens) who, in the opinion of such Project Participant, demonstrate the requisite knowledge "subject only to the enforcement of immigration (including visa and residence permit regulations), customs, criminal and other relevant laws related to ingress and egress" (s. 7.2).

Under the HGA, Project Participants shall not be required to follow any employment practices or standards that (i) exceed those international labour standards or practices which are customary in international Petroleum transportation projects or (ii) are contrary to the goal of promoting an efficient and motivated workforce. The Azerbaijan Republic is a party to a broad range of multilateral and regional agreements in relation to regulation labour rights, including a large number of International Labour Organisation Conventions.

# 6.2.4 Other international agreements and conventions

The key international agreements and conventions of relevance to social issues are outlined in Section 6.1.2 above.

# 6.2.5 International Finance Institution (IFIs) policies and guidelines

The key international finance institution policies and guidelines of relevance to social issues are outlined in Section 6.1.5 above.

# 6.2.6 BP Corporate social policies

Relevant BP corporate social policies will be applied to the project. These are outlined in full in the BP booklet, "What We Stand For". Contractors will be required to comply with these policies, and appropriate clauses are included in the Invitations to Tender and Contracts. Key aspects of BP Business Policies on social issues are highlighted below. BP will also apply the project Statement of Social Objectives, as set out in Table 6-5 below.

#### Table 6-5 BTC Statement of Social Objectives

The BTC Project is committed to delivering mutual benefits to communities along the pipeline route and to establishing long-term relationships with these communities, during both the construction and operational phases. We will:

- Minimise potential negative social impacts through identification and mitigation, in particular via a social impact assessment
- Publish regular updates on the environmental and social aspects of the project, and conduct regular dialogue with interested organisations
- Maintain regular contact with communities along the pipeline route through a team of Community Liaison Officers prior to, during and following the construction period
- Compensate for damage to land and property in a legal, transparent and ethical manner that respects the interests of those involved
- Manage expectations on employment opportunities, by providing information on the level and duration of employment requirements
- Seek opportunities to increase employment of country nationals, and in particular those in villages along the pipeline route, subject to availability of appropriate skills
- Establish recruitment procedures that are transparent, public and open to all regardless of ethnicity, religion, or gender
- Provide periodic training to enhance the skills and capacity of both employees and contractors
- Draw up procedures and management plans for all construction camps, in relation to contacts with local communities
- Provide periodic training on liaison with local communities to all staff employed by the BTC project and contractors
- Establish a social investment programme that delivers mutual benefits to BP and communities along the pipeline route
- Seek opportunities for communities to mutually benefit from the activities undertaken, and infrastructure required, by the project.

The following extracts from the BP booklet "What We Stand For" are of particular relevance:

#### 6.2.6.1 Ethical conduct

"We will pursue our business with integrity, respecting the different cultures and the dignity and rights of individuals in all the countries where we operate. BP supports the belief that human rights are universal. They are enshrined in the United Nations Declaration of Human Rights (UNDHR), which we support".

#### 6.2.6.2 Employees

"We respect the rights and dignity of all employees. Everyone who works for BP contributes to our success and to creating a distinctive company. Working together, drawing from our diverse talents and perspectives, we will stimulate new and creative opportunities for our business. Collectively we will generate a more exciting and rewarding environment for work in which every individual feels responsible for the performance and reputation of our company".

#### 6.2.6.3 Relationships

"We believe that long-term relationships founded on trust and mutual advantage are vital to BP's business success. Our commitment is to create mutual advantage in all our relationships so that others will always prefer to do business with BP".

# ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT METHODOLOGY

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# 7. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT METHODOLOGY

# 7.1 INTRODUCTION

The Environmental and Social Impact Assessment (ESIA) process incorporates a number of key steps as illustrated in Figure 7-1. The assessment process constitutes a systematic approach to the evaluation of the proposed project in the context of the natural, regulatory and socio-economic environments in which development is proposed.



#### Figure 7-1 The ESIA process

Each of the steps in the ESIA process will be described in turn in the following sections. However key to understanding the process applied to minimizing the impact of this project has been the development of mitigation measures. All of the potential impacts arising from this project have been identified and subjected to either standard recognized best practice mitigation measures or to impact specific, feasible and cost effective mitigation. Any impacts that remain after the application of mitigation measures are considered residual impacts. Figure 7-3 (Section 7-10) illustrates the process of addressing potential impacts, mitigation and

residual impacts.

All residual environmental impacts are assigned a level of impact of Low, Medium or High, following the methodology described in Section 710. High and Medium level environmental residual impacts are considered for compensation including offset mitigation measures. Residual social impacts, are designated High, Medium, Low or Beneficial. All levels of impact are considered for compensation including additional offset measures such as community investment since those that are considered low for a community may still have a high impact on individuals making the classification more complex. All High, Medium and Beneficial residual impacts are discussed further in Section 12.

# 7.2 CONSULTATION, PARTICIPATION AND DISCLOSURE

# 7.2.1 Overview

The process of stakeholder consultation and disclosure is an ongoing overarching requirement that applies to the entire ESIA process. Consultation is of critical importance in gaining insights into the key environmental and social issues, concerns of communities and other stakeholders, and in aiding the development of potential strategies for addressing project impacts. BTC Co recognizes the importance of stakeholder consultation, participation and disclosure during the lifetime of the BTC project.

Effective consultation with stakeholders is:

- Key to understanding the concerns and requirements of affected communities and ensuring their participation in the formulation and refinement of the project design
- Effective disclosure, through the release of timely, accurate and comprehensive information to stakeholders. This is essential to ensure that the likely impacts (both positive and negative) are understood by stakeholders, and that they can provide feedback to the project

The benefits of effective consultation, participation and disclosure are illustrated in Figure 7-2.

#### Figure 7-2 Benefits of effective consultation and disclosure

Positive impacts

<ul> <li>Decreased costs of communication and disclosure during ESIA</li> <li>Decreased costs of communication and disclosure during operation</li> </ul>	<ul> <li>Early understanding of key issues</li> <li>Development of practicable, appropriate and effective baseline and monitoring programme</li> <li>Development of practicable, appropriate and effective mitigation</li> <li>Responsive, flexible and committed local workforce</li> <li>Early warning of local community issues</li> <li>Early warning of ROW related issues</li> <li>Reduced costs of supervision and security</li> <li>Effective community related problem solving</li> <li>Reduced number of claims for compensation</li> <li>Reduced value of compensation claims</li> </ul>
Poor communication & disclosure	Good communication & disclosure
<ul> <li>Poor understanding of key issues</li> <li>Development of impracticable, inappropriate and ineffective baseline and monitoring programme</li> <li>Development of impracticable, inappropriate and ineffective mitigation</li> <li>Uncooperative local workforce</li> <li>Possible direct and indirect disruption of project</li> <li>Possible vandalism including tap-ins</li> <li>Increased risk of oil spill</li> <li>Increased costs of supervision and security</li> <li>High number of claims for compensation</li> <li>Unrealistic compensation claims</li> </ul>	<ul> <li>Increased costs of communication and disclosure during ESIA (compensated by reduced local workforce costs)</li> <li>Increased costs of communication and disclosure during operation (compensated by reduced risk of Interference with pipeline) (compensated by reduced local workforce costs)</li> </ul>
Negative	impacts

rieganie impacis

Methodologies for disclosure and consultation are discussed in more detail in the following sections:

- Section 16, Consultations provides a full outline of the consultations which have taken place to date
- Part 5 of Technical Appendices, the Public Consultation and Disclosure Plan (PCDP), includes further information on the methodology used for data collection, consultation and lists of stakeholders consulted at each point
- Section 9, Socio-economic Baseline, outlines many of the social and economic issues raised by stakeholders during the consultation process

The consultation and disclosure process is both comprehensive and complex and care has been taken to capture and document stakeholder concerns.

# 7.2.2 Stakeholder identification

BP and the local and international ESIA consultants worked together to identify the key stakeholders who should be consulted with at various stages of the project. This was done using a combination of previous project experience, knowledge of Azerbaijan and the NGO community, and consultation with authorities, NGOs, academics, etc. This has ensured that all the people who may be affected by or have an interest in the proposed project have had an opportunity to obtain information about the project and to express their opinions and concerns.

Stakeholders were drawn from the following groups:

- Authorities comprising national, regional and local government bodies, of primary political importance to the project and to the ESIA process
- International, National and local NGOs, are organizations which have a direct interest in the project, and which may have useful data or insight into the local and national challenges faced by the project
- **Interest groups** include for example, media, academics, institutions, foundations and community groups
- **Residents, landowners and land users** of the towns and villages in what are known as the pipeline affected communities, those within a 2km corridor either side of the pipeline or pipe yard, or within 5km of a construction camp or large AGI
- International Finance Institutions, including the IFC and EBRD
- BTC Owners and other project partners

A full list of the stakeholders consulted can be found in the PCDP.

# 7.2.3 Tracking consultation

Documentation of public consultation is important in ensuring that inputs are captured and fed into the project planning process and to maintain a record of issues raised by consultees. A database was established to log all meetings with stakeholders at national, regional and local levels to ensure effective tracking of the consultation process throughout the ESIA and later the land acquisition process. This contains the dates of the meetings, minutes, issues raised, persons involved and agreed actions and responsibilities including:

- Records of meetings with government departments, scientists and conservancy bodies
- Records of meetings with local communities
- Records of meetings with NGOs

It was decided that data relating to consultation with individual households should be recorded separately to protect the anonymity of individual respondents. This is in line with international practice and helps to ensure that responses are truthful and more accurately reflect the opinions of the householders. The database is also used as a tool to ensure that actions are followed up and completed. A clear outline of the results of consultations carried out is presented in Section 16, Consultations.

# 7.3 THE SCOPING PHASE

Having decided that an ESIA was required for the BTC project, a Scoping Process was undertaken to identify key issues and develop the terms of reference for the ESIA. At this stage, it was considered essential to identify the likely environmental and social impacts and to define the project's area of influence. As part of this process, information about the project and its likely effects was disseminated to local affected communities, national scientists, academic institutions, and NGOs, in addition to the authorities and regulatory bodies. This was followed by consultations with representatives of these groups. The main purpose of these consultations was to focus the ESIA on issues of concern at the local level. The scoping led to a focused ESIA for a manageable number of important issues.

It was important for the successful completion of the ESIA that the scoping process was

undertaken early and in an open manner involving appropriate disclosure and consultation with relevant stakeholders.

#### 7.3.1 **Objectives**

The objectives of the scoping phase were to:

- Define the project in sufficient detail to allow the Scoping exercise to effectively and efficiently shape the environmental and social impact assessment
- Review relevant policy, legal and administrative frameworks including corporate environmental policy and management system, relevant national and international legislation and guidelines
- Identify key issues
- Identify and confirm the stakeholders
- Initiate disclosure and consultation with the stakeholders, identify and document their key concerns and obtain their agreement on the key issues to be addressed
- Identify data gaps and agree with stakeholders any necessary fieldwork to fill these gaps
- Where appropriate, to identify potential mitigation measures for further analysis •
- Establish the work plan and Terms of Reference for the remainder of the ESIA process, including a continuing programme of stakeholder disclosure and consultation.

#### 7.3.2 Scoping workshops and report

A series of scoping workshops were held with the following key stakeholders in Azerbaijan:

- Local Communities
- National Regulators (Azerbaijan State Committee on Ecology (ASCE), now replaced • by the Ministry of Ecology and Natural Resources (MENR))
- Scientists and academics from Institutes and Universities in Azerbaijan •
- Regional and National Government •
- BP Research and Monitoring Group •
- NGOs
- IFIs

The workshops set out to inform key stakeholders on the project scope, the ESIA activities, and the schedule. They also solicited feedback on key issues to be addressed during the ongoing consultation process.

A Scoping Report was produced summarizing the results of this initial phase and was made available to the following organizations:

- Azerbaijan Government
- The BP Monitoring and Research Group
- Key external stakeholders, eg the World Bank Group, EBRD
- BP and other partners of the BTC Co
- The engineering design teams (Kvaerner (now John Brown Hydrocarbons), Bechtel, Fluor Daniel and Brown & Root)

# 7.4 CONSIDERATION OF PROJECT ALTERNATIVES

Prior to agreeing the pipeline route and other aspects of project design, viable alternatives were identified so that a realistic base-case design could be developed. However, design development is an iterative process and the design is modified continuously to take account of new information as and when it has become available, including information from the ESIA process.

A full discussion of the alternative options that were assessed during the scoping and project development are discussed in detail in Section 4, including the social and environmental implications of a 'no development option'.

# 7.5 DETAILED LEGISLATIVE REVIEW

The Legislation and Policy Framework review for this project is described in Section 6. This review addressed social and environmental policies and requirements at the following levels:

- Host Government Agreement
- National Legislation
- International legislation and guidelines relevant to the project
- BP corporate policy and management systems
- Archaeology and Cultural Heritage
- Biodiversity and Sensitive Areas
- Social Regulations

The definition of relevant national and international standards and requirements has ensured that the project development has been assessed against all relevant existing environmental and social regulations and guidelines as well as the project proponent company's environmental, social, ethical and business policies and standards.

# 7.6 ESTABLISHING BASELINE INFORMATION

The Scoping report identified a number of key issues and associated information gaps. In order to understand the potential impacts of the proposed pipeline with respect to these issues, it is necessary to have a good understanding of the pre-project, or baseline, conditions. The key issues relate to a range of environmental and socio-economic attributes including:

- Noise
- Air quality
- Traffic
- Ecology
- Soils
- Cultural heritage
- Contamination of land
- Landscape
- Water resources
- Employment
- Energy

- Land acquisition
- Infrastructure and resources
- Safety
- Community relations

A good understanding of the baseline for these attributes has been achieved through two activities:

- Detailed review of all secondary resources (ie existing documentation and literature)
- Undertaking primary (baseline) field studies to collect necessary supplementary data

# 7.6.1 Environmental baseline information

The EIA consultants AETC, used a combination of local scientists and western experts to conduct detailed environmental baseline studies of a 100m corridor centered on the BTC pipeline route, and areas identified as being potential sites for construction camps, pipe yards and AGIs. Sensitive receptors and pathways to oil spill were also identified but over a wider area.

BP has already undertaken projects in the same region as the BTC pipeline, notably the Western Route Export Pipeline (WREP) constructed in 1997 and baseline data gathering for the SCP pipeline (undertaken between summer 2000 and spring 2001). A wide array of baseline environmental information applicable to the BTC project was therefore already available. However, where data were lacking or out of date (particularly in relation to assessing oil spill sensitivities), additional environmental baseline data were collected. Environmental baseline data have been collected for the following main topics:

- Botany
- Zoology
- Archaeology
- Geology
- Soils
- Water resources
- Traffic
- Air quality
- Climate and Meteorology
- Noise
- Landscape
- Land Contamination

# 7.6.2 Socio-economic baseline information

A socio-economic survey was undertaken by local SIA consultants Synergetics, supported by ERM, in the communities<sup>1</sup> within (or encroaching on land within) 2km of the pipeline or pipe

<sup>&</sup>lt;sup>1</sup> This represents data from a total of 74 communities which were identifiable from the maps available at the time. More detailed maps have identified 83 communities which encroach in some way within the 4km corridor, or a close to a potential construction camp or pipe yard. 90% of the original 74 surveyed communities are still within the revised 83 and the survey data has been considered transferable.

yard, and within 5km of a potential construction camp or major AGI. This zone of influence of construction and operation was determined on the basis of previous pipeline experience and confirmed as appropriate for Azerbaijan. As sections of the pipeline have been rerouted from time to time in response, in part, to ESIA results, the 'surveyed communities' no longer correspond 100% to the 'pipeline affected communities'<sup>2</sup>. (There are a few communities which have been included in the survey which are no longer considered pipeline affected as they are now outside the 4km corridor. Conversely, there are communities which are now within the corridor which have not been consulted, though it is intended that this will take place during Disclosure.)

Data were collected by the team using standard methodologies for the collection of qualitative and quantitative information. 814 semi-structured 'qualitative' interviews with individual householders or land users in the corridors were undertaken. In addition socio-economic data were collected using a 'quantitative' questionnaire during interviews with 74 community leaders or community representatives. The quantitative questionnaires completed with each community leader covered the following main topics:

- Basic geography
- Population and Demographics
- Labour and livelihoods
- Culture, local administration, decision making and planning
- Infrastructure, resources and services
- Attitudes and perceptions

The number of households interviewed in each settlement reflected the settlement size (one person interviewed per household):

- At least 5 households in small villages (below 1,000)
- At least 10 households in medium size villages (1,001 to 5,000)
- At least 20 households in large settlements (above 5,000)

Due to the homogeneity of the study area (in terms of socio-economic characteristics), the above sample sizes are considered sufficient to provide representative data for the study area as a whole.

Respondents were chosen using a combination of stratified, random and quota sampling techniques. Stratified sampling is adopted to achieve a more representative sample of the study area. This is achieved by dividing ones study area into groups of 'sampling units'. Within each of these sampling units, a random sample is then selected. Thus, for the BTC project, sampling units were based on income levels and associated living conditions. Where these existed, random sampling was conducted within each of these groups.

Random sampling selects households based on criteria that do not introduce any biases into the sample. Thus, every third house on the left hand side of the street was selected. Where the

<sup>&</sup>lt;sup>2</sup> Pipeline Affected Communities are defined as those within (or which partly encroach on) a 2km corridor either side of the pipeline or pipe yard, within 100m of an access road, 5km of a construction camp or major AGI. A list of known Pipeline Affected Communities can be found in Part 11 of Baseline Reports (Appendices).

settlement was homogenous (in terms of income levels), only random sampling was carried out. Households are selected at random until the desired sample size is reached (eg 10 households for medium sized villages).

Within the stratified and random sample groups, a quota sampling technique was introduced. This technique aims to obtain a cross-section of the population by setting a quota for number of questionnaires per category identified. A quota sample can be based on either one or a combination of variables (eg gender, levels of income, ethnicity). A designated number of respondents for each category is then selected from the population. In the socio-economic survey for this project, a quota on the number of men and women to be interviewed was introduced (ie a male:female ratio of 50:50). Where possible, a cross section of age groups were interviewed, although no official target was set for this.

Data gathered and analysed from the quantitative and qualitative surveys were cross-checked with each other and with census data. It was collected in a format that could easily be transferred to a database and GIS for later analysis using SPSS<sup>3</sup>, and mapping of attitudes and impacts.

In addition to the initial baseline surveys, some specific interviews were undertaken as the project design process progressed. For example, the project needed to understand villagers perceptions in relation to cumulative effects of two pipelines, and attitudes to oil vs. gas pipelines. Villages included in this survey were identified to ensure that a representative sample of the population of pipeline affected communities were included. Factors taken into consideration included, geographical spread and size of communities, gender and age distribution of respondents.

In addition to village level data, the consultants also collected socio-economic data from Government officials in the regional centers and towns, census data and economic data from international sources.

# 7.7 ENVIRONMENTAL AND SOCIAL HAZARD AND RISK ASSESSMENT

Environmental Hazard and Risk Assessment (EHRA) and Social Risk Assessment (SRA) are processes whereby the ESIA team can:

- Confirm its understanding of the project with the design engineers
- Identify to the design engineers areas of potential environmental concern
- Jointly develop alternatives so that potential impacts can be avoided where possible, or proactively mitigated.

EHRAs/SRAs meetings were conducted with key project engineers and HSE advisors and were facilitated by members of the ESIA team. They provided an opportunity to gather additional information on the project where necessary. Each meeting allowed input from all participants in the identification of potential environmental and social hazards associated with the project activities. In addition possible alternatives and options were evaluated.

<sup>&</sup>lt;sup>3</sup> Standard Specialist Software designed to assist in the analysis of data gathered through interviews and questionnaires.

The process considered each activity that will, or may, occur during the project including:

- Planned routine activities
- Planned but non-routine activities
- Unplanned or accidental activities.

This process culminated in the development of a list of activities and the identification of aspects that may affect the environment or local communities. It is important to note that existing mitigation measures designed into the project were considered during these meetings.

# 7.8 ENVIRONMENTAL ASPECT AND IMPACT IDENTIFICATION

Once baseline information had been collated, predictions and modelling of potential changes resulting from the proposed BTC pipeline development were conducted. This was undertaken through identification of the projects aspects and impacts resulting from each activity during construction and operation.

# 7.8.1 Environmental aspect identification

The ISO's standard for Environmental Management Systems (EMS), ISO 14001 defines an environmental aspect as:

'An element of an organization's activities, products or services that can interact with the environment.'

This definition has been used in the identification of the proposed project's environmental, legal and socio-economic aspects. To identify project aspects, all proposed activities, have been considered in terms of their direct or indirect potential to:

- Breach relevant policy, legal and administrative frameworks including HGA and national legislation, relevant international legislation, standards and guidelines, and corporate environmental policy and management systems
- Interact with the existing natural environment including its physical and biological elements
- Interact with the existing socio-economic environment

Activities assessed during site preparation, construction, reinstatement, operation and decommissioning include:

- Planned routine activities
- Planned but non-routine activities
- Unplanned or accidental events

### 7.8.2 Environmental impact assessment

ISO 14001 defines environmental impact as:

'Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services.'

An impact may result from any of the identified project aspects. Table 7-1 illustrates the links between activity, aspects and impact.

ACTIVITY	ASPECT	IMPACT	
Handling hazardous materials	Potential for accidental spillage	Contamination of soil or water	
		Mortality of flora and fauna	
Use of vehicles	Diesel exhaust emissions	Contribution to global warming and ground level ozone	
	Fuel and oil leaks	Contamination of soil or water	
	Noise	Disturbance to surrounding environment/ dwellings	

#### Table 7-1 Examples of project-related activities, aspects and impacts

The aspects and impacts of the BTC pipeline project have been identified for each activity undertaken and are summarized in Section 10, Environmental Impacts and Mitigation, Table 10-1.

Impacts may be direct or indirect. Indirect impacts are often produced away from the project as the result of a complex pathway, for example the interruption to groundwater flow may result in vegetation dieback and damage at a remote wetland. In addition impacts may be further divided into residual, cumulative and trans-boundary. These types of impact are discussed below. During the impact appraisal process all types of potential impact have been addressed (see Section 10, Environmental Impacts and Mitigation).

The ROW encounters not only significantly different terrains in Azerbaijan but also varying climatic conditions, vegetation and landscape. In view of these changing factors along the route the ROW has been separated into units (linear or point), each of which have common characteristics with regard to the following three factors:

- Project activities (that could result in impacts)
- Biotope (similar physical and biological environments, eg mountainous coniferous forest)
- Environmental sensitivity

Archaeologically sensitive sites or river crossings are units of limited geographic extent (point units) whilst forest habitats or faunal sanctuaries may have a broader geographic extent (linear units).

Some elements of the project will occur at a distance from the ROW, for example, construction traffic, camps and construction yards are activities off the ROW and therefore are discussed independently from the ROW units.

# 7.8.2 Social impact assessment

The evaluation of socio-economic impacts involves the assessment of both quantitative and qualitative data and the use of professional judgment. Quantitative data collected through national sources or local level interviews is assessed and analysed by traditional economic or sociological techniques. However, qualitative data collected using the same methodology is more open to interpretation. In addition, what is a major impact to one person, one household

or one community may be a minor impact to another according to specific personal circumstances. Hence, the results do not lend themselves easily to being ranked or assessed in exactly the same way as environmental data. As a result, the application of assessment language in the evaluation of results tends to be more qualitative in relation to the socio-economic impacts than in the equivalent environmental sections.

Another difference is the use of the terms Issues and Impacts. Issues can be broadly defined as an element requiring consideration and assessment for which a policy or a specific mitigation strategy may need to be defined. Impacts are elements with a potential direct or indirect impact on a specific household, community or sector of a community. In this sense, the overall management of community relations is an issue, where the need to compensate a farmer for the removal of his fence would be described as an impact.

In assessing the scale of the issues and impacts, the following factors are taken into consideration:

- The likelihood of the impact
- Changes to the assets that households depend upon for their livelihoods
- The duration of this change: short-term disturbance (eg during construction only), long term (eg during operation period) or permanent
- The manageability of the change and potential for it to lead to further changes beyond the control of the project
- The ability of the affected people to adapt to changes and thus maintain livelihoods over the long-term
- The magnitude of the impact is then viewed from the perspective of those affected, by taking into account the perceived importance of the impact or perceived impacts in the eyes of communities

Field survey data have been used to help identify specific communities in which a particular aspect of the project, or potential impact, is likely to be particularly important or to have a particularly acute, or chronic, effect. Where these impacts are quantifiable statistical data have been provided.

# 7.8.3 Impacted groups

Socio-economic impacts apply and are assessed at the household and community levels. Different households will often be affected in different ways by the same impact. It is therefore necessary to assess variation in impacts between different households. For example, a poor household dependant upon natural resources over which it has no legal rights may not have access to compensation or may be ill equipped to use compensation money in an appropriate way. However, since most of the communities within the pipeline corridor have a similar economic profile, many of the impacts can be assessed at the community level in order to develop further specific community level mitigation measures where appropriate.

Impacts, such as wealth creation or demographic change, are also assessed at a more macro level where appropriate in order to capture the cumulative impacts caused by the whole project as well as its individual parts.

# 7.9 MITIGATION OF POTENTIAL IMPACTS

Mitigation measures are the actions or systems that are used, or have been proposed, to manage or reduce a potential negative impact or enhance a positive impact.

Mitigation has been an integral part of the BTC project, from conceptual design through to construction and operation. Mitigation measures are generally identified to avoid, minimise or remedy the adverse effects of impacts. They may also be used to enhance the positive benefits of the project, especially in relation to social issues. They are developed using professional judgment and experience within the legal, technical, political and economic constraints of the project and may involve policy changes, technical solutions or various forms of compensation. The project team, community and other stakeholders have been consulted to ensure that the mitigation measures are both practical and appropriate.

Mitigation measures, either already implemented or proposed for the BTC project are discussed in Sections 10, Environmental Impacts and Mitigation, 11, Socio-Economic Impacts and Mitigation, and 12, Residual Impacts, and include:

- Routing of pipeline to avoid areas of high sensitivity
- Measures in the original project design (eg ensuring the pipeline goes around and not through people's houses)
- Engineering design solutions during the ESIA process (eg moving a site for spoil, increasing pipe thickness)
- Alternative solutions to processes and methods to achieving objectives (eg methods of transporting materials, or recruitment of unskilled workers)
- Operational control procedures (eg fines for damage outside the ROW)
- Conservation management
- Management systems (eg reporting mechanisms for Community Liaison officers and Key Performance Indicators (KPIs)/targets for contractors)
- Development of policies and procedures (eg Statement of Social Objectives for the project, compensation plans for land/livelihoods)
- Timing restrictions (eg construction activities near villages and schools)

Following assignment of mitigation measures, any impact that remains is termed a **residual impact**. Assessment of residual impacts is discussed in the following section.

# 7.10 RESIDUAL IMPACTS

The flow diagram below illustrates the process of addressing potential and residual impacts (Figure 7-3).

Any impacts remaining after mitigation measures have been applied are considered residual impacts. The significance level of the residual impact is assessed on the basis of:

- The severity/consequence of an impact
- The likelihood that the impact will occur

The significance level is ranked on four levels: High, Medium and Low, or Beneficial. These

rankings are used for both environmental and social residual impacts. Evaluating the level of residual impact is discussed further in Section 7.9.4.





# 7.10.1 Consequence/severity of residual environmental impacts

As shown in Figure 7-3, residual environmental impacts have their consequence/severity determined, on a one to five tiered scale, using Impact Consequence Criteria. These Criteria

have been developed for key issues listed as dot points below, and are contained in sections 7.10.1.1 to 7.10.1.11. There are a number of considerations that have been built into these Impact Consequence Criteria including temporal, spatial, impact reversibility, direct and indirect impacts, and relevant legal or policy constraints.

- Noise
- Air quality
- Traffic
- Ecology
- Soils
- Archaeology
- Social
- Contamination of land
- Landscape
- Water Resources

It should be noted that it is often difficult to compare residual impacts consistently across different natural and socio-economic environments. Scientific evidence as well as predictions based on observation of similar activities has been used in the impact assessment process. Where this is not possible qualitative judgment has been used to ascribe impact based on the project and ESIA team's extensive experience and knowledge.

## 7.10.1.1 Noise (for human receptors)

CATEGORY	VERY	LOW	MEDIUM	HIGH	VERY
	LOW				HIGH
Ranking	1	2	3	4	5
Construction	Ambient noise level raised by <3dBA (not perceptible by most people) and less than $L_{Aeq 5 minutes}$ 70/75 dB(A) <sup>1</sup> outside dwellings between agreed daytime working hours and limit of $L_{eq (1-$ hour) 45 dB(A) <sup>2</sup> at night (to avoid sleep disturbance)	Ambient noise level raised by 3- 5dBA and less than L <sub>Aeq</sub> 5 minutes 70/75 dB(A) outside dwellings between agreed daytime working hours and limit of L <sub>eq (1-hour)</sub> 45 dB(A) at night	Ambient noise levels at sensitive receptors raised by 6- 10dB (A) and less than L <sub>Aeq</sub> 5 minutes 70/75 dB(A) outside dwellings between agreed daytime working hours and limit of L <sub>eq (1-hour)</sub> 45 dB(A) at night	Ambient noise levels at sensitive receptors raised by >10dB (A); or exceedance of L <sub>Aeq 5 minutes</sub> 70/75 dB(A) outside dwellings between agreed daytime working hours and limit of L <sub>eq (1-hour)</sub> 45 dB(A) at night	As for Level 4 and either tonal or impulsive noise present.
Continuous operational noise in residential areas	L <sub>eq (1-hour)</sub> <45 dB(A) <sup>3</sup> at night and L <sub>eq</sub> (1-hour) <55 dB(A) <sup>3</sup> during the day	L <sub>eq (1-hour)</sub> <45 dB(A) at night and L <sub>eq (1-hour)</sub> <55 dB(A) during the day but ambient noise level raised by no more than 3dBA	L <sub>eq (1-hour)</sub> <45 dB(A) at night and L <sub>eq (1-hour)</sub> <55 dB(A) during the day but ambient noise levels at sensitive receptors raised by 3- 6dB (A)	Exceedance of $L_{eq}$ (1-hour) <45 dB(A) or $L_{eq}$ (1-hour) <55 dB(A) during the day As guidance any operational noise of duration greater than 1 hour and exceeding the above standards and that is more frequent than once per	Exceedance of $L_{eq}$ (1-hour) <45 dB(A) or $L_{eq}$ (1-hour) <55 dB(A) during the day and tonal or impulsive noise present As guidance any operational noise of duration greater than 1 hour and exceeding the above standards

Table 7-2 Ranking of noise consequence/severity

#### BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA

CATEGORY	VERY LOW	LOW	MEDIUM	HIGH	VERY HIGH
				week	and that is more frequent than once per week
Continuous operational noise in industrial/com mercial areas	L <sub>eq (1-hour)</sub> <70 dB(A) <sup>3</sup>	L <sub>eq (1-hour)</sub> <70 dB(A) and ambient noise level raised by no more than 3dBA	$L_{eq (1-hour)} < 70$ dB(A) ambient noise levels at sensitive receptors raised by 3- 6dB (A)	Exceedance of L <sub>eq (1-hour)</sub> 70 dB(A)	Exceedance of $L_{eq (1-hour)}$ 70 dB(A) or $L_{eq (1-hour)}$ and tonal or impulsive noise present

 Table 7-2 Ranking of noise consequence/severity

1 World Bank Group "Pollution Prevention Abatement Handbook – General Environmental Guidelines". Recommended level for Industrial installations.

2 WHO "Guidelines for Community Noise" (1999).

3 World Bank Group "Pollution Prevention Abatement Handbook – General Environmental Guidelines". For a residential area, the World Bank recommend that daytime limits do not exceed LAeq 55dB daytime, and LAeq 45dB night-time, or a maximum 3dBA increase than the existing noise level should the existing ambient noise level already exceed 45dBA.

4 World Bank Group "Pollution Prevention Abatement Handbook – General Environmental Guidelines" 5. Duration – Should any of the construction impacts occur for more than 2 weeks, the next consequence/severity level up will be used.

### 7.10.1.2 Air quality

CATEGORY	VERY LOW	LOW	MEDIUM	HIGH	VERY HIGH
Ranking	1	2	3	4	5
Short term (<24 hours) concentrations	Process concentrations that are not discernable	Process concentratio ns that are <75% of the EU standards	Process concentrations that are 75- 100% of the EU standards	Process concentrations that are 100- 149% of the EU standards	Process concentrations that are >150% of the EU standards
Long term (>24 hours) concentrations	Maximum process and baseline concentrations are <10% of the EU standards	Maximum process and baseline concentratio ns are 10- 20% of the EU standards	Maximum process and baseline concentrations are 20-50% of the EU standards	Maximum process and baseline concentrations are 50-100% of the EU standards	Maximum process and baseline concentrations are >100% of the EU standards
	Maximum process annual emissions are <0.5% of the Azerbaijan National	Maximum process annual emissions are 0.5-2% of the	Maximum process annual emissions are 2-5% of the Azerbaijan National	Maximum process annual emissions are 5-10% of the Azerbaijan National	Maximum process annual emissions are >10% of the Azerbaijan National

Table 7-3 Ranking of air quality consequence/severity
CATEGORY	VERY LOW	LOW	MEDIUM	HIGH	VERY HIGH
	Emissions Inventory values	Azerbaijan National Emissions Inventory values	Emissions Inventory values	Emissions Inventory values	Emissions Inventory values

Note: EU standards refer to ambient air quality (Section 10).

#### 7.10.1.3 Dust

CATEGORY	VERY LOW	LOW	MEDIUM	HIGH	VERY HIGH
Ranking	1	2	3	4	5
Construction Nuisance	No measurable or notable increase	Measurable and notable increase in dust levels	Nuisance to people but no adverse health effects or on crops/property	Significant nuisance to people or with sensitive individuals affected, or minor property or crop damage	Very significant nuisance to people with measurable health effects, or significant damage to property or crops

Table 7-4 Ranking of dust consequence/severity	able 7-4 Ranking of dust cons	equence/severity
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Note 1: Nuisance takes account of duration by the inherent assumption that in order to cause a nuisance the impact must last for a reasonable duration (eg. greater than one week or repeated impacts). Note 2: The above criteria are qualitative in nature, but require professional judgement in order to assign the appropriate ranking

#### 7.10.1.4 Traffic impact

The approach for determining severity/consequence for traffic impacts relates to changes in traffic flow and the presence of receptors, as well as the duration of the impact. Impacts upon the road system itself will be limited by upgrading of the roads required to the standards required to enable project activities, such as heavy vehicle movement.

The presence of receptors (eg built-up areas, villages, schools, pedestrians, etc) is a necessary prerequisite in order for impacts to occur. The next consideration is the percentage increase in traffic flow, with the following rankings assigned:

- Not measurable Very Low
- <5% increase Low
- 6-10% increase Medium
- 11-20% increase High
- >20% increase Very High

The final consideration in determination on the consequence/severity level is that the duration of the impact. Should any of the above noted increased traffic flows be predicted to occur for

more than two weeks duration, the next consequence/severity level up will be used.

#### 7.10.1.5 Ecology

The consequence/severity of ecological impact has been evaluated taking account of the following factors:

- The magnitude of the impact, as determined by its intensity, its extent in space and time and the likelihood of it occurring
- The vulnerability of the habitat or species to the change caused by the impact
- The ability of that species or habitat to recover
- The value, in nature conservation and ecological terms of affected receptors including species, populations, communities, habitats, landscapes and ecosystems

Any contravention of legislation relating to conservation is considered to be a High (4) consequence/severity.

CATEGORY	VERY LOW	LOW	MEDIUM	HIGH	VERY HIGH
Ranking	1	2	3	4	5
Habitat integrity	Impact on the habitat integrity <sup>1</sup> largely not discernable	Loss of habitat integrity not measurable using standard techniques	Reduction in integrity of regionally (in the country context) important habitat using standard techniques	Reduction in integrity of nationally important habitat using standard techniques	Reduction in integrity of internationally important habitat using standard techniques
Species behaviour and interactions	No discernable effect due to disruption <sup>2</sup> on behaviour or species interactions	Disruption of behaviour or species interactions discernable using standard techniques	Disruption of behaviour or species interactions of regionally (in the country context) important species discernable using standard techniques	Disruption of behaviour or interactions of nationally important species discernable using standard techniques	Disruption of behaviour or interactions of internationally important species discernable using standard techniques
Habitat/ species recovery	Immediate return to baseline	Return to baseline conditions	Return to baseline conditions	Return to baseline conditions after	Return to baseline conditions after
(temporary landtake)	conditions on completion of reinstatement activities	within 2 years on completion of reinstatement activities	within 2-5 years on completion of reinstatement activities	5-10 years on completion of reinstatement activities	>10 years on completion of reinstatement activities
Protected	Not impacting	Activities may	Potential to	Potential to	Contravenes the

Table 7-5 Ranking of ecological consequence/severity

CATEGORY	VERY LOW	LOW	MEDIUM	HIGH	VERY HIGH
Habitats	an area	temporarily	contravene the	contravene the	provisions or
	affected by	disturb	very high (5)	provisions or	intent of
	national laws,	protected areas	category;	intent of national	national laws,
	international	but not lead to	assuming re-	laws,	international
	conventions,	any long-term	instatement	international	conventions,
	company	effects on the	likely within	conventions,	company
	policies or IFI	ecological	three years	company policies	policies or IFI
	Policies	integrity of the		or IFI Policies	Policies.
		protected area		after mitigation,	
				assuming full re-	
				instatement to	
				pre-disturbance	
				condition within	
				five vears	

#### Table 7-5 Ranking of ecological consequence/severity

Note 1 Ecological integrity includes issues such as loss of habitat, fragmentation of habitat, disruption and loss of wildlife corridors, ecological carrying capacity.

Note 2 Disruption due to physical changes, noise, visual intrusion and air emissions behaviour on, for e.g. breeding, nesting, mating/spawning, diurnal and seasonal migration, hibernation, territorial activities, predator-prey relationships and ultimately mortality

#### 7.10.1.6 Soils

The severity/consequence of impacts on soils has been evaluated by taking account of the following factors:

- The magnitude of the impact, as determined by its intensity and extent in space and time;
- The vulnerability of the soils to the change caused by the impact; and
- The ability of the soils to recover from the impact.

CATEGORY	VERY LOW	LOW	MEDIUM	HIGH	VERY HIGH
Ranking	1	2	3	4	5
Soil erosion	Soil erosion generally not discernable	Soil erosion predicted to occur at approximately the same rate as soil formation	Soil erosion predicted to be visibly active but no rill and gully formation evident	Rill and gully formation predicted to be evident	Rill and gully formation predicted to be extensive
Reduced soil productivity	Productivity losses generally not discernable	Productivity losses are discernible and predicted to last less than three months after construction	Limited productivity losses predicted to last less than one year after construction but more than three months	Moderate areal extent of productivity losses predicted to last more between one and five years after construction	Productivity losses are predicted to be extensive last more than five years after construction
Waterlogged	Water logging	Water	Water predicted	Water predicted	Water

#### Table 7-6 Ranking of consequence/severity on soil

CATEGORY	VERY LOW	LOW	MEDIUM	HIGH	VERY HIGH
soils	generally not discernable	predicted to remain in surface depressions less than three months after	to remain in surface depressions less than one year after construction but more than three	to remain in surface depressions for between one and five years after construction	predicted to remain in surface depressions permanently
Sediment transport to water courses	Visible sediments generally not discernable	construction Visible sediment predicted in watercourses for less than three weeks after construction and no obscuration of the bed	months Visible sediment predicted in watercourses for longer than three weeks after construction but no obscuration of bed	Visible sediment predicted in watercourses for longer than three weeks after construction and obscuration of the bed	Permanent features in watercourses

Table 7-6 Ranking of consequence/severity on soil

#### 7.10.1.7 Cultural heritage

Information on archaeological features normally only becomes available during the construction phase of the project due to the intrusive nature of the process. Therefore, the assignment of accurate consequence/severity prior to the construction phase is often not possible. Nonetheless, there are a number of factors to be taken into account in assigning the consequence/severity of a potential impact on archaeology.

A matrix has been employed in order to be able to determine the consequence/severity of the impact by taking account of the protected status and the potential for destruction of archaeological remains

RANKING	1	2	3	4	5
Potential for Destruction	Deposits will not be affected, because of distance from the pipeline, or method of construction.	A small (1-10%) proportion of the surviving deposits damaged or destroyed	A moderate (10-25%) proportion of the surviving deposits damaged or destroyed	A large (25- 50%) proportion of the surviving deposits damaged or destroyed	Most (50-100%) of the surviving deposits damaged or destroyed
Protected Status	Resources whose importance is unknown, sites of uncertain date or character	Resources which have little or no archaeological or historical value, or where remains may have been previously destroyed	Locally important resources of low or minor importance	Regionally important resources of a reasonably defined extent, nature and date and significant	Internationally and nationally important resources, legally protected remains of national importance

Table 7-7 Ranking of consequence/severity on cultural heritage

		examples in a	
		regional	
		context	

A 1 to 5 score is assigned for both "Potential for Disturbance" and "Protected Status" using the above table. These scores are entered into the matrix below and the final consequence/severity score determined by multiplying the Potential for Destruction score by the Protected Status score, and dividing by five.

ion	5	5	10	15	20	25
structi	4	4	8	12	16	20
r Des	3	3	6	9	12	15
ial fo	2	2	4	6	8	10
otenti	1	1	2	3	4	5
P		1	2	3	4	5

#### Protected Status

#### 7.10.1.8 Contamination of land due to project activities

CATEGORY	VERY LOW	LOW	MEDIUM	HIGH	VERY HIGH
Ranking	1	2	3	4	5
Description	Concentrati ons below DIV	DIV concentration s exceeded by <25% in project area and can affect receptors	DIV concentrations exceeded by 25- 50% in project area and can affect receptors	DIV concentrations exceeded by 50- 100% in project area and can affect receptors	DIV concentrations exceeded by >100% in project area and can affect receptors

Table 7-8 Ranking of contamination	of land consequence/severity
------------------------------------	------------------------------

<sup>1</sup> DIV refers to Dutch Intervention Standards used internationally as screening criteria. The DIV Intervention Standards are levels at which intervention to clean up is recommended. Their use here is to provide a measure of impact rather than as a trigger level for intervention during construction should any contamination be exposed

#### 7.10.1.9 Landscape

Assessing the consequence/severity of landscape and visual impact is a qualitative process, which relies upon subjectivity and reasoned judgment supported where possible by evidence.

CATEGOR Y	VERY LOW	LOW	MEDIUM	HIGH	VERY HIGH
Ranking	1	2	3	4	5
Impact on Visual Receptors (resident and transitory)	Change in view not discernable from most viewpoints	Few viewpoints affected / minor change in view	Many viewpoints affected / moderate changes in	Majority of viewpoints affected / major changes in view	All of viewpoints affected

 Table 7-9 Ranking of consequence/severity on visual receptors and landscape

CATEGOR Y	VERY LOW	LOW	MEDIUM	HIGH	VERY HIGH
			view		
Duration, and extent of change in landscape / Quality and value of Landscape	No noticeable change in landscape / or landscape is low quality	Virtually imperceptible change in the I landscape; or Reinstatement within 1-2 years	Changes in the natural landscape in a localized area; or Reinstatement in 2-5 years	Change in natural or high value landscape over an extensive area; or Reinstatement in 5-10 years	Change in natural or high value landscape over an extensive area; and Reinstatement not possible

### 7.10.1.10 Groundwater – quality and quantity

CATEGORY	VERY LOW	LOW	MEDIUM	HIGH	VERY
					HIGH
Ranking	1	2	3	4	5
For groundwater used, or may be used, as a resource, being of sufficient quantity and quality	No discernible change in groundwater baseline conditions <i>and</i> no discernible change in groundwater resource quantity.	Change of <25% in any parameter from the DIV <sup>1</sup> criteria <i>or</i> depletion of resource that does not recover within 6 months post construction (within 10% of original elevation).	Change of $25-50\%$ in any parameter from the DIV <sup>1</sup> criteria <i>or</i> depletion of resource that does not recover within 6-12 months post construction (within 10% of original elevation).	Change of 50- 100% in any parameter from the DIV <sup>1</sup> criteria <i>or</i> depletion of resource that does not recover within 1-2 years post construction (within 10% of original elevation).	Change of >100% in any parameter from the DIV <sup>1</sup> criteria or depletion of resource that does not recover after 2 years post construction (within 10% of original elevation).
Effect on beneficial users	No effect	Temporary effect	Short term but reversible effect	Long term but reversible effect	Permanent and irreversible effect

#### Table 7-10 Ranking of groundwater consequence/severity

<sup>1</sup> DIV refers to Dutch Intervention Standards. The DIV Intervention Standards are levels at which intervention to clean up is recommended. Their use here is to provide a measure of impact rather than as a trigger level for intervention should contaminated groundwater be encountered during construction.

#### 7.10.1.11 Surface Water – quality and quantity

CATEGORY	VERY LOW	LOW	MEDIUM	HIGH	VERY HIGH
Ranking	1	2	3	4	5
For surface water used, or may be used, as a resource, being of sufficient quantity and quality	No discernible change in surface water baseline conditions and no discernible change in downstream river discharge.	Change of <25% in any parameter from the DIV <sup>1</sup> ; or visible sediment observed for less than 3 weeks; or <15% decrease of downstream river discharge for no more than 1 day.	Change of 25-50% in any parameter from the DIV <sup>1</sup> ;or visible sediment observed for more than 3 weeks; or 15-40% decrease of downstream river discharge for 1-2 days.	Change of 50- 100% in any parameter from the DIV <sup>1</sup> ; or visible sediment observed for more than 3 weeks; or >40% decrease of downstream river discharge for 2-3 days.	Change of >100% in any parameter from the DIV <sup>1</sup> ; or visible sediment observed for more than 3 weeks; or >40% decrease of downstream river discharge for >3 days.
Effect on Beneficial Users	No effect	Temporary effect	Short term but reversible effect	Long term but reversible effect	Permanent and irreversible effect

Table 7-11 Ranking of surface water consequence/severity

<sup>1</sup> DIV refers to Dutch Intervention Standards. The DIV Intervention Standards are levels at which intervention to clean up is recommended. Their use here is to provide a measure of impact rather than as a trigger level for intervention (See Annex B)

# 7.10.2 Likelihood

To assign likelihood of residual impact, five criteria were defined and ranked. This five-tiered likelihood ranking criteria are in line with international practices (e.g. Australian/New Zealand Risk Management Standard AS/NZS: 4360). The criteria for likelihood are shown in Table 7-12.

RANKING	DEFINITION
5	The impact will occur under normal operating conditions.
4	The impact is very likely to occur under normal operational conditions.
3	The impact is likely to occur at some time under normal operating conditions.
2	The impact is unlikely to but may occur at some time under normal operating conditions.
1	The impact is very unlikely to occur under normal operating conditions but may occur in exceptional circumstances.

## 7.10.3 Evaluating level of residual environmental impact

The residual environmental impacts are assigned a level of significance based on the likelihood of the impact and the consequence of that impact. For each residual impact a consequence/severity ranking between 1 and 5 has been assigned using the impact criteria tables above. The likelihood is assigned using Table 713. The significance level of residual environmental impact is then determined using the matrix below where L denotes a Low-level of impact, M a Medium-level and H a High-level.



Table 7-13 Level of residual environmental impact

CONSEQUENCE/SEVERITY

Note 1. A residual impact of Medium is ascribed to a level 5 impact for a likelihood of 1, even though it is very unlikely to occur.

## 7.10.4 Residual social impacts

As per environmental impacts, residual social impacts are any potential impacts remaining once mitigation measures have been implemented. However, in the case of socio-economic impacts, these may not be directly related to the aspects of the project, but may arise from unmet expectations or difficulties in communication (eg access to energy, or in relation to employment opportunities).

Once identified, these residual impacts are assessed according to their significance for individuals or communities according to the table below. Note that the same ranking system is used as for residual environmental impacts ie High, Medium, Low and Beneficial. A comment on likelihood of the residual impact is also provided.

IMPACT CATEGORY	SOCIAL IMPACT
Beneficial	<ul> <li>Improvement in the ability of household or settlement to maintain or improve its livelihood/store of assets</li> <li>Enhancement in quality or availability of resource leading to improvement in quality of life. For example: <ul> <li>Enhancement in physical capital including availability of infrastructure</li> <li>Enhancement in social capital, including skills for future employment</li> <li>Enhancement of relationship between BP/Construction Contractor and communities</li> <li>Enhancement in health and safety of local population</li> </ul> </li> </ul>

IMPACT	SOCIAL IMPACT
CATEGORY	
Low	Possible short term decrease in availability of resource or access to infrastructure not affecting livelihood Possible short term decrease in quality of life of household or settlement not affecting long term outcomes No effect on human health No discernable long term effect of the local economy Impacts which are long lasting but to which the community is able to adapt, such as increased access to information/possible slow cultural change/changes in economic structure
Medium	Potential effect or perceived effect on ability of household to maintain livelihood/store of assets in short term Potential reduction in quality of life in short term Potential disruption to lifestyle in short term Perception of missed opportunity to improve Possible decrease or perceived decrease in access to infrastructure to which community is unable to adapt in the short term Quality of life Negative effect on human health which can be contained and is therefore short term with no increased mortality Impacts which may result in high levels of complaint in the short term
High	Negative effect on safety of humans or animals Negative effect on human health which can not be contained or results in increased mortality Effect or perceived effect on ability of household to maintain livelihood/store of assets to an extent not acceptable to affected people Permanent or perceived permanent reduction in quality of life Permanent cultural change to which the communities are unable to adapt Widespread perception of missed opportunity to improve quality of life, resulting in frustration and disappointment Result in tensions with communities which lead to sabotage to pipeline construction or operation by local communities, or outbreaks of violence between workers and communities

# 7.10.5 Addressing residual impacts

The following approach is applied to addressing environmental and social residual impacts.

#### High (H)

- Check that the residual impact has been subject to feasible and cost effective mitigation where possible
- Where no further reduction in impact levels can be made, it remains a High-level impact and which may therefore be subject to compensation or offsets

#### Medium (M)

• Check that the residual impact has been subject to feasible and cost effective mitigation and that no further measures are practicable

#### Low (L)

• Not mitigated further

An assessment of the significance of the residual impacts from the BTC pipeline was undertaken and the results are presented and discussed in Sections 10, Environmental Impacts and Mitigation, and 11, Socio-Economic Impacts and Mitigation. Further discussion of residual impacts is provided in Section 12, Residual Impacts.

### 7.11 CUMULATIVE IMPACTS

The December 1998 IFC "Procedure for Environmental and Social Review of Projects" states that that an environmental assessment should also address cumulative impacts. The objective of the cumulative impact assessment is to identify those environmental and/or socio-economic aspects that may not on their own constitute a significant impact but when combined with impacts from past, present or reasonably foreseeable future activities associated with this and/or other projects, result in a larger and more significant impact(s). Examples of cumulative impacts include:

- The recurring loss of habitat in areas that are disturbed and re-disturbed over an extended period
- Additional emissions as a processing plant is extended and expanded over a period of time
- The ongoing development of employment opportunities and enhancement of local labour skills base as successive projects (related or unrelated) come on stream

Cumulative impacts considered in this ESIA relate to impacts due to BTC project and:

- The development of the SCP project
- Developments in local industry and associated projects
- Silk Road development
- ACG full field development
- Catastrophic failure of the SCP pipeline

The project also considers the cumulative impacts of BTC pipeline on the WREP pipeline in those locations where the corridor, and therefore the pipeline-affected communities, are the same.

Cumulative impacts have been assessed for the BTC pipeline ESIA and the results are presented in Section 13.

## 7.12 TRANSBOUNDARY IMPACTS

The World Bank document OP 4.01 stipulates that transboundary impacts (eg impacts that cross the border of Azerbaijan into neighbouring countries) should be considered during the ESIA process. The assessment of transboundary impacts for the BTC pipeline ESIA examines:

• Air emissions

• Oil spill migration

The significance of identified transboundary impacts has been assessed broadly using the methodology described above, and is presented in Section 13.

# 7.13 REGULATORY APPROVAL PROCESS

Until May 2001 the national environmental regulatory body of Azerbaijan was the State Committee of Ecology and Nature Use Control (ASCE). The ASCE has now been replaced by the Ministry for Ecology and Natural Resources (MENR), which also take over the responsibility for reviewing the ESIA. Further information on the formation of the MENR can be found in Section 6, Legislation and Policy Framework.

The expert review and approval of environmental documentation, including this ESIA, will be carried out by the MENR over a 30 day period, in accordance with the procedures described in the Host Government Agreement.

This ESIA report, once approved by the MENR, will enable the project to proceed based on the concepts, strategies and commitments that are contained in the report. During this review process, new commitments or modifications to those presented in this ESIA may arise in order to satisfy the needs and opinions of the reviewing authority. Further commitments may arise in order to address key concerns raised by members of the public.

The approval document from the MENR acts in effect as a permit for the various planned operations, discharges and emissions that are documented and will remain effective throughout the entire project. If, for technical or other reasons, changes are required in the project description that might alter the impacts arising from the BTC project, these will be conveyed to the MENR; the environmental implications will be assessed and any additional mitigation measures agreed with the MENR.

# 7.14 MANAGEMENT AND MONITORING

To assist in the management and implementation of the measures designed through the ESIA, and the monitoring of their effectiveness, Environmental and Socio-economic Management and Monitoring Plans have been developed. These are presented in Section 14. The plans describe the management and monitoring strategies and present generic procedures for their implementation. Further, they identify the roles and responsibilities for implementation and for ensuring that monitoring is undertaken, that the results are analysed and any necessary amendments to practices are identified and implemented in a timely manner.

Monitoring during the construction and operational phases of the project, through the audit of impact predictions and mitigation measures, will ensure:

- That mitigation measures are implemented effectively
- That mitigation measures are appropriate and if not, that they are amended or additional measures designed and implemented
- Compliance with international standards, guidelines and best practice, and BP corporate policies, and international best practice

- Assessment of cumulative and residual impacts, so that appropriate measures can be designed if necessary
- The perpetuation of the ESIA as an iterative process



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# 8 ENVIRONMENTAL BASELINE

### 8.1 INTRODUCTION

This section provides a summary of the environmental baseline information collected for the BTC project. The purpose of the environmental baseline characterisation is to:

- Document environmental conditions along the proposed route prior to the commencement of the project
- Evaluate those environmental components that might affect, or be affected by, the construction or operation of the BTC pipeline system

More detailed baseline reports and descriptions of the environment are provided in Parts 1-14 of the Baseline Reports Appendix. A full list of references is also provided in this Appendix.

### 8.2 **REGIONAL GEOGRAPHICAL SETTING**

Azerbaijan is the largest of the three Trans-Caucasian countries covering an area of 86,600 sq. km (roughly the size of Austria) and includes the geographically separate Autonomous Republic of Nakhchevan. Azerbaijan shares land borders with Armenia, Russia (Dagestan), Iran, Georgia and Turkey (via the Nakhchevan exclave). In addition, Azerbaijan has an 825km coastline with the Caspian. Kazakhstan and Turkmenistan are Azerbaijan's immediate neighbours on the opposite, eastern shore of the Caspian.

Azerbaijan is predominately a mountainous country. Average elevation is 384m and 71% of the territory is above 500m, with 3.5% above 2,500m. It is surrounded by three separate mountain ranges. The Greater Caucasus form part of the northern border and include the nation's highest peaks of Bazar-Dyuzi (4,466m), Shakh-Dag (4,243m) and Tufan (4,205m). The Lesser Caucasus consists mostly of mountainous folds with peaks up to 3,900m orientated in a south-easterly direction, bwards Iran. These folds form the Shakh-dag, Karabakh and Congur-Alangez ranges. Other ranges of the Lesser Caucasus include the Mrov-dag and Daralagez ranges. As well as ridges, the Lesser Caucasus includes plateaux, mostly of volcanic origin, such as the Karabakh plateau, and lowlands, which extend along the Middle Araks. In the extreme south-east of Azerbaijan are the smaller but ecologically and geographically distinct Talysh Mountains (highest point, Kyumyurkey at 2,477m). The remaining area of the territory consists of lowlands and plains, 18% of it below sea level. Chief amongst these is the central, flat, alluvial Kura-Araks Lowlands, through which the majority of the BTC pipeline has been routed. The Kura and Araks Rivers divide these lowlands into three parts: the Shirvan steppe, north from the Kura River; Mil-Karabakh steppe, between the Kura and Araks Rivers; and the Mugan steppe, south of the Araks towards the lower reaches of the Kura River. There are also many small islands along the Caspian coast. The Caucasus region is seismically active and prone to earthquakes; landslides are common in mountains.

## 8.3 METEOROLOGY AND CLIMATE

### 8.3.1 Introduction

Several climatic types can be differentiated in Azerbaijan, principally depending on the altitude of the area and distance from the Caspian. The main climate types are:

- Arid subtropical
- Humid subtropical
- Temperate
- Cold

The arid subtropical climate is typical for the Kura-Araks Lowlands where the majority of the BTC pipeline route is located. The highest air temperatures occur in the Kura-Araks Lowland and along the Caspian coastline. Average July temperatures are more than +25°C, whilst during the winter temperatures rarely fall below freezing. The average annual temperature in this area is 14-15°C. Average rainfall is 200-400mm per year but can be as little as 150-200mm in semi-desert areas such as Gobustan south of Baku, where summer droughts occur regularly.

Azerbaijan has a number of climate and meteorology measuring stations, some of which are located in the vicinity of the pipeline route. These include the stations at Baku, Puta, Alyat, Kazi-Magomed, Kurdamir, Yevlakh, Ganja, Shamkir, Kazakh and Akstafa (Figure 8-1). Some of the stations have collected meteorological data for many decades (although a number are now closed), which makes the long-term climatic averages relatively reliable. Data have also been obtained for the area of Ganja from the UK Meteorological Office. Ganja is located within 50km of the proposed location of pump station PS-A2.



Figure 8-1 Location of meteorological stations along the BTC route in Azerbaijan

## 8.3.2 Temperature

#### 8.3.2.1 Sunshine and solar radiation

The average number of sunshine hours experienced annually along the BTC pipeline route is high. The Agroclimatic Atlas of Azerbaijan (1993) shows that most regions receive approximately 2,200 hours of sunshine per annum. Around 60% of this total is incident between June and August when, for example, up to 11 hours of sunshine per day can be expected in Baku. This declines to an average of just three hours per day in winter.

Mean annual solar radiation fluxes alter little along the BTC pipeline corridor. They vary between 128 and 132kcalcm<sup>-2</sup> (kilocalories per square centimetre) at the eastern end, and decline to a little less than 124kcalcm<sup>-2</sup> at the slightly cloudier western end, a region with one of the lowest annual solar radiation levels in Azerbaijan. In the winter period, between October and March, the whole route receives only between 36 and 40kcalcm<sup>-2</sup>.

#### 8.3.2.2 Air temperature

These large inputs of solar energy, combined with limited thermal moderation by cooling vegetation (especially around the eastern semi-desert part of the route) means that air and soil temperatures are high, particularly in the peak of summer. Mean annual air temperature increases steadily eastwards from approximately 12°C at the Georgian border (KP442) to 13.2°C at Ganja (KP340) and 14.6°C at Alyat. Alyat is registered as one of the warmest places in Azerbaijan.

The coldest month is usually January whilst the warmest months are July and August. Mean January air temperatures at Puta and Ganja are 3.4°C and 1.1°C respectively, while in Akstafa the January mean drops to -0.1°C. In July the cooling effect of the Caspian means that average monthly air temperatures are virtually the same at Puta and Ganja (25.8°C and 25.4°C respectively). The hottest parts of the BTC pipeline corridor in July are normally in the centre of the country, around Kurdamir and Yevlakh (both 27.3°C). These locations are far enough inland to be isolated from the moderating effects of the Caspian, yet not at a sufficiently high elevation to be affected by altitudinal cooling.

As regards temperature extremes, mean monthly minimum air temperature in January varies from 0.7°C at Puta to -2.4°C at Ganja. Mean monthly maximum air temperatures in July vary from 30.4°C at Puta to 34.6°C at Kurdamir.

Figure 8-2 shows hourly average temperature, by calendar month, for Ganja during 1999 (data supplied by the UK Meteorological Office). The percentage of data points recorded was poor (36%), indicating that the recording station was out of operation for much of the time.



Figure 8-2 Hourly mean temperature by month, Ganja 1999

Long-term meteorological records for Yevlakh District show an average annual temperature of 14.6°C. January is the coldest month, averaging 1.7°C, whilst July is warmest, averaging 27.3°C. Table 8-1 shows long-term meteorological information for Yevlakh District (Budagov, 2002), indicating temperature fluctuations by calendar month.

Table 8-1 Long-term temperature data (°C), Yevlakh Distric	g-term temperature data (°C), Yevla	kh District
--	-------------------------------------	-------------

	Month						Annual Mean						
	J	F	М	Α	Μ	J	J	Α	s	0	Ν	D	
Average temp.	1.7	3.7	7.6	13.5	19.6	24.3	27.3	26.6	21.7	15.6	9.0	3.9	14.6
Average absolute minimum temp.	-8	-7	-4	1	8	12	15	15	10	4	-3	-6	3.1

#### 8.3.2.3 Soil temperature

The temperature of the soil is dependent on the nature of the soil surface, the amount of solar radiation incident on the area and the energy balances at the surface. Soil particle grain size, soil moisture content and degree of vegetation cover are all significant issues in relation to soil temperature.

Mean daily soil surface temperatures are around  $2^{\circ}$ C to  $3^{\circ}$ C higher than air temperatures. This reflects strong solar heating of the soil surface (especially in summer), the lack of a shading/transpiring vegetation cover, and a limited soil moisture supply for evaporation. Mean annual soil surface temperatures are relatively constant along the route, varying between  $16^{\circ}$ C and  $18^{\circ}$ C. Mean July soil temperature along the whole route varies between  $30^{\circ}$ C and  $35^{\circ}$ C. In January, mean soil surface temperatures along the entire route are between  $0^{\circ}$ C and  $3^{\circ}$ C, except near Puta where average values tend to exceed  $3^{\circ}$ C.

Potential evapotranspiration (PE) is strongly linked to temperature regimes. PE is the maximum amount of evaporation and transpiration that can take place if an unlimited moisture supply is available. PE rates in the April to October period are very high, at more than 800mm in eastern Azerbaijan and 600mm in the west. The summer evapotranspiration

peak is controlled by the amount of solar radiation received, wind speeds and atmospheric humidity, among other factors.

The fact that PE losses exceed precipitation inputs by some margin is largely responsible (along with soil salinity and overgrazing) for the sparse vegetation cover in the eastern part of the route. Irrigation systems are extensive in the central parts of the BTC corridor, and replenish evaporated and transpired soil moisture to sustain agricultural activity. Overirrigation is, however, common in these areas, with high evaporation rates leading to a build up of saline deposits in the soil.

#### 8.3.2.4 Humidity

Mean annual absolute humidity increases from around 11 gcm<sup>3</sup> in the west to around 13 gcm<sup>3</sup> in the eastern coastal areas. Strong seasonality exists, however, and in the Shirvan Plain lowlands, values range from 4.0-7.2 gcm<sup>3</sup> in January, and 14.3-22.2 gcm<sup>3</sup> in August. Mean annual relative humidity displays little spatial variability, increasing from 67% at Shamkir (close to KP315) to 72% at Kurdamir (near KP110). Summers are hot and dry, and peak relative humidities are achieved in winter. The highest average daily humidity recorded along the route is 87% during the winter in Kurdamir, a value that declines to 72% in July.

### 8.3.3 Precipitation

#### 8.3.3.1 Annual and seasonal precipitation

Average annual precipitation decreases steadily from around 350-400mm near the Georgian border to 104mm at Puta. Rainfall is the most strongly varying climatic parameter in the BTC corridor (Figure &3). The arid desert plain in the Puta/Sangachal region is one of the driest areas in Azerbaijan. Variability from year to year is high, as is common with semi-arid and arid environments, and Puta has received as much as 390mm in one year (1968), and as little as 78mm in another (1925). Similarly, annual totals at Akstafa (approximately KP357) have ranged from 567 to 253mm (Table &2). It should be stressed however, that the much greater precipitation (and snowmelt) over the Caucasus ranges controls the magnitude and seasonal variation of flows in the rivers crossed by the BTC pipeline (see Section 8.10 – Hydrology and water quality).

Station	Total Rainfall for Year (mm)					
	Mean	Average Max	Average Min			
Puta	104	390 (1968)	78 (1925)			
Alyat	188	NA	NA			
Kurdamir	325	551 (1963)	195 (1947)			
Ganja	248	397 (1948)	150 (1932)			
Akstafa	359	567 (1915)	253 (1925)			

 Table 8-2 Precipitation statistics for meteorological stations along the BTC pipeline route

Note: NA indicates data that are not available at the time of this report

Seasonal distribution of precipitation is not especially pronounced in the region, although there are some variations along the BTC pipeline corridor (Table 8-2). Two seasonal peaks in rainfall intensity are evident: one in the March-May period, and a second in autumn/winter. Most precipitation falls between September and April. The driest month is July, when the average rainfall is 8mm in Baku, 2mm in Puta, and 32mm in Akstafa.

Meteorological data gathered for Yevlakh District indicate low levels of precipitation due to the district's low-lying location. Long-term records show average annual precipitation of 323mm. On average, the months of July and August experience the lowest rainfall, approximately 15mm and 13mm respectively, whilst March and October experience the greatest average precipitation of 37mm and 34mm respectively. Long-term records indicate 78 rainy days per annum on average.





#### 8.3.3.2 Rainfall event magnitudes and frequencies

On average, rain falls on approximately 58 days a year in Baku, and 71 days in Kurdamir. The maximum daily precipitation along the route varies from 65mm in Baku to 100mm in Kazi-Magomed (KP52). These extreme events occur mostly in summer, but can also occur in winter, especially near the coast. Eyubov (1996) states that large daily rainfalls, in the 75-100mm range, may occur once every 100 years.

Rainstorms in semi-arid environments along the route are recorded, on average, approximately every 2-4 years. These events can lead to significant floods, associated erosion and substantial sediment loads in the channel networks, which may be dry or at low flow for most of the year (see Section 8.10, Hydrology and water quality). Heavy rainstorms may also trigger mudflows (see Section 8.6.4, Geohazards).

#### 8.3.3.3 Snowfall and snowmelt

Precipitation along the route occurs almost entirely as rain: only 6 days of snow per annum on average are recorded at Baku and Kurdamir, increasing to 15-18 days near the Georgian border. However, heavy snow accumulations occur in the Greater and Lesser Caucasus mountains every winter, affecting the rivers crossed by the BTC pipeline. The snow in the mountains melts each spring, and rainstorms can augment snowmelt. The considerable quantities of meltwater generated through the snowmelt and mountain rainfall can cause significant flooding downstream in the pipeline zone.

Snow tends to disappear from the BTC pipeline route by the end of March at the latest. However, snow usually persists in the mountain river source areas until the end of May/early June, and a risk of flooding downstream at BTC pipeline river crossings usually remains until late June. Most annual meltwater floods begin in March, peak in April or May, and are over by the end of June.

## 8.3.4 Wind speed and directions

Mean annual wind speeds are very high near the eastern end of the BTC pipeline, decline toward the central part of the corridor and then rise again near the western end. Stronger winds are especially common in August. Very high wind velocities (greater than 25ms<sup>-1</sup>) occur regularly throughout the Apsheron region. Dust-storm events are likely to occur in the Sangachal area, due to the occurrence of wind speeds in excess of 15ms<sup>-1</sup> for over 100 days per year and the presence of local dry and fine surface materials.

Data for Yevlakh District indicate that 60% of the winds observed are from the north-west or south-east. According to long-term meteorological information, there is an average of 21 days per year with high wind velocities (exceeding 15ms<sup>-1</sup>) in that region.

At the eastern end of the pipeline, northerly winds dominate (55% of the time), and can, in winter, bring sudden reductions in temperature and occasionally snow. Westerly winds become increasingly common towards the Georgian border, especially in winter.

Figure 8-4 is a windrose for Ganja obtained from 1999 monitoring data supplied by the UK Met Office. Wind data for Ganja have been used for modelling air emissions from the pump station at KP298, since they provide the closest validated dataset available. However, the percentage of data recorded was poor (36%), indicating that the recording station was out of operation for much of the time. Data from Tbilisi, where the coverage was more complete, were therefore also used.

#### Figure 8-4 Windrose, Ganja 1999



## 8.3.5 Key issues

Key characteristics of the climate along the route of the pipeline in Azerbaijan are as follows:

- Hot dry windy summers predominate in the east, particularly in the Gobustan region
- Largely dry winters are experienced over the entire the pipeline route
- Hot, humid conditions with little wind prevail around Yevlakh near the centre of the pipeline route
- Cooler weather predominates in the west towards the Georgian border

## 8.4 AIR QUALITY

### 8.4.1 Introduction

This Section characterizes the existing (baseline) air quality in the vicinity of the proposed pump station (PS-A2) and pipeline route. Particular emphasis is placed on the pump station location, since operation of the pump station is the most significant source of air emissions associated with the BTC project (see Section 10). Reference is also made to the Sangachal Terminal as cumulative impacts on air quality have been evaluated at this location (see Section 13).

## 8.4.2 Baseline air quality monitoring survey at PS-A2

A baseline air quality sampling survey has been undertaken at the proposed site of pump station PS-A2, at KP243.5, near the village of Yardili in central Azerbaijan (for the full report, including methodology, see Air Quality (Pump Station) Report, Part 12 of the Baseline Reports Appendix). This location is considered to be representative of other rural locations along the proposed pipeline route.

The survey was carried out at eight locations, over approximately five weeks, and measured concentrations ( $\mu$ g/m<sup>3</sup>) of oxides of nitrogen (NO<sub>x</sub>), sulphur dioxide (SO<sub>2</sub>) and hydrocarbons (VOCs) using diffusion tubes.

An indication of levels of particulate matter was obtained by means of adhesive strip dust gauges.

## 8.4.3 Other data sources

Background air quality data for the Sangachal area and the area around the WREP pump stations PS-5 and PS-8 were obtained from an air monitoring survey (AIOC Air Quality Survey 2000, R. Finney) undertaken in 2000 by BP. NO<sub>2</sub> and SO<sub>2</sub> and VOCs were monitored using diffusion tubes. Air quality in the vicinity of Sangachal is considered to be typical of that in similar areas within the country.

## 8.4.4 Background air quality data

Table 8-3 presents a summary of the results of the diffusion tube survey conducted for this baseline assessment at PS-A2, previous data obtained for the Sangachal Terminal and the town of Sangachal (AIOC Air Quality Survey 2000, R. Finney) are also shown.

Substance	PS-A2	Sangachal <sup>(1)</sup>	WREP	WREP
		Iown	PS-5 <sup>(2,3)</sup>	PS-8 <sup>(2,4)</sup>
	concentration (µg/m <sup>3</sup> )			
Oxides of nitrogen (total NOx as NO <sub>2</sub> )	6.5	2.8	6.0	8.7
Nitrogen dioxide	2.6	ND	ND	ND
Sulphur dioxide	3.4	3.56	4.4	4.3
Benzene	2.3	1.3ND	1.7	1.6ND
Toluene	4.7	1.7ND	ND	ND
Ethylbenzene	1.0	1.3ND	ND	ND
Xylene (all isomers)	2.5	1.3ND	ND	ND
Total hydrocarbons	109	54ND	50	43ND

#### Table 8-3 Baseline Air Quality Data

<sup>(1)</sup> Average concentration for a number of locations in the vicinity of Sangachal town and Terminal.

<sup>(2)</sup> Average concentrations for four monitoring locations at each pump station.

<sup>(3)</sup> WREP PS-5 is located at approximately KP 190 on the BTC route, near to the village of Shahliq.

<sup>(4)</sup> WREP PS-8 is located at approximately KP 324 on the BTC route, near to the village of Karadjamirli.

ND – indicates non-determination.

The results from the baseline survey at PS-A2, Sangachal and the WREP pump stations (PS-5 and PS-8) show that the air quality in these areas is good. No pollutant concentrations levels approach the standards and guidelines discussed in section 10 of the ESIA. The results of these surveys are typical of the types of rural and urban areas encountered on the pipeline route.

#### 8.4.5 Dust

The average result for particulate matter deposition at the proposed location of PS-A2 was 0.4% effective area covered per day. The supplier of the dust gauges used at PS-A2 has advised that an effective area covered per day of less than 2% particulate matter will not generally cause nuisance. Although dust levels measured by the sampling survey described above were low, much of the BTC pipeline route will be in areas of clayey, silty or fine sandy soil. Under dry conditions such soil types are prone to generate dust emissions through physical disturbance of the soil surface (eg by wind erosion and vehicle movements on unpaved roads). Dust storms are a frequent occurrence, particularly in the eastern part of the route.

### 8.4.6 Key issues

Key air quality issues in the context of the BTC pipeline are as follows:

- Air quality at the location of the proposed pump station and Sangachal town is good; the baseline data gathered at these locations is considered to be typical of rural and urban locations, respectively, along the BTC route
- Under dry conditions, the soil types present along the pipeline route are prone to generate dust when disturbed; dust storms are a frequent occurrence, particularly in the eastern part of the route

## 8.5 NOISE

## 8.5.1 Introduction

The BTC pipeline is routed almost entirely through quiet desert, semi-desert and rural areas where ambient noise levels, particularly at night, can be expected to be low or very low (typically less than 20dB(A) at night). However, background noise levels can be significantly higher during periods of strong winds, with levels typically in the range of 45-55dB(A).

## 8.5.2 Environmental noise surveys

Background noise surveys have been undertaken in the vicinity of the pump station and Sangachal Terminal. The annoyance produced by noise is dependent upon many complex interrelated factors such as 'loudness', its frequency (or pitch) and any variations in level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors. In accordance with normal practice, the surveyors:

- Took measurements on the 'A' scale over a period of fifteen minutes using the 'fast' time weighting that is exceeded for 90% of the time interval sampled (referred to as ' $L_{A90}$ , 15min'). The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the internationally recognised 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is heard by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level
- Made detailed subjective observations to define the character of the ambient noises
- Filtered out intermittent noises close to the monitoring positions (from wind, rainfall, running water, fauna, unrepresentative traffic [road, rail, air], and from other manmade sources)
- Took measurements at night as well as during the day
- Sampled at noise sensitive points (eg, outside dwellings, etc)

### 8.5.2.1 Pump station PS-A2 (KP244)

A background noise survey was undertaken at the proposed site of pump station PS-A2 in November 2001 (for full report see Noise (Pump Station) Report, Part 13a, Baseline Reports Appendix). This location is typical of rural conditions in the central area of Azerbaijan, comprising a featureless plain with occasional trees and irrigation channels. A medium sized village (Yardili) and a refugee camp are close by and the Karabakh Canal runs to the west. Measurements were taken at eight locations during a four-day survey.

During the daytime period, measured minimum ( $L_{A90}$ , 15min) background levels at the monitoring locations ranged between 29 and 39dB(A). The noise environment was dominated by local activity, agricultural machinery and at positions close to roads, by individual traffic movements.

Measured night-time background noise levels ( $L_{A90}$ , 15min) during the survey period were in the range 22 to 35dB(A) at the monitoring locations. These background noise levels are considered to be typical of a rural/agricultural area during the night.

At one location, noise levels were entirely dominated by a neighbouring electricity sub-station which was in continuous operation day and night. At this location the minimum measured background noise level was 60dB(A).

#### 8.5.2.2 Sangachal Terminal (KP0)

A background noise survey undertaken in 1996 in the Sangachal area, prior to the construction of the existing terminal facilities, revealed generally high noise levels ( $L_{A90}$ , 15min) of up to 55dB(A) (AIOC EOP EIA, 1996). The levels measured are considered typical of a windy coastal location near to road traffic in Azerbaijan, but may not represent the existing noise environment as they pre-date construction of the terminal facilities. Conversely, as the measurements were taken during windy conditions they may be an over estimate of what conditions would be like in calmer weather.

## 8.5.3 Key issues

Key noise issues in the context of the BTC pipeline are as follows:

- The proposed pump station will be located in a generally quiet rural area. Minimum background noise levels ( $L_{A90}$ , 15min) ranged mainly from 29 to 39dB(A) during the day and 22 to 35dB(A) during the night. However, much higher noise levels (60dB(A)) were recorded at one location due to the proximity of an electricity substation that was operating continuously
- Noise levels of up to 55dB(A) (L<sub>A90</sub>, 15min) have been recorded at Sangachal and are considered typical of a windy coastal location near to road traffic

# 8.6 GEOLOGY

### 8.6.1 Introduction

The BTC pipeline route in Azerbaijan is located in a depression (the Kura River Valley) within the southern extension of the Great Caucasus mountain range. The formation of the Caucasus is associated with the Alpine-Himalayan orogenic belt, which originated due to the closure of the Tethyan ocean and the subsequent collision of the Eurasian continental plate with the African and Indian continental plates. The regional structure is dominated by compressional deformation of sedimentary rock, which led to the formation of nappes verging towards the south-east. There was some volcanic activity during this long period of compressional tectonism. Thrust faulting in the Late Miocene period lifted Jurassic and Cretaceous rocks over the Pliocene deposits of the Great Caucasus. Associated fault zones are located along the margins of this zone and have been a focal point for seismic events. Of particular importance are vertical faults orientated in a north-east/south-west direction which led to block faulting of the basement.

## 8.6.2 Stratigraphy

Relatively recent solid geology in the form of Cretaceous, Tertiary and Quaternary sedimentary rocks underlie the BTC pipeline route. These comprise predominantly sandstones, limestones and marls, with relatively minor sections underlain by metamorphic and igneous formations.

During the Quaternary, the Caucasus (especially the Greater Caucasus) experienced valley and mountain glaciation, resulting in moraines and fluvioglacial deposits. Thick alluvial/proluvial plains developed at the foot of the mountains, forming (for example) the inclined Ganja-Kazakh Piedmont Plain (Nalivkin 1960). Over most of the pipeline route a superficial Quaternary cover of varying thickness and character mantles the solid geology. These deposits mainly comprise alluvial materials, although fluvio-glacial deposits and mud flows are also encountered.

Mudflows from mud volcanoes occur only in the Gobustan region in the eastern part of the pipeline route. In places they occur within the pipeline corridor (KP25-29 in particular). They form a layer of basic mud and possibly rock breccias up to 10m thick. In some areas the mud flows are susceptible to rapid rates of erosion. Outcrops of mainly Pliocene rocks (limestone, marl, argillites) are observed in this area of the pipeline route, however none are crossed by the pipeline.

Alluvial deposits predominate along the majority of the route between Kazi-Magomed and the Georgian border (KP52-442) and comprise clay to cobble sized sediments. Clays and finer grained sediments tend to predominate in the eastern sections of the route, tending to gravels and cobbles west of the Kura East River crossing (KP224) to the Georgian border. The extensive flatlands of the Shirvan and Karabakh Plains are still accreting due to the high sediment load of the rivers with catchment areas in the Greater Caucasus. This accretion is also a characteristic of the plain and lowlands of the Lesser Caucasus in the west. These flood plain deposits provide fertile soils and are the basis for intensive agriculture of these regions.

## 8.6.3 Economic geology

Every effort has been made during routing of the pipeline to avoid economic geology reserves. The pipeline is however, routed close to three areas where sand and gravel extraction occurs:

- Downstream (approx. 200m) from the Kura East River crossing (KP224) there is active sand and gravel dredging
- At the Shamkir River crossing gravel extraction is currently taking place at the crossing point and immediately downstream (KP332)
- Upstream (approx. 1km) of the Tovuz River crossing (KP377)

With the exception of the Shamkir River crossing, the scale of aggregate extraction in these areas appears to be limited, probably providing a source of aggregate for the local area. The extent of extraction at Shamkir is greater and is likely to be of regional importance.

Oil and gas exploration and production has taken place along certain sections of the route and some areas are still active concessions. However, although the route passes close to disused (and sometimes leaking) oil exploration or production wells, current production facilities have been avoided. This is discussed further in Section 8.9, Land Contamination.

## 8.6.4 Geohazards

Geohazards are defined as geological phenomena or conditions, either natural or man-made, which are dangerous (or potentially dangerous) to the environment and its inhabitants. Natural hazards include earthquakes and volcanic eruptions. Ground subsidence due to mining is an example of an anthropogenic geohazard. There are a number of potential geohazards along the BTC pipeline route as discussed below. Geohazards related to river crossings

(Hydrological characteristics and channel dynamics) are discussed in Section 8.1, Hydrology, and in more detail in the Geohazards Report Part 7, Baseline Reports Appendix.

#### 8.6.4.1 Seismicity and fault activity

Due to continuing tectonic plate convergence in the Caucasus Region, Azerbaijan experiences high levels of seismic activity (Figure 8-5). The identification of the level of seismicity of the region gives an indication of earthquake activity risk that will have consequences for the design, construction and operation of the BTC pipeline.

Three classes of seismic activity are generally recognised, namely tectonic, volcanic and artificially induced. The tectonic variety is by far the most devastating and is caused by the build up of stress due to movements of the plates that make up the earth's crust. The Caspian is located in a zone stretching from the Mediterranean to the Himalayas that is characterised by tectonic earthquakes. Although active geological structures are encountered at the eastern and western ends of the BTC pipeline route, the extensive Kura Valley region is generally not tectonically active.





Seismicity along the BTC pipeline route

The BTC pipeline route crosses a seismically active area where earthquakes of up to 8 on the Richter scale occur. Data about the severity of earthquakes in Azerbaijan are usually given in Energy Classes (K), whereas Europeans are used to Magnitude (Mw). Both systems are comparable and describe the energy at the source of an earthquake. Intensity figures based on the Richter Scale cannot be directly compared as they relate to surface effects of an earthquake.

The highest densities of earthquakes in Azerbaijan occur north of the BTC pipeline route in the foothills of the Great Caucasus, where strong earthquakes have led to the destruction of complete cities in the past. High densities occur along the BTC pipeline route in a zone from Kazi-Magomed to 25km east of Kurdamir (KP52 to KP107) and for another 15km from

Mingechaur to Goranboy (KP243 to KP258). Zones of medium density cover about one third of the length of the BTC pipeline and more than 200 epicentres can be identified as occurring within a 30km corridor along the route since 1962.

In the Kazi-Magomed region (where the pipeline crosses the Kazi-Magomed and Western Caspian Faults), earthquakes of moderate energy class are registered. Between Yevlakh and the Georgian border there is a fairly even distribution of epicentres, producing a zone of high tectonic and seismic activity.

#### Recent earthquakes in Azerbaijan

Two major earthquakes have occurred in the region within the last three years. The largest earthquake to occur within the BTC pipeline region in recent years took place on 25 November 2000, close to the Caspian. The magnitude of the earthquake was recorded as 6.3Mw, with an epicentre located in the vicinity of Baku. At least 27 people were killed and more than 400 were injured in the Baku area.

An earthquake was recorded on 4 June 1999 in the Eastern Caucasus region, with a magnitude of 5.5Mw. The epicentre was located in the Eastern Caucasus, over 50km to the north of the BTC pipeline area. Fifteen people were injured and approximately 50 houses damaged in the immediate area.

#### Fault identification

In terms of construction and operation of the pipeline and associated facilities, an important factor, which may affect integrity, is movement along zones of active faulting during an earthquake event. Once these areas have been defined, the pipeline and facilities can be located away from such areas, or if necessary, designed to accommodate any anticipated movement.

EQE International, on behalf of BTC Co, carried out a thorough investigation into seismic hazards presented by faults along the route. The main objectives of the work were to identify active faults, characterise them for engineering design purposes and carry out ground motion hazard assessments. Faults and tectonic units along the pipeline route are illustrated in Figure 8-6.

As mentioned, the Kura River Valley, is not prone to active tectonic faulting. At both the western and eastern ends of the route, the active geological fault zones of the Greater and Lesser Caucasus Mountains are encountered. In many fault zones, slope instability hazards coincide with active faulting, which suggests that the faulting is at least in part responsible for the presence of slope instabilities.

Study of aerial photographs, and subsequent field investigation indicated that the BTC pipeline will cross five active faults at the following locations: KP24, KP29, KP50-51(2 faults) and KP410-420.





#### Solid liquefaction

Tremors produced during an earthquake can cause the pore-fluid pressure in a sediment or soil to increase to the point at which the particles can readily move with respect to each other, temporarily transforming the soil or sediment into a fluid mass. This phenomenon is known as liquefaction and may be triggered as a result of seismic activity. Preferential conditions for liquefaction occur in saturated soils when earthquake shaking or other rapid loading reduces the strength or stiffness of a soil. Earthquake shaking can often trigger this increase in water pressure, but this can also be caused in connection with construction related activities such as blasting.

In relation to the BTC pipeline route, this hazard is minimal, as most of the sediments are rich in clay, which is far less prone to liquefaction than well-sorted granular sediments such as sands. Well-sorted sands are present to a greater degree along the pipeline route between the Kura West River crossing (KP409) and the Georgian Border, which may cause this area to be more prone to liquefaction. However, during the field survey and review of aerial photographs no evidence of liquefaction was identified in Azerbaijan.

#### 8.6.4.2 Mud volcanoes

Over 300 mud volcanoes are present in Azerbaijan, the majority of which are found in the Gobustan region (KP0-29). Their distribution is related to anticlines and they are orientated in chains along the axes of these folds and/or along the lines of larger faults, in a north-west to south-east orientation. They are formed at the points at which pressure within the earth's crust

(up to 6km deep) is released, and consist of hills with bubbling craters of cold mud, methane and water (Figure 8-7). Occasionally violent eruptions occur when mud and larger clasts of rock, liquids and gases erupt from the ground surface. Eruptions can be violent and unexpected, and the gases discharged may ignite. Mudflows form as the mud travels downslope away from its source. With time the erupted material will form a conical or plateau-like structure. Since mud volcanoes are geologically short-lived and tend to move along fault lines; the direction of migration of existing mud volcanoes along active ridges is also relevant to pipeline routing.

Figure 8-7	/ Mud	Volcano
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Only three mud volcanoes are considered to be close enough to the BTC pipeline route to have the potential to influence its construction or operation (see Figure 8-8 and Table 8-4). These features are as follows:

- Otman-Bozdag mud volcano, one of the largest in Azerbaijan, lies 4.6km to the northwest of the Sangachal Terminal. The Otman-Bozdag volcano is active, eruptions being registered in 1845, 1904, 1922, 1951, 1965 and 1994. Mudflows would have to reach lengths of 4.9km in order to affect the BTC pipeline. This is considered to be unlikely, even if an event of the maximum predicted magnitude were to occur
- The Turagay mud volcano (located approximately 2.5km to the south of the BTC pipeline route at KP 16) last erupted in 1955 and although not currently active, further eruptions are considered likely
- The structural-front mud volcano complex (Mud Volcano Ridge) is an elevated ridge of mud volcanoes, running north-west to south-east bounded by two active geological faults. It is crossed by the BTC pipeline route between KP24 and KP30. The main concern in this area is where the BTC pipeline crosses broad mud breccia fields where active mud volcanism is occurring. As mud volcanism is fracture-controlled in this region, there is the potential for the opening and/or shear of fresh fractures, which

could damage buried pipelines. Existing mud volcanoes in the Mud Volcano Ridge area have been avoided

Mud Volcano	Distance from pipeline route
Otman-Bozdag	4.9km
Turagay	2.5km
Mud Volcano Ridge	Crossed by route

Table 8-4 Proximity of mud volcanoes to the BTC pipeline route



Figure 8-8 Locations of mud volcanoes along the BTC pipeline route

In summary, mud volcanoes pose a potential risk to structures through ground rupturing and mud flows. Hazards include extrusion, subsidence and displacement along fissures and faults around the vent area. Mudflow tracks can be up to 100m wide and up to 12m thick (although less than 5m is more usual). Buried pipes may be subjected to hazards associated with loading.

#### 8.6.4.3 Terrain geohazards

#### Badlands

Badlands are areas of highly dissected and easily eroded terrain. They are encountered at certain areas along the pipeline route where a combination of highly erodible, silty clay soils and steep slopes has led to severe erosion of the terrain. This is discussed in more detail in Section 8.8, Soils.

The BTC pipeline has been routed to minimise the distance traversed in the badlands.

#### Soil salinity

In many regions, the soil has a high salinity (discussed further in Section 8.8, Soils). Where soils are habitually wet, accelerated corrosion of subsurface structures such as pipelines may occur if adequate corrosion protection is not provided.

#### Sinkholes

Smaller scale terrain issues include the presence of sinkholes, which may result in an uneven bed for the BTC pipeline. These can occur at locations along the pipeline route where slopes are crossed within areas of poorly consolidated fine-grained soils, particularly badland areas (discussed further in Section 8.8, Soils).

#### Landslides and debris flows

Landslides and debris flows are caused by rainstorms, earthquakes, volcanic activity and various human activities and can seriously affect pipeline integrity. Evidence for these can be seen in the form of mass movement along slip planes. Every effort has been made to avoid areas prone to landslide and debris flows when routing the pipeline.

### 8.6.5 Key issues

Key issues in terms of geology and geohazards along the pipeline route are as follows:

- Relatively soft unconsolidated sediments that are likely to be easily excavated underlie the majority of the pipeline route
- Azerbaijan is situated in the seismically active Caucasus region and experiences frequent earthquakes; however, the pipeline route is situated mainly within the less seismically active Kura River plain
- The pipeline route crosses four seismically active fault zones
- The pipeline route crosses a ridge of active mud volcanoes

## 8.7 TOPOGRAPHY AND GEOMORPHOLOGY

### 8.7.1 Introduction

The topography and geomorphology along the pipeline route is characterised by distinct sections as described below (see Figure 8-9, Geographical Regions).

## 8.7.2 Gobustan region (KP0 - KP52)

The Gobustan area consists of plains and low mountains with elevations of up to 400m, for example the Turagay mud volcano. They are part of the tectonic structure of the Apsheron Basin and the Shemaka-Gobustan Trough. Erosion and denudation occur in the hilly areas with the subsequent creation of steep slopes, badlands, gorges, gullies and the local exposure of carbonaceous bedrock (although not along the route of the pipeline). Mud volcanoes are distinct features of this area and are described in detail in Section 8.6.



Figure 8-9 Geographical Regions along the BTC Pipeline

## 8.7.3 Shirvan Plain (KP52 - KP224)

The central part of the pipeline route consists of the vast Shirvan Plain. In this area Quarternary alluvial deposits from the Greater and Lesser Caucasus form huge fans, cones and terraces (Novocaspian formations). The topography is flat and altitudes are low, varying from -12 to +10 metres above mean sea level (mamsl). The sedimentary cover of the basement reaches more than 5,000m in thickness and is of Mesozoic and Cenozoic age. The Shirvan Plain is highly intersected by rivers sourced in the Greater Caucasus and by irrigation canals.

## 8.7.4 Karabakh Plain and Caucasus Plain (KP224 - KP442)

The western section of the pipeline route consists of the Karabakh Plain and the Caucasus Plain, which includes the foothills of the Lesser Caucasus. Altitudes on this section of the route range from 80m to 330m. The cover of Palaeogene to Miocene sediments reaches a maximum thickness of 2,000m to 3,000m. This section is characterised by Quarternary alluvial and proluvial deposits which are derived mainly from the Small Caucasus. North of the Kura River, the plain is fed by alluvium from the Greater Caucasus, the watershed being situated near Poylu at an altitude of 197m. Major braided rivers, derived from the Lesser Caucasus mountains, are crossed by the pipeline in this section.

### 8.7.5 Key issues

Key topographical and geomorphological features along the pipeline route are as follows:

- The majority of the route runs through the Kura Valley on the Shirvan and Karabakh Plains
- Topography is slightly more elevated and undulating in the east in the Gobustan region

# 8.8 SOILS

### 8.8.1 Introduction

The various soils found along the BTC pipeline route are described below, beginning at the eastern end of the route, near the Sangachal terminal.

# 8.8.2 Eastern section (KP0 to KP52)

The soils in this region generally comprise yellow brown silty and stony clays and loams with consistencies varying from soft and loose to slightly hard. The soil structure is generally fine to medium. The soil surface often has a platy structure 3mm to 5mm thick that serves as a partial barrier to infiltration and contributes to high soil aridity. The topsoil in the Gobustan desert region, in particular, is very thin and has an elevated salinity, supporting sparse, saline tolerant vegetation (Figure 8-10).
Figure 8-10 Gobustan Desert Region



# 8.8.3 Central section, including the Shirvan Plain (KP52 to KP224)

Soils found on the plains of the central area of the route are depositional soils that are generally pale coloured (light yellowish brown) loams with a composition including significant quantities of silt, clay or sand. To the west of Kurdamir (KP128), the soil characteristics undergo a marked change. Unless currently irrigated, the surface tends to be highly cracked, with high concentrations of salt deposits seen on the surface (Figure 8-11). Poor irrigation practice in the past has been the principal contributor to soil saliniation in this region.



Figure 8-11 Soil Salination in the Kurdamir Agricultural Region

## 8.8.4 Western section (KP224 to KP442)

Between the two crossings of the Kura River (KP224 - KP411) alluvial deposits are present, with soils typified by grey-brown silty, sandy and clayey loams. These soils often have a high gravel and cobble content. The vegetation encountered is mixed, varying from natural, uncultivated regions (which are generally grazed hills and slopes), to semi-natural and agricultural lands (generally flat areas and valley floors).

Erosion and deposition play major roles in soil formation in certain hillslope regions, so that in some regions gravel from upland areas covers soils lower on the slopes. The soils developed in this manner have little resistance to erosion, and when severely eroded lead to the landscapes classified as badlands (see Section 8.8.7). These are found particularly in a 20km section to the east of Ganja and on the approaches to the Hasansu River crossing.

At the western end of the route, from the Kura West River crossing (KP411) to the Georgian border (KP442), the soil is generally a light brown sandy or clayey loam. In the more easterly part of this section, the soils often comprise wet and waterlogged sands making up the Karayazi Wetland and aquifer (see Sections 8.10 and 8.12).

# 8.8.5 Occurrence of gypsum-rich soils

Gypsum (hydrated calcium sulphate) is often found both on and just below the soil surface. The resulting saline conditions (in both soil and groundwater) are highly aggressive towards steel and concrete in subsurface structures such as pipelines. Gypsum within soil can also lead to problems, since the dissolution of gypsum can result in ground collapse beneath foundations and pipes.

# 8.8.6 Soil stability and susceptibility to erosion

There are certain areas (termed 'badlands') along the route where the soils are unstable and highly susceptible to erosion and dissection. Water and wind erosion of soils in these areas has led to the creation of gully and ravine complexes in areas where even moderate relief is encountered (Figure 8-12). Movement of topsoil and subsoil during levelling and grading of the ROW and the excavation of subsoil during trenching will break up the soil structure. In such badland areas, this may lead to an increased likelihood of erosion of the topsoil and subsoil piles and from the ROW. This is likely to be a particular problem in the following areas:

- Parts of the Gobustan desert with significant slope, particularly the Mud Volcano Ridge (KP26-29)
- Badland areas (approximately 20km long) to the west of Ganja
- Approaches to the Hasansu river crossing (KP395.9-398)

These areas already have severe erosion and stability problems, which could be exacerbated by construction of the pipeline if not managed correctly.

#### Figure 8-12 Erodible soils on the Mud Volcano Ridge



# 8.8.7 Potential for dust/silt generation

The majority of soils underlying the route are prone to dust generation during dry conditions; even light traffic may generate considerable quantities of dust. Silt generation is likely along the majority of the route since desiccation of the soil tends to increase the likelihood of silt and fine sand being incorporated into surface water flow.

## 8.8.8 Key issues

Key factors that may affect construction and operation of the pipeline are:

- Many of the soils encountered along the BTC pipeline route exhibit high levels of salinity, which can contribute to accelerated corrosion of both steel and concrete
- The soils with high clay and silt content are particularly prone to erosion and compaction

# 8.9 LAND CONTAMINATION

## 8.9.1 Introduction

This Section summarises the and contamination issues that may affect the project and describes those areas of known contamination that may be traversed by the pipeline. It should be noted that this section is based on information available at the time of writing this ESIA, but it is very likely that additional contamination will be identified during the land clearance and trench excavation phases of construction.

Land contamination can affect surface and ground waters if a suitable pathway exists from land to water. The main focus of this Section, however, is land contamination since existing surface and ground water quality are discussed in Section 8.10, Hydrology and Section 8.11, Hydrogeology.

## 8.9.2 Potential contaminants

On the basis of work done to date and experience gained during construction of the WREP, the most likely potential contaminants that may be encountered on the pipeline route have been identified and are summarised in Table 8-5. Other contaminants that are less likely to be encountered are summarised in Table 8-6.

Contaminant	Typical Sources	Characteristics
Petroleum hydrocarbons	Fuel storage, exploration/production activities, pipelines, railways, waste disposal (including fly tipping)	Most toxic constituents are typically also the most mobile. Majority of the compounds will biodegrade. Direct toxicity risks associated with inhalation of volatile components. Health risks associated with ingestion and dermal contact. Some constituents (such as benzene) are suspected human carcinogens.
Heavy metals (particularly chromium, mercury and lead)	Industrial activities and waste disposal (including fly tipping)	Often persistent in soil. Some salts have relatively high solubility. Typically less mobile in alkaline conditions. May be toxic to humans, animals and plants. Principle exposure through inhalation and ingestion.
Asbestos	Industrial activities (gaskets, lagging, filters, break pads), waste disposal (including fly tipping)	Usually white, grey/blue or brown fibrous material. Carcinogenic and respiratory risks to humans through inhalation. Mobility (and therefore exposure risks) limited by surface coatings and damp conditions.
Polycyclic aromatic hydrocarbons (PAHs)	Oil production, incinerators and fires, timber preservatives, tars	Often persistent in soils. Generally exhibit low solubility and are at best semi-volatile. Potential human carcinogens (especially benzo[b]fluoranthene and

 Table 8-5 Contaminants most likely to be present along pipeline route

Contaminant	Typical Sources	Characteristics
		Benzo[a]pyrene). Most common exposure routes are through ingestion and inhalation. Dermal contact may also pose risks.

Table 8-6 Other potential contaminants that m	nay be present along pipeline route
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Contaminant	Typical Sources	Characteristics
Radioactive materials	Military activities, oil exploration and production (radionuclides may be released by operations such as drilling wells, oil collection, produced water disposal and oil storage)	May be encountered in a wide variety of forms and materials. Potentially carcinogenic and mutagenic.
Chlorinated solvents (TCE, PCE, TCA etc)	Industrial activities (degreasants, chemical plants)	Typically colourless volatile liquids with a density greater than water. Mobile in the environment, but with relatively low solubility in water. Potential mutagens and in some cases directly toxic. Exposure via inhalation, ingestion or dermal contact.
Pesticides & herbicides	Agricultural activities	Various. Typically persistent in soil. Potentially carcinogenic and mutagenic.
Polychlorinated biphenyls (PCBs)	Electrical switchgear, waste disposal	Often persistent in soil. Suspected carcinogens in humans. Principal risks associated with inhalation or ingestion and, to a lesser extent, dermal contact.
Dioxins	Incinerators, waste disposal	Usually encountered in ash from fires or incinerators that included chlorinated materials in the fuelstock. Potentially carcinogenic at very low concentrations. Persistent in soil. Typical exposure via ingestion or inhalation.
Biological hazards	Sewage, animal carcasses, tanneries, occasionally soil	Various. Possible pathogens in soil include anthrax, foot and mouth and tetanus.

# 8.9.3 Potential sources of contamination

#### 8.9.3.1 Settlements & industry

In the majority of settlements, central sewage collection and treatment facilities are absent. The situation is aggravated during periods of high precipitation, when contamination of surface and groundwater bodies by sewage, domestic and industrial wastes regularly occurs. This is a particular problem in the area between Kazi-Magomed and Yevlakh.

Secondary contamination related to industrial activities carried out along the pipeline corridor in Azerbaijan is likely to be limited to the larger towns. Outside of these areas, the route principally passes through agricultural areas where the potential for substantial contamination as a result of industrial (farming) related activities is small. In the Shirvan Steppe section of the pipeline, Kazi Magomed and Ucar are small industrial towns where printing, brick making and cotton processing takes place. There are also oil storage bases here. The principal contaminants that may be associated with such activities are hydrocarbons, solvents, dyes and agricultural chemicals. The pipeline corridor is located 1km to the north of Kazi Magomed and 5km south of Ucar.

The Karabakh Plain area traversed by the pipeline route has the potential for contamination mainly due to the industrialisation at Yevlakh. The industry at Yevlakh includes concrete and ferro-concrete production, asphalt production, wool processing and oil storage facilities. The pipeline corridor is located 1km south-west of Yevlakh.

The town of Ganja has a high level of industrial activity including concrete production, aluminium oxide production, machinery manufacturing, non-ferrous metal production, instrument engineering, wood processing, furniture manufacture and oil storage facilities. The aluminium oxide and non-ferrous metal production work is likely to have generated a mixture of heavy metals and fluorides in any shallow groundwater. Instrument manufacture may have involved contaminative materials such as radionuclides (fluorescent paints) and mercury. The other industries would be expected to generate a range of organic compounds (including chlorinated solvents). The pipeline corridor is located approximately 8km north of the outskirts of Ganja.

The towns of Tovuz, Kazakh and Akstafa also have oil bases and light industry such as wine distilleries and bread baking. These industries could potentially cause soil and groundwater contamination by a variety of materials including metals, hydrocarbons and agricultural chemicals.

Given the distances between the settlements/industrial areas and the pipeline route, it is unlikely that the route will have been directly impacted by the industries based in the towns. The most significant risks are therefore likely to be associated with inappropriate disposal of waste materials from the urban areas on the route.

The pipeline traverses the Borsunlu, Dalimammedli, Giragkasaman, Dallar-Tovuz, Khatunli and Akstafa oilfields, some of which are in operation. Only local contamination around the drill sites is apparent within these fields, however the potential exists for the presence of soil and groundwater contamination throughout the area.

## 8.9.3.2 Agricultural activities

The soils of the Gobustan region east of Kazi Magomed are too dry and saline to be used for extensive agricultural purposes. The majority of the remainder of the route passes through areas that are used, to a greater or lesser extent, for agricultural purposes. All such areas have the potential for soil contamination by agricultural chemicals such as pesticides and herbicides. In particular, soils throughout the Karabakh Plain area are reportedly contaminated with pesticides and herbicides.

## 8.9.3.3 Military areas/ordnance

All former and current military installations on the pipeline route have the potential for significant soil and groundwater contamination issues. In most cases these issues will principally relate to localised hydrocarbon contamination due to poor storage practices, however, a significant minority of sites may be contaminated by hazardous wastes and/or ordnance. Potential contaminants include radionucleides, organic compounds and explosives.

In the Gobustan region, the pipeline crosses a military area between KP5 and KP13. This area was apparently used for military training purposes and is reputed to contain anti-personnel mines. Other forms of live ordnance may also be present.

In the Karabakh Plain area the pipeline route crosses the Amirax oil prospecting area that was reportedly damaged by bombing during the conflict with Armenia. As a result the area may exhibit local crude oil contamination and the presence of live ordnance is a possibility.

In the Lesser Caucasus Plain and Lowland area, there is a military training area north of the Kura West river crossing at Poylu, extending westwards to Jandari Lake and the Georgian Border. The presence of ordnance (and possibly radioactive materials) in this area may be significant. However, given the location of the route it is unlikely to directly affect construction of the pipeline.

## 8.9.3.4 Existing pipelines and infrastructure

Given the poor construction practices and maintenance procedures historically employed in the Soviet Union, it is likely that many of the transmission pipelines crossed along the route will be in a poor state of repair. Two principal issues arise from this situation, as follows:

- The potential exists for losses from older pipelines to result in contamination of the soil and groundwater to an extent which results in impacts on construction of a new pipeline
- Catastrophic failure of existing pipelines may compromise the functioning of either the new pipeline or its associated infrastructure. This is particularly the case with respect to failures of natural gas lines which may lead to combustion of the gas at the ground surface. We understand that such incidents have been reported in both Georgia and Azerbaijan in recent years

It should also be noted that leaking oil pipelines are known to have caused contamination of the WREP corridor in two places in the Gobustan area.

Railway lines and sidings are frequently associated with localised soil and groundwater contamination. Typical contaminants include:

- Hydrocarbons (from fuel and lubricant spillages)
- PCBs (from electrical switchgear and transformers)
- PAHs, phenolic compounds, copper, chrome and arsenic (from wood preservatives)
- Asbestos (from brake linings, gaskets and fire prevention materials)
- Herbicides (from line clearance activities)

The potential exists for any or all of these contaminants to be present at railway crossings and pipe yards adopted for the project.

# 8.9.4 Natural contamination

## 8.9.4.1 Hydrocarbons

In the Gobustan area between KP0 and KP29, natural seepages of crude oil occur in small quantities from mud volcanoes and faults. As a result, elevated concentrations of hydrocarbons, metals and phenols from natural sources (mudflow and seepage) may be present in the vicinity of the pipeline.

#### 8.9.4.2 Radioactivity

Mamedov (1996) indicated that the Gobustan region has a general background radiation level of between 4 and  $15\mu$ rhr<sup>-1</sup>. However, in areas of intense tectonic and mud volcano activity, the background levels become elevated to  $20-22\mu$ rhr<sup>-1</sup>. These levels are considered to be within 'normal' background radiation levels of  $<33\mu$ rhr<sup>-1</sup> (2.5mZvyr<sup>-1</sup>) according to the established standard (NRPB 76/87).

The background radiation level in the Shirvan Steppe area is lower than in Gobustan, at between  $58\mu$ rhr<sup>-1</sup>, due to the less active tectonic regime. There is still the potential for elevated levels of radiation to be released during hydrocarbon operations.

In the Karabakh plain area the background radiation level is low and stable at 5.5-6µryr<sup>-1</sup> due to the less active tectonic regime. Hydrocarbon operations could also have released elevated levels of hydrocarbons, phenols, heavy metals and radionuclides.

The background radiation level in the Lesser Caucasus plain and lowlands area is believed to be relatively low and stable (around  $6\mu ryr^{-1}$ ), although the area has not been as intensively surveyed as the eastern areas traversed by the pipeline corridor.

#### 8.9.4.3 Biological hazards

Anthrax is known to be present along the route. The disease occurs most commonly in wild and domestic vertebrates (sheep, cattle, goats, camels and other herbivores). Transmission occurs by inhalation, ingestion or through the skin. Spores can survive in the soil for many years, and can result in infection of humans who are involved in handling products from infected animals or contaminated soil.

Anthrax occurrences in humans in Azerbaijan between 1992 and 1996 are indicated in Table 8-7.

Year	Number of cases of human Anthrax
1992	33
1993	55
1994	50
1995	45
1996	76

Table 8-7 Anthrax cases in Azerbaijan

## 8.9.5 Field observations of soil contamination

Table 8-8 outlines the findings of field work carried out during 2000 and 2001. This work identified twenty three sites of observed soil contamination close to the proposed route of the BTC pipeline (see Figure 8-13).

In the majority of instances, the observed contamination was the result of uncontrolled disposal of wastes (fly tipping). Due to the uncertainty of their sources, and therefore their composition, fly tipped materials have the potential to present particular challenges to the project. In some cases it may be necessary to undertake a programme of sampling and laboratory analysis to determine the constituents of the material in order to quantify the risks that it may pose to the project.

Nearest KP	Contamination Source	Potential Contaminants	Apparent Depth	Proximity to Pipeline centreline (m)
0	Oil industry	Hydrocarbons	Surface	600
51	Fly tipping/asbestos tiles	Mixed wastes	Surface	Within 20
52	Fly tipping	Mixed wastes	Surface	120
55	Oil industry - old oil exploration site with degraded oil, separation ponds and cuttings	Hydrocarbons	Unknown	70
64	Other Industrial (proposed camp/pipe dump site). White fibrous deposit in patches	Unknown, possible asbestos	Surface	500
77	Oil industry - old well site	Hydrocarbons	Unknown	Within 20
92	Oil industry – probable former oil exploration site with iron rich water in ponds	Heavy metal/iron	Unknown	40
223	Vehicle oil 4m from East bank of Kura in waterlogged ground	Hydrocarbons	Unknown	Within 20
224	Fly tipping/asbestos tiles	Asbestos tiles	Surface	400
227	Municipal	Household waste	Surface	40
231	Oil industry	Hydrocarbons	Unknown	300
254	Fly tipping - possible asbestos tiles plus household waste, paint cans, oil cans	Asbestos	Surface	50
271	Oil industry - disused oil well. Actively leaking oil and water into 3 lagoons around wellhead	Hydrocarbons	Unknown	40
276	Oil industry pumping station	Possible hydrocarbons	Surface	80
304	Fly tipping/asbestos tiles. Close to river, stream and earth dam	Asbestos tiles	Surface	Within 20
308	Industrial activities and fly tipping - possible smelting site- building rubble	Metals, hydrocarbons, mixed wastes	Unknown	Within 20
338	Fly tipping - possible asbestos tiles	Asbestos	Surface	20
343	Fly tipping - possible asbestos tiles	Asbestos	Surface	Within 20
354	Fly tipping	Asbestos tiles	Surface	60
364	Fly tipping including possible asbestos tiles, rubble, car remains, wire, cans	Asbestos, mixed wastes, solvents, metals	Surface	40
377	Fly tipping - possible asbestos tiles	Asbestos	Surface	60

#### Table 8-8 Observed contamination along the BTC pipeline route

Nearest KP	Contamination Source	Potential Contaminants	Apparent Depth	Proximity to Pipeline centreline (m)
395	Building rubble and fly tipping with possible asbestos tiles.	Asbestos	Surface	30
422	Fly tipping - barbed wire, metal, glass (chemical) bottles, tiles (possibly asbestos) on East bank of Kurudera River	Asbestos, mixed wastes, solvents, hydrocarbons, metals	Unknown	Within 20

The presence of hydrocarbon contamination at various points along the pipeline route may also pose health and safety and waste disposal issues, particularly during the construction phase of the project. In some cases it may be appropriate to undertake a programme of soil and groundwater sampling in areas of observed contamination in advance of the commencement of the construction phase of the project.

## 8.9.6 Field sampling programme at pipe yards and camps

A survey of the potential pipe dumps and camp locations was undertaken in September 2001. One camp and eleven pipe dump locations were surveyed. Samples of surface soil material were collected for laboratory analysis. These results were compared to internationally recognised standards. In general terms the levels of contamination identified were low. Levels of nickel, arsenic, mercury and crysotile (white asbestos) were found to be locally slightly elevated over the UK Government Interdepartmental Committee for the Redevelopment of Contaminated Land (ICRCL) guidelines.

# 8.9.7 Key issues

The principal key issues with respect to the BTC project and land contamination are as follows:

- Risks to worker health and safety, particularly during construction
- The difficulties associated with the safe management, remediation and disposal of contaminated soil or groundwater
- Confusion as to the source of contamination along the pipeline route (eg, the potential for the BTC project to be wrongly assumed to be responsible for contamination that in fact pre-dates the project)
- Contamination of land due to project construction and operational activities



Figure 8-13 Contaminated Areas along the BTC Pipeline Route

# 8.10 HYDROLOGY AND WATER QUALITY

## 8.10.1 Introduction

A study of the hydrology of the area traversed by the BTC pipeline was undertaken for the purposes of this ESIA. The study identified and characterised the main rivers, lakes, reservoirs and canals along the BTC pipeline route and assessed their generic hydrological characteristics and the existing sources of pollution.

# 8.10.2 Outline of the key hydrological features

Water resources are scarce and valuable along the majority of the BTC pipeline route. The main uses are for potable supplies, power generation, industrial operations, irrigation systems, domestic activities and cattle watering (Aliev, 1995), especially towards the western end of the route. The following rivers, crossed by the route, provide large quantities of water for drinking:

- Kura
- Aksu
- Geokchay
- Ganjachay
- Zayamchay
- Shamkirchay
- Tovuschay

The largest and most regionally significant hydrological features crossed or approached by the BTC pipeline, in Azerbaijan are as follows:

- The main stem of the Kura River system, which runs close by the route in the west, and is crossed by the BTC pipeline twice (KP222 and KP411)
- Large Kura tributary rivers draining the Great Caucasus and Lesser Caucasus Mountains
- Mingechaur Reservoir and dam
- Shamkir Reservoir and reserve
- Karayazi Wetland near the Georgian border
- Canal and pipe networks supplying drinking or irrigation water
- The dry Gobustan area in the east, with flash flooding in wadis and rivers
- Jandari Lake (which straddles the Azerbaijan-Georgian border)

The locations and courses of the rivers and other hydrological features along the pipeline route in Azerbaijan are illustrated in Figure 8.14.

Clear hydrological differences exist along the route from east to west. In the west:

- River flow seasonality is slightly more pronounced
- The seasonal river flow peak tends to arrive earlier (May rather than June)
- Suspended sediment concentrations, turbidity, pH and TDS values are lower

On the basis of these parameters, four distinct hydrological regions along the BTC pipeline route are identifiable:

- At its easterly end between Sangachal and Pirsagat, the route passes through very dry territory and over a number of semi-arid channel systems, including two main rivers (the Djeyrankechmes and Pirsagat) and many ephemeral ravines, gullies and wadis which may experience flash floods
- Further inland the line crosses the less arid Kura River lowland and four left-bank tributaries of the Kura River sourced in the Great Caucasus, before it crosses the Kura River for the first time (Kura East river crossing)
- To the west of the Kura East river crossing, the route crosses seven sizeable, highenergy, right-bank, Lesser Caucasus tributaries
- Finally, the route re-crosses the Kura River (Kura West river crossing) at Polyu and passes close to the important Karayazi Wetland

# 8.10.3 Main watercourses crossed by the pipeline route

A major part of the hydrological assessment for the baseline survey was to identify the main watercourses and water features in the vicinity of the BTC pipeline and their specific characteristics that may interact with the BTC project.

The BTC pipeline route crosses 20 significant watercourses from the Sangachal Terminal (KP0) near the Caspian to the Azeri/Georgian border (KP442), (Table 8-9, Figure 8-14 and Volume 2, Environmental Route Maps). The route also crosses numerous streams, wadis, canals, drainage ditches and irrigation systems in various states of repair. Table 8-9 outlines the key characteristics of each watercourse crossed (including the ecological value).

Information has been taken from a River Corridor Survey, undertaken in November 2001, for each main river crossed by the pipeline (the full survey is reproduced as Part 5 of the Baseline Reports Appendix.).

Downstream sensitivities such as reserves and water resources from each of the main watercourse crossings are discussed in Section 10.4, Unplanned events.





#### Table 8-9 River systems crossed by the BTC pipeline

River	KP	Main Features	
Djerankechmes	9.3	20m wide wadi which is often dry. Poor bank stability. Liable to	
River		flash flooding during periods of heavy rain. High sediment load	
		during periods of flow.	
Pisgarat River	42.1	Narrow canalised river with slow flow. High sediment load.	
Girdmanchay	111.2	Wide canalised river – approx. 20m. Flowing water with high	
River/ Agsu		sediment load. Flow would take any contaminant downstream	
Canal	474.0	rapidly.	
Geokchay River	171.3	Narrow canalised river in deep cutting. Vegetation indicates wide	
		any contaminant downstream rapidly	
Turianchay	193.5	Narrow canalised river in deep cutting. Vegetation indicates wide	
River	100.0	fluctuations in water level. High sediment load. Flow would take	
		any contaminant downstream rapidly.	
Kura River (east	223.6	Wide (200m approx) fast flowing major river with extensive fishing	
crossing)		and wildlife value. Sand and gravel extraction 200m downstream.	
-		Any contaminant would be transported rapidly downstream.	
Karabach Canal	245.1	Fast flowing, concrete lined major irrigation canal, approx 20m	
		wide Any contaminant would be carried rapidly downstream.	
Goranchay	257.8	Small and often dry.	
River Kurokobay Piyor	276.5	Wide braided gravel and cabble dominated channel with seasonal	
Rulekchay River	270.5	flow River well used by villagers for washing etc. Livestock use	
Korchay River	202	Wide dammed valley (both upstream and downstream) with	
Roronay River	232	braided narrow (2m) flowing channel within extensive area of	
		marshy reed. Ecologically diverse. Spread of any contaminant	
		would be partially impeded by the reeds but could have significant	
		local effects. Livestock use.	
Ganjachay River	296	Deeply incised channel of variable width (approx. 15m) but	
		negligible flow. Dammed approx. 300m downstream from pipeline	
		crossing. Dam would probably retain contaminant provided that	
	040.4	abstraction could be stopped.	
Sarysu River	316.1	Small stream with good species diversity.	
River	316.7	Livestock use.	
Karasu River	320.9	Narrow watercourse within a wide channel, mainly vegetated by	
		reeds Valuable bird habitat but relatively low risk of a contaminant	
		spreading because of the reeds.	
Shamkirchay	332	Wide (approx. 150m) braided channel composed largely of gravel	
River		and cobbles. Dry for most of the year, but liable to flash flooding.	
		Extensive gravel extraction from dry river bed.	
Zayamchay	357	Wide (approx. 150m) braided channel composed largely of gravel	
River		and cobbles. Seasonal flow. Archaeology (ancient bridge	
Toyuzahov	277.4	Supports) within dry area of channel.	
Pivor	3/7.1	Soasonal flow, which may introduce the risk of any contaminant	
River		travelling downstream	
Hasansu River	397.8	East flowing clear 'mountain' stream within deenly incised steen	
	007.0	vegetated valley. Ecological diverse and valuable habitat.	
		Sediment or contaminant release would have adverse impacts and	
		could be carried considerable distance downstream.	
Kura River (west	411	Major river - fast flowing and wide (approx. 300m) braided channel	
crossing)		composed largely of gravel and cobbles. Extensive fishing. Any	
		contaminant would be carried rapidly downstream to the Shamkir	
		and Mingechaur Reservoirs.	

## 8.10.4 The Kura River system

The Kura is the largest river system of the Caucasian region, crossing Turkey, Georgia and Azerbaijan. Its tributaries are sourced by high altitude precipitation, at elevations of between 1,900m and 3,600m, from the Great Caucasus (1,000mm per year precipitation to left bank tributaries) and Small Caucasus (800mm per year to right bank tributaries). The great majority of the water courses crossed by the pipeline route are elements of the Kura River system (ie, the Kura River itself or a tributary of it).

The Kura River is the most important water resource in Azerbaijan, both for human use and habitat provision, and includes sturgeon fisheries (Dames & Moore, 2000b). The Kura River flows into Azerbaijan upstream of Polyu, and then enters the Shamkir and Mingechaur Reservoirs; the outflow river crosses the Kura lowlands and discharges into the Caspian. The Kura River has a strongly seasonal snowmelt-driven regime, with the main flow period concentrated between March and June and an April peak. Mingechaur and Shamkir Reservoirs have a substantial regulatory effect on the flow of the Kura River and also serve to remove substantial volumes of sediment from the river flow.

The Kura River itself is crossed twice by the BTC pipeline route: first at Yevlakh (KP223.5), upstream of important sturgeon breeding areas and secondly at Polyu (KP411), upstream of the important Shamkir and Mingechaur Reservoirs.

The river at the proposed Kura River East crossing has experienced bank erosion problems linked to its erodible sediments, with bank stabilisation works evident (Dames & Moore, 2000). Though flow is regulated by the Mingechaur reservoir, Lawler (1997) identified the persistence of significant seasonal discharge fluctuations. The crossing point of the Kura River at KP223.5 is illustrated in Figure 8-15.

The Kura River West crossing is upstream of the key Mingechaur and Shamkir Reservoirs. These reservoirs are of vital significance to the water supply and habitats of Azerbaijan. River discharges can be very high and highly variable seasonally. The river is very active erosionally. Gravel mining activities are compounding scour and bank erosion effects (Dames & Moore, 2000). The site is also complicated by a number of existing road, rail and pipeline crossings.

# 8.10.5 Main Kura tributaries crossed by the BTC pipeline route

Many of the tributaries of the Kura River are high-energy, laterally-active, erosive mountain rivers. The rivers in the east flow south-west from the Great Caucasus; and where they are crossed by the pipeline, are dominated by finer grained silts and clays. The Turianchay river is the most powerful of these. In the west, the rivers flow north-east from the Lesser Caucasus mountains and, being closer to their source where they are crossed by the pipeline, are generally dominated by braided gravel and cobble rich channels. The Shamkirchay, Zayamchay and Tovuzchay are typical of such rivers. Most Greater and Lesser Caucasus rivers have floods generated by snowmelt in spring/early summer and by rainstorms in the autumn. Rainstorm-generated floods can last up to 15 days.

The Kura River tributaries in the wetter Great Caucasus have higher average, maximum and minimum discharges at the gauging stations than the Lesser Caucasus rivers. Many of the Lesser Caucasus tributaries have highly seasonal flow, and due to uses for irrigation upstream, often exhibit low or no flow for much of the year.

Figure 8-15 Kura East River Crossing



# 8.10.6 Other key rivers and waterbodies

## 8.10.6.1 Djerankechmes

The Djeyrankechmes is a 20m wide wadi, which is often dry, incised into the Gobustan desert, flowing through the Gobustan Cultural Reserve for approximately 1km south of the pipeline crossing point. It drains into the Caspian approximately 8km downstream at Sangachal and is crossed by the pipeline at KP8.9. It exhibits poor bank stability and is liable to flash flooding during periods of heavy rain. During periods of flow, it has a high sediment load.

## 8.10.6.2 Canals

Numerous canals are crossed by the pipeline, particularly between Kurdamir and Yevlakh, where they are used extensively for irrigation purposes. Many of the canals are in disrepair. The main canal crossed by the pipeline is the Karabakh Canal (KP245). The Karabakh Canal, which recharges from the Kura River at the Mingechaur Reservoir (Figure 816), carries significant amounts of water for many important uses including irrigation and industrial supply.

Figure 8-16 Karabakh canal



## 8.10.7 Water quality

Water quality data are important in a pipeline ESIA (Lawler *et al.*, 1996) because: mobile sediment can abrade pipelines; high sediment transport rates can indicate problems of channel or hillslope instability; river water of a particular quality may be required for hydrotesting or test-water disposal; water quality data provide baseline information against which to assess impact of effluent disposal from pipeline construction, testing or operation; and water quality is important for habitat quality for freshwater biota (eg, Aliev, 1990; Berdichevskaya *et al.*, 1991; Kownacki, 1985).

River temperatures vary seasonally from around 2°C to 7°C in winter (January/February) to 17°C to 25°C in summer (mainly August). Average suspended sediment concentrations (SSC) and loads (SSL) are high by world standards, and are comparable to those of other glacial/snowmelt rivers (eg, Iceland: Lawler and Wright, 1999). Mean annual SSC values for the Great Caucasus rivers are ten times those of the Lesser Caucasus systems, the highest being for Girdemanchay River (5,220mg I<sup>1</sup>), which flows into the Aksu Canal, and Geokchay River (4,810mg I<sup>1</sup>). Suspended sediment transport is highly seasonal, with peak fluxes in the high-flow period between March and June. The Great Caucasus rivers also deliver the higher suspended sediment loads: Geokchay River is the highest, with a peak monthly SSL of  $184kgs^{-1}$  in May. Mingechaur Reservoir, built in 1953, has rapidly silted up (capacity in 1953 =  $16km^3$ ;  $1982 = 14.5km^3$ ). It removes approximately 70% of the sediment discharge from the Kura River (Selivanov, 1996).

High sediment transport rates relate to high soil erosion rates driven by steep slopes, intense rainstorms, seasonally concentrated snowmelt-generated river flows, flash floods, limited vegetation cover and fine, erodible soils. Sediment supplies appear to be generated by mountain landslides, gullying, bank erosion, deformation of upstream channels, and occasional mudflows and sheetwash events. Erodible soil is a key issue. For Great Caucasus soils, average scouring velocities required for a flow 2cm deep are only 0.20 -  $0.24ms^{-1}$  (Kuznetsov *et al.*, 1998).

Total dissolved solids concentration (TDS) values tend to be higher for the Great Caucasus rivers (mean TDS values: 274 - 1,812mg l<sup>1</sup>). This may reflect slower runoff in the lowland reaches, greater solute acquisition opportunities, and contributions from solute-rich

agricultural runoff. There is also a switch in river chemistry from hydrocarbonate and carbonate chemistry in the west to sulpate-dominated chemistry in the east. Water quality snapshot reconnaissance surveys of November/December 1996 by Lawler (1997) and in August 2000 by ERM, confirmed the east-west patterns of SSC and TDS identified in the average data above. They also revealed that river waters were alkaline (pH values 7.82 - 7.20). The easterly Great Caucasus rivers tend to have a lower water quality, ie, higher TDS, turbidity and pH values.

Very limited data are available with respect to baseline pollutant levels in the Azerbaijan water bodies crossed or approached by the BTC pipeline. However, many water bodies in neighbouring Caucasus and FSU republics suffer from significant problems with highly persistent pesticides (eg, DDT), nutrients and eutrophication, heavy metals, hydrocarbon contamination, and toxic defoliants used in the production of cotton. It is likely therefore that at least some water resources in Azerbaijan will be affected by measurable concentrations of these pollutants. Aliev considers the waters of the Kura River downstream of Mingechaur Reservoir to be polluted by heavy metals beyond the normal standards, and only usable for irrigation and industrial activities.

# 8.10.8 Hydrological characteristics and channel dynamics

## 8.10.8.1 River flow seasonality

All rivers crossed by the BTC pipeline have highly seasonal flow regimes, driven by annual snowmelt processes. Peak discharges occur between April and June on average, with low flows between September and February.

## 8.10.8.2 Hydrological extremes

Substantial flows have been recorded at some time for most rivers, especially the Great Caucasus rivers. The Geokchay River and Aksu Canal have the most constant flows. The Pirsagat and Djeyrankechmes Rivers in the east can dry up in the summer. Around 15-25% of total annual flow takes place in May alone. For half of the rivers more than 50% of the total annual discharge occurs between April and June.

## 8.10.8.3 River channel instability

Braided channels such as those commonly found on the rivers in Azerbaijan normally exhibit large width-depth ratios, steep channel slopes, high energy conditions, high bedload transport rates, a flashy discharge regime and active lateral instability.

Many of the fluvial systems crossed by the route are active, dynamic and meandering or braided, especially in the west, where the BTC pipeline approaches the foothills of the Lesser Caucasus. Many of the Kura tributaries are high-energy, mountain rivers, many occupying laterally mobile floodplain zones or incised into narrow gorges.

Mudflows have been identified as significant events affecting seven rivers crossed by the BTC pipeline. Of the 41 documented events, 34 occurred in the four main Great Caucasus river basins (Turianchay, Geokchay, and Agsu), where damage was also greatest. All mudflows took place between April and October (peak frequency in May, June and July. However the pipeline crosses these rivers a considerable distance from their source where they are slower flowing and have often been canalised. Therefore mudflows are less likely to have a significant effect.

## 8.10.8.4 Indicators of channel dynamism

Dynamic channels result from the interaction of high river energy levels with erodible channel boundary materials. Numerous bank erosion examples are observable in the major Kura River tributaries and these are strong indicators of channel dynamism. Bank erosion is evidenced by steep, bare, undercut banks, extensive erosion cliffs, tension cracks behind certain bank faces, loose, easily-erodible sand and gravel bank materials, and damage to existing revetments, bridge and trestle supports and old pipelines. Bed scour is apparent and clearly demonstrated through the suspension of old pipelines that were once installed on the river bed as pseudo-aerial crossings. River bed gravels appear fresh, without significant algal growths, and are likely to be mobile during parts of the high-flow season.

The Shamkirchay River suffers from intense scour and bank erosion. Detailed engineering design was carried out in 1999, based on a one in 100-year flood event. Datasets for this crossing include flood frequency estimates, scour depth estimates and grain size analyses. The crossing also has gravel winning close by and immediately downstream.

Many of the rivers crossed by the pipeline after the Kura River East crossing have potentially dynamic regimes, particularly the Kurekchay (KP276.5) Shamkirchay (KP332), Zayamchay (KP357) and Tovuzchay (KP377.1). However many have been dammed upstream from the crossing points.

Crossings of the wadis in the drier eastern parts of Gobustan may also exhibit significant channel instability, particularly in relation to flash flood events.



Figure 8-17 Shamkirchay crossing reach in flood

#### 8.10.8.5 Anthropogenic effects on watercourse stability

Gravel and sand extraction is actively taking place in the river beds of the Kura East, Shamkirchay and Tovuzchay Rivers. Extention of these activities into areas close to the pipeline route could impact on pipeline integrity. Periodic dredging of canals by farmers may also result in the disturbance of shallow services.

# 8.10.9 Environmental change and pipeline corridor hydrology

Hydrologically important changes have taken place throughout the Azerbaijan/Trans-Caucasian region over the twentieth century, such as a mean air temperature rise, a significant rise in annual precipitation over the last 60 years, substantial fluctuations in the level of the Caspian and regional alterations of socio-economic conditions.

Given these recent changes and future climate predictions, significant environmental changes may be anticipated within the design life of the pipeline. These may include:

- Altered climate (precipitation and temperature)
- Changes to land use, agricultural activities (including irrigation), industrial activities (including water abstraction and discharge)
- Variation in water elevation in the Caspian

Such changes may alter hydrological regimes and water quality, affect future flood characteristics, river flows and soil erosion rates over the design life of the BTC pipeline.

## 8.10.10 Key issues

Key issues relating to hydrology along the route of the pipeline are as follows:

- Importance of the Kura River for water resources in Azerbaijan
- Seasonal flow regime of many of the rivers crossed
- High sediment load of many rivers crossed
- Poor channel stability of rivers such as the Djeyrankechmes River and Kura East River
- Ecological value of certain rivers, such as the Kura East and West River, Korchay River and Hasansu River (discussed further in Section 8.14, ecology and Protected areas)

# 8.11 HYDROGEOLOGY

## 8.11.1 Introduction

The hydrogeological characteristics along the pipeline route have been assessed using the following criteria:

- Soil/subsoil permeability from depth 1m to depth 4m, according to the following scale, (using data from the Shah Deniz midstream geotechnical investigations (Gibb 2001)):
  - Class 1 = very low permeability (clay)
  - Class 2 = low permeability (silt and fine sand)
  - Class 3 = medium permeability (medium to coarse sand)
  - Class 4 = high permeability (gravels / cobbles)
  - Class 5 = very high permeability (fissure flow)

- Groundwater vulnerability, based on type and importance of aquifer, using the following scale:
  - Class 1 = Non-aquifer
  - Class 2 = Confined aquifer local importance
  - Class 3 = Confined aquifer regional importance
  - Class 4 = Unconfined aquifer local importance
  - Class 5 = Unconfined aquifer regional importance

In terms of subsoil permeability, it should be noted that there is a degree of subjectivity in the classification for the following reasons:

- Trial pit logs do not extend below 4m, therefore the assessment has been made only of a partial profile. Classifications based on borehole data are thus more representative than those based on trial pits
- The relevant section of the logs may contain different lithologies. In most cases, we have chosen to err on the side of caution. For example, if the 3m section (1-4m) contains 1.5m silt and 1.5m gravel, the location would receive a rating '4'. If, however, the gravel was only a thin bed within silts, a compromise designation of '3' may be chosen
- The trial pits and boreholes are not evenly distributed along the borehole route, and do not reach a density of one per kilometre. Thus, a significant amount of interpolation between investigation points has been necessary. For example, between KP414 and KP426 there is no available geological survey information
- The route used for the geotechnical investigation deviates significantly from the latest BTC pipeline route (route 010) between KP365 and KP390

With regard to groundwater vulnerability, it should be noted that the applied classification is not ideally suited to the situation along the pipeline route for several reasons:

- It takes no explicit account of water quality (ie, whether water is potable or not)
- Along parts of the pipeline route, there may exist a vertical sequence comprising an unconfined aquifer complex and several confined aquifer complexes
- It does not recognise that a deep unconfined aquifer may be overlain by a substantial protective (though not confining) layer of silt and clay, whereas a confined aquifer may be very shallow and confined by only a relatively thin layer of clay

The results of the classification are displayed graphically in Figure 8-18. In general, groundwater can be regarded as vulnerable to contamination from pipeline construction or operation where the subsoil permeability is high, and where there exists an unconfined aquifer of local or regional importance.

## 8.11.2 Hydrogeological conditions east of Yevlakh

From KP0 (Sangachal) to the Kura River at KP223, there is likely to be little conflict between potential contamination from the pipeline and potable groundwater interests. This is because the subsurface sediments are generally fine-grained, groundwater recharge is very low and groundwaters are saline and not suitable for exploitation as potable water resources. Regional head gradients are also likely to be dominantly upwards. Aliyev (2001) and the published hydrogeological map (Aliyev et al. 1992) support this viewpoint.





Between Sangachal and Kazi Magomed, terrain varies in elevation and is, in places, steep. Sediments are dominantly argilla ceous and groundwaters saline. The main exception is in the alluvial deposits of the Pirsagat River, where limited fresh groundwater resources are stated to occur (Aliyev 2001).

On the Shirvan Plain, head gradients are low (0.03 to 0.0007) and decrease in the direction of the Kura River. The thickness of significantly transmissive strata also decreases towards the Kura River and is believed to be of the order of 10-20m in the pipeline corridor. Hydraulic conductivities are believed to be 0.1-3md<sup>-1</sup> in the water-bearing strata. On the pipeline route across the Shirvan Plain, groundwater mineralisation is typically in the range 5-100gI<sup>1</sup>. The water table is generally within 3m of the ground surface over 90% of the area of the Shirvan Plain, partially owing to protracted infiltration of irrigation water from canal systems. On the pipeline route, only in the regions of Kurdamir and Shakyar-Kobu is the groundwater level expected to be deeper, approximately 5-10mbgl (Aliyev 2001).

Three caveats to the general designation of low groundwater vulnerability in this section should be noted:

- There may exist small (unmapped) pockets or lenses of fresh groundwater along the route. These, if they exist, are likely to be extremely important to local herdsmen, nomads and villagers in this arid region because fresh groundwater reserves are scarce (in the arid east of Azerbaijan, water is often tankered in and sold by the bucket - Wolfson and Daniell 1995)
- Where permeable strata exist, groundwater resources are likely to be brackish or saline, and thus of little use as a drinking water resource. They may, however, have a potential use as irrigation water (under some circumstances) or as a water resource for industrial use. Such uses of water are obviously less sensitive to contamination than potable usage. However, even such low sensitivity usages will be susceptible to gross contamination by hydrocarbons
- Even where usable groundwater resources do not exist, permeable strata in the subsurface may be efficient at transporting spilled or leaked contaminants to surface water receptors such as streams or irrigation canals, where the presence of contamination could have an adverse impact

In the immediate vicinity of the Kura East River crossing, high permeability alluvial sediments occur, which are assumed to have potential value as aquifers (KP217-225). Such deposits are also likely to be efficient at transporting spilled or leaked contaminants via the subsurface to the Kura River.

# 8.11.3 Hydrogeological conditions west of Yevlakh

West of the Kura River, through Yevlakh and in the western outskirts of Yevlakh, confined aquifers exist which are exploited for reserves of fresh groundwater. This confined groundwater is not believed to be vulnerable to contamination from construction or operation of the proposed pipeline, as it is confined typically by at least 10m of clay. In this area, shallow 'unconfined' groundwater is encountered at depths of only 12mbgl, typically in sands and loamy sands with hydraulic conductivities of  $0.1-3md^{-1}$ . It is usually highly mineralised  $(10-15gI^{-1})$  and generally unsuited to potable supply, but may conceivably have applications for industrial usage. The subsurface may also permit spilled hydrocarbons to migrate to surface water recipients, or permit vapours to migrate into dwellings. In general, however, the sensitivity of groundwater to contamination is regarded as low.

Further west, especially west of the Goranchay River, on the Ganja-Kazakh Piedmont Plain, unconfined groundwater becomes progressively fresher and should be regarded as an

exploitable resource. Its sensitivity to contamination thus increases. The aquifer complex here comprises proluvial and alluvial deposits of sands, gravels and cobbles, alternating with silty/clayey interlayers. The complex generally becomes finer grained away from the Lesser Caucasus towards the Kura River. The aquifer horizons here are conventionally divided into one upper, partially unconfined aquifer complex (Russian *gruntovaya voda*) and four confined aquifer complexes (Russian *napornii vodonosnii gorizont*), largely on the basis of the stratigraphic proximity of aquifer horizons with similar water chemistry. These subdivisions are largely symbolic and arbitrary as the real structure of the aquifer is complex with many alternating coarse and fine layers that vary laterally. Ultimately, the sedimentary succession must be viewed as a single unit.

On the Piedmont Plain, depths to groundwater are low (<5m) in the Goranboy/Goranchay River area and in the valleys of the main rivers. Depths to water table can exceed 25m in interfluve areas. Groundwater is generally fresh (<1gt<sup>-1</sup> mineralisation) except in the area immediately north and north-east of Goranboy. The hydraulic conductivity of the upper aquifer complex is stated by Tagiev and Alekperov (2001) to be in the range 0.1-13.4md<sup>-1</sup>, although values of 20-100md<sup>-1</sup> may be more typical for the gravelly/cobbly strata.

In the immediate subsurface of interfluve areas of the Ganja-Kazakh Piedmont Plain, there are often layers of silt or clay, which will hinder (although not necessarily prevent) the downward migration of hydrocarbons to the water table. Several confined aquifer horizons, with fresh groundwater reserves, also exist beneath most of the area. These are generally not regarded as being vulnerable to potential contamination from pipeline-related activities.

Throughout the Ganja-Kazakh Piedmont Plain, both unconfined and confined aquifers are exploited by wells, boreholes, springs and karizes for potable, irrigation and industrial uses. In recent years, the total rate of production of subsurface waters for the entire Piedmont Plain was between 820,000 and  $1,130,000m^3d^{-1}$  (9,500 to  $13,100ls^{-1}$ ). Musaev and Panakhov (1971) reported more than 300 karizes in the unconfined aquifer of the Piedmont Plain, with a total flow of more than 6,000ls<sup>-1</sup>.

In the valleys of the major rivers (Tovuzchay River, etc) draining the north-eastern slope of the Lesser Caucasus, vulnerability of groundwater is regarded as extremely high, for the following reasons:

- The immediate subsurface is generally sandy/gravelly/cobbly, with a high degree of interconnectivity
- The water table is relatively shallow
- The gravels of the immediate subsurface may have been 'winnowed' of fine material by fluvial reworking and the deposits may thus be especially permeable

A spill in such valleys could have particularly severe implications because contaminants may migrate rapidly vertically downwards to groundwater resources, down-valley through fluvial sediments or laterally to the surface watercourse through fluvial sediments.

For similar reasons (shallow water table, gravelly/cobbly subsurface strata, highly permeable aquifer strata), large portions of the Karayazi Plain section of the pipeline route are regarded as rather sensitive as regards groundwater contamination. In this area, inhabitants are known to use shallow groundwater for drinking water supply. Shallow groundwater also supports wetland areas of considerable ecological value.

## 8.11.4 Key issues

Key issues relating to hydrogeology along the pipeline route are as follows:

- Groundwater east of Yevlakh is largely unpotable and not exploited
- Groundwater is shallow and heavily exploited for potable and irrigation use to the west of Yevlakh
- Groundwater in the Karayazi aquifer, to the west of the Kura West River crossing is particularly vulnerable due to its shallow nature and highly permeable overlying strata

# 8.12 LANDSCAPE AND LAND USE

## 8.12.1 Introduction

Landscape and land use along the BTC pipeline are mainly determined by the combination of relief, climate, geology, topography soils and hydrology. Land use, with an emphasis on social issues, is studied in greater detail in Section 9.

Four distinct landscape areas can be identified along the BTC pipeline route:

- Sangachal Terminal to Kazi-Magomed (KP0-52)
- Kazi-Magomed to the Ganjachay river (KP52-296)
- Ganjachay river to Akstafa (KP296-357)
- Akstafa to the Georgian Border (KP357-442)

The extent of these areas can be seen on the Environmental Route Maps in Volume 2. It must be emphasised that these are broad categories intended only to provide a guide to land type and usage. Whilst each region does have its own general characteristics, there is also much variation within these landscape and land use regions. A description of each area is provided below.

# 8.12.2 Sangachal to Kazi-Magomed (KP0-52)

From the Sangachal Terminal, the BTC pipeline route runs south-west to Kazi-Magomed, passing through semi-desert and desert habitat. The landscape is generally arid and flat, with no trees, hedges or fences to obscure long distance views in all directions.

However, several ranges of low hills are crossed by the BTC pipeline, each extending for approximately 1km. Characteristic of this region is the occurrence of mud volcanoes, full details of which are provided in Section 8.6.

A number of erosion channels and wadis are present in this district; they are dry throughout summer but flow following periods of heavy rain. Sinkholes are present along the courses of many of these wadis.

There is little cultivation of land due to aridity and agricultural practice is predominantly limited to the over-wintering of grazing livestock. There are small regions devoted to fruit and vegetable production, especially the drier sub-tropical crops such as figs, almonds and olives.

# 8.12.3 Kazi-Magomed to Ganjachay River (KP52-296)

For the whole of this section, the BTC pipeline route is located on the almost-flat alluvial plains of the fertile Kura River valley and consequently the land use is dominated by agriculture. Agriculture is sustained through an extensive system of irrigation canals and ditches, although over-production and poor irrigation in combination have lead to a slow decline in agricultural activities. There are also some larger scale water management schemes such as the damming of the Korchay River (KP292) in the vicinity of the pipeline crossing. The main crops grown in this region are cereals, subtropical fruits (such as melons and watermelons), vegetables and cotton. The land also provides good grazing for cattle.

The intensive agriculture practised here has led to the development of complementary light industry. Cotton cleaning and food processing are both widespread.



Figure 8-19 Fallow and cultivated land along the pipeline route between Ganja and Tovus

# 8.12.4 Ganjachay River to Akstafa (KP296-394)

There is a clear variability in topography across this region, especially in comparison to land at the eastern end of the route. As well as areas that are flat and in arable use, there are long stretches of rolling hills, which provide grazing for livestock (Figure 8-20).

The hills are low, with a sparse desert or semi-desert vegetation and are occasionally interrupted by a flat, broad river flood plain. Erosion processes are common in these hills and gullies form a common feature of the landscape.

Agriculture again dominates the land use of this region (Figure 819). In addition to the cereals and cotton grown on the Shirvan Plain there are numerous vineyards in the region, around Shamkir, Tovuz and Akstafa, which is one of the major wine producing areas of Azerbaijan.

# 8.12.5 Akstafa to the Georgian border (KP394-442)

The BTC pipeline route passes to the north east of Akstafa, traversing undulating land crosscut by minor tributaries which feed into the Kura River. Some of this land is used for agricultural purposes.

After the western crossing of the Kura River (KP411) the route runs parallel to the river, through agricultural land, to the border with Georgia. The land is used extensively for the grazing of livestock and it is maintained by a complex system of irrigation canals.



Figure 8-20 Cultivation in valley areas, grazing on hills in the Ganja to Tovus region

The BTC pipeline passes over the Karayazi Aquifer at the western end of the route within Azerbaijan, between KP405 and the Georgian border. Land here is relatively flat and often waterlogged.

# 8.12.6 Landscape character of the proposed pump station development area

A detailed landscape and visual assessment has been carried out for the site of a proposed pump station (PS-A2) at KP243.5. The full landscape and visual assessment report is presented in Part 14 of the Baseline Report Appendix. This Section is a summary of the baseline landscape conditions of the site.

The proposed site is located approximately 0.75km to the south west of the village of Yardili, and approximately 2.78km south of the Baku-Tbilisi road crossing of the Karabakh Canal.

The area in which the proposed pump station is situated is essentially an open, rural agricultural landscape. The landscape is characterised by a predominantly flat topography of low lying open fields that have a mixed agricultural use of crop growing and grazing land, and large expanses of unmanaged grassland.

A regular pattern of large rectilinear fields exists, with an extensive irrigation system of channels and linear mounds of earth. These irrigation channels often feature rushes in the channels and marginal vegetation on the banks.

The settlement pattern of the area is of small, scattered villages linked to the main Baku to Tbilisi road. The villages, such as Yardili, are typically based on a grid system of roads, and feature a distinctive architecture of houses built from local, sandy-buff coloured stone, and corrugated sheet metalled roofs often featuring ornate detailing.

The majority of mature trees and vegetation within this landscape are located within or close to the fringes of the villages, softening the hard lines of the built form and integrating the villages into the landscape (see Figure 8-21).



Figure 8-21 Landscape character of the pump station site

There are distant views across the flat open landscape only occasionally interrupted by variations in topography such as the embankments of elevated sections of the main Baku to Tbilisi road, the banks of the Karabakh Canal, and the linear earth mounds associated with the irrigation system. The flat relief and the lack of any well-vegetated field boundaries compound the openness of the landscape.

# 8.12.7 Key issues

Key issues relating to landscape along the pipeline route are as follows:

• Much of the route is flat, with no trees, hedges or fences to obscure long distance views

- The mud volcano ridge and the approaches to the Tovuschay, Azrinchay and Hasansu rivers are steep, erodable ridges; gullies form a common feature of the landscape in these areas
- Land use within almost-flat alluvial plains of the fertile Kura River valley is dominated by agriculture, which is sustained by an extensive system of irrigation canals and ditches
- The desert and semi-desert areas are used for grazing
- The proposed pump station site is in a generally level agricultural area adjacent to the village of Yardili

# 8.13 CULTURAL HERITAGE AND ARCHAEOLOGY

# 8.13.1 Introduction

The cultural heritage of an area may be profoundly affected by a large-scale construction project if not handled sensitively. With careful management and planning however, it is possible to complete such projects with minimal impact on the cultural resources of an area and in addition, to provide a substantial increase in the quantity of archaeological information available for a region.

The known archaeological sites along the pipeline have been identified for an area approximately 1km wide around the pipeline route and potential areas of concern have been highlighted. An archaeological strategy was designed at an early stage of the work and this has led to the development of a Cultural Heritage Management Plan for the pipeline.

Archaeologists from the Institute of Archaeology and Ethnography have surveyed the pipeline route in Azerbaijan. The extent and nature of features visible on the ground has been taken into account during the pipeline routing process. At locations where large archaeological areas were identified, other route options were considered. The most appropriate management technique for each site that could not be avoided, and/or might be affected, was then developed.

In addition, a series of aerial photographs of the pipeline route has been examined to assess their value in determining the visibility of archaeological information. A large number of features of potential archaeological interest have been identified through this exercise.

Results of the field surveys combined with previously known archaeological information has produced a large quantity of information. This information is being assessed to provide data on the extent and significance of individual sites in the pipeline corridor. Although this evaluation is ongoing, it is already apparent that there are areas of interest along the BTC pipeline route that will need to be addressed by further surveying. Agreement has been reached with the Institute of Archaeology and Ethnography on the proposed programme of work.

# 8.13.2 The archaeological monuments of Azerbaijan

Azerbaijan has a wealth of evidence for earlier human societies that lived in the area. All stages of human development have been encountered on archaeological sites in the country. Archaeologists have recorded monuments of the Palaeolithic, Mesolithic, Neolithic and Eneolithic eras, together with Bronze and Iron Ages. These include the oldest settlements of

the Stone Age - Azykh and Taglar, the monuments of the Kura-Araks culture, rock drawings of Gobustan and sites connected with the nomadic tribes of Skiphs, Sakkses and others.

Azerbaijan is also rich in the cultural remains of later developed social states, such as various settlements, caravanserai, defensive walls and burial grounds. The region has always been an important trade route, both east to west and north to south, but it was mainly during the Middle Ages, that many of the important trading centres developed.

In Azerbaijan, the BTC pipeline follows one of the historic east-west routeways passing between the two Caucasian mountain ranges. Close to the pipeline corridor, there are two major trading cities, Shamkir and Shirvan, both dating from medieval times. These cities were based on the wealth of traders and passing contacts travelling along the Great Silk Road from Asia to the Mediterranean.

This part of Azerbaijan also contains the most productive soils of the country and there are many settlements based on agriculture. The earliest farmers were the Neolithic Kura-Araks culture, whose remains are found all over Transcaucasia, through the Anatolian Plateau and into parts of Iran and Iraq. The area around Akstafa contains many large settlement mounds, or tepe, formed from the occupational debris of many hundreds of years of occupation. These date from the late Neolithic and Bronze Age to much later.

Azerbaijan contains many archaeological monuments of international importance for the understanding of human development. There are many sites that can be classed as being of national significance, and others are important at a local level.

# 8.13.3 Legal protection of cultural monuments

Immovable architectural and archaeological monuments are provided with state protection in Azerbaijan. The Cabinet of Ministers of the Azerbaijan Republic has approved the list of monuments shown in Tables 1 and 2 Part 2c, Baseline Reports Appendix.

The monuments of the whole of Azerbaijan are divided into three classes in accordance with their importance:

- Monuments of world and national importance, comprising 64 architectural and archaeological monuments
- Monuments of national importance, including 583 architectural monuments and 3109 archaeological monuments
- Monuments of regional importance, comprising 3318 architectural monuments, 195 monuments of garden-and-park culture and landscape architecture, and approximately 2000 archaeological monuments

A number of national reserves have been established by the Order of the Cabinet of Ministers of the Azerbaijan Republic. Currently, 14 historical-and-architectural, historical-and-archaeological, historical-and-cultural, and historical-and-ethnographical reserves exist. These are listed in Table 3 in 2c, BaseIne Reports Appendix.

With the exception of the Gobustan Archaeological Reserve (see Section 13.4.1), none of the sites described above fall within the pipeline study corridor.

Cultural heritage and archaeological remains and artefacts are legally protected in the Azerbaijan Republic by national legislation which is supported by the various international conventions and recommendations ratified by the Republic. These include the Convention on

Protection of World Cultural and Natural Heritage (Paris, 1972) and the European Convention on the Protection of the Archaeological Heritage (Valletta, 1992).

The national legislation regarding cultural sites in Azerbaijan has recently been amended. Article 18 of the Law on '*Protection and Utilisation of the Cultural and Historical Monuments*' requires the promoter of a new project to conduct archaeological surveys. In cases where archaeological features are encountered, excavation and adequate recording must be carried out prior to construction works.

As a result of the recent amendments, the Ministry of Culture of the Republic of Azerbaijan is responsible for issuing permits for the excavation of archaeological and heritage sites. Decisions about the granting of permission are made following advice from the Academy of Sciences of the Republic of Azerbaijan.

Restoration works on architectural monuments may only be carried out if the Ministry of Culture has issued a licence for such works.

## 8.13.4 Archaeological sites on the pipeline route

The archaeological surveys to date on the various route options of the pipeline have identified over 150 sites. The route selected for the BTC pipeline contains approximately 70 locations of archaeological potential close to the alignment (see Figure 8-22). The pipeline route has been amended to avoid a number of these archaeological locations.

The most significant archaeological features on, or close to the route, are described below and are shown on the Environmental Route Maps (Volume 2).

#### 8.13.4.1 Gobustan archaeological reserve

The Gobustan area contains many hundreds of rock drawings or petroglyphs of humans and animals together with other evidence of human occupation. The rock art dates back up to 10,000 years, with some carvings being interpreted as even older. Rock decoration in Gobustan continued into the historic period as evidenced by a Roman inscription and a possible depiction of Arab traders.

The continued use of the area is a reflection of the changing sea levels of the Caspian. During the Mesolithic period, the sea was higher and came to the foot of the rock outcrops, which then formed a suitable location for habitation. Many of the early depictions of deer, goats and cattle are thought to be part of a shamanistic belief system, while others show scenes of everyday life.

Rock decoration is found on three of the hills in the area (Figure 8-23); Beyouk Dash (Big Rock) which contains most of the famous carvings, Kichik Dash (Little Rock) to the south and Djingir Dag to the north. The carvings were first noticed in the 1930s; many more were identified during surveys and excavations by I Jafarzade and others during the 1950s and 60s. Other hills also contain similar rock art, for example, goat petroglyphs were found during an archaeological survey in 2001 on the hill to the north of Sangachal terminal (Site 159).



Figure 8-22 Archaeological Sites along the Pipeline Route

The pipeline crosses the Archaeological Reserve of Gobustan for about 1km at a position close to the Reserve's northern border (approximately KP9–10). The pipeline route runs approximately 1km to the north of Djingir Dag and crosses an open area of semi-desert between Djingir Dag and a small hill (apparently an extinct eroded mud volcano) known as Topa after crossing the Djerankechmes. No archaeological sites have previously been identified in this area, but a number of potential locations have been identified during the archaeological survey through surface finds of medieval and later pottery.

#### Figure 8-23 Rock Art in Gobustan



## 8.13.4.2 Surface spreads of artefacts

Many of the potential areas of archaeological interest have been identified by the observation of artefacts on the surface of the ground, either in areas of thin vegetation cover or on cultivated soil. Some of these represent parts of sites previously recorded or known through work conducted during the WREP project. Examples of these are Neymatabad, Mingechaur and Dalmamedli (Sites 56, 57 and 60, See Environmental Route Maps, Volume 2). Due to the difficulty of assessing the significance and extent of these sites, the programme of further work will include a sample of this type of site.

## 8.13.4.3 Earthworks and other surface features

Some of the archaeological areas can be recognised by surface features, in particular the mounds left by multi period settlements. Examples of these are Nadirkand, Zayem 2 and Girag Salakhli (Sites 59, 111 and 138). Other features such as the abutments of the medieval

bridge over the Zayamchai (Site 114) and the towers and walls of the citadel of old Shamkir can be easily identified.

## 8.13.4.4 Aerial photography

A series of aerial photographs of the pipeline route were examined for potential archaeological features. The vertical photographs taken at a scale of 1:15,000 in colour each covered an area slightly over 2km wide. Both print and digital copies were examined. The full extent of the aerial view was examined and information was obtained about features within 1km of the pipeline route.

Almost 1500 features were identified in the survey. The majority of these are thought to be recent in origin and include features formed by agricultural, military and oil extraction activities. Others originate from nomadic herding and represent the winter occupation areas of pastoralists. These were particularly dense south of the road between Guzdek and Sigirli and in places, showed superimposition that implies the features could span a considerable period of time. Many of the present day pastoral settlements are surrounded by evidence of previous phases of settlements. There is a considerable variation in the form of these settlements that suggests traditions have changed over the period of use.

After further evaluation, approximately 40 of the features were felt to be of archaeological origin. This was either due to their location (proximity to known archaeological sites) or through their form. Many appear to be enclosures, usually circular in shape. From an initial examination of the sites, 7 appear to be within approximately 200m of the BTC pipeline as shown on the Environmental Route Maps (Volume 2).

Known archaeological sites were also examined on the aerial photographs, but no additional information was obtained about their extent. This was particularly disappointing for the larger sites such as Zayamchay (Site 111).

# 8.13.5 Key issues

Key archaeological issues along the pipeline route are as follows:

- The pipeline has unavoidably crossed the Gobustan Cultural Reserve for approximately 900m
- Several important sites have been identified and will be the subject of intrusive investigation prior to pipeline construction
- Much of the archaeology along the pipeline route is as yet unknown

# 8.14 ECOLOGY AND PROTECTED AREAS

## 8.14.1 Introduction

Natural habitats and the species of plants and animals within them are of vital importance to the protection, maintenance and continuing functionality of the world's ecosystems. The conservation of these natural habitats and their biodiversity, not only of species but also of genes and populations, is therefore essential for long-term sustainable development.

This Section summarises the findings, in terms of ecological and nature conservation interest, of a desk-top study and field surveys conducted along the proposed BTC pipeline route. A

detailed description of the ecological baseline, including the surveys undertaken for this project, is provided in the Ecological Baseline Report, Part 1 of the Baseline Reports Appendix.

The conservation status of species of flora and fauna has been assessed with reference to:

- The Red Data Book (RDB) for Azerbaijan (1989)
- Information from local scientists on proposed additions to the Red Data Book (pRDB)
- European Bird Populations: Estimates and Trends (Birdlife International/ European Bird Census Council, 2000)
- The 2000 IUCN Red List of Threatened Species

Description of conservation status categories, referred to throughout the following sections is provided in Table 8-10.

Status Category	Description
le	Species of International Conservation Concern – endangered
lv	Species of International Conservation Concern – vulnerable
llr	Species of International Conservation Concern – low risk
Ee	Bird of European Conservation Concern - endangered
Ev	Bird of European Conservation Concern - vulnerable
Er	Bird of European Conservation Concern – rare
Ed	Bird of European Conservation Concern - declining
RDB	Listed in Red Data Book of Azerbaijan Republic
PRDB	Proposed for inclusion in Red Data Book of Azerbaijan Republic

Table 8-10 Threatened species status categories

## 8.14.2 Overview of flora and fauna in Azerbaijan

Azerbaijan lies at the convergence of at least three biogeographic provinces, where species typical of Europe (eg brown bear, lynx, chamois, red deer), Central Asia (eg wild goat, leopard), and Asia Minor (eg striped hyena, goitered gazelle) occur. This geographic position, combined with the country's varied climate, topography and geology, has resulted in high levels of biodiversity. The key biodiversity ecosystems within Azerbaijan include marine and coastal biomes, forests (lowland and montane), subalpine and alpine meadows, dry and semidesert areas, grassland/steppes and wetlands.

The flora of Azerbaijan comprises approximately 4,200 identified species, divided into 125 families and 920 genera. An estimated 270 species of plants (6.4%) are endemic to Azerbaijan. The fauna of the country is represented by 99 species of mammals, 360 species of birds, 54 species of reptiles, 11 species of amphibians, 95 species of fish and 14,000 species of insects. Azerbaijan is particularly important for some animal groups especially birds and bats.

In all, Azerbaijan has 77 animal species and three plant species that are considered threatened (IUCN, 2000). The RDB for Azerbaijan was first published in 1989. It lists 50 species of plant, five species of fish, five amphibians, eight reptiles, 36 birds, and 14 species of mammal as threatened (no information is provided on how the degree of threat has been assessed). A second edition is currently in preparation.
The main threats to Azerbaijan's biodiversity have been identified as pollution, habitat destruction, over-exploitation of wildlife populations and other threats such as war and rise in Caspian sea level.

## 8.14.3 Protected areas

In Azerbaijan, sites or areas of particular importance for nature conservation are designated as protected areas covered by the *Law on the Protection of the Nature Environment and the Utilisation of Natural Resources* (Anon, 1992). There are a number of different levels of protection (see Table 6, Part 1 of Baseline Reports Appendix) ranging from the Nature Reserve (where no public access is allowed) through to Hunting Areas (where licenced hunting is possible) and the protection of individual trees or palaeontological sites. Several of the Protected Areas in Azerbaijan have also been assigned a Management Category by IUCN (1994).

Only ten protected areas, of which four are proposed sites, are situated within 10km of the proposed pipeline route. Table 8, Part 1 of Baseline Reports Appendix gives an indication of the location and proximity of the protected areas to the proposed BTC pipeline, while the Environmental Route Maps (Volume 2) show the spatial extent of the areas.

During the BTC pipeline routing process emphasis was placed on avoiding designated protected areas, as well as habitats or species sensitive to disturbance. As a consequence, the majority of the proposed BTC pipeline route crosses agricultural land (62.2%). Figure 8-24 shows how it has been possible to route around the Korchay and Shamkir Reserves which were crossed by the WREP.

It has not been possible, however, to avoid crossing the proposed Gobustan State National Park (KP 19.5-28.5), which comprises a range of desert habitats. The proposed State National Park has an area of 178,700ha and includes 2% of the total route (see Figure 8-24).

Other protected areas that are close to, but not directly affected by, the proposed route are:

- The Barda State Forbidden Area which is directly downstream from the Kura East River crossing. This State Forbidden Area comprises 7,500 ha on Tugay river forest in the Barda/Agdas Regions
- The Karayazi reserve downstream of the Kurudera River crossing and comprising 17,873ha of Tugay river forest in the Kazakh Region
- The Samukh State Hunting Area, which covers 40,424ha of primarily wetland habitats and includes part of the Mingechaur Reservoir

Azerbaijan is in the process of becoming a Contracting Party to the Ramsar Convention having recently submitted its instrument of accession to UNESCO. The Ramsar Convention is aimed at protecting the wildlife and habitats of internationally important wetlands. Lake Jandari, which is located approximately 3km to the north of the proposed BTC pipeline route and straddles the border between Azerbaijan and Georgia, has been included in the book of potential Ramsar sites in Azerbaijan. However, it is not known when, or if, this site will become designated.



Figure 8-24 Location of Protected Areas and Species Observations along the Pipeline

## 8.14.4 Habitats & vegetation

The vegetation types along the proposed BTC pipeline route have been categorised into six broad habitat types and specific community types where possible. These are detailed in Table 8-11 and have been mapped on the 1:50,000 scale Environmental Route Maps (Volume 2).

Habitat Type	Length in km	% of Total Length
Desert	110.15	24.9
Semi-desert	35.5	8.0
Scrub and trees	4.3	1.0
Wetland (including watercourses)	16.25	3.7
Agricultural	275	62.2
Other (quarries, refugee camps, etc)	0.8	0.2
Total	442	100

Table 8-11 Extent of the main habitat types crossed by the proposed BTC pipeline

The majority of land crossed by the proposed BTC pipeline route is agricultural and is of little nature conservation interest, with respect to plant species. 0.2% of the route is taken up by other land uses such as quarries and has negligible ecological value.

The remaining 37.6% of habitats along the proposed BTC pipeline route are of increased nature conservation importance since they have a greater structural and species diversity compared to agricultural land and are more semi-natural in character (although many of these habitats have been subject to significant degradation).

A description of the main habitat types and their distribution along the proposed BTC pipeline route is provided below.

### 8.14.4.1 Desert and semi-desert

The following 14 desert plant communities were identified along the proposed BTC pipeline route during field surveys and are identified by the codes D1 - D14 on the Environmental Route Maps (Volume 2):

- D1 Artemisia fragrans (Mugwort species)
- D2 Artemisia fragrans and Salsola nodulosa (Mugwort and saltwort species)
- D3 Artemisia fragrans and Salsola dendroides (Mugwort and saltwort species)
- D4 Artemisia fragrans and Suaeda dendroides (Mugwort and seablight species)
- D5 Salsola nodulosa (Saltwort species)
- D6 Salsola dendroides (Saltwort species)
- D7 *Suaeda dendroides* (Seablight species)
- D8 Kalidium caspicum
- D9 Halocnemum strobilaceum
- D10 Capparis spinosa (Spineless caper)
- D11 Ephermal desert
- D12 Interzone
- D13 Salsola nodulosa and Artemisia fragrans (Saltwort and mugwort species)
- D14 Salsola ericoides (Saltwort species)

Of the above, the most common types encountered along the proposed BTC pipeline route were mugwort species (*Artemisia fragrans*) and saltwort species (*Salsola nodulosa*), either occurring as individual dominants or as co-dominants.

The desert communities in the Gobustan area represent the most ecologically important habitats from a botanical point of view, along the proposed BTC pipeline route. The Gobustan area is of national significance as this area is a stronghold for mugwort (*Artemisia fragrans*) communities and is one of the reasons why a significant proportion of the Gobustan desert has been proposed as a State National Park. Desert plant communities such as these, which develop slowly, are particularly susceptible to disturbance and are easily lost, taking many years to recover.

Semi-desert habitat is more prevalent in the slightly wetter western part of the proposed BTC pipeline route and is differentiated from desert by a greater density of plant cover and the interconnection of the root systems from different plants. However, the species that comprise semi-desert habitats are generally the same as those in the desert. The most frequently encountered semi-desert type along the proposed BTC pipeline is the mugwort (*Artemisietum*) community characterised by green grass in winter due to autumn rains.

### 8.14.4.2 Wetlands

Numerous small-scale wetlands are located along the proposed BTC pipeline route and can be split into four types: rivers, irrigation canals and ditches, marsh or chal meadow and lakes and ponds.

### Rivers

Due to the variable and often turbid flow of the rivers crossed by the proposed BTC pipeline, the associated vegetation is limited to the bank sides and seasonally inundated margins. The riverside vegetation generally comprises scrub and tree species such as tamarisk species (*Tamarix ramosissima*), oleaster (*Elaeagnus angustifolia*), willow species (*Salix spp*), and poplar species (*Populus spp*) as well as swamp species such as common reed (*Phragmites australis*), sea club rush (*Bolboschoenus maritimus*), water-pepper (*Polygonum hydropiper*) and galingale (*Cyperus longus*).

### Irrigation channels and ditches

Many irrigation ditches and canals occur in the extensive agricultural areas between Kazi-Magomed and the Georgian border. Due to disturbance by man, their flora is largely limited to common aquatic and shrub species including the common reed (*Phragmites australis*), bulrush (*Typha latifolia*) and purple loosestrife (*Lythrum salicaria*). The banks commonly support species such as tamarisk species (*Tamarix meyerii*), orache species (*Atriplex tartarica*) and camel prickle (*Alhagi pseudoalhagi*). Glabrose liquorice (*Glycyrrhiza glabra*), a pRDB species is also found in some of the shallow ditches.

### Marsh or chal meadow

The chal meadow marsh community develops in hollows and low-lying areas and is generally slightly saline. It is usually seasonally inundated, is species-rich and is widely encountered along the proposed BTC pipeline (eg, the drained Lake Shilyan (KP146), to the west of Kurdamir). Typical species include glabrose liquorice (*Glycyrrhiza glabra*) (pRDB), sea lavender species (*Limonium meyerii*), camel prickle (*Alhagi pseudoalhagi*), Bermuda-grass

(Cynodon dactylon), saltwort species (Salsola dendroides) and orache species (Atriplex tartarica).

### Lakes and ponds

Several man-made lakes occur along the proposed route, which support very similar vegetation to the river and canal banks, being dominated by common reed (*Phragmites australis*) and tamarisk species (*Tamarix spp*).

### 8.14.4.3 Trees and scrub

Woodland is extremely restricted on the proposed BTC pipeline route. Small sections of approximately 150m to 600 m are crossed at KP105.5, KP106, KP175, KP223, KP387.5 and KP411.5 and KP423.5. The plantations are dominated by ash species (*Fraxinus spp*) and vardim oak (*Quercus longipes*). Some limited areas of scrub are also encountered at KP175, KP192.5 and KP411.5; these areas are dominated by tamarisk species (*Tamarix ramosissima*), forming either a mosaic with chal meadow species or dense scrub along river and canal banks.

### 8.14.4.4 Protected plant species

Several species, which are included in the RDB for Azerbaijan or, which are proposed for inclusion in the revised RDB have been recorded along the proposed BTC pipeline route. These are listed in Table 8-12.

Species	Status	Occurrence	Location along the Route	
Glycyrrhiza	pRDB	confirmed (AIOC, 1997)	Artificial watercourses and chal	
glabra		(ERM, 2000), (AETC, 2001)	meadow areas	
Iris acutiloba	RDB	confirmed (AIOC, 1997)	Gobustan area	
Merendera	pRDB	confirmed (AETC, 2001)	KP51 to the east of Kazi-	
trigyna			Magomed at the western extent of the Gobustan desert area	
Punica	RDB	confirmed (AIOC, 1997)	Generally associated with	
granatum			canals, ditches and river banks	
Vitis sylvestris	RDB	confirmed (AIOC, 1997)	Generally associated with	
			canals, ditches and river banks	

Table 8-12 RDB plant species recorded along the BTC pipeline route

It should be noted that two species, namely woodland grape (*Vitis sylvestris*) and pomegranite (*Punica granatum*), will not be included in the revised edition of the RDB since further assessment of their status found it to be unnecessary. None of the RDB species have protected status internationally.

## 8.14.5 Fauna

There are many species of fauna present along the proposed BTC pipeline route and within the survey corridor, the majority of which are common and widespread. This Section, therefore highlights those species which have been identified as being of some level of conservation concern, either on a national, European or world scale. The status categories used in tables in the following sections are described in Table 8-10. Table 8-13 provides a list of those species of concern along the proposed BTC pipeline route, which are most likely to be affected due to their ecological habits. These, and other, species are described in more detail in the following sections.

Species	Status	Occurrence
Spur-thighed tortoise	RDB, Iv	Confirmed (AIOC, 1997), (ERM,
(Testudo graeca)		2000), (AETC, 2001)
Ship sturgeon	pRDB, le	Probable
(Acipenser nudiventris)		
Black francolin	RDB, Ev	Confirmed (AIOC, 1997), (AETC,
(Francolinus francolinus)		2001)
Ruddy shelduck	Ev	Confirmed (AETC, 2001)
(Tadorna ferruginea)		
Chukar	Ev	Confirmed (AIOC, 1997), (AETC,
(Alectoris chukar)		2000)
Stone curlew	Ev	Confirmed (AIOC, 1997), (AETC,
(Burhinus oedicnemus)		2001)
Blue rock thrush	Ev	Confirmed (AETC, 2001)
(Monticola solitarius)		
Black-winged pratincole	RDB, Er	Confirmed (ERM, 2000)
(Glareola nordmanni)		
Kingfisher	Ed	Confirmed (AETC, 2001)
(Alcedo atthis)		
Glossy ibis	pRDB, Ed	Confirmed (ERM, 2000)
(Plegadis falcinellus)		
White-tailed plover	RDB	Confirmed (ERM, 2000)
(Chettusia leucura)		
Porcupine species	pRDB	Confirmed (ERM, 2000)
(Hystrix indica)		
Water vole	pRDB	Confirmed (AIOC, 1997)
(Arvicola terrestris)		
Common toad	RDB	Confirmed (ERM, 2000)
(Bufo bufo)		
Death's-head hawkmoth	RDB	Confirmed (ERM, 2000)
(Manduca atropos)		
Freshwater terrapin species	pRDB	Confirmed (AIOC, 1997), (ERM,
(Clemmys caspica)		2000)
European pond terrapin	pRDB	Confirmed (AIOC, 1997)
(Emys orbicularis)		

### Table 8-13 Species of conservation concern along the proposed BTC pipeline

### 8.14.5.1 Mammals

There are 14 species of mammal, identified as rare on a national or international scale, which have the possibility of being present in the vicinity of the proposed BTC pipeline route (see Table 13, Part 1 of Baseline Reports Appendix). Of these 14, eight have been confirmed as present along the proposed BTC pipeline route and are described below.

The following four species, all located along the proposed BTC pipeline route, are listed by the 2001 IUCN Red List of Threatened Species as being internationally rare:

- The barbastelle bat (*Barbastella barbastellus*), greater horseshoe bat (*Rhinolophus ferrumequinum*) and lesser horseshoe bat (*Rhinolophus hipposideros*) are known to be present in the Gobustan region
- The edible, fat or squirrel-tailed dormouse (*Glis glis*) has been recorded in the Tugay forest along the route of the WREP where it lives in the tree canopy during the summer and hibernates at lower levels and sometimes underground during winter

A further two of the eight species are included in the RDB for Azerbaijan:

- Goitered gazelle (Gazella subgutterosa) confirmed in the Gobustan area
- Wild field cat (*Felis lybica*) present in the region of KP349 (just to the south of the Shamkir State Forbidden Area)

The remaining two species have been proposed for inclusion in the revised RDB:

- Water vole (*Arvicola terrestris*), recorded several times along the route of the WREP, lives in burrows in grasslands
- Porcupine species (*Hystrix indica*) spines of this species were recorded at KP 171.5 (bank of the Goychay river), KP315 (near Kushkarachay) and KP 320.5 (near the Karasu river)

### 8.14.5.2 Birds

The avifauna along the proposed BTC pipeline route is diverse, with assemblages varying between the different habitats of desert, woodland, agricultural and wetland habitats. These assemblages also change throughout the year due to their high mobility and ability to migrate such that species can be summer breeders, resident, wintering or migratory.

Thirty-three species of bird of national, European or international conservation importance were highlighted during the surveys as possible species present along the proposed route; all but two of the species have been confirmed (see Table 14, Part 1 of Baseline Reports, Appendices).

Of the thirty-one confirmed species recorded along the proposed route, the following two are listed on the 2001 IUCN Red List of Threatened species, but are unlikely to breed in the vicinity of the proposed BTC pipeline:

- White-tailed eagle (*Haliaeetus albicilla*), which was recorded in Gobustan and in the Shamkir and Akstafa areas at KP0, KP328, KP402.5 and KP414
- Pygmy cormorant (*Phalacrocorax pygmeus*), which was recorded at the Kura East River crossing (KP223.6) and Jandari Lake

Eight species of birds of prey were regularly recorded in the vicinity of the proposed BTC pipeline route, but are unlikely to nest near it, preferring buildings or rocky crags. However, one, the hen harrier (*Circus cyaneus*), a species of European conservation status, does nest on the ground and has been recorded at KP368 and at KP144.5.

Several of the thirty-one species confirmed along the proposed route are ground-nesting species favouring desert, agricultural and wet meadow habitats. Those classed as vulnerable on a European basis include:

- Stone curlew (Burhinus oedicnemus) confirmed in the Gobustan region at KP13.5
- Chukar (*Alectoris chukar*) recorded at KP12, KP106 and KP291.5, around the Korchay River
- Black francolin (*Francolinus francolinus*) also recorded at KP106.5 and KP291.5, around the Korchay River

Three of the ground nesting species are listed in the RDB:

• Black-winged pratincole (*Glareola nordmanni*) recorded at KP13.5

- White-tailed plover (*Chettusia leucura*) recorded at KP116, KP315 and KP411.5
- Sociable plover (*Chettusia gregaria*) recorded at KP140.5

The potential RDB species, glossy ibis (*Plegadis falcinellus*) was recorded near the irrigation canal at KP145.5, in a wetland habitat of Kushkarachay at KP319 and at KP396.5.

In addition, other breeding birds which have been recorded along the proposed BTC pipeline route include kingfisher (*Alcedo atthis*), blue rock thrush (*Monticola solitarius*), white stork (*Ciconia ciconia*) and collared pratincole (*Glareola pratincola*).

### 8.14.5.3 Amphibians

With respect to amphibians, only two species of conservation importance are thought to be present along the BTC pipeline route: the common toad (*Bufo bufo*) and the European tree frog (*Hyla arborea*). Of these, only the RDB species common toad (*Bufo bufo*) was recorded during surveys. This species was found near an irrigation canal at KP140.5 and on the edge of Tugay forest in a hollow fallen tree (KP223.5).

### 8.14.5.4 Reptiles

Reptile communities can be split between those which inhabit arid desert and semi-desert regions and those inhabiting wet lowland marsh, forest and waterbodies. Five species of national rarity are thought to be present in the vicinity of the BTC pipeline route.

One of these, the spur-thighed tortoise *(Testudo graeca)* (see Figure 825), is classed as vulnerable on an international basis by the 2000 IUCN Red List of Threatened Species. They live in burrows and usually hibernate during winter. This species has been recorded frequently in the desert, semi-desert and scrub habitats, mainly in the west of the BTC pipeline route and particularly in the Shamkir region. The population is large within Azerbaijan but the tortoise is susceptible to persecution and other anthropogenic impacts.





During the field surveys evidence of snakes was noted, specifically around man-made pond areas in the first 20km of the BTC pipeline. The ladder snake (*Elaphe hohonackeri*) (pRDB), was recorded towards the western end of the BTC pipeline route (KP311.5).

Two species of terrapin (*Clemmys caspica* and *Emys orbicularis*), both proposed for inclusion in the revised RDB, were regularly recorded in waterbodies such as lakes, ponds, canals and marshy areas along the BTC pipeline route.

### 8.14.5.5 Fish

The proposed BTC pipeline crosses 21 principalrivers and numerous minor watercourses. All the major rivers crossed, apart from the Djeyrankechmes and Pirsagat Rivers (which occur in the eastern part of the BTC pipeline route and flow directly into the Caspian) form part of the Kura catchment .

Ten species of fish of conservation importance, which are either already in the RDB or proposed for inclusion, are known to exist within the Kura River and its tributaries (see Table 18, Part 1 of Baseline Reports Appendix. The Djeyrankechmes and the Pirsagat do not hold any Red Data Book fish species.

### 8.14.5.6 Invertebrates

Many hundreds of species of invertebrate are thought to be present along the proposed BTC pipeline route, nine of which are RDB species (see Table 18, Part 1 of Baseline Reports Appendix). These include two species of bumble bee, two species of beetle, two species of butterfly, two species of hawk-moth and one species of crayfish.

Only one RDB species, hawk-moth (*Manduca atropos*) has been recorded along the proposed route, at KP139.5 and KP396.5. It is also likely that the crayfish (*Astacus pyzolwi*) is present in many of the watercourses along the proposed BTC pipeline route.

## 8.14.6 Key issues

The key issues in terms of habitats and species of flora and flora along the pipeline route, with respect to construction of the pipeline are:

- Artemisia and Salsola deserts of the proposed Gobustan National Park
- Potential presence of *Iris acutiloba* in Gobustan desert habitat
- Potential presence of Merendera trigyna in Gobustan desert habitat
- Presence of *Glycyrrhiza glabra* on watercourses
- Presence of Testudo graeca in many locations along the pipeline route
- Presence of ground nesting birds of conservation importance
- Potential presence of Hystrix indica at several watercourses
- Potential presence of *Arvicola terrestris* at watercourses

## 8.15 EXISTING TRAFFIC CONDITIONS

## 8.15.1 Introduction

In order to develop an understanding of the baseline traffic conditions a traffic census was carried out on roads in Azerbaijan likely to be used by construction traffic during the lifetime of the BTC pipeline project. The baseline traffic information report is presented in The Traffic Baseline Report and Management Plan, Part 4 of the Baseline Reports Appendix.

The key objectives of the traffic census were to:

- Define the number of vehicle movements along the key access routes at different times of day
- Provide a breakdown of total vehicles on key access routes by type
- Identify key pinch points, restrictions and sensitivities along these access routes

## 8.15.2 Methodology

### 8.15.2.1 Route identification

Consultation with the route definition team and logistics engineers was carried out in order to optimise the choice of survey locations. Information on proposed pipe yard and construction camp locations was studied, in combination with the routes of suggested access roads. Forty nine survey locations were selected, at which traffic counts could be carried out on both main roads (generally the Baku to Tbilisi highway) and the more minor access roads.

Standard western traffic survey forms were modified to take into account the specific road conditions and the likely users of the roads in Azerbaijan. This included the addition of animal drawn carts and animal herds such as sheep, cows or flocks of geese.

### 8.15.2.2 Baseline traffic

Baseline surveys were required in order to identify the current levels and nature of traffic on the roads likely to be directly affected by the construction and operation of the BTC pipeline. Different types of vehicle using the road have different impacts in terms of noise, vibration, speed and amount of highway capacity (and space) required. Manual classified vehicle counts were used to determine both the volume and type of vehicle using the roads.

Census points were chosen at critical sections where construction traffic would be likely to travel. These included main roads in towns, river crossings, and access roads between pipe dumps, camps and the pipeline. A total of ten traffic surveyors were employed over a two-week period at the end of November and beginning of December 2001. The average count-day covered 8 hours, encompassing the busiest times of the day.

The survey census forms allowed differentiation between road users as identified in the left hand column of Table 8-14. These various sorts of users have differing impacts on the local environment, the highway pavement and the road capacity. They are also differentially sensitive to the impacts of the heavy lorry traffic that will be generated by construction of the pipeline. In order to assess the variation in traffic flows throughout the week, two survey sites were surveyed over a seven day period. The locations of all the survey sites are provided in Part 4 of Baseline Reports Appendix.

## 8.15.3 Analysis of traffic data

After data collection and summation, the following analyses were undertaken:

- Assessment of additional flows generated by the construction and operation phases
  - Analysis of total traffic flows
  - Determination of highway capacity
  - Identification of pinch-points
  - Development of management measures

The traffic flow information has been processed so that the data can be compared consistently across all sites and against well-defined capacity standards.

A road user classification scheme has been developed, as presented in Table 8-14. The 'slow' category does not generally take up a considerable amount of the highways capacity but can reduce vehicle speeds and will be very sensitive to increases in heavy goods traffic. Light vehicles will generally move more quickly, take up more road space and could be disadvantaged by increases in slow moving heavily laden vehicles. Heavy vehicles will be less affected by construction traffic but the existing volumes will have implications in terms of net increases in noise and vibration and impact on pavements.

Vehicle type	Category
Pedestrians	Slow
Animal Flocks	Slow
Bicycles	Slow
Animal Drawn Carts	Slow
Motorcycles	Light vehicle
Agricultural Vehicles	Light vehicle
Cars	Light vehicle
Minibuses	Light vehicle
Buses	Heavy vehicle
Trucks	Heavy vehicle

### Table 8-14 Road user classification

### 8.15.3.1 Average weekday traffic flows

Flows were very low over the survey period on almost all roads surveyed. Minimum two-way flows of less than 100 vehicles per day were observed and a maximum flow of just over 6,000 vehicles per day was recorded. Only two roads (the main and access roads at survey site 50) exceed 4,000 vehicles per day during the survey period.

Vehicle compositions vary greatly between sites. However, almost universally the proportion of pedestrians, cycles, animal drawn carts and animal herds represents less than 15% of roads users on the main routes.

The proportion of heavy vehicles on most of the roads was high, with 15-25% of vehicles falling into this category on many of the main roads. Many of the proposed access routes also

form parts of the local road network feeding villages and towns from the main route between Baku and Georgia. Many of these also have substantial proportions of goods vehicle traffic.

Generally, the main road network is characterised by low traffic flows but serves a large volume of goods vehicle traffic. Most of the proposed access roads have lower volumes of traffic with a smaller proportion of light vehicles. On these roads the predominance of slow moving vehicles and heavy vehicles results in very slow travel speeds.

### Figure 8-26Typical railway underpass

### 8.15.3.2 Road capacity

The nature of the road network along the route has a considerable bearing on the ability of the roads to handle volumes of traffic. The following observations were identified as affecting the capacity of the local road system:

- A large proportion of roads are not metalled
- There is a lack of street lighting in most areas, and it is limited in urban areas
- Poor signage is typical
- A lack of road markings is typical
- Extensive use is made of single track roads
- Poorly maintained road surfaces and road drainage systems are common
- There is a lack of crash barriers and other safety infrastructure
- Direct frontage of commercial activities onto the roads is common
- Fixed infrastructure (bridges, underpasses and level crossings) are poorly maintained

Only direct observation can identify the maximum traffic capacities of the roads but as an approximation the following hourly two-way traffic flows are appropriate:

- For the main road, which has a reasonably well maintained road surface and is of adequate width 1500 vehicles per hour
- For unmetalled access routes that allow two-way operation of traffic 1,000 vehicles per hour
- For access roads with passing spaces at least every 100m 500 vehicles per hour

• For access roads with passing spaces less frequently - 250 vehicles per hour

Key data were analysed, and the results are shown in full in Part 4 of the Baseline Reports Appendix. Table 8-15 provides information on the 10 busiest and 10 quietest survey locations, to give an indication of figures encountered.

Site and road type	Average daily flow Flow composition (%) Maximum f			Maximum flow	
	(Vehicles)	Slow	Light	Heavy	Vehicle/hour
1 Main	2524	0	77	23	434
4 Access	2408	1	69	29	300
7 Access	47	32	45	23	8
14 Access	44	70	30	0	9
15 Access	44	31	66	4	11
16 Access	2872	12	77	10	746
A28 Access	11	82	0	18	3
A29 Access	20	70	30	0	6
A47&A49 Access E	2857	8	77	15	189
A47&A49 Access W	2557	6	79	15	193
A50 Access (Ganja)	6273	37	58	5	480
A50 Main (Ganja)	4793	8	83	9	497
A51 Access SW	2061	13	77	10	217
A64 Main	2677	14	78	8	280
A70 Access	31	11	81	8	7
A71 Access	39	14	71	15	14
A72 Access	68	7	86	7	10
A76 Access	18	10	77	14	7
A76 Main	29	1	94	6	8
Ganja Main Road	1829	3	88	9	272

## 8.15.4 Key issues

### 8.15.4.1

Key issues relating to traffic conditions in the context of the proposed pipeline are as follows:

- The road network in Azerbaijan is generally poorly maintained, with poor signage, limited lighting and other safety infrastructure
- In some towns and villages, buildings front directly onto the road and street vendors occupy areas of pavement and road
- In rural areas many slow moving road users are encountered such as donkey carts and livestock herds
- Many underpasses beneath the Baku-Tbilisi railway line have limited headroom (Figure 8-26)
- There are several pinch points near the pipeline route including the roundabout in the centre of Kurdemir, sharp bends in streets in the centre of Kazi-Magomed and an underbridge in Randjbar

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# 9 SOCIO-ECONOMIC BASELINE

## 9.1 INTRODUCTION

This Section provides an introduction to the demographic, social and economic characteristics of the study area within the national context. This baseline will be used to assess the socioeconomic impacts of the project and to compare the effectiveness of the mitigation measures in the future. It provides an overview of the key socio-economic indicators along the pipeline corridor in Azerbaijan, as well as a review of attitudes and expectations, focusing on data from the communities that lie along the route of the proposed pipeline. It also includes an analysis of data relating to communities that are in proximity to a potential camp for construction workers, or a storage yard for equipment.

The information presented has been collated through a series of extensive social surveys conducted by a team of international and national consultants using standard questionnaires, methodologies and tools. Details of this consultation process are presented in Section 16, Consultations. Much of the quantitative information has been sourced through structured interviews with the heads of communities and community representatives in each administrative district of the Azerbaijan BTC/SCP pipelines corridor. Much of the qualitative data have been obtained through interviews with individual households or land users in communities likely to be directly influenced by the pipelines or associated developments. A total of 73 interviews were conducted with community leaders and 814 interviews with responses to around 40,000 questions and a summary of its analysis is presented.

This section is divided into the following sub-sections:

- Background
- Socio-economic baseline
- Project attitudes and perceptions

## 9.1.1 National context

### 9.1.1.1 Nagorno-Karabakh conflict

Since the beginning of 1988 a conflict has been enduring between Azerbaijan and Armenia over the disputed area of Nagorno-Karabakh. This conflict has resulted in a considerable refugee crisis, with the number of displaced persons exceeding one million. Although a ceasefire has been in place since 1994, no formal peace agreement has been reached and the situation continues to cause great damage to the country's economic, political and social structure.

### 9.1.1.2 Oil industry

Since the mid-19th century oil has played an important part in the country's development and its considerable energy resources will play a vital role in its long-term prospects. Production from the Caspian oil and gas fields declined for several years after the collapse of the Soviet

Union, though it has made a considerable recovery in the last few years. This is due partly to the 17 production sharing agreements (PSAs) signed with foreign multinationals that have committed extensive funds to oil field development. These funds are expected to assist future industrial development.

## 9.1.1.3 The economy

Since independence from the Soviet Union in 1991, transition towards a market economy has been slow:

- Gross domestic product (GDP) dropped by 55% in the 1991-1997 period
- The country has only recently begun making progress on economic reform, with old economic ties and structures slowly being replaced
- The conflict with Armenia over Nagorno-Karabakh has impeded economic development, acting as a disincentive to foreign investment
- The economy is hampered by corrupt practices at all levels of administration. President Aliyev has acknowledged the situation, attributing to "corruption and embezzlement" a fuel shortage in January 2000 which caused major electricity cuts across the country and forced Azerbaijan to import oil from Turkmenistan
- There is a considerable underground economy. The World Bank has estimated that 'unofficial' economic activity accounts for half of Azerbaijan's overall economy

However, with the advent of foreign investment in the oil and gas sector from 1997 onwards, GDP rose by almost 10% in 1998 and such rates of growth have been maintained. In 1999, GDP per capita was US\$508.3. Foreign investment in 2000 was US\$500 million (12% of GDP). Inflation was around 3% in 2001. Among the major foreign investors in Azerbaijan's enterprises are Turkey (providing 32% of total investment), UK (22%), USA (14%), and France (12%). In parallel with this major foreign investment, Azerbaijan has been attempting to re-focus its trading relationships away from Russia and the former Soviet Republics and towards Europe, Turkey, Iran and the UAE.

The economy is heavily dependent on its oil and gas sector. A serious long-term challenge remains in ensuring the competitiveness of non-oil exports in world markets.

The country's labour force was 2.9 million in 1997 with 15% in industry and construction, 32% in agriculture and 53% in services (48% of these being in the state sector). 60% of the population is estimated to be living below the poverty line.

### 9.1.1.4 Agriculture

Agriculture remains an important sector of the economy in Azerbaijan contributing to 20% of GDP, employing 32% of the labour force and providing a livelihood to about half the country's population (Official statistics, 1999). The make up of agricultural production has been stable since 1995 comprising 59% crop-based farming and 41% livestock production. In 1999, national production output increased for cereals, potatoes, other vegetables, watermelons, fruits, teas and livestock (including dairy produce). Output fell in the production of grapes and cotton<sup>1</sup>.

Major agricultural cash crops are grapes, cotton, tobacco, citrus fruits and vegetables. The first three crops account for over half of all production, and the last two together account for an additional 30%. Livestock, dairy products and wine and spirits are also important farm products.

In the early 1990s, Azerbaijan's agricultural sector required substantial restructuring:

- prices for agricultural products did not rise as fast as the cost of inputs
- the Soviet-era collective farm system discouraged private initiative
- equipment in general, and the irrigation system in particular, were outdated
- modern technology had not been introduced widely and the administration of agricultural programmes was ineffective

The privatization process in the agricultural sector began in 1996 and has progressed rapidly. Price controls for agricultural products have been eliminated and trade has been liberalized. The system of state and collective farms has been dismantled, and a wide variety of smallholder farming structures have emerged ranging from small family farms to medium-sized companies.

However, the country's primary sector is still far from competitive and many of the food products consumed in Azerbaijan are imported. Furthermore, land productivity was significantly damaged by extensive and uncontrolled use of pesticides and fertilizers during the Soviet period. This has led to severe erosion and salination of soils and chemical contamination of land.

### 9.1.1.5 Industry

In 1991 the food industry contributed the largest share of Azerbaijan's industrial output, followed by light industry (defined to include synthetic and natural textiles, leather goods, carpets and furniture), fuels, and machine building. Significant food processing and cotton textile operations are located in Ganja in western Azerbaijan, and petrochemical-based industries are clustered near Baku.

Industrial production in Azerbaijan has collapsed to less than one-third of its 1991 level and the composition of industrial output has changed greatly. According to the Statistical Yearbook of Azerbaijan 1999, the production of energy – including fuel and electricity –

<sup>1</sup>Azerbaijan Human Development Report, UNDP 2000.

declined much less significantly than production in any other industrial sub-sector, causing a substantial increase in the share of industrial output that arises from energy production (from 16% in 1990 to 68% in 1998). The fuel industry alone has accounted for more than half of the total value of industrial production for the past three years. At the same time, all other industrial output has continued to decline. For instance, light and machinery industries each accounted for nearly 20% of industrial production in 1990 but now represent only 2.5 and 3.3% respectively.

## 9.1.2 Administrative structure

The Head of State of the Republic of Azerbaijan is President Heydar Aliyev.

The Republic of Azerbaijan is a secular democracy with the Government based on the separation of powers between three branches:

- Legislative power (the Milli Mejlis of the Republic Parliament)
- Executive power (the President of the Republic)
- Judicial power (Courts of the Republic)

The country is divided into 78 semi-autonomous administrative districts, 65 of which are rural and 13 urban. There are a total of 69 towns and cities.

The Constitution, adopted by National Referendum in 1995, provides for the separation of powers between central and local authorities. It mandates the creation of the municipal bodies as a locally elected third tier of government. These municipal bodies have authority over local taxation and budget, the possession and use of municipal property and local programmes for social protection, economic development and environmental protection. There are generally several municipalities within each administrative district.

The last Presidential elections were held in 1998 and parliamentary elections in 2000. Municipal elections were held in December 1999.

At the village level there is a locally elected municipal representative as well as a representative of the executive power (who is not elected). There is also usually a village council in each community, which reports to the Head of the Executive Committee of the administrative district.

## 9.1.3 The survey area

In Azerbaijan the proposed pipeline route crosses a total of 12 administrative districts, of which 11 have affected communities. Within these districts, a total of 83 communities have been identified as being located within (or partly encroach into) a 4km corridor centred on the route, or are close to a potential construction camp or pipe yard. These are considered by the project as pipeline-affected communities. A summary of information on these communities can be found in Appendix Volume 2 part 11. In addition villages within 100m of an access road to the ROW will also be considered as pipeline-affected communities. The latter will be identified when the information is available. Mitigation measures in Section 11. Socio-Economic Impacts and Mitigation, have been designed to minimise the impacts on these pipeline-affected communities.

BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA

Approximate KP Point	Districts
0-8	Garadag (not included in the baseline
	survey)
9-40	Absheron (not included in the baseline
	survey)
41-95	Hadgiqabul
96-140	Kurdemir
141-195	Ujar
196-215	Agdash
216-250	Yevlakh
251-292	Geranboy
293-320	Samukh
321-360	Shamkir
361-385	Tovuz
386-442	Akstafa

Table 9-1: Administration districts and population

Due to changes in the pipeline route and decisions that have yet to be made in terms of access road locations, in addition to identification of land ownership, the communities surveyed during the compilation of baseline information, do not correlate exactly with the communities defined as directly affected. 71 (or about 90%) of the communities located within the 4km corridor are however included in the baseline survey. A list of these can be found in Appendix Volume 2 part 11. The methodology for how these surveys were conducted can be found in Section 7, ESIA Methodology. Additional testing of mitigation measures and the collection of basic information from any remaining communities will be conducted during the disclosure phase.

The districts of Garadag (where household interviews were conducted to ascertain perceptions about a pipe yard near the community of Sangachal), Absheron, and Ganja (where household interviews were conducted to ascertain perceptions about a construction camp and a pipe yard close to the city of Ganja) have also not been included within the overall baseline analysis. In the case of Ganja this is because the corridor does not pass through the district. Garadag is not included in the analysis because it is included within the assessment of BP's upstream oil development activities. Absheron is not included in the analysis as there are no communities within 2km of the pipeline route. This means that survey data cover 10 districts instead of the 12 through which the pipeline passes. However, data from both Ganja and Garadag district are included in the analysis of information and development of mitigation measures that specifically relate to the management of yards and camps.

Within the corridor the majority of locations visited are villages, however there are also several towns and 'large' villages with a population of over 5,000 as well as migratory communities such as herders. The large towns include Kazi-Magomed (KP51-55), Aran (KP242-244), Yevlakh (KP 225-235), Ujar (KP172-178) and Kurdemir (KP128-132). For simplicity, all of the locations visited are referred to as communities throughout this report.

Figure 9-1 shows the pipeline route, as well as population centres within the study area.



Figure 9-1: Administration districts and population

#### 9.2 POPULATION DISTRIBUTION AND DEMOGRAPHICS

#### 9.2.1 Population and migration

According to official statistics (1 January, 1999) the total population of Azerbaijan is 7,949,300 of which 52% reside in urban areas and 48% in rural areas. The continuing occupation of one-fifth of the territory of Azerbaijan by Armenia has left the country with over one million Internally Displaced Persons (IDPs) and refugees. These people are dispersed throughout the country with just under half of them in rural areas. The Republic also includes the Nakhchivan Autonomous Republic (population 354,000 people), separated from the rest of the country by the territory of Armenia.

The total population of all the communities surveyed along the BTC/SCP pipeline route is 257,223, of whom just over 96% are permanent residents, 0.3% temporary residents, and 3.3% IDPs and refugees (see Figure 9-2). The total population of all the communities in the wider survey area (which includes settlements close to pipe yards and construction camps) is 593,016 (this difference is mainly due to the inclusion of Azerbaijan's  $2^d$  largest city – Ganja).

Refugees and IDPs are found predominantly in the districts of Yevlakh (49%), Kurdemir (17%) and Shamkir (12%). 58% of the total number of temporary residents in the corridor (ie, 300 people) are in the Shamkir district in Western Azerbaijan (see Figure 9-2).



Figure 9-2 District population structure

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The average size of villages has increased over the past decade largely due to in-migration. In addition to IDPs and refugees, the displaced population in Azerbaijan includes nearly 50,000 Meskhetian Turks<sup>2</sup>. Most of these refugees came to Azerbaijan in the early 1990s to escape ethnic conflict in Uzbekistan.

According to Government statistics about one-quarter of the total number of IDPs and refugees live with friends and relatives, while the remainder live in tent camps, public buildings (such as schools), partially constructed buildings, tourist and health facilities, railway wagons and other temporary settlements in existing Azeri villages.

"Young people move to Russia to get jobs as there are no employment opportunities in the village". (Agdash District, Amirarh Village)

"It is hard to find work in the village. There is no work. Many young people have left to find work in Russia. Some stay there only temporarily but others reside permanently." (Shamkir region, Dallyar Djeir Village)

"Even though quite a few people left the village because of no water and gas supply, the population still has grown." (Agdash District, Hanitlu village)

## 9.2.2 Gender distribution

Gender issues are very important indicators of human development, in relation to employment opportunities. The female population slightly exceeds the male population in communities along the pipeline route. This is caused by the fact that, in many communities, men have migrated to Russia or Baku to look for employment.

Figure 9-3 depicts gender distribution for each district along the corridor. This is representative of the national average.

<sup>2</sup> See Footnote 4.



Figure 9-3 Gender distribution in each district in the surveyed area

In Azerbaijan, women and men possess equal rights and liberties under the constitution. The country's labour law also explicitly prohibits wage discrimination on the basis of gender.

Nevertheless, while gender disparities are minimal in health and education, current wage and employment profiles show women to be at a clear disadvantage<sup>3</sup>. Gender inequalities persist with regard to economic empowerment. Women's employment is concentrated in lower-paying sectors of the economy and women are poorly represented at the higher levels of management, even in sectors that employ predominantly women. For example, women account for more than two-thirds of employment in health, education and cultural work where remuneration levels are particularly low. However, they represent only about 35% of the heads of clinics and polyclinics and less than 20% of management in the education system. The average wages paid to women are lower than those paid to men in all sectors. Unemployment is likely to be a particular issue among women. Government statistics show that women accounted for about 60% of the registered unemployed throughout the 1990s<sup>3</sup>.

## 9.2.3 Age distribution

Figure 9-4 shows the age distribution of the population. The age distribution of the male and female population is very similar, and has been combined. The data are based on statistics and verbal information from government officials at the district centres and from the heads of 58 communities out of the 74 community leaders interviewed. The survey team was unable to obtain population distribution data for the remaining 16 communities. Partial data only are therefore presented for the following districts: Ujar (77%), Yevlakh (57%), Geranboy (54%)

<sup>3</sup>Azerbaijan State Statistics Committee, Women and Men in Azerbaijan, 1999.

and Shamkir (64%). Consequently, although the distributions in Figure 94 are illustrative of each district, the absolute numbers of population for these four districts are incorrect.

Working age is taken to be from 19 to 59. Figure 94 demonstrates that the working age group is the largest age group in all districts.



Figure 9-4 Age distribution of population by district

## 9.2.4 Religion and ethnicity

Azerbaijan has a very homogeneous religious and ethnic society. 99.5% of the population are Muslims and 0.5% are either Orthodox Christian or Jewish. 91% of the population are of Azeri origin. Table 9-2 shows the total numbers of minority groups in Azerbaijan<sup>4</sup>.

Ethnic Origins	Population
Lazs	178,000
Russians	142,000
Armenians	121,000
Talish	77,000
Avars	51,000
Turkish	43,000
Tatarian	30,000
Ukrainians	29,000
Sakhur	16,000
Georgians	15,000
Kurds	13,000
Tats	11,000
Jews	9,000

Table 9-2 Total numbers of minority groups

<sup>4</sup> This table has been sourced from official statistics, however it does not mention the presence of Meskhetian Turks. Other sources suggest there are up to 55,000 Meskhetian Turks refugees in Azerbaijan and fieldwork suggests that approximately 50% of the community of Sary Tepe (community population 510) are Meskhetian Turk..

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Udins	4,000

Table 9-3 shows where the small ethnic and religious minority communities are located along the BTC route. The largest non-Azeri populations are found in Yevlakh district although this is representative of the larger relative population of the district. Azeri citizens have been granted the right within the Constitution to practice any religion freely.

District	Ethnic structure			Religious structure		
	Azeri	Russian	Other	Muslim	Christian	Other
Hadgiqabul	29443	350	104	29547	350	0
Kurdemir	22356	21	5	21266	20	0
Ujar	41471	343	1	41486	342	0
Agdash	8395	10	1	8395	11	0
Yevlakh	57530	224	798	58239	310	27
Geranboy	13707	10	7	17166	14	0
Samukh	2741	1	249	2854	2	0
Shamkir	39831	65	484	40340	68	3
Tovuz	2774	0	0	2774	0	
Akstafa	9509	27	97	9770	89	0

Table 9-3 Ethnicity and religion along the route

## 9.2.5 Public health

A lack of attention to the health sector has resulted in deteriorating medical buildings and equipment, and the near collapse of emergency services and primary care in most rural areas<sup>5</sup>. The quality of health care in Azerbaijan is also hindered by a complex, hierarchical and inefficient network of medical structures within the public sector, for which funding has been decreasing over the last 10 years. Access to health care is no longer free or universal. Almost 95% of medicine, medical equipment and supplies are now provided through international humanitarian assistance. The weakness in the public health system and the persistence of poor standards of living are reflected in the poor health status of the population. Rural communities have suffered the biggest decline in health care standards.

Additional factors impacting the poor health status of communities include:

- local industry and the associated industrial discharges and municipal sewage
- the absence of central sewage collection and treatment facilities in most communities
- high precipitation, which causes the contamination of surface and groundwater bodies by sewage, domestic and industrial wastes. This is a particular problem in the area between Kazi-Magomed and Yevlakh, where cases of malaria and anthrax were reported in 1996

<sup>5</sup> Two published sources have provided much of the national level data in this section: Dr Vladimir Verbitski, WHO Regional Office for Europe in Azerbaijan. and Dr Richard Zalesky, Head of the Chair of Tuberculosis of the Latvian Medical Academy. Article published in Azerbaijan International (3.4) Winter 1995; and Dr Irada Yusifli, The Return of Infections and Contagious Diseases, published in Azerbaijan International, (3.4) Winter 1995. Average life expectancy at birth in Azerbaijan is 71.6 years (75.1 years for women and 68.1 years for men).

The infant mortality rate is 16.5 per 1,000 live births. This figure does not seem extraordinarily high by international standards. However, Azerbaijan's official definition of live births excludes many infants who die in the first seven days of life, resulting in an infant mortality rate that is 25-30% lower than the level that would be found if the World Health Organization's (WHO) definition of live births were used. In addition, deaths following home deliveries are less likely to be reported and many deliveries now take place at home.

The leading causes of mortality in Azerbaijan are (1) cardiovascular disease, (2) cancer and other tumours, (3) respiratory infections, and (4) traumas and poisonings<sup>6</sup>. Alcoholism, smoking, environmental contamination, diet and lifestyle are also serious health concerns. Diarrhoea is highly prevalent among children, particularly children of the displaced, and the past decade has seen major outbreaks of measles and diphtheria. Inadequate shelter and a shortage of anti-malarial drugs and insecticides necessary for malaria control have allowed a resurgence of malaria in some districts. Insufficient supplies of anti-thyroid drugs and iodination have led to a high incidence of iodine deficiency disorder, which is associated with goiter and mental retardation<sup>7</sup>. 18 community leaders (24% of the total) mentioned psychological stress as one of the key causes of health deterioration. Eight of these leaders were in the Ujar district.

Additionally, the incidence of communicable diseases is increasing despite having been successfully reduced during Soviet times. In particular cases of diphtheria, tuberculosis, hepatitis A, diarrhoea and acute respiratory infections are all important public health problems.

### 9.2.5.1 Malaria

The most common form of malaria in Azerbaijan is vivax malaria, which is responsible for milder disease forms (ie, is not commonly lethal).

Twenty years ago malaria was virtually eradicated from Azerbaijan. However, there was an alarming upsurge in cases during the mid-1990s. This was reversed through the efforts of a public-private partnership brokered in 1998 by the Roll Back Malaria global partnership.

### 9.2.5.2 Anthrax

Anthrax occurrences in humans in Azerbaijan between 1992 and 1996 are indicated in Table 8-4. The disease is treatable with antibiotics, but these must be started early in the infection. If anthrax remains untreated it can be fatal. There have been reports of anthrax affecting areas of the BTC pipeline route in Azerbaijan in 2000/2001, however, no further information is currently available on these outbreaks.

<sup>6</sup> http:://www.icrc.org

<sup>&</sup>lt;sup>7</sup>Azerbaijan Human Development Report, UNDP 2000.

Year	Number of cases of human anthrax
1992	33
1993	55
1994	50
1995	45
1996	76

Table 9-4 Anthrax cases in Azerbaijan

### 9.2.5.3 Cholera

In recent years, there have been a number of recorded outbreaks of cholera in the Former Soviet Union (FSU), including the north Caucasus area.

### 9.2.5.4 AIDs/STDs

HIV/AIDS and STD incidences are increasing in Azerbaijan with only seven cases registered between 1987 and 1992, but 164 HIV cases confirmed by January 2000<sup>8</sup>. The real statistics are likely to be much higher as many cases go unreported. Baku has an HIV/AIDS Resource Centre.

## 9.3 LIVELIHOODS

The income level of most Azeri households remains low, though several indicators suggest that real household incomes have increased in recent years. In 1999 and 2000, salary increases in some sectors have led to an increase of 16.4% in real incomes. In 2000, the average income was 203,400 manats per month<sup>9</sup> (US\$46). In rural communities, household incomes are considerably lower than the national average. Rural salaries tend to be 20-30% higher where cattle breeding has developed, compared with areas engaged primarily in cultivation activities<sup>7</sup>. The main types of household expenditure are shown in Figure 9-5.

The value of pensions varies according to the recipient's work experience. In addition, pensions are higher for women who have many children or disabled children. Currently the minimum pension is 70,000 manats<sup>10</sup> per month (about US\$14.50).

<sup>8</sup> Field Report, Joint UN Project to prevent STDs and HIV/AIDS in Azerbaijan, March 2000.

9 Azerbaijan Human Development Report, 2000

<sup>10</sup> Azerbaijan's President Order, 26 December 2001



Figure 9-5 Main items of household expenditure in the surveyed area

Changes in household consumption patterns during the 1990s reveal that standards of living have fallen. Also, these changes reveal that households have concentrated their expenditure on food products, as prices have risen, and reduced their purchasing power. The ability to pay for other goods and services – such as medical care, education, clothing and recreation – fell sharply after the transition from communism began. According to national government statistics, households spent less than half of their incomes on food products in 1990 but have spent nearly 70% on food every year since 1994<sup>11</sup>.

## 9.3.1 Employment

National average unemployment was estimated to be around 25% in 2000, and up to 50% in some districts. The problem of unemployment is particularly serious for those aged between 18-30, as well as for IDPs and refugees. With such a high proportion of the population seeking work, wage levels remain low and working conditions are extremely poor<sup>12</sup>.

Substantial labour migration to Russia has been observed in recent years. Data on numbers of migrant workers were collected from communities along the pipeline corridor, and are shown in Table 95. The total number of migrant workers along the corridor is 8,803 people. The largest proportion of people leaving in search of employment was from the Yevlakh district (2,530 people; 29% of the total number of migrant workers along the route).

<sup>11</sup> Azerbaijan Economic Trends, March 1999

<sup>12</sup> Azerbaijan Human Development Report, UNDP 2000

District	Number of migrant workers		
Hadgiqabul	530		
Kurdemir	480		
Ujar	1550		
Agdash	272		
Yevlakh	2530		
Geranboy	650		
Samukh	161		
Shamkir	2085		
Tovuz	150		
Akstafa	395		

Table 9-5 Total numbers of migrant male workers, by district

All communities surveyed stated that they had members who would be available for temporary work. This demonstrates that large numbers of working-age people are actively searching for work along the pipeline corridor. People with useful skills (engineers, drivers, welders, etc) were reported to exist in every community. Communities close to potential construction camps also reported the availability of workers skilled in catering, laundry, cleaning, food production, etc.

## 9.3.2 Source of livelihoods

According to the data obtained from government officials in the district centres and towns, crops and animal husbandry are the main sources of cash income along the pipeline corridor. This income is supported by the following secondary sources:

- State budget, e.g, teachers, doctors, government administration and other state sector jobs
- Material aid provided by international NGOs and the State to IDPs and refugees
- Social transfers state pensions, benefits, etc
- Hunting, fishing and gathering
- Trade including local shops and businesses (70% of communities have at least one shop or market)

Table 9-6 presents data on income sources in each district, as reported by community leaders.

Table 9-6 Income sources by district

District	Approx KP	Main sources of income	Secondary source of income	
Hadgiqabul	ladgiqabul 41-95 Animal husbandry		Crops	
		Industry		
			Trade	
			State budget	
			Material aid	
			Social benefits	
			Humanitarian aid	
Kurdemir	96-140	Crops	Trade	
		Animal husbandry	State budget	
			Material aid	
			Social benefits	
Llior	141 105	Crops	Trada	
Ujai	141-195	Animal husbandry	State budget	
		Hunting fishing gathoring	Material aid	
		riunung, iisning, gamening		
			Humanitarian aid	
Aadaab	106 215	Cropp	Trada	
Aguash	190-215	Animal hughandry	State budget	
		Animal nusbandry	State Duuget Motorial aid	
		Hunting, lisning, gathering		
Mandalda	040.050	0		
reviakn	216-250		Industry	
		Animai nusbandry		
			State budget	
			Social benefits	
<u> </u>			Humanitarian aid	
Geranboy	251-292	Crops	Irade	
		Animal husbandry	State budget	
			Material aid	
			Social benefits	
			Humanitarian aid	
Samukh	293-320	Crops	Trade	
		Animal husbandry	State budget	
			Material aid	
			Social benefits	
			Humanitarian aid	
Shamkir	321-360	Crops	Industry	
		Animal husbandry	Trade	
		Hunting, fishing, gathering	State budget	
			Material aid	
			Social benefits	
			Humanitarian aid	
Tovuz	361-385	Crops	Industry	
		Animal husbandry	Trade	
		Hunting, fishing, gathering	State budget	
		Social benefits	Material aid	
Akstafa	386-442	Crops	Industry	
		Animal husbandry	Trade	
		Hunting, fishing, gathering	State budget	
		Social benefits	Material aid	
			Humanitarian aid	

The data presented in the above table are not fully supported by the results of interviews with individual householders (Figure 9-6). Householders report that the main income source derives from state allowances/pensions or jobs taken outside of the district (generally in Russia or Baku by male members of the family).



Figure 9-6 Main source of income reported by individual households in the surveyed area

## 9.3.3 Agricultural production

Data obtained from government officials show that in nine of the districts along the pipeline corridor, vegetable cultivation is the largest component of all agricultural production. The exception is Samukh district, where the population is primarily engaged in animal husbandry and growing grapes and grain. Some communities also have beehives, however these are maintained for personal consumption and occasional sales rather than as a source of livelihood.

Overall, 86% of the total number of communities is engaged in vegetable cultivation, 57% in growing grain and almost all of them in small amounts of animal husbandry. Most households will have one or two cows and a small number of sheep and poultry for subsistence purposes (wool, milk and meat). In general there is one fruit harvest per year, however in the central districts, there can be two crops grown each year. The first is generally a food production crop and the second is winter animal feed (hay). In other areas there is only one harvest per season. Modern farm machinery tends to be owned by one of the wealthier landowners in the area and is rented out to other farmers as needed (or afforded). Farming machinery in general does not reach deeper than 20cm.

A significant portion of Azerbaijan's fruit output is destined for export to Russia, particularly pomegranates, watermelon and quince. Communities will often pool their produce to be taken to Russia as one load. Alternatively, larger landowners will make trips to Russia to sell their produce on their own.

Structural bottlenecks continue to impede agricultural productivity. Private landholders do not have good access to the inputs, services and know-how that would maximise their output. Most important among these are the lack of rural financing, the poor condition and management of the irrigation system and the absence of extension and support services. The Government recognizes many of these problems and a Presidential Decree on Measures to Accelerate the Reforms in the Agricultural Sector has been issued to rectify them (March 1999).

In addition, much of the agricultural land is located far from people's homes and there is little transport available to communities to reach distant land plots.

"Our concern is that if the pipeline goes through our farmland it might decrease the available arable area..." (Agdash District, Amirarh Village)

"One can grow everything here from wheat to cotton, but there is no money for that. There is no money for livestock breeding either." (Ujar District, Anver Memmedhanly)

"Villagers don't grow anything on the farmland because there is no water. All they grow is fruit in backyard gardens." (Kurdemir District, Chokhranly Village)

"There is not enough water to farm the land. People only have enough to grow vegetables in their backyard plots." (Shamkir Region, Dallyar Dashbulak Village)

## 9.3.4 Seasonal grazing

During the winter season, municipal and state land is frequently used by migratory sheep herders as winter grazing grounds. In summer, these herds are moved to the more mountainous northern districts of Azerbaijan where the traditional homes of the herders are located. From October to December herds are moved to lower pastureland across the central corridor area of Azerbaijan, along the pipeline route. The herds are driven north again from mid-May to July. One thousand sheep plots are allocated each year to herder groups. Herders work within a hierarchy often based on family relationships. They maintain communication with each other using mobile phones.

While there are official migratory routes, other informal routes are also established each year. These will track along rivers, access roads, etc, as necessary to reach preferred grazing areas. The pipeline route frequently crosses potential herders' grazing areas.
Communities on Pipeline	Number of Grazing	Estimated Number of
Route	Grounds (approx)	Sheep
Hadgiqabul including	100	180,000
Randjbar		
Qarasu		
Mugan		
Padar		
Kurdemir, including	30	30,000
Sigirly		
Ujar, including	7	10,000
Alpout		
Agdash	13	10,000
None of communities along		
corridor appear directly		
involved		
Yevlakh	50	50,000
None of communities along		
corridor appear directly		
involved		
Geranboy, including	22	90,000
Jinli Boluslu		
Borsunlu		
Samukh	82	60,000
Specific communities not		
known		
Shamkir	11	100,000
Specific communities not		
known		
Tovuz	14	117,000
None of communities along		
corridor appear directly		
involved		
Akstafa	29	225,000
None of communities along		
corridor appear directly		
involved		

Table 9-7	Communities	along the <b>H</b>	<b>ROW</b> where	winter grazir	g is carried out
	000000000000000000000000000000000000000	mong me -		The second second	5

#### 9.3.5 Land ownership

The privatization process in the agricultural sector began in late 1996 and has progressed rapidly. Some state and co-operative farms are still in operation in Azerbaijan, with little actual difference between the rights and privileges of state and co-operative holdings. However, many of the collectives and state-owned farms have been privatized under the 1996 'Law on Land Reform', and about 36,000 small farms were estimated to be in private hands at the beginning of 2000 <sup>13</sup>.

Across the surveyed districts, the share of land that is privately owned ranges widely. Table 9-8 presents data on the variations of land ownership across the districts obtained by the BP

<sup>13</sup> Azerbaijan Human Development Report UNDP 2000

lands team. The lands team has also compiled a list of potentially vulnerable landowners which includes female-headed households, elderly landowners, IDPs/refugees and invalid or disabled land owners.

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DISTRICT	STATE %	MUNICIPAL %	<b>PRIVATE %</b>
Hadgiqabul	67	23	10
Kurdemir	12	23	65
Ujar	5	50	45
Agdash	10	41	49
Yevlakh	7	33	60
Geranboy	3	24	73
Samukh	4	18	78
Shamkir	2	24	74
Tovuz	4	14	82
Akstafa	37	20	43

#### Table 9-8 Land ownership by district

Azerbaijan's land reform and privatization programme failed to take into consideration the distribution of machinery and maintenance of irrigation channels, and these networks have fallen into the hands of individuals who now charge high prices for their usage.

Irrigation is essential for much of the land along the pipeline route. Many farmers living within the pipeline corridor can no longer afford to pay for irrigation and therefore have difficulties working their land. Instead, they are renting their land out to richer farmers who have access to machinery and water. Other farmers are not interested in cultivating their land because of poor soil quality. They prefer to raise poultry (ducks, turkeys or geese) and if possible, cattle and sheep, since grazing does not require the high maintenance of crops. Farmers along the route can therefore be divided into the following groups in accordance with their land use priorities:

- people using their land:
  - for their own needs only
  - as their main source of income
- people who don't use their land:
  - for economic reasons, ie, they can't afford it
  - because they lack agricultural skills
  - because they received land plots with bad soil during the land allocation process

While 95% of people interviewed have their own land only 50% use this for cultivation, and 17% do not use their land at all (due to water shortage, lack of good facilities or other reasons - see Figure 9-7).

Figure 9-7 Land use in the surveyed area



# 9.3.6 Industrial, commercial and public sector employers in the communities

There are a number of industrial facilities located along the pipeline corridor as follows:

- Kurdemir cotton refinery plant
- Ujar cannery plant, cotton refinery plant and concrete manufacturing plant
- Agdash cotton refinery plant and plastic materials factory
- Yevlakh grain processing factory, tobacco factory, cotton refinery plant, wool factory and tractors repair plant
- Shamkir winery plant

Generally, these facilities are either non- or semi-operational and 80% of all respondents stated that there were no industrial facilities in their community. Other commercial ventures in the communities surveyed are shops, hairdressers, cafes, shoe-repair workshops, furniture workshops, etc. See Figure 9-8 and Table 9-9 for a breakdown by district.

Public sector employers in the communities include health facilities (present in 43% of the surveyed communities) and post offices (present in 32% of the surveyed communities).



Figure 9-8 Total numbers of commercial employers in the surveyed area

Table 9-9 Numbers of commercial facilities in impacted communities, by district

District	Approx KP	Cafe	Petrol station	Shop	Hairdresser	Other
Hadgiqabul	41-95	3	2	4	5	2
Kurdemir	96-140	3	3	4	3	5
Ujar	141-195	8	2	10	6	9
Agdash	196-215	1	C	5	0	4
Yevlakh	216-250	7	1	6	5	5
Geranboy	251-292	5	1	5	8	8
Samuh	293-320	2	C	2	2	3
Shamkir	321-360	7	4	7	7	8
Tovuz	361-385	0	1	1	1	0
Akstafa	386-442	2	2	6	3	2

# 9.4 INFRASTRUCTURE, RESOURCES AND SERVICES

In general, infrastructure and services in the survey area have suffered from poor maintenance and a lack of investment.

### 9.4.1 Energy

Access to energy is poor along the proposed pipeline route in general. This is mainly because of insufficient availability of power, particularly in winter when national demand increases approximately two-fold. However there are other factors as well:

- There is an element of termination/interruption to supply due to non-payment collection rates in rural areas are very low. Reasons for non-payment include:
  - People do not have the money to pay
  - The transition from an expectation of free gas to one of payment for services used is in it's early stages
  - The metering system is obsolete and generally does not allow accurate calculation of individual consumer consumption. This situation is currently changing within the Baku area, and can be expected to gradually extend to rural areas.
- Obsolete power transmission accounts for extensive power losses.
- Lack of efficient management within the payment collection and fuel distribution system hinders both the ability to generate power and make improvenments to the existing power infrastructure.

#### 9.4.1.1 Electricity

Hadgiqabul and Ujar are the only districts where some villagers have a continuous supply of electricity. For 62 communities (84% of communities or 89% of people) electricity is only available for a few hours a day. There is no electricity at all in two communities (Yolpak and Zelimhan villages) of the Geranboy and Akstafa districts respectively. Figure 99 shows electricity availability by district.



Figure 9-9 Numbers of communities and electricity supply, by district

#### 9.4.1.2 Gas

Gas is used for heating and cooking purposes where it is available. Gas supply infrastructure exists in 85% of communities surveyed, though supply for the last few years has been limited and the infrastructure is badly deteriorated. As a result, only four communities (in the Hadgiqabul district) have a permanent supply of gas. 58 communities have no gas supply at all. Figure 9-10 shows the availability of gas by district.

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Figure 9-10 Gas supply by district



65% of people interviewed stated that lack of gas is a problem. In the absence of piped gas, gas canisters are widely used in all districts. 64 communities purchase gas canisters because of their local availability and relative low cost compared to other fuel sources.

"Due to intermittent power supply people sit in the dark at nighttime." (Agdash District, Amirarh Village)

"The biggest problems in the village are unemployment, absence of gas, and limited power supply." (Akstafa District, Ashagy Kesamanly Village)

"There is no gas supply. Villagers cannot afford gas cylinders or firewood. They use brushwood that is picked from nearby trees." (Geranboy District, Eyvazlilar Village)

"Part of the village is sufficiently supplied with gas, the other part is not, some households don't have any gas at all and have to use firewood." (Hadgiqabul District, Randjbar Village)

Approximately 4% of communities stated that they cannot afford the purchase of gas canisters and instead use wood, reeds or cow dung for fuel purposes. Given the minimal number of wooded areas along the corridor, extensive use of wood for heating purposes is not feasible.

Figure 911 shows the purchase of gas canisters by district. Two of the communities with permanent piped gas supply responded that they also purchase canisters for additional uses.

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Figure 9-11 Purchase of gas canisters by district

### 9.4.2 Water

Water resources are scarce in Azerbaijan, and the problem of scarcity is compounded by extremely inefficient water transportation and use. The dilapidated and poorly managed irrigation system is responsible for agricultural water losses of about 50%. In industry the recycling of water is virtually non-existent.

Water quality in many parts of Azerbaijan is also very poor. More than 80% of the population lives in areas without modern water or sewage networks<sup>14</sup>. The Kura and Arax rivers, which provide most of Azerbaijan's fresh water are contaminated with industrial, agricultural and domestic wastes that are generated both inside and outside Azerbaijan. The Caspian, the world's largest inland water body, is also polluted but is vital for economic livelihoods in Azerbaijan because of both its hydrocarbon resources and its biological resources.

73% of communities in the survey area have no communal piped water supply and obtain their water mainly from canals. 16% have continuous piped water supply while 5% have an interrupted supply. The remaining sources are household wells or spring water. Figure 9-12 shows the status of communal water supply by district for the surveyed communities.

<sup>14</sup> Azerbaijan Human Development report, UNDP 1999.



Figure 9-12 Communal water supply by district

Figure 9-13 Water supply sources by district



"People buy potable water. For other purposes they use water from the canal, but there is not enough of it for irrigation. Water use from the canal raises disputes among neighbours." (Agdash District, Amirarh Village) "The major problem of the settlement is the shortage of drinking water. When there is electricity to power the water well pump, people have to stand in queues for hours." (Yevlakh District, Aran Settlement)

"There was a fire in the village two or three years ago and because villagers didn't have enough water to extinguish it several houses burned down." (Geranboy District, Beshirly Village)

"There is almost no economic development potential in the village, even though the farmland is fertile they can't use it due to the lack of irrigation water." (Shamkir region, Dallyar Djeir Village)

#### 9.4.2.1 Agricultural use of water

Because of its arid climate, Azerbaijan has an extensive irrigation network. Over 80% of Azerbaijan's arable lands (which total over 1,000,000ha) are irrigated by more than 40,000km of canals and pipelines. Decreases in agricultural water consumption since independence are not a result of improved resource management, but rather a reflection of the overall decline in agricultural production. Irrigation channels have fallen into disrepair in some communities. This limits the agricultural productivity of some of the land where high levels of soil salinity mean that extensive irrigation is required to make the land productive. As shown in Figure 9-14, the main sources of irrigation waters in the survey area are canals and rivers, followed by use of community artesian wells.





## 9.4.3 Sewerage and waste disposal

#### 9.4.3.1 Sewage

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Only eight communities (11%) and 7% of households/respondents have some kind of communal sewage collection system (see Figure 9-15). 68% of people stated that they do not have any sewerage system but that this did not present a real problem, while 25% responded that the lack of sewerage infrastructure was indeed an issue.





#### 9.4.3.2 Waste disposal

Of the communities surveyed 26 stated that they take their waste and dump it outside of the community, 36 communities stated that they burn it and 17 bury it in the land around their homes. Waste disposal methods by district are shown in Figure 9-16.



Figure 9-16 Waste disposal methods by district

#### 9.4.4 Telecommunications

In 43 of the communities along the corridor, most households have a telephone. 17 of the communities have telephones only at communal points and 12 have no access to telecommunications at all. Household telephones are most common in the districts of Ujar, Geranboy and Shamkir. In the Samukh district, telephones are only found at communal points. Figure 9-17 shows the availability of telecommunications by district.



Figure 9-17 Telecommunications by district

## 9.4.5 Roads

The main Baku to Tbilisi road is in reasonable condition for most of its route, although there are sections of this road that are in need of repair. This road is currently undergoing an upgrade under the Silk Road Project between Alyat and Hadgiqabul (See Section 13, Cumulative Impacts for a brief description of this project). Secondary and tertiary roads are generally in a very poor state of repair. District officials stated that poor roads are one of the main problems for communities in all districts along the pipeline route.

"The roads in the village are in a bad condition, in rainy seasons they get muddy and it's hard to go places." (Agdash District, Amirarh Village)

"Village roads are in a good condition as the municipal chairman funded their repair." (Agdash District, Ashagy Garhun Village)

"Village roads are in a poor condition. In the summer they are dusty and in the winter they are muddy. Students have a hard time getting to school". (Yevlakh District, Aran Settlement)

"Roads are not asphalted, in the winter people have trouble to travel. It is especially hard for school children since they have to walk about 3 km to their school". (Samukh District Ashagy Agasybeyli Village)

As shown in Figure 9-18, 41% of all respondents stated that roads in their communities are in poor condition and not paved, and only 5% said that they are in good condition and paved.

Figure 9-18 Condition of roads in the surveyed area



## 9.4.6 Health and education

#### 9.4.6.1 Health

94% of community leaders highlighted problems with health services. There are 11 polyclinics<sup>15</sup> along the corridor, three of which are in the Kurdemir district. 53 communities (73%) have access to some kind of medical posts. However, many of these have either no or very basic facilities and medicines. All of these facilities require some form of payment. Figure 9-19 shows the percentage of respondents with access to some form of health facility. Access to medical services is hindered by poor roads, resulting in neither patients nor doctors readily being able to travel to other communities to seek/provide services. Therefore, village inhabitants typically use local health services for emergencies and go to district centres in case of serious diseases or conditions.

<sup>15</sup> The term polyclinic refers to a small hospital or clinic with a small number of staff and the capacity to undertake operations, but not large enough to have an ambulance service.



#### Figure 9-19 Availability of health care services in the surveyed area

"There is a secondary school in the village but it is in a bad condition. The classes are held in two shifts there." (Akstafa District, Ashagy Kesamanly Village)

"There is a secondary school in the village. It has problems with power and there is no heating. Students' parents have to pay for school repairs." (Samukh District, Hodjaly Village)

"The village school has been renovated with the money from parents and donations from villagers living in Russia." (Hadgiqabul District, Qarasu Village)

"Healthcare services are of poor quality. For a better medical treatment people have to go to the regional centre." (Ujar District, Taza Shilyan)

There are currently no epidemiological data available for specific communities in Azerbaijan. Information on community level facilities has been obtained from consultation with leaders of communities along the corridor. 41 communities (57%) stated that villagers' health had worsened in recent years, 13 (18%) said that it has improved and the remaining eighteen (25%) believe that villagers' health had remained the same.

#### 9.4.6.2 Education

Azerbaijan inherited from the Soviet Union a strong and comprehensive system of education. The literacy rate for Azerbaijan in 2000 was 97.3% with an average of ten years of schooling per person. As is the case in many countries of the FSU, however, Azerbaijan's educational progress is now jeopardized by funding problems and structural weaknesses within the education system (according to the Azerbaijan Human Development Report, 1999).

All but six of the communities surveyed have at least one school. Seven communities have incomplete secondary schools (only 4 of the 9 grades) and many children have to travel long

distances to complete their secondary education. Almost all of the schools have no heating system and are in a poor state of repair, as well as lacking facilities and books.

No school exists in the following communities:

- Chiyny KP159
- Anver Memmedhanly KP163
- Amirarh KP205
- Agdjaqovak KP217
- Eyvazlilar KP251
- Ashagy Agasybeyli KP293

The Constitution of Azerbaijan guarantees 11 years of free education to all citizens starting from the age of six. In general, education enrolment rates at both primary and secondary levels exceed 90% and there is no significant gender difference. The enrolment figures may disguise actual attendance levels, though. According to a World Bank household survey data, about 10% of enrolled children are absent from school for extended periods (one month or more during an academic year). There are significant district differences in the extent of extended absence. For example, among the very poor 6 to 16 year olds extended absence rates can be as high as 43%.

Figure 9-20 shows the total number of people who have had a higher education (degree or similar) by district, within the pipeline corridor. The highest level is in Ujar, though even here this only represents 0.7% of the district population within the corridor



Figure 9-20 Numbers of people with higher education, by district

#### 9.4.7 Other social services

Figure 921 shows the breakdown of different types of social services available along the route. Of note is the high provision of local government and police posts in nearly all communities. In contrast, very few communities have any fire or sanitation services.



Figure 9-21 Types of social services in the surveyed area

# 9.5 CULTURAL ASPECTS

## 9.5.1 Current information sources

Interviews reveal that all communities generally receive information via television, ensuring that televisions are turned on when electricity is available. 61% of householders reported obtaining information via television

Householders reported using additional information sources:

- 18% via radio
- 10% via newspapers
- 9% via conversations with other people

"People get most of their information from the television, but due to intermittent power supply they cannot watch it much. They also get news and information from local government executives and municipality officials." (Samukh District, Ashagy Agasybeyli Village)

"We wish our local authority representatives would keep us informed." (Kurdemir District, Chokhranly village)

"We are unaware of a possible pipeline construction because we don't have power long enough to watch TV to get info." (Geranboy District, Eyvazlilar Village)

"It is a good idea to distribute the project information leaflets, since we cannot receive much info from television due to power cuts." (Yevlakh District, Narimanabad Village)

"TV is the best source of information, but we cannot watch it often because of interrupted power supply." (Samukh District, Seyidlyar Village)

## 9.5.2 Points of conflict and community problems

In Table 910 the primary and secondary community problems perceived by each district along the corridor are summarized. The question asked was, "What in your opinion are your settlement's three most important problems?".

District	Approx KP	Main problems	Secondary problems
Hadgiqabul	41-95	Inadequate health care	Poor roads
		inducique inigeriori	Poor drinking water supply
			Lack of employment opportunities
Kurdemir	96-140	Poor roads	Inadequate health care
		Poor drinking water supply	Political problems
		Lack of employment	Lack of money
		opportunities	Electricity/gas supply
Ujar	141-195	Lack of employment	Inadequate telecommunication
		opportunities	Inadequate irrigation
		Poor roads	Inadequate health care
		Inadequate schools	Electricity/gas supply
		Poor drinking water supply	
Agdash	196-215	Lack of employment	Inadequate irrigation
		opportunities	Electricity/gas supply
		Poor roads	
		Poor drinking water supply	
Yevlakh	216-250	Electricity/gas supply	Poor drinking water supply
		Poor roads	Lack of money
		Lack of employment	Inadequate irrigation
		opportunities	
Caraabay	254 202		Deer reade
Geranboy	251-292	Electricity/gas supply	Poor roads
		Pool diffiking water supply	madequate telecommunications
		opportunities	

Table 9-10 Primary and secondary problems by district

District	Approx KP	Main problems	Secondary problems
Samukh	293-320	Electricity/gas supply Poor roads Poor drinking water supply Inadequate irrigation Lack of employment opportunities	Inadequate schools Inadequate telecommunications Ethnic conflicts
Shamkir	321-360	Electricity/gas supply Inadequate irrigation Poor drinking water supply Lack of employment opportunities	Inadequate telecommunications Inadequate schools Poor roads
Tovuz	361-385	Poor roads Poor drinking water supply	
Akstafa	386-442	Electricity/gas supply Poor roads Lack of employment opportunities Inadequate health care Inadequate telecommunications Inadequate irrigation	Poor drinking water supply Lack of money

## 9.5.3 Community decision-making structures

71 communities stated that they prefer to solve their problems through community meetings. Most of the communities also ask advice of elderly people (often known as the Aksakal) and will also arrange meetings with municipality representatives and district authorities on some matters.

Problems are voiced to both the local representative of the executive power and to the locally-elected municipal representatives, who generally endeavour to lobby higher levels of government on community concerns. There is very little evidence of a wider active civil society along the route to represent local communities, except for several NGOs based in Ganja.

Most communities are waiting for the government to come and improve the levels of infrastructure, but have not actively mobilized themselves to solve their problems. On the other hand, IDP communities, which have been extensively involved with national and international NGOs, firstly as service providers but subsequently in capacity-building projects, have developed a stronger ability to resolve their own problems, to ensure access to infrastructure, land and resources <sup>16</sup>.

During consultation in the villages, men were frequently found congregating in larger groups outside the home (such as the local teahouse) where community issues were discussed. By contrast, women generally remained indoors with little access to these informal meetings.

<sup>16</sup> Information based on discussions with Oxfam International, December 2001

## 9.6 PROJECT-SPECIFIC ISSUES: ATTITUDES AND PERCEPTIONS

In addition to the overall baseline survey data, this Section draws on an analysis of information on specific attitudes and perceptions relating to construction camps, pipe yards and AGIs. It also analyses information taken from interviews aimed at characterizing any changes in perceptions to an oil pipeline from a gas pipeline, or to two pipelines instead of one. A total of 120 interviews were conducted in respect to camps and yards, with an additional 35 conducted with respect to AGIs. 72 additional interviews were also conducted addressing attitudes to the oil and/or gas pipeline. The latter interviews were conducted in each district across the corridor, in the communities shown in Table 9-11.

District	Community	KP
Hadgiqabul	Qarasu	79
Kurdemir	Karrar	110
Ujar	Taza Shilyan	150
Agdash	Amirarh	205
Yevlakh	Ashagy Garhun	220
Geranboy	Sarov	285
Samukh	Hodjaly	302
Shamkir	Mahmudlu	330
Tovuz	Khatinly	382
Akstafa	Boyuk Kesik	440

Table 9-11 Communities interviewed on oil vs gas project issues

#### 9.6.1 Previous pipeline experience

Nearly 80% of the communities surveyed in the corridor have previous experience of the construction process for either the Azerigaz pipeline or WREP. There have been previous gas explosion incidents near two of the communities along the route: namely Randjbar village (in 1980, Hadgiqabul district) and Jinli Boluslu village (in 1973, Geranboy district). However, both of these incidents occurred well before the construction of the WREP in 1997.

60 of the communities surveyed (80%) are also located within 2km of an existing pipeline (either the Azerigaz pipeline or the WREP). Most of the population along the corridor is therefore aware of safety issues and measures to take in case of emergency.

"There are quite a lot of people with pipeline construction experience in the village. There are engineers, drivers and unskilled workers". (Shamkir Region, Dashbulag Village)

"There are many pipeline construction specialists in the village that are more than happy to start working." (Kurdemir District, Karrar Village)

"WREP construction did not bring any benefits to the village. We suppose that this time it will be the same." (Shankir Region , Talish village)

# 9.6.2 Overall attitudes and perceptions to BTC/SCP project

Approximately half of those interviewed had already heard about the proposed new pipeline construction. However, most did not have much detailed information and did not know whether this was an oil or gas pipeline or that two pipelines were planned. People expressed an interest in knowing more, specifically:

- Details of construction including the schedule
- What to expect in terms of numbers of people involved, machinery, etc
- Details of the possible benefits of the pipeline, including compensation options
- The exact pipeline route in their area
- The potential for employment and the nature and number of jobs
- Potential damage to grazing land and what mitigation measures would be offered
- Long-term land use issues
- Details about construction camps and foreign workers
- Health and safety on the pipeline
- Potential for improving local infrastructure

In general, the overall attitude to the pipelines was positive but cautious. An interesting feature was the slightly more cautious attitude toward the gas pipeline than the oil pipeline. For example, 80% d all respondents stated that they perceived the project as a positive development and attributed the same categories of perceived benefits to both pipelines. However, 94% were positive about the development of the BTC oil pipeline and only 68% positive about the development of the SCP.

From the initial consultations with communities along the proposed pipeline route, the main perceived benefits of both proposed pipelines related to employment opportunities. The dominant concerns about the pipelines related mainly to damage or impediments to crop irrigation and grazing areas.

Key impacts anticipated by the communities were access to energy, employment, land, construction workers and social investment. These are discussed in more detail in the following sections. In addition to these the following attitudes can be noted:

- 94% of all respondents stated they were essentially positive about the construction of the oil pipeline
- Villagers along the route are wary of indirect benefits such as improved roads, after negative experiences with previous pipeline construction
- Respondents (mainly those employed in the state sector: health, education and social work) thought the pipeline would be beneficial to the state budget and improve the country's economic situation. Most respondents that are not working in the state sector were doubtful about the benefit to the state budget, noting that the average rural Azeri farmer has seen little if any direct benefit from oil and gas projects and foreign investment in the past
- Some of the wealthier landowners along the route expressed an interest in working and renting equipment during the construction process of the pipeline
- Eight respondents mentioned opportunities for social interaction with the construction team as a pipeline benefit
- Respondents mentioned improved social infrastructure

- Some respondents mentioned that they would like to use the construction crew's heavy machinery for their own needs.
- 26 respondents gave no response when asked if they saw benefits to the construction or explicitly stated that they saw none

The perceived benefits of the project are summarized in Figure 9-22.

"We support the construction of a gas pipeline, and expect that overall it'll be beneficial to the people in the country, new jobs will be created, pensions will grow, and living standards improve." (Samukh district, Aly Bayramly Village).

"I support the construction of a gas pipeline in our area, I think it will contribute to socioeconomic welfare of a future generation." (Yevlakh District, Aran Settlement)

"We will be disturbed because of the noise all day long, they are going to be making money and we just have to stand it all." (Akstafa District, Ashagy Kesamanly Village)

"Irrespective of any compensation I get it will still bother me if pipeline goes through my territory." (Agdash District, Ashagy Garhun Village)

"Because the pipeline construction is a large-scale project there will be environmental damage done, but I don't think it will be significant." (Shamkir Region, Dallyar Djeir village)

"I support the construction of a gas pipeline because it will a big contribution to an economic development of the country." (Samukh District, Hodjaly Village)

"The only problem is safety. If all safety measures are in place and complied with, I don't think there will be a problem." (Samukh District, Hodjaly Village)

"They should keep us in mind and build pipeline away from our territory. The dust here is very bad and looks like cement." (Agdash District, Khatinly Village)

"I am opposed to the pipeline construction if we don't get gas supply." (Geranboy District, Sarov Village)



Figure 9-22 Overall perceived benefits of the project (% of respondents)

The respondents anticipated that the lengthier construction period for two pipelines (both BTC and SCP) would benefit them with longer lasting employment opportunities (either directly or through the supply of services).

The most frequently reported concern associated with the construction of the pipelines was the longer-term temporary or permanent land take. The longer construction period was also seen as contributing to the deterioration of main and internal village roads, increased dust and noise pollution. Figure 9-23 depicts respondents' overall concerns in respect of the pipelines.



Figure 9-23 Overall perceived problems of the project (% of respondents)

## 9.6.3 Specific attitudes to AGIs

There will be three major AGIs outside the Sangachal Terminal during the operation of the pipeline; an intermediate pigging station at KP124 near Chokhranly, a pigging station which will later become a pumping station at KP243 near to Aran and Yaldilly, and an intermediate pigging station at KP342 near to Dallyar Djeir and Dallyar Dashbulak.

Interviews were undertaken with communities potentially impacted by the development of an AGI. Of this sample set, 87% said they were essentially positive about the developments and 10% said they felt negatively, while 3% gave no response. The most important benefit that was perceived by the development was direct employment (65%) whilst the second most important was access to energy (13%).

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The greatest concerns expressed by these communities were that the project would take their land, or land that they use (52%), followed by concerns over safety (13%) and noise (10%). Problems perceived to be associated with living in proximity to an AGI are shown in Figure 9-25.

"We are concerned about the safety of a pipeline. Also our lands could be taken." (Shamkir District, Dallyar Djeir Village)

"I am ready to bear all inconveniences if only somebody shows that they care about us." (Kurdemir District, Chokhranly Village)



Figure 9-25 Perceived problems/concerns of living in proximity to an AGI

## 9.6.4 Attitude to pipe yards and construction camps

Interviews were undertaken with all communities potentially impacted by the development of a construction camp or a yard for the storage of equipment and materials. A total of 109 respondents were interviewed and all of them stated that they were positive about the development (see Figure 9-26). Again, the most important perceived benefit of the development was direct employment (70%), followed by employment/provision of services (7%).



Figure 9-26 Perceived benefits of living near a construction camp or pipe yard

While all respondents stated that they were positive about their proximity to a site proposed for a yard or a camp (indeed 90% did not foresee any problems), 10% of respondents (11 people) highlighted concerns as shown in Figure 9-27.



Figure 9-27 Perceived problems of living near a construction camp or pipe yard

The following key issues were identified in respect of community perceptions about the project, as summarized below:

- Energy
- Employment
- Impacts to land and infrastructure

These issues are addressed in Sections 11, Socio-Economic Baseline, 12, Residual Impacts, 13, Cumulative Impacts, and 15, Overall Project Assessment, which discuss the impacts of the pipeline and proposed mitigation measures.

"There was a pipe yard in our village 2 years ago. We'll interact with workers, and learn some news." (Akstafa District, Boyuk Kesik Village)

"Noise would not disturb us. We are used to noises coming from nearby plants." (Ganja Town)

"Location of a pipe yard nearby is not desirable. Though I could temporarily lease my house to workers." (Yevlakh District, Yevlakh Town)

"If workers behave properly there shouldn't be any problems, though I am a little afraid, my husband and brothers are away in Russia, and I am all alone here." (Hadgiqabul District, Mugan Village)

"We don't want the project employees to be near our houses, as our wives are home the whole day." (Garadag District, Sangachal Village)

"If workers behave decently they won't have any problems with villagers." (Shamkir District, Zeyem village)

"Heavy machinery could damage our road, it is suggested that BP will restore them after construction is complete.".(Agdash District, Leki Village)

## 9.6.5 Energy

Access to electricity and gas supply was one of the most important issues for communities along the pipeline corridor, eg, only 11% of people stated that they have regular access to electricity and 12% of people have a piped supply of gas.

Most people within the proposed route corridor want improvements to their gas and electricity supply and hope that some increase to their energy supply will result from the pipeline, although most recognize that this would not come directly from the pipe itself. There is concern among some villagers that in the end they won't get an increased energy supply and all the country's oil and gas will go to Turkey.

"People hope that they will be provided with gas from the pipeline, in that case they will not have to cut down trees for firewood as they do now." (Shamkir Region, Dellyar-Djeir Village)

"The biggest benefit could be gas supply, and also some help to solve the water problem." (Geranboy District Erevanly Village)

## 9.6.6 Employment

High levels of unemployment in the districts crossed by the pipeline mean that most respondents welcome the opportunity for any employment that the pipeline offers. There is a strong desire to participate in the construction process and also to supply different types of services to the construction workers.

Figure 9-28 shows that the majority of people believe that the greatest opportunities for income generation lie in supplying services to the construction workers, rather than in direct employment. The reason for this is that many people lack the necessary skills for pipeline construction. Also, there is recognition that the number of jobs available will be limited. Many communities along the proposed pipeline route are located near the main road and there are numerous canteens and restaurants eager to supply food to the construction crew(s). Provision of food to the pipeline construction workers was cited by 230 (28%) of all respondents as a perceived benefit.

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Figure 9-28 Interest in employment by district

There was strong promotion of local skill levels by community leaders during the consultation process, particularly for skills such as welding and bulldozer/ excavator driving.

Considerable concern has been voiced throughout consultation activities that the hiring process would involve nepotism, making it difficult or expensive for some people to get hired.

"Me and many others would love to be employed during construction. There are many people unemployed in the village that would take any employment opportunities." (Samukh District, Garaarh Village).

"Young people don't have anything to do, since there is no work, they could work at the pipeline construction." (Shamkir District, Mahmudlu Village)

"It would be a great benefit if people from our village are employed during construction." (Akstafa District, Zelimhan Village).

## 9.6.7 Impacts on land

144 people (18% of the baseline sample) indicated that appropriation of land from locals was one of the main problems with the proposed pipeline construction. The population's attitude towards the proposed pipeline has been affected by negative experiences during construction of the WREP, in particular in relation to land compensation and damage to roads and irrigation networks<sup>17</sup>. Respondents mentioned that land compensation should first be directly

<sup>&</sup>lt;sup>17</sup> Nevertheless, it should be pointed out that during WREP construction, land reform had not yet been completed and in some regions not even started. Some villagers are still claiming compensation for land and production that was damaged during (PTO) construction. In

negotiated with landowners and paid directly to them rather than to a central fund. The population of Ashagy Garhun community (KP220) in the Yevlakh district expressed strong objections to the pipeline going through their cemetery. The pipeline has been re-routed to avoid the cemetery.

Some villagers are hoping for some financial compensation for impacts on property and private land during construction. Certain villagers, particularly in the west of the country, are concerned that the pipeline will disturb grazing of sheep and cattle.

People who don't use their land plots hope to get compensation for them from the pipeline. Those who do use their land are either opposed to use of their land or determined to secure a high level of compensation. These concerns are very significant, since agriculture is such an important source of income.

One of the respondents' main concerns is that they will be unable to use their land not only during the construction process but also once the pipeline is completed and operational. However, owners will be able to re-use the land with a number of restrictions, following reinstatement of the ROW.

Herders consulted along the route informally, who use municipal land during the winter months for grazing purposes (see Section 9.3.4, Seasonal grazing) expressed a positive attitude towards the pipeline and do not expect that the construction period will have major negative impacts for them. This group perceives that the biggest potential impacts will be loss or damage to livestock and restrictions on moving herds to their preferred grazing areas. Some shepherds who had previous experience of BP's operations also felt that BP's safety measures were too strict and that they would affect their grazing practices.

"The pipeline won't be harmful for the village, but it can damage our farmland." (Samukh District Ashagy Agasabeyli Village)

"We are concerned that we won't be allowed to use our land after construction. If that is the case we want to receive fair compensation." (Shamkir Region, Dashbulak Village)

"I want to know whether the pipeline will go straight through my house. If that is the case, what should I do? I don't want to move." (Shamkir Region, DashbulagkVillage).

"Vehicles can do damage to the land." (Geranboy District, Eyvazlilar Village)

#### 9.6.8 Impact on infrastructure

#### 9.6.8.1 Roads

Damage to roads during construction was noted as a concern of the surveyed communities. People are worried about possible road damage because the roads are in very poor condition. During the survey it was discovered that following the completion of the WREP, the

the village of Ranjbar (Hadgiqabul region) farmers showed a copy of a letter regarding production losses and compensation claims, which had been sent to AIOC.

construction company had repaired roads damaged during the construction process. However, in certain communities, it was claimed that roads were not restored.

#### 9.6.8.2 Irrigation channels

Respondents stated that they always dig irrigation and drainage channels in the same place, and that most of these channels are also cemented. Some of the respondents think that construction operations could damage their irrigation channels. Again, this was a key concern following construction of the WREP.

#### 9.6.8.3 Waste and sanitation

Respondents do not anticipate that the proposed pipeline construction will cause any problems for the communities' sanitation.

#### 9.6.8.4 Telecommunications

Based on experience of the WREP, some of the respondents think that there might be the opportunity to use the construction workers' mobile telephones and see this as a benefit.

### 9.6.9 **Possible community investment benefits**

Many community leaders and members of the communities themselves are hoping that the construction crew will be able to help them improve their basic living conditions. For example, people noted that they were hoping to have access to bulldozers and excavators, or expertise to repair water pumps and other basic community infrastructure. Others are hoping for improvements to social infrastructure especially roads, irrigation systems, schools and medical facilities that are beyond the pipeline project mitigation requirements. About a year after the major survey work had been completed, discussions were held with all communities to help identify their basic needs beyond project mitigation and the results of this exercise are being fed into the development of a separate social investment programme.

"Villagers hope that they'll be allowed to use construction equipment to solve some village problems. Otherwise they won't be able to do it themselves." (Kurdemir District, Chokhranly Village)

"People hope to get roads repaired if pipeline goes through their territory." (Kurdemir District, Sigirly Village)

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# 10 ENVIRONMENTAL IMPACTS AND MITIGATION

# 10.1 INTRODUCTION

This Section sets out the environmental aspects and potential environmental impacts that could arise as a result of the construction, operation, decommissioning and abandonment of the BTC project. It also discusses the proposed environmental mitigation measures that will be applied in order to reduce or remove the potential impacts.

The potential environmental impacts are linked to the general aspects associated with the project which are identified in Section 10.2. The impacts and proposed mitigation measures have been defined in line with the methodology described in Section 7, and are discussed in Section 10.3. The potential impacts have been evaluated with particular reference to the sensitivities of the key environmental components identified in Section 8.

The significance of the impacts that remain after implementation of the mitigation measures (ie the 'residual impacts') has also been assessed. Residual impacts are discussed briefly in Section 10.3 and in more detail in Section 12, Residual Impacts. Section 10.4 addresses the likelihood of an oil spill occurring during operation of the pipeline and discusses the impacts that might arise in the event of a spillage. It also describes a range of measures that would be considered if a spillage occurs.

Section 10 should be read with reference to Tables 10-2 and 10-3 and the Environmental Route Maps provided in Volume 2. A flow diagram illustrating how to read this Section in combination with the Tables and with the Environmental Route Maps is provided in Figure 10-1.

# 10.1.1 Aspect, impact, mitigation and residual impact tables (10-2 and 10-3)

The impacts, environmental mitigation measures and residual impacts associated with the generic aspects identified for the project in Section 10.2 are described and summarised in Table 10-2. The impacts, mitigation and residual impacts associated with route specific concerns (ie those relating to areas of particular environmental sensitivity, as identified through the baseline surveys outlined in Section 8) are described and summarised in Table 10-3. The assessment of the level of significance of the residual impacts has been undertaken in line with the methodology provided in Section 7, ESIA Methodology (None, Low, Medium or High) and is also included in Tables 10-2 and 10-3.

# 10.1.1 Environmental route maps

Environmental Route Maps are provided as a separate volume to this ESIA (Volume 2). The maps illustrate the route specific constraints that are referred to in Table 10-3, together with additional baseline information from Section 8, Baseline. The maps should also be referred to when reading this Section.





# 10.1.2 Monitoring and management plans

The mitigation measures detailed in this section will be implemented during the project with the aim of minimising the potential impacts on the environment. They will be incorporated into a number of management plans, listed below, which are referred to both in the text of this Section and in Tables 10-2 and 10-3.

- Community Safety Management Plan
- Community Liaison Management Plan
- Construction Camp Management Plan
- Infrastructure and Services Management Plan
- Procurement and Supply Management Plan
- Employment and Training Management Plan
- Procurement and Supply Management Plan
- Transport Management Plan
- Cultural Heritage Management Plan
- Reinstatement Summary Plan
- Pollution Prevention Management Plan
- Waste Management Plan
- Emergency Response Plan
- Oil Spill Response Plan
- Environmental Investment Plan

Information about the environmental scope of the plans is given in Section 14, Management and Monitoring.

#### 10.2 **IDENTIFICATION OF ENVIRONMENTAL ASPECTS**

The environmental aspects of the BTC project have been identified for all activities associated with construction and operation of the pipeline and associated facilities (Table 10-1).

ACTIVITY	ASPECT NO. <sup>1</sup>	ENVIRONMENTAL ASPECT			
General Activities during Construction and Operation					
Procurement	A1	Use of raw materials and natural resources			
Land take for facilities, construction	A2	Loss of habitat			
camps, pipe yards, access roads,	A5	Introduction of competitive species or			
AGIs and working width	A6	diseases			
Lise and storage of materials (og	Δ <b>7</b>	VISIDIIITY Rellution by accidental spillage of			
lubrication fluids oils paints diesel	A7	hazardous materials			
etc)	A8	Production and disposal of solid and			
	A9	liquid waste			
		Production of black and grey water			
Maintenance, use & movement of	A11	Vehicle movements			
vehicles, plant and equipment	A12	Soil compaction			
	A13	Dust generation			
	A14	Combustion gases			
	A7	Pollution by accidental spillage of			
		hazardous materials (particularly fuel &			
	A16	oil leaks from vehicles and plant)			
Construction Compo and Storage Va	rdo	Noise emissions			
	lius				
Pipe and materials delivery	A11	Vehicle movements			
	A3	Rail movements			
Power generation	A14	Combustion gases			
Water supply	A17	Groundwater abstraction			
Occupation of camps	A8	Production and disposal of solid and			
	A16	liquid wastes			
Construction of Dinaling and Equilitie		Noise emissions			
	s				
Construction of temporary roads	A1	Use of natural resources			
and access routes	A12	Soil compaction			
	A11	Vehicle movements			
	A13	Dust generation			
Final survey and staking		(No additional aspects to those listed in General Activities)			
Boundary (fences, tree lines,	A2	Loss of habitat			
ditches) and vegetation removal	A6	Visibility			
	A44	Loss of boundaries			
	A18	Disruption of drainage/irrigation channels			
Topsoil stripping	A13	Dust generation			
	A19	Soil erosion			
	A20	Disturbance of archaeology			

#### Table 10-1 Identification of activities and environmental aspects

<sup>&</sup>lt;sup>1</sup> Note: Some aspect numbers were removed during drafting; the numbers have not been reallocated to avoid the introduction of cross referencing errors ENVIRONMENTAL IMPACTS AND MITIGATION

ACTIVITY ASPECT ENVIR		ENVIRONMENTAL ASPECT
	NO. <sup>1</sup>	
Topsoil storage	A21	Loss of soil structure & fertility
	A22	Loss of viability of seed bank
	A23	Impeded movement of wild animals and
		domestic herds
	A24	Increased flood risk
	A19	Soil erosion
Grading	A13	Dust generation
	A19	Soil erosion
	A20	Disturbance of archaeology
	A25	Modified topography
Tranching (avapuation & starage of	A20	Disposal of surplus subsoli
subsoil)	A13 A10	Soil crosion
subsolij	A19 A28	Soli elosion Disturbance of known/unknown
	A20 A20	contaminated land
	Δ29	Disturbance of archaeology
	A23	Disposal of trench water
	A30	Impeded animal movements
		Public and animal safety
Dewatering	A17	Groundwater abstraction
	A42	Discharge of ground water
Pipe stringing and bending	A23	Impeded movement of wild animals and
		domestic herds
Pipe welding and inspection	A14	Combustion gases
	A4	Metal vapour emissions
Field coating (including application	A8	Disposal of solid & liquid wastes
of concrete coating in field)		
Lowering and backfill	A13	Dust generation
	A19	Soil erosion
	A27	Altered drainage
Site clean-up and restoration	A13	Dust generation
<ul> <li>Replacement of subsoil to</li> </ul>	A19	Soil erosion
create pre-construction profile	A27	Altered drainage
<ul> <li>Replacement of topsoil</li> </ul>	A25	Modified topography
<ul> <li>Replacement of boundaries</li> </ul>	A5	Introduction of competitive species and
(fences, tree planting)		diseases
<ul> <li>Removal of all construction</li> </ul>		
equipment		
Revegetation		
Construction of Crossings		
Road crossings	A34	Partial road closure
Open-cut watercourse crossings	A35	Sediment release
Benching of river bank	A19	Soil erosion
<ul> <li>Excavation of river bed</li> </ul>	A36	Modified river flow
Installation of flume pipes	A37	Impeded fish migration
Over-pumping	A6	Visibility
	A2	Loss of (aquatic) habitat

#### Table 10-1 Identification of activities and environmental aspects

ACTIVITY	ASPECT	ENVIRONMENTAL ASPECT
N	NO.	
Non-open cut watercourse	A29	Disposal of trench/pit water
crossings	A27	Altered drainage
	A30	Public & animal safety
	A16	Noise from pliing activities
Horizontal directional drilling	A41 A8	Potential for drilling fluid breakout/spillage Disposal of drill cuttings
Testing and Commissioning		
Hydrostatic testing	A17	Groundwater abstraction
<ul> <li>Abstraction of water</li> </ul>	A36	Modified river flow
<ul> <li>Discharge of water</li> </ul>	A19	Soil erosion
	A8/9	Disposal of liquid wastes/water
Drying (vacuum and nitrogen) and venting	A16	Noise emissions
In situ testing of AGIs	A14	Combustion gases
, , , , , , , , , , , , , , , , , , ,	A16	Noise emissions
Operation		
Normal operation	A6	Visibility
	A10	Disturbance of land surface and vegetation
	A14	Combustion gases
	A38	Vented and fugitive emissions of gas
	A8	Disposal of solid & liquid waste
	A9	Disposal of black & grey water
	A7	Pollution by accidental spillage of
		hazardous materials (particularly fuel &
		oil leaks from vehicles and plant)
	A16	Noise emissions
	A39	Change of crude oil composition
	A11	Vehicle movements
	A13	Dust generation
	A15	Light emissions
Pipeline rupture/leak	A40	Oil spill (see unplanned events)
Decommissioning & Abandonment		
Eventual removal of pipeline and	A40	Oil spillage
facilities	A13	Dust generation
	A14	Combustion gases
	A8	Production & disposal of solid wastes
	A10	Disturbance of surface vegetation
	A11	Vehicle movements
	A16	Noise emissions

#### Table 10-1 Identification of activities and environmental aspects

# 10.3 IMPACT ASSESSMENT AND MITIGATION DEVELOPMENT

# **10.3.1 Introduction**

This Section sets out the potential environmental impacts that could arise as a result of development of the BTC project. It also discusses the proposed environmental mitigation measures, which will be applied during construction and operation of the BTC pipeline and associated facilities in order to reduce, or remove, the potential impacts. The significance of the residual impacts after implementation of the proposed mitigation measures has also been assessed and is discussed briefly in this Section. Where a residual impact is of Medium or High significance, it is discussed in more detail in Section 12, Residual Impacts.

# 10.3.2 Pipeline routing and design

Environmental protection and mitigation of potential impacts is an integral part of the BTC project development, from conceptual design through to construction and operation. A key mitigation already implemented has been routing of the pipeline to avoid areas of high environmental sensitivity, including those crossed by the existing WREP, as follows:

- Shortening of the route by approximately 12km through the sensitive Gobustan Desert habitat
- Routeing to avoid the Korchay State Forbidden Area
- Routeing to avoid the Shamkir State Forbidden Area

These deviations from the WREP have reduced the impact on sensitive habitats and have shortened the route from the outset, thereby reducing the overall environmental impact of the pipeline.

The engineering process has also been used to mitigate identified environmental impacts, through design and operation changes and the selection of equipment. This aspect of the mitigation process is described in detail in Section 4, Project Alternatives, and Section 5, Project Description.

# 10.3.3 Climate and air quality

This section assesses the potential impacts on air quality and climate as a result of construction and operation of the BTC pipeline. The evaluation focuses on the following pollutants:

- Carbon dioxide (CO<sub>2</sub>)
- Methane (CH<sub>4</sub>)
- Nitrogen oxides (NO<sub>x</sub>) (nitrogen dioxide (NO<sub>2</sub>) and nitric oxide (NO))
- Sulphur dioxide (SO<sub>2</sub>)
- Carbon monoxide (CO)
- Volatile organic compounds (VOCs)<sup>2</sup>
- Particulate matter  $(PM)^3$

<sup>&</sup>lt;sup>2</sup> The term VOC is loosely applied to a wide range of organic compounds but in this context it is used as defined in the UNECE VOC Protocol (1991) as "all organic compounds of an anthropogenic nature, other than methane, that are capable of producing photochemical oxidants by reactions with nitrogen oxides in the presence of sunlight"

• Nuisance dust<sup>4</sup>

These substances represent the atmospheric pollutants that will be released as a result of the BTC project that are most commonly regulated and monitored internationally, due to their potential to impact on local air quality and climate.

 $CO_2$ , CO,  $NO_x$ ,  $SO_2$ , PM, VOC and  $CH_4$  are generated in varying amounts as a result of burning fossil fuels and are often termed 'combustion gases'.

 $NO_2$ , CO,  $SO_2$ , and PM are most commonly associated with impacts on local air quality. Ambient air quality standards set pollutant concentrations that ensure healthy air quality. EU air quality standards and World Health Organisation (WHO) guidelines for these pollutants are internationally recognised and are presented below in Table 10-4. Pollutants can have acute (short-term) and/or chronic (long-term) effects on human health/ecosystems. The standards and guidelines are expressed over averaging periods that reflect whether a substance has an acute and/or a chronic effect.

POLLUTANT	AVERAGING PERIOD	NO. OF EXCEEDENCES PERMITTED	LIMIT/GUIDELINE VALUE (µ g m <sup>-3</sup> )	RELEVANT STANDARDS/ GUIDELINES
NO <sub>2</sub>	1 year	N/A	40	WHO guideline
			40	EU (human health)
			30	EU (vegetation)
	1 hour	0	200	WHO guideline
	1 hour	18	200	EU (human health)
SO <sub>2</sub>	1 year	N/A	20	EU (ecosystems)
			50	WHO guideline
	24 hours	0	125	WHO guideline
	24 hours	3	125	EU (human health)
	1 hour	24	350	EU (human health)
CO	8 hour	0	10,000	EU standard
	8 hour	0	10,000	WHO guideline
	1 hour	0	30,000	WHO guideline
PM <sub>10</sub> <sup>(1)</sup>	1 year	N/A	40	EU (Stage 1)(human
			20	health)
				EU (Stage 2)(human
				health)
	24 hours	35	50	EU (Stage 1)(human
		7	50	health)
				EU (Stage 2)(human
				health)

Table 10-4 EU and WHO ambient air quality standards/guidelines

Note: Stage 1 standards should be met by 31 December 2005; stage 2 by 31 December 2010

Carbon dioxide and methane are the two main compounds commonly referred to as 'greenhouse gases'. It is believed that the accumulation of such gases in the atmosphere can contribute to global warming. Other pollutants such as the oxides of nitrogen and carbon monoxide, although not important greenhouse gases in their own right, can influence the atmospheric formation of other greenhouse gases, in particular ozone.

VOCs are indirect greenhouse gases in that they can break down in the atmosphere, in the presence of sunlight, to form methane and photochemical oxidants. VOCs are also precursors of ground level ozone, which is primarily formed by a series of complex reactions, initiated by

<sup>&</sup>lt;sup>3</sup> Particulate matter is used in this context to describe inhalable particles

<sup>&</sup>lt;sup>4</sup> Nuisance dust is a term commonly used to describe deposition of inert dust on or around sensitive receptors (eg on vegetation, dwellings and clothes on washing lines etc)

ENVIRONMENTAL IMPACTS AND MITIGATION

sunlight, between VOCs and  $NO_x$ . Ozone is produced naturally in the upper atmosphere (stratosphere) where it helps to provide protection against incoming UV radiation. In the lower levels of the atmosphere ozone is an irritant gas and has the potential to impact on local air quality.

## **10.3.3.1** Principal sources of atmospheric emissions

#### Sources of atmospheric emissions during construction

The most significant issues that could potentially impact on air quality and climate during construction are combustion gas emissions and nuisance dust.

The principal sources of combustion gases are the exhausts of vehicles and construction equipment, power generation at the work camps and pipe storage yards and waste incineration. A small amount of combustion gases will be released as a result of power requirements at PS-A2 during testing and commissioning of the pump station.

There may be some venting of small amounts of VOCs, as oil vapour, during testing and commissioning of the pipeline and facilities.

Dust will be generated as a result of vehicle movements and typical construction activities (eg stripping, compacting and trenching etc).

#### Sources of atmospheric emissions during operation

During operation the most significant source of atmospheric emissions will be from combustion processes at the pump station (PS-A2 at KP244), where the sources are:

- Pump driver turbines
- Electricity generating engines
- The possible crude topping plant (CTP) (ie a fired heater and a flare)
- Firewater pumps (diesel driven)

There will also be a small quantity of combustion gases released from the two standalone Intermediate Pigging Stations (IPS) as a result of power generation.

Emissions of combustion gases are not normally anticipated from the pipeline block and check valves. The check valves do not require power to operate and, within Azerbaijan, it is anticipated that all of the block valve stations will be powered by electricity from the national grid. Each block valve station will be equipped with a small (<10 kW) diesel backup generator, which will only be used in the event of electricity from the grid failing.

During operation, there may also be small quantities of fugitive<sup>5</sup> emissions of VOCs, as oil vapour, from piping, valves, shafts, rotating equipment, connections and storage tanks at the AGIs. There may also be fugitive emissions of methane from the possible gas pressure reduction station (PRS) at PS-A2. The PRS will be required to supply PS-A2 with gas from the SCP project, should it become available.

<sup>&</sup>lt;sup>5</sup> 'Fugitive emissions' is a term used to describe releases of a substance from open (or area) sources rather then those that are discharged to the atmosphere in a confined flow or stream (eg a vent). Fugitive VOC emissions include leaks (eg from imperfect seals) and evaporative sources

# 10.3.3.2 Impacts and mitigation – construction

Combustion emissions - construction

Emissions of combustion gases have been estimated for:

- Diesel exhaust emissions from construction vehicles and plant required for pipeline construction
- Construction waste incineration at the construction camps
- Power generation at construction camps and pipe storage yards

Emissions of methane from putresible waste and waste incineration at the construction camps are not included as they are not anticipated to be significant relative to the  $CO_2$  from combustion emission sources, even considering the higher global warming potential per unit mass of methane.

Due to the nature of the construction process, emissions will not be constant and will fluctuate according to the operating periods for each item of plant and the combination of machinery being used at any one time. The location of emission sources will also change as the construction spread progresses along the pipeline route. Intensive construction activities will not generally be carried out at night. Potential receptors, such as residents in local villages and flora and fauna will not, therefore, be continually exposed to pipeline construction emissions for extended periods (ie generally no more than 1-3 months and limited daily exposure).

A summary of the combustion emissions resulting from the estimated 15 month construction period is presented in Table 10-5.

SOURCE	NO <sub>x</sub> <sup>(5)</sup>	СО	SO <sub>2</sub>	PM	VOC	CO <sub>2</sub>	CH₄
		1		Tonne	S	l	
Pipeline construction	2,096	960	170	197	249	150,000	15
Waste incineration <sup>(1)</sup>	4	1	4	29	No data <sup>(3)</sup>	2,000	No data <sup>(4)</sup>
Power generation at construction camps and pipe storage yards <sup>(2)</sup>	1,158	249	77	82	86	43,000	8
Total	3 258	1 210	251	308	336	195 000	23

 Table 10-5 Assessment of combustion emissions arising from construction activities over the entire 15 month construction phase in Azerbaijan

Note: This inventory covers only the pipeline spread and does not account for construction of the AGIs as information is not available at this stage.

<sup>(1)</sup> Based on the total estimated volume of waste incinerated for all camps.

<sup>(2)</sup> Based on total power requirement, for all camps and storage yards, of 5.61MW.

(3) No data was available to enable estimation of VOC emissions from waste incineration, however VOC emissions from this source are not expected to be significant.

<sup>(4)</sup> No data was available to enable estimation of methane emissions from waste incineration, however methane emissions from this source are expected to be negligible in comparison to CO<sub>2</sub> emissions.
 <sup>(5)</sup> As NO<sub>2</sub>.

Although stack emission limits have been defined for some of the sources of combustion emissions arising from construction activities, these standards have not been used to estimate the emissions in Table 10-5. It is not appropriate to use stack emission limits to provide annual emissions data in the absence of corresponding stack parameters (eg diameter, efflux velocity, exhaust gas temperature, oxygen concentration, etc). This level of detailed information is not available at the current stage of project design. In the absence of this data emission factors from various sources have been applied to generate emissions estimations. In general, the emission factors will over estimate emissions. They often do not account for emission control technologies. The emissions presented in Table 10-5 should therefore be taken as indicative, conservative estimates. Mitigation measures and the BTC Project emission standards are discussed in more detail below. The detailed methodology and assumptions used to produce these data are presented in Part 4, Technical Appendix.

#### Mitigation - combustion emissions arising from construction activities

For generators, construction vehicles and equipment a programme of regular maintenance will be implemented to ensure that fuel use is efficient and emissions are within acceptable limits.

New vehicles will be purchased to comply with the European Community emissions standards in force at the time of purchase. Older vehicles and equipment, not purchased 'as new', after the contract award will be maintained so that emissions levels are maintained at acceptable levels.

European efficiency and emission standards have been specified for diesel generators. For power generation during construction the following stack emissions standards will be achieved by each item of plant (as defined in the project HSE Requirements):

•	Particulates	$50 \text{mg m}^3$
•	NO <sub>x</sub>	$150 \text{mg m}^{-3}$
٠	SO <sub>x</sub>	0.2% w/w S in fuel
٠	CO	150mg m <sup>-3</sup>
•	VOCs and hydrocarbons	$100 \text{mg m}^{-3}$

At the construction camps atmospheric emissions from incinerator plant will meet emission limit values based on the requirements set out in:

- EU Directive 89/369/EEC of 8 June 1989 on the prevention of air pollution from new municipal waste incineration plants. (For domestic waste.)
- EU Directive 94/67/EC of 16 December 1994 on the incineration of hazardous waste.

The relevant limits are summarised in Table 10-6.

#### Table 10-6 Stack emissions limits for waste incinerators during the construction phase

Substance	Limit (mg m <sup>3</sup> )
Domestic waste <sup>(1)</sup> (89/369/EEC):	
Sulphur Dioxide (SO <sub>2)</sub>	300
Carbon Monoxide (CO)	100
Organics (as total carbon)	20
Total Dust	200
Hydrogen Chloride (HCl)	250
Hydrogen Fluoride (HF)	4
Lead, Chromium, Copper and Manganese (Pb, Cr,	
Cu and Mn)	5
Nickel and Arsenic (Ni and As)	1
Cadmium and Mercury (Cd and Hg)	0.2
Hazardous waste <sup>(2)</sup> (94/67/EEC):	
(daily 100% compliance, 30 minute average values @	100% and 97% compliance)
SO <sub>2</sub>	50, 200, 50
CO	50, 100
Total organic carbon (TOC)	10, 20, 10
Total dust	10, 30, 10

#### BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA

Substance	Limit (mg m <sup>3</sup> )
HCI	10, 60, 10
HF	1, 4, 2
Mercury (Hg)	0.05 (total)
Cd and Thallium (TI)	0.05 (total)
Antimony (Sb), As, Pb, Cr, Cobalt (Co), Cu, Mn, Ni,	
V, & Tin (Sn)	0.05 (total)
Dioxins and furans	0.1 ngm <sup>-3</sup> (total)

<sup>(1)</sup> Limits expressed at reference conditions: 273K, 101.3kPa, 11% oxygen, dry.

(2) Limits expressed at reference conditions: 273K, 101.3kPa, 11% oxygen, dry or at 3% oxygen for liquid waste.

The following emission concentrations and exhaust gas parameters will be monitored at the stacks on a regular basis:

- Total dust
- CO
- oxygen
- HCl
- Temperature
- Water vapour content
- **SO**<sub>2</sub>
- TOC

The remaining substances will be monitored periodically, if required.

#### Air quality- combustion emissions

Release of combustion gases will result in an increase in concentrations of airborne pollutants, which have the potential to result in acute and/or chronic impacts on human health, flora and fauna.

To put construction emissions of  $NO_x$ , CO, SO<sub>2</sub>, PM and VOC into a national context Table 10-7 compares the BTC project annual construction emissions to the Azerbaijan Inventory for 1994 (the latest year for which data are available).

Table 10-7	Comparison of annual	construction phase	atmospheric	emissions to	Azerbaijan
		Inventory			

SOURCE	NO <sub>x</sub> <sup>(2)</sup> tonne	CO Tonne	SO₂ Tonne	PM tonne	VOC tonne
BTC Construction <sup>(1)</sup>	2,607	968	201	246	268
National Inventory	113,000	174,000	48,000	No data <sup>(3)</sup>	281,000
% BTC contribution	2.3	0.6	0.4	-	0.1
1) Annual DTC construction ami	seione hore has	n coloulated fre	m the totals fo	r tha 15 month	aconstruction

Annual BTC construction emissions have been calculated from the totals for the 15 month construction period on a pro rata basis to enable direct comparison to the Azerbaijan National Inventory

(2) As NO2

<sup>(3)</sup> The 1994 Azerbaijan National Emissions Inventory does not report particulate matter

Existing (background) concentrations are low (see Section 8.2, Baseline, for more details), so the increase is not expected to cause concentrations to exceed the EU standards and WHO guidelines for the protection of human health and vegetation (EU and WHO standards/guidelines are presented in Table 10-4).

Relative to Azerbaijan national emissions the residual impact of construction emissions on air quality will be **Medium** for emissions of NO<sub>2</sub> but **Low** for emissions of CO, SO<sub>2</sub>, PM and VOCs.

#### **Climate - combustion emissions**

Though emissions of  $CO_2$  and methane are generally accepted as contributing to global warming the effect has not been quantified. To reduce the threat of global warming it is widely agreed that emissions of greenhouse gases need to be reduced on a global scale.

Each individual greenhouse gas has a different potential effect on climate per unit released. Global Warming Potential (GWP) provides a means of equating the potential contribution to global warming arising from different process units/activities which can generate different emissions. GWP is measured in terms of equivalent emissions of CO<sub>2</sub>; hence the GWP factor of  $CO_2$  is 1.  $CH_4$  has a GWP factor of 21 - ie an emission of 1 kg of  $CH_4$  is defined as having 21 times the GWP of an emission of 1 kg of CO<sub>2</sub>.

The construction phase will result in estimated GWP emissions of ~196,000 tonnes of CO<sub>2</sub> equivalent over 15 months. To put this into a national context, Table 10-8 compares annual estimated CO<sub>2</sub> and methane emissions to the Azerbaijan Greenhouse Gas Inventory for 1994 and to predicted national greenhouse gas emissions for 2000 and 2005.

Table 10-8 Comparison of annual GWP of construction phase to Azerbaijan	l				
greenhouse gas inventory					

SOURCE	EMISSION (TONNE)		GWP (TONNE CO <sub>2</sub>
	CO2	CH₄	EQUIVALENT PER YEAR)
BTC Construction <sup>(1)</sup>	156,000	18	157,000
National Inventory 1994	32,806,000	442,000	42,748,000 <sup>(3)</sup>
National Inventory Forecast 2000	24,689,000	730,000	40,887,000 <sup>(3)</sup>
National Inventory Forecast 2005	41,544,000	1,253,000	68,818,000 <sup>(3)</sup>
% BTC contribution to 2000 emissions <sup>(2</sup> )	0.6	0.002	0.4

(1)Annual BTC construction emissions have been calculated from the totals for the 15 month construction period on a pro rata basis to enable direct comparison to the Azerbaijan National Inventory.

(2) BTC annual construction emissions have been expressed as a percentage of the predicted Azerbaijan national emissions for 2000 as construction is expected to start in 2003 and this provides worst case comparison.

(3) National GWP includes nitrous oxide (N<sub>2</sub>O) emissions. The GWP figure for BTC does not account for N<sub>2</sub>O emissions, as these are not anticipated to be significant relative to  $CO_2$ and methane emissions from combustion sources.

Relative to Azerbaijan national emissions the residual impact of construction emissions of greenhouse gases on climate will be Low.

#### Nuisance dust

Construction activities and vehicle movements can cause dust agitation in addition to that already caused by the wind. It is likely that this will be exacerbated as a result of clearance of the ROW. Once airborne, dust will generally travel down wind before resettling. The distance travelled depends primarily on wind speed and particle size. For example, smaller particles and strong winds result in greater dilution effects but mean that the dust is deposited over a larger area.

Dust may cause nuisance on a local scale in certain areas along the pipeline due to the nature of the fine clayey, silty and sandy soils that are present. The potential impacts are nuisance to people in the area, coverage of crops (possibly leading to reduced yields) and deposition on natural vegetation and small animals, including bees.

#### Mitigation and control measures for nuisance dust emissions

The contractor will employ adequate dust reduction measures to prevent wind erosion and local pollution where necessary (at many locations along the route dust generation is not likely to be an issue). These techniques will include one or all of:

- Damping down of running track
- Wheel washes where appropriate
- Imposition of a speed limit of 30 kmhr<sup>-1</sup> on unmade roads under dry conditions
- Correct storage and handling of materials that may give rise to nuisance dust emissions

When raw materials that could release dust particles (eg concrete and stone) are transported they will be treated and handled in a manner that minimises the release of dust. If necessary, the vehicle load will be covered with a sheet.

Dust generation and levels in the air will be monitored during construction near communities and certain agricultural areas when necessary. Additional mitigation measures, such as the imposition of tighter speed limits, will be implemented if necessary to meet acceptable standards.

#### Air quality- construction dust emissions

The long-term impact of nuisance dust will decline as stripped areas of land re-vegetate. Due to the temporary nature of construction, dust emissions are not anticipated to have a long-term impact on local air quality. The short-term residual impact arising from pipeline construction activities is anticipated to be **Medium**.

# 10.3.3.3 Impacts and mitigation – operation

#### Combustion Emissions - Operation

Annual combustion emissions have been estimated for operational activities based on the pump station operating at maximum capacity and are summarised in Table 10-9.

Source <sup>(2)</sup>	NO <sub>x</sub> <sup>(3)</sup>	СО	SO <sub>2</sub>	PM	VOC		CH₄
			Ton	nes per g	year		
Pump driver turbines (PS-A2) fired by liquid fuel	435	169	145	47	220	201,000	25
Pump driver turbines (PS-A2) fired by gas fuel	359	184	0	14	24	173,000	615
Generators (PS-A2) fired by liquid fuel	820	70	45	20	63	15,000	6
Generators (PS-A2) fired by gas fuel	65	96	7	7	74	10,000	460
Firewater pumps	0.4	0.1	0.0	0.0	0.0	15	0

Table 10-9 Assessment of annual combustion emissions arising from operational activities <sup>(1)</sup>

#### BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA

Generators (standalone IPSs)	119	26	8	8	9	4,000	1
Total – (gas available)	544	306	15	30	107	187,000	1,076
Total – (gas not available)	1374	265	198	76	292	220,000	32

(1) Based on PS-A2 operating at maximum capacity

(2) This inventory does not include emissions from the possible CTP, as sufficient information is not available at this time.

<sup>(3)</sup> As NO2.

For most substances emissions from the pump driver turbines and pump station generator engines have been calculated using maximum stack pollutant concentrations supplied by plant vendors (see Table 10-10), with corresponding stack parameters (such as: diameter, efflux velocity, exhaust gas temperature, oxygen concentration). In some cases the vendors' provisional stack pollutant concentrations are greater than those specified in the Project Standards and emissions will therefore be overestimated. In the absence of stack pollutant concentrations, in particularly for methane, emission factors were used to estimate emissions.

No vendor data were available at this stage of design for the IPS generators and firewater pumps. Emission factors have therefore been used to estimate emissions from these units. The annual emissions presented in Table 10-9 should therefore be taken as indicative, conservative estimates. Mitigation measures and the BTC Project emission standards are discussed in more detail below.

The detailed methodology and assumptions used to produce the emissions estimates are presented in Part 4, Techncial Appendix.

#### Mitigation – combustion emissions arising from operational activities

A regular maintenance programme for fixed equipment will be implemented to ensure that their operation is efficient and within the design specification.

The sulphur content of the liquid fuel from the CTP will be low, less than 0.1% by weight. The SCP gas that may be used for firing the turbine and PS-A2 generator units has negligible sulphur content, therefore sulphur dioxide emissions are negligible when gas is the fuel.

The pump driver turbines will incorporate low- $NO_x$  technology to reduce  $NO_x$  emissions. Provisional vendor data for stack emission concentrations from the turbines and the PS-A2 generators is given in Table 10-10.

Source	NO <sub>x</sub> <sup>(3)</sup>	СО	SO <sub>2</sub>	РМ	VOC
		(mg m <sup>-3</sup>	) (unless otherwis	se stated)	
Pump driver turbines fired by liquid fuel <sup>(1</sup> )	165	64	~55	18	25 ppm
Pump driver turbines fired by gas fuel <sup>(1</sup> )	125	64	0	5	2.5 ppm
Generators (PS-A2) fired by liquid fuel <sup>(2)</sup>	2000	No data	110	50	150 <sup>(4)</sup>
Generators (PS-A2) fired by gas fuel <sup>(2</sup> )	230	No data	25	25	225

Table	10-1	0 P	rovisional	stack	emission	concentrations	for t	turbines and	PS-A2	generators
rabic	10-1		1 0 1 15101141	stath	cimission	concentrations	101 0	ui pines anu		generators

Stack emissions data were supplied by vendors

<sup>(1)</sup> Indicative stack emission concentrations. Expressed at reference conditions: 273K, 101.3kPa, 15% oxygen, dry

Maximum stack emission concentrations. Expressed at reference conditions: 273 K, 101.3 kPa, 3% oxygen, dry
 As NO<sub>2</sub>

<sup>(4)</sup> Total hydrocarbons

The emissions limits for the power generators at the standalone IPSs will be the same as the diesel generators described above for the construction phase.

Emissions will be monitored to ensure they are within internationally recognised limits. It is anticipated that at minimum the turbine driver emissions will conform to the standards set out in the World Bank industry sector guidelines for Oil and Gas Development (Onshore) and/or Thermal Power: Guidelines for New Plants (Pollution Prevention and Abatement Handbook, the World Bank Group, 1996), as appropriate. The specification of the generator engines has not been finalised, however the World Bank limits will be taken into account in their design. The World Bank limits are summarised in Table 10-11.

	NO <sub>x</sub> <sup>(2)</sup>	SO <sub>2</sub>	PM	
Diesel-Fired Plant	460 mgm <sup>-3</sup>			
	130 ngJ <sup>-1</sup>	$2000 \text{ mgm}^{-3}$	50 mgm <sup>-3</sup>	
Gas-Fired Plant	320 mgm <sup>-3</sup>	2000 mgm	50 mgm	
Ods-Filled Fiant	86 ngJ <sup>-1</sup>			
Combustion Turbine – gas (dry @ 15% O <sub>2</sub> )	125 mgm <sup>-3</sup>	0.2 tonnes per	50 mgm <sup>-3</sup>	
Combustion Turbine – diesel (No. 2 oil) (dry @ $15\% O_2$ )	165 mgm <sup>-3</sup>	day per MW(e)	ou mgm	

Concentrations in units of mgm-3 are expressed at reference conditions: 273 K, 101.3 kPa
 As NO2

#### Air quality - operational combustion emissions

To put combustion emissions of  $NO_x$ , CO, SO<sub>2</sub>, PM and VOC into a national context Table 10-12 compares operational emissions to the Azerbaijan Inventory for 1994 (the latest year for which data are available). Figures are based on all units firing on liquid fuel, as this generally provides a worst-case scenario. Total emissions of all pollutants except carbon monoxide are higher on liquid fuel than on gas for equivalent power capacity.

 Table 10-12 Comparison of operational phase atmospheric emissions to Azerbaijan Inventory

SOURCE	NO <sub>x</sub> <sup>(2)</sup> CO		SO <sub>2</sub>	PM	VOC			
	Tonnes per year							
BTC Operation <sup>(1)</sup>	1,374	265	198	76	292			
National Inventory	113,000	174,000	48,000	No data <sup>(3)</sup>	281,000			
% BTC Contribution	1.2	0.2	0.4	-	0.1			

<sup>(1)</sup> Not including CTP emissions.

(2) As NO2

<sup>(3)</sup> The 1994 Azerbaijan National Emissions Inventory does not report emissions of particulate matter.

A comprehensive atmospheric dispersion modelling study has been undertaken to assess the impact of emissions from the pump driver turbines at PS-A2 on local air quality. Table 10-13 reproduces the summary table of results, comparing the worst-case maximum predicted ground level concentrations (GLCs) of pollutants with relevant standards and guidelines. The possible CTP was not included in the modelling study. The CTP will be evaluated, if required, when appropriate data are available. The modelling study is presented as Part 4, Technical Appendix.

The modelling study was undertaken based on conservative assumptions, explained in detail in the Pump Station Atmospheric Dispersion Modelling Report, in Part 4, Techncial Appendix. The results of the study predict that the short-term and long-term EU ambient air quality standards and WHO guidelines will not be exceeded as a result of the operation of PS-A2.

On the basis of the modelling results and the comparison of annual combustion emissions to Azerbaijan National Inventory the residual impact on human health and vegetation is predicted to be **Low** for short-term impacts for all pollutants. The residual long-term impacts on human health are predicted to be **Low** for VOC, PM and CO but **Medium** for SO<sub>2</sub> impacts on vegetation and NO<sub>2</sub> impacts on human health and vegetation.

POLLUTANT	AVERAGING PERIOD	PERCENTILE	MAX PREDICTED GLC (µg m-3)	BACKGROUND (μgm-3)(1)	TOTAL GLC (μg m-3)	STANDARDS /GUIDELINES (µg m-3)(2)
	1 year	N/A	12	2.6	15	40/30
NO <sub>2</sub>	1 hour	100 <sup>m</sup>	135	-	135	200
	1 hour	99.79 <sup>th</sup>	111	-	111	200
	1 year	N/A	8	3.4	11	50/20
SO <sub>2</sub>	24 hours	100 <sup>th</sup>	47	-	47	125
502	24 hours	99.18 <sup>m</sup>	43	-	43	125
	1 hour	99.73 <sup>rd</sup>	72	-	72	350
0	8 hr running	100 <sup>th</sup>	76	-	76	10,000
00	1 hour	100 <sup>th</sup>	114	-	114	30,000
PM	1 year	N/A	3	-	3	20
1 171	24 hours	98.08 <sup>th</sup>	12	-	12	50

# Table 10-13 PS-A2 pump drivers: comparison of modelling results with WHO and EU air quality standards and guidelines

Background data from ambient monitoring carried out at the proposed site of PS-A2 (refer to Section 8.2 for details) Table 10-4 presents the EU and WHO ambient air quality standards in full

#### Climate - operational combustion emissions

(2)

The operation of PS-A2 and the IPSs will result in a maximum annual GWP emissions estimate of around 221,000 tonnes of  $CO_2$  equivalent per year. Figures are based on all units firing on liquid fuel, as this generally provides a worst-case scenario. Total emissions of carbon dioxide are higher, and emissions of methane are lower, on liquid fuel than on gas (for the equivalent power capacity).

To put GWP into a national context, Table 10-14 compares operational methane and  $CO_2$  emissions to the Azerbaijan Greenhouse Gas Inventory for 1994 and to predicted greenhouse gas emissions for 2000 and 2005.

SOURCE	EMISSION Ye	(TONNE PER EAR)	GWP (TONNE CO₂ EQUIVALENT PER YEAR)
	CO2	CH₄	
BTC operation <sup>(1)</sup>	220,000	32	221,000
National Inventory 1994	32,806,000	442,000	42,748,000 <sup>(3)</sup>
National Inventory Forecast 2000	24,689,000	730,000	40,887,000 <sup>(3)</sup>
National Inventory Forecast 2005	41,544,000	1,253,000	68,818,000 <sup>(3)</sup>
% BTC contribution to 2005 emissions <sup>(2)</sup>	0.5	0.003	0.3

#### Table 10-14 Comparison of annual GWP of operational activities to Azerbaijan greenhouse gas inventory

<sup>(1)</sup> Worst case emissions based on SCP gas not being available, however, emissions from the possible CTP are not included, nor are fugitive emission from the possible PRS. Emissions from the PRS or CTP will be evaluated, if required, when data becomes available

<sup>(2)</sup> BTC annual operational emissions have been expressed as a percentage of the predicted Azerbaijan national emissions for 2005, as the pump station is not anticipated to be fully operational before 2005

(3) National GWP includes nitrous oxide (N<sub>2</sub>O) emissions. The GWP figure for BTC does not account for N<sub>2</sub>O emissions, as these are not anticipated to be significant relative to CO<sub>2</sub> and methane emissions from combustion sources

Relative to Azerbaijan national emissions the potential impact of operational emissions on climate will be **Low**.

#### Fugitives VOCs and dust

Fugitive emissions of VOCs will principally arise from fixed equipment at the IPS and PS-A2. Whilst it is not possible to eliminate such emissions entirely, the design will be to a high specification and the facilities will be maintained to a high standard. As a result, quantities of fugitive VOC emissions are anticipated to be very small but cannot be quantified at this stage.

Mitigation to reduce fugitive emissions of VOCs will be incorporated into the engineering design and operation of the facilities.

Residual impact of fugitive VOC emissions on air quality will be Low.

The number of vehicles and the use of vehicles on un-surfaced roads, and hence disturbance to the ground surface during operation, will be very low. Dust mitigation measures, including appropriate driving speeds and the use of designated accesses will, however, still be implemented.

Residual impact of dust emissions from vehicle use during operation will be Low.

# 10.3.4 Noise

Noise emissions may arise from:

- the maintenance and use of vehicles, plant and equipment during construction
- any piling and drilling activities during construction
- drying and venting activities during testing and commissioning
- operation of the AGIs

# 10.3.4.1 Construction noise impacts

This assessment has been prepared using the most recent, typical noise data available for pipeline construction activities and the anticipated duration of such operations.

The pipeline construction contractor's responsibilities will include reference to this ESIA prior to commencement of site operations and the submission of comparative data for noise and vibration levels associated with the operations and plant items proposed. No blasting is anticipated.

#### Standard pipeline construction

Activities associated with standard pipeline construction methods have been cross-referenced with standard noise source data to give the most accurate estimate of site noise possible at this stage. These values have been calculated using the procedures described in BS5228: 1997<sup>[6]</sup>. Table 10-15 shows typical noise levels that may be expected at various distances from the ROW.

<sup>&</sup>lt;sup>6</sup> BS5228: 'Noise and Vibration Control on Construction and Open Sites: Part 1. Code of practice for basic information and procedures for noise and vibration control', 1997

L <sub>AEQ</sub> <sup>171</sup> (DB) CALCULATED FROM BS 5228 AT VARYING DISTANCES FROM ROW								
	50m	150m	250m	350m	450m			
Initial access & fencing	76	67	62	59	57			
Site preparation & ROW	74	65	60	57	55			
Topsoil stripping & site grading	82	72	68	65	63			
Pipe haul & stringing	83	73	69	66	64			
Cold pipe bending	73	63	59	56	54			
Mainline welding	79	70	65	62	60			
Trench excavation	79	70	65	63	60			
Pipe lower and lay & tie-in	75	66	61	58	56			
Backfilling	72	62	58	55	52			

Table 10-15 Typical noise levels associated with various construction activities.

Due to the nature of the construction process, noise levels will fluctuate in line with operating periods for each item of plant and with the combination of machinery being used at any one time. Noise levels will also vary depending on time, and distance as the construction spread progresses along the pipeline route. Local residents will not, therefore, be continually exposed to the noise levels shown above for extended periods.

#### Specialist pipeline construction

Specialist teams will work along the pipeline route in advance of and following behind the main construction team. These are teams for initial preparation and final reinstatement works and for special works, such as major road, railway, river and canal crossings. Particular aspects of construction-related noise are described in greater detail below. Preliminary crossing methods for major linear features have been identified and will be finalised upon appointment of a construction contractor. Noise emissions associated with special crossing methods will be assessed on a case-by-case basis.

#### Road traffic noise

Construction traffic associated with the pipeline construction will be routed via main roads and along the ROW as far as is possible (eg the main Baku - Tbilisi highway). Some minor roads will have to be used for access to the pipeline spread itself and some new access roads will be created.

The increase in traffic movements on minor roads may cause a noticeable increase in daytime noise levels through small villages; this effect will be localised and temporary, and will, for the most part, be restricted to the construction phase of the project.

A number of roads will require repair prior to use for construction vehicle access. These repairs will help to reduce noise levels generated by such access, and other vehicular movements

#### Blasting

The vast majority of the pipeline trench will be constructed in materials which can be excavated by back hoe or trenching machine. Such materials include unconsolidated clays, sand, gravel and friable rock. No requirement for blasting is anticipated in Azerbaijan, and excavation is therefore likely to result in relatively low levels of noise and vibration.

 $<sup>^{7}</sup>$  L<sub>Aeq</sub> is the A-weighted continuous equivalent sound pressure level, an average value used to represent fluctuating noise sources, as heard by the human ear

# 10.3.4.2 Construction noise mitigation

Some noise impact on the surrounding environment and nearby residents is inevitable during any construction operation. Regular maintenance, monitoring and, where necessary, the use of silencing equipment will be employed with the aim of reducing noise emissions.

In order to reduce significant disturbance from noise emissions to neighbouring residents, the following mitigation measures will be adopted:

- The selected contractor will be required to submit detailed information on the noise levels which will be generated by the specific methods and equipment proposed and to identify actions required to minimise the noise impact
- All vehicles, plant and powered equipment will be well maintained and adequately silenced
- Vehicles/ equipment purchased 'as new' after contract award will comply with European Community emission standards in force on the purchase date
- Vehicles/ equipment not purchased 'as new' after contract award will be maintained so that noise and emissions levels are no greater than when the vehicle/equipment was new
- Pumps, generators and other mobile equipment will be sited as far as practicable from housing and other noise sensitive locations
- The contractor will meet agreed noise control targets as defined in the Section below. Compliance will be monitored and additional noise suppression techniques applied as required to meet the targets
- During periods of inactivity, equipment will be switched off whenever possible
- A limited number of construction activities may have to continue on a 24-hour basis. These include horizontal direction drilling, pipeline cleaning and hydrostatic pressure testing which are relatively low noise activities. Consultation will be undertaken with the relevant authorities in advance of any such operations
- Where appropriate, residents living near to the pipeline construction activities will be kept informed of the contractors proposed working schedule (through implementation of the Community Liaison Management Plan) and will be advised of the times and duration of any abnormally noisy activity likely to cause concern
- The contractor will be responsible for employing best practice techniques to avoid unnecessary noise from the sites, particularly at night

The above mitigation measures, which reduce the impact of construction activity noise, will result in a residual impact, which is classified as **Low/Medium**.

#### Noise control targets

Control of noise from the normal activities associated with pipeline construction will be achieved by restricting normal working hours, and by the mitigation measures described above. All contractors will be required to meet the noise limits defined in Table 10-16.

	LAeq DURING THE DAY (8 hours)	LAeq DURING THE EVENING (1 hour)	LAeq DURING THE NIGHT (5mins)
At limit of the ROW and at the boundaries of camps and other sites	85dB(A)	65dB(A)	60dB(A)
At residences close to the pipelaying route	70dB(A)	60dB(A)	40dB(A) <sup>8</sup>
At residences affected by the noise from camps and other sites	70dB(A)	50dB(A)	45dB(A)

#### Table 10-16 Noise control limits for construction of the BTC

Where:

- Daytime is dawn or 7 am (whichever is later) to dusk or 7 p.m. (whichever is earlier)
- Evening is from the end of daytime to 10 p.m.
- Night is from 10 p.m. to the start of daytime

If any limit is exceeded, or if there is a significant risk of exceedance, noise screening will be provided. This typically comprises:

- Earth mounds between the pipelaying activity and the dwelling (eg using trench spoil)
- Solid fencing of a height to screen the line of sight between the house and the construction activities

Screening will be provided for hospitals, medical facilities, schools, day and residential nurseries and residential geriatric homes at which any limit is likely to be exceeded. Where an affected dwelling is close to a semi-permanent site and noise targets are exceeded, or are at risk of exceedance (eg main camp), the contractor will be asked to consider improvements to the building, such as the replacement of doors or windows and eaves barriers.

# 10.3.4.3 Commissioning and testing

Commissioning and testing procedures are required prior to operation as described in Section 5, Project Description. These include hydrostatic pressure testing of the whole pipeline, section by section.

These hydrostatic test activities, which will each last for several days and nights, are extremely unlikely to give rise to significant noise levels along the pipeline itself, but pumps and air compressors are needed to fill and pressurise the pipeline at the test ends. Generators will also be required at selected locations along the route for security lighting at night.

The combined noise levels for one diesel pump and one generator predicted from BS 5228 are shown in Table 10-17.

DISTANCE FROM SOURCE (m)	50m	150m	250m	350m	450m
Noise Level L <sub>Aeq,15min</sub> dB	70	60	56	53	50

Table 10-17 Combined noise levels from one diesel pump and one generator

Generators and pumps will be sited to avoid close proximity to residences wherever practicable. In any areas where this is unavoidable, a combination of local screening and low noise equipment will be employed to ensure that night-time noise levels at residences are generally maintained below 50 dB(A) which is classified as a **Low** residual impact of short duration.

# 10.3.4.4 Operation

The pipeline will be buried at least 1 metre deep and, therefore, the sound of the oil passing through it will be inaudible at the ground surface.

There will be some noise emissions from the AGIs during operation. Pump stations and pigging stations are both capable of producing noticeable noise levels, the scale of which is generally related to the physical scale of the AGI. In all cases, careful siting of the facilities will ensure that the noise that is produced does not impact on local residents.

At the pump station there is a very slight possibility that there may be some generation of low frequency noise which can travel over significant distances before being attenuated. This effect will be minimised through the design and selection of equipment before considering any other active methods. Other more traditional noise control methods can prevent the generation of whistles, whines, hums, screeches or other pure tones by above ground pipework, all of which can cause disturbance to local residents even at relatively low sound pressure levels.

Noise emissions control criteria will apply to the operation of the AGIs, dependent on local circumstances and prevailing background noise levels. The specific criteria applied in each case will be below a severity ranking of *low* and, where possible, will comply with the *very low* categorisation (see Section 7, Methodology, for severity ranking tables)

Exceptions can be expected, however, in areas where prevailing background noise levels are already exceptionally low (as defined in BS4142) and there is no additional mitigation achieved by matching this level. In such cases a criterion in the range between *low* and *very low* will be selected on the basis of ranges of prevailing background noise levels and other significant noise sources in the area.

A noise survey has been carried out in the vicinity of the pump station site at KP244, on the basis of which specific design criteria have been set. Noise emissions modelling has established that a further 5 dB(A) noise reduction is required to meet these criteria if the pump station site boundary noise complies exactly with the proposed 60dB(A) limit. This additional noise control would take the form of relatively standard engineering solutions, including low noise plant options, sound attenuating enclosures and use of available noise screening within the site itself.

At the block valves, noise during operation will be limited to occasional maintenance activities and visits for inspection purposes.

The residual impact resulting from operation of the AGIs on the ambient noise conditions will be **Low**.

Occasional road traffic movements associated with maintenance and operation of the pipeline will be insignificant in terms of normal traffic flows on local roads, and resultant noise impacts will be very **Low**.

# 10.3.5 Geology and geohazards

# 10.3.5.1 During construction

Impacts to geology will be limited as no blasting is expected to be necessary in Azerbaijan.

Landslides and debris flows can be triggered by human activity, including ground disturbance during pipeline construction. Every effort has been made during pipeline routeing to avoid areas prone to landslides and debris flows, thereby minimising the potential impact.

Wherever possible the pipeline has been routed to avoid economic geological reserves, although the pipeline corridor is close to areas where sand and gravel extraction are practiced (downstream at the Kura East and Shamkir River crossings and upstream at the Tovuz River crossing). There may be slight disruption at the Kura East and Shamkir crossings during construction, due to the proximity of the extraction activity to the pipeline spread. There will possibly be a residual impact during operation as it may be necessary to restrict these activities (see below).

Oil and gas exploration and production has taken place along certain sections of the route and some areas are still active concessions. However, current production facilities have been avoided during routing of the pipeline and therefore impact on oil and gas reserves is unlikely. There will be no residual impact on oil and gas production.

# 10.3.5.2 During operation

Operation of the pipeline and associated AGIs is not expected to impact on the geology of the area. However, as the Section below describes, there are several risks to the pipeline due to the local geology.

# Aggregate extraction

There may be a risk to the integrity of the pipeline from ongoing quarrying activities, particularly those at the Kura East, Tovuz and Shamkir river crossings. This is discussed in further detail in Section 10.3.8, Hydrology.

# Geohazard risks

Several geohazard risks to pipeline integrity were discussed in Section 8. Those that are considered to be of risk to pipeline or AGI integrity can be summarised as follows (note geohazards relating to river crossings are discussed in Section 10.3.8):

- The pipeline crosses two major fault zones at KP26 to KP29 and KP48 to KP51. These areas are also more susceptible to landslide than other areas along the route.
- Medium density earthquake zones cover about one third of the length of the pipeline route, with more than 200 epicentres identified within 30 km of the route since 1962
- Mudflows can occur which could lead to loading of buried pipes and displacement of surface structures
- Ground rupturing associated with mud volcano activity may cause subsidence or displacement along fissures and faults, although the occurrence of these hazards tends to be concentrated around the volcano vents

• The possibility of new mud volcano activity affecting the pipeline in the Mud Volcano Ridge area (KP25 to KP28)

The majority of the risks to pipeline integrity, which are outlined above, have been mitigated during the engineering design phase for the pipeline and associated AGIs as outlined below. The residual risk associated with geohazards is incorporated into the Risk Assessment as discussed in Section 10.4, Unplanned Events.

#### Seismic activity risk minimisation

AGIs

The magnitude of the seismic force to be designed for has been minimised by choosing sites where the expected peak ground accelerations are low. All key buildings have been designed with resistance to seismic events as a key consideration. The fabric of each building will comprise a steel-frame with metal cladding where appropriate. This type of construction is suitable for earthquake regions and the structural design has been carried out using appropriate design codes for such regions. The use of reinforced concrete framed structures has been avoided, as such structures are typically relatively inflexible and therefore susceptible to earthquake damage. Further, the design specifies that any building masonry shall be reinforced specifically to reduce the potential for earthquake damage.

Pipeline

Where the pipeline crosses active faultlines the trench design will be modified to accommodate anticipated differential ground movement induced by earthquakes. This reduces excessive stresses in the pipeline, which may lead to failure or loss of containment. The recommended mitigation at fault crossings includes the modification of standard trench cross sections to a trapezoidal shape such that differential lateral movement causes the pipe to raise out of the trench. Consolidation of back fill material will be less to allow the pipe to move more easily. Pipeline wall thickness has been increased at one location to provide additional pipe strength. Mitigation measures for each specific fault crossing location have been defined on a site-bysite basis on detailed crossing drawings, which will be adhered to by the construction contractor.

#### Mud volcano activity

The pipeline has been routed to bypass active mud volcanoes. Where the pipeline crosses the mud volcano ridge (which also contains active geological faults), the special trench construction for fault line crossing has been extended to account for differential movements. On the basis of current engineering design information, other mud volcanic hazards, such as mud flows, pose negligible threat to the current pipeline route and require no additional mitigation during construction.

AGI sites have been selected on level ground remote from areas susceptible to risk from mud flows caused by either seismic activity or mud vokanoes.

# 10.3.6 Soils

The details of the main impacts, proposed mitigation measures and residual impacts on soils during the construction and operational phases are discussed below. It is important to note that the main mechanism for mitigating the impacts from construction will be through adherence to the Reinstatement Specification, which has been summarised in the Project Description and in

Part 5, Technical Appendix. A Reinstatement Plan will be developed from this specification, as discussed in Section 14, Monitoring and Management. Certain elements of the Reinstatement Specification are summarised below, with reference to mitigation of impacts on soils. A more detailed discussion of the relative merits of the mitigation measures considered, particularly in relation to areas where the residual impacts are significant, is contained in Section 12, Residual Impacts. Potential impacts on soil from contamination to leaks and spills from plant during normal construction, operation and maintenance activities are addressed in Section 10.3.7, Contamination.

# 10.3.6.1 During construction

The construction of the pipeline will result in direct disturbance of soil. Topsoil and subsoil will be stockpiled for re-use in backfilling and reinstatement. Temporary camps for the construction workforce will also result in the disturbance of topsoil, which will be reinstated following construction. The establishment of permanent facilities will result in the permanent loss of soil from these sites. The resulting potential impacts and mitigation measures associated with this soil disturbance are discussed in detail in the Sections below.

#### Compaction

Compaction of soils during construction may occur where the bearing strength is exceeded by the weight of construction vehicles. This is most likely on the ROW and access roads, which will be subject to repeated vehicle movements. Soil compaction alters drainage characteristics and decreases the ability of vegetation to re-establish.

Methods for minimising compaction are addressed in the Reinstatement Specification. In highly sensitive areas (particularly Gobustan), the impact of soil compaction will be mitigated, wherever possible, by undertaking construction activities during periods when the soil is least prone to compaction (ie avoiding very wet weather). In order to avoid compaction impacts outside the ROW, deviation from the ROW or access roads will be prohibited. During reinstatement, the trench back-fill material will be compacted to a similar value to the original surrounding soils to avoid subsidence as a consequence of rain water channelling. After backfilling, the running track will be tined where necessary to alleviate compaction in sensitive areas. The residual impact of construction activities on soil compaction will be **Low**.

#### Erosion

Topsoil stripping during levelling and grading of the ROW and the excavation of subsoil during trenching will break up the soil structure. Depending on the nature of the soil, this may lead to a temporary increase in erosion (from the topsoil and subsoil piles and the graded ROW).

Adequate reinstatement following construction will help the subsequent re-establishment of vegetation and thereby reduce the risk of soil erosion. As discussed above, a project specific Reinstatement Plan will be produced and will include mitigation for impacts to soils based on the following:

- Recreation of a stable landform that mirrors the pre-disturbed condition (eg contours, shape, level of compaction) as this will minimise the risk of preferential erosion and therefore facilitate natural revegetation
- Ensuring protection of topsoil through separation from subsoil and storage in a manner that, as far as possible, retains the soil structure and seed bank and minimises the risk of topsoil loss. The trench will be subsequently backfilled with subsoil, followed by topsoil.

- Establishment of appropriate mechanisms to stabilise the working width if temporary demobilsation of the pipeline spread is necessary
- Development of bio-restoration methodology to achieve the following objectives:
  - To re-establish the pre-construction vegetation cover particularly the variety and distribution pattern of plant species
    - To establish sufficient vegetation cover to minimise erosion of the ROW

The most likely scenario is that SCP installation will commence within one year of completing BTC. In this event, full reinstatement will be limited to those areas that will not be disturbed by SCP construction activities. An interim level of reinstatement will usually apply to the other disturbed areas. Particularly sensitive and erodible areas have already been identified through surveys and desk top studies. In these areas, or if there is a delay of more than 12 months between completion of interim reinstatement and the start of construction of SCP, then full erosion control measures and reinstatement will be implemented over the whole of the disturbed area.

The construction contractor will be required to ensure that for both temporary and permanent reinstatement the ROW exhibits no more than a moderate level of erosion potential. For the purposes of the BTC project, moderate erosion has been defined as less than 10 tonnes per hectare for a one hour duration,10 year return period, storm. Sediment interception devices will be installed where there is a risk of sediment contained in rain water run-off contaminating water bodies.

The reinstatement works will be undertaken in a manner that achieves the following minimum standards:

- Very low risk of the depth of cover above the pipeline being reduced
- Very low risk of off-site pollution and sedimentation
- Low risk of damage to bio-restoration by washing-out of seeds and plants

In areas that will be disturbed by the subsequent installation of the SCP pipeline, interim reinstatement measures may be implemented. The construction contractor will prepare a detailed method statement that identifies appropriate measures for such areas of the pipeline according to the erosion potential of that area.

Wherever practical, the subsoil will be graded during reinstatement to reflect the original profile across the working width and all other construction areas (camps, access roads etc.). In steep areas with highly erodible soils, the ground will be carefully profiled to ensure that the integrity of the pipeline is not compromised.

To facilitate natural revegetation of the ROW, the separately stockpiled topsoil and vegetation debris will be spread over the surface of the ROW following completion of grading. Once the topsoil has been replaced it will be stone picked to remove large stones, which are not in keeping with the surrounding soil texture. It will then be tined and cultivated as necessary to ensure effective re-vegetation.

Areas of sensitive natural habitats or high erosion potential will be seeded with a mixture of native plant species to facilitate revegetation; in some desert areas a nurse crop of annual grasses may be used to provide surface stabilisation while the slow growing desert plants reestablish. If deemed necessary by site restoration personnel, additional surface stabilisation measures will be adopted in areas of high erosion potential. Where necessary, erosion mats or hydroseeding will be used to assist in stabilising vegetation growth. Additional reinstatement procedures that will be employed as necessary are summarised below:

- Upon completion of subsoil and topsoil reinstatement, disturbed areas will be inspected jointly by the construction contractor and BTC Co. personnel for slope stability, relief, topographic diversity, acceptable surface water drainage capabilities, and compaction
- A target of a 70% cover of adjacent off ROW ground vegetation established within one year of planting will be set for most areas. This will minimise erosion and provide a sustainable, self-generating plant community under virtually all conditions. It is, however, recognised that the achievability of this target will be dependent on local conditions along the pipeline route and will be reduced for the desert sections

Erosion is most likely to be a problem in the following areas along the route:

- Parts of the Gobustan semi-desert area with significant slope, particularly the Mud Volcano Ridge area (KP25-KP29)
- Intermittent sections of Badlands to the west of Ganja, KP351-KP399 including the approaches to the Hasansu river crossing (KP395.9-KP398)

These areas in particular already exhibit active erosion, which could be exacerbated by construction of the pipeline if not managed correctly. This may also lead to accelerated erosion of the ROW and pipe trench following reinstatement, thereby risking the integrity of the pipeline. Additional mitigation to that outlined above has been adopted in order to manage the erosion problem in these areas. This is discussed in Section 12, Residual Impacts.

To minimise any potential impact following hydrostatic testing of the pipeline, the release of hydrotest water will be undertaken in a controlled manner in order to avoid soil erosion or scour. This will be detailed in the hydrotest method statement and is also detailed in the Reinstatement Specification.

Following mitigation by reinstatement in accordance with the Reinstatement Plan, the residual impacts of construction activities on soil erosion will be **Low** in most areas to **Medium** on the narrow ridges (Mud Volcano Ridge and Hasansu River approaches) and badland areas west of Ganja. These will therefore be discussed further in Section 12.

## Topsoil Storage

Prolonged storage of topsoil can lead to a loss in fertility of the soil as nutrients become leached out by rainfall. This process can lead to impaired vegetation growth once the soil is reinstated. In addition, prolonged topsoil storage can lead to the loss in viability of the seed bank contained within this soil.

Storage of topsoil is addressed in the Reinstatement Specification, as summarised in Section 5, Project Description. To mitigate for these potential impacts, topsoil (where present), and subsoil will be kept separate and replaced in the correct order during backfilling and reinstatement. In order to prevent loss of fertility and degradation of the seed bank within stored topsoil (where present), the topsoil will be stored for as short a time as possible, allowing for engineering constraints. In the sensitive Gobustan desert area, topsoil will not be stripped from the ROW, since the depth of topsoil is minimal and the viability of the seed bank and subsequent re-establishment of flora is likely to be compromised by stripping. In this area, the working width will be reduced to decrease the impact on the sensitive habitat.

The residual impact on the viability of the soil and seed bank will generally be **Low**. However in Gobustan, the residual impact will be **Medium** (but over a more limited area) since vehicle movements and clearance due to initial grading of the ROW will disturb the topsoil and seed bank. The sensitive Gobustan habitat is discussed in more detail in Section 12, Residual Impacts in terms of residual impacts on soil, ecology and landscape.

#### Permanent loss of soil/agricultural land

Construction of the pump station will require the excavation of topsoil and subsoil. Although removed soils will be stockpiled for later use in bund wall construction, land levelling and/or site rehabilitation works, it will be permanently lost from its point of origin.

At other AGIs, new access roads and where existing roads are widened, construction will entail the movement of topsoil and subsoil which will be permanently lost from its point of origin. Topsoil of any botanical value will be re-used elsewhere on the route.

The residual impact of construction on soil resources is considered to be of **Medium** significance, and is therefore discussed further in Section 12, Residual Impacts.

## 10.3.6.2 During operation

Once the pipeline and associated AGIs are in operation there will be minimal additional impact on the soils of the area except where compaction is caused by vehicle movements. There mayalso be risks to the integrity of the pipeline due to soil salinity and erosion, as discussed below.

#### Compaction

Maintenance of the pipeline will require limited movement of whicles along the permanent easement, which will lead to some disturbance, and compaction of the soils. However, this will be minimal and will not cause a significant impact. Surveillance will not normally call for vehicle movements.

In order to avoid soil compaction and rutting in areas where the reinstated ROW might be used as an unauthorised short cut by vehicles, access will be blocked. This will be achieved by the construction of berms (or similar) of sufficient height (minimum 1.5m high) to provide a barrier to vehicles. Where possible, the berms will be tied to vegetation or rocks adjacent to the ROW to prevent traffic from circumventing the barrier. Where available, large rocks excavated during construction may be used as an alternative to earth berms. Residual impacts on soil compaction and rutting during operation will therefore be of **Low** significance where this mitigation is suitable. However in most areas along the pipeline, this is not a realistic and implementable form of mitigation; in practice, mitigation will depend on persuading local people not to use the pipeline as a road. The residual impact is therefore regarded as **Medium** significance and is discussed further in Section 12.

#### Soil salinity

Risks to pipeline integrity during operation are present in the form of highly saline soils which could lead to accelerated pipeline corrosion in certain areas. Gypsum (hydrated calcium sulphate) is often found both on and just below the soil surface. The resulting saline conditions (in both soil and goundwater) are highly aggressive towards steel and concrete used in pipeline construction.

This has been mitigated through the design of the pipeline coating and cathodic protection (CP) systems. Ongoing mitigation will be provided through the regular monitoring and maintenance of pipeline and associated infrastructure, including the CP system, which will

greatly reduce the risk of a pipeline leak due to corrosion. Residual risk to pipeline integrity has been taken into account in the Risk Assessment outlined in Section 10.4, Unplanned Events.

#### Erosion

Risks to pipeline integrity during operation are also present where highly erodible soils are crossed. Specific reinstatement methods developed as part of the construction contractors Reinstatement Plan will ensure that soil erosion will not be a risk to pipeline integrity during operation. Rigorous inspection and maintenance during operation will also minimise the risk to pipeline integrity due to erosion. Residual risk to pipeline integrity has been taken into account in the Risk Assessment outlined in Section 10.4, Unplanned Events.

# 10.3.7 Contamination

Contaminated land impacts and mitigation are addressed in this Section in terms of:

- Construction and operation of the pipeline in the presence of pre-existing contaminated land
- Contamination of the land due to pipeline construction and operational activities

Communicable diseases are assessed as a social impact in Section 11.

# 10.3.7.1 Known existing contamination

Twenty-three sites of existing contamination were recorded along the pipeline route as detailed in Section 8. The impacts of encountering both known or unknown contaminated soils during construction could be twofold:

- Risk to Health and Safety of construction personnel
- Risk of spreading contaminants into the wider environment
- During pipeline routing areas of known contamination have been avoided wherever possible. Where this has not been possible, or where unknown contamination may be present, the ROW will be cleared to an appropriate standard (in terms of construction personnel HSE) of existing and recorded contamination prior to construction. Wherever possible the excavation of contaminated soil will be limited to the pipeline trench and clearance of fly-tipped waste from the working areas.

The residual impacts of the construction activities on existing contaminated land are **beneficial** if it is cleared.

# 10.3.7.2 Unknown contamination

There is a risk that areas of as yet unidentified contamination may be encountered during pipeline construction, particularly in the following areas:

- Where the BTC pipeline crosses existing oil pipelines, which may have had underground leaks
- Where the BTC pipeline crosses watercourses where contaminants (particularly heavy metals) may have accumulated in river bed sediments, particularly on the outside bends of meanders. Pipeline crossings downstream from heavily industrial

areas may therefore be at risk of contamination (it is considered, however that the Kura East crossing is the only crossing where this may be a significant risk).

- If contamination is suspected sampling will be undertaken and if necessary for the Health and Safety of construction personnel, the contaminated soil will be removed. Wherever possible the excavation of contaminated soil will be limited to the pipeline trench.
- The residual impacts of the construction activities on existing unknown contaminated land are positive if it is cleared.

# **10.3.7.3** Contamination during construction

Activities associated with construction have the potential to produce soil, groundwater and surface water contamination. The principal potential contaminants associated with the construction activities are as follows:

- Fuels and lubricating oils
- Domestic wastes
- Welding wastes and field welding and coating materials
- Paints and solvents
- Sewerage
- Hydrotesting chemicals if used (eg biocides, oxygen scavengers and corrosion inhibitors)

Soils, surface or ground water may become contaminated by fuel, oil and chemical spills from plant and by hazardous, non-hazardous or aqueous wastes. This will be mitigated by the use of a Pollution Prevention Management Plan (including protocols for managing hazardous materials as well as pollution control) and a Waste Management Plan. These documents will detail how hazardous materials will be stored and used in order to prevent spillage, how contaminated soil will be remedied if a spill occurs and how all types of waste will be disposed of to prevent contamination of the soil.

If a spill does occur, a detailed contaminated land cleanup strategy will be implemented as follows:

- The need for remedial work in any specific area will be determined on the basis of the observed contaminants, sampling and analysis to determine their concentrations and the risks that they may pose to local receptors (social and environmental)
- In the first instance, the Dutch IV guidelines will be used as screening values to determine whether additional risk assessment or remedial work is required. The Dutch IV guidelines are an internationally recognised method for assessing contaminated land. In the case of contaminants that are not included in the Dutch guidelines, internationally recognised alternatives may be used
- In each area of identified contamination, a site-specific remedial plan will be developed. The plan will include a summary of the environmental risks posed by the contamination and the procedures that are to be adopted to mitigate those risks
- The preferred options for the treatment of contaminated soil will be based on the risks posed by the material. In keeping with the aim of minimising the transportation of hazardous materials and minimising waste generation, preference will be given to in-situ and low technology remedial approaches

Remedial targets will be set on the basis of the Dutch IV values, other internationally recognised values or through a site specific risk assessment.

If a spill occurs, the potential impact will depend on the type and amount of the chemical that has been spilt and the sensitivity of receiving environment. The residual impact on soils will generally be **Low** if the remediation strategy outlined above is followed, and considering the relatively small volumes of hazardous materials to be used during construction. Consideration of contamination due to more serious unplanned events is discussed in Section 10.4.

All hydrotest water, which could potentially contaminate receiving waters, will be tested and treated prior to discharge. This will be covered in the Hydrotest Method Statement. The residual impact will be **Low**.

Where horizontal directional drilling (HDD) is undertaken, an HDD Method Statement will be developed by the contractor and agreed by BTC Co. It will include a detailed soils assessment to minimise the risk of drilling mud leakage. It will also include procedures for cleanup if a leak occurs. Approved procedures for the disposal of drill cuttings will be included in the Method Statement. The residual impact will be **Low**.

# 10.3.7.4 Contamination during operation

The most serious potential operational aspect of the pipeline that may result in soil or groundwater contamination is the release of oil as a result of a pipeline leak. Oil spills during operation are discussed in detail in Section 10.4, Unplanned Events.

Other day to day operational activities such as pigging, fuelling of vehicles and the supply of fuel to pump-stations may also have the potential to lead to unplanned releases of potential contaminants.

The Oil Spill Response Plan and associated procedures will be put in place for the project to achieve minimisation of soil, groundwater and surface water contamination as a result of spillages or leakages during operation. Additional measures will, however, be required to remediate residual contamination following the completion of the initial oil spill response procedures. The residual impact will be **Low**.

# 10.3.7.5 Workforce health and safety

The construction contractor will be required to develop a project specific Health and Safety plan. The plan will include a specific section on the management of Health and Safety risks associated with contaminated land.

# **10.3.8 Surface water hydrology and water quality**

Each stage of the BTC project has the potential to impact on surface water resources as summarised in Table 10-18. Key concerns include the discharge of sediment into watercourses, releases of potentially toxic materials, disruption to flow rates and the loss of amenity of the waterways (eg contaminants entering the Shamkir and Mingechaur Reservoirs which provide a major water resource for the whole country). The main surface water resources that could be impacted by the BTC project are outlined in Table 10-3, together with proposed mitigation measures. The protection of surface water resources has been a fundamental consideration in the route selection and engineering design for the BTC pipeline and associated facilities. This emphasis will be continued throughout the construction and operational phases of the pipeline.

Oil spills during operation of the BTC pipeline would have the capacity to significantly affect surface water quality and are discussed in detail in Section 10.4, Unplanned Events. Ecology of surface watercourses, including fish spawning, is addressed in Section 10.3.12, Ecology and Protected Areas.

PIPELINE PHASE	EXAMPLE ACTIVITY	POLLUTION SOURCE/ TYPE	POLLUTION PATHWAY	POLLUTION RECEPTOR
Construction	Vegetation stripping; soil removal; trenching; river disturbance at crossings; vehicle use; temporary camps	Fine sediment from erosion; spillages of fuel, lubrication oil, sewage wastewater & hazardous chemicals	Overland flow across soil surface; river systems; subsurface migration; groundwater flow	Downslope/downstr eam river, canal, ditch, lake reservoir, aquifer.
Testing	Cleaning and hydrotesting	Contaminated cleaning and hydrotest water (eg with chemicals, manufacturing residue, swarf/scale, sediment)	Overland flow across soil surface; throughflow via subsurface soil; groundwater flow	Downslope/downstr eam soil water, river, canal, ditch, lake, reservoir, aquifer, wetland
Operation & maintenance	Oil pipeline leakage or rupture	Crude oil	Overland flow across soil surface, throughflow via subsurface soil; groundwater flow; river water at river crossings	Downslope/downstr eam soil water, river, canal, ditch, lake, reservoir, aquifer, wetland
Pump station & AGI operation & maintenance	Accidental spillage; drainage/ sewerage system breach	Fuel; lubrication oil; engine washdown water; hazardous substances; wastewater (sewage)	Drainage pipes; surface contamination or treated water discharges, throughflow via subsurface soil; groundwater flow	Downslope/ downstream soil water, river, canal, ditch, lake, reservoir, aquifer, wetland

# 10.3.8.1 During construction

## Sediment release

The principal hydrological impacts associated with the construction of the pipeline are anticipated to be those associated with the release of sediment. Sediment is considered a water pollutant because it subdues light levels within the water column and at the channel boundary, and can therefore impact freshwater ecosystems. High levels of suspended sediment also cause deposition and clogging within river gravel bars. Gravel bars are often important habitats; clogging can therefore be highly detrimental to fish communities by, for example, starving fish eggs of oxygenated water supplies. A number of sediment-generating activities have been identified during construction, but will vary according to the final techniques selected. Vegetation has to be removed from the working width, exposing bare soil to rain wash, overland flow and freeze-thaw processes. Where there is a significant slope, consequent erosion may deliver fine sediments from the site to nearby rivers, where onward propagation can be fast and widespread.

The presence of high levels of suspended sediment concentration can also render potable water supplies unpalatable. In Azerbaijan, many of the rivers already contain high sediment loads, thus reducing the significance of additional sediment introduced during construction. Those rivers that are considered to be most at risk are recorded in Table 10-3.

#### Surface water contamination

There is a potential for pollution from chemical contaminants at all stages of the project. Spillage of fuel, lubrication oil or wastewater is potentially important at the watercourse crossings, pump station, block valves and AGIs during construction, testing, maintenance and operation. Contaminants introduced by construction and operational phase plant could migrate downstream to key receptors such as Mingechaur and Shamkir Reservoirs or sensitive ecological areas such as the Karayazi Wetland (Kurudera crossing), or the Barda State Forbidden Area (Kura East Crossing). Migration to these key receptors could take place very quickly - in a matter of a few hours in some cases. River crossings where the risk of impact on downstream receptors could be significant have been recorded in Table 10-3.

Although the likelihood of a major loss of crude oil from the BTC pipeline to a watercourse is considered to be very low, the potential impacts of such a loss would be wide ranging and severe. It is possible that a loss of oil to the surface water system could compromise sensitive habitats, drinking water supplies, industrial water supplies and settlements. This is discussed further in Section 10.4, Unplanned Events.

#### Flow rates

Flow quantity is often as important as water quality in rivers. Interruption of river flows has the potential to adversely impact ecological sustainability, fisheries, water abstractions and waste dilution downstream. It should be noted that the flow characteristics of Azerbaijan's rivers are typically highly seasonal and that many river crossings may be dry or at low flow from August to February.

#### Mitigation during construction

River crossing points have already been determined through pipeline routing surveys to ensure that the crossing points minimise the impact on sensitive hydrological and ecological features. This includes adequate design controls to minimise the impact on the hydraulic regime of the rivers.

To minimise impacts at particularly sensitive rivers (as outlined in Table 10-3), the following measures will be implemented:

- The designation of sensitive river crossings as trenchless, or seasonally constrained open-cut, to minimise impact on spawning and migration of fish and to minimise the generation of suspended solids
- The timing of pipeline construction at certain river crossings, in particular the Ganjachay, Shamkirchay, Zayamchay and Tovuzchay Rivers will reflect their highly seasonal flow regimes. Wherever possible, construction of the pipeline crossings will be undertaken during periods of low flow
- Oil spill clean up equipment will be available at significant water crossings for quick response should a spill occur. Personnel will be trained to use such equipment. The type and quantities of equipment will be agreed before construction begins

- Training of appropriate personnel will be carried out to educate them on the environmental sensitivities of river crossings
- Wherever practical, to avoid oil and diesel pollution, vehicles will not travel through rivers and watercourses when water is present. Vehicles will therefore use flume pipe crossings or work from pontoons and barges; alternatively draglines will be used to dig the pipeline trench through active watercourses. Refuelling will not take place within 30m of a watercourse and drip trays will be used under standing plant
- Restore banks as much as possible to their pre-existing contours. A revegetation plan is to be prepared as part of the Reinstatement Plan and submitted by the contractor prior to the commencement of construction
- Sediment traps (straw bales or purpose-built barriers/bunds or settling tanks) will be used to trap sediment-laden runoff from the ROW

Seasonally high loads of suspended solids are a common natural occurrence in many of the rivers in Azerbaijan. However, there is a need to ensure that these are not increased significantly, and that potential impacts on fisheries, particularly in the Kura, are minimised. Fish migration and spawning occurs most commonly between October and June. This has been taken into consideration at certain river crossings where construction constraints have been specified, as detailed in Table 10-3.

#### Management Plans

The protection measures to be implemented during the project with the aim of minimising impacts on surface water resources will be incorporated into a number of management plans (as described more fully in Section 14, Monitoring and Management). The plans with particular pertinence to watercourse crossings are listed below:

- An Emergency Response Plan, which will detail actions to be taken if a contaminant enters a watercourse. This may include the use of spill clean-up kits (kept in vehicles) and the deployment of booms and absorbents at designated river crossings
- A section on sediment and erosion control within the Reinstatement Plan, identifying sections with the highest risk of erosion and/or excess sediment generation. This document will also identify temporary erosion control measures to be implemented at these locations
- A section on wastewater management within the Waste Management Plan, addressing the disposal of black and grey waters, generated during construction
- The Pollution Prevention Management Plan which will detail how to store and handle hazardous materials with respect to the prevention of surface water contamination

## **River crossing Method Statements**

In general, River Crossing Method Statements will detail how each river will be crossed, and will include:

- Storage of channel bank and bed material separate from topsoil and subsoil
- Rreinstatement of the river banks and bed, which may require the use of rip rap or gabions to reinforce the river banks at the crossing points and prevent erosion in the future
- The use of sediment filters and sediment fencing to reduce sediment release into rivers
- Installation of temporary flumes to channel the river flow away from construction works and to form bridges across watercourses (where necessary)

The contractor will prepare specific Method Statements for the crossing and reinstatement of wadis, including actions to be taken in the event of a flash flood.

Where horizontal directional drilling (HDD) is undertaken, an HDD Method Statement will be developed which will include a detailed soils assessment designed to minimise the likelihood of drilling mud leaking into a watercourse. Appropriate disposal of drill cuttings to avoid ingress into watercourses will also be included in the Method Statement.

Within those areas which could be liable to flooding at the time of construction, further measures will be adopted to reduce the potential impact of the works in the event of a flood, including:

- Minimising temporary storage of material above ground level
- Immediate removal/disposal of surplus material off site
- Provision of drainage/gaps within soil bunds to reduce influence upon the drainage pathways of flood water, etc
- Replacement of any flood defence banks breached by the pipeline

Following implementation of the above mitigation measures, the residual impact on hydrology is generally considered to be **Low** for most rivers. Rivers with a particular environmental sensitivity are listed in Table 10-3, together with specific mitigation measures that will be applied (including non-open cut crossing methods and seasonal constraints on construction). Those rivers where the residual impact remains **Medium** are:

- Djeyrankechmes
- Hasansu
- Kura West

At all three locations, engineering considerations preclude the use of non open-cut techniques. The residual impacts on these rivers are discussed in more detail in Section 12, Residual Impacts.

# 10.3.8.2 Hydrotesting

Cleaning and hydrotesting will be carried out prior to pipeline commissioning. The volumes of water required are potentially significant. The sources available in arid and semi-arid areas are restricted and heavily committed for potable, industrial and agricultural uses. It is likely that the Kura River will be utilised as the main source of hydrotest water.

The appropriate consents will be obtained for any abstractions from, and discharges to, watercourses. Any cleaning and hydrotest water which could cause contamination of surface (or ground) waters will be tested and treated as necessary prior to discharge, including debris and sediment removal. The contractor will prepare a Hydrotest Method Statement, which will include contingency plans in the event of a leak. The main concerns will be the introduction of hydrotest chemicals and eroded sediments into a watercourse close to, and upstream of, a potable abstraction point or fish spawning area.

Temporary storage ponds or tanks may have to be built to provide buffer storage if it is necessary to even-out abstraction rates or remove sediment from the source water, and also to facilitate any treatment required prior to discharge.

Local communities will be consulted on the abstraction, discharge and re-use of hydrotest water.

The principal hazard introduced by hydrotesting is the very unlikely event of a failure of the line under test, resulting in the unplanned discharge of water. This could result in local erosion on steep slopes, particularly in poorly consolidated soils. However, the presence of very low gradients along most of the BTC pipeline route in Azerbaijan suggests that slope erosion is unlikely to be very significant.

Following implementation of the mitigation measures described above, the residual impact on hydrology as a result of hydrotesting is likely to be **Low**. However, at this stage, the exact volumes of hydrotest water required, length of pipe to be hydrotested in each test and the extent to which hydrotest water will be reused between test sections cannot be specified. This may increase or decrease the impact accordingly and will be assessed once the details are known.

# 10.3.8.3 During operation

Risks to pipeline integrity associated with the hydrological regime of the rivers crossed by the pipeline are discussed in Section 8, Baseline and can be summarised as follows:

- Highly variable flow rates and bed materials will affect river dynamics in terms of bank erosion and bed scour potential. This will influence the burial depth beneath the bed of the river that is required to protect the pipeline's integrity
- There is a risk to pipeline integrity from river mud flows, which can be significant events in at least seven rivers crossed by the pipeline
- There is active sand and gravel extraction occurring in the river beds of the Kura East, Shamkirchay and Tovuzchay Rivers that has potential to impact upon pipeline integrity (Table 10-3)

Washout and scour are distinct possibilities at river crossings and could compromise the functioning of a pipeline. Many of the rivers crossed by the BTC pipeline are seasonally active and capable of eroding their banks and bed. Lateral mobility and bed scour are possibilities at a number of river crossings, especially the Shamkirchay, and the Kura West and Kura East, and possibly the Tovuzchay.

In the Gobustan region, the pipeline route crosses many wadis, the largest of which is the Djeyrankechmes. These wadis rarely contain flowing water, but on occasion high intensity rainstorms can cause flash floods and the wadis are then subject to very high flows and sediment transport rates.

High-intensity rainstorms combined with substantial snowmelt upstream of the pipeline route in many rivers, particularly those between the Kura East crossing and the Georgian Border, can also cause flash floods; it is therefore important to ensure that the river channels are not restricted. It should be noted that many key rivers (eg Kura, Shamkirchay, Ganjachay and Tovuzchay) have control devices, such as dams, upstream from the pipeline crossing point. This serves as a mechanism for irrigation and water supply for upstream communities, but will also reduce the impact of flood events at the crossing points.

All of these risks have been and will continue to be taken into account during the design and execution phase of the project. The risks to pipeline integrity during operation due to bed scour will be taken into account during the detailed engineering design phase which will ensure that the pipeline is buried to a sufficient depth below the river bed. Lateral scour will be allowed for by incorporating adequate set-back distances into the design of each crossing.
During operation, monitoring of river crossings will be undertaken. Channel erosion will be monitored at least at the locations of major watercourse crossings (Agsu Canal, Turianchay, Kura (East and West), Karabakh Canal, Kurekchay, Ganjachay, Shamkirchay, Zayamchay, Tovuschay and Hasansu).

In those rivers where Third Party sand and gravel extraction or long term changes in river bed dynamics may affect the integrity of the pipeline, the following mitigation measures are proposed:

- Close consultation with the owner/operator and agreement with the Licensing Authorities for the Kura East, Shamkirchay and Tovuzchay sand and gravel extraction operations, to raise the level of awareness about the risk to pipeline integrity
- Consideration of increased burial depth of the pipeline at the Shamkir crossing, to accommodate not only future aggregate extraction activities, but also the potential bed scour depth during periods of flash flood
- Increased surveillance of the pipeline route across these rivers
- Monitoring of changes in channel cross section at all crossings

The residual risk associated with the geohazards at river crossings has been incorporated into the Risk Assessment discussed in Section 10.4. The residual impacts are considered to be **Low**.

# 10.3.9 Hydrogeology (groundwater)

The main impacts on groundwater due to pipeline construction and operation are:

- Impact on Groundwater Quality
- Impact on Groundwater Flows

Impacts on groundwater quality resulting from accidental events during operation of the pipeline are discussed, and results of modelling are presented, in Section 10.4, Unplanned Events. General mitigations for impacts on groundwater quality are outlined in Section 10.3.8, Surface Water Hydrology, since they are also applicable to surface water quality. These issues are therefore not discussed in detail in this Section.

## 10.3.9.1 Impact on quality of groundwater

During construction and operation, spills, discharges or leakages of a variety of substances could have an impact on groundwater quality (Table 10-19).

The important factors when determining the magnitude or likelihood of an impact on groundwater are the:

- Nature and quality of the spill, discharge or leak
- Type and thickness of the overburden (including porosity and permeability)
- Depth of the water table
- Rock type
- Aquifer thickness
- Attenuation properties of the aquifer (ie the ability of the aquifer to dilute and disperse any spill)

#### Table 10-19 Potential groundwater contamination-related hazards during construction and operation of BTC pipeline

ACTIVITY	POTENTIAL HYDROGEOLOGICAL IMPACT						
General Activities during Construction and Operation							
Vehicle, plant and equipment; fuel and oil leaks	Contamination of soil or groundwater by hydrocarbons						
Storage, handling and disposal of hazardous materials	Contamination of soil or groundwater by variety of substances (lubrication fluids, solvents, paints, oils)						
Production of solid wastes	Disposal, degradation and leaching of wastes releasing contaminants to groundwater.						
Disposal of waste water and sewage	Disposal of waste water if to ground, may result in contamination of groundwaters by micro-organisms, detergents, nitrates						
	Specific to Construction of Pipeline						
Drilling (HDD or abstraction well construction)	Contamination (due to increase in suspended solid content) of groundwater by drilling fluids or leaching of drilling cuttings						
Cleaning and hydrostatic testing of pipeline	Possible contamination of groundwater by hydrotest chemicals, or by imported test water of different quality to local ambient groundwater (salinity, redox etc.)						
	Specific tO Operation of Pipeline						
Leakage or rupture of pipeline	Release of crude oil to groundwater environment resulting in contamination of groundwater by hydrocarbons, and modification of groundwater pH/redox conditions (mobilisation of Fe, Mn; generation of methane, $H_2S$ etc.) Subsurface migration of free phase hydrocarbons, resulting in: Migration of vapour phase to inspection chambers, confined spaces, dwellings etc. Direct impact on abstractions or surface water						

The areas most likely to be impacted are between Yevlakh and the Georgian border where groundwater is heavily abstracted and is close to the surface (often within 1-2m). The Karayazi Aquifer (from the Kura West crossing at KP411 to the Georgian border at KP442) is particularly vulnerable as permeable sands and gravels overlie it. The main mechanisms available to ensure mitigation against adverse impacts on groundwater quality will be the development of, and adherence to, a Pollution Prevention Management Plan, a Waste Management Plan and an Emergency Response Plan, as well as an HDD Method Statement and a Hydrotest Method Statement, as described in Section 10.3.8, Surface Water Hydrology.

Any hydrotest water that could cause contamination of groundwaters (eg due to salinity or the presence of other contaminants) will be tested and treated prior to discharge. This will be covered in the Hydrotest Method Statement.

The Emergency Response Plan will detail actions to be taken if significant quantities of a contaminant are released to the subsurface. The likely required elements of such a plan with respect to groundwater contamination are discussed further in Section 14, Management and Monitoring.

Measures to prevent groundwater contamination will be especially stringent in the valleys of the rivers of the Ganja-Kazakh Piedmont Plain, on the Kura floodplain and on the Karayazi Plain, as these are the most hydrogeologically sensitive parts of the BTC pipeline route.

Following implementation of the mitigation measures outlined above, the significance of the residual impact on groundwater quality during construction is considered to be **Low**.

Impacts on groundwater during operation are only likely to result from an unplanned event (oil leak). This issue is discussed in Section 10.4, Unplanned Events.

## 10.3.9.2 Impact on groundwater flows

#### Physical presence of pipeline

The pipeline will be buried, with the top of the pipe at least one metre below ground level and the pipeline typically lying at between one and two metres below ground level. Along the majority of the pipeline route it will thus lie above the water table. The physical impact on groundwater flow will therefore be **Negligible**.

#### Pipe trench as a rapid flow conduit

The backfilled trench material, even if compacted, may have a higher permeability than the undisturbed strata. Thus, the pipeline trench may act as a 'rapid flow' conduit for groundwater if:

- The water table is shallow or the area is subject to high precipitation rates
- The terrain has a gradient
- The soils/subsoils are of low permeability

This, in turn, may lead to:

- Subsurface erosion/outwashing of fines from the backfill material
- Lowering of groundwater levels along the trench at higher terrain elevations
- Waterlogging and/or appearance of springs where water discharges from the trench at lower elevations

Placing trench breakers where necessary to impede the movement of groundwater along the trench, will mitigate this potential impact. Following mitigation, the residual impact will be of **Low** significance.

#### Derogation (lowering of groundwater levels) due to abstraction

Groundwater levels may be impacted by abstraction for the supply of water to construction camps and operational facilities. Abstraction of groundwater causes a temporary depression of the water table in the vicinity of the abstraction point (the radius of influence). This drawdown may have an adverse effect on the yield of nearby boreholes, wells, springs and karizes. Springs, karizes and shallow dug wells, most commonly used by poorer sections of the community, are especially vulnerable to small declines in the water table. Similarly, wetlands supported by groundwater, such as the Karayazi Wetland, may be highly sensitive to declines in the water table.

The shape, depth and extent of the cone of depression of the water table around an abstraction well depends on the transmissivity and storage properties of the aquifer and on the recharge of groundwater to the aquifer. When abstraction ceases, if other factors do not materially change and natural recharge is effective, the water table will normally recover to its original level.

If groundwater is abstracted for construction or operation of the pipeline, the following procedures will be undertaken:

- The transmissivity and storage properties of the aquifer will be estimated from current information
- The likely radius of influence of the proposed abstraction point will be calculated

- Abstractions (boreholes, wells, springs, karizes) or environmental features (wetlands, springs, streams or surface water features in continuity with groundwater) will be identified within the likely radius of influence of the abstraction point
- Permission/licence to drill and abstract groundwater will be obtained from the relevant Azerbaijani Authorities
- The abstraction borehole, when completed, will be test pumped. During the test pumping, other features (as listed above) will be monitored
- Abstraction rates will be adjusted to ensure that existing uses will not be compromised

Although it is difficult to assess the significance of the residual impact at this stage, as it will vary on a case-by-case basis, with the implementation of the mitigation proposals outlined above, the residual impact is likely to be **Low**.

# 10.3.10 Landscape and land use

The aspects of the project that will impact on the landscape of the area are the temporary use of land for construction (ROW, roads, construction camps and pipe yards) and the permanent adoption of land for the pump station, intermediate pigging stations, block valves and access roads.

# 10.3.10.1 During construction

The ROW and the temporary facilities will be visible from the time of vegetation or topsoil removal until reinstatement is complete and vegetation has re-established fully. Those areas of the pipeline ROW that will be disturbed by the installation of SCP during the following year will be left partially reinstated (as described in Section 5, Project Description and Section 13, Cumulative Impacts). This will inevitably increase the duration of visual impact in these sections, as discussed in Section 13.

All disturbed areas will be reinstated in accordance with the Reinstatement Specification (summarised in Part 5, Technical Appendix) and the contractor will be required to develop and implement a Reinstatement Plan as described in Section 14, Management and Monitoring. One of the main objectives of reinstatement of the pipeline route is to return the visual integrity of the landscape as closely as possible to its previous condition. Reinstatement techniques are constantly evolving and improving so high standards of reinstatement can usually be achieved.

Past experience suggests that arable land and pasture will recover fully within three years of reinstatement; semi-natural habitats with slow growing plants may take longer as discussed in Section 10.3.12, Ecology. In the context of this pipeline it is expected that most of the semi-desert and desert areas will recover visually within 5-10 years of reinstatement. However, in Gobustan, where the plant communities are dominated by exceptionally slow growing species, recovery may take up to twelve years (see Section 10.3.12). Specific mitigation measures for Gobustan are described in Section 10.3.6, Soils.

At a number of locations, the pipeline crosses linear features such as lines of trees, watercourses, lanes or tracks. These features form important visual focal points along the route, which will be disrupted until reinstatement and regrowth of vegetation is complete. Wherever possible the removal of existing mature trees will be avoided. Provided that the integrity of the pipeline is not jeopardised, any removed trees will be replaced during the reinstatement phase using indigenous species, preferably of local provenance. It will be necessary to protect newly planted trees from grazing animals.

In areas where grading of the working width impacts on the local topography, reinstatement will be undertaken in a manner which is generally sympathetic to the existing contours. At most locations the disturbed ground will be indiscernible once the vegetation has re-established and the residual impact will be **Low**.

There are, however, locations along the route where extensive grading will be required to provide a level working area. This particularly applies to the Mud Volcano Ridge area (KP26–28), the approaches to the Tovuzchay and Asrinchay Rivers (KP375.6–377), the approaches to the Hasansu River (KP395.9–398) and scattered locations where the pipeline crosses a side slope (ie it runs approximately parallel to the contours). At these locations it will not be possible to return the topography to its pre-existing form as this may exacerbate erosion risks (see Section 10.3.6, Soils) and would preclude access to the pipeline for inspection, maintenance or emergency response. The visual impact of the flattened ridges will be minimised by:

- Considering potential visual impacts when selecting spoil disposal locations
- Grading the edges of the levelled platform
- Reducing the separation distance between the two pipelines if construction of the SCP goes ahead (see Section 13, Cumulative Impacts)
- In these localised areas, the residual impact of pipeline construction on topography is classified as **High** as it is a permanent change
- The creation of a level working platform on the ridges will generate large volumes of surplus subsoil which will generally be disposed of locally to minimise vehice movements. Visibility will be taken into account when determining spoil disposal locations to ensure that any change is restricted to a localized area. The residual impact is likely to be **Medium**

During construction, the permanent access roads and facilities will present similar visual impacts to the temporary facilities, but they will continue to be visible throughout the operational phase of the project (as discussed below).

In all areas of construction activities, items such as large plant, earthworks, pipe joints and other vehicles will be visible throughout construction. This is a temporary impact, the duration of which will be minimised by the prompt removal of vehicles, plant and materials on completion of the works.

The disposal of waste from construction activities will be strictly in accordance with the Waste Management Plan (Section 14, Management and Monitoring). Disposal will be restricted to approved locations which will be subject to an environmental review. Among other considerations, disposal will only be allowed at locations where the waste can be adequately screened from sensitive viewpoints.

Monitoring programmes will be instigated to ensure that all proposed mitigation measures are being applied and are effective.

## 10.3.10.2 During operation

#### Pipeline

Once the temporary working areas have been reinstated, the majority of the landscape will return to its former condition. The buried pipeline will therefore have minimal visual impacts during its operational life. The only persistent visual impacts will take the form of:

- Aerial and pipeline markers required to identify the route. Although permanent, they are considered to have a Low residual impact
- Levelled ridges at specific locations as discussed above

It is possible that some sections of the pipeline route will be used as a vehicle track following reinstatement. In this event, the erosion risk will be increased and recovery of the vegetation will be slowed or prevented. This will increase the duration and potentially the magnitude of visual impact. BTC Co's operational procedures will prevent their workforce from driving along the reinstated ROW except in an emergency. With the implementation of these mitigation measures, and taking into account the many existing tracks along the general alignment of the pipeline, the residual visual impact is considered to be of **Low** significance. Further discussion of mitigation measures to prevent vehicles using the ROW for access is given in Section 12, Residual Impacts.

#### Facilities

The main impact on landscape and land use during operation will be the physical presence of AGIs and in particular the pump station. A sensitive and sustainable design approach to integrating installations into the landscape has been adopted which will retain and respect the landscape character as much as possible.

A landscape and visual impact assessment of the proposed pump station site has been undertaken. Sensitive receptors and potential viewpoints were identified during a site visit in October 2001 and are listed in the Landscape Assessment of the Pump Station Report (Part 14, Baseline Appendix).

The greatest potential for visual impact as a result of the proposed pump station is the introduction of an industrial type facility, next to a significant village and refugee camp, in an essentially rural landscape. The facility includes four turbine stacks and a flare, each of which will be approximately 25m high. All of these features will be visible as they protrude above the proposed security wall. The security wall will screen the majority of low-level facilities and associated structures but itself constitutes a visual impact in a rural area. Photomontages of the proposed development are included in the Part 14, Baseline Appendix. Visual impacts resulting from the presence of the pump station will be minimised by adopting the following measures:

- Minimising the apparent height and mass of the complex through the careful choice of design, plant layout and colour scheme. The walls of buildings, associated pipe work and stacks will be finished with a colour that is similar to that of the stone used in local buildings. Roofs of the buildings will be treated to blend with the distinctive metallic roofing material used in local buildings.
- The perimeter wall will be finished with local materials, if possible, to provide consistency with other buildings in the area
- The pump station has been positioned so that when seen from a distance it is viewed against distant horizons to make use of existing local topography as a backdrop
- Planting will be undertaken on the banks around the pump station to minimise land take. The introduction of native species planting, in a mix reflecting those species found in the general area, will help to screen and soften the hard lines of the proposed buildings and facilities

The effects of the proposed mitigation measures can be seen in the Photomontage Views in Part 14, Baseline Appendix.

To ensure survival and development of the planting, a monitoring and aftercare plan will be developed as part of the Reinstatement Plan and implemented by the contractor. This plan will include:

- Watering/irrigation
- Regular inspections
- Adjustment of stakes and ties
- Re-firming of plants
- Replacement of dead and diseased plants
- Weed and pest control
- Pruning and thinning

Immediately following construction the significance of the residual impact on the landscape and visual amenity around the pump station is assessed as being **High**. This will reduce to **Medium** after approximately five years.

At night, the local landscape in the vicinity of the pump station is almost completely dark, with only very limited sources of light visible, primarily from the residential properties in the nearby village of Yardili. The local roads are unlit, with car headlights providing a temporary light source. Lighting at the pump station will be designed to minimise outward light emissions. Extensive use will be made of down-lighter fittings on the plant itself. Within the external areas, low-level bollard lighting along roadways, around the administration and maintenance buildings and within the car park is proposed. It is therefore concluded that although the pump station will be lit at night, light pollution is unlikely to constitute a nuisance and the residual impact is classified as Low.

The two IPSs and the block valve stations will remain visible throughout the operational phase of the BTC pipeline. As with the pump station they have been designed to minimise outward light emissions and will not normally be lit at night. The residual impact resulting from their presence is assessed as **Low**.

# 10.3.11 Cultural heritage and archaeology

The aspects of the project, which could impact on archaeological deposits, are:

The removal of topsoil and subsoil during preparation of the ROW, facilities and access roads Trenching

Once the pipeline is operational, there will be no further impact on archaeology or cultural heritage.

Activities associated with the construction of a pipeline may affect the archaeological record by physically damaging part or all of an archaeological monument. These features may be known prior to construction of the project, or may be discoveries of previously unsuspected sites. Although evidence is physically lost, if the site is properly excavated and recorded, the information obtained can be studied by future generations and will add to the general understanding of the history of the area. A linear project creates an increase in knowledge both in previously explored areas, and also in locations where archaeological surveys have not previously been conducted. The observation of the project can create a link between archaeological sites and the landscape and environment that it crosses.

The BTC pipeline has already added new information to the archaeological record of the area, and will continue to do so during the course of pre-construction surveys and during the

monitoring of pipeline construction. These results will increase the understanding and awareness of the history and development of the territory of Azerbaijan. A further benefit for the area will be the number of people employed on archaeological excavation and research. This will involve not only local people employed in the physical process of excavation, but will also provide opportunities for an increase in skills for specialist staff in recording, documenting and conserving the discoveries along the pipeline route.

Modern cultural resource management practice seeks to preserve archaeological deposits *in situ* and only to excavate as a last resort. Archaeological excavation is a form of destruction in itself, as the only evidence for an excavated site lies in the records kept by the excavator. Preservation of archaeological remains allows future generations an opportunity to examine monuments with more resources and better techniques that should recover more information about past societies.

An archaeological strategy for the project has been created to allow for the progressive assessment and mitigation of the effects of construction of the pipeline. The principle contained in the strategy is that areas of potential impact will be examined and any necessary excavations conducted prior to construction. During construction, other archaeological sites may be identified and these will be archaeologically recorded. The strategy is outlined below and given in more detail in Part 2a, Baseline Appendix.

Phase 1	Baseline Surveys including desktop studies, walk through surveys and examination of aerial photographs leading to the development of a Cultural Heritage Management Plan
Phase 2	Intrusive work - trial pits and preliminary investigation of potentially significant sites
Phase 3	Full investigation of major confirmed sites
Phase 4	Activities during construction - watching brief and excavation of newly discovered sites
Phase 5	Post construction work - analysis of finds, archiving and reporting, dissemination of the results

The second phase of the strategy (started in February 2002) has identified areas of highest potential impact; further work is planned during the pre-construction period in these areas to determine the nature and extent of archaeological features. The number of areas to be examined may increase as the programme of survey and assessment progresses and further information is gained about the archaeology of the pipeline route. This increase in knowledge is being carried out by a number of different techniques, and is a gradual process.

The archaeological surveys to date on the various route options of the pipeline have identified over 150 sites within approximately 5km of the route. Of these, approximately 70 locations with archaeological potential have been identified within 100m of the pipeline (see Figure 8 22).

Table 10-20 shows 9 areas that have been identified during the archaeological survey as sites requiring further evaluation during Phase 2 of the archaeological strategy. These 9 areas comprise 16 of the potential locations identified during the archaeological survey (several 'locations' are close together and are therefore regarded as one 'area').

SITE	DESCRIPTION
Sites 4,5,6	The route between two large hills contains three areas with
Gobustan	artefact scatters. Trial trenching will be conducted in these areas
KP9-11	to determine the nature of any archaeological features present
Sites 21,22	Nomadic settlement shown by spread of medieval pottery
Kazi-Magomed	covering a large area. Trial trenching will be conducted in this
KP54	area
Sites 52, 53, 54	Medieval settlement is suggested by surface spreads of
Yevlakh	artefacts. The area however lies in an area of river meanders of
KP221	the Kura, which may have eroded archaeological features. Trial
	trenching will be conducted in this area
Site 56	Very heavy spread of medieval pottery in ploughed fields
Neymatabad	extending over 500 m along the pipeline route. Trial trenching
KP236	will be conducted in this area
Site 57	Surface spread of artefacts along the pipeline route. Trial
Mingechevir	trenching will be conducted in this area
KP248	
Site 59	The pipeline will cross a field adjacent to a settlement mound
Nadirkand	crossed by the WREP. Pottery from several periods is found
KP276	over the mound. Although the mound itself will not be affected by
	the pipeline, there is a strong potential that associated evidence
0:100	will be impacted. I rial trenching will be conducted in this area
Site 60	Extensive Medieval pottery scatter. The pipeline has been re-
	routed to the west, but the scatter continues in this area. That
NF200 Sitop 111 112 112	The archaeological surveys have leasted a proviously unknown
Siles 111, 112, 113	amplex actilement area asvering many pariods from the
Zayamenay	Complex settlement area covering many periods from the
KF 300	200m to the south to avoid the main focus of the site. There is a
	strong potential for further features to be found on the new route
	Trial trenching will be conducted in this area
Site 138	The most prominent feature in the area is the extensive
Girag Salakhli	dravevard to the south of the pipeline. On the pipeline route
KP405	there is a mound that may be a settlement mound and to the
1.1.100	east are many pottery fragments of Antique and Medieval origin.
	Trial trenching will be conducted in this area

#### Table 10-20 Archaeological sites to be evaluated before construction

An archaeologist with a watching brief will accompany the construction activities on the pipeline, and will record the presence of archaeological features. The archaeologist conducting the watching brief will also advise on procedures to be followed by the construction supervisor.

If areas of archaeological significance are revealed on the pipeline route, the appropriate response will be decided upon in consultation with the Ministry of Culture and Institute of Archaeology and Ethnography. In some cases it may be possible to alter the route of the pipeline and avoid damage to the feature. Where the pipeline cannot be sensibly moved, significant sites may need to be excavated and recorded prior to construction activities continuing in the area. The additional information that this may add to the archaeology record of Azerbaijan will be a positive benefit.

Through implementation of the archaeological strategy, the negative impact on the archaeological resource of Azerbaijan will be reduced to a minimum and the positive benefits will be maximised to the greatest extent practical. Significant areas where unavoidable impact

will occur will be fully recorded, published in academic journals and in a popular form. In this way, the information can be made available for the people of Azerbaijan and other nations.

Overall, it is expected that the benefits of increased knowledge will outweigh any adverse effects on the archaeological resource. The overall significance of residual impacts is therefore classified as **Beneficial**.

# 10.3.12 Ecology and protected areas

The aspects of the project that have the potential to impact on protected areas and flora and fauna in general are land take (both permanent and temporary), disturbance to the land surface, removal and storage of topsoil, spillages (including crude oil during operation) and inadequate disposal of hazardous and non-hazardous waste. In addition, soil compaction will primarily affect flora, while noise emissions will only have the potential to affect fauna.

# 10.3.12.1 During Construction

Ecologists will accompany the construction crews when they are setting out the centreline and clearing vegetation along the ROW. The ecologists will check that routing constraints are adhered to and will participate in any decisions concerning realignment of the route. The ecologists will also undertake a final check for protected species and will organise any additional translocation that is required. If necessary, BTC Co. will instruct the contractor to suspend work on a section whilst species are moved.

Most of the ecological impacts resulting from pipeline construction will be temporary provided that all disturbed areas are reinstated quickly and effectively after construction in accordance with approved plans. As discussed in Section 5, Project Description, a detailed Reinstatement Specification has been prepared (summarised in Part 5, Technical) and requires the construction contractor to develop and implement a Reinstatement Plan. The environmental content of this Plan is outlined in Section 14, Management and Monitoring.

A general target of establishing plant cover equivalent to 70% of the original plant density within one year of reinstatement has been set for the BTC project, although in difficult areas a lower target of 50% has been set. It must however be realised that these targets may not be achieved for fragile desert habitats where full recovery of plant communities is expected to take 10 - 12 years as shown in Table 10-21.

#### Protected areas

A number of protected areas or proposed protected areas are located in proximity to the proposed route. The following paragraphs summarise the potential impacts and mitigations for each protected area. It should, however, be recognised that the pipeline has been routed to avoid protected areas wherever possible and only the proposed Gobustan State National Park will actually be crossed, and therefore directly impacted, by the pipeline.

#### BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA

COMMUNITY	SOIL TVPF	PE	RCE	NTA	GE R	ECO	VERY	Y TO	PRE-	-PRO	JECT	LEVI	EL 9
	1112	1	2	3	4	5	6	7	8	9	10	11	12
Salsola nodulosa + Suaeda dendroides association	Argillaceous saline	0	0	5-10	10-20	20-30	30-40	40-50	20-60	02-09	06-08	001-06	90-100
Artemisia fragrans + Salsola nodulosa association	Argillaceous saline	0	0	5-10	10-20	20-30	30-40	40-50	50-60	60-70	80-90	90-100	90-100
Tamarisk thickets	Relatively moist Argillaceous soil	10-30	30-50	20-22	<b>60-65</b>	65-70	5 <i>L</i> -0 <i>L</i>	75-80	58-08	85-90	90-95	95-100	95-100
Marsh/meadow	Argillaceous saline	10-30	30-40	45-55	60-65	65-70	70-75	75-80	80-85	85-90	90-95	95-100	95-100

#### Table 10-21 Habitat natural recovery rates

Source: Dr. V. Hajiyev, Azerbaijan Academy of Sciences.

#### **Proposed Gobustan State National Park**

In the Gobustan desert a pipeline route has been identified that deviates significantly from the WREP as this shortens the length through sensitive habitats. There will, therefore, be less overall impact to the Gobustan flora and fauna than there would have been had the BTC route run in close proximity to WREP. However, the extensive nature of the proposed State National Park means that it cannot be avoided completely and 9km of the pipeline route is within the proposed protected area (KP19.5 to 28.5). After consideration of several options for crossing the proposed State National Park, the alignment shown in Figure 4.2 was chosen because it:

- Minimises the length of pipeline within the proposed protected area
- Parallels the WREP, thereby avoiding disturbance of hitherto undisturbed areas
- Avoids active mud volcanoes
- Is feasible in engineering terms (the steep topography and unstable substrates restrict options for crossing the mud volcano ridge)

Within Gobustan, pipeline construction is likely to cause localised degradation of the natural *Artemisia* and *Salsola* habitats and the potential damage to, and loss of, soils. These desert communities are very slow growing and recovery of population levels and community structure is expected to take at least 10 - 12 years.

Within Gobustan, KP0–29, only the trench line will be stripped of vegetation at the start of construction. Observation of the reinstated WREP indicates that in the desert areas vegetation recovery is at least as good (and in some areas, better) where the plants were left *in situ* compared to areas that were stripped. There are several advantages associated with restricting topsoil removal to the trenchline. This approach will:

<sup>&</sup>lt;sup>9</sup> Natural variation in re-vegetation time is implied where the "Recovery Time in Years" is a range.

- Significantly reduce the quantity of soil that has to be stored and will allow the ROW to be reduced to approximately 20m. This represents a 30% reduction in the disturbed area
- Reduce the risk of erosion as the existing plant cover will help bind the surface together, at least during the early stages of construction
- Reduce the loss of topsoil and the seed bank that is entrained within it.

The Reinstatement Specification requires the construction contractor to develop detailed proposals for restoration of the desert habitats that will be disturbed by construction within the proposed Gobustan State National Park. This will include the prevention of erosion of the soil and reseeding with species from the area. As seeds of the local flora are unlikely to be available commercially it will be necessary to either organise seed collection (under botanical supervision) or to arrange for plants to be cultivated so that their seeds can be harvested.

The residual impact on the Gobustan desert habitat is classified as **High** as it will take over 10 years to reinstate. This impact and proposals for offset mitigation to comply with the World Banks' Natural Habitats policy are discussed further in Section 12, Residual Impacts.

#### Barda State Forbidden Area

The Barda State Forbidden Area lies approximately 5 km downstream of the Kura East East crossing point. Although this protected area could potentially be subject to indirect impacts from construction due to increased sediment load or pollution incidents washed downstream in the river water, this is thought to be an unlikely occurrence as an HDD crossing is proposed for this location.

There is a small risk of a bentonite break out during the HDD operation. If this were to happen, bentonite clay particles could be released into the Kura and add to the sediment load. As the river has a naturally high sediment level and there is a gravel extraction operation immediately downstream from the crossing point, this is unlikely to have significant adverse ecological impacts. The risk of bentonite break out will be addressed during detailed design of the Kura East East crossing and in the Pollution Prevention Management Plan. The residual impact is classified as **Low**.

#### Karayazi-Akstafa State Forbidden Area

The Karayazi-Akstafa State Forbidden Area is 0.5 km upstream from the Kura West crossing point. No project activities are planned within the designated area, so no direct or indirect construction impacts are anticipated.

#### Lake Jandari

The proposed Lake Jandari Ramsar site is 3km north east of the pipeline route. It is upstream from the pipeline route and is separated from it by a low ridge of hills. No adverse effects on the proposed Ramsar site are therefore anticipated.

#### Terrestrial flora

The main impact to habitats crossed by the pipeline will be the temporary loss of vegetation on the construction ROW, temporary access roads, pipe dumps and camps. There will also be a small permanent loss of vegetation associated with the AGIs and permanent access roads.

This will have a greater significance in the natural and semi-natural habitats crossed, since these areas are of greater ecological value and are generally more difficult to reinstate than agricultural land. Agricultural land represents the majority of the habitats crossed by the pipeline so specialist reinstatement programmes will be limited in their extent.

#### Desert and semi-desert flora

The most significant impact will occur where the pipeline crosses the *Artemisia* and *Salsola* deserts of the Gobustan area. This desert habitat is very sensitive to disturbance and takes many years to develop. A detailed Reinstatement Plan and monitoring programme will be implemented to ensure restoration of this habitat, much of which falls within the boundary of the proposed Gobustan State National Park. The mitigation measures for the Gobustan section are addressed under the 'Protected Areas' heading above.

In addition to the specific reinstatement measures that are to be developed for the desert habitats of the proposed Gobustan State National Park and surrounding areas, other standard mitigation measures will be put in place to minimise habitat loss along the pipeline route. These will include ensuring that the working width is generally kept to a maximum of 32m, with reductions considered in sensitive locations (KP1-29) and the prohibition of vehicle movements except on the ROW or assigned access roads.

The Reinstatement Plan will also detail the requirements for other areas of natural and seminatural desert and semi-desert.

#### **Protected plant species**

A translocation programme will protect the populations of *Merendera trigyna* at KP50 and *Iris acutiloba* at KP28 and KP50. The bulbs will be removed and stored elsewhere during the period of construction and then replaced during reinstatement. A monitoring programme will be developed to establish the success of the mitigation. Provided the translocation is successful, there will be **No** residual impact.

Several records of glabrose liquorice (*Glycyrrhiza glabra*) have been noted and it may not be practical to undertake mitigation measures for each recorded location. In this case, the largest affected populations will be determined and specimens will be translocated to a safe area and subsequently replaced once ground profiles have been reinstated. This would reduce the magnitude of loss of this species but will not eliminate it completely. Therefore, the residual impact is anticipated to be **Low** to **Medium**.

#### Summary

In conclusion, the residual impact on flora and vegetation of construction activities will vary depending on the naturalness and rarity of the habitats and species which are lost or disturbed. The residual impact for agricultural land will be **Low**, but for the Gobustan desert habitat the significance will be **Medium** to **High**.

With respect to the permanent habitat loss associated with the AGIs, this has been mitigated by careful site selection following field surveys to ensure that the habitats lost are not of ecological interest and do not support any rare species except for spur-thighed tortoise (*Testudo graeca*) which has special mitigation (see below). Therefore, the residual impact on permanent habitat loss will be **Low**.

Pollution events due to fuel, oil and/or chemical spills could lead to the smothering and mortality of vegetation and to the contamination of soils, which may prevent future regeneration of vegetation. A Pollution Prevention Management Plan and Emergency Response Plan will be prepared and will detail measures for protecting vegetation and soils.

#### Terrestrial fauna

The main impact on the majority of fauna will be the temporary noise and visual disturbance of construction activities and the potential destruction of breeding sites and young. Construction activities and noise will be regulated as described in Section 5, Project Description, but some temporary disturbance is unavoidable. It is, however, anticipated that all fauna will recolonise or reuse the area of construction once works are completed.

The significance of disturbance depends on a number of factors including the habitat, the species and its ecology, the time of year, amount and duration of the disturbance and the existing levels of disturbance. For instance, large mammals or birds will be more sensitive to disturbance in the remote parts of the Gobustan desert area or other areas further to the west (eg the Shamkir region), than similar mammals and birds will be in highly agricultural areas which are regularly disturbed.

It is likely that large mammals and birds will temporarily move away from the construction area, however there is likely to be some mortality associated with small mammals, reptiles, amphibians and invertebrates that are not able to move away quickly. This is unlikely to cause a significant impact in the majority of cases, since individuals of the same species will recolonise the area once construction is completed. However, the spur-thighed tortoise (*Testudo graeca*) (RDB, Iv) is one such species where loss of individuals could result in a significant impact to the population due to its international rarity.

The periods when fauna will be most affected by disturbance are their breeding season, migratory periods and the main over-wintering season. Construction is planned to take up to 15 months, thereby encompassing all sensitive periods. There are no major terrestrial migration routes crossed by the pipeline and it is likely that migratory birds would move away from the construction area. Therefore no significant impact on migratory animals is expected. The residual impact of loss of breeding sites or habitat and loss of young on fauna due to construction activities will be **Low** to **Medium** depending on the rate of recovery of populations.

The greatest potential impact will be to those animals that are likely to breed along the construction ROW. This includes burrow dwelling spur-thighed tortoise (*Testudo graeca*) (RDB, Iv), water vole (*Arvicola terrestris*) (pRDB) and porcupine (*Hystrix indica*)(pRDB), which lives in burrows in river banks, as well as several ground nesting birds of national and European rarity such as stone curlew (*Burhinus oedicnemus*) (Ev), black francolin (*Francolinus francolinus*) (RDB, Ev) and white tailed plover (*Chettusia leucura*) (RDB). Other species associated with wetlands may also be at risk and include common toad (*Bufo bufo*) (RDB), freshwater terrapin (*Clemmys caspica*) (pRDB) and European pond terrapin (*Emys orbicularis*) (pRDB).

Any disturbance caused by construction activities during the breeding season could lead to the direct destruction and/or the desertion of nests, eggs and dependent young. This could lead to a reduction in breeding success of the species concerned during the construction period, which would have greatest significance for the species whose populations are already rare or in decline.

Mitigation measures have been developed to ensure that, wherever possible, those species which are of national, European or international significance are not impacted by pipeline construction. A specific mitigation plan is being prepared for spur-thighed tortoise (*Testudo graeca*) (RDB, Iv). Areas likely to support this species will be searched prior to clearance of the ROW; any animals discovered will be removed to a safe distance. Wherever practical, grading activities in these areas will be undertaken outside hibernation periods. Further to this,

additional searches will be carried out prior to each main construction activity (eg stringing, trenching and welding) as animals may move into the working area during the course of construction; any tortoises found on or near the site will be moved to a safe distance. Tool box talks will be held to raise the awareness of the contractors about the importance of preserving the spur-thighed tortoise.

At river crossings where evidence of porcupine spp. (*Hystrix indica*) (pRDB) has been recorded, a detailed search for any active burrows will be undertaken by local experts immediately prior to construction. Where active dens are present, minor re-alignments will be considered to ensure that the dens are not destroyed or adversely affected by their proximity to the construction activities. If this is not possible, the animals will be moved to suitable habitat remote from the pipeline works.

If occupied water vole (*Arvicola terrestris*) (pRDB) burrows are found at any of the river crossing locations, the vegetation will be cut back to encourage the animals to move elsewhere. If this is not successful, individuals will be moved to suitable habitat remote from the pipeline works.

Expert ornithologists will survey areas identified as containing suitable habitat for ground nesting birds such as stone curlew (*Burhinus oedicnemus*) (Ev) at KP12–14 or black francolin (*Francolinus francolinus*) (RDB, Ev) at KP106 during the peak breeding season (late March to mid-June) in 2002. If ground nesting birds are found to be present, a protocol for mitigating the impacts of construction will be developed. This will include options for discouraging birds from nesting on the ROW. Clearance of the ROW, particularly in more vegetated areas, may present a temporary barrier to movement for some fauna such as small mammals, amphibians and reptiles. In addition, animals may fall into the open trench and die if they cannot escape. This is not likely to cause a significant effect on the population of any species but to minimise the risk, not more than 15km of trench will be open at once in any section. In order to allow animals to escape from the open trench, planks (or another type of walkway) will be placed in the trench at intervals. The residual impact will be **Low**.

Waste foodstuffs can encourage vermin if not adequately managed. The Waste Management Plan will include procedures for the disposal of food and other organic wastes. The vermin population will be monitored and controlled so that it does not become a nuisance or disease risk.

#### Aquatic species

Within watercourses, impacts on fish are most significant during the migrating and spawning periods (October to June) and could be caused by fish passage restrictions, sediment-laden runoff from the working width and river bed sediments that become suspended during trenching activities. This could affect the survival of fish eggs in gravel beds or spawning grounds as a result of de-oxygenation caused by silt deposition. The survival of fish and aquatic invertebrates may also be affected as a result of gill damage from sediment particles and through water de-oxygenation.

The Rivers Kura and Hasansu contain spawning grounds. In order to minimise impacts:

- The Kura East crossing will be constructed by HDD. As discussed above (protected areas) this minimises the risk of sediment release during construction, although there is a small risk of bentonite break-out
- A non-open cut technique for the Kura West and Hasansu crossings is precluded by ground conditions. These two rivers will therefore be open-cut outside the spawning season. In Azerbaijan this means restricting construction to a window between late June and early October

• Adopting the sediment reduction measures described in the Reinstatement Plan will further reduce impacts on fish and other aquatic life. These include the use of sediment traps to reduce the input of construction-derived sediments into the river systems. The residual impact on fauna in watercourses will be Low. Where construction is to be carried out by HDD, no seasonal constraint will be imposed upon pipeline construction.

Where construction across watercourses is by an open cut technique, it will take place as quickly as possible to minimise the impact to the aquatic environment. It will however normally be necessary to retain vehicle access across most of the watercourses until that section is reinstated. The Reinstatement Plan will consider reinstatement techniques for each watercourse and will take account of the river corridor survey results; the chosen methodology will vary according to the ecological significance of the channel and banks. Where practical watercourse banks will be re-profiled to their pre-existing form using original bank material, stored separately on the ROW. Where erosion protection measures are necessary to ensure long-term stability, the design will take account of ecological considerations and will seek to provide minimal changes to the bed or bank substrates and profiles.

Pollution events due to fuel, oil and /or chemical spills may lead to the smothering and mortality of some faunal species, such as invertebrates, or fish, amphibians and aquatic reptiles if the spill is into or near a watercourse. Contamination of fauna by spills or leaks will be minimised by compliance with the Pollution Prevention Plan as described in Section 10.3.8, Hydrology. These will include restrictions on refuelling within 30m of a watercourse and will detail spill containment and cleanup procedures.

Temporary dsruption of vegetation corridors along rivers and their banks may result in the temporary fragmentation of these habitats causing disruption to wildlife corridors and the movement of fauna. To minimise disruption, riverbank vegetation will be reinstated as quickly as possible. All watercourses, and 25m either side of them, will typically be fully reinstated once the BTC pipeline has been installed; interim measures will not usually be employed. This will allow the earliest recovery of the riverine ecosystem.

## 10.3.12.2 During operation

Once the pipeline is operational, it is not anticipated that routine activities will result in any significant impacts on the ecology and protected areas along the route. Occasionally there may be localised disturbance from the pipeline inspection team, but this will be of negligible significance. The residual impact is classified as **Low**.

Occasional noisy operations related to maintenance of the pipeline system will generally be restricted to the immediate vicinity of the AGIs. No significant effects on wildlife are anticipated.

The potential impacts that would result from spillage of crude oil during operation of the pipeline are addressed in Section 10.4, Unplanned events. In the event of a spillage of crude oil reaching natural habitats, the Oil Spill Response Plan will be implemented. Clean up will be undertaken as described in Section 10.4. Development of, and compliance with, the operational Pollution Prevention Management Plan and Waste Management Plan will ensure that waste and spills do not impact on flora and fauna in operational areas. The residual impact on flora and fauna will be **Low**.

# **10.3.13** Traffic and transportation

The volumes of traffic generated during construction of the pipeline and associated facilities far exceed those that will be required for the operational phase of the pipeline, where traffic impacts will be negligible. Temporary impacts during construction are likely to be considerable if not adequately managed, and are discussed in detail below.

# 10.3.13.1 Operation of the existing road network

The volumes of traffic generated during the execution phase of the project, although large, will cause only a minor operational impact on the existing road network. Whilst on some roads the volumes will represent more than a doubling of existing traffic flows, the volumes are sufficiently low for this not to be a concern. No locations have been identified where the additional volumes will create delays, queues, or disadvantage to other road users.

However, there are a number of problems associated with the increased level of heavy goods vehicles on the roads:

- Conflict with slow road users on most of the access roads where the road is too narrow to allow convenient passing
  - Physical constraints in urban areas
- Anti-social aspects of goods vehicles near sensitive receptors
- Accidental events

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Each of these items is discussed in detail below, followed by a section on mitigation for these potential impacts

## 10.3.13.2 Conflict with pedestrians and livestock

Slow road users will be disadvantaged in a number of ways by the general increased level of traffic along the roads being used. The vast majority of slow road users in Azerbaijan are pedestrian. The most significant potential impact for pedestrians is in terms of safety. In many cases pedestrian activity is a significant proportion of the total level of traffic on the road. As such, conflicts with large construction vehicles are possible and any incidents will probably be of a serious nature.

Sensitive receptors such as hospitals, schools, shops, markets and major employment centres may be affected by increased traffic, as would slow road users such as horse/donkey drawn carts. Schools are of particular concern as young children often have not developed an appropriate level of traffic and road awareness and so are at greater risk.

On the majority of roads along the route, the movement of animal flocks is significant. Such movements often take up the whole road for a period of time. Therefore, it is likely that interaction with animal flocks will occur.

## 10.3.13.3 Physical constraints in urban areas

The size and weight of the vehicles used to transport the pipe and other materials will be substantial, particularly in comparison to the other road users and given the size and state of repair of the roads. This will be particularly noticeable in towns and villages, where there are physical constraints such as buildings, tight corners and numerous street vendors with small stalls. However, in the more rural areas such vehicles are less likely to cause problems as traffic density is generally lower and the roads are more open.

Field observations during the traffic surveys indicate that there are likely to be few restrictions in terms of vertical constraints (ie the presence of overhead features). Access problems are therefore most likely to result at junctions where the vehicles are required to make a turn.

In urban areas, shops and stalls are often sited immediately along the side of the road. Such activities create pinch points either directly or through vehicle parking in close proximity.

The volume of parking and pedestrian use on roads in villages and urban areas, particularly where street vendor stalls are located, reduces the effective operating width of the carriageway and may mean that larger vehicles cannot safely negotiate a section of the road.

## 10.3.13.4 Anti-social aspects of goods vehicles near sensitive receptors

Anti-social aspects of construction vehicles are considered to be noise, vibration and emissions. Issues in this regard will be related to both time and location. Noise and vibration caused by heavy vehicles could affect considerable numbers of local residents in urban areas, particularly in areas where sensitive receptors such as schools and hospitals are located. They will also affect roadside pedestrians and street vendors, particularly during busy market days.

## 10.3.13.5 Accidental events

Impacts may be experienced as a result of accidental actions. With a considerable volume of vehicles being used, some following circuitous routes, there is the potential for vehicles to follow the wrong routes. This could lead to a wide range of issues including:

- Bridge strikes and grounding
- Bogging down on roads unprepared for the loads
- Damage to pavements
- Damage to other infrastructure
- Accidents involving injury

The behaviour of other road users, such as erratically driven cars (including Ladas heavily laden with fruit and vegetables) and mini buses may cause pipe trucks to swerve to avoid an accident. This could lead to damage to other infrastructure such as pavements and street stalls or injury to people.

#### 10.3.13.6 Mitigation

The main mechanism through which potential traffic impacts will be managed is through development and adherence to a Transport Management Plan. The following mitigation measures will be included in the Transport Management Plan, and are outlined in more detail in Section 14, Management and Monitoring:

- Identifying optimum routes from pipe storage areas to the ROW to avoid sensitive receptors such as schools and hospitals, wherever possible
- Identifying weight/height restrictions and alternative routes
- A sign posting strategy for the routes
- Enforcement of maximum speeds at which vehicles are permitted to travel

- Restrictions on hours of driving (including night time restrictions where sensitive receptors may be affected)
- Timing of vehicle movements to avoid busy periods in urban areas, particularly the start and end of school and the working day
- Driver training, assessment and monitoring
- Journey management planning
- Control over routes used by vehicles to avoid construction traffic using inappropriate roads and other road users gaining access to the pipeline spread and access roads
- Development of procedures to follow when herds are blocking the road and educating drivers to reduce speed in this situation
- Development of guidelines to avoid excessive noise, vibration and nuisance in populated areas
- Ensuring adequate vehicle maintenance to ensure that vehicles do not produce significant emissions and that all safety features including brakes, lights etc are in good condition

Following implementation of the Transport Management Plan, it is anticipated that the Residual Impact due to increased traffic movements will be generally **Low** on the open Baku to Tbilisi Highway and rural roads. However in some villages and towns there is likely to be a **Medium** residual impact. This is discussed further in Section 12, Residual Impacts.

# 10.4 ASSESSMENT OF UNPLANNED EVENTS

# **10.4.1 General introduction**

The BTC pipeline system has been designed to meet or exceed the relevant international codes and standards and a large effort has been directed towards ensuring that the design and integrity of the pipeline is maintained in order to ensure that there is no loss of containment. Rigorous application of best practice leak prevention and detection measures have been incorporated into the design and are outlined in Section 5, Project Description. These are summarised in Table 10-22.

Nevertheless, despite high levels of design and operational standards, there is always a small residual risk of a loss of containment.

A Quantified Risk Assessment (QRA) has been carried out with the following objectives:

- To demonstrate that the base case design is robust and to verify that that residual risk of a loss of containment is extremely small. It is important to note that the QRA was used both as an assurance tool and a tool to inform the design. The QRA was used as a tool to analyse the base case project design, which included specific features for mitigating risk of a loss of containment event. Based on this analysis, additional design features were incorporated as necessary
- To evaluate the potential consequences of a loss of containment event in specific areas which have been selected on the basis of elevated environmental risk

# 10.4.2 Quantified risk assessment

Environmental risk incorporates the risk to the environment as a whole, that is air, water, land, plants and animals, including direct or indirect impact on people. The environmental risk

described in this report used in the assessment of the relative risk along the pipeline has been calculated as:

# *Environmental Risk* = *Frequency of failure x Volume of oil spillage x Environmental sensitivity factor*

The major steps in the risk assessment process were:

- Failure frequency analysis, ie determination of spill frequency (which involves both the identification of causes of failure and the likelihood of the failure)
- Evaluation of potential spill volumes associated with the failure scenarios
- Determination of environmental sensitivity, ie susceptibility of the receiving environment to impact from an oil spill. It should be noted that this category includes sensitivity of human population as well as the environment.
- Quantification of risk by combining spill frequency, magnitude and sensitivity of affected environmental features

These steps are described in more detail below. Figure 10-2 shows the schematic flow diagram of the QRA inputs and considerations.



Figure 10-2 Schematic of risk assessment approach for BTC pipeline

#### BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA

			Fail	ure Mode	e Ado	dressed	
	MITIGATION MEASURE	Corrosion	Mechanical Fault	Interaction with Adjacent Pipelines	Geohazards	Third Party Accidental	Third Party Deliberate
	Route selection to avoid natural hazards; populated and environmentally sensitive	×		X	Y	K	Y
	aleas Safety factors applied to design	×	v	×	×	×	×
	Buried pipeline (Im to top of pipe)	^	^	^	^	x	×
	Increased wall thickness at vulnerable					~	~
	areas				х	х	x
	Increased burial depth at vulnerable areas					x	x
	Impressed current (CP) system	х		х			
	3 Layer HDPE coating	х					
	Welded buried valves		х				
	Buried valves in pits					х	х
7	Extra pipeline flexibility / trench design modifications at fault crossings				x		
	8m wide ownership / exclusion zone					х	Х
DES	Adequate separate from existing utilities and infrastructure					х	
CONSTRUCTION AND COMMISSIONING	Quality control measures during manufacture of pipe		x				
	Hvdrotesting		х				
	Internal inspection pigging	х	х				
0	Planned maintenance	Х	Х				
Z UI	Operational staff training / awareness	Х	Х			х	Х
AC AC	Line walking				X	X	X
AN	Regular patrois				Х	X	X
LEN	Public awareness					х	X
		X					
<b>MA</b>	Monitoring of CP system	X					
		^					

#### Table 10-22 Base case design and operational measures to prevent loss of containment

# 10.4.2.1 Spill frequency estimation

#### Benchmark spill frequency estimates

The first task associated with this risk assessment is the identification of the causes of failure and the likelihood (or frequency) of the failure. This part of the analysis involves the consideration of historical data and site-specific conditions to estimate a predicted frequency of failure or spill events. In this study, Western European pipeline failure and leakage data compiled by CONCAWE, an industry sponsored research organization, were used to develop an initial estimate that formed the spill frequency 'benchmark'. Table 10-23 illustrates the historical record of pipeline spill events presents CONCAWE spill statistics associated with the following categories of failure:

- Corrosion, both internal and external
- Mechanical faults, covering failure of the pipeline and fittings
- Operating faults, such as over-pressurisation
- Intentional hostile action against the pipeline, including sabotage and vandalism
- Accidental or intentional action against the pipeline, normally in the form of physical impact from mechanical tools
- Natural hazards, such as earthquakes, mud volcanoes, rockfalls, landslides, mudflows, ground subsidence or heave, erosion and river scour
- Man-made hazards, such as railways, roads, and adjacent pipelines or plant

By combining frequency figures with the types of leaks attributable to the various causes, an appreciation of both frequency and volume is apparent. Figure 10-3 shows the while a high frequency of failure is associated with mechanical failure, these tend to be in the small leak volume category. Third party damage is associated with the highest frequency of both 50mm and full bore rupture.

CONCAWE data are derived from Western European pipeline experience and represents the most comprehensive failure data set available to use for the purposes of risk assessment. It gives a very good general indication of historic trends with respect to failure mode and frequency. However, the data may not be fully representative of hazards and experiences from other geographical settings. Therefore, professional judgement is required in the application of these data to pipelines that fall outside of the data set area such as in the case BTC pipeline.

For example, whilst third party spills, which include activities like installation and repair of services and farming, accounted for the majority of the 48% of leaks, it could be argued that such activities can be expected to be significantly less frequent in Azerbaijan. Population densities and the number of services being worked on are both significantly lower than in Western Europe and different farming practices apply where deep digging mechanical activities are infrequent. The use of CONCAWE data may, therefore, result in a conservative assessment of risk from this particular type of event. On the other hand there can be expected to be a potential increase in risk from intentional malicious damage from third party activities.

Another example of the limitation of the direct use of the CONCAWE analysis is the underrepresentation or absence of geographical factors relevant to this project. Earthquakes occur more frequently in the border region between Europe and Asia than in Western Europe and differences in weather and geographical features can result in flash flooding in a large number of seasonal rivers (see Section 8.6.4 for discussion of geohazards).

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Figure 10-3 Leak frequency or likelihood by leak size and fault category

These considerations generally highlight that a realistic estimate of the likelihood and size of a leak in the BTC oil pipeline requires an adapted approach beyond the simple extrapolation of CONCAWE data. In particular, area-specific data using confirmed field survey information has been used wherever possible. Preliminary consultation with key stakeholders highlighted the need to include consideration of the additional hazards posed by rivers and landslide areas.

#### Project-specific conditions

The spill frequency estimates developed from CONCAWE historical data were modified to more specifically address project-specific conditions. These modifications address site-specific natural hazards, special concerns regarding intentional third-party damage, and several project design features that differ from the "average" European pipeline addressed by the CONCAWE data. These modifications generally resulted in an increase in the predicted spill frequency associated with the BTC pipeline. The refinement of spill frequency estimates is described below. This refinement was developed by review of each kilometre along the Azeri section of the BTC pipeline, and site-specific spill frequencies input into the model.

#### Site-specific natural hazards

Natural hazards represent a variable risk for pipelines depending on their location. Refinement of historical risk frequencies requires the use of information from a geohazard review specific to the BTC pipeline route. Specialist consultants were engaged to analyse the failure data from landslides, mudflows, fault crossings and river erosion hazards.

Two faults were identified for specific consideration (see Section 8.6.4.1). Each of these faults were evaluated to define a recurrence interval for fault displacement exceeding pipeline design specifications, and this was used to define an annual probability of a design-level fault displacement. This information was used to develop a conservative estimate of the annual spill frequency (spills per kilometre-year) associated with pipeline segments directly exposed to each fault displacement.

Landslides were also specifically addressed in this study. An analysis of slope stability and existing landslide features was conducted to identify potential hazards to the pipeline. This analysis included slopes with failure potential and identified landslide areas. Each segment of the pipeline route was characterised in terms of slope-related damage potential based on professional judgment, and this characterisation was used to define the landslide-related spill frequency estimate for each segment.

River crossings were identified as another natural feature with the potential to affect spill frequencies. Twenty one river crossings were considered to justify special consideration in spill frequency calculations. These spill frequency estimates were combined with the fault crossing and landslide spill frequency estimates to develop the overall spill risk associated with natural hazards for each one kilometre pipeline segment

#### Third party intervention

Another topic of special concern for the BTC pipeline design is the potential for intentional third-party damage to the pipeline. The CONCAWE historical record of such events is not considered representative of the socio-political environment along the BTC pipeline route. Specific measures have been incorporated in the base case design to mitigate this risk and, therefore, CONCAWE frequency estimates are still considered appropriate. It could be argued that the third party risk from accidental events is less in Azerbaijan as mentioned previously and CONCAWE frequency estimates perhaps over estimate the frequency. The frequency estimates were not altered in this assessment and therefore perhaps overestimate the risk slightly.

#### South Caucasus Gas Pipeline

Another design feature considered in the spill frequency analysis is the proximity of the SCP through Azerbaijan that, if it progresses, will be installed in the same corridor as the BTC line. The hazard from the gas pipeline was added as an increased spill frequency in the spill occurrence model.

#### **Overall spill frequency results**

The oil spill frequencies which have been used in this study are a combination of CONCAWE estimates and project specific factors. These are shown in Table 10-23.

SPILL CAUSE	FREQUENCY OF SPILLAGE	FREQUENCTOF
		SPILLAGE
	(CONCAWE, 1998)	(Project Specific - CONCAWE
		Modified)
	(Incidents/km-y)	(Incidents/km-y)
Mechanical Failure - Line	8.44E-05	8.44E-05
Pipe Failure		
Mechanical Failure -	5.06E-05	Specific frequency applied
Valves and Fittings		on km with valves or
5		fittings. Range:1.6E-4 -
		4.0E-4
Operational Fault	4.78E-05	4.78E-05
External Corrosion	5.35E-05	5.35E-05
Internal Corrosion	4.22E-05	4.22E-05
Natural Hazards	1.41E-05	Specific frequency applied
		on kilometers with natural
		hazard features. Ranges
		noted below
- River Crossings		2.0E-5 - 2.0E-4
- Landslides		1.0E-6 - 1.0E-4
- Faults		2.1E-04 - 5.0E-4
Third Party - Accidental	1.55E-04	1.55E-04
Third Party - Intentional	1.41E-04	1.41E-04
South Caucauses Pipeline	NA	4.54E-05

#### Table 10-23 Statistical failure data for onshore pipeline systems (CONCAWE)

The analysis of potential oil spill frequencies resulted in the determination of location-specific spill occurrence frequencies as shown in Figure 10-4.



#### Figure 10-4 Location-specific spill occurrence frequencies

# 10.4.2.2 Potential spill volumes

The magnitude of potential oil spills is an important element in the assessment of overall risk. The volume of oil spilled is influenced by several factors, including:

- Size of the hole
- Pressure and flow rate at the leak site
- Time required to detect and respond to the leak
- Leak location and associated factors such as topography, static liquid head pressure, valve placement, and response access

This evaluation of spill sizes begins with the separation of spill events into three categories based on the size of the leak opening. These categories include pipe openings of 5mm or less, 6mm to 50mm, and full pipe rupture. Table 10-24 presents the proportion of leaks in each size group associated with each spill cause. This information was used to define the frequency of occurrence of leak openings of each size category for each one-kilometre long segment of pipe.

CAUSE	<b>PROPORTION OF TOTAL LEAKS (%)</b>						
	PROPORTION OF LEAK (5mm or less)	HOLE (6mm to 50mm)	RUPTURE (full bore)				
Mechanical Failure							
Line Pipe Failure	70	24	6				
Valves & Fittings Failure	70	24	6				
Operational Fault (System Malfunction/Human Error)	90	10	0				
Corrosion-related Spills							
External Corrosion	90	9	1				
Internal Corrosion	90	9	1				
Natural Hazards	34	33	33				
Third Party Damage							
Accidental and Incidental	25	56	19				

 Table 10-24
 Leak size distribution by spill cause (EGIG, 2000)

For each kilometre point, an estimated spill volume, associated with each spill size category, was calculated based on pipeline operating characteristics and location-specific data. This calculation addresses three distinct phases of oil release associated with each spill event:

- The first phase involves the calculation of eak volume, V1, from the initial leak until to initiation of pump shutdown and valve-closure. Spillage during this first phase involves leakage at full operation of the pipeline system
- The second phase spill release volume, V2, is a calculation of leak volume during the depressurisation of the pipeline section. This phase begins immediately following controlled closure of pipeline valves, and continues until free flow from the leak opening associated with gravity drainage and siphon effects is established
- The third phase (V3) continues until response crews arrive at the leak site to contain the release or until the line empties itself of the fluid

Table 10-25 indicates the leak detection and response times and other details estimated to develop the spill volume calculations used in this study.

ACTIVITY	HOLE DIAMETER 5mm (LEAK)	HOLE DIAMETER 50mm (HOLE)	HOLE DIAMETER FULL BORE (RUPTURE)
Time to detect and confirm leak (T1).	48 hours	1 hour	1 minute
Time to shutdown pumps (T2).	10min	10min	10min
Time to close Block valves in affected section (T3).	10min	10min	10min
Time to mobilise Spill Response Team and contain/control leak (T4).	24 hours	24 hours	24 – 72 hours to mobilise team and equipment sufficient to deal with catastrophic spill.
Total spill/leak duration (T1 + T2 + T3 + T4)	72 hours	25 hr 20min	Time for affected section to drain down.

#### Table 10-25 Assumed response times in calculation of spill volumes

#### Spill volume inputs to the risk model

The total volume of oil spilled in any one kilometre section of the pipeline arising from each of the three leak categories considered has been calculated using the computer program AUMEX developed by ILF (the design contractor for the Turkish section of the BTC pipeline).

#### Overall spill volume results

With the completion of this element of the analysis, an understanding of the magnitude of potential oil spills is available to supplement the estimate of spill occurrence frequencies. Taken together, these two elements of the risk study provide an understanding of the most likely spill volumes at specific locations along the pipeline route Table 10-26).

#### Table 10-26 Average volume of spill

	SPI	LL SIZE CATEGO	RY
	LEAK (5mm)	HOLE (50mm)	RUPTURE (FULL BORE)
Minimum Spill Volume (m <sup>3</sup> )	170	1,000	3,700
Maximum Spill Volume (m <sup>3</sup> )	670	6,700	22,000
Average Spill Volume (m <sup>3</sup> )	370	2,700	7,200

## **10.4.2.3** Consideration of environmental sensitivity

A method for the determination of environmental sensitivity was developed with the environmental consultants undertaking the ESIAs for the project. The matrix shown in Table 10-27 was produced to enable the sensitivity to be assessed for each kilometre of the pipeline. It should be noted that although the environmental sensitivity is represented as a numerical

value, which is input into the model, this aspect of the study is qualitative and judgment based and relied on the expert judgment of the consultants.

The environmental sensitivity was determined based on the potential movement of spilled oil to sensitive resources and the degree of sensitivity of those resources. Simply put, for the environmental sensitivity to be rated as "very high" the oil must easily reach the receptor and the receptor must be highly sensitive to impact from oil. This evaluation was accomplished for each one kilometre-long segment of the pipeline, and focused on the following elements:

- Gradient to nearest downhill surface water
- Proximity to downhill surface water
- Sensitivity of downslope surface water
- Capacity of surface water to transport oil
- Soil permeability
- Groundwater sensitivity
- Terrestrial ecological resources
- Land use
- Proximity to downslope known archaeological resources

These kilometre-sections were first rated in terms of environmental sensitivity levels: 1 being "not sensitive", to 5 "very high sensitivity". The sensitivity rating was then multiplied by a weighting factor to reflect the assessment of the severity of spill impacts to the environmental receptor. This weighting factor took into account the nature of the effort required to respond and remediate the spill. It also accounted for the degree of recovery expected following the remediation for the receptor categories of:

- Surface water
- Groundwater
- Terrestrial Ecological Resources
- Land Use
- Archaeology

The environmental sensitivity matrix used for the kilometre-by-kilometre assessment is outlined in Table 10-27. The environmental sensitivity of the kilometre segment was characterised by the environmental receptor with the highest sensitivity within that kilometre. In the example highlighted in Table 10-27, the "Terrestrial Ecological Resources" of that particular kilometre segment determine the overall sensitivity of that segment (which in this case is 3).

The results of this phase of study showed the relative environmental sensitivity rating on a kilometre by kilometre basis and provided for the environmental sensitivity input data to be input into the model as shown in Figure 10-5.

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Figure 10-5 Distribution of relative environmental sensitivity in Azerbaijan



# 10.4.2.4 Risk analysis results

The previous sections describe how frequency of spill, spill volumes and environmental sensitivity were determined. The risk analysis model combines these three elements and enables a computation of the relative environmental risk along the pipeline on a kilometre-by-kilometre basis.

The relative environmental risk was not uniform and varied significantly dependant on location. The results enabled the project team to evaluate where additional mitigation measures could be considered and the impact of these on the risk profile. The application of the model is an iterative process and allows multiple run of the model to evaluate the benefit of changing various design features on the relative environmental risk profile.

#### Changes to the base case design as a result of the risk assessment process

The project design engineers reviewed the model results and identified further opportunities reduce the frequency and size of oil spills. This enabled an evaluation of benefit of increasing the number of block valves and check valves to reduce the volume of potential oil spilt versus the slight increase in spill frequency associated with the additional valves. Figure 10-6 outlines the impact of changing the configuration of the block valves on the environmental risk profile.

The residual risk after changing the block valves is not a uniform profile and there are still areas which present relatively more environmental risk than others. These "peaks" are mainly due to natural hazard risks of faults and river crossings. The design engineers are using this data to determine what additional design mitigations can be applied to lower the environmental risk.

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The outputs from the risk assessment have been assessed to better understand the types of activities that pose the largest risk to the pipeline, and are presented in Figure 10-7. This graph highlights the fact that whilst there are some locally high risk areas associated with fault crossings and other natural hazards, the largest overall risks are associated with potential failure causes that may occur at any point along the pipeline. Therefore whilst some further reduction in risk at specific locations could possibly be achieved, the main environmental risks for the pipeline as a whole are associated with human activity.





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Figure 10-7 Summary of environmental risks for different pipeline failure modes

# 10.4.3 Potential impacts of oil spills

# 10.4.3.1 Introduction

#### **During construction**

Small oil spills occur during pipeline construction, typically from storage tanks, bowsers, vehicles and mobile plant and equipment. These are normally small scale, localised, easily contained and cleaned up and the effects are reversible and have only a short-term impact. Their management is described in the Environmental Management Plan.

#### During operation

For the operational pipeline, the previous Sections outlined how the risk assessment was used to develop the design and operational strategy. The results can be used to select key locations at which to undertake a detailed analysis of the consequences of a potential oil spill.

This Section considers the unmitigated impacts of a pipeline failure  $\dot{\mathbf{n}}$  terms of damage to environmental resources (rather than risk of loss of life or serious injury to an individual or a group of people).

The factors that are considered are shown in Table 10-27. The speed at which oil will travel is significant in terms of determining the environmental impact of a leak. For example, it is estimated that in the absence of spill response measures a spill from the BTC pipeline at the upper Kura crossing at Poylu would reach the Mingechaur Reservoir in 12 to 24 hours depending on seasonal conditions.

Environmental damage can be minimised by a combination of the design improvements that have been described above (see Section 10.4.2), by minimising the volume lost by planned surveillance/leak detection and by the rapid implementation of spill response measures.

## 10.4.3.2 Generic behaviour of oil

Once oil has been released to the environment it will spread. A large proportion of the lighter fractions of the oil will evaporate and some of the residual hydrocarbons will become attached to soil particles or pool at the surface. A proportion of the oil may penetrate to deeper layers of permeable soils, particularly gravels.

Releases close to rivers will be distributed downstream and might, in the absence of spill response measures, reach as far as the Mingechaur Reservoir or the Caspian. Potential receptors include those water bodies themselves and other sensitive habitats including the Kura Delta. As noted in Section 8, flow rates in the rivers can be very high and as a consequence the available time to respond to a spill will potentially be limited.

If an oil spill were to happen at a time of low, or even no flow in a river, then the spreading potential is much reduced. However, this depends on the cleanup of oil before new periods of rainfall or snow melt, in which case oil may be released from the riverbed. It must be noted that

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an oil spill into a dry riverbed will almost certainly lead to some level of groundwater pollution. The hydraulic conductivity of the bed materials is generally high and these materials often provide preferential migration pathways to the aquifer. In all cases the spreading will occur at the spill location and downstream in the watercourse or canal. For oil spills on flat land, the spreading potential is typically low.

Potential effects on groundwaters – particularly the Ganja – Kazak – Karayazi aquifers - are considered in Section 10.4.2.3.

# 10.4.3.3 Generic impacts

Acute crude oil pollution may degrade the environment in several ways.

Land surfaces tend to be significantly less sensitive than surface and groundwaters. The greater part of the BTC route is of low gradient, is farmed, of low ecological value and of low sensitivity. Areas of desert and semi-desert that are of high ecological value are of moderate sensitivity, and locally may be of high sensitivity such as in Gobustan.

The susceptibility of organisms to oil depends on a wide range of factors, including:

- Their ability to resist contamination (physically, or by possessing the ability to metabolise contaminants)
- The degree to which they are stressed by natural factors (their physical environment and biological competition)
- Their breeding condition
- Their ability to move away from impacted areas

The time that it takes for an oil-damaged habitat to recover varies considerably and depends on the severity and duration of the disturbance and the reproduction potential of individual species.

#### Habitat type

This Section considers the impact of oil spillage on the various habitat types located along the BTC pipeline route and provides a brief description of suggested mitigation for those impacts discussed.

#### Desert and semi-desert - possible oil spill effects

Heavy oiling, eg with pools of oil in depressions, can kill shrubs and bushes. Information on the structure of desert root systems (Rundel and Nobel, 1991) provides some indication of likely vulnerability. The most vulnerable group of plants are likely to be the shallow-rooted perennials (many of the low desert shrubs), whose finely branched root systems are concentrated in the top 200mm of soil. Deep-rooted perennials such as *Tamarix* (which has recorded rooting depths of up to 20 m) are less likely to be affected by surface oiling. There could be serious effects on ephemeral species according to the time of year. Summer oiling is likely to kill plants before seed is set, which will affect the following year's production. Oiling of seeds in late winter and early spring can reduce germination.

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#### Scrub and trees - possible oil spill effects

Severe oiling with heavy penetration of the soil can kill trees by affecting the root systems. A more commonly reported effect is temporary stress (as evidenced by leaf drop) followed by recovery within a year. If the soil is very wet or flooded this probably gives some protection to tree root systems.

#### Wetlands - possible oil spill effects

Many wetlands are dominated by robust, productive perennial plants with substantial underground root systems (Westlake, 1982). These underground systems, with their food reserves and protected buds, provide some potential for recovery from surface damage, including oil spill damage. There is an annual cycle of winter dieback, rapid growth from subterranean buds in the spring, and transfer of nutrients to underground reserves in the autumn. Seasonal cycle information for the reed Phragmites australis is given by Fiala (1978). This has a bearing on plant performance following damage to emergent shoots from oil pollution and cleanup. Regrowth from secondary buds is quick after cutting during the period of rapid growth (in spring and early summer). However, after the emergence period, cut shoots are not (or hardly) replaced, and, with part of the growing season lost, the crop is reduced the following year.

The underground systems of wetland plants commonly grow in oxygen-poor environments, and the plants are adapted by having oxygen diffusion pathways from the aerial to the underground parts, through spongy aerenchyma tissue. Experimental work suggests that oxygen diffusion rate could be reduced if aerial parts are oiled. Armstrong (1967) found that if petroleum jelly was applied to the aerial parts of the bog plant Eriophorum angustifolium, the oxygen diffusion rate out of the roots was reduced. The outcome might be increased stress for the plant, and a decrease in the oxidized rhizosphere environment that is probably important for a number of soil microorganisms. Another way in which the oxygen diffusion system could be upset is by cutting plant stems if the cut ends are subsequently flooded with water.

Wetland characteristics depend particularly on the water regime, which is subject to seasonal variations. Water regime characteristics at the time of a spill can profoundly affect the distribution of oil within a wetland, with large areas at risk during times of flood. Conversely, at times when water is draining down through the substratum, relatively small areas may be affected but with enhanced penetration of the substratum. This in turn may lead to longer residence times and difficult cleanup problems.

#### Agricultural land

It is likely that the same problems would arise with cultivated species as have been recorded for natural plant communities. These are likely to include reduction of germination for oiled seeds, relatively high mortalities for annual species, and greater tolerance of deep-rooted perennial species. Bioremediation involving addition of fertiliser and ploughing (to stimulate bacterial breakdown of oil in the soil) is likely to be a particularly appropriate remediation technique.

#### Developed land

Any spillage in residential and industrial areas and in parks and open spaces will requires specialist cleaning methods but is unlikely to have any significant adverse effects on ecological interests.

#### Surface waters

Contamination of water resources may directly affect water used for drinking or irrigation due to the dissolved toxic components of oil in the water. Small concentrations of oil in water may result in tainting of the water or, if the spill is on land, of agricultural produce.

Dissolved oil components in river water may have acute toxic effects on fish and invertebrates, and the adsorption of oil onto sediments may cause chronic effects over a longer period of time due to slow but continuous release.

Oiling of water surfaces (of rivers, canals, lakes, ponds and ditches) can also affect birds, not only in terms of toxic ingestion, but also in terms of oiling of their feathers, particularly in diving species.

#### General considerations - impact of oil spills on water

The processes, which most rapidly transport oil from where it is spilt to other places, involve movement by water. Oil spills to water may be divided into two categories:

- Those to surface waters (rivers, streams, canals, lakes, ponds, ditches)
- Those to groundwater (having migrated through the overlying soils or bedrock, as detailed above)

A single release to ground may impact both surface water and groundwater.

The severity of the impact of an oil spill into one of the large rivers crossed by the BTC pipeline will be determined by the release rate, release volume and the water flow in the river at the time of the spill. As noted in Section 8, the flow regime of these rivers is highly seasonal.

At times of high flow the oil will be rapidly dispersed downstream and the toxic components of the spill will be diluted, but it will affect a larger area than if the spill occurred at a time of low or no flow. If the riverbed is dry, the oil will either form a pool on the riverbed or - depending on the hydraulic conductivity of the bed materials - will percolate through the bed materials until it reaches an impermeable layer or groundwater. If there were still, stagnant water in the river, the oil would float on the surface leading to concentrated toxic components that would spread over only a small area.

A leak from a small hole may tend to partially evaporate and be diluted in the period prior to detection and repair. A similar volume of oil lost from a medium- or large-sized leak in a shorter period may have greater potential to cause harm.

When oil is spilt onto the surface of any water body, it undergoes a number of changes, termed "weathering", some of which enhance its natural dissipation, whilst others cause it to persist.
Therefore the fate and effects of any particular type of oil, as well as the clean-up requirements, will depend primarily on the combined physical and chemical properties of its components.

Other factors such as the amount of oil spilled, location, weather and water conditions and the time of year will also all have a major influence on the fate and effects of the oil spill. For these reasons, no two spills are likely to be the same in terms of their impact or clean-up requirements.

Some freshly spilled oils may contain a high proportion of toxic hydrocarbons such as aromatic compounds. However, although these components are among the most soluble in water, they are also those that are lost most rapidly by evaporation. Lethal concentrations of toxic components leading to fish, invertebrate and plant mortalities will therefore be rare in turbulent waters and more common in calm waters, where they will be highly localised and short lived.

The key factors that affect the fate of spilled oil are:

- Biodegradation
- Spreading
- Evaporation
- Natural dispersion
- Dissolution
- Formation of water-in-oil emulsions
- Sedimentation, and
- Various oxidation processes

In times of high flow, any oil entering a watercourse will be rapidly dispersed over a wide area. Large numbers of organisms may therefore be exposed to fairly low concentrations of oil that are quickly broken down.

In times of low flow, oil entering a watercourse will tend to be more concentrated at the surface, but distributed throughout the water column. In this case it will have a more significant effect on local fish populations as the oil persists for longer in one location.

## Groundwater

## General considerations - impact of oil spills on land on groundwater

Following a spill, oil will tend to penetrate porous sub-soils. There it will move downwards under the influence of gravity and capillary action. The amount of oil retained in soil at saturation is normally between 5 and  $40 \text{ l/m}^3$ , depending upon soil porosity and physiochemical characteristics.

The rate of penetration depends on the type of oil (principally its viscosity), the type of soil and the soil's saturation with water. Low viscosity oil and coarse gravel provide the combination with the fastest penetration rate. In practice, highly viscous oils, such as some crude oils, do not penetrate to a significant extent.

In the event of an oil spill onto land, several migration pathways exist.

- On impermeable soils, oil will flow downslope over the surface and may form a pool or enter a ditch, drain or other watercourse.
- On permeable soils, migration of oil into the subsurface can be divided into three stages:
- Seepage through the unsaturated zone
- Spreading over the water table
- Stability within the water capillary zone

Once a significant volume of oil is released, it migrates downward, generally under the influence of gravity and subordinate capillary forces, until it reaches the capillary fringe above the water table. In homogenous materials, seepage occurs with minimal amounts of lateral spreading.

While the extent of surface spreading is less on porous soils than on those that are impermeable, the depth of penetration is typically greater and lateral subsurface spreading can be significant.

Primary factors affecting the amount of lateral spreading include the rate of release, the volume of release, and the presence of significant permeability contrasts, as would be anticipated in heterogeneous materials. For example, a large instantaneous release into the unsaturated zone will have a higher degree of spreading in comparison to a continuous small release. Furthermore, slow releases may also develop dendrites of free phase liquid migrating downward (Van Duijvenbooden and Kooper, 1981).

Where soil or rock heterogeneity exists, as is most often the case, flow paths can be substantially different from those anticipated. This phenomenon is common when zones of significant permeability contrasts are encountered, as for example with clay perched zones. To complicate matters, lateral seepage within the unsaturated zone may in some cases occur in directions contrary to the overall direction of groundwater flow due to geologic conditions such as stratification, channelling and bedding orientation.

In areas where soils have a low permeability, the viscous nature of crude oil typically results in the oil from a leak forming a pool on the soil surface.

The Caspian crudes to be transported in the BTC are light, with a high proportion of volatile organic fractions. It is anticipated that virtually all significant losses will be initiated at least one metre below the ground surface (though a major pipe failure may be expected to affect the ground surface). A leak from a small hole, typically over a prolonged period due to difficulties in detection such a failure, may therefore cause subsurface pollution affecting aquifers. A larger hole or rupture is likely to cause oil to be released under pressure, cratering at the surface and the spraying of oil locally that may affect water bodies and watercourses in addition to the pooling and flow of oil over the ground surface.

## 10.4.4 Modelling of impacts on sensitive sites

It is planned that modelling of oil spills at specific locations along the BTC route in Azerbaijan will be undertaken to assess:

- Potential spill volumes
- Areas likely to be affected by "worst case" incidents (including ponding and the probability of the spill reaching watercourses and the likely volume involved)
- Sensitive receptors
- Critical spill response times

This information will be used to review and, if necessary, to improve the Oil Spill Response Plan in terms of where equipment and materials are stored, the planned response actions and training of staff.

## 10.4.5 Mitigation of impacts of oil spills

While risk assessment indicates that the probability (frequency) of pipeline failure affecting any one site is very low, the occurrence of such an incident would potentially result in considerable impact on environmental and social receptors. The degree of impact is likely to be highly dependent on the mitigative and remedial actions undertaken. As such, any oil spill is likely to warrant substantial efforts aimed at containing / recovering the oil, protecting local receptors and remediating any residual contamination.

The selection of appropriate containment, recovery and remedial actions is highly dependent on the local conditions at the spill site (eg topography, land use, vegetative cover, hydrology, and hydrogeology) and the characteristics of the spill (eg oil quantity, areal extent, and nature of the failure). Given the range of influencing factors with respect to the choice of oil spill response and remediation techniques, it is not typically appropriate to attempt to prescribe the nature of these activities in detail in advance of an incident. The key mitigative actions for any oil spill will therefore comprise:

- Rapid implementation of primary containment and recovery activities aimed at minimising the release volume, physically protecting highly sensitive receptors, containing the spill within as small an area as possible and recovering available free phase oil;
- The rapid deployment of expert personnel to the spill site to carry out site specific appraisals of the spill, to develop site specific clean up/remediation plans and to direct clean up activities;
- The implementation of the recommendations of the expert personnel (eg site characterisation, risk assessment, remediation of residual contamination); and
- Ongoing monitoring and review of the clean up activities

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Each of these measures will be conducted under the framework provided by the management and monitoring programmes for the project. The measures to be taken to mitigate oil spills are specifically addressed in the following:

- Section 14: Management and Monitoring
- Part 6 of the Technical Appendix: Oil Spill Modelling
- Part 7 of the Technical Appendix: Oil Spill Response Plan Framework

## Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		L5; C3; MEDIUM			Temporary loss L5; C3-5;	MEDIUM/HIGH	Permanent loss L5; C1; LOW
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)		Finite, but reduced, use of natural resources.			Temporary loss of	c.1500ha of habitat;	Permanent
MITIGATION		Include environmental considerations in the project procurement process and the Procurement and Supply Management Plan;	Responsible use of materials to minimise waste in accordance with the project Waste Management Plan;	Recycling and reuse of materials in accordance with the project Waste Management Plan.	Completion of pre-construction surveys in accordance with the Reinstatement	Plan;	Sites & routes selected to avoid protected (ecological) areas and
POTENTIAL IMPACT	ind Operation	Depletion of non-renewable natural resources eg stone, steel, oil, gas and timber			Reduced biodiversity and habitat structure	Reduced breeding potential	Loss of breeding & foraging areas
ASPECT	s during Construction a	A1 Use of raw materials & natural resources			A2 Loss of habitat		
ACTIVITY	General Activitie	Procurement			Landtake for facilities,	construction camps, pipe	yards, access

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Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		L1; C1-5; LOW
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)	loss of c.15ha of habitat with low ecological value	Reduced likelihood
MITIGATION	ecologically sensitive areas wherever practical; Development and implementation of species translocation programmes; Clear demarcation of workspace boundaries and sensitive areas in accordance with the construction method statements; Access only on designated roads and ROW in accordance with the project Transport Management Plan; Development, implementation and monitored compliance with a project Reinstatement Plan.	Inclusion of environmental issues in workforce and visitor induction training in accordance with the Employment
POTENTIAL IMPACT	Habitat severance - impeded animal movements due to changed nature of ground surface and presence of structures	Damage to ecosystems
ASPECT		A5 Introduction of competitive species or
ACTIVITY	roads, AGIs, working width	

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT			
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)			
MITIGATION	and Training Management Plan;	Access confined to demarcated working areas in accordance with the construction method statements and the Transport Management Plan;	Inclusion of invasive species assessments in the project Construction Environmental Monitoring Programme and the Reinstatement Plan.
POTENTIAL IMPACT			
ASPECT	diseases		
ACTIVITY			

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

ACTIVITY	ASPECT	POTENTIAL IMPACT	MITIGATION	RESIDUAL	LIKELIHOOD
				IMPACT (COMPARED	(L); CONSEQUENCE
				TO IMPACT	(c);
				BEFORE	SIGNIFICANCE
				<b>MITIGATION</b>	OF RESIDUAL
					IMPACT
	A6 Visibility	Disruption of natural landscape	Site selection for permanent facilities	Permanent	L5; C3; MEDIUM
			has taken visual impact into	facilities will	
			consideration;	remain visible,	
				but choice of	
			Reinstatement of temporary works	finishes of the	
			areas as close as practical to existing	main AGI	
			conditions as defined in Reinstatement	(pump station)	
			Plan;	will reduce	
				visual intrusion	
			Use of toning finish for pump station		
			perimeter wall.		
Use and	A7 Pollution by	Ground/ soil contamination	Development and implementation of a	Reduced	L1; C1-5; LOW
storage of	accidental		hazardous materials management plan	likelihood and	
materials	spillage of	Surface water and/or ground water	(as part of the Pollution Prevention	magnitude	
	hazardous	contamination	Management Plan Management Plan).	•	
	materials (eg		At a minimum the plan is to include		
	fuels, lubrication	Stress/mortality of flora and fauna	sections addressing the following		
	fluids, oils, paints,		provisions:		
	diesel etc).		Ensure no storage of hazardous		
			materials in floodplains or within		

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Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT	
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)	
MITIGATION	30m of water course Minimise storage of hazardous materials in areas of known groundwater vulnerability Storage of hazardous materials within designated hazardous storage areas Requirements for the establishment of hazardous materials storage (eg bunding, impermeable surfaces, secure drainage, limited access, labelling) Record keeping and on site maintenance of Material Safety Data Sheets (MSDS) Segregation of potentially reactive materials Establishment of procedures to determine acceptability of material storage and to promote
POTENTIAL IMPACT	
ASPECT	
ACTIVITY	

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT					
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)					
MITIGATION	the minimisation of storage volumes	Training of personnel in safe use & handling of hazardous materials;	Ensure a high standard of vehicle maintenance in accordance with the Transport Management Plan;	Use only designated refuelling procedures in accordance with the Hazardous Materials section of the Pollution Prevention Management Plan;	Ensure oil spill response equipment is available (absorbents etc) and emergency response training is provided for the appropriate
POTENTIAL IMPACT					
ASPECT					
ACTIVITY					

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT			
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)			
MITIGATION	construction crews (in accordance with the Employment and Training Management Plan, the Pollution Prevention Management Plan and the Emergency Response Plan);	Rapid response in event of spillage in accordance with the Emergency Response Plan;	Monitored compliance with the project Pollution Prevention Plan (which will include relevant precautions for refuelling) & Oil Spill Response Plan (which will include management of initial clean up of any contaminated soil or water).
POTENTIAL IMPACT			
ASPECT			
ACTIVITY			

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

ACTIVITY	ASPECT	POTENTIAL IMPACT	MITIGATION	RESIDUAL	LIKELIHOOD
				IMPACT	(L);
				(COMPARED	CONSEQUENCE
				BEFORE	SIGNIFICANCE
				<b>MITIGATION</b>	<b>OF RESIDUAL</b>
					IMPACT
	A8 Production &	Potential for ground/ soil/water	Implementation of Waste Management	Waste ash	Air quality
	disposal of solid	contamination if disposal uncontrolled	Strategy and the development of a	from	L3; C1; LOW
	& liquid waste		project Waste Management Plan to	incineration	
		Decreasing air quality (if incinerated)	include:	unavoidable if	Ecological impacts
			Enforcement of a strict duty of care on	used as	L1; C3; LOW
		Mortality of flora and fauna	the project managers and the	disposal route	
			contractors		Contamination
		Increase of vermin (if organic)	Establishment of secure waste storage	Landfill – use	L2; C3; LOW
			in defined areas away from	of void space,	
		Contribution to global warming (from	watercourses and drains and	leachate	
		decomposition & incineration)	secure from vermin	production and	
			Prohibition of uncontrolled burning or	potential	
			burial of waste	production of	
			Requirements for the environmental	methane	
			review of potential landfill &		
			incinerator sites including site		
			selection & proposed mode of		
			operation		
			Monitoring and auditing procedures		
	A9 Production of	Pollution by accidental or uncontrolled	Implementation of Waste Management	Controlled	L5; C1; LOW

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT	
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)	discharges with reduced likelihood and severity of consequences of pollution
MITIGATION	Strategy and the development of a project Waste Management Plan to include; Monitoring quality of water before discharge Prohibition of the discharge of contaminated wastewater to the environment Sewage treatment facilities incorporated into design of construction camps and pump station Avoidance of disposal in hydrogeologically vulnerable areas Environmental risk assessment to be included in consideration of disposal options and locations Development and implementation of a routine wastewater monitoring
POTENTIAL IMPACT	discharge Soil contamination Surface water and/or groundwater contamination
ASPECT	black and grey water
ACTIVITY	

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		Traffic L1-5 (varies	with locations); C1-	3; LOW/MEDIUM		Air	L5; C1; LOW		Dust	L3; C3; MEDIUM		Noise	L3; C2; LOW		(Safety issues are	addressed in	Section 11)			
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)		Controlled	traffic	movements	during	construction.		Air emissions	during	construction	unavoidable	but managed		Reduced	likelihood and	magnitude of	dust		Mitigation	measures
MITIGATION	programme.	Development, implementation and	monitoring of a Transport Management	Plan designed to take account of road	capacities & define approved routes for	specific categories of vehicle.	Provisions to include;	Strict enforcement of project speed	limits	Driver safety and environmental	awareness training, assessment	and monitoring	Journey management planning	Effective vehicle maintenance to	minimise emissions & fuel	consumption	Place warning signs at road crossings	and other appropriate locations	Temporary traffic control where	necessary at road crossings and
POTENTIAL IMPACT		Additional vehicles using road network		Safety risk to people (see Section 11)	and animals		Fuel consumption													
ASPECT		A11 Vehicle	movements																	
ACTIVITY		Maintenance,	use &	movement of	vehicles,	plant and	equipment													

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

ASPECT	POTENTIAL IMPACT	MITIGATION		
			(COMPARED TO IMPACT	CONSEQUENCE
			BEFORE MITIGATION)	SIGNIFICANCE OF RESIDUAL IMPACT
		junctions	reduce risk to	
		Local community safety awareness	people and	
		programme	animals	
12 Soil	Loss of drainage capacity with	Ensure that soil storage areas are	Mitigation	Soils
ompaction	increased surface water run-off	protected from vehicle movements;	measures	L3; C2; LOW
			reduce	
	Impaired re-establishment of	Ripping of subsoil beneath running	likelihood of	
	vegetation after construction	track prior to reinstatement;	run-off during	
			construction	
	Localised habitat changes	Use of load bearing materials (eg bog	and recovery	Vegetation
		mats, straw, geotextile membrane) in	period.	L2; C2; LOW
		areas of soft ground;		
			Vegetation	
		Provision of temporary drainage where	recovery	
		appropriate;	unlikely to be	
			affected by	
		Development and implementation of	compaction.	
		method statements to specifically		
		address construction through soft		
		around.		

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT	L3; C3; LMEDIUM
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)	Impact minimised: localised effect only
MITIGATION	Access limited to demarcated ROW and specified access roads in accordance with the Transport Management Plan; Strict enforcement of project speed limits in accordance with the Transport Management Plan; Reinstatement as early as practical & in accordance with the Reinstatement Plan; Damping down of ROW in accordance with the requirements of the Pollution Prevention Management Plan and construction method statements; Identification of areas of particularly sensitive crops or animals, eg cotton
POTENTIAL IMPACT	Degradation of local air quality causing: Respiratory problems – animals and people Reduced photosynthesis and therefore productivity of plants Nuisance to local residents
ASPECT	A13 Dust generation
ACTIVITY	

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

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Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		L3; C2; LOW
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)		Reduced likelihood of unacceptable noise emissions and nuisance
MITIGATION	emergency response training is provided for the appropriate construction crews (in accordance with the Employment and Training Management Plan, the Pollution Prevention Management Planand the Emergency Response Plan)	Inclusion of noise mitigation measures within the Pollution Prevention Management Plan and the Transport Management Plan. Provisions to include: Regular maintenance of plant and equipment to meet relevant standards Use of noise abatement equipment where appropriate Defined working hours Responsible use of vehicles Procedure for informing local residents
POTENTIAL IMPACT		Disturbance to surrounding environment and populations
ASPECT		A16 Noise emissions
ACTIVITY		

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Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT	
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)	
MITIGATION	of noisy activities Monitoring against noise control targets
POTENTIAL IMPACT	
ASPECT	
ACTIVITY	

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		Traffic L1-5 (varies with locations); C1- 3; LOW/MEDIUM	L2; C3; LOW	NO <sub>x</sub> (in combination with vehicle emissions)L4; C3; MEDIUM Other gases L4; C2; LOW
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)			Reduced risk of disruption to local supplies and services	
MITIGATION			Procurement and Supply Management Plan to address issues relating to the capacity of the rail network; Rail movements to be planned to avoid disruption to local supplies and services.	
POTENTIAL IMPACT	e Yards	See above for A11	Reduced capacity of local rail network	See above for A14
ASPECT	Camps and Storage	A11 Vehicle movements	A3 Rail movements	A14 Combustion gases (CO <sub>2</sub> , CO, NO <sub>2</sub> , NO, SO <sub>2</sub> , PM, CH <sub>4</sub> , VOCs)
ACTIVITY	Construction	Pipes & materials delivery		Power generation

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT	L5; C1; LOW					
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)	Reduced likelihood and magnitude					
MITIGATION	Identification of vulnerable water bodies, wetlands & groundwater sources;	Sampling and analysis of water from existing boreholes to monitor contamination;	Ensure that all new abstractions for use by the project are subject to an Environmental Review;	Adherence to national and local licensing policy for abstractions;	Test-pumping of new abstractions and monitoring of impacts on existing abstractions flow rates;	Monitoring of water levels in wetlands.
POTENTIAL IMPACT	Reduced quality or quantity of established groundwater sources (springs, karizes, wells etc.)	Drying out of wetlands				
ASPECT	A17 Abstraction of Ground Water					
ACTIVITY	Water supply					

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT	L5; C1; LOW	L5; C2; MEDIUM
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)		Reduced magnitude of emission and likelihood of causing nuisance nuisance
MITIGATION		Ensure environmental considerations are incorporated into the siting and design of camps; Implement workforce education with respect to minimising disruptive activities. Incorporate into the project induction training; Implementation of camp rules including restrictions on noisy activities (eg inappropriate use of personal radios) to avoid causing nuisance; Provide mechanisms for the lodging of complaints and for action in response
POTENTIAL IMPACT	See above for A8	Disturbance of local community
ASPECT	A8 Production and disposal of solid and liquid wastes	A16 Noise emissions
ACTIVITY	Occupation of camps	

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Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT	
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)	
MITIGATION	to such complaints in accordance with the Community Liaison Management Plan.
POTENTIAL IMPACT	
ASPECT	
ACTIVITY	

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

TIVITY	ASPECT	POTENTIAL IMPACT	MITIGATION	RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)	LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT
tion of F	<sup>D</sup> ipeline and Facilities				
ction orary	A1 Use of natural resources	See above for A1			N/a
	A12 Soil compaction	See above for A12			L3; C2; LOW
	A11 Vehicle movements	See above for A11			Traffic L1-5 (varies with locations); C1- 3; LOW/MEDIUM
	A13 Dust generation	See above for A13			L3; C3; MEDIUM
ce ig ry tree	A2 Loss of habitat	See above for A2			L5; C3-5: MEDIUM/HIGH

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		L5; C1; LOW	L2; C2; LOW	L2; C2; LOW
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)			Short term loss of containment for animals	Reduced likelihood and
MITIGATION			Develop and implement the project Reinstatement Plan, including detailed provisions for: Reinstatement of boundary on completion of construction Provision of temporary fencing to meet land owner's requirements Ensure consultation with landowners, occupiers and users in accordance with the Community Liaison Management Plan and the Resettlement Action Plan.	Include provisions for drainage/irrigation management in the
POTENTIAL IMPACT		See above for A6	Loss of containment for farmed animals	Impeded drainage during wet periods
ASPECT		A6 Visibility	A44 Loss of boundaries	A18 Disruption of drainage/irrigation
ACTIVITY	ditches) and vegetation removal			

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT	
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)	magnitude Temporary disruption while temporary arrangements are installed
MITIGATION	Infrastructure and Services Management Plan and the Reinstatement Plan. At a minimum: Maintain the integrity and viability of any existing active drainage or irrigation systems during construction work (including the use of measures such as pumping, channel diversions and fluming). Reinstate or replace any disrupted drainage or irrigation systems to a standard at least equal to the original conditions upon completion of construction work Undertake surveys of irrigation and drainage systems as necessary to identify existing systems and devise temporary replacement measures if
POTENTIAL IMPACT	Reduced crop growth if irrigation channels disrupted
ASPECT	channels
ACTIVITY	

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		L3; C3; MEDIUM	Generally L3; C2; LOW	L3; C4; MEDIUM	
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)			Reduced likelihood and magnitude		
MITIGATION	required, including liaison with land owners/land occupiers/land users (in accordance with the Community Liaison Plan and the Resettlement Action Plan).		Implementation of erosion control measures in accordance with the project Reinstatement Specification;	Preparation & implementation of a project Reinstatement Plan and approved crossing methods;	Ensure compliance with the requirements of the project Reinstatement Specification, including: Undertake reinstatement at the earliest
POTENTIAL IMPACT		See A13 above	Increased surface water run-off Siltation of watercourses	Loss of topsoil necessitating importation for reinstatement & associated risk of introducing unwanted species	
ASPECT		A13 Dust generation	A19 Soil erosion		
ACTIVITY		Topsoil stripping			

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

IDUAL LIKELIHOOD PACT (L); PARED (L); PARED (C); PARED		<pre>3y will Not quantifiable at</pre>	this stage but	tion of some BENEFICIAL	vn effects	ology as	For a qualitative	ered. discussion of the	residual impact	upon archaeology	refer to Section 12.							
RES IMF (COM TO IN TO IN BEF MITIG		Strateo	allow	evalua	unknov	archae	it is	discov										
MITIGATION	viable opportunity (given engineering constraints)	Pipeline routed to avoid major known	archaeology;		Development and implementation of	an Archaeological Protection Strategy	for the project and a Cultural Heritage	Management Plan for the construction	phase;		Undertake pre-construction works to	evaluate & record important	known/suspected archaeological sites	in accordance with the Cultural	Heritage Management Plan;	Implement a programme of	archaeological surveillance during the	clearance of the ROW and ancillary
POTENTIAL IMPACT		Loss/disturbance of archaeology		Discovery of unknown archaeology	during construction													
ASPECT		A20 Disturbance	of archaeological	remains														
ACTIVITY																		

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Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		L4; C4; MEDIUM
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)		Reduced likelihood and magnitude but some topsoil will be stored 2 years if SCP follows
MITIGATION	facility sites in accordance with the Cultural Heritage Management Plan; Ensure that issues of archaeological awareness (such as ownership of finds, notification of finds and protection of archaeological sites) are included in induction training.	Ensure compliance with the requirements of the project Reinstatement Specification and Reinstatement Plan with respect to topsoil, including: Monitoring of compaction and aerobic status of topsoil stacks Segregation of subsoil and topsoil Undertaking of manual aeration if anaerobic conditions develop Undertake prompt reinstatement in accordance with the
POTENTIAL IMPACT		Reduced agricultural productivity following reinstatement Development of anaerobic conditions in stored soil
ASPECT		A21 Loss of soil structure and fertility
ACTIVITY		Topsoil storage

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		L4; C2-4; LOW/MEDIUM
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)		Reduced likelihood and magnitude, but some topsoil will be stored 2 years if SCP follows BTC
MITIGATION	Reinstatement Plan and construction programme thus minimising storage time Store topsoil outside running track used by all construction plant, equipment and vehicles	Ensure compliance with the requirements of the project Reinstatement Specification with respect to topsoil and seeds; Undertake reinstatement at the earliest viable opportunity given the engineering constraints and thus minimise storage time; Undertake an environmental review of the route to identify areas where pre- construction seed collection, harvesting of seeds from surrounding
POTENTIAL IMPACT		Poor re-colonisation following reinstatement
ASPECT		A22 Loss of viability of soil seed bank
АСТІИТҮ		

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		L3; C2; LOW	L2; C3; LOW
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)		Reduced magnitude, but movement of some animals will be impeded	Reduced likelihood and magnitude
MITIGATION	areas and/or the establishment of nursery crops should be carried out; Implement the recommendations of the environmental review.	Ensure that gaps are left in topsoil stacks at strategic locations in accordance with the Infrastructure and Services Management Plan and the construction method statements.	Ensure that gaps are left in topsoil stacks to allow floodwater through in accordance with the Infrastructure and Services Management Plan and construction method statements; Ensure the continued viability of pre- existing drainage and irrigation systems throughout the project (See
POTENTIAL IMPACT		Disruption of herd and wild animals movements	Localised changes to flooding pattern
ASPECT		A23 Impeded movement of wild animals and domestic herds	A24 Increased flood risk
ACTIVITY			

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		L3; C2; LOW		L3; C3; MEDIUM	L3; C2; LOW	Not quantifiable at this stage	L5; C3-5; MEDIUM/HIGH	
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)		Reduced likelihood and	magnitude				At steep ridges with unstable	ground ('badlands') and at some river crossings
MITIGATION	A18).	In addition to the provisions set out in item A19:	Compaction of stack surface to prevent erosion.				Ensure that reinstatement is sympathetic to existing contours	(where not precluded by risk to integrity of pipe & erosion considerations) in accordance with the Reinstatement Specification and the
POTENTIAL IMPACT		See A19		See A13 above	See A19 above	See A20 above	See A25 above	
ASPECT		A19 Soil erosion		A13 Dust generation	A19 Soil erosion	A20 Disturbance of archaeology	A25 Modified topography	
ACTIVITY				Movement of subsoil during grading				

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

AL LIKELIHOOD T (L); ED CONSEQUENCE CT (C); E SIGNIFICANCE ON) OF RESIDUAL IMPACT		e MEDIUM/HIGH
RESIDUA IMPAC1 (COMPAR (COMPAR TO IMPA( BEFORE MITIGATIC	it will not be possible to reinstate to original contours-	Impacts will depend on choice of disposal site Additional vehicle movements (not yet quantifiable
MITIGATION	Reinstatement Plan.	Ensure that reinstatement is conducted in accordance with the Reinstatement Plan, including provisions to minimise the generation of surplus subsoil through spreading on ROW prior to replacement of the topsoil; Where excess subsoil is generated, it will be managed and disposed of in accordance with the provisions for inert waste set out in the Waste Management Plan; Ensure that all potential subsoil disposal sites and disposal plans are
POTENTIAL IMPACT		Smothering of native flora and fauna Changed topography and landscape Additional vehicle movements
ASPECT		A26 Disposal of surplus subsoil
ACTIVITY		

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		L3; C3; MEDIUM	L2; C3; LOW
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)			Reduced likelihood and magnitude
MITIGATION	subject to an environmental review prior to their adoption.		In addition to A19 above: Undertake the following actions in accordance with the Pollution Prevention Management Plan and construction method statements: Installation of sediment fencing, drainage channels & trench barriers where appropriate No more than 15km of trench to be open at any one time on each spread Undertake temporary dewatering or trench stabilisation where
POTENTIAL IMPACT		See A13 above	See A19 above
ASPECT		A13 Dust generation	A19 Soil erosion
ACTIVITY		Trenching (excavation & storage of subsoil)	

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		L1; C2; LOW
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)		Reduced likelihood and magnitude
MITIGATION	required to minimise slumping of trench walls	Avoid construction in areas of known or suspected contamination as far as is practical (N.B. the pipeline has been routed to avoid many areas of known or potential contamination and a baseline contamination survey has been carried out.); Ensure that where contaminated land is encountered it is managed effectively, including: Completion of pre-construction investigation and clearance of contamination to promote worker safety Ensure segregation of contaminated
POTENTIAL IMPACT		Mobilisation of contaminants with associated risk of polluting ground/surface waters Risks to worker health and safety
ASPECT		A28 Disturbance of known/unknown contaminated land
ACTIVITY		

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Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		Not quantifiable at this stage	L2; C2; LOW
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)			Reduced likelihood and magnitude
MITIGATION	soil from uncontaminated materials Provision of containment measures (ditches, impermeable base membranes, covers) to minimise run-off from contaminated soil piles Where offsite disposal or long-term storage of contaminated material is required it will be undertaken in accordance with the provisions set out in the project Waste Management Plan.		Ensure that trench-water disposal is undertaken in accordance with the provisions of the Pollution Prevention Management Plan and construction
POTENTIAL IMPACT		See A20 above	Sediment contamination of surface waters; Erosion of receiving area
ASPECT		A20 Disturbance of archaeology	A29 Disposal of trench-water
ACTIVITY			
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# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		L3; C2; LOW
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)		
MITIGATION	method statements avoiding direct discharge to watercourses where practical, possibly through the use of evaporation basins and soakaways (soakaways not to be used over sensitive aquifers); Where discharge to watercourses cannot be avoided: Discharge of water through filtering medium Use of appropriate measures to minimise scour at the discharge point (eg controlled rate of discharge & placement of geotextile mats or other physical erosion prevention measures at the discharge points)	
POTENTIAL IMPACT		See A23 above
ASPECT		A23 Impeded
ACTIVITY		

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		L4; C1; LOW	L3; C2; LOW	L3; C2; LOW
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)		Reduced likelihood		Reduced likelihood and magnitude
MITIGATION		Erection of warning barriers where significant risk to public and livestock exists; Installation of soft plugs in ditch with sloped edges to allow animal egress.		Ensure that groundwater disposal is undertaken in accordance with the provisions of the Pollution Prevention Management Plan and construction method statements;
POTENTIAL IMPACT		Risk of falling in trench	See A17 above	Discharge of sediment to watercourses; Erosion of receiving watercourse
ASPECT	animal movements (Note - Impacts on people are considered in Section 11)	A30 Public & animal safety (Note – Impacts on people are considered in detail in Section 11)	A17 Groundwater abstraction	A42 Discharge of ground water
ACTIVITY			Dewatering	

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# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT			L3; C2; LOW	
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)			Reduced disruption of movements	
MITIGATION	Filter discharge if contains visible suspended solids;	Use of appropriate measures to minimise scour at the discharge point (eg controlled rate of discharge & placement of geotextile mats or other physical erosion prevention measures at the discharge points).	Leave gaps in welded strings at critical locations to allow passage of domestic herds in accordance with Community Liaison Management Plan	Minimise interval between welding and ditching in accordance with construction method statements and the Pollution Prevention Management
POTENTIAL IMPACT			See A23 above	
ASPECT			A23 Impeded movement of wild animals & domestic herds	
ACTIVITY			Pipe stringing and bending	

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		L5; C1; LOW	L5; C1; LOW	L5; C1; LOW	L3; C3; MEDIUM	L2; C3; LOW
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)			Negligible environmental impact			Reduced likelihood and magnitude
MITIGATION	Plan		Ensure adequate dispersion of vapours in accordance with Health and Safety Procedure.			Implementation of erosion control measures in accordance with the project Reinstatement Specification including:
POTENTIAL IMPACT		See A14 above	Degradation of local air quality (primarily affecting the welders)	See A8 above	See A13 above	A19 above, plus Risk of pipe exposure
ASPECT		A14 Combustion gases (CO <sub>2</sub> , CO, NO <sub>2</sub> , NO, SO <sub>2</sub> , PM, CH <sub>4</sub> , VOCs, )	A4 Metal vapour emissions	A8 Disposal of solid & liquid wastes	A13 Dust generation	A19 Soil erosion
ACTIVITY		Pipe welding and inspection		Field coating (including application of concrete coating)	Lowering and Backfill	

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

ш					
LIKELIHOOD (L); CONSEQUENC (C); SIGNIFICANCE OF RESIDUAL IMPACT		L2; C4; LOW		L3; C3; MEDIUM	
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)		Reduced likelihood and magnitude			
MITIGATION	Placement of trench breakers Effective consolidation of backfill (95/105% of original) Monitoring	Consolidation of backfill in accordance with Reinstatement Specification (95/105% of original);	Implementation of erosion control measures in accordance with the Reinstatement Plan (eg use of trench breakers).		
POTENTIAL IMPACT		Trench can act as conduit for groundwater, draining higher areas and flooding lower areas	Disruption of drainage patterns	See A13 above	
ASPECT		A27 Altered drainage		A13 Dust generation	
АСТІИТҮ				Site clean-up and	restoration Replacement of subsoil to create pre-

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

KELIHOOD (L); NSEQUENCE (C); SNIFICANCE F RESIDUAL IMPACT		C3; LOW	C3; LOW	C2-5; DIUM/HIGH
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION) OI		L2;	L2;	L5; MEI
MITIGATION				
POTENTIAL IMPACT		See A19 above	See A27 above	See A25 above
ASPECT		A19 Soil erosion	A27 Altered drainage	A25 Modified topography
ACTIVITY	construction profile Replacement of topsoil Replacement of boundaries (fences, tree planting) Removal of all construction equipment Revegetation			

## Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

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# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT	L4; C2; LOW	L2; C3; LOW	L1; C2-5 (depending on species); LOW
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)	Reduced likelihood and magnitude		Reduced likelihood and magnitude
MITIGATION	As A35 above. In addition: Avoid open cutting spawning rivers (the West Kura and the Hasansu) between early October and late June Include environmental considerations in the selection of crossing design and choice of methodology.		Include provisions for flow management in the Infrastructure and Services Management Plan, construction method statements and the Reinstatement Plan. At a minimum:
POTENTIAL IMPACT	See A35 above	See A19 above	Disruption of economic uses (eg, fishing); Decreased numbers of fish and invertebrates
ASPECT	A35 Sediment release	A19 Soil erosion (on approaches)	A36 Modified river flow
ACTIVITY	Open cut watercourse crossings Benching of river bank Excavation of river bed Installation of flume pipes Over- pumping		

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# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		L1; C2-5 (depending on species); LOW
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)		Reduced likelihood and magnitude
MITIGATION	Where possible, maintain the integrity and viability the existing river flows during construction work (including the use of measures such as trenchless crossings, pumping) If temporary damming is required, undertake a pre construction engineering and environmental review with the aim of minimising the duration of the flow interruption Minimise the duration of any flow interruptions	If river is dammed, undertake an environmental review to identify key sensitivities for the fish population;
POTENTIAL IMPACT		Impaired breeding or death
ASPECT		A37 Impeded fish migration
ACTIVITY		

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# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

ACTIVITY	ASPECT	POTENTIAL IMPACT	MITIGATION	RESIDUAL IMPACT	LIKELIHOOD (L); (L);
				TO IMPACT BEFORE	CONSECTOENCE (C); SIGNIFICANCE
				MITIGATION)	OF RESIDUAL IMPACT
			Include environmental considerations in the scheduling of the crossing;		
			Include provisions for fish capture and release on far side of dam or for channel diversions;		
			Minimise the duration of any flow interruptions.		
	A6 Visibility	See A6 above			L5; C1; LOW
	A2 Loss of (aquatic) habitat	See A2 above			L5; C1; LOW
Non open cut watercourse	A29 Disposal of trench/pit water	See A29 above			L4; C1; LOW
crossings (auger,					
thrust, micro- tunnel)					
Deep					

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		L3; C2; LOW	L2; C3; LOW	L2; C3; LOW	L2; C2-5 (depending on sensitivity of receiving environment); LOW to MEDIUM
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)					Reduced likelihood and magnitude
MITIGATION					Adequate geotechnical survey work conducted during design; Risk assessment to be undertaken before drilling in vicinity of sensitive surface waters; Storage of dilling muds in bunded area;
POTENTIAL IMPACT		See A27 above	See A30 above	See A16 above	Soil contamination Surface water and/or groundwater contamination
ASPECT		A27 Altered drainage	A30 Public & animal safety	A16 Noise from piling	A41 Potential for drilling fluid breakout/spillage
ACTIVITY	excavations for launch/ reception pits Piling				Horizontal directional drilling

## Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

ACTIVITY	ASPECT	POTENTIAL IMPACT	MITIGATION	RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)	LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT
			Avoid use of toxic chemicals in drilling fluid; Production and adherence to HDD Method Statement & Waste Management Plan.		
	A8 Disposal of drill cuttings	See A8 above			L3; C2; LOW
Testing and C	Commissioning				
Hydrostatic testing Abstraction of water Discharge of	A17 Groundwater abstraction	See A17 above			L2; C3; LOW

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		L2; C2; LOW	L1; C3; LOW	L3; C2-5 (depending on	sensitivity of receiving water);	LOW to MEDIUM			
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)				Reduced					
MITIGATION				In addition:	Risk assessment to be undertaken before any chemical additives are used	in hydrotest water;	Controlled discharge of water to reduce soil erosion;	Testing and treatment of water before discharge to ensure it meets standards agreed with Regulatory Authorities;	Responsible disposal of waste water; no disposal of incompatible water in areas of groundwater or surface water
POTENTIAL IMPACT		See A36 above	See A19 above	See A8 & A9above					
ASPECT		A36 Modified river flow	A19 Soil erosion	A8/9 Disposal of	wastes/water				
ACTIVITY	water								

## Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT			L3; C2; LOW	L3; C1; LOW	L3; C3; MEDIUM		Facilities initially	L5; C4; HIGH After 5 years
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)							Reduced	visibility
MITIGATION	vulnerability; Development of hvdrofest Method	Statement and Waste Management Plan.					Implementation and maintenance of	planting scheme for pump station in accordance with management proposals in Section 14;
POTENTIAL IMPACT			See A16 above	See A14 above	See A16 above		Permanent facilities and marker posts	will remain visible
ASPECT			A16 Noise emissions	A14 Combustion gases (CO <sub>2</sub> , CO, NO <sub>2</sub> , NO, SO <sub>2</sub> PM, CH <sub>4</sub> , VOCs)	A16 Noise emissions		A6 Visibility	
ACTIVITY			Drying and venting	In situ testing of AGIs		Operation	Normal	operation

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

ACTIVITY	ASPECT	POTENTIAL IMPACT	MITIGATION	RESIDUAL	<b>LIKELIHOOD</b>
				(COMPARED	(L); CONSEQUENCE
				BEFORE	(C); SIGNIFICANCE
				<b>MITIGATION</b> )	OF RESIDUAL IMPACT
					L5; C3; MEDIUM
			Maintenance of perimeter wall at pump station to screen low level equipment;		Marker posts
					L5; C1; LOW
			Maintain IPSs and block valves to		
			ensure tidy and well maintained		
			appearance.		
	A10 Disturbance	Loss of habitat	Vehicle movements confined to defined access routes in with the	Reduced trafficking and	L3; C3; MEDIUM
	vegetation	Localised erosion	Transport Management Plan;	erosion away	
			Community liaison to discourage local	from designated	
			use of ROW as road;	access routes	
			Common access routes to be used for		
			BTC pipeline, SCP and WREP where practical;		
			T66		
			i rainc movements to be preceded by an assessment of ground conditions;		

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

_	POTENTIAL IMPACT	MITIGATION	RESIDUAL	<b>LIKELIHOOD</b>
			(COMPARED	(L); CONSEQUENCE
			BEFORE	(C); SIGNIFICANCE
			<b>MITIGATION</b> )	OF RESIDUAL IMPACT
	j	ourneys to be avoided if possible.		
Degradatior	n of local air quality	lonitoring and maintenance of plant to neure emissions standards are met	Reduced	Long term SO <sub>2</sub> and NO <sub>5</sub>
	>			L4; C3; MEDIUM
				Other gases &
				short term SO <sub>2</sub> and
				L4; C2; LOW
See A38 abov	e.	Ingoing environmental review of	Reduced	L5; C1; LOW
	00	esign with objective of minimising missions;	likelihood	
		berational procedures including		
		equirements for maintenance and		
	2	nonitoring of fugitive emissions.		
See A8 and	9 above V	Vaste water treatment facility at pump	Reduced	L5; C1; LOW
	S	tation;	likelihood and magnitude	

## Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT		L4; C2; LOW	L3; C2; LOW	N/a	Traffic L1-5 (varies
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)				N/a	
MITIGATION	Environmental review of permanent waste disposal arrangements.		Monitoring of emissions; Maintenance of plant to ensure compliance with project noise limits.	Risk assessment to be undertaken before any significant changes to oil inventory.	
POTENTIAL IMPACT		See A7 above	See A16 above	Altered risk & consequence profile	See A11 above
ASPECT		A7 Pollution by accidental spillage of hazardous materials (particularly fuel and oil leaks from vehicles)	A16 Noise emissions	A39 Future change to crude oil composition	A11 Vehicle
ACTIVITY					

# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

IVITY	ASPECT	POTENTIAL IMPACT	MITIGATION	RESIDUAL	
				(COMPARED TO IMPACT	CONSEQUENCE
				BEFORE	SIGNIFICANCE
				MITIGATION)	OF RESIDUAL IMPACT
	movements				with locations); C1- 3: LOW/MEDULIM
	A13 Dust	See A13 above			L3; C2; LOW
	A15	Light emissions	Lights will be designed and installed to minimise nuisance in accordance with the Pollution Prevention Management Plan. Measures will include the use of low level bollard lighting and the installation of down-lighters at the pump station	Reduced magnitude	L5; C1; LOW
			The IPSs and block valves will not normally be lit.		
<u> </u>	A40 Oil spill	Habitat and species loss	Implementation of Oil Spill Response	See unplanned	See unplanned
۷		Impaired breeding	Tial I.	evellis	in Section 10.4
		Ground and water Contamination			

## Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

ACTIVITY	ASPECT	POTENTIAL IMPACT	MITIGATION	RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)	LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT
Decommissionin	ig and Abandonment				
Eventual removal of pipeline and facilities	A40 Oil spillage	See A40 above			L1; C5; MEDIUM
	A13 Dust	See A13 above			L3; C3; MEDIUM
	A14 Combustion gases (CO <sub>2</sub> CO, NO <sub>2</sub> , NO, SO <sub>2</sub> PM, CH <sub>4</sub> VOCs)	See A14 above			L4; C2; LOW
	A/8 Production and disposal of solid waste	See A 8 above			L5; C2; MEDIUM
	A10 Disturbance of surface vegetation	See A10 above			L5; C2-4; MEDIUM/HIGH
	A11 Vehicle movements	See A11 above			Traffic L1-5 (varies with locations); C1-

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# Table 10-2 General impacts and mitigation measures (construction and operation)

Note: see Section 7.0, ESIA Methodology, for definitions of 'aspect', 'impact', 'mitigation', 'residual impact' and for the methodology used to assign values and scores to likelihood, consequence and significance

LIKELIHOOD (L); CONSEQUENCE (C); SIGNIFICANCE OF RESIDUAL IMPACT	3; LOW/MEDIUM	L3; C2; LOW
RESIDUAL IMPACT (COMPARED TO IMPACT BEFORE MITIGATION)		
MITIGATION		
POTENTIAL IMPACT		See A16 above
ASPECT		A16 Noise emissions
ACTIVITY		

#### Table 10-3 Impacts and mitigation measures - route specific impacts

Note: Entries progress sequentially from the Sangachal terminal of the pipeline towards the Georgian border. The KP points contained within this table are based on BTC route revision 010.

KP (see Environmental Route Maps, Volume 2)	CONSTRAINT	IMPACTS	MITIGATION/ CONTROL	SIGNIFICANCE OF RESIDUAL IMPACT
0-7.0	Gobustan Desert Region (habitat) - sensitive fauna and flora. Soils easily eroded if not properly reinstated. Parts of the area are within the proposed Gobustan National Park where patches of pristine <i>Artemisia</i> desert with <i>Iris acutiloba</i> are found (although the pipeline route crosses areas somewhat degraded due to human activity including farmsteads, tracks and military use). Mud volcanoes are also found in the area.	Impact of construction on biodiversity and loss of habitat (20mx29km) Soil Erosion Visual Impact due to slow re- colonisation of vegetation cover	Reduce working width and no topsoil strip (except of trenchline) aximise use of existing tracks as access routes for vehicles (to avoid vegetation damage) evelop Reinstatement Plan evelop Transport Management Plan plement Environmental Investment Programme, (see Section 14)	Temporary and partial loss of sensitive habitat for approximately 10- 12 years - Medium Soil Erosion and Visual impact - Low
-	Potential Archaeology Site 1 Sangachal	Construction may have an adverse effect on artefacts in the immediate vicinity ( <b>BB1</b> )	arry out intrusive investigation to identify the existence of any archaeological remains (Section 10.3.11) ( <b>B2</b> ) ultural Heritage Management Plan developed to mitigate impacts during construction ( <b>B3</b> )	Unknown (see Section 7, Methodology)

,	LI I	L	
	OF RESIDUAL IMPACT	Medium based c visual impact	Unknown
	CONTROL	Reinstatement to minimise increased bank erosion. Incorporation of river energy levels into design and burial depth of pipeline Minimise risk of sediment run-off and spills (tool box talks, spill kits, bunded storage, refuelling and oil change areas, use of drip trays etc). Develop Pollution Prevention Management Plan Sensitive reinstatement of banks, including benching, sloping and planting	See B2 and B3 BTC Co is in discussions with the Ministry of Culture over potential cultural investment programmes focused on supporting Reserve management (see Section 14 for additional details) Reduced working width and careful management of construction
	IMPACIS	Fuel and oil leaks and sediment release during construction could affect semi-desert habitat and water quality. The clayey soils and sudden flash floods lead to poor bank stabilities, which may be exacerbated by pipeline construction. There will be a visual impact resulting from an open cut crossing through the steep banks of the river	See B1B1
THE	CONSTRAIN	Djeyrankechmes River – Incised channel with vertical banks, ongoing erosion of which is evident. The Djeyrankechmes is a seasonal river with a channel width of 20 m within the sensitive Gobustan desert habitat	Potential Archaeology Sites 4, 5, 6 Gobustan Cultural Reserve
	кр (see Environmental Route Maps, Volume 2)	ო თ	9.4-10.4

SIGNIFICANCE OF RESIDUAL IMPACT	Low/Medium	Unknown	Unknown	Unknown	Unknown	Medium - erosion	High - visual	Unknown	Unknown
MITIGATION/ CONTROL	Further survey to identify breeding areas prior to construction (Section 10.3.12) Discourage birds from nesting directly on the ROW	See B3	See B3	See B3	See B3	Dual lay of BTC and SCP pipelines to minimise duration of	construction impacts and allow rapid, full reinstatement Special reinstatement method statement for this section Minimise separation distances between BTC and SCP pipelines Reinstate immediately and close this section to traffic	See B3	See B3
IMPACTS	Ground nesting bird which could be disturbed by pipeline construction	See B1B1	See B1B1	See B1B1.	See B1B1	creased erosion and gulleying einstated ridge profile not in keeping	with landscape	See B1B1	See B1B1.
CONSTRAINT	Protected species (fauna) – <i>Burhinus</i> <i>oedicnemu</i> s (European conservation concern) – potential breeding area	Potential Archaeology Site 11 Koch Nohur	Potential Archaeology Site 12 Djingir	Potential Archaeology Site 13 Djingir	Potential Archaeology Site 14 Turagay	Mud Volcano Ridge- narrow, easily eroded ridges		Potential Archaeology Site 15 Kazi- Magomed	Potential Archaeology Site 16 Turagay
KP (see Environmental Route Maps, Volume 2)	13.5-26.5	14.9	16.2	16.9	24	26-28		48.5	48.9

SIGNIFICANCE OF RESIDUAL	IMPACT	None	Unknown	None/ positive impact if cleared	Unknown	Unknown	None/ positive impact if cleared	Unknown	None/ positive impact if cleared	Unknown
MITIGATION/ CONTROL		Further survey to establish extent of the populations conducted in April 2002 (section 10.3.12) As necessary, translocate affected populations and replant after reinstatement (section 10.3.12)	See B3	ean up and dispose of waste to an appropriate facility prior to construction (C3) Undertake risk assessment for mobilisation of contaminants into the surrounding environment (section 12.7)(C4) Develop Waste Management Plan (section 14) (C5)	See B3	See B2 and B3	See C3, C4 and C5	See B3	See C3, C4 and C5	See B3
IMPACTS		Localised loss of individuals	See B1B1.	ealth and safety of workforce (C1) isk of mobilisation of contaminants into the wider environment (C2)	See B1B1.	See B1B1.	See C1 and C2	See B1B1	See C1 and C2	See B1B1
CONSTRAINT		Protected species (flora) near Kazi Magomed- <i>Merendera trigyna, Iris</i> <i>acutiloba and Colchicum speciosum,</i> (which are to be included in the updated Red Data Book (RDB) of Azerbailan).	Potential Archaeology Site 17 Kazi- Magomed	Contamination - Areas of fly tipping and asbestos tiles on surface at Kazi Magomed, approx 1km south of existing Azerigaz compressor station	Potential Archaeology Site 18 Kazi- Magomed	Potential Archaeology Sites 21, 22 Kazi-Magomed	Contamination - Old oil exploration site with degraded oil separation ponds NW of Kazi Magomed	Potential Archaeology Site 26	Contamination - Old well site - degraded oil.	Potential Archaeology Site 35 Kerrar
KP (see	Environmental Route Maps, Volume 2)	50	50.6	51-52	51.5	53.7 and 54	55	71.2	77	87

COL OF RESIDUAL IMPACT	None/ positive	entify breeding Low/Medium	struction om nesting W	struction am nesting W Unknown	struction w nesting w entify breeding Low/Medium truction w nesting	struction W nesting M introver intruction intruction W unknown Unknown	struction m nesting w itruction itruction itruction w n nesting w entify presence in the pipeline gation plan	itruction in nesting <i>N</i> entify breeding itruction in nesting <i>N</i> entify presence action plan entify presence Low I unknown itruction itructi
CONTROL	See C3, C4 and C5	Further survey to identify breareas prior to construction (Section 10.3.12)	Discourage birds from nestin directly on the ROW	Discourage birds from nestin directly on the ROW See B3	Discourage birds from nestin directly on the ROW See B3 Further survey to identify bre areas prior to construction (Section 10.3.12) Discourage birds from nestir directly on the ROW	Discourage birds from nestin directly on the ROW See B3 Further survey to identify bre areas prior to construction (Section 10.3.12) Discourage birds from nestir directly on the ROW See B3	Discourage birds from nestin directly on the ROW See B3 Further survey to identify bre areas prior to construction (Section 10.3.12) Discourage birds from nestin directly on the ROW directly on the ROW See B3 See B3 See B3 Further survey to identify pre (see Section 14) If den site present on the pit route, develop mitigation pl (see Section 14)	Discourage birds from nestin     directly on the ROW     See B3     Further survey to identify breareas prior to construction     (Section 10.3.12)     Discourage birds from nestin     directly on the ROW     See B3     Discourage birds from nestin     directly on the ROW     See B3     See B3     Further survey to identify pre     (see Section 14)     If den site present on the pip     route, develop mitigation pl     (see Section 14)     If burrow site present on the     pipeline route, develop mitigation pl     (see Section 14)     If burrow site present on the
	See C1 and C2	Ground nesting bird which could be disturbed by pipeline construction		See B1B1	See B1B1 Ground nesting bird which could be disturbed by pipeline construction	See B1B1 Ground nesting bird which could be disturbed by pipeline construction See B1	See B1B1 Ground nesting bird which could be disturbed by pipeline construction See B1 Potential loss of individuals and disruption to breeding success of species of national conservation concern	See B1B1 Ground nesting bird which could be disturbed by pipeline construction See B1 Potential loss of individuals and disruption to breeding success of species of national conservation concern Potential loss of individuals and disruption to breeding success of species of national conservation concern
	amination - Former oil exploration See C vith iron rich water in ponds.	cted/ rare species (fauna) – Ground usia leucura(RDB) – potential disturb ling area		ntial Archaeology Site 42 Shilyan See B	tial Archaeology Site 42 Shilyan See B' cted/ rare species (fauna) – Ground usia gregaria/ Plegadis ellus (RDB)– potential breeding	tial Archaeology Site 42 Shilyan See B cted/ rare species (fauna) – Ground usia gregaria/ Plegadis ellus (RDB)– potential breeding tial Archaeology Site 47 Ali- See B	tital Archaeology Site 42 Shilyan See B cted/ rare species (fauna) – Ground <i>usia gregarial Plegadis</i> <i>ellus</i> (RDB)– potential breeding <i>ellus</i> (RDB)– potential breeding tital Archaeology Site 47 Ali– See B muli cted/ rare species (fauna) – Potenti pine species ( <i>Hystrix indica</i> ) disrupt pine species ( <i>Hystrix indica</i> ) – tital breeding den on bank of concer chay	tital Archaeology Site 42 Shilyan See B cted/ rare species (fauna) – Ground <i>usia gregarial Plegadis</i> <i>ellus</i> (RDB)– potential breeding <i>ellus</i> (RDB)– potential breeding <i>ellus</i> (RDB)– potential breeding tital Archaeology Site 47 Ali– See B tital Archaeology Site 47 Ali– See B umli Ceted/ rare species (fauna) – Potenti pine species ( <i>Hystrix indica</i> ) – Concer tital breeding den on bank of chay – canalised river with Potenti ble presence of water voles specie: <i>ola terrestris</i> ) which are RDB – concer sei in Azerbailan.
see onmental e Maps, ume 2)	92 Contamini site with ir	I2-117 Protectedν Chettusia breeding ε		129.8 Potential /	129.8 Potential / 40-148 Protected/ Chettusia falcinellus area	129.8 Potential /   40-148 Protected/   40-148 Protected/   afalcinellus falcinellus   159 Potential /   Bayramli	129.8 Potential /   40-148 Protected/   40-148 Protected/   159 Potential /   159 Potential /   171 Protected/	129.8 Potential /   40-148 Protected/   40-148 Protected/   159 Potential /   159 Potential /   171 Protected/   171 Protected/   133.5 Turiancha   193.5 dense bar   possible p possible p   (Arvicola t species in

SIGNIFICANCE OF RESIDUAL IMPACT	Unknown	Unknown	Unknown	None/Positive if cleaned up	w W
MITIGATION/ CONTROL	See B3 Maximise distance between pipeline spread and cemetery Liaison with local villagers	See B2 and B3	See B2 and B3	See C3, C4 and C5	Identify groundwater abstraction points in close proximity to pipeline Minimise risk of spills (tool box talks, spill kits, bunded storage, refuelling and oil change areas, use of drip trays etc) Develop Pollution Prevention Management Plan (see Section 15) Develop Oil Spill Response Plan (see Section 14) Pipeline Design and Maintenance to reduce likelihood of oil spill, including burrial, increased wall thickness and burrial depth in certain locations, monitoring and surveillance (see Section 10.4)
IMPACTS	See B1	See B1	See B1.	See C1 and C2	Groundwater resource is at risk from pollution from fuel and oil leaks during pipeline construction. Potential impacts and mitigation from oil spill during operation of the BTC pipeline are discussed in Section 10.4
CONSTRAINT	Potential Archaeology Site 52 Laki Cemetery	Potential Archaeology Site – 53 Yevlakh	Potential Archaeology Site 54 Yevlakh	Contamination - Oil (thought to be from a vehicle sump) 4m from east bank of Kura in waterlogged ground.	Groundwater in Yevlakh-Ganja area. This is a region with high hydraulic conductivity, with less than 1m to groundwater in the Kura floodplain. The groundwater is abstracted for potable and agricultural use.
KP (see Environmental Route Maps, Volume 2)	220.6	220.9	221.7	223	Centred on 223.5

					1	
SIGNIFICANCE OF RESIDUAL IMPACT		Low if open cut between late June and early October	None/ positive impact if cleared	None/positive impact if cleared	Unknown	Unknown
MITIGATION/ CONTROL	Develop Waste Management Plan	Non-open cut Minimise risk of spills (tool box talks, spill kits, bunded storage, refuelling and oil change areas, use of drip trays etc) Develop Pollution Prevention Plan Develop Oil Spill Response Plan (see Section 14) Pipeline Design and Maintenance to reduce likelihood of oil spill, including burial, increased wall thickness and burial depth in certain locations, monitoring and surveillance (see Section 10.4) Monitor quarrying activity/initiate discussions with owner/operators	See C3, C4 an C5	See C3, C4 and C5	See B2 and B3	See B2 and B3
IMPACTS		Potential impact on ecology (including fish spawning and downstream receptors) from fuel and oil leaks and sediment release during pipeline construction Impact on water quality affecting water abstraction Disturbance of bank-side habitats and birds may result in short-term effects such as temporary migration occurring during construction. Increased bank erosion and threat to integrity of pipeline. Potential impacts and mitigation from oil spill during operation of the BTC pipeline are discussed in Section 10.4	See C1 and C2	See C1 and C2	See B1	See B1
CONSTRAINT		Kura River (east crossing) - The Kura River is a 100m wide meandering river and is the most important river system in Azerbaijan. Sand extraction is taking place immediately downstream from the proposed route. Tugay Forest of the Barda State Forbidden Area is downstream from the river crossing. The natural habitat of this area (Kura River and related streams) provides favourable conditions for wetland birds and mammals and the river supports several species of RDB fish.	Contamination - Municipal waste	Contamination - Hydrocarbons entering drainage system upstream of WREP ROW, thought to emanate from tank farm SW of Yevlakh (unlikely to affect BTC ROW)	Archaeology Site 56 Neymatabad	Archaeology Site 57 Mingechevir
KP (see Environmental Route Maps, Volume 2)		223.5	226.8	231	235.0	247.6

SIGNIFICANCE OF RESIDUAL IMPACT	None/positive impact if cleared	Unknown	None/positive impact if cleared	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Low/Medium	Low – water quality
MITIGATION/ CONTROL	See C3, C4 and C5	See B3	See C3, C4 and C5	See B2 and B3	See B2 and B3	See B3	See B3	See B3	See B3	See B3	See B3	See B3	Further survey to identify breeding areas prior to construction (Section 10.3.12) Discourage birds from nesting directly on the ROW Possible translocation of nests and individuals if appropriate	Develop Pollution Prevention Plan Open cut using pressure relief
IMPACTS	See C1 and C2	See B1	See C1 and C2		See B1	See B1	See B1	See B1	See B1	See B1	See B1	See B1	Ground nesting birds which could be disrupted by pipeline construction Eucland oil leaks and sediment	Fuel and oil leaks and sediment release during pipeline construction
CONSTRAINT	Contamination - Fly tipping of suspected asbestos tiles, household waste, paint cans and oil. North of Kasum Ismailov.	Potential Archaeology Site 58 Goran	Contamination - Disused oil well. Actively leaking oil and water. Borsunlu	Archaeology Site 59 Nadirkand	Potential Archaeology Site 60 Dalimamedli	Potential Archaeology Site 62 Sarab	Potential Archaeology Site 65 Guneshli	Potential Archaeology Site 67 Fahraly	Potential Archaeology Site 68	Potential Archaeology Site 70	Potential Archaeology Site 71	Potential Archaeology Site 72 Korchay	Protected/ rare species (fauna) – <i>Francolinus francolinus, Alectoris</i> <i>chukar, Tetrax tetrax</i> (RDB)– potential breeding area observed in Korchay River area	Korchay- Braided river with narrow flowing channels within extensive
KP (see Environmental Route Maps, Volume 2)	253	257.9	271	276	280	285	287	289	289.9	290.8	291.3	291.7	291-292 201-292	7.67.

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SIGNIFICANCE OF RESIDUAL IMPACT	Low - faunal	Unknown	Unknown	Unknown	Unknown	Unknown
MITIGATION/ CONTROL	techniques as appropriate with strict sediment and spill prevention measures. Construct during low flow, as per AGA guide Develop Oil Spill Response Plan (see Section 14) Pipeline Design and Maintenance to reduce likelihood of oil spill, including burial, increased wall thickness and burial depth in certain locations, monitoring and surveillance (see Section 10.4) Develop Waste Management Plan	See B3	See B3	See B3	See B3	See B3
IMPACTS	will affect water quality. However downstream damming will aid protection of Korchay Forbidden Area from spills. Disturbance of Fauna within reed bed/wetland area. Potential impacts and mitigation from oil spill during operation of the BTC pipeline are discussed in Section 10.4	See B1	See B1	See B1	See B1	See B1
CONSTRAINT	areas of marshy reeds. The Korchay State Forbidden Area is 25km downstream. Dammed downstream and upstream	Potential Archaeology Site 73 Agasybeyli	Potential Archaeology Site 74	Potential Archaeology Site 76 Ali- Bayramli	Potential Archaeology Site 77	Potential Archaeology Site 78 Ganjachay
KP (see Environmental Route Maps, Volume 2)		292.2	293.5	295.0	295.7	295.9

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SIGNIFICANCE OF RESIDUAL IMPACT	Low
MITIGATION/ CONTROL	Minimise risk of sediment run-off and spills (tool box talks, spill kits, bunded storage, refuelling and oil change areas, use of drip trays etc) Develop Pollution Prevention Plan Non-open cut OR develop reinstatement plan to minimise bank and channel erosion. Incorporate river energy levels into design and burial depth of pipeline. Include adequate set back distances in design. Develop Oil Spill Response Plan (see Section 14) Pipeline Design and Maintenance to reduce likelihood of oil spill, including burial, increased wall thickness and burial depth in certain locations, monitoring and surveillance (see Section 10.4) Develop Waste Management Plan
IMPACTS	Fuel and oil leaks and sediment release during pipeline construction will affect water quality. However downstream damming will aid protection of downstream receptors from spills (except for possible overtopping during periods of flood). Poor bank stability may be exacerbated by pipeline construction and could affect pipeline integrity Disturbance of nesting fauna in cliffs Potential impacts and mitigation from oil spill during operation of the BTC pipeline are discussed in Section 10.4
CONSTRAINT	Ganjachay - Wide valley with eroded banks and shallow channel in centre. Alluvial silty clays lead to poor bank stability, with visible erosion along the banks during seasonal flow. The crossing site is upstream of the Korchay State Forbidden Area and Mingechaur Reservoir. Dammed downstream from pipeline crossing. Burrows in cliffs.
KP (see Environmental Route Maps, Volume 2)	295.9

SIGNIFICANCE OF RESIDUAL IMPACT	Low	Unknown	nknown	Unknown	Unknown	Unknown	Unknown	None/ positive if cleared
MITIGATION/ CONTROL	Identify groundwater abstraction points in close proximity to pipeline Minimise risk of spills (tool box talks, spill kits, bunded storage, refuelling and oil change areas, use of drip trays etc) Develop Pollution Prevention Plan (see Section 15) Develop Oil Spill Response Plan (see Section 14) Pipeline Design and Maintenance to reduce likelihood of oil spill, including burial, increased wall thickness and burial depth in certain locations, monitoring and surveillance (see Section 10.4) Develop Waste Management Plan	See B3	See B3	See B3	See B3	See B3	See B3	See C3, C4 and C5
IMPACTS	Groundwater resource is at risk from pollution from fuel and oil leaks during pipeline construction. Potential impacts and mitigation from oil spill during operation of the BTC pipeline are discussed in Section 10.4	See B1	See B1	See B1	See B1	See B1	See B1	See C1 and C2
CONSTRAINT	Groundwater in Ganja-Kazakh area. Continuous groundwater at a depth of 1-1.5m. Heavily abstracted for potable and agricultural use. and agricultural use.	Potential Archaeology Site 81 Hodjaly	Potential Archaeology Site 82 Hodjaly	Potential Archaeology Site 83 Yenikend	Potential Archaeology Site 84 Yenikend	Potential Archaeology Site 85 Hodjaly	Potential Archaeology Site 86 Hodjaly	Contamination - Fly tipping including possible asbestos tiles. 1.5km west of Hajalili village, adjacent to dry channel
 KP (see Environmental Route Maps, Volume 2)	Entire route from Ganja to Kazak Centred on 295.9	300.9	301.3	301.5	302.3	302.6	303.5	304

KP (see Environmental Route Maps, Volume 2)	CONSTRAINT	IMPACTS	MITIGATION/ CONTROL	SIGNIFICANCE OF RESIDUAL IMPACT
306.4	Potential Archaeology Site 88 Samukh	See B1	See B3	Unknown
308	Contamination - Possible smelting site, building rubble, fly tipping. North of Fizuli	See C1 and C2	See C3, C4 and C5	None/ positive if cleared
315	Protected/ rare species (fauna) – <i>Hystrix indica</i> and <i>Chettusia leucura</i> (National conservation concern) – potentially present or breeding	Medium sized mammal which lives in burrows and ground nesting bird which could be disrupted by pipeline construction	Further survey to identify breeding areas and burrows prior to construction (Section 10.3.12) Discourage birds from nesting directly on the ROW Possible translocation of nests and individuals if appropriate	Low/Medium
320	Potential Archaeology Site 96 Qarasu	See B1	See B2 and B3	Unknown

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SIGNIFICANCE OF RESIDUAL IMPACT	Low L	Low/None
MITIGATION/ CONTROL	Minimise risk of sediment run-off and spills (tool box talks, spill kits, bunded storage, refuelling and oil change areas, use of drip trays etc) Develop Pollution Prevention Plan Clearance of reeds within working width prior to construction to deter birds from næsting (to be undertaken outside bird nesting season) (see Section 14) Develop Oil Spill Response Plan (see Section 14) Pipeline Design and Maintenance to reduce likelihood of oil spill, including burial, increased wall thickness and burial depth in certain locations, monitoring and surveillance (see Section 10.4) Develop Waste Management Plan	Further survey to identify breeding areas and burrows prior to construction (Section 10.3.12) Discourage birds from nesting directly on the ROW Possible translocation of nests and individuals if appropriate
IMPACTS	Water quality may be threatened by fuel and oil leaks and sediment release during pipeline construction, although this would be slowed by the presence of reed beds. Disturbance to nesting birds Potential impacts and mitigation from oil spill during operation of the BTC pipeline are discussed in Section 10.4	Medium sized mammal which lives in burrows and ground nesting bird which could be disrupted by pipeline construction
CONSTRAINT	Karasu River - wide channel mainly vegetated with reeds. Valuable bird habitiat. Upstream of the Mingechaur Reservoir (potable water and irrigation source) and the Samukh Hunting Area which includes riverine forest and wetlands.	Protected/ rare species (fauna) – <i>Hystrix indica</i> and <i>Plegadis falcinellus</i> (National conservation concern)– potentially present or breeding
KP (see Environmental Route Maps, Volume 2)	320.9	320.9-321

I SIGNIFICANCE OF RESIDUAL IMPACT	Unknown
MITIGATION CONTROL	See B3
IMPACTS	See B1
CONSTRAINT	Potential Archaeology Site 97 Shamkir Memorial
KP (see Environmental Route Maps, Volume 2)	328.2

SIGNIFICANCE OF RESIDUAL IMPACT	Low
MITIGATION/ CONTROL	Construct during low flow periods Minimise risk of sediment run-off and spills (tool box talks, spill kits, bunded storage, refuelling and oil change areas, use of drip trays etc). Develop Pollution Prevention Plan Reinstatement to avoid increased bank erosion. Incorporate river energy levels into design and burial depth of pipeline. Include adequate set back distances in design. Discussion with gravel extraction company for to increase awareness Consultation with local licensing authority Increase burial depth to 4m cover Develop Oil Spill Response Plan (see Section 14) Pipeline Design and burial depth in certain locations, monitoring and surveillance (see Section 10.4) Develop Waste Management Plan
IMPACTS	During periods of flooding, sensitive downstream receptors may be affected by any fuel and oil spills or sediment release during construction High energy river environment during periods of flood, poor bank stability and quarrying activity all have potential to affect integrity of pipeline. Potential impacts and mitigation from oil spill during operation of the BTC pipeline are discussed in Section 10.4
CONSTRAINT	Shamkirchay River - The 170 m wide braided Shamkirchay River has poor bank stability with high levels of bank erosion, although bank stability in the vicinity of the pipeline crossing appears relatively good. The riverbed is used for gravel extraction approximately 200m downstream. Usually dry, the river is liable to flash flooding, particularly during spring. The crossing site is upstream of the Shamkir State Forbidden Area with riverine forest, and the Shamkir Reservoir
KP (see Environmental Route Maps, Volume 2)	332

SIGNIFICANCE OF RESIDUAL IMPACT	Unknown	None/ positive if cleared	None/ positive if cleared	Medium-Low	Unknown		
MITIGATION/ CONTROL	See B3	See C3, C4 and C5	See C3, C4 and C5	Undertake Phase II fieldwork to further define habitat locations Develop Spur-thighed tortoise translocation plan and implement before construction in conjunction with Institute of Zoology (see Section 14) Employ zoological watching brief during construction in these areas Implement Environmental Investment Programme, see Section 14	See B3		
IMPACTS	See B1	See C1 and C2	See C1 and C2	Loss of individuals of an Internationally Vulnerable species Disturbance of breeding pattern during year of construction	See B1		
CONSTRAINT	Potential Archaeology Site 101 Shamkir Memorial	Contamination - Fly tipping – possible asbestos tiles. Dellerçirdaxan village.	Contamination - Fly tipping – possible asbestos tiles. Dallyar Djeir village	Spur-thighed Tortoise - <i>Testudo graeca</i> (National conservation concern) – likely to be present throughout route, particularly Gobustan desert area and Shamkir Area to the Georgian Border Shamkir Area to the Georgian Border	Potential Archaeology Site 103 Shamkir		
KP (see Environmental Route Maps, Volume 2)	335.5	338	343	0-29.8 & 347-441	347.8		
SIGNIFICANCE OF RESIDUAL IMPACT	Unknown	Unknown	Unknown	Unknown	None/positive if cleared	Unknown	Unknown
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MITIGATION/ CONTROL	See B3	See B3	See B3	See B3	See C3, C4 and C5	See B3	Pipeline has been routed to avoid known areas of extensive settlement See B2 and B3
IMPACTS	See B1	See B1	See B1	See B1	See C1 and C2	See B1	See B1
CONSTRAINT	Potential Archaeology Site 104 Shamkir	Potential Archaeology Site 105 Shamkir	Potential Archaeology Site 106 Shamkir	Potential Archaeology Site 108 Shamkir	Contamination - Fly-tipping, possible asbestos tiles	Potential Archaeology Site 110 Zayem	Archaeology Sites 111, 112, 113, 114
KP (see Environmental Route Maps, Volume 2)	348.5	348.8	350.5	350.8	354	354.5	355-357

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SIGNIFICANCE OF RESIDUAL IMPACT	Low	Unknown	Unknown	Unknown	Unknown
MITIGATION/ CONTROL	Construct during low flow periods Minimise risk of sediment run-off and spills (tool box talks, spill kits, bunded storage, refuelling and oil change areas, use of drip trays etc). Develop Pollution Prevention Plan Reinstatement to avoid increased bank erosion. Incorporate river energy levels into design and burial depth of pipeline. Include adequate set back distances in design. Develop Oil Spill Response Plan (see Section 14) Pipeline Design and Maintenance to reduce likelihood of oil spill, including burial, increased wall thickness and burial depth in certain locations, monitoring and surveillance (see Section 10.4) Develop Waste Management Plan	See B3	See B3	See B3	See B3
IMPACTS	During periods of flooding, sensitive downstream receptors may be affected by any fuel and oil spills or sediment release during construction High energy river environment during periods of flood may all affect integrity of pipeline. Potential impacts and mitigation from oil spill during operation of the BTC pipeline are discussed in Section 14	See B1	See B1	See B1	See B1
CONSTRAINT	Zayamchay-Braided channels within main wide flat-bedded channel. High energy river environment during periods of flood. The crossing site is upstream of the Shamkir Reservoir and Shamkir State Forbidden Area that contains riverine forest.	Potential Archaeology Site 116	Potential Archaeology Site 117 Diyarly	Potential Archaeology Site 119 Asagi Ayibli	Potential Archaeology Site 121 Asagi Ayibli
KP (see Environmental Route Maps, Volume 2)	356.6 2	357.1	358.2	358.3	360.0

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SIGNIFICANCE OF RESIDUAL IMPACT	Unknown	Unknown	Unknown	None/positive if cleared	Low	Medium - erosion Medium - visual	
MITIGATION/ CONTROL	See B3	See B3	See B3	See C3, C4 and C5	Further survey to confirm presence and breeding status (see Section 14) If present on the pipeline route, develop mitigation plan (see Section 14)	Dual lay of BTC pipeline and SCP being considered Reinstatement Plan to be developed to address erosion issues (section 14)	Sympathetic recontouring of ridge profile Reduced separation distance between BTC and SCP pipelines in this section as required
IMPACTS	See B1	See B1	See B1	See C1 and C2	Medium sized mammal which lives in burrows and could be disturbed by pipeline construction	creased erosion and gulleying sual- ridge profile not in keeping with landscape	
CONSTRAINT	Potential Archaeology Site 122 Asagi Ayibli	Potential Archaeology Site 123 Asagi Ayibli	Potential Archaeology Site 124 Asagi Ayibli	Contamination - Fly tipping – possible asbestos tiles, rubble and car. Duz Kirikli village	Protected/ rare species (fauna) – <i>Hystrix indica</i> (National conservation concern) – potentially present	Approaches to Azrinchay - narrow ridges	
KP (see Environmental Route Maps, Volume 2)	361.8	362.3	362.7	364	376-378 either side of Tovuschay	375.6-377	

SIGNIFICANCE OF RESIDUAL IMPACT	Low – downstream receptors None - erosion	None/positive if cleared	Unknown	None/positive if cleared
MITIGATION/ CONTROL	Construct during low flow periods Minimise risk of sediment run-off and spills (tool box talks, spill kits, bunded storage, refuelling and oil change areas, use of drip trays etc) Monitor quarrying activity (allow for in depth of burial of pipe) Develop Pollution Prevention Plan (see Section 15) Develop Oll Spill Response Plan (see Section 14) Pipeline Design and Maintenance to reduce likelihood of oil spill, including burial, increased wall thickness and burial depth in certain locations, monitoring and surveillance (see Section 10.4) Develop Waste Management Plan	See C3, C4 and C5	See B3	See C3, C4 and C5
IMPACTS	During periods of medium to high water flow, sensitive downstream receptors may be affected by any fuel and oil spills or sediment release during construction Quarrying upstream may affect sediment dynamics and hence increase bed erosion/deposition regime Potential impacts and mitigation from oil spill during operation of the BTC pipeline are discussed in Section 10.4	See C1 and C2	See B1	See C1 and C2
CONSTRAINT	Tovuschay– wide cobble river bed with narrow flowing channel. The crossing site is upstream of the Shamkir Reservoir and Shamkir State Forbidden Area which contains riverine forest. Quarrying upstream from crossing.	Contamination - Fly tipping – possible asbestos tiles. Alimardanli	Potential Archaeology Site 133	Contamination - Demolished building with possible asbestos tiles. North of Kirili, to the east of the Hasansu River
KP (see Environmental Route Maps, Volume 2)	277	377	390.5	395

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landscape
Loss of individua
disruption to bree

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SIGNIFICANCE OF RESIDUAL IMPACT	Medium	Unknown	Unknown	Unknown	Unknown
MITIGATION/ CONTROL	Avoid fish spawning season (October to June) Minimise risk of sediment run-off and spills (tool box talks, spill kits, bunded storage, refuelling and oil change areas, use of drip trays etc) Develop Pollution Prevention Plan Reinstatement Plan to be developed to address avoidance of increased bank erosion and sediment run off from steep valley sides Develop Oil Spill Response Plan (see Section 14) Pipeline Design and Maintenance to reduce likelihood of oil spill, including burrial, increased wall thickness and burrial depth in certain locations, monitoring and surveillance (see Section 10.4) Develop Waste Management Plan	See B3	See B3	See B2 and B3	See B3
IMPACTS	Potential impact on ecology (including fish spawning and downstream receptors) from fuel and oil leaks and sediment release during pipeline construction Impact on water quality affecting water abstraction. Disturbance of bank-side habitats may result in short-term effects such as temporary migration occurring during construction. Potential impacts and mitigation from oil spill during operation of the BTC pipeline are discussed in Section 10.4	See B1	See B1	See B1	See B1
CONSTRAINT	Hasansu River – fast flowing, clear stream in steep sided valley. Ecologically diverse and valuable habitat. Important for local fishing. Small holding 100m downstream from crossing abstracting water.	Potential Archaeology Site 134 Girag Kasamanly	Potential Archaeology Site 135 Girag Kasamanly	Archaeology Site 138 Girag Salakhli	Potential Archaeology Site 139 Girag Kasamanly
KP (see Environmental Route Maps, Volume 2)	397.8	399.2	400.5	405.5	407.8

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	SIGNIFICANCE OF RESIDUAL IMPACT	Medium	
	MITIGATION/ CONTROL	Open-cut with seasonal constraint since it is not possible to HDD due to geological conditions Avoid fish spawning season (October-June) Minimise risk of sediment run-off and spills (tool box talks, spill kits, bunded storage, refuelling and oil change areas, use of drip trays etc) Develop Pollution Prevention Plan Reinstatement Plan to be developed to address avoidance of increased bank erosion and sediment run off from steep valley sides (if open cut) Incorporate river energy levels into design and burial depth of pipeline. Include adequate set back distances in design. Further survey to confirm presence and breeding status of protected species with development of mitigation plan if necessary Develop Oil Spill Response Plan (see Section 10.4) Pipeline Design and burial depth in thickness and burial depth in	certain locations, monitoring and surveillance (see Section 10.4) Develop Waste Management Plan
PLC FIFELINE ESIA AZERBAIJAN FINAL ESIA	IMPACTS	Potential impact on ecology (including fish spawning and downstream receptors) from fuel and oil leaks and sediment release during pipeline construction which would be carried rapidly downstream Impact on water quality during construction affecting water abstraction, both in the immediate vicinity and Shamkir Reservoir downstream Disturbance of bank-side habitats and birds (including protected species) may result in short-term effects such as temporary migration occurring during construction. Increased bank erosion and threat to integrity of pipeline. Potential impacts and mitigation from oil spill during operation of the BTC pipeline are discussed in Section 10.4	ENVIRONMENTAL IMPACTS AND MITIGATION DECEMBER 2002 10-151
	CONSTRAINT	Kura River (west crossing) – Braided sub-channels within main flat-bedded river channel, with wetland habitat in some areas along the flood plain. The natural habitat of this area (Kura River and related streams) provides favourable conditions for water-swamp birds and mammals. Seasonally high flow rates Protected/ rare species (fauna) – <i>Chettusia leucura, Alcedo atthis,</i> <i>Porphyrio porphyrio</i> potentially breeding. Shamkir Reservoir is downstream a main water resource for Azerbaijan. Protected fish species present.	
	KP (see Environmental Route Maps, Volume 2)	411.412	

SIGNIFICANCE OF RESIDUAL IMPACT	Low
MITIGATION/ CONTROL	Ongoing program of research to fully understand aquifer properties along the pipeline route ldentify groundwater abstraction points in close proximity to pipeline Minimise risk of spills (tool box talks, spill kits, bunded storage, refuelling and oil change areas, use of drip trays etc) Develop Pollution Prevention Plan (see Section 15) Installation of targeted groundwater monitoring wells between the pipeline corridor and identified key abstraction wells Develop Oil Spill Response Plan (see Section 14) Pipeline Design and Maintenance to reduce likelihood of oil spill, including burrial, increased wall thickness and burrial depth in certain locations, monitoring and surveillance (see Section 10.4) Develop Waste Management Plan
IMPACTS	Groundwater resource and Karayazi Wetland is at risk from pollution from fuel and oil leaks during pipeline construction. Potential impacts and mitigation from oil spill during operation of the BTC pipeline are discussed in Section 10.4
CONSTRAINT	Karayazi Aquifer This is a region with high hydraulic conductivity, with less than 1m to groundwater in the Kura floodplain. Heavily abstracted for potable and agricultural use. Karayazi Wetland is down-hydraulic gradient.
KP (see Environmental Route Maps, Volume 2)	411.5-442

SIGNIFICANCE OF RESIDUAL IMPACT	None/positive if cleared	Low - water quality Low - habitat	Unknown	Unknown
MITIGATION/ CONTROL	See C3, C4 and C5	Minimise risk of sediment run-off and spills (tool box talks, spill kits, bunded storage, refuelling and oil change areas, use of drip trays etc) Develop Pollution Prevention Plan (see Section 14) Develop Oil Spill Response Plan (see Section 14) Develop Oil Spill Response Plan (see Section 14) Pipeline Design and Maintenance to reduce likelihood of oil spill, including burial, increased wall thickness and burial depth in certain locations, monitoring and surveillance (see Section 10.4) Develop Waste Management Plan	See and B3	See B3
IMPACTS	See C1 and C2 – potential to mobilise into nearby river.	Impact on water quality during construction affecting water abstraction, both in the immediate vicinity and downstream receptors Disturbance of bank-side habitats and birds may result in short-term effects such as temporary migration occurring during construction. Potential impacts and mitigation from oil spill during operation of the BTC pipeline are discussed in Section 10.4	See B1	See B1
CONSTRAINT	Contamination - Barbed wire, metal, glass (chemical?) bottles, possible asbestos. On east bank of Kurudera River.	Kurudera River – Narrow flowing channel, sand cliffs immediately downstream provide potential nesting habitat for birds. Karayazi-Akstafa State Forbidden Area (Tugay Forest) with riverine forest and wetland is downstream	Potential Archaeology Site 150	Potential Archaeology Site 156 Beyouk Kesik
KP (see Environmental Route Maps, Volume 2)	422	422.3	422.4	437.9

## SOCIAL IMPACTS AND MITIGATION

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# 11 SOCIAL IMPACTS AND MITIGATION

## 11.1 INTRODUCTION

This Chapter sets out the potential socio-economic impacts of the BTC project and describes the management and mitigation measures to address these impacts. It specifically addresses the impacts of the project on pipeline affected communities<sup>1</sup> at each stage of the project<sup>2</sup>. It also briefly describes any residual impacts on these communities after implementation of the measures. Section 12 considers residual impacts in further detail.

#### 11.1.1 Project specific issues and impacts

Five categories of issues related to project activities have been identified as a result of the field survey work and wider consultation. These are as follows:

- Local employment and procurement opportunities (Section 11.3)
- Land acquisition and land-based livelihoods (Section 11.4)
- Local infrastructure, services and natural resources (Section 11.5)
- Community relations, management of construction workers and camps (Section 11.6)
- Safety and nuisance (Section 11.7)

#### 11.1.2 Non project issues

An additional indirect issue, (i.e. an issue not a result of the project itself, but nonetheless a concern related to the project), access to energy, was identified and is discussed separately in Section 11.2 below.

#### 11.1.3 Assessing Impacts

The evaluation of socio-economic impacts is not an exact science and always requires a considerable degree of subjective professional judgement, based on in-country and previous project experience. This is primarily because data on potential socio-economic impacts consists not only of fact but also of individual and community perceptions and attitudes often meaning that the impact will vary according to the individuals or communities involved. The data that have been collected provide evidence and support for this evaluation, but do not allow impacts to be fully quantified or their importance to be assessed or ranked numerically. A general categorisation of the significance of the residual impact is however provided and is based on professional judgement of the likelihood and consequence of the impact. (See Section 7, ESIA Methodology, for an explanation of this categorisation).

<sup>&</sup>lt;sup>1</sup>Pipeline affected communities are defined as those that are located within (or partly encroach into) a 2km corridor either side of the route, are within 5 km of a potential construction camp or pipe yard, or are within 100m of an access road. A summary of the known pipeline affected communities can be found in the Baseline Appendix.

<sup>&</sup>lt;sup>2</sup> There are a number of other social and socio-economic issues that are regional in nature as opposed to route specific. These are being examined within the scope of another study entitled 'Economic and Social Implications of ACG/BTC (and Shah Deniz) in the Regional and National Context'. This regional study addresses broader issues of interest, including revenue management, access to energy, economic linkages, conflict and human rights. One issue covered in this review that may be of particular interest to readers of the ESIA is the project's approach to pipeline security. The BTC security arrangements are described in Chapter 5, Project Description.

#### 11.2 ACCESS TO ENERGY

Access to energy was identified as a major concern among those living along the route during consultation. This is due to the limited availability of energy in communities on the pipeline route, caused by a lack of infrastructure, intermittent supply and poverty (see Section 9, Socio-Economic Baseline for more information). During the winter months particularly, the lack of gas or electricity to heat and light homes has a severe negative impact on the health, well-being and the standard of living of communities.

The initial perception of many people living within project-affected communities was that development of the BTC pipeline and SCP would directly provide them with energy. The nature of this issue however differs from others discussed in this Section since the project as designed will have little direct impact on existing access, and the provision of national energy supply and infrastructure remains the responsibility of the national Government. Given the limited impact of the project in this domain, the broader indirect issue of improving access to energy for pipeline-affected communities has not therefore been dealt with in detail in this ESIA. These issues are however reviewed in the macro-level report 'Economic and Social Implications of ACG/BTC (and Shah Deniz) in the Regional and National Context'. As development of the BTC and SCP projects will indirectly increase the ability of the Government to address energy supply issues access to energy has also been addressed in more detail in Section 12, Residual Impacts. During the consultation process care has been taken to ensure that people have been increasingly informed of this situation.

#### 11.3 LOCAL EMPLOYMENT AND PROCUREMENT OPPORTUNITIES

Community level consultation showed that unemployment, and the poverty that accompanies it, is the primary concern amongst communities along the proposed pipeline route.

Local employment and procurement opportunities will be available to both project affected communities, and to workers and companies at the national level. Mitigation measures seek to address each of these two groups, but provide opportunities to candidates from pipeline affected communities in preference to other Azerbaijani nationals where practical.

# 11.3.1 Aspects of Project giving rise to Employment and Procurement Impacts

#### 11.3.1.1 Local labour requirements during construction

The detailed labour requirements for the project will not be known until the appointment of the construction contractor. This section therefore includes a preliminary assessment of the number of workers that will be required which should be regarded as indicative only, and will change prior to commencement of the project.

It is currently estimated that approximately 2300 people will be employed during peak construction periods (approximately 12 months) for construction of the pipeline and AGIs and in management of the construction camps and pipe yards. This includes a combination of skilled, semi-skilled and unskilled workers. Skilled workers will include experienced professional staff in categories such as welding and machinery operation. Semi-skilled workers will include experienced drivers, mechanics, night watchmen and chefs. Unskilled work may include sand bag filling, acting as a banksman for machine operators, hustling skids etc and

workers may be employed with no prior construction experience, though preference will be given to applicants with experience. Approximately 1600 of these jobs will be in pipeline construction.

Skilled and semi-skilled workers will normally be expected to move with the construction activities along the length of the pipeline to avoid safety issues associated with constant rehiring. Unskilled workers will probably be hired for shorter periods as construction passes through their area.

- At peak, the number of pipeline jobs created by this project will be approximately 1600. It is currently estimated that Azerbaijani nationals should be able to fill 50 to 80% of these jobs. This will be dependent upon whether a suitable number of Azerbaijani nationals are found to possess the necessary skills for certain jobs
- Approximately 400 workers will be required for the construction of AGIs. These are likely to be 50% skilled and semi-skilled workers and 50% unskilled labourers. The skilled workers are likely to be recruited internationally.
- Approximately 300 workers will be employed at the potential construction camps<sup>3</sup> and pipe yards<sup>4</sup> at peak periods in the pipeline construction process. Each camp is likely to require around 100 support staff and each pipe yard is likely to require around 30 support staff. The majority of these will be Azerbaijani nationals. The total of 300 workers is based on the assumption that two construction camps will be operating at any one time, and about four of the eleven yards. The actual number of camps and yards will be determined by the construction contractor.

The construction phase is expected to last about 15 months. However the peak construction period will be approximately 12 months and many of the jobs will only be available for a proportion of the overall period.

#### 11.3.1.2 Direct Local Labour during Operations

BTC Co anticipates that approximately 100 staff will be directly employed during the operational phase for BTC and SCP in Azerbaijan and Georgia combined. In the first year of operation (2004), approximately 80% of these staff are expected to be Azerbaijani and Georgian nationals and the remainder expatriate workers. Staff that are expected to be employed include operations staff or technicians, security staff, cleaners, kitchen staff and drivers working at the AGIs, plus up to 100 horse patrol staff, employed in patrolling the WREP, SCP and BTC pipelines.

<sup>&</sup>lt;sup>3</sup> Mugan KP 63, Kurdemir KP 128-132, Ganja KP 297-302 and Poylu KP 410.

<sup>&</sup>lt;sup>4</sup> Proposed sides at Sangachal (Umbakie)KP 2, Mugan KP 63, Kurdeimiir KP 128-132, Udjar KP 175-177, Leki KP 205, Guvekend KP 205, Yevlah KP 231, Ganja KP 297-302, Deller KP 340, Zeyem KP 354, Boyuk Kesik KP 440 were investigated during this ESIA.

# 11.3.1.3 Procurement of Goods and Services During Construction and Operation

The project will provide direct service opportunities for companies at the national and regional level, and also to some extent for communities along the route. This is contingent on whether local suppliers can offer sufficient quality and reliability and can meet the stringent standards, particularly on health and safety set by BTC Co, but required of all parties involved in the project (including sub-contractors). The types of local contracts that are anticipated during construction and operation are shown in Table 11-1 below. A large proportion of these services are most appropriate for the construction camps. In addition there will be secondary employment and local development of small supporting businesses.

CONSTRUCTION	OPERATION
<ul> <li>Catering services to camps and construction sites</li> </ul>	<ul> <li>Catering services to manned AGIs</li> </ul>
<ul> <li>Laundry services to camps</li> </ul>	<ul> <li>Laundry services to manned AGIs</li> </ul>
<ul> <li>Security services at camps and construction sites</li> </ul>	
<ul> <li>Supply of vehicles (e.g. imported tractors, trucks)</li> </ul>	
<ul> <li>Provision of food supplies (indirectly through catering services)</li> </ul>	
<ul> <li>Supply of bottled water</li> </ul>	
<ul> <li>Supply of some construction equipment and materials, including timber, stone, land re- instatement materials</li> </ul>	
Aggregate for road repairs	

Table 11-1 Goods and Services with Potential to be Procured Locally

#### 11.3.2 Identification Of Employment and Procurement Impacts

Table 11-2 outlines potential employment impacts, the management and mitigation measures developed to address these, and any residual impacts following the management of the impact. The table includes both positive and negative impacts. The management and mitigation measures aim to maximise the proportion of Azerbaijani staff employed during pipeline construction and operation.

Except for measures which will be directly implemented by BTC Co, the majority of these mitigation measures have been integrated into the Invitation To Tender (ITT) documents for both pipeline and AGIs construction so that each construction contractor will be required to implement these measures as part of their contract. The proposed implementation measures from each contractor will be judged during the bid evaluation process. The contractors may identify additional or alternative measures and these will be agreed in discussion with BTC Co. Details will be finalised in the Environmental and Social Management Plans and other relevant management plans prepared by the selected contractors. Further mechanisms will be agreed to monitor implementation of the measures. Section 14, Management and Monitoring Plan provides further details on this.

The management and mitigation measures in this Section focus on BTC. Mitigation measures relating to training and skills development will be developed in association with SCP, in recognition of the common interests of the two projects. This section is based on the assumption that construction of the SCP pipeline will follow immediately on from the BTC project. The following impacts are discussed in Table 11-2:

- E1 Direct Employment
- E2: Wide Distribution of Employment Opportunities
- E3: Recruitment process
- E4: Employment Expectations
- E5: Working Conditions
- E6: Wage Levels among Project Workforce
- E7: Enhanced Local Skills
- E8: Indirect Employment Opportunities
- E9: Local Produce Supply/Neglect of farmland
- E10: Direct Employment operational
- E11: Local Skills operational

Table 11-2 Impacts and Mitigation Measures: Employment Issues

Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of the High and Medium residual impacts)
	CONSTRUCTION PHASE		
E1	Direct Employment	Recruitment Targets	
	There will be a positive short-term	BTC Co will establish local and national employment	Additional money injected into
	impact on workers employed during	targets with the construction contractor during contract	communities from wages: beneficial
	the construction phase, and on their	negotiations, to maximise local employment. This will	
	families and communities, particularly	include a breakdown of targets for skilled and unskilled	
	given the lack of employment in the	labour, from pipeline-affected communities and from	
	Districts crossed by the pipeline.	Azerbaijan as a whole. Performance against these	
	Unskilled workers will benefit most	targets will be monitored during construction.	
	since skilled workers are more likely		
	to have left the region to find		
	employment elsewhere.		

Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT
			(see Section 12 for a discussion of the High and Medium residual
			impacts)
E2	Wide Distribution of Employment Opportunities	Managing Local Recruitment	
	The scale and distribution of this	The contractor will ensure there is a "preferential"	Wide Distribution of Economic
	impact will depend on the	approach to recruitment. Priority will be given to workers	Benefit: beneficial
	geographical spread of employment, the period of employment and to what	Ifom pipeline affected districts.	Un-met Employment Expectations:
	extent new workers can be hired in	The construction contractor is required to outline an	high
	amerent aistricts. The recruitment process will therefore largely	emproyment strategy for unskilled and skilled labour based on regional recruitment (as opposed to	
	determine this impact.	recruitment only in Baku) and to ensure a focus on	
		pipeline affected communities and to demonstrate	
		that similar numbers of people are employed from each	
		region. This will be monitored as a KPI. A project	
		crossed by the nineline and will serve as a collice of	
		information on notential ich opportunities and prohably	
		as a Incation for recruitment	
		This strategy will include procedures to identify and	
		Verify the areas in which applicants live, as well as information on evneriance skills and notantial training	
		In the event that it is not possible to recruit sufficient,	
		suitably qualified workers at the local level, the	
		contractor will recruit at the national level.	
		The contractor will be required to set out the rationale	
		for any employment of third country nationals.	

	SUES / IMPACIS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT
			(see Section 12 for a discussion of the High and Medium residual impacts)
3 Rt	ecruitment process		
>μτμγος Ω88	Thenever and wherever employment aportunities are available there is e potential for undue influence ad/or bias in the recruitment ocess. This can lead to an unfair stribution of employment portunities and resentment among cal communities. onsultation showed that this is a oncern within project-affected ommunities.	The contractor will be required to work with BTC Co to establish recruitment procedures that are transparent, public and open to all regardless of ethnicity, religion, sexuality or gender. Deviations from these procedures will not be tolerated. 'Preferred individuals' lists will not be accepted by the contractor – applications will be accepted from all people within the appropriate geographic area. Recruitment procedures will be overseen by BTC Co to address community concerns about the transparency and openness of the process. It is possible that a respected, informal, local community leader such as an Aksakal can also oversee recruitment. If corruption is discovered, action will be taken immediately to halt this. In addition, the contractor will be required to ensure that a clear and sufficiently specific description of available jobs is available to interested parties. The employment strategy will be distributed to all pipeline affected communities, at least one month prior to the date of recruitment in that area. This will probably be done via distribution of leaflets and posters placed in public locations.	Un-met Employment Expectations: high

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Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT
			(see Section 12 for a discussion of the High and Medium residual impacts)
E4	Employment Expectations		
	Given the high levels of local unemployment, the number of people applying for jobs is likely to be greater that the jobs available. Further, the project will be constrained in its ability to employ Azerbaijani nationals by the availability of appropriate skills. There may therefore be a negative impact of frustration and potential resentment among unsuccessful applicants, and in communities where none or very few workers are employed by the project. The levels of frustration and resentment will depend on the final distribution of employment, and how well the expectations of applicants are managed.	The project will seek to manage expectations of employment at both local and national levels. The limited number of jobs available duration, has been operation, and their estimated duration, has been outlined to communities during a part of the ESIA consultation process (December 2001 and January 2002). This will be reinforced in greater depth during the ESIA disclosure process. Information will be provided to communities and potential applicants once the construction contractor has finalised the recruitment plan with BTC Co. Information will include job descriptions specifying skills levels required. By doing this, wholly unsuitable candidates are less likely to apply for jobs and be rejected. BTC Co will also provide details of the estimated number and duration of employment opportunities to Government, media, and other interested stakeholders prior to and during the construction process. Information on recruitment procedures and the location of information centres will also be provided.	Un-met Employment Expectations: high
ES	Working Conditions	-	: : : :
	The terms and conditions of work (e.g., hours of work, overtime, wages etc) that are specified in workers' contracts will have an important effect on the quality of life of local and foreign workers, (e.g. health and	Construction contractors have been required (via the ITT) to apply BTC Co's corporate policies on employees, relationships and ethics and the 8 core ILO conventions (See Section 6, Legislation and Policy Framework). Contractors will also be required to abide by the BTC project Statement of Social Objectives (See	There should be no residual impact if mitigation measures are effectively implemented.

Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT
			(see Section 12 for a discussion of the High and Medium residual impacts)
	safety effects of long work hours).	Section 6, Legislation and Policy Framework).	
E6	Wage Levels among Project Workforce		
	There is a potential impact, in terms of frustration and resentment, if local	The contractor will be expected to pay at least the minimum wage to all workers.	Differential Wages among Project Workforce: Low
	workers perceive that foreign workers are receiving better pay or conditions	Community Liaison Teams will be made aware of this	
	highlighted as an issue during highlighted as an issue during consultation In reality it is unlikely	of inequality, which can persist and needs to be diffused	
	that a foreign worker will be		
	employed in a job for which there is a local labour pool and therefore this		
	impact is more one of perception rather than fact.		
E7	Enhanced Local Skills	Training	
	There will be a positive impact on	The contractor will be required to develop a	Enhanced Local Experience and
	local skills through the experience	comprehensive training programme to enhance the	Employability: Beneficial
	gained by workers and any naming that they receive The scale of the	fiurtibets and skiils level of national employees /including through subcontractors) This training	Subsequent out-migration as a result
	impact will depend upon the quality of	programme will be designed to maximise the	of enhanced skill levels: Low
	the training programme, the work	opportunities for country nationals to gain employment	
	experience, and the individuals	in skilled and semi-skilled roles during the construction of the pipelines. The training programme will be part of	
		the contractor's employment strategy and will be	
	It is likely that the entire workforce will	reviewed and approved by BTC Co. Training will be	
	need at least some training prior to	provided in the appropriate language. The ITT specifies	
	employment, in order to perform	the following training programmes must be provided:	
	tasks to the international standards that have been set by the project on	<ul> <li>Welder training</li> <li>Road vahiola training</li> </ul>	
	······································		

Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of the High and Medium residual impacts)
	issues such as Health, Safety and Environment (HSE).	<ul> <li>Construction plant operation training and</li> <li>English language training</li> </ul>	
		The training programme will include refresher and induction training to ensure that all recruits have the necessary understanding and knowledge levels for each job, in particular with regard to HSE issues.	
		On the job informal training sessions and discussions will be provided as necessary during the construction and operation of the pipeline.	
E8	Indirect Employment Opportunities		
	There will be a positive economic impact through the provision of goods and services at national and local levels, close to construction activities and at camps, and pipe yards during	As part of the tender process, the construction contractor is required to identify and pursue opportunities to enhance local sourcing of goods and services. This will include sourcing for construction camps.	Economic benefit from in-direct employment opportunities: beneficial Enhanced capacity to tender for
	facilities during operation.	In addition, a seminar was held in early March in Baku to update local businesses on supply opportunities that will be available. This seminar:	
		<ul> <li>explained what sub-contracts might be available;</li> <li>explained what sub-contractors need to do in order to be better placed for this work</li> <li>provided the same level of information to all potential sub-contractors</li> </ul>	
		In addition BTC Co will open an Enterprise Centre in Baku to help Azerbaijan-owned and based companies to develop their business in support of major oil and gas developments in Azerbaijan. The centre will provide	

Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT
			(see Section 12 for a discussion of the High and Medium residual impacts)
		resources for suppliers, and information on current and future supply opportunities, Health and Safety Expectations, quality and business conduct, required technical standards etc. The centre will also provide training, workshops and seminars.	
63	Local Produce Supply/Neglect of farmland		- - - - -
	There is a potential `boom-bust' impact on communities in the vicinity	Communities will be provided with information about the duration of construction activities in their vicinity during	Economic benefit from in-direct employment opportunities: Beneficial
	of construction activities for a short period. This could be caused by a	the consultation and community liaison process.	
	short term high demand for goods	The construction contractor is required to submit	
	and services followed by a decline in demand as construction moves on.	procedures for local sourcing needs to BTC Co. These will be made available to local businesses via the	
		Enterprise Centre in Baku. This will help local	
	The probability of this occurring is considered to be fairly low	communities to plan more effectively. The more detailed the plan the more effective it will be in allowing	
	The most likely areas of impact are in	communities to assess their ability to provide goods and	
	communities nearest to large construction camps where economic	services without compromising their own standard of living and their future livelihood.	
	opportunities are greatest.		
	Thors is close the risk of the society of	The Project is also developing a Community Investment	
	findle is also the risk of the hegred of farmland given the likelihood of better	will provide communities with sustainable skills that will	
	wages associated with the project.	help them in the longer term.	
	However, there is considerable excess labour available at community		
	level to maintain agricultural		
	activities. Hence this is unlikely to be		

Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT
			(see Section 12 for a discussion of the High and Medium residual impacts)
E10	Direct Employment		
	There will be a major positive	BTC Co will support initiatives and programmes to	Additional cash injected into
	economic impact on the number of	increase the proportion of local staff employed in the	communities from wages: Beneficial
	the operational phase. This will have	operational phase with a long term view to maximising	Reduced Economic Spend in
	a small multiplier effect for local	local operation. Local staff will be supplemented in the short-medium term by experienced expartiate staff that	Communities by Foreign Workers in
	significant given the small number of	will provide necessary supervision and coaching during	
	people who will be employed.	the initial period of pipeline operation. These expatriate	
	There will be additional positive	start will be selected for their training and coaching Iskills, as well as their proven HSE and technical	
	impact from those employed in	expertise.	
	associated activities e.g. waste		
	management, reinstatement etc.	Expatriate staff will be phased out when national staff	
		have acquired and demonstrated the required competence and skills.	
E11	Local Skills		
	Individuals employed during the	A comprehensive training programme will be developed	Enhanced Local Experience and
	operational phase will benefit from	for all national staff. The training will be carried out early	Employability: Beneficial
	personal development opportunities.	enough to enable local staff to participate in site pre-	- - - -
		commissioning and commissioning activities. The	Reduced Economic Spend in
		framework of BTC Co's Competence Management	Communities by Longin workers in Operational Phase: Low
		Assurance system, which will involve the identification	_
		of required and actual skills profiles for all operational	
		staff and the development of associated training and	
		assessment modules. BTC Co will continue to	
		encourage national staff to develop their skills during	
		their employment	

#### 11.4 LAND ACQUISITION AND LAND-BASED LIVELIHOODS

#### 11.4.1 Introduction

Experience of the WREP has shown that land and the protection of land-based livelihoods is an important community issue. This section outlines policies and principles to be applied in all cases where the BTC project construction activities and operations involve impacts on land, houses and structures, non-moveable assets, land-based livelihood and employment. Detailed land expropriation and compensation procedures are still being formulated and will be documented in a Land Acquisition and Resettlement Plan based on World Bank Group requirements. This Section outlines the principles that are being followed to address land expropriation and associated physical and economic impacts on land owners, users and occupiers in Azerbaijan. No households will require physical resettling.

Project land acquisition and associated livelihood impacts will be addressed in accordance with international good practice as embodied in the policies and guidelines of the IFC/World Bank Group. Requirements contained in Azerbaijan legislation and the project HGA will also be complied with. The principal World Bank instrument governing project impacts resulting from land expropriation is World Bank OD 4:30 *Involuntary Resettlement*<sup>5</sup>. (See Section 6 for further information on this policy).

#### 11.4.2 Project Land Requirements

The BTC project in Azerbaijan will make use of the following land areas during a 15-24 month construction period<sup>6</sup>:

- A construction corridor approximately 32m wide by 442km long<sup>7</sup>
- Land for construction camps (approximately 500 x 500m). Sites considered in this ESIA are at Mugan (KP 63), Kurdemir (KP 128-132), Ganja (297-302) and Poylu (KP 410), however the construction contractor will determine the number and location of sites to be used.
- Pipe yard sites, ranging in size from 2,000-50,000 square metres. Sites considered in this ESIA are at: Sangachal (KP 1-2), Udjar town (KP 178), Leki (KP 205), Guvekend (KP 205), Yevlah town (KP 231), Ganja town (KP 297-302), Deller (KP 340), Zeyem (KP 354), and Boyuk Kesik (KP 440), however the construction contractor will determine the number and location of sites to be used
- Land for temporary access roads (may become permanent and revert to local authority control in environmentally non-sensitive areas where communities make a case to maintain them)

<sup>&</sup>lt;sup>5</sup> There are presently two involuntary resettlement policies in force within the World Bank Group. IFC, the World Bank's private sector lending arm, uses OD 4:30 Involuntary Resettlement (June, 1990). World Bank public sector operations use OP 4:12 and BTC CO 4:12 Involuntary Resettlement (January, 2002). On advice of the World Bank Group, the project has adopted OD 4:30.

<sup>&</sup>lt;sup>6</sup> If SCP construction follows BTC, this land will be used for 3 -4 years.

<sup>&</sup>lt;sup>7</sup> Acquisition of an additional 12 m required for the SCP project will take place at the same time, creating a total of 44 m by 442km.

The total land area required for construction (temporary use) is about 2000 hectares (preliminary estimate).

The BTC project will permanently acquire or acquire the rights to:

- 8 metre by 442 kilometre corridor of land where the pipe will lie (former owners will be able to re-use the land, subject to certain restrictions) with some restrictions on a wider corridor
- Land for construction of three permanent AGIs. These will include a pigging station at KP 124 (Chokranly and Yeni Shiximly), a pump station at KP 243 (Aran and Yaldilly) and 1 intermediate pigging station at KP 342 (Sary Tepe, Dallyar Djer and Dallyar Dashbulak). The pump station will require approximately 180 x 450m of land. The pigging station will require approximately 125 x 125m of land.
- Land for access roads to the permanent AGIs approximately 4 6m wide that will remain after completion of the construction process.
- Approximately 21 remotely actuated block and/or check valves, which are likely to be relatively small (in the order of 7m by 8m) and located on the pipeline corridor. However, during construction additional surrounding land will be needed for each valve for temporary work space. The significance of this impact on any one individual will be assessed during the land documentation process.

Mechanisms for acquiring rights to construct and operate the BTC pipeline are presently still under consideration. These range from full ownership to various leasing arrangements. In selecting the most appropriate approach, key considerations will include:

- The overriding objective of allowing landowners, lessees and other users to resume their pre-project activities on the land around the pipeline upon completion of construction.
- The need to establish a good long-term relationship with adjacent landowners whereby there is an ongoing commitment to maintaining the pipeline corridor.
- Sufficient flexibility for BTC Co to safely construct and operate the pipeline and associated facilities.

All approaches will involve compensation for any loss of land or land use (temporary or permanent), assets or income caused by the project.

#### 11.4.3 Potential Land and Livelihood Impacts

Through careful pipeline alignment and facilities siting, the BTC project will minimise impacts on housing and the need to physically relocate households. The project will involve impacts on land, productive assets, and livelihood through (i) temporary use of land for construction purposes; (ii) permanent acquisition of land (or imposition of rights to construct and operate a pipeline under existing ownership) for the pipeline alignment and three permanent AGIs; and, (iii) imposition of restrictions on land use adjoining the pipeline. The project will impact privately owned land, municipal and state land, some of which is leased to private entities and individuals.

Land and related livelihood impacts of the BTC project will include some or all of the following:

- Temporary loss of use of cultivated land, with resultant loss of income for owners/lessees/other users for the three to four year construction period (assuming SCP construction will follow on from BTC).
- Permanent loss of land (and any related income) for large AGIs, block and check valve locations, access roads and other ancillary works.
- Impairment of livelihood in areas adjacent to the pipeline and ancillary facilities that are affected by restrictions on use (particularly affecting vineyards, orchards and other tree crops).
- Temporary loss of use, or physical constraints on movement, on grazing land and pasture.
- Loss of structures and land attachments (eg. wells, fences, drying yards, animal pens, water tanks etc) in the 32 metre corridor
- Possible impacts on irrigation and drainage systems
- Loss of trees / perennial crops in the 32 metre construction corridor
- Loss of annual / seasonal crops in-ground at the time land is occupied for construction
- Loss of other productive assets (such as fish ponds)
- Loss or restriction of access to communally used forests
- Impacts on enterprises (including loss of productivity, downtime)
- Loss or damage to community property and resources
- Loss or damage to community services and infrastructure
- Severance of lots with loss of productivity and income.

In-principle measures for compensation are summarised in Table 11.4. Detailed compensation and other mitigation measures for people affected by these impacts will be described in the BTC Azerbaijan Land Acquisition and Resettlement Plan (forthcoming).

#### 11.4.4 Objectives for Land Acquisition and Resettlement

The overarching goal of the BTC land acquisition and resettlement process is:

To restore or enhance project affected peoples' living standards, income earning capacity and production to at least without-project levels

Other objectives for land acquisition and livelihood restoration are as follows:

- To align the pipeline to avoid houses and settlements so that physical relocation of people and their dwellings is minimised.
- While working within technical constraints, to carefully consider pipeline alignment and siting of ancillary facilities to minimise impacts on productive land and livelihood.
- To develop fair and transparent procedures for determining compensation for (i) temporary use of land for construction purposes; (ii) permanent acquisition or otherwise obtaining of rights to construct and operate a pipeline on private and state land; and, (iii) any restrictions on use that may be applied to areas adjoining the corridor and other facilities.
- To acquire land (or right to use land) through negotiated agreement, with use of powers of eminent domain only as a last resort.
- Upon completion of construction, to reinstate the pipeline corridor to a condition whereby landowners/users/lessees are able to resume their pre-project agricultural activities.
- To adopt design standards that minimise the need to impose restrictions of use on adjoining areas.

- To compensate for permanent use of land at full replacement cost inclusive of all transaction costs.
- To keep affected people and communities fully informed about the project, the process that will be followed to acquire and compensate for land, and their related rights and avenues for redress.
- To monitor the effectiveness of mitigation measures described in the BTC Azerbaijan Land Acquisition and Resettlement Plan and, if necessary, to take corrective action to ensure affected peoples' living standards and incomes are fully restored.

## 11.4.5 Land Acquisition and Resettlement Procedure

BTC Azerbaijan's land acquisition process is shown diagrammatically below in Figure 11.1.



Figure 11-1 Land Acquisition Process

#### 11.4.6 Implementing Roles and Responsibilities

Roles and responsibilities for land acquisition are summarised in the Table 11-3 below

Activity	Purpose	Period	Responsible Authority	Implementation
Application for allocation of land for the pipeline corridor	To secure Azerbaijan Government approval for allocation of land for the project	Pre-sanction	SLCC	SOCAR & BTC Co prepare the application
Research of land title & ownership details	Preliminary identification of project affected landowners, occupants or other users.	Pre-sanction	SLCC	SLCC with Lands Departments, District Authorities
Notification & preliminary consultation with project affected people	Meetings to advise landowners, users, & / or occupiers of the need to acquire their land and the procedures that will be followed.	Pre-sanction	District Authorities	Local Executive Authorities, municipalities, with Joint Land Acquisition Team
Socio-economic survey of affected people	To assess affected household characteristics, living standards & livelihood sources as basis for identifying resettlement impacts, & establishing monitoring baseline.	Pre-sanction	BTC Co	BTC Co with local SIA consultants
Signing of Initial Land Acquisition Agreements with land owners & users	Agreement by affected owners that corridor land may be acquired with a description of acquisition area & its condition including any affected premises or facilities, crops, trees or other attachments	Pre-sanction	SLCC	Representatives of SLCC, district government, SOCAR, BTC Co & owner sign the Initial Agreement.
Survey and loss assessment	To asses all land, assets, livelihood impacts as basis for valuation	Pre- construction	District Executive Authority	District Commission
Valuation of land, assets & livelihood to be lost & recommendation on compensation	To define amount of compensation payable for temporary & permanent use of land.	Pre- construction	District Executive Authority	District Commission
Final negotiation of compensation	Based on the recommendation of the District Commission, LAT negotiates final negotiation with affected people.	Pre- construction	SOCAR/BTC CO	Joint Land Acquisition Team <sup>9</sup>

#### Table 11-3 Land Acquisition Roles and Responsibilities<sup>8</sup>

<sup>8</sup> The Government of Azerbaijan has been assigned responsibility for land acquisition within the HGA. However BTC Co is assisting the government to ensure a fair and equitable process.

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Execution of Final Land Acquisition Agreements	To summarise the basis and compensation to be received by each affected landowner/user/occupiers	Pre- construction	SLCC	Representative of SLCC, district government, SOCAR, BTC Co & owner sign the Final Agreement.
Payment of compensation	To review relocation site options & recommend a preferred option – in consultation with affected owner	Construction (30 days before land required for construction)	SOCAR	BTC Co makes compensation payment direct to affected parties (& later reconciles with SOCAR through HGA)
Issue of new ownership agreements (if ownership option is taken)	To formalise all transfers of land ownership - (replacement land to affected people, 8+8 corridor to SOCAR	Post- construction	Cabinet of Ministers	SLCC prepares State Act & Certificates of Land Ownership & Use
Exclusion Zone Agreements	Formalise restrictions of use over the pipeline corridor with adjacent landowners/users	Post- construction	Ministry of Fuel & Energy	SOCAR, District Authorities
Monitoring	To verify reinstatement, receipt of entitlements & monitor effectiveness of any livelihood restoration	All phases	AIOC/BTC Co	BTC Co Community Liaison Officer supported by local SIA consultants Third Party Monitor

#### 11.4.7 Consultation and Disclosure

Measures for consultation and disclosure are outlined in the BTC project Public Consultation and Disclosure Plan (PCDP). The IFC/World Bank Group requirement for 120 day incountry and international disclosure of the Land Acquisition and Resettlement Plan will be complied with.

#### **11.4.8 Grievance Procedures**

So far as possible, the BTC project will seek to resolve grievances outside of the judicial system. Avenues for project affected people to express grievances, including through independent third parties, will be publicised in each village as part of the land acquisition notification process and in project information pamphlets. The project will establish mechanisms to receive grievances, facilitate grievance and dispute resolution and monitor outcomes. A register of all grievances, corrective actions and outcomes will be maintained from the commencement of the land acquisition process.

In the event of failure of non-judicial approaches to grievance resolution, Azerbaijan legislation provides for aggrieved parties to take action through civil courts, with avenues for appeal.

<sup>9</sup> Joint Land Acquisition Team comprises representatives from SLCC, SOCAR, relevant district authorities and BTC Co.

#### 11.4.9 Liaison with Communities

A tripartite land acquisition team has been formed to notify and inform affected people about the nature of the project, the need for land acquisition, and their rights and obligations with respect to the acquisition process. The land acquisition team is made up of officers from the State Land Committee, SOCAR (the government agency acquiring the land) and BTC Co. Land officers received three weeks training covering the legal framework governing land acquisition, the World Bank's land acquisition and resettlement policies and techniques for consultation and interaction with affected communities.

This team will represent the project in terms of notifying project affected people, negotiating preliminary and final agreement, carrying out inventories of affected crops and assets, and determining compensation amounts.

Selected land officers will be available as a point of contact for communities on property and land issues during construction. They will report to the project Community Relations Manager who will be appointed prior to construction commencement.

#### 11.4.10 Valuation Methods and Compensation

In each district crossed by the pipeline, the Head of the Executive Power will establish a "valuation commission" to undertake a valuation of land, crops and assets that will be lost to the project. The commission will consist of representatives of the District Agricultural Industry Association (normally the Chairman), District Financial Department and Land Department as well as representatives of other interested parties. The commission will prepare a recommendation on the compensation payable to affected land owners and users, using methods defined in Azerbaijan legislation. Using this recommendation as a starting point, the joint land acquisition teams will negotiate a final settlement with affected land owners and users.

Taking into account Azeri legislation and the requirements of the World Bank, whichever is more stringent, BTC Co will develop fair and transparent procedures for valuation and compensation for temporary use and permanent expropriation of land. Where appropriate, the project will make use of independent third party land appraisers to assist with determining fair compensation rates. All compensation rates and entitlements will be publicly disclosed and adjusted if necessary to take into account any feedback received.

#### 11.4.11 Documentation of Land Ownership and Use

The SLCC, with support from the project land acquisition teams, has completed land parcel and owner identification surveys. Land parcel and ownership information is subsequently verified with district officers, and where necessary in the field. In instances where land owners with formal land rights have not registered their ownership or lease, or where land has been transferred without registration, the project will facilitate owners/lessees with completion of registration formalities ahead of negotiations.

#### 11.4.12 Negotiations

The tripartite land acquisition teams will negotiate directly with the owner, lessee, or user of any asset (land or otherwise). All transaction costs including fees for notarisation, registration and transfer taxes will be borne by the project.

## 11.4.13 Eligibility for Compensation

In determining eligibility for compensation, the BTC project will follow the guidelines of the World Bank. World Bank OD 4:30 *Involuntary Resettlement* notes that lack of legal title does not disqualify people from receiving resettlement assistance. A census of all project affected people, including informal dwellers, has been undertaken as part of project resettlement planning. Based on the findings of the census and of an associated socio-economic survey, resettlement assistance measures will be formulated to address the needs of informal dwellers.

Table 11.4 outlines the potential impacts, mitigation measures and residual impacts for property damage and land acquisition issues as follows:

- L1: Permanent expropriation of land
- L2: Land Use on the ROW and on construction sites
- L3: Separation/isolation of land plots with loss of productivity and income
- L4: Soil fertility investments/Future Degradation to land
- L5: Infrastructure: Houses and other buildings, fencing, irrigation channels etc
- L6: Damage to property outside ROW and approved construction areas
- L7: Loss/damage to other productive assets
- L8: Impacts on enterprises (including loss of productivity, downtime)
- L9: Impacts on forestland used by locals for wood and non-wood products
- L10: Use of wood cleared from ROW
- L11: Restrictions on land use

Table 11-4 Imnacts and Management and Mitigation Measures: Property Damage and Land Acquisition Issues

	Laure 11-4 mupaus and management at	IN MINISAUUN MICASULOS. FIUPOLLY DAMAGE ANU LANG	n Acquisition Issues
lssue	) ISSUES/IMPACTS المراجع	MANAGEMENT AND MITIGATION	RESIDUAL IMPACT
°N N		MEASURES	(see Section 12 for a discussion of the High and Medium residual impacts)
	Construction		
L1	Permanent expropriation of land (and any related income) for AGIs, block and check valve locations, access roads and other ancillary works.	In-principle measures – to be developed in detail during Land Acquisition and Resettlement Plan preparation)	
		Cash compensation based on market value of land or where this is not readily assessable on	Loss of productive land: low
		an expert appraisal of land value based on an	Changes in livelihood source as a result
		explicit procedure. These will take into account	of land loss: low
		iano quainy, extent or improvements, access to irrigation, historical productivity, etc.	Additional cash injected into local
		Loss of productive land has been minimised through careful attention to siting AGIs and	communities: beneficial
		permanent facilities.	
		Where project land expropriation results in a household permanently losing use of land to the extent that the of balance land is no longer economically viable, project to provide option of cash compensation or replacement land within the village (if available) of equivalent size and quality. Where replacement land is of lower quality, the project will provide transitional income support and assistance with land improvement. Assistance with full resettlement to World Bank standards, if required.	

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o Z		MEASURES	(see Section 12 for a discussion of the High and Medium residual impacts)
L2	Land Use on the ROW and on construction sites		
	Land use, both agricultural and pastoral, will be	The extent of household reliance on subsistence	Additional Damage to Land and/or
	Interrupted by the construction process for three to	food sources will be assessed during the Land	Property: Low
	This will impact on the ability of households and	economic surveys.	Possible small increases in demand for
	communities to sustain their agricultural livelihoods,		staple foods in local markets as land
	as in general, it is likely to affect land on which grain and venetables are grown or pastures on which	BTC Co will be responsible for compensation for property damage and loss of amenities within the	affected households replace consumption of crops prown for subsistence with
	animals are grazed.	designated construction corridor, and at all	purchased foodstuffs: low.
		designated construction sites outside the pipeline	
	The land acquisition process will determine exactly	corridor. Cash compensation will be provided for	Additional cash injected into local
	how many individual households will be impacted by	lost agricultural productivity during the	communities: beneficial
	the temporary or permanent land take.	construction period.	
			Reduced labour requirement in some
	The construction process is less likely to affect land	Adequate notice of the pipeline construction	affected households due to reduced area
	immediately adjacent to or nearby houses as the	schedule will be provided to affected farmers so	for cultivation and harvest: low
	proposed pipeline will in general not be close to such	that they don't un-necessarily lose crops.	
	land plots, except at Anver Memmedhanly (KP 163		The Community Liaison Grievance
	+400), Gulabend (KP 169 +500) and Garaberk (KP	Cash compensation will be provided based on	Procedures may be used by households
	174+800). HDD has been specified at KP 163 +400	the cost of planting, labour and fertiliser inputs	who experience hardship as a result of
	and KP 174 +800.	required to bring the tree or vine to maturity, plus	the project.
		the cost of the lost production for the period it will	
	Construction will have a major impact for those who	take a sapling to reach the production level of the	
	own orchards that cross the ROW given that all trees on the route will be removed and the time required to	tree/vine at the time it is lost to the project.	
	re-grow trees to harvesting maturity.	For mitigation measures to minimise damage to	
		houses close to construction activities see issue	
		L4 below	
		; ; ; ; ; ;	
		Lang used guring the construction process will be re-instated. A reinstatement summary can be	

lssue No	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of the High and Medium residual impacts)
		found in Part 5 of the Technical Appendix. In summary, all agricultural and pasture land, except that needed permanently for AGIs and new access roads, will be restored to at least the condition it was in prior to construction. Agricultural land will be left graded and tilled ready for the farmer to re-plant. Where land must be re-planted in order to prevent erosion, the regime will be agreed with the landowner.	
Г3	Separation/isolation of land plots with loss of productivity and income.		
	Construction activity or the building of permanent infrastructure (including access roads) may in some instances separate or isolate a land plot leaving a portion inaccessible or of a size that is not economically viable or feasible to work.	The project will consider; (i) compensation for lost production on that portion for the construction period; or (ii) outright purchase where the severance is long term and has a negative economic impact.	Grievances over land compensation: Medium
		In the case of (ii) livelihood restoration measures (such as replacement land or agricultural intensification on the affected households' remaining land) will also be required.	

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BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA
ssue	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION	RESIDUAL IMPACT
No No		MEASURES	(see Section 12 for a discussion of the
	0 - 11 fe - 461144 - 11		High and Medium residual impacts)
4	Soll fertility investments/Future Degradation to land		
	There is potential for a long-term negative impact to	A Reinstatement Plan has been developed to	Grievances over land compensation:
	farmers along the route if the soil fertility, and	ensure that agricultural fertility is maintained as	Medium
	construction. While it is unlikely that there will be a	ומו מס ליומכווכמו.	
	long-term decline in soil fertility along the ROW,	If necessary, BTC Co will provide compensation	
	VVKEP experience shows it is possible that there will be pockets of such cases. Without additional	as outlined in the compensations procedures of the RAP.	
	mitigation to address reduced soil fertility, the		
L5	Infrastructure: Houses and other buildings,		
	tencing, irrigation cnannels etc		
	Farmers commonly dig irrigation and drainage	BTC Co and the construction contractor will	Damage to infrastructure or housing not
	ditches, install fences or walls on land. These	always seek to avoid causing damage to	repaired or not compensated: low
	"investments in infrastructure" may be impacted	infrastructure where possible. General	
	during pipeline construction. They are more common	measures to protect infrastructure impacted	Grievances over land compensation:
	on certain types of land than others. For instance,	through the construction process are outlined in	Medium
	fields for growing cereals or fodder are rarely irrinated but venetable fields often are	Section 11.5.	
		Where damage can not be avoided cash	
	In addition to individually owned and maintained	compensation based on full replacement cost (as	
	irrigation channels, large-scale irrigation systems	required by the World Bank), or replacement	
	may be impacted. While many are already in a state	structures/facilities will be provided.	
	of disrepair, the project must be careful not to leave		
	systems in worse condition than found in.	in addition, the construction contractor will	
		assess and document the likely impact on	
	Any houses or other buildings located close to the	houses adjudged to be close enough to traffic	
	construction corridor and to access roads may be	routes where there is a risk of vibration induced	
	limpacted by vibration damage due to the use of	impacts. This documentation will be agreed with	

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lssue No	IISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of the High and Medium residual impacts)
	heavy vehicles. Most likely damage would be cracking to walls.	the house owner/occupants and a copy of documentation provided to the house owner/occupants.	
	The areas of impact will not be determined until the contractor has finalised the Traffic Management Plan. Based on current knowledge, this impact could occur at housing close to heavily used access roads	The full re-instatement option will involve direct replacement of the structure by BTC Co with πο cash transaction taking place.	
L6	Damage to property outside ROW and approved construction areas		
	There is a potential impact of damage to land, property and infrastructure outside of the ROW.	All construction activities will be undertaken within predetermined working areas for which	Additional damage to land/and or property: low
	This could involve:	compensation procedures maye been completed. Any damage caused by the construction contractor outside these boundaries will be	Grievances over land compensation: Medium – low depending on the number
	<ul> <li>clearing land beyond the project working areas for which compensation has been paid;</li> </ul>	compensated accordingly and will be the responsibility of the construction contractor.	of incidents within a community
	<ul> <li>vehicles or people straying outside working areas and causing damage to land and crops.</li> </ul>	The requirement to keep within the working area	
	Damage to farming land near the ROW if access to irrigation is blocked by construction	will be strictly enforced and emphasised to the work-force during inductions and tool-box talks.	
	Adverse effects of dust on crops	Working arase will be determined prior to	
		construction. Sites will be demarcated as	
		necessary using fencing, marker posts or, signs. Permanent facilities will be fenced. For the	
		pipeline ROW, stakes will be placed to identify	
		the working width. Fences will be used close to	
		occupied properties or sensitive areas where this is deemed the most appropriate mechanism to	
		assure safety of people, livestock and property	

lssue No	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of the
			<u> High and Medium residual impacts)</u>
		BTC Co will monitor the impact on land and property outside the ROW and approved construction areas.	
		The construction contractor will also be responsible for negotiating compensation for any additional construction sites required and BTC Co will monitor this.	
L7	Loss/damage to other productive assets In addition to land crops and trees the construction	Livestock BP and the construction contractor will identify	No residual impact if mitigation
	process may damage other productive assets such	principal livestock movement corridors and	implemented.
	as livestock, bees, etc.	program construction activities to avoid seasonal movements, or incorporate appropriate crossings	However if beekeepers fail to move any
	Livestock	at key locations. Further measures are identified	hives within 300m of the ROW before the
	During construction, the ROW open trenches will be	in Section 11.5, I5 and I6.	start of the honey production season,
	a physical constraint to livestock movement, and		these will need to be moved 5km to
	pastures in the 32-metre corridor will be lost for	Bees	ensure that bees are not lost.
	grazing use.	The Community liaison team will seek to identify any beekeepers whose hives are within 300m of	
	There is a potential impact arising from loss of	the route before the start of the honey production	
	livestock due to accidents related to construction	season. These beekeepers will be requested to	
	(animals being struck by machinery, animals talling	move their hives (both mobile hives and stationary hives) to a distance of at least 300	
		metres from the route for the season.	
	Bees		
	Bee keeping is not a major commercial activity along	Compensation if necessary	
	the route. However some households do keep bees to provide honey for personal use and occasional	If a temporary loss of use to a productive asset	
	sale.	estimate of average annual revenue lost over the	
	The project may physically disturb bees where hives	construction period will be provided. The asset will be restored to its original condition upon	
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lssue No	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of the High and Medium residual impacts)
	are located within about 250-300 metres of the pipeline. This is primarily due to dust (bees are	construction completion.	
	sensitive to intensive dust on themselves and the surrounding flora), noise of the machinery and	For permanent loss to the asset, cash compensation based on a multiplier of fixed	
	vibration at very short distances. Once the honey production season begins, bees, if moved, will	market rates, will be provided.	
	attempt to return to their original home even if the hive has been moved unless the move is greater		
	than a 5 km radius.		
	Hives within about 5km of the pipeline corridor will also be affected by loss of venetation caused by the		
	pipeline corridor. However with a corridor of		
	approximately 32m and assuming that there is an equal distribution of flora suitable for honey		
	production in the 5km radius, the maximum loss of		
	area would be less than 0.2% and is not considered significant.		
L8	Impacts on enterprises (including loss of	Cash compensation will be provided equivalent	
	productivity, downtime)	to lost productivity to enable employer to pay salaries and wages for duration of any downtime. Assistance will also be provided to find	
		alternative premises and relocate plant and equipment if required.	
		Measures to develop replacement employment will be implemented where the project results in any loss of employment.	
F9	Impacts on forestland used by locals for wood and non-wood products		
	There are no areas of significant forest on the ROW,	No mitigation measures required	None

lssue No	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of the High and Medium residual impacts)
	and none of the communities surveyed cited gathering or trade in wood products as a significant source of livelihood.		
L10	Use of wood cleared from ROW		
	Access to wood for heating purposes is a positive benefit for communities, since this is already an important source of energy for communities on the pipeline route.	All trees and branches will be offered to local communities to use as firewood and building materials. Community Liaison Officers will identify appropriate pick up points for the wood	Use of wood cleared from ROW: beneficial
	Minor impact in Azerbaijan as very little forest on proposed route.	off the ROW, through discussions with the community.	
	OPERATIONAL PHASE		
L11	Restrictions on land use		
	Following the construction period, some restrictions will apply to land use in relation to planting trees, building, drilling and deep ploughing. See the RAP for details of the land corridor which will require restricted land use.	BTC Co will provide compensation to landowners for restrictions on land use as set out in the RAP.	Grievances over land compensation: medium
	A combination of pipeline marker posts, concrete slabs, pipeline marker, tape, ongoing agricultural liaison, easement agreements, etc. will be used to minimise the impacts of land users on the pipelines and cables involved in BTC.		
	There will be a significant impact on vineyards and orchards which cannot be replanted (checking relevance in relation to no of orchards/vineyards)		

# 11.5 LOCAL INFRASTRUCTURE SERVICES AND NATURAL RESOURCES

Chapter 9 (Socio-Economic Baseline) shows a lack of infrastructure and supply deficits in community services along the pipeline route and the impact of this on quality of life. This Section uses the baseline information from Chapter 9 to assess the potential impacts of the project on existing infrastructure, services and resources while Section 13.7.2, Community Investment, considers opportunities for enhancement of local infrastructure to improve the overall quality of life.

# 11.5.1 Aspects of Project Giving Rise to Impacts on Infrastructure, Services and Natural Resources

#### 11.5.1.1 New and upgraded access roads for construction purposes

The construction contractor will use the ROW itself as an access road as far as possible to minimise the need to build additional roads for access purposes. Where possible, transportation routes will not go through local communities and AGIs have been located as close as possible to existing tracks. However, there will still be a requirement for use of existing and new roads to access the route, particularly for:

- The transportation of an estimated 7,800 loads of pipe by rail through the country: This equates to approximately three 750m long trains every two days, assuming that there are 45 wagons per train, and that a rail car load is 5 lengths of pipe. Other materials for the project will also be transported by rail. This will include construction material, the check and block valves themselves etc.
- The transportation of an estimated 12-13000 loads of pipe and other materials from the pipe yards (adjacent to the rail heads) onto the route itself. A truck load is a single trailer truck with 3 sections of pipe (12 metres long). If double joints are made at the pipe yards the number of loads will be considerably reduced, although the weight and lengths will increase.
- Transportation of numerous heavy vehicles to the ROW probably from rail heads.
- Transportation of local workers from designated pick-up points to the construction site and back again on a daily basis using as many as 40-50 buses daily during peak construction times
- Access to the pigging stations and pump station
- On-going pipeline maintenance during operation

The Project team have identified potential access roads. These have been classified as either in good condition, with no upgrade requirement, in poor condition with upgrades required or to be newly constructed for the project. Up to approximately 30 km of these roads could be new. Exactly which potential access roads will be used will not be known until the construction contractor has drawn up the Traffic Management Plan.

# 11.5.1.2 Power use by construction facilities and AGIs during construction and operation

The project will require electrical power prior to and during the construction phase to move rail trucks loaded with pipe and other construction materials. The power for rail transportation will be drawn from the Azerbaijani rail grid. Although this grid is separate from the national grid supplying communities, both grids are supplied from the same power stations and additional draw on the railway grid could affect supply available to the national grid. Data on the amount of power required for rail transportation is currently unavailable.

With regard to both temporary construction sites (camps and pipeyards) and permanent facilities (valves, pump stations, etc.), the ITT suggests that main power can be drawn from local supplies as long as it does not adversely affect supplies to local communities. However, because of unreliable power supplies in Azerbaijan, it is expected that all power needs will be self-generated by diesel generator. If the contractor does wish to draw power from local supplies, this will be approved by local authorities and BP in advance.

Power is needed for the operation of the 21 small AGIS, the block and check valves, and will where possible be drawn from overhead lines from existing Railways or substations or from existing power sources on the WREP. If these options are not available or reliable then standalone power generation will be installed in each location. The electricity requirement for the pipeline itself during operation will usually be around 100 kilowatts for BTC stand alone, or approximately 107 kilowatts for the operation of BTC and SCP combined. The maximum power needed for BTC pipeline operation at any one time would be 132 kilowatts.

## 11.5.1.3 Water needs for construction activities, facilities and at AGIs (construction and operations)

The project will require water for construction purposes, e.g. dust minimisation and hydrotesting of the pipeline and operations.

Construction camps will also require water for domestic uses for up to 750 people. Water for drinking purposes must meet World Health Organisation standards. This water will be bottled, trucked in or treated on site. The camps, constructions sites and AGIs will take either surface or groundwater for domestic and process use. The following volumes are estimated to be required for each activity:

- Construction camps will each require approximately 172 cubic metres per day (based on estimate on 750 workers in a camp, and including water used by the associated construction teams in the field)
- Operations phase total water use of approximately 4 cubic metres per day

Potential water sources have been identified along the route.

Prior to start-up, the pipeline will be hydro-tested; that is filled with water and pressured to check its integrity. The testing will be carried out in sections. Nevertheless, considerable quantities of water may be required. Additionally chemicals may have to be added to protect the pipeline. Sourcing and disposal arrangements for hydro-test water are therefore very important. The quantities will depend on the selected construction contractors detailed construction testing programme.

#### 11.5.1.4 Construction and operational wastes

Construction camps will need to dispose of solid waste, human waste and domestic wastewater. In addition there will be waste arising from construction activities on the ROW and at facilities. Table 5.10 Indicative Construction Waste Breakdown contains data on the volume and types of waste that are likely to be generated by the BTC project. Mitigation

measures for dealing with these wastes are described in Section 10, Environmental Impacts and Mitigation.

#### 11.5.1.5 Telecommunications for construction and operation

The existing fixed telephone and mobile phone networks will be used for telecommunications in both the construction and operational phase. In addition, a new fibre-optic system dedicated to pipeline operation will be installed for data transfer and telecommunications when the pipeline becomes operational.

#### 11.5.1.6 Medical and Health and Safety Infrastructure

Construction contractors will provide their own self-contained health and fire protection services.

During operations private medical and fire protection services will be used.

#### 11.5.1.7 Open Trench

Trenches and pipes - the trenches will be on average 2.4 metres deep, approximately one metre of which will then be taken up with pipe. This is likely to be deeper in places such as river and gully crossings or landslide areas, where the depth could reach 15m in very extreme cases. It is expected that the maximum trench length open at any one time will be 15 kilometres (non-continuous) including tie-ins, crossings and special sections.

The pipeline will cross access roads, canals, and other transportation networks along the route. During construction, the average length of time the trench will remain open at a crossing is approximately 2 days.

# 11.5.2 Identification of Impacts on Infrastructure, Services and Natural Resources

Table 11-5 and the general measures below describe specific impacts and mitigation measures developed in relation to local infrastructure, services and natural resources. Except for measures which will be directly implemented by BTC Co (e.g. measures for the operational phase) these mitigation measures have been integrated into the Invitation To Tender (ITT) documents for pipeline and AGI construction. They will therefore form a part of the contract for the construction work and the construction contractors will be required to implement them. The proposed implementation measures for each contractor will be judged during the bid evaluation process. Details will be finalised in the Environmental and Social Management Plan and other relevant management plans prepared by the selected construction contractor. Additional or alternative measures may be identified in discussion with the selected construction of the measures. Chapter 14, Management and Monitoring Plan provides further details.

The project will pursue the objective of 'No Net Loss' in relation to infrastructure, wherever feasible. This means that the project will aim to result in 'No Net Loss' in the quality, quantity, or availability of existing local infrastructure, where this will impact adversely on ability of communities to undertake subsistence or economic activities or reduce access to education, health or other emergency services.

#### 11.5.2.1 General Construction Mitigation Measures

The overall approach to management of potential impacts on infrastructure and resources is as follows:

- All construction activities will take place within agreed areas
- Construction techniques will be used to minimise disruption to infrastructure and services. Examples of these measures have been identified in the project description (e.g. trenchless crossing of busy roads (via Auger bore or Pipe Jack). Others are identified in the following sections. The contractors will have the freedom to suggest alternative or additional measures, but will be required to demonstrate that these measures will achieve the mitigation objectives as effectively as those specified in this ESIA
- A crossing schedule including all known roads, telephone and electricity facilities and oil, gas and water pipes has been prepared and will be given to the selected construction contractor. The contractor is expected to cross these in agreement with owners and without damage. During construction the contractor will be aware of the potential for un-identified services and structures and will take care to avoid any damage there will be no planned disruption to services. The Contractor will be required to repair any damage caused.
- Where there will be planned diversion to infrastructure or services, this will be identified by the contractors in advance as far as possible. All planned diversion will be communicated to local authorities at least 3 days in advance and also to communities through pre-construction meetings (see Section 11.6, Community Relations). The timing and duration of the diversion will be agreed. Where infrastructure is to be impacted, the timetable for repair of the infrastructure will be agreed with the authorities and the communities. Should the diversion be judged by the affected party to result in loss in livelihood, the validity of the claim and necessary compensation will be determined as described by compensation procedures in the Resettlement Action Plan (see Section 11.4).
- Should infrastructure or services be disrupted accidentally, the authorities of the affected communities will be informed of the reason for the disruption and the contractor will work with the service owner to effect repair in the shortest time possible. Within 1 day, written information will be provided to the village executive (or the district centres) providing details of the disruption, of alternative measures (if appropriate) and any measures that will be taken to assess any damage caused as a result of the disruption. The Community Liaison Officer will ensure that there is an announcement in public places and that notices are posted on the community notice board, such that the local residents are informed of the disruption.
- The contractor is responsible for maintenance on all work undertaken as part of the contract for 2 years following the completion of the pipeline.

The measures outlined in Table 11-5 below relate to specific issues as follows:

- I1: New roads
- I2: Upgrades and Damage to existing roads
- I3: Roads: Increase in traffic and traffic -related accidents
- I4: Road Access
- I5: Access restrictions
- I6: Open trench

- I7: Electricity and Power: Depletion of local electricity supply due to electricity use during construction
- I8: Electricity and Power: Depletion of local electricity supply due to electricity use during operation
- I9: Water: Increased pressure on water resources for construction activities, camps and AGIs
- I10: Water: Damage to community water supplies
- I11: Sewage and Waste Disposal: Increased Waste
- I12: Telecomm: Congestion of network
- I13: Extraction of Aggregates
- I14: Education

Ê ol D, d Natin . ข้ Ę al Infractri F N d Mitigatio ÷ Table 11-5 Iv

	und ladie 11-5 ampacts and	igation Measures: Local Intrastructure, Services and Naturi	l Kesources Issues
lssue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of the Hich and Modium residual imnacts)
۲	New roads		
	The project will require the use of	The construction contractor will be required to consult	New roads: beneficial
	roads, both new and existing, to transport pipe, equipment and staff to	with communities and landowners before building any new roads. In addition, many of the communities close	
	the ROW. Many communities	to potential access roads who are also within 2km of the	
	anticipate that this will result in a	pipeline route or 5km of a construction camp or pipe	
	positive impact due to the need to	yard have been consulted during the ESIA process.	
	upgrade existing roads and build new		
	roads, which will remain for community	Following construction, communities will be able to make	
	use following the completion of	a case to keep any new roads not in ecologically	
	construction.	sensitive areas. BTC Co will consider requests on a	
		case-by-case basis, in consultation with authorities and	
	The base case is that all new roads not	specific landowners impacted and taking into account	
	required during operation will be	the land acquisition impacts.	
	removed at the end of the construction		
	period.		

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	pgrades and Damage to existing ads espite extensive use of the ROW as		High and Medium residual impacts)
and <u>c</u>	pgrades and Damage to existing ads espite extensive use of the ROW as		
a De e X	espite extensive use of the ROW as		
an ex		The construction contractor will be required to document the initial condition of all roads that will be used during	Improvement to roads: Beneficial
eX	i access road, there will be use of	construction. This documentation will include	
	isting major and minor roads to	photographic evidence and will be agreed with the	
roŝ	ads are already in a very poor	contractor will be required to maintain roads to a	
0 C C	and ition, there is a community concern	reasonable standard throughout the period they are	
fur	at titese toads will be datitaged rther by construction activities and	used for construction and to ensure that all roads used are left in a condition at least as dood as found on	
lef	It in a worse condition than prior to	completion of the work.	
MC	ork beginning. This would be of major		
CO	incern, given the poor state of roads		
at	present and the importance placed		
uo	the transport network by		
CO	mmunities. The conditions of roads		
ha	is been one of the most important		
00	mmunity issues for the WKEP.		
3 2 2	oads: Increase in traffic and traffic-		
re	lated accidents		
ЧL	here will be an increase in traffic on all	Traffic safety is a high priority for the BTC project. The	Increase in traffic and traffic related
th€	e roads used for construction. On	project will seek to minimise the amount of traffic through	incidences: high
SO	me roads, particularly smaller access	communities, the distance travelled by individuals	
ĭõ	ads passing through communities,	carrying out the work and the distances over which	
ţ	is is likely to be more significant (See	equipment will need to be transported by road, through	
12	2.2.7). The duration of this impact will	maximum use of the rail network	
. De	snort-mealum term in any one place	- - - - - - - - -	
20	ven the pace at which the spreads	The construction contractor is required to develop a	
	II MOVE. THIS WIII FESUIT IN INCLEASED lisence and general disturbance for	Tramic Management Plan. The plan will take into account routes speeds times of travel beviroads in	
	mmunities as well as higher safety	terms of Incial services and delivery of goods to market	
	sks for both people and animals.	and measures to be taken to limit impacts on these key	

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and major pe ed and neck be reviewed ontractor, ar speed limit c m/hour in re i subject to j be required int workers t mill include a mill include a
the BTC si peed limit of m/hour in re subject to j e required it workers t it workers t iess raising iess raising
nt workers t nt workers t vill include ( ness raising be carried (
will include and the second se
ction 11.6)
nform comn required, a ted. Alterna able. This v as well as an itractor.

lssue	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT
No No			(see Section 12 for a discussion of the High and Medium residual impacts)
15	Access restrictions		
	During the construction phase open	The ROW will be clearly demarcated. The contractor,	Access restrictions due to open
	trenches and other construction work	with assistance of community liaison team, will be	trench: low
	will limit access along or across the	responsible for identifying the need for crossing points,	
	ROW. This will hinder access to	and reaching agreement with landowners, land users	
	grazing land or fields under cultivation.	(including migratory herders) and communities on the	
	It may also hinder access to schools,	most appropriate quantities and locations to ensure that	
	markets etc. The scale of impact will	disruption is minimised. Crossing points must be safe,	
	depend on the location of the crossing,	clearly visible and illuminated where necessary.	
	the ability to identify convenient		
	alternative crossing points, and the	All crossings of tracks and roads will be re-instated on	
	length of time the trench is open at	completion of activities.	
	these locations.		

RESIDUAL IMPACT (see Section 12 for a discussion of the High and Medium residual impacts)		Accidents involving community members: high but unlikely Accidents on open trench involving livestock: medium
MANAGEMENT AND MITIGATION MEASURES		The amount of trench open at any one time will be limited to 10 km of continuous trench or 15 km of non- continuous trench. Fences will be used close to occupied properties or sensitive areas where this is deemed the most appropriate mechanism to assure safety of people, livestock and property Fencing and illumination will be used all trench crossing points. Stockproof fencing will be erected in areas of danger for livestock. The Community liaison team will agree areas for fencing with relevant communities and livestock owners in advance of construction activities. Community Liaison teams will provide safety briefings during their meetings in every community along the route prior to construction. This will include information on road safety and also an explanation of the hazards posed by the construction activities. Briefings will also be provided to groups outside formal settlements, but within two kilometres of the construction ROW, including herder communities. In addition to this, watchmen will be employed to monitor the trench and the night-time vehicle storage areas to discourage public infringement onto the ROW.
ISSUES / IMPACTS	Open trench	The pipeline corridor will contain an open trench, averaging 2.4 meters deep, heavy machinery and spoil. See Section 5, Figure 5-12, for an illustration of an open trench. Although only construction personnel will be permitted to enter the working corridor of 44 metres, there is the possibility that community members and animals will nonetheless gain access to the ROW and trench. Danger will be increased at night. It is possible that livestock will fall into open trench.
lssue No	91	

Issue	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT
22			High and Medium residual impacts)
21	Electricity and Power: Depletion of local electricity supply due to electricity use during construction		
	Any reductions in local community access to power will have a negative	Even though the ITT allows the contractor to draw from public electricity supplies if this would not adversely immost the cubics it is probable that there will be call	Electricity and Power use depleting supply to communities: medium - high
	problems and concern among problems and concern among communities about access to power. The impact may be real, but there is	generation (using diesel) of power at construction camps, pipe yards.	draw from the local electricity network and the amount of electricity used for rail transportation)
	also likely to be an issue of perception if the project is seen as further reducing the power supply available to households.	Transparency If complaints are raised that the project's energy draw is having a negative impact on community access to power, BTC Co will provide information on monthly	Economic benefits from local purchase of diesel to use in power generation: beneficial
	The geographical distribution of any	power to individuals or organisations requesting it.	The project's payments for any local
	effects of a drain on domestic power supply depends upon how the national grid prioritises distribution in response		network electricity used will potentially benefit regional power supply as cash will be injected into the local energy
	to supply problems. Should this impact be significant, the distribution of this effect could be determined through		network, enabling increased expenditure on upgrade of the domestic svstem.
	discussion with domestic energy providers. Given that most power needs for the project will be filled through selfgeneration. it is not		Communities in the vicinity of facilities may well benefit from the projects demands for reliable supplies.
	anticipated that it will be a major issue. The amount and therefore the effect of		:
	une power drawn norn une ran gru to transport pipe and other materials is unknown at this stage.		
	Additional perceived negative impacts	CLOs will liaise with communities to address concerns	

		MANACEMENT AND MITICATION MEASUBES	
No			KESIDOAL INFACT (see Section 12 for a discussion of the High and Medium residual impacts)
	are likely to be encountered where	that may arise over the absence of any positive benefits	
	villages with no/minimal access to	in relation to access to energy.	
	power are close to facilities where		
	access to power will be continuous.		
8	Electricity and Power: Depletion of		
	local electricity supply due to		
	electricity use during operation		
	There will be self-generation (using	No mitigation measures have been designed to off-set	Electricity and Power use depleting
	diesel or gas) of power at pump and	any electricity drawn from grid to power block and check	supply to communities: low
	pigging stations and therefore no	valves during operations as impact considered minimal.	
	negative impact on the availability of		
	power to communities.	Transparency	
		It complaints are raised that the project's energy draw is having a negative impact on community access to	
	During operation if the pipeline was to	power, BTC Co will provide information on monthly	
	use its peak requirements (132	power to individuals or organisations requesting it.	
	kilowatts) constantly for a year, this		
	would equate to the annual power		
	consumption of approximately 600		
	Azerbaijanis, ie less then .01% of the		
	population and can be regarded as		
	minimal. However the effect of the		
	draw on local distribution is currently		
	unknown.		
	Additional perceived negative impacts		
	are likely to be encountered where		
	villages with no/minimal access to		
	power are close to the large AGIs		
	where power supply is continual.		

lssue	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT
No			(see Section 12 for a discussion of the High and Medium residual impacts)
61	Water: Increased pressure on water resources for construction activities, camps and AGIs		
	Most communities experience difficulties in getting sufficient clean water for either domestic or agricultural	This impact will be eliminated by identification of water sources for project use that do not affect the amount of water required for local use. Communities who use the	Community access to water restricted for a short duration: medium
	use. The primary constraint is the absence / poor quality of water pipes and pumps but water scarcity is also an	same water source as the project will be routinely consulted to understand whether there has been any negative impact on their access to water and project	Perception of inequity in water resources: medium
	issue. Hence, water used by the project could result in shortages in local	water draws adjusted as appropriate.	Economic benefit from supply of bottled water if locally supplied:
	communities, who use these sources for irrigation, domestic uses and livestock watering.	Large volumes of water will be required for hydro-testing and therefore only very substantial sources may be used. The total volume of water used for hydrotesting is not expected to have a social impact, as sources will be	beneficial
	In such locations, there is additional risk of a perceived impact if construction camps and sites are seen	carefully selected. Appropriate approvals will be sought from the regulators for hydrotest water abstraction.	
	to have access to fresh water while villages do not.	It is likely that drinking water at the camps and on the construction sites will be bottled, so there will be no use of local sources for drinking.	
110	Water: Damage to community water supplies		
	30% of villages have constant communal water supply, while 50% never receive communal water. Many communities often drink river or canal	Sediment control measures will be used on all river crossings and where water that is used for drinking is disrupted by construction activities. Where access to drinking water sources is halted by construction,	Damage to water supplies from an oil leak in pipeline: high (See 12.2.11, environmental residual impacts assessment for discussion)

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Issue	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT
No			(see Section 12 for a discussion of the High and Medium residual impacts)
	water. These are frequently already polluted, resulting in public health problems. Construction activities	alternative sources of supply will be provided to communities during the period of disruption.	Pollution of community water sources during operation: medium
	found waterways and river crossings could result in high levels of sediment in water sources used by communities for drinking purposes and render them	The pipeline design has specifically incorporated features to address the main causes of a pipeline leak, including third party interference, geohazards, corrosion etc	-
	consumption, requiring settling to consumption, requiring settling to remove the sediment. The presence of sediment would also make the water less usable for agricultural and other domestic uses besides drinking.	See section 10.4 for a description of the risk assessment procedures.	
	Albeit very small, there is also a risk of oil pollution to water supplies, either river, canal or aquifer, from a leak of the pipeline during operation. This will have a negative impact on land based livelihoods. This is discussed in further detail in 10.3.5, 10.3.7-10.3.9.	Should an emergency occur, a comprehensive oil spill response plan will also be developed to control, minimise and clean-up any pollution including rivers and other water sources in the unlikely event of pipe leakage during operation. This plan will include measures for community liaison, including grievance procedures and compensation for loss/damage to land or livelihoods in the event that a spill does occur.	
2	Sewage and Waste Disposal: Increased Waste Given that there are no waste or landfill sites in Azerbaijan that meet the international standards specified by BTC Co, it is probable that a landfill will need to be created. Sites have yet to be identified. Hence an analysis of the social impacts of these sites has not been completed as part of this ESIA	The contractors are responsible for waste management and the ITT requires these construction contractors to meet European standards for the management of waste. They will prepare detailed Waste Management Plans for the construction activities. Sites proposed for waste management will be assessed for social impacts and must meet any requirements needed for local regulatory approval.	Visual and health nuisance from smoke generated by incineration of waste: low

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	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT
•			(see Section 12 for a discussion of the High and Medium residual impacts)
	Communities do not consider waste disposal a serious issue. This is probably because other issues are seen as far more significant. However consultation will be required with communities located adjacent to proposed waste disposal sites. While the magnitude of any negative social impact related to a waste management site may be low and the impact localized, the duration will be long-term and the impact could be high if the site is badly located.	The volume sent to waste management sites will be minimised by re-use, recycling and incineration where possible. See section 10.X on the standards required on generation of smoke. Section 5 contains a description of the anticipated types and volumes of wastes arising as a result of the project.	
	around waste disposal sues. Telecomm: Congestion of network The mobile network will receive high usage during the construction process by project personnel. Fixed networks may also be used wherever they are available. Fixed and mobile infrastructures are not well developed and have been implemented for low demand. However the impact of project usage on local communities will be negligible. Only around 0.5% of those surveyed have mobile phones. 40% of villages have no access to phones or only have phones at communal points.	Discussions are being held with the fixed line and mobile network providers to inform them of the project activities and likely demand for services.	Congestion of networks: low Improved telecoms network as a direct result of the project: beneficial

lssue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of the High and Medium residual impacts)
	For the operational phase, the use of the fibre optic cable will result in minimum impact on the existing land- line network. There will be some use of mobile phones during operation. However, this is expected to have a limited impact given the small number of staff required for this phase.		
113	Extraction of Aggregates		
	The extraction of aggregates from local borrow pits will have positive social benefits in terms of economic impact for local aggregate businesses, as long as aggregate demand from the construction contractor does not restrict local access for other purposes.	The ITT has specified that construction contractors should aim to use local aggregate extraction sources. It also specifies that the contractor will need to undertake an environmental and social assessment prior to extraction.	Economic benefit from supply of aggregate: beneficial Limiting availability of supplies: low
	There will also be an increased noise, dust and visual impact from increased aggregate extraction, however the project is not expected to require large quantities of aggregate and this is therefore unlikely to be a significant impact.		

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	RESIDUAL IMPACT (see Section 12 for a discussion of the High and Medium residual impacts)		None
BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA	MANAGEMENT AND MITIGATION MEASURES		None required.
	ISSUES / IMPACTS	Education	There will be no direct impacts on educational infrastructure, as all construction workers will be employed on a single status basis. Nevertheless there are a number of potential secondary impacts in this respect: • In-migration into the project area resulting in increased pressure on schools. This is not anticipated to occur to a significant extent, as in- migration will be strongly discouraged by the project. (See section 11.6, C1) • Children of school age may replace parents with temporary construction jobs in the "family work" such as farming, animal husbandry or looking after family members. Children of school age already undertake some unpaid family work in busy agricultural seasons, particularly at harvest time. Given the existing high levels of adult unemployment and that most jobs are likely to be short term, it is not expected to be a common occurrence.
	lssue No	114	

### 11.6 COMMUNITY RELATIONS, MANAGEMENT OF CONSTRUCTION WORKERS AND CAMPS

Despite maximising local employment throughout the construction phase of the pipeline, up to 750 either foreign workers or workers who are not local to the pipeline affected communities may be required. Influxes of foreign and non-local workers based in construction camps can have a major impact on local communities, as well as attracting additional migration of people seeking economic opportunities into an area. Hence, the management of the camps themselves, and the management of community relations in connection with the camp and other construction issues is of critical importance to minimising potential impacts of the project.

This section sets out not only specific measures related to the management of the influx of foreign workers and of the construction camps, but also addresses community relations management plans in regard to the pipeline project as a whole. The community consultation process indicates that the vast majority of communities regard interaction with construction workers positively, primarily due to potential economic benefits. However there is also awareness that some issues will need to be managed carefully to avoid negative impacts that could give rise to conflicts between workers and local people.

The majority of the measures outlined here relate to the construction phase, and will be implemented by the contractor. Many of these measures have been included in the ITTs for construction of the pipeline and AGIs. They will be developed in more detail in management plans for community relations and construction camps that will be reviewed and finalised with the BTC Co. community relations team during contractor negotiations and prior to the start of construction activity. BTC Co. will be responsible for implementing measures in the operational phase.

### 11.6.1 Aspects of the project giving rise to Impacts on Community Relations

The various impacts relating to relationships between the construction workers and local communities are centred on the construction camps and the construction sites and spreads themselves, to and from which workers will be transported on a daily basis. A number of construction camps are anticipated in Azerbaijan, with potential sites identified close to Mugan<sup>10</sup>, Kurdemir<sup>11</sup>, Ganja<sup>12</sup> and Poylu<sup>13</sup>. The final number and location of construction camps will be determined by the construction contractor, and it is unlikely that all of the camps will be operating at the same time.

Each permanent camp will measure approximately 500m x 500m and will have the capacity to accommodate up to 600 construction personnel. The camps will be open in the sense that workers will generally be free to come and go, and to interact with the local communities in

<sup>&</sup>lt;sup>10</sup> KP 63

<sup>&</sup>lt;sup>11</sup> KP 128-132

<sup>&</sup>lt;sup>12</sup> KP 297-302

<sup>&</sup>lt;sup>13</sup> KP 410

their leisure time. However there will be some restrictions on these freedoms such as after hours limits on movement outside the camps. In addition full recreational facilities will also be provided within the camps to minimise the need for finding recreation in the local community. The camps will generally hold skilled and semi-skilled workers, who will be employed for significant periods of the construction phase.

There will also be interaction between communities and construction work teams along the pipeline route, and at the location of AGIs and pipe yards<sup>14</sup>.

Section 9.9.4 sets out the results of community consultation at each of the proposed locations for construction camps and pipe yards. Any other sites for construction camps will be subject to further environmental and social assessment, in line with regulatory requirements before approval by local authorities. This will be the responsibility of the construction contractors.

## 11.6.2 Identification of Impacts

Table 11-6 below lists the impacts, measures and residual impacts associated with these issues, and with the overall community relations process. The residual impacts are discussed further in Section 12.3. The community relations programme is designed to assist in the management of issues affecting communities that have been described earlier, in Sections 11.3 (impact on land and land-based livelihoods), Section 11.5 (impact on infrastructure, services and natural resources).

The impacts that are discussed in Table 11-6 are as follows:

- C1: In migration
- C2: Tension between communities and workers
- C3: Damage to local land and property
- C4: Crime & Violence arising from Drugs and alcohol
- C5: Spread of communicable diseases to communities along pipeline route
- C6: Health Provision
- C7: Positive social interaction
- C8: Community Relations general measures
- C9: Complaints Procedure general measure
- C10: Community Relations General measures

<sup>&</sup>lt;sup>14</sup> The following potential pipe yard sites were reviewed under the ESIA process: Sangachal (Umbaki) KP 2, Mugan, KP 63, Kurdemir KP128-132, Udjar KP 175-177, Leki KP 205, Guvekend KP 205, Yevlah KP 231, Ganja KP 297-302, Deller KP 340, Zeyem KP 354, Puylu, KP 410, Boyuk Kesik KP 440. Further sites as Kazi Magomed, and Baku have since also been identified.

Table 11-6 Impacts and Mitigation Measures: Construction Personnel and Community Relations

<b>JUSSI</b>		MANAGEMENT AND MITIGATION	RESIDUAL IMPACT
NO		MEASURES	(see Section 12 for a discussion of the High and Medium residual impacts)
	CONSTRUCTION		
C1	In migration		
	Experience shows that it is highly	In migration in search of employment opportunities	In-miaration: medium
	likely that people will be attracted	will be actively discouraged by the construction	0
	to areas around construction	contractor and BTC Co. through implementing and	
	activities seeking to sell goods and	publicising the recruitment strategy outlined in	
	services ranging from food to	section 11.4 as early as possible. This gives	
	prostitution. This could cause	preference to candidates from pipeline affected	
	tension with local communities,	communities and specific job descriptions for semi-	
	limit opportunities for local	skilled and skilled work (see section 11.4).	
	businesses, lead to the		
	establishment of informal	Recruitment will only take place at designated	
	settlements in the vicinity of the	centres and not via informal requests or approaches	
	project area, increase competition	from community members either at construction	
	for public services and resources,	camps or on the route.	
	and increase the potential for the		
	spread of diseases and illegal	The construction contractor will publicise the fact that	
	activities including drugs use.	no goods needed for the project will be purchased	
		Informally at camp locations of work sites, but	
	Areas of Impact: This would be	instead through formal contracts with suppliers.	
	most likely to occur in the vicinity of	Informal settlements close to camp boundaries will	
	construction camps, i.e. Mugan,	be reported to the relevant authorities.	
	Kurdemir, Ganja, and Poylu.		
ຍ	Tension hetween communities	Overall Management of Construction Workers	
40	and workers		
	Cultural differences. behaviour by	The employment policies defined in Section 11.3	

NO         MEASURES         MEASURES         Resolution 12 for a clausarion of th and Medium residual impacts)         Resolution of the and Medium residual impacts)           nonstruction workers, potential reasking of coal cultural norms, potential for possition, and the attraction of hangers or at camp, and the workers and camps. This socio-cultural values.         above to maximise job opportunities for local people attraction of hangers or at camp. Socio-cultural values.         Tension between communities, workers potential for position, and the and the workers and camps. This socio-cultural values.         project. medium.           not workers and camps. This and the workers and camps. This and the workers and camps. This socio-cultural sensitivities and mitigation measures, and in part also on the origin of the origin and the origin or onstruction camps 15. The construction camp 15. The construction camps 15. The construction camp 26. The c	ISSUE	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION	RESIDUAL IMPACT
construction workers, potential     above to maximise job opportunities for local people     Tension between communities, workers, potential for postitution, and the group ot and the potential for postitution, and the group ot an earny state could lead a currant and attraction of 'hangers on' at camp sites could lead to increase and the workers and communities, workers and the workers and communities on camp management rules and overall discipline and curtural awareness. This will include:     Project, medium.       and the workers and communities for nonzing management rules and overall and the workers and communities and the workers and in part also on the origin of the workers and in part also on the origin of the workers and in part also on the origin of the workers and the workers and the workers and the workers and community relations orientation. The objective also on the origin of the workforce above of Conduct. <ul> <li>a briefing on Camp Rules</li> <li>a community relations orientation. The objective and the workforce above of Conduct.</li> <li>a community relations orientation will be to increase awareness about the origin of the workforce of Conduct.</li> <li>a wareness raising on health considerations, including community relations orientations.</li> <li>The construction camps 1<sup>s</sup>.</li> <li>The construction camp the local second conduct.</li> <li>a wareness raising on health considerations, including community lision</li> <li>Community lision</li> <li>Bislophine</li> <li>Community lision</li> <li>Community lision</li> <li>Community lision</li> <li>Community lision</li> <li>Community lision</li> <li>Community lision</li> <li>Commun</li></ul>	Ŋ		MEASURES	(see Section 12 for a discussion of the High and Medium residual impacts)
<ul> <li>breaking of local cultural norms, potential for prostitution, and the attraction of hangers on at camp attraction of hangers on at camp rate attraction of hangers on at camp retraction on the orgin of the workers and camps. The scale of this impact will depend on successful implementation of milgigation measures. and in part also on the origin of the workforce staying in construction camps 15. The construction camp 16. The construction camp 15. The construction camp 25. The constructio</li></ul>		construction workers, potential	above to maximise job opportunities for local people	Tension between communities, workers and the
<ul> <li>attraction of 'hangers on' at camp attraction of 'hangers on' at camp sites could lead to increased and the workers and camps. The and the workers and camps. The and the workers and camps. The and the workers and camps. The scale of this impact will depend on successful implementation of mitigation measures, and in part also on the origin of the worker also on the origination staying in construction camps 15, the construction contractor is required in the pipeline ITT to develop a Construction Camp Management Plan to address:</li> <li>Community liaison</li> </ul>		breaking of local cultural norms,	will help to minimise tensions caused by different	project: medium.
attraction or nangers on a camp state scole dat bi increased and the workers and camps. The scale of this impact will depend on successful implementation of miligation measures, and in part also on the origin of the workforce staying in construction camps <sup>15</sup> . The construction camps <sup>15</sup> . The construction camps <sup>15</sup> . The construction camp success including communicable diseases awareness including communicable diseases. The construction camp success including communicable diseases. The construction camp succing miligation) and the develop a Construction camp management plant black distribution (see <i>employment and local</i> sourcing miligation) a Communicable diseases and the develop a construction (see <i>employment and local</i> sourcing miligation) a Communicable diseases and the develop a construction (see <i>employment and local</i> within the Construction Camp Rules will be required within the Construction Camp Rules will be required		potential for prostitution, and the	socio-cultural values.	
Iraining will be provided to all sart, both national and tension between local communities and the workers and camps. The scale of this impeat will end curtural awareneess. This will include: scale of this impeat will end curtural awareneess. This will include: a community relation so interation. The objective of this orientation will be increase awarenees about the local area, cultural sensitivities and the workforce staying in construction camps <sup>15</sup> . The construction camps <sup>15</sup> . The construction camps <sup>16</sup> . The construction camp will be provided to the code of Conduct to develop a Construction Camp Management Plan to address. Discipline the code of Conduct the construction camps <sup>16</sup> . The construction camp address. The construction (see employment and local sourcing mitigation) and the conduct and camp Rules will be required within the Construction Camp Management Plan.		attraction of nangers on at camp		
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<ul> <li>including communicable diseases.</li> <li>The construction contractor is required in the pipeline ITT to develop a Construction Camp Management Plan to address: <ul> <li>Discipline</li> <li>Discipline</li> <li>Community liaison</li> <li>Ethnic tensions</li> <li>Market distortion (see employment and local sourcing mitigation) and</li> <li>Communicable diseases</li> <li>A Code of Conduct and Camp Rules will be required within the Construction Camp Management Plan.</li> </ul> </li> </ul>			<ul> <li>awareness raising on health considerations,</li> </ul>	
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<ul> <li>Discipline</li> <li>Community liaison</li> <li>Ethnic tensions</li> <li>Market distortion (see <i>employment and local sourcing mitigation</i>) and</li> <li>Communicable diseases</li> <li>A Code of Conduct and Camp Rules will be required within the Construction Camp Management Plan.</li> </ul>			Plan to address:	
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<ul> <li>Market distortion (see employment and local sourcing mitigation) and</li> <li>Communicable diseases</li> <li>A Code of Conduct and Camp Rules will be required within the Construction Camp Management Plan.</li> </ul>			<ul> <li>Ethnic tensions</li> </ul>	
<ul> <li>sourcing mitigation) and</li> <li>Communicable diseases</li> <li>A Code of Conduct and Camp Rules will be required within the Construction Camp Management Plan.</li> </ul>			<ul> <li>Market distortion (see employment and local</li> </ul>	
Communicable diseases     A Code of Conduct and Camp Rules will be required     within the Construction Camp Management Plan.			sourcing mitigation) and	
A Code of Conduct and Camp Rules will be required within the Construction Camp Management Plan.			<ul> <li>Communicable diseases</li> </ul>	
within the Construction Camp Management Plan.			A Code of Conduct and Camp Rules will be required	
			within the Construction Camp Management Plan.	

(1) Semi-skilled and skilled workers will be housed in the construction camps. Unskilled workers will generally be sourced from the local communities and will therefore not require housing.

	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION	RESIDITAL IMPACT
NO		MEASURES	(see Section 12 for a discussion of the High and Medium residual impacts)
		<ul> <li>These will include the following:</li> <li>limits on hours of movement outside of camps</li> <li>no access to camps by non-authorised</li> <li>personnel and use of security passes for</li> </ul>	
		<ul> <li>workers</li> <li>zero tolerance of illegal activities including use of illegal drugs by construction personnel</li> </ul>	
		<ul> <li>no hunting, fishing or unauthorised gathering</li> <li>zero tolerance of bribery or requesting gifts</li> </ul>	
		trom communities. Any "gitts" to be immediately reported. This policy must be in line with the BP's policy on Ethical Conduct	
		<ul> <li>no use of camp vehicles for non-work business</li> </ul>	
		<ul> <li>no use of personal vehicles for work business (safety and liability issues)</li> </ul>	
		<ul> <li>a strict policy with respect to alcohol</li> </ul>	
		consumption	
		<ul> <li>rules on access to, and use of camp entertainment facilities if these are to be</li> </ul>	
		opened up to neighbouring communities	
C3	Damage to local land and	The general mitigation measures outlined above for	Tension between communities, workers and the
	property	C2 will help to manage the behaviour of workers and minimise the likelihood of this impact.	project: medium.
	Lack of control over the		
	movements of construction staff		
	(during and after working hours)		
	could result in trespassing and		
	damage to local land and property.		
	I his lack of control could also		
	result in residents feeling		
	vulnerable to the behaviour of		
	construction personnel as well as		

SSUE VO	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of the High and Medium residual impacts)
	create a sense of their privacy		
	being invaded. Such reactions will		
	however depend on the on-going behaviour of construction staff and		
	the extent to which local residents		
	feel comfortable about their		
74	Crime & Violence arising from		
-	Drugs and alcohol		
	)	Limited quantities of alcohol will be available to	Tension between communities, workers and the
	There is a possibility of some	workers within the camps, to discourage them from	project: medium.
	incidents of construction workers	seeking alcohol outside the camps. The contractor	
	obtaining and consuming illegal	will be required to have a programme for drug and	
	substances and/or excessive	alcohol abuse prevention and random testing that is	
	amounts of alcohol in communities	equivalent in scope and objectives to the . Drug and	
	along the route. This can have a	Alcohol Abuse policy. There will be a zero tolerance	
	negative impact on communities by	policy of drunkenness on the ROW.	
	increasing incidents of crime		
	and/or violence and threats to the	As part of the community relations plan, the Code of	
	safety of community members.	Conduct will be publicised in settlements potentially	
		affected by the construction camps. This will help	
	Most likely to be an issue in	ensure that the local residents are aware of the	
	villages nearest to construction	expected behaviour of construction staff. Posters	
	camps, i.e. Mugan, Kurdemir,	with the Camp Rules will also be posted in	
	Ganja, Poylu	neighbouring settlements.	
		Construction camps will provide entertainment	
		facilities for workers to encourage them to remain	
		within the camp boundaries during leisure time.	

ISSUE NO	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of the High and Medium residual impacts)
C5	Spread of communicable diseases to communities along pipeline route		Increase in diseases: medium
	There is a strong likelihood that there will be prostitution associated with camps, as is common for all large construction projects. This carries a risk of the spread of	The Construction Contractor will operate a personal health programme in order to prevent illness or disease occurring or spreading, including immunisations if required.	Improved health awareness: beneficial
	communicable diseases, either to workers on the project or to the prostitutes that move into these areas.	BTC Co will develop a community outreach programme on communicable diseases, eg HIV/AIDS. This is likely to be in partnership with a local expert NGO.	
	Azerbaijan) Azerbaijan) There is also a risk that the existence of the construction workers and their interaction with	<ul> <li>The construction contraction is required to provide:</li> <li>Health awareness training for workers including communicable diseases at induction and then periodically throughout construction.</li> <li>Awareness raising on communicable diseases for communities close to camps (via posters, leaflets, communities close to camps (via posters, leaflets, communities close to camps)</li> </ul>	
	introduce new diseases to the country or the region, or might significantly increase the rate of transfer from one community to another.	<ul> <li>Itaison with local medical authorities</li> </ul>	
	Villages nearest to construction camps will be most affected, i.e. close to Mugan, Kurdemir, Ganja, and Poylu.		

ISSUE NO	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of the High and Medium residual impacts)
C6	Health Provision		
	There is a risk of a perceived	Medical facilities within camps will not be made	Perceived inequity in health provision: medium
	indirect negative impact of	available to local communities in general. However,	
	increased resentment towards the	workers, including local workers, will be able to use	
	project and project team where	the project's medical facilities and this will reduce	
	communities see that construction	demand on the existing community health services	
	Workers are provided with superior	for the auration of construction in each community s	
	realiti actinues to which the community has no access. This	alea.	
	will also increase frustration at the	The community investment programme, discussed in	
	poverty of the services available to	Section 13, may involve projects to improve local	
	them.	health care infrastructure.	
C7	Positive social interaction		
	· · ·		Access to new cultures and international
	Interaction between workers and	None, beyond community relations induction listed	attitudes: beneficial
	communities can be a positive	above.	
	benefit, bringing information and	· · · · · · · · · · · · · · · · · · ·	
	ideas to relatively isolated	Individual events may include community cultural or	
	communities.	sporting events etc.	
	However, the mitigation measures		
	defined above that are required to		
	counteract the negative impacts of		
	construction workers in the area		
	may limit the scale of this positive impact		
C8	Community Relations – general		Tension between communities, workers and the
	measures		project: medium.
	There could be a cumulative	The construction contractor will be required to submit	
	negative community impact	a Community Relations Plan for review and approval	
	deriving from the negative impacts	DY BIC CO. INIS IS DESCRIDED IN TURNER DETAIL IN THE	

ISSUE	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION	RESIDUAL IMPACT
NO		MEASURES	(see Section 12 for a discussion of the High
	outlined in all sections within this Chapter. This could result in a poor	Public Consultation and Disclosure Plan (PCDP), in the Appendices.	
	between the community and BTC	The construction ITTs require the contractor to	
	the Construction workers.	integrated into a joint BTC Co/Contractor team lead	
		ру а соттилту кегацолs маладег героглад to tne BTC Co. The Community Relations Manager will be	
		in place early enough to oversee the development of management plans and carry out community liaison	
		in relation to preparatory construction activities.	
		Community Liaison Officers employed by the	
		construction contractor will work alongside the	
		construction activities (re carinos, pipeline and Act construction). The leader of this team will be in place	
		at least 6 months before construction commences,	
		and the full team will be in place at least two months prior to the start of pipeline or camp construction.	
		-	
		For further details of the structure and roles of	
		Rection 5 in the PCDP annexed in Part 8 of the	
		Technical Appendices. In addition to a community	
		relations plan, BTC Co. will implement a community	
		invesument programme for pipeline allected	
	_	communities in order to merp maintain positive relationships. This is discussed in further detail in	
		Section 13.5.1.39.	
		Colortad land affinance until also ramain tha main t	
		selected land onlicers will also remain the main point of contact for communities on property and land	
		issues during construction to monitor and assist the	

ISSUE NO	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of the High and Medium residual impacts)
		construction contractor's pre-entry agreement procedure and final re-instatement sign-off with owners and users and for resolving outstanding issues. They will report to the Community Relations Manager that BTC Co. plan to have in place prior to construction.	
లి	<b>Complaints Procedure General</b> <b>Measure</b> Despite mitigation measures outlined in this section and in earlier management and mitigation sections, there are likely to be incidences where community members will want to make formal complaint, e.g., to record an incident of poor worker behaviour in a community, to apply for compensation as a result of damage to property etc.	The Contractor will aim to minimise formal complaints through the use of community liaison mechanisms outlined above. However, a formal complaints procedure will be set up to record and address any complaints. A nominated individual (normally the Community Liaison Officer) will be provided for community Liaison Officer) will be provided for community Liaison Officer) will be at community meetings and via posters to all community meetings and via posters to all communities in the vicinity of the working area, construction camps and close to roads that will experience significant increases of traffic movements. The telephone will be answered in person whenever possible during working hours and recorded at all other times. Details of the complaint, source, its location and date/time of offending event must be recorded. The Contractor's Community Liaison Officer and/or the Community Relations Supervisor will investigate the complaint. The location of the community liaison team will also be widely publicised	Complaints procedure: beneficial The aim of these mitigation measures is to establish a legacy of trust and good relations with communities.

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ISSUE NO	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of the High and Medium residual impacts)
		The communities will also be provided with contact numbers for the BTC Co Community Relations Manager in the event that the Contractor does not satisfactorily handle a complaint.	
		BTC Co. will respond to all complaints that are received from local community members or local authorities within two weeks at the latest. The resolution of any complaints will be dealt with as speedily as possible. Full details of the complaints procedure are contained in the PCDP in the Appendices.	
	OPERATIONAL PHASE		
C10	Community Relations – General measures		
	A community liaison team will be required to manage community relations during the operational phase. It is not expected that dav-	Good community relations are key to the inherent security of the pipeline and this is recognised by the Project, and will be reflected in the Community Relations Plan for operations	No direct negative residual impact anticipated. Additional money injected into communities from wages: beneficial
	to-day operations will create any negative community relations	A community relations team will be in place during	
	impacts. However communities will expect to be kept informed of	<ul> <li>operation of the pipeline. This team will</li> <li>hold regular meetings with communities;</li> </ul>	
	activities surrounding the pipeline	<ul> <li>maintain awareness of safety issues;</li> </ul>	
	and rande to up this will create a small amount of hostility towards	<ul> <li>monitor the pipeline route to ensure compliance with land use constraints;</li> </ul>	
	the project.	<ul> <li>provide monthly reports to the Operations Management on issues arising from community</li> </ul>	
	In the event of a safety incident, the communities' information needs will be even more important	liaison; and report breaches of safety or land use constraints, or serious disputes.	

ISSUE NO	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of the High and Medium residual impacts)
	to minimise any safety related impacts (for both persons and	Full details of the general community relations	
	livelihoods) and to minimise negative feelings towards BTC Co.	measures are contained in the PCDP in Part 8 of the Technical Appendices.	
	A number of workers during the		
	operational phase are likely to be		
	drawn from the local communities,		
	such as for the pipeline patrol		
	teams that monitor the line. This		
	will have a beneficial economic		
	impact to both the project and to		
	local communities through local		
	employment while also enhancing		
	awareness of the pipeline amongst		
	the communities, so enhancing		
	inherent security		

## 11.7 SAFETY AND NUISANCE IMPACTS

The community consultation process has indicated that levels of concern about safety and nuisance issues are relatively low along the whole of the proposed route. This rather surprising fact can be attributed in part to the fact that communities are not fully aware of the nature and extent of this disturbance, and also that their hope of employment on the project leads them to downplay these potential negative impacts. It is anticipated that the level of concern regarding safety and nuisance will rise once construction has commenced. In particular, while it is considered that the likelihood of a safety incident involving a community member is very low, if one indeed takes place it will have a significant negative impact on the community itself and on community attitudes towards the project

Most of these issues covered in Chapter 10, Assessment of Potential Environmental Impacts:

- 10.3.3: Air quality (including dust)
- 10.3.4: Noise
- 10.3.10: Landscape and Land-use (including visual impacts)

The remaining safety and nuisance mitigation measures without an environmental facet have been integrated into others areas of Section 11 as follows:

- 11.4 I5: Access Restrictions
- 11.4 I6: Open Trench
# **RESIDUAL IMPACTS**

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12.2 Env	vironmental residual impacts	12-1
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12.3 Res	idual social impacts	
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	1 L	

# 12 **RESIDUAL IMPACTS**

# 12.1 Introduction

Section 10, Environmental Impacts and Mitigation, and 11, Social Impacts and Mitigation described the potential impacts that would occur along the route as a result of different phases of the project and how the proposed mitigation measures would contribute to minimising or eliminating the impacts. As discussed, not all impacts can be fully mitigated and residual effects will be experienced by the environmental and social receptors affected by the project.

This Section discusses and summarizes the potentially significant environmental and social residual impacts of the BTC project, ie, those identified as **High** or **Medium** in Sections, 10 Environmental Impacts and Mitigation, and 11, Social Impacts and Mitigation. Residual impacts are the effects that will, or may arise as a consequence of the project after implementation of the mitigation measures. Where necessary, this Section identifies activities that will determine the nature or extent of particular residual impacts that are not yet fully defined. The management plans outlined in Section 14, Management and Monitoring, have been designed to ensure effective implementation of the mitigation measures are being have been designed as a mechanism to record whether the mitigation measures are being correctly implemented and are working effectively.

The methodology used to define the significance of each residual impact is provided in Section 7.

The objectives of this Section are to:

- detail the **Medium** and **High** significance residual impacts
- describe why it has not been possible to mitigate these **Medium** and **High** residual impacts
- outline programmes for providing offset benefits in relation to these residual impacts

The discussions in this Section are structured generally in order of the severity of the residual impact.

# 12.2 Environmental residual impacts

# 12.2.1 Introduction

This Section summarises the residual environmental impacts as:

- High (H) or Medium (M) significance
- Unknown (U)
- Beneficial (B)

It should be noted that the designation of **High** and **Medium** rankings to unplanned events (i.e. an oil spill) is subjective, but based on experience and professional judgement. The strict application of the severity/consequence tables in Section 7.10 is not considered appropriate for unplanned events as these vary in magnitude and consequence depending on the location, size and duration of the event.

Following completion of the initial environmental impact assessment, a constructability review was undertaken by a multi-disciplinary team at many of the locations associated with residual impacts scored as **Medium** or **High**. The review included an assessment of alternative measures for these sites to reduce the level of residual impact. Alternative measures assessed included:

- different crossing techniques for rivers
- a reduced ROW in some short sections
- reduced separation distance between SCP and BTC pipeline in some locations
- the possibility of dual laying specific sections of the SCP and BTC pipelines

The results of this review have been incorporated into the mitigation measures described in Section 10, Environmental Impacts and Mitigation, and are discussed in more detail in this Section.

# 12.2.2 Ecology

#### 12.2.2.1 Habitats

The IFC's Natural Habitats Policy (OP 4.04) includes measures to protect 'critical natural habitats'. Critical natural habitats are defined as including areas proposed by governments as protected areas. It is therefore necessary to consider potential impacts on the proposed Gobustan State National Park in the context of the Natural Habitats Policy. The policy requires project sponsors to avoid critical natural habitats. Only if this is not possible should impacts be reduced by the application of direct mitigation measures and the provision of offset compensation.

The extensive nature of the Gobustan desert and the proposed Gobustan State National Park and their proximity and position substantially surrounding the Sangachal Terminal means that it is not possible to completely avoid these areas with any pipeline route from the terminal. In accordance with the IFC's Natural Habitats Policy (OP 4.04) alternative routes have been assessed (Section 4, Project Alternatives) and the shortest route has been taken across the proposed State National Park. 9km of the pipeline route is within the proposed Gobustan State National Park area (KP19.5 to 28.5) and a further 19.5km (KP0 to 19.5) through nondesignated, but botanically sensitive, desert habitat. It is also relevant to note that the areas crossed by the pipeline route are sometimes significantly degraded due to human activity, traffic, other infrastructure (eg existing pipelines), farmsteads, and military use.

The mitigation measures outlined in Section 10 will considerably reduce impacts on the habitats and soils of the desert, but the residual impact on the Gobustan desert habitat is classified as **High** as it is expected to take over 10 years to fully reinstate.

In order to minimise the impact on the Gobustan desert, various alternative working methods have been considered, including:

- topsoil stripping the entire ROW, storing the topsoil and then reinstating
- only removing topsoil from the trenchline and running vehicles direct on the existing vegetation

For the section between KP5 and 27, the second alternative is proposed because:

- it allows a reduction in the ROW and therefore the extent of habitat disturbance
- the topsoil horizon containing the seed bank is particularly thin in this area, so it reduces the risk of topsoil and subsoil mixing and therefore dilution of the seedbank
- it reduces the risk of wind erosion which would also deplete the seedbank

From KP27 to KP28.3 (the edge of the proposed Gobustan State National Park) the ROW will be dictated by the definition of a safe working platform along the Mud Volcano ridge. This is still being evaluated but is likely to be similar to that proposed for KP5 - 27.

After installation of the pipeline the ground will be lightly scarified. Revegetation will be primarily by germination of indigenous seeds entrained in the topsoil, but may be supplemented by seeding with locally sourced material. A specialist in the reinstatement of arid environments is currently evaluating potential seed sources, application methods and sowing rates. Information from this study will be supplied to the construction contractor and will be incorporated into the detailed reinstatement plan for Gobustan

The recovery of the Gobustan desert habitat will be monitored during the operations phase until fully reinstated. Corrective action will be taken as necessary to ensure that the developing flora reflects undisturbed adjacent areas and is not dominated by ruderal species.

In addition to the above direct mitigation measures, in order to meet the 'no net loss' principle the BTC owners have developed an Environmental Investment Programme (EIP) as discussed in Section 13, Cumulative Impacts. Wherever possible, the EIP will go further than mitigating adverse effects and has the dual objectives of maintaining or, where desirable, enhancing biodiversity and the provision of environmental additionality. The restoration of an area of desert habitat is under consideration as part of the EIP and would offset the temporary habitat loss within Gobustan.

#### 12.2.2.2 Spur-thighed tortoise

Further field surveys are currently under way (April 2002) to identify the precise location of tortoise burrows in relation to the pipeline works. A translocation plan will be developed in conjunction with Institute of Zoology and other organisations and implemented before construction in these areas. At the identified locations an ecologist will be on site during construction to provide ongoing advice about tortoise management and to assist with animal recovery, if any are found within the ROW. If fully successful, the impact on the spur-thighed tortoise population will be **Low**. However, dependent upon the season that construction occurs in these areas there is a residual risk that hibernating tortoises may be disturbed by grading activities It is also recognised that there is a mortality risk attached to moving tortoises to safety. Because of these risks, and the sensitivity of the species, the overall potential impact on the spur-thighed tortoise is classified as **Medium**.

A spur-thighed tortoise augmentation programme is under development as part of the ACG upstream development and is described in the EIP, Section 13, Cumulative Impacts. This conservation programme includes a captive breeding effort with the objective of breeding the animals and subsequently releasing reared individuals to the wild, thereby adding to currently viable populations in Azerbaijan. The EIP is being developed and implemented with the assistance of specialists with previous experience of conducting such programmes. The spurthighed tortoise was highlighted among the red-listed fauna identified in the project activity area, because:

- the species is nationally and internationally protected (red-listed)
- the species is included in International conventions such as the Convention on the International Trade of Endangered Species (CITES), to which Azerbaijan is a signatory
- individuals of the species are considered to be most vulnerable to, and unable to avoid, direct construction impacts
- the hibernation pattern of the species makes it particularly vulnerable to excavation activities during construction

Azerbaijani scientists and NGOs will be closely involved with the development of this programme and local educational institutions will be included in the programme's implementation. This conservation programme is meant not only to educate people regarding this species, but also to introduce conservation in general and in practice to the pipeline corridor area and beyond.

#### 12.2.2.3 Glabrose liquorice

Wherever possible glabrose liquorice (*Glycyrrhiza glabra*) will be translocated from the area of pipeline construction to a suitable receiving site and subsequently replaced once ground profiles have been reinstated. However, it may not be practical to undertake mitigation measures for each recorded location. In this case, the largest affected populations will be determined and sufficient specimens will be translocated to ensure that there is no long-term effect on the population size. With this approach there will therefore be a short term **Medium** impact on the population, but assuming establishment is successful, there will be **No** long-term impact

# 12.2.3 Landscape

At the locations along the route where extensive grading is required to provide a level working area, the residual impact of pipeline construction on topography is classified as **High** as it is a permanent change. This particularly applies to the Mud Volcano Ridge area (KP26 – 28), the approaches to the Tovuzchay and Asrinchay Rivers (KP375.6 – 377), the approaches to the Hasansu River (KP395.9 – 398). The visual impact of the flattened ridges will be minimised by:

- Reducing the separation distance between the BTC pipeline and SCP (see Section 13, Cumulative Impacts)
- Consideration of dual lay of the BTC pipeline and SCP
- Considering potential visual impacts when selecting spoil disposal locations if required
- Grading the edges of the levelled platform where practical

At these locations it will not be possible to return the topography to its pre-existing form as this may exacerbate erosion risks and would make access along the pipeline for inspection, maintenance or emergency response more difficult.

Immediately following construction the significance of the residual impact on the landscape and visual amenity around the pump station is assessed as being **High**. This will reduce to **Medium** after approximately five years once the proposed landscaping has developed and visually breaks up the outline of the facility. More extensive screening is not considered appropriate because trees are sparse in the local landscape, and because the land surrounding the pump station is valuable agricultural land and it is necessary to balance the visual impact against the local agricultural and economic requirements.

# 12.2.4 Archaeology

Pipeline construction has the potential to affect the archaeological record by physically damaging part or all of an archaeological monument but also offers potential benefits as discussed in Section 12.2.10.2. Evaluation of potential archaeological areas is ongoing so at this stage it is not meaningful to attach significance levels to the potential impacts on individual sites.

It is, however, relevant to note that the pipeline route cannot completely avoid the Gobustan Cultural Reserve due to its extensive nature and location in relation to the Sangachal Terminal. The Azerbaijani Ministry of Culture has applied to UNESCO for the Gobustan Cultural Reserve to become a World Heritage Site. The application is currently under review. To minimise impacts the pipeline has been routed as close to the boundary as possible, through a relatively disturbed area and away from known locations of archaeological significance. The distance of the pipeline route across the reserve has been minimised to approximately 900m. Trial trenching will be conducted in this area to determine if there are any archaeological features present and a mitigation strategy will be developed in accordance with the Cultural Heritage Management Plan (Part 2a, Baseline Appendix).

The BTC Owners are currently discussing the possibility of working in conjunction with the Azerbaijan Ministry of Culture to develop a management plan for the Gobustan Cultural Reserve. This would result in a long term positive impact and a legacy for the future. Positive archaeological residual impacts are discussed further in Section 12.2.10.2.

# 12.2.5 Soils

## 12.2.5.1 Soil erosion

As discussed in Section 10, Environmental Impacts and Mitigation, the significance of the residual impact of construction activities on soil erosion will generally be **Low** after reinstatement in accordance with the Reinstatement Plan. However certain areas crossed by the pipeline are particularly prone to erosion and any soil disturbance in these areas could initiate a significant increase in present erosion rates. In these areas the significance of the residual impacts can only reasonably be mitigated to a **Medium** level. Such areas are:

- certain parts of the Gobustan desert (low ridges and banks of wadis)
- narrow ridges (Mud Volcano Ridge and Hasansu River approaches)
- badland areas west of Ganja

Mitigation is proposed in line with the Reinstatement Summary Plan (Part 5, Technical Appendix). Following trench backfill and topsoil replacement, erosion matting will be installed where appropriate to provide immediate protection to the slope against erosion, prevent washing out of seeds and enhance the micro-climatic conditions in the soil for plant growth.

In order for erosion to be minimised, a uniform pattern of water infiltration into the soil needs to be obtained. This is best achieved through the establishment of a uniform cover of ground vegetation. However, in the badlands and ridge areas, it may be difficult to establish vegetation in the short term and hence keep erosion to an acceptable level.

It has not been possible to route the pipeline so that it does not cross the Mud Volcano Ridge feature, as this terrain constraint is oriented in a north-south direction. This area is particularly subject to considerable wind erosion, which could lift the edges of the erosion matting pegged to the loose unconsolidated soils. Hydroseeding is being considered as an alternative method of stabilisation in such areas.

The ridges and badland areas generally support fragile vegetation, which may take a considerable time to re-establish following reinstatement (see discussion on Gobustan desert above). This will have the effect of reducing the stabilising effects of the root structure from the vegetation and a uniform pattern of water infiltration will be more difficult to establish.

Consideration will be given to various native seed mixes to determine which may re-colonise these areas most effectively and provide the most efficient erosion prevention.

SCP construction in the same corridor as BTC potentially exacerbates the potential for soil erosion on the narrow ridges and badland areas as the period of disturbance is prolonged. This cumulative impact will, however, be reduced at the Mud Volc ano Ridge by the installation of both the BTC pipeline and SCP at the same time. Once reinstatement of this ridge is complete all further construction traffic will be diverted around the completed section, in order to aid rapid restoration and minimise erosion. In order to minimise the impacts upon the ridge a reduced separation distance between the BTC pipeline and SCP will be adopted.

Consideration is also being given to dual lay (laying both pipelines at the same time) at the Hasansu River crossing and at the ridges approaching the Azrinchay.

#### 12.2.5.2 Topsoil degradation

The residual impact of topsoil degradation in the Gobustan region is considered to be **Medium**. Vehicle movements and clearance due to initial grading of the ROW will disturb the thin topsoil and seed bank in the sensitive Gobustan desert environment.

In order to minimise the impact to topsoil in Gobustan, various alternative mitigation methods have been considered, as outlined in Section 12.2.2.1, Habitats. Such mitigation measures are unlikely to reduce the residual impact to **Low**, but will minimise the extent of the impact as far as practical.

Cumulative impacts with SCP are significant in terms of topsoil degradation in the Gobustan region, since topsoil stored outside KP5-27 (but still within the fragile desert environment) will be subject to an extended period of storage. This will result in an increased degradation in the viability of the seed bank. Residual impacts and mitigation for this issue are discussed further in Section 13, Cumulative Impacts.

#### 12.2.5.3 Permanent loss of soil/agricultural land

Construction of the pump station and helipad will necessitate construction of a built-up platform on topsoil and subsoil and hence the permanent loss of agricultural land. In a local context permanent loss of agricultural land at the pump station is considered to constitute an impact of **High** significance. However, though of local importance, loss of productive agricultural land in regional terms is less significant, therefore the residual environmental impact is considered to be **Medium**. Residual social impacts of loss of land are described in Section 12.3.

In addition construction of other AGIs, new access roads to AGIs, and upgrading of existing roads (where such upgrading includes widening) will entail or require the excavation of topsoil and subsoil which will be permanently lost from its point of origin. In some cases, such as the construction of the pump station, described above, this will also entail loss of agricultural land. In other areas, this may entail loss of local habitat and natural soil layers. In a regional context, impacts at other facilities are considered to be less significant than in a local context as the total area affected represents only a small percentage of the surrounding (similar) habitat and/or productive agricultural land. Therefore, although habitat and/or agricultural land is permanently lost, the residual impact is considered to be **Medium** and further mitigation in terms of compensation or habitat creation is not considered necessary. It is also anticipated that viable topsoil removed from such areas will be reused wherever possible.

#### 12.2.5.4 Compaction

The residual impact of compaction of soils following reinstatement is determined to be of **Medium** significance. Experience from the WREP has shown that, particularly in the desert and semi desert areas, it is not possible to restrict local traffic from using the reinstated ROW. Hence in many non-agricultural areas the ROW has become a frequently-used track for local vehicles. This has the effect of increasing the compaction of the soils on the ROW and also impeding biorestoration and vegetation establishment. This will be particularly significant in the sensitive Gobustan desert where a significant period will be required for vegetation to reestablish even in undisturbed areas (see discussion above).

Maintenance of the pipeline will require limited movement of vehicles along the permanent easement, which will lead to some disturbance and compaction of the soils. However, this will be minimal and will not cause a significant impact. The majority of normal pipeline surveillance will not require vehicular access.

However, in very sensitive areas along the pipeline, particularly the fragile Gobustan desert, the BTC owners are assessing a number of ways to eliminate usage of the ROW by local vehicles. Options include:

- Education of the local inhabitants
- Encouraging the locals to use the numerous tracks that exist in many areas, including Gobustan

Further mitigation is not considered to be practicable and the residual impact will be of **Medium** significance.

# 12.2.6 Watercourses

Mitigation measures employed during construction have reduced the potential impact on most of the rivers crossed by the BTC pipeline to **Low** significance, but there are three rivers where residual impact remains **Medium** and further mitigation is not practicable. Each of the three river crossings, where residual impacts remain **Medium**, are discussed below.

#### 12.2.6.1 Djeyrankechmes (KP9)

This is a deep wadi in the Gobustan desert which is often dry, but liable to flash flooding during periods of heavy rain. During the period when it is flowing, it has a high sediment load. It exhibits poor bank stability at the crossing point, with the western bank being a 10m high vertical cliff of unstable clay rich sediment. It is proposed to open cut this river which

will cause a **Medium** visual impact as it will not be possible to recreate the vertical sand cliffs without compromising ground stability and therefore pipeline integrity.

There will also be a short-term and very localised impact on flora and fauna as the vegetation within the riverbed provides a varied habitat and the banks provide sites for nesting birds. However, following sensitive reinstatement it is likely that the extent and diversity of this habitat will be maintained while also retaining the natural visual characteristics of the area.

Consideration is being given to dual lay and minimising separation of the BTC pipeline and SCP at this crossing in order to minimise the significance of the cumulative impacts of both pipeline developments. This is discussed further in Section 13, Cumulative Impacts.

#### 12.2.6.2 Hasansu (KP397.7)

The Hasansu is a fast flowing clear stream within a deeply incised, steep sided and vegetated valley. The valley and stream constitute ecologically diverse and valuable habitats, with a good variety of species including an Azerbaijan RDB moth.

Geological conditions and the deeply incised nature of the crossing preclude using non-open cut techniques such as HDD for pipeline construction at this crossing.

To manage the potential environmental impacts associated with an open cut crossing, a seasonal constraint has been imposed on the construction in order to protect spawning fish (particularly salmonids), and strict sediment and pollution control procedures will be put in place.

Based on a number of factors including the potential visual impact resulting from earthworks at the riverbanks, habitat and species sensitivities, the residual impact of pipeline construction at this watercourse crossing is considered to be **Medium** significance.

Consideration is being given to dual lay and minimising separation of the BTC pipeline and SCP at this crossing in order to minimise the significance of the cumulative impacts of both pipeline developments. This is discussed further in Section 13, Cumulative Impacts.

#### 12.2.6.3 Kura West (KP411)

The Kura is the main river in Azerbaijan. At this location it is a fast flowing, wide (approximately 300m) braided channel, composed largely of gravel and cobbles. Any sediment release or leak of oil or diesel during construction would be carried rapidly downstream towards the Shamkir and Mingechaur Reservoirs.

Geological conditions at the Kura West crossing preclude using non-open cut techniques such as HDD for pipeline construction.

To manage the potential environmental impacts associated with an open cut crossing, a seasonal constraint has been imposed on the construction in order to protect spawning fish and strict sediment and pollution control procedures will be put in place.

Based on a number of factors including the potential visual impact resulting from earthworks at the riverbanks, habitat and species sensitivities, the residual impact of pipeline construction at this water course crossing is considered to be **Medium** significance.

Consideration is being given to dual lay and minimising separation of the BTC pipeline and SCP at this crossing in order to minimise the significance of the cumulative impacts of both pipeline developments. This is discussed further in Section 13, Cumulative Impacts.

# 12.2.7 Traffic

Following implementation of the Transport Management Plan, it is anticipated that the residual impacts will be generally **Low**. However there may be a **Medium** residual impact resulting from increased traffic evels on some of the smaller roads used for construction traffic. These issues are discussed in more detail in Section 12.3, Residual Social Impacts.

# 12.2.8 Air Quality

#### 12.2.8.1 Combustion Emissions (Operation)

On the basis of the modelling results and the comparison of annual combustion emissions to the Azerbaijan National Inventory the residual impact on human health and vegetation is predicted to be Low for short-term impacts for all pollutants. The residual long-term impacts on human health are predicted to be Low for VOC, PM and CO but Medium for  $SO_2$  impacts on vegetation and  $NO_2$  impacts on human health and vegetation. This impact will reduce to low when a gas fuel source becomes available with the construction of the SCP and is based on a conservative emissions estimate. The actual emissions are likely to be about 30% lower than those used in the modelling, but have not been used, as the lower levels cannot be guaranteed at this stage. Stack emissions will be monitored to ensure they remain within EU and other relevant limits.

Transboundary effects on air quality and issues such as global warming and acid rain are discussed in Section 13, Cumulative Impacts.

#### 12.2.8.2 Dust (construction)

Dust generation is an inevitable consequence of pipeline construction as it is necessary to remove surface vegetation and topsoil so that soil structure is not excessively damaged during construction. Although dust generation would initially be less if vehicles ran direct on the vegetation, this would be a short term benefit as the vegetation would soon be uprooted after which it would provide no further protection against dust generation.

The generation of dust will be controlled as much as possible through wet suppression, speed limits for vehicles and the appropriate handling and storage of materials with the potential to generate dust. The assessment of **Medium** significance recognises that Azerbaijan is a windy country, that the soils generally comprise small particles that readily become windborne and that, for most of the year, water is in short supply along parts of the route. Dust generation is therefore likely to occur and deposition on crops has the potential to cause reduced crop yields and a nuisance to local residents. The social impacts of dust generation are discussed in Section 12.3, Residual Social Impacts.

Dust generation and deposition is a short-term, intermittent, residual impact. It will primarily be associated with vehicle movements along the ROW during construction. The severity of the impact will fall to **Low** once reinstatement is complete and vehicle movements cease. A further reduction will be seen as vegetation becomes re-established along the ROW.

Dust will be monitored throughout construction and additional dust suppression methods will be adopted if deposition is a nuisance.

# 12.2.9 Noise

Noise emissions are inevitable during construction and commissioning, and may be of **Medium** significance for short periods in close proximity to dwellings during the evening and night. This will generally be a consequence of construction or commissioning activities which must run continuously once started (usually less than 14 days at any one location). Some exceedance of the stated night-time noise criterion are anticipated. Extensive noise mitigation measures are already proposed and noise will be monitored at sensitive locations (ie dwellings at which the criteria are thought to be at risk). If noise is likely to cause a nuisance at sensitive locations, additional noise suppression techniques will be considered, but may not be practical. Further measures to control the effect of such noise levels would include close liaison with and, in the extreme, temporary relocation of, specific residents.

# 12.2.10 Beneficial residual impacts

#### 12.2.10.1 Contamination

As discussed in Section 10, BTC Co will ensure that all areas of recorded contamination along the BTC pipeline ROW will be cleaned to an appropriate standard prior to commencement of construction. Provided that site-specific risk assessments are undertaken and procedures put in place to eliminate the possibility of mobilisation of contaminants into the wider environment, this will be a positive residual impact.

## 12.2.10.2 Archaeology

Although pipeline construction has the potential to affect the archaeological record by physically damaging part or all of an archaeological monument it also offers potential benefits in terms of providing information that can be studied by future generations and will add to the general understanding of the history of the area. A linear project creates an increase in knowledge both in previously explored areas, and also in locations where archaeological surveys have not previously been conducted. Observation during the construction activities can create a link between archaeological sites and the landscape and environment that it crosses.

The BTC pipeline has already added new information to the archaeological record of the area, and will continue to do so during the course of pre-construction surveys and during the monitoring of pipeline construction.

A further benefit for the area will be the number of people employed on archaeological excavation and research. This will involve not only local people employed in the physical process of excavation, but will also provide opportunities for training and technology transfer and the sharing of expertise among specialist staff in recording, documenting and conserving the discoveries along the pipeline route.

#### 12.2.10.3 Traffic

There will be a positive residual impact arising from upgrades to existing roads and the construction of new roads. The roads required to carry construction vehicles are typically wider and more robust than the roads that are already in place in Azerbaijan, and upgrades will be required prior to construction. This is discussed more fully in Section 12.3, Social Residual Impacts.

#### 12.2.10.4 Environmental Awareness

Beneficial residual impacts will also be generated by the BTC project as a result of data sharing and knowledge building generally on environmental matters, particularly in Azerbaijan itself. The general level of environmental awareness has already been raised among the local institutes and universities that have taken part in baseline surveys and literature reviews as part of the ESIA process. This will continue throughout the life of the BTC project.

# 12.2.11 Unplanned Events

An oil spill as a result of an unplanned event may have a significant impact on sensitive environments along the pipeline, as discussed in Section 10.4. The residual risk of an unplanned event occurring has been outlined in Section 10.4. In the highly unlikely event that there is a spill, the residual impact on the environment following implementation of the Oil Spill Response Plan (OSRP) and subsequent remediation will vary from **Low to High** depending on the location and size of leak, pathway and receptor.

The pipeline has been designed in order to minimise the risk of a spill occurring (including CP leak detection systems). Block valves have been located along the route to protect sensitive receptors such as main rivers, ecological reserves and aquifers. Regular surveillance will be undertaken to monitor the integrity of the pipeline both in terms of third party interference or geohazard impacts.

The OSRP will ensure that the long-term residual impact of an oil spill on affected habitats, surface and groundwater resources is manageable. The OSRP will stipulate locations where OSR equipment should be located to limit the geographical extent of the damage from a spill, particularly in the most sensitive areas. It will also set out short- and long-term cleanup and remediation measures that must be implemented should a spill occur.

# 12.3 Residual social impacts

# 12.3.1 Introduction

This Section describes in more detail the residual social impacts of the BTC pipeline. Where necessary, this Section identifies activities that will determine the nature or extent of particular residual impacts, which are not yet fully defined.

The methodology used for defining the significance of each residual impact is provided in the ESIA methodology (Section 7). The following sections detail High, Medium, and Beneficial residual impacts. The number of the related initial impact, as detailed in the tables in Section 11, is provided for ease of reference. Low impacts identified within the tables in Section 11 are not discussed further.

# 12.3.2 High residual impacts

#### 12.3.2.1 Access to energy

(Related impact: Section 11.3)

As outlined in Section 9 (Socio-Economic Baseline), access to energy is perceived at national level and among pipeline-affected communities to be of high importance as determined

during consultation on both the BTC pipeline and SCP, (although more strongly related to the SCP gas pipeline). There will, therefore, be a **High** residual impact of un-met community expectations as the project will not provide communities with additional power directly.

Although it is a legitimate expectation of people to have access to energy, the obligation to provide energy rests with the Government of Azerbaijan. However, BP is in discussion with the Government of Azerbaijan to explore ways in which BP operations in the region can support the Government in this objective.

Gas associated with the ACG oil field that is not used for reservoir pressure maintenance will be provided to the Azerbaijan Government from the Sangachal Terminal. Gas from the Shah Deniz offshore gas field will also be made available to the Government of Azerbaijan under the terms of a sales and purchase agreement.

#### 12.3.2.2 Un-met employment expectations

(Related impacts: E2, E3, E4)

Because unemployment in rural Azerbaijan is high, residents in directly affected settlements who are unsuccessful in their job applications are likely to become frustrated when they do not gain employment. All the major towns in the area will also anticipate employment opportunities. This could create resentment and possibly hostility towards those who win jobs and could cause resentment towards the project and BTC Co.

Measures to manage expectations regarding employment opportunities will help to reduce this potential impact. However, it is likely to remain a key concern of communities and the public in general given the high interest in employment found during the consultation. Hence the impact could be **High**.

It is also possible that there will be a short-term residual impact of discontent and perhaps resentment towards the project arising from perceptions of bias in the recruitment process. Experience of large scale construction projects indicates that it will be extremely difficult to eliminate all bias from the recruitment process. This residual impact is therefore expected to have be **Medium**.

#### 12.3.2.3 Accidents involving community members

(Related impacts: I3, I6)

It is possible that accidents involving local community members will occur at some stage in the project activities. This could include traffic-related accidents, accidents involving the open trench or other accidents. Although all practical steps will be taken to ensure that no accidents occur any incident that harms a person will have a **High** residual impact in terms of diminishing quality of life for that person, negatively impacting them or their household livelihood, and potentially creating hostility towards the project and project team.

Successful implementation of the proposed mitigation measures, including safety training, traffic management and driver training, and the high priority placed on safety by BTC Co. throughout its work, should ensure that the risk of serious accidents is low.

Mitigation measures have been developed to ensure safety close to residential areas, thereby avoiding the possibility of residual impacts occurring. But, as fencing will not be used on all

open lengths of trench, there is still a residual risk to the safety of people who move on to dangerous areas of the ROW.

The community liaison team will work with communities to manage issues or anxiety surrounding accidents and to advise on the risks and dangers associated with the project.

# 12.3.3 Medium residual impacts

#### 12.3.3.1 Grievances over land and livelihood compensation

(Related Impacts: L1, L2, L3, L4, L5, L7, L10)

WREP experience suggests that there will be disputes and disaffection between the project and some landowners and users on the pipeline route. These will be caused by perceived or actual instances of disagreement with regard to the compensation process and/or methodology, and associated impact on livelihoods. This could cause resentment and possibly hostility towards the project and BTC Co.

The nature and scale of these negative residual impacts will depend on the quality of implementation of the land acquisition and compensation process, community relations and the grievance procedures. However where grievances occur it is expected that these will be of **Medium** significance until resolved.

#### 12.3.3.2 Infrastructure and services

(Related impacts: Section 11.5)

The mitigation measures identified for infrastructure and services will, if implemented correctly and in full, prevent any planned significant impacts. However, in a project of this size it is likely that there will be instances when infrastructure or services are accidentally disrupted without notice and prior planning. Such disruptions could affect large numbers of people living in extensive areas and, although temporary, there is a possibility that an unplanned disruption could hinder income generation (including subsistence activities) of those affected, for example by impeding irrigation to crops or by accidental damage to an irrigation channel. This will also result in residual resentment towards the project. Such instances will be dealt with through the compensation and complaints procedure.

#### 12.3.3.3 Resentment over condition of roads

(Related impact: I2)

While roads will be maintained in at least as good a condition as prior to the commencement of construction, this may not be sufficient to meet community expectations and there may be residual discontent and resentment toward the project and project team, as experience of the WREP has shown. Evidence gathered in some communities through the qualitative survey suggests that this could be significant. The extent of discontent will depend on the temperament and perceptions of individual communities.

However, conversely there is also a real residual beneficial impact regarding roads discussed in Section 12.3.4 below.

#### 12.3.3.4 Accidents on open trench involving livestock

(Related impact: I6)

It is likely that there will be minor accidents involving livestock on the ROW. Basic health and safety management measures are in place to minimise this but as stock proof fencing will not be used on all open lengths of trench there is still a risk that animals could move beyond any marker fences and on to the ROW, which could result in accidents. Compensation measures via a grievance process will be established which will mitigate any losses incurred reducing the impact to **Low**.

#### 12.3.3.5 Access to water resources

(Related Impact: I9)

There is potential for a residual perception of inequity from the communities with poor potable water close to construction camps who are aware that workers have constant access to potable water.

Although water sources will have been carefully selected by the project to avoid impact on local communities, there is a small chance that the project could have a very short term negative impact on the availability of water for communities, particularly during the construction phase, but to some extent during operation for communities near the large AGIs. Mitigation measures developed in Section 11 require the construction contractor to consult with local communities on whether the project's water consumption is impacting household and agricultural supplies so that project water consumption is adjusted accordingly. Similarly BTC Co will consult during operation to ensure that the project's water consumption has no negative impact. However, in cases where a negative impact is identified, there will be a short time delay before consultation takes place and the project's water consumption is adjusted, during which household and agricultural water access will be hampered. This will impact both quality of life and livelihoods, particularly agriculturally based livelihoods. The extent of the impact will depend on a number of factors: the season (ie in summer, irrigation is required and the impact will be more severe), the speed at which the water source can be replenished, the number of users relying on the source, and the amount the project is drawing. However, given that the impact will be short-term, the significance has been assessed as Medium rather than High.

#### 12.3.3.6 Pollution of community water sources during operation

(Related impact: I10)

In the unlikely situation that an unplanned event leads to a leak of oil from the pipeline it is possible that water resources could be affected. However, the project OSRP will include measures for the cleanup of water sources. The long-term residual impact of an oil spill on the water supply of communities is assessed as being of Medium significance but manageable.

#### 12.3.3.7 In-migration

(Related impact: C1)

In-migration is likely to occur to a very limited extent, for short periods around construction camps, despite mitigation measures. This could result in a residual impact of increased competition for public services and resources, and increased potential for the spread of

diseases and illegal activities including prostitution. The significance of this residual impact is assessed as being **Medium**.

#### 12.3.3.8 Tension between communities, workers and the project

(Related impacts: C2, C3, C4, C8)

It is likely that there will be incidents and tensions between workers and communities at particular times and locations during the construction phase given the number and range of impacts that will affect communities.

Mitigation measures outlined in Section 11 will minimise project impacts but where any incidents are not completely resolved there could be a localized residual impact in loss of trust and increased discontent with the project and project team. The community relations plan and activities are designed to address these situations and to minimise residual discontent or resentment among communities.

The level of trust/resentment will also be affected by the scale, quality and impact of the project's Community Investment Programme which is designed to deliver benefits to communities impacted by construction (see Section 13, Cumulative Impacts).

#### 12.3.3.9 Increase in severe diseases

(Related impact: C5)

There is a residual risk that the existence of construction camps and the interaction of the workforce with local residents might either introduce new diseases to the country or the region, or might significantly increase the rate of transfer from one settlement to another, despite health training on communicable diseases. The likelihood and severity of this risk will depend upon the health of the workforce and the level of interaction with local settlements. This impact may include short-term outbreaks of diseases with an impact on mortality rates, but also more serious communicable diseases with a long-term effect on community mortality levels.

A rise in communicable diseases is more likely to occur in the large towns rather than the smaller communities along the route where prostitution is strongly discouraged because of stricter social norms in small villages.

It is most likely that the residual impact will be of **Medium** significance, whereby there is a shorter term impact on the quality of life and potentially the ability of households to maintain their livelihoods (either through formal work or from subsistence activities). The residual impact on individuals affected by disease, however, would be **High** if the disease is severe.

#### 12.3.3.10 Perceived inequity in health provision

(Related impact: C6)

Resentment is likely to remain over the lack of access to the project's health services. The residual impact would be concentrated in communities close to construction camps as that is where the project will have health facilities. This has been assessed as of **Medium** significance given the poor quality of the existing health infrastructure.

# 12.3.4 Beneficial residual impacts

#### 12.3.4.1 Additional cash injected into communities

(Related impacts: E1, E10, L1, L2)

Employment is the most significant positive social impact associated with the BTC pipeline project in the short-medium term. There will be a positive residual impact of the income obtained and spent by local workers in the community. This will be limited in each individual community by the short-term nature of the employment of unskilled workers, but more prolonged in the case of semi-skilled or skilled labour. The result should be an increase in the standard of living for families and additional indirect employment for local businesses as a result of more cash in the local economy. The key issue in determining the scale of this impact will be the total number of Azerbaijanis employed in construction, and the duration of their employment. Potential construction contractors have been encouraged to maximise the national employment on the project and targets for levels of national employees will be agreed in discussion with the preferred contractor.

There will also be a positive residual impact from the money spent locally on goods and services by foreign construction workers in the local communities, which could also help to create temporary indirect employment.

Additional cash will also be injected into local communities through the land compensation programme. This positive impact will depend on the extent of out-migration from the affected communities.

#### 12.3.4.2 Wide distribution of economic benefits

(Related Impact: E2)

Management measures for the recruitment process should ensure that the distribution of jobs and therefore the distribution of economic benefits is spread out over the route. However, individual unskilled jobs will be relatively short (ie 2-3 months). Skilled and semi-skilled workers may benefit from longer periods of employment.

#### 12.3.4.3 Enhanced local experience and employability

(Related Impacts: E7, E11)

There will be benefits in terms of the additional experience and skills gained by pipeline workers and workers in the operational phase. This will apply to some extent to all workers. However it will be more significant for those participating in skills development programmes, and also for skilled workers who will be employed for longer periods. The future employment prospects of these workers will be enhanced, especially as regards SCP. Hence, the indirect benefit to the families and communities could be significant.

The potential to realise this positive impact will depend on the training programmes developed by the construction contractor, future business development demands, and to some extent on the individuals' willingness to learn. Employees are more likely to have enhanced employment prospects following construction, since they may also be eligible for positions in other industries.

There will be a positive residual impact for companies (and their employees) benefiting from supply contracts through increased skill levels and experience. The scale and distribution of this impact will depend on the number of contracts let.

#### 12.3.4.4 Economic benefit of indirect employment opportunities

(Related Impacts: E8, E9, I3, I7, I8, I9, I13)

If local people remain living within the local communities much of the cash injected is likely to remain within the local economy beyond the construction period, creating a positive residual impact.

Road-side stalls (I3)

Many communities perceive that there will be an economic benefit to local businesses from additional traffic.

Local purchase of diesel (I7, I8)

The in-country purchase of diesel will have a positive economic impact for Azerbaijan, primarily Baku as this is likely to be purchased through Baku-based companies. In addition diesel will probably be used for power generation at the construction camps and major facilities along the route. This will have a further positive economic impact.

Bottled water (19)

If bottled water is sourced locally, there would be a positive economic impact in terms of money earned from the sale of water. This will not impact pipeline affected communities who do not have local sources for bottled water.

Local purchase of aggregate (I13)

Positive economic impact, though short-term in nature. The scale of this impact will depend on the quantity the selected contractors purchase and the sources selected.

#### 12.3.4.5 Enhanced capacity to tender for contracts

(Related Impacts: E8)

Skills developed by local businesses during contracting arrangements for this project will enhance the ability of these Azerbaijani companies to respond to other tenders. This will include overall business management skills such as health and safety, quality assurance and project management.

#### 12.3.4.6 Use of wood cleared from ROW

(Related Impact: L9)

Because small trees and branches cleared from the ROW will be given to local communities to use for firewood, there is a positive short-term residual impact arising from provision of

additional fire wood at no cost and minimal effort to the individual. This impact is expected to be **Low** in Azerbaijan because of the low numbers of trees along the ROW.

#### 12.3.4.7 New roads / improvements to roads

(Related impacts: I1, I2)

There will be a **Beneficial** impact arising from upgrades to roads, particularly as the roads required will be typically larger roads than are currently used (excepting main highways). Consultation with affected communities in Azerbaijan shows that communities list improvements to roads as a priority and this will therefore be an important benefit of the project.

There will be a **Beneficial** residual impact arising from construction of reasonable quality new roads where they can be used by the local population for access to markets, education, etc. This is dependent on community support for not removing the roads once construction is complete and local government ability and willingness to maintain the new roads. If communities want the roads removed, there is no residual impact.

See 12.3.3.3, Resentment over conditions of roads.

#### 12.3.4.8 Improved health awareness

(Related impact: C5)

Health awareness raising programmes in local communities will result in a positive residual impact for the quality of life of local communities. This will be reinforced by any BTC Co. community investment projects which focus on health.

#### 12.3.4.9 Access to new cultures and international attitudes

(Related impact: C7)

There are some opportunities for the internationalisation of local communities / greater tolerance and awareness of other cultures which can be seen as a positive residual impact if communities welcome this.

#### 12.3.4.10 Complaints procedure

(Related impact: C9)

A fair and effective complaints procedure will help to establish a legacy of trust and good relations with communities. The level of trust will be determined by the quality of implementation of all measures, not simply those related to community relations.

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# 13 CUMULATIVE IMPACTS

# 13.1 INTRODUCTION

This Section presents the assessment of cumulative impacts that may result from the interactions of construction and operation of the BTC pipeline with other projects and activities.

# 13.1.1 Scope of cumulative impact assessment

The IFC Procedure for Environmental and Social Review of Projects (IFC, December 1998) states that environmental assessment should include consideration of:

"...cumulative impacts of existing projects, the proposed project and anticipated future projects."

To identify which other projects need to be considered alongside the project being assessed the IFC Procedure states that:

"Assessment of cumulative impacts would take into account projects or potential developments that are realistically defined at the time the environmental assessment is undertaken, where such projects and developments could impact on the project area".

Cumulative impacts are those that may result from the combined or incremental effects of past, present or future activities. While a single activity may itself, result in an insignificant impact, it may, when combined with other impacts (significant or insignificant) in the same geographical area and occurring at the same time, result in a cumulative impact that is significant.

This cumulative impact assessment covers past present and future interactions between the BTC project and other activities in the same geographical area.

# 13.2 SPATIAL AND TEMPORAL BOUNDARIES

The cumulative effects of the project are considered in this section at a Regional (Section 13.4), National (Section 13.5) and Route Level (Section 13.6).

**Regional level:** The spatial boundaries of the regional cumulative effects assessment reflect the overall geographic span of the project scheme from the Caspian to Turkey. Within this region, and in the context of oil and gas production and transportation systems, the region can be defined as including the Caspian, the Caucasian belt and Southern Russia, the Black Sea and Turkey.

The region will be hereinafter referred to as the Trans-Caucasian belt. The assessment of cumulative effects on the natural and social environment therefore includes regional activities directly and indirectly related to the project. For the BTC project this includes the development of the ACG field and other hydrocarbon fields in the Caspian, and the development of regional oil and gas transportation systems.

The assessment of regional cumulative impacts is complemented by a broad-based review commissioned by BP to identify the economic, social and environmental benefits of the ACG, BTC and Shah Deniz projects at the regional and national level, and to advise BP and other

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interested parties, on steps to enhance the sustainable development opportunities presented by the projects and to minimize any risks that they present. This study is entitled 'Economic, Social and Environmental Review in the National and Regional Context'.

The Regional Review covers the following issues:

- Revenue management
- Local employment and supply chain management
- The non-oil economy
- Poverty and inequality
- Human rights
- Conflict
- Access to energy
- Regional export options
- Climate change
- Biodiversity and
- Institutional capacity

The full Regional Review report will be made available in 2002. A summary of findings is presented in this section.

This Review concludes that the ACG, BTC and Shah Deniz projects will have a large effect on the development of Azerbaijan and Georgia primarily because of their size in relation to the rest of the economy. The extent to which they contribute to sustainable development depends largely on the decisions taken by government, especially concerning revenue use and the fight against corruption.

The Review concludes that the major economic and socio-economic implications of the projects are expected to be in Azerbaijan and Georgia as opposed to Turkey. Government revenues will be generated by the project in both countries that could be used to finance reform and redevelopment. Here the footprints of the projects are larger in comparison to current government revenues, to other investment plans and donor credits, and have a greater potential to influence other foreign direct investment decisions. They also have a higher public profile than in Turkey.

Poverty and inequality, corruption, human rights and conflict are issues in each of the three countries. There are initiatives by governments and the international community to reduce poverty and corruption, to bolster human rights and to resolve the several 'frozen' conflicts in the region. There is scope for the projects to contribute positively on these issues by applying high standards and setting best practice in dealing with them. Several important steps have been taken in the design stages of the projects in relation to construction, operations and engagement to set and apply these high standards.

The projects will also make a contribution to the shortfall of energy available in Azerbaijan and Georgia largely by providing gas at lower prices to both countries' gas infrastructure. However the projects alone will not solve the deep and complex problems of access to energy.

From a regional environmental perspective, the Review concludes that the projects would facilitate the large-scale introduction of international standards for health, safety and environmental protection. There are oil spill risks as with any other oil production and pipeline project, and some areas of high biodiversity will be affected, although a range of project-level activities and a regional biodiversity initiative will compensate these impacts.

**National level:** In this ESIA report, national level cumulative effects refer to those that could occur within Azerbaijan as a result of the interaction of the various projects taking place within the country. These include other oil and gas related projects in Azerbaijan (eg the operation of the WREP and the Sangachal Terminal) and other non-oil and gas projects in the area (eg curent industrial emissions within Azerbaijan).

**Route level**: The cumulative effects assessment at the route level is based on the likely construction of the BTC pipeline and SCP sequentially in the same corridor. This will extend the overall construction period and therefore the period over which the most significant impacts are felt.

The temporal boundaries of the assessment coincide with the operational life of the project, which is 40 years. The majority of the effects will occur in the short and medium term, during construction.

## 13.3 **PROJECTS OVERVIEW**

# 13.3.1 General

The Trans Caucasian belt has seen recent developments in the oil and gas sector following the discovery of new fields and development of known fields in the Caspian Sea and in many onshore areas of the region.

The development of early production and transportation facilities by multi-national oil majors has heightened environmental awareness in the region and highlighted the key environmental and social concerns. The main oil and gas projects that are under way in the region are discussed in Section 13.3.2 below.

# 13.3.2 Summary of relevant projects

The two major oil and gas developments currently under development in the Azerbaijan sector of the Caspian Sea are the ACG oil and Shah Deniz gas projects. Crude oil from the early development of the ACG fields is currently transported through the WREP and NREP pipelines. The BTC pipeline will provide transportation capacity for crude oil volumes from subsequent phases of the ACG full field development, transporting the oil to world markets.

Gas will be produced from the Shah Deniz field and transported by pipeline to Turkish and domestic markets. It is proposed that the pipeline transporting this gas, the SCP will run along the same route as the BTC pipeline in Azerbaijan. The oil and gas from these two developments will be transported via an onshore terminal at Sangachal, 40 km outside Baku.

The routes of existing and proposed export pipelines from Azerbaijan are shown in Figure 13-1, while Figure 13-2 shows the location of the offshore oil and gas fields and Sangachal Terminal, and the approximate routes of the offshore export pipelines.



Figure 13-1 BTC pipeline alignment in relationship to other export pipelines from Azerbaijan

Figure 13-2 ACG and Shah Deniz contract areas and offshore export pipelines



#### 13.3.2.1 The Azeri-Chirag-Gunashli (ACG) development

The ACG project consists of the phased development of the Azeri, Chirag and Deep Water Gunashli (DWG) oil fields, offshore Azerbaijan. One production platform, Chirag-1, is currently producing 120,000 bopd which is transported by offshore pipeline to the Sangachal Terminal,

then primarily exported via the WREP to Supsa on the Black Sea coast of Georgia, and then by ship to international markets. A portion of the oil may also be exported by the NREP to Novorossiysk on the Russian Black Sea coast, also for onward shipment. Expansion of the ACG project consists of three phases, as described below:

**Phase 1:** Offshore development of the Azeri field comprising a production, drilling and quarters platform, and a gas compression and water injection platform. The oil will be transported to Sangachal Terminal via a new 30" oil export line. A certain amount of the produced gas will be re-injected into the oil reservoir to enhance oil recovery, whilst the remaining gas will be transported to Sangachal for processing via a new 28" pipeline.

The Sangachal Terminal will be expanded to process the additional oil and gas produced.

**Phase 2:** Development of the remaining part of the Azeri field which is expected to consist of two further production, drilling and quarters platforms, with associated pipelines and a further expansion of the Sangachal Terminal.

**Phase 3:** Development of the DWG field which is expected to consist of two platforms: a production, drilling and quarters platform, linked to a gas compression and water injection platform.

Predicted production profiles for the ACG developments are shown in Figure 13-3.



Figure 13-3 Production profiles from ACG ld development

#### 13.3.2.2 The Shah Deniz project and SCP

The Shah Deniz project involves extracting gas/condensate from offshore deposits in the Caspian and exporting it to Turkey through Azerbaijan and Georgia.

The first stage of the Shah Deniz development will consist of a production and drilling platform, offshore gas and condensate pipelines to the onshore Sangachal Terminal, and expansion of the terminal facilities. At the terminal, gas will be conditioned for export, and the stabilised condensate will be blended with the crude oil produced from the ACG development. Some of the gas will be provided to the Governments of Azerbaijan and Georgia under the terms of sales and purchase agreements. Gas to Azerbaijan will be input directly into the existing national supply grid in the vicinity of Sangachal. The majority of the gas will be exported for sale to Turkey, via the SCP, where it will feed into the domestic supply grid.

It is intended that the SCP will follow the same alignment as the BTC pipeline within Azerbaijan and Georgia. The pipeline will be 42" in diameter in Azerbaijan and 46" in diameter in Georgia, and is approximately 690km long, terminating at the Georgia/Turkey border.

It is currently proposed that the BTC and SCP projects are fully integrated, with BTC being constructed first, to maximise the synergy benefits of the two projects, including minimising the environmental and social impacts.

The two pipelines will be built within a construction corridor of approximately 44m. The current proposal is that 32m of the 44m total is stripped for the construction of the BTC pipeline, and that once this is installed, 12m of the strip is immediately reinstated, and the remaining 20m is stabilised as required. In the following year, the untouched 12m section is stripped to provide a total ROW of 32m for the second pipeline (SCP). After installation of the SCP the whole 32m used for SCP will be reinstated. This scenario is illustrated in Figure 13-4.

SCP construction is currently programmed to follow in the year immediately after the construction of the BTC pipeline (Scenario 1). However, the potential cumulative impacts from the construction of the SCP at periods of between two and four years (Scenario 2), and more than four years (Scenario 3) after the construction of the BTC pipeline have also been considered in this Section.

In the event that the SCP construction is not scheduled for the year following BTC pipeline construction, the whole 32m ROW will be reinstated after installation of the BTC pipeline. For subsequent construction of the SCP 20m of ROW which had originally been stripped for BTC pipeline installation would be re-stripped along with an additional 12m, to give a total SCP ROW of 32m.

#### Figure 13-4 Proposed working width for both BTC and SCP construction

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#### 13.3.2.3 The WREP and NREP

Two pipelines have already been developed by the AIOC to export oil from the early production of the ACG field. The pipelines, known as the NREP and WREP, are currently in operation and transport 100,000bpd (this volume includes some additional oil from SOCAR) and 115,000bpd respectively.

The routes of both pipelines are shown in Figure 13-1. The BTC pipeline will be constructed along predominantly the same route as the WREP within Azerbaijan. There will be no cumulative impacts as a result of the NREP and BTC pipeline projects.

#### 13.3.2.4 Other oil and gas developments in the vicinity of BTC

In addition to the development projects mentioned above there are other oil and gas concessions, both onshore and offshore, which are the subject of Production Sharing Agreements (PSAs) between private companies and the Azerbaijani Government. The Azerbaijan onshore concessions that are close to the route of the BTC pipeline are shown in Figure 13-5. It can be seen from Figure 13-5 that the BTC pipeline route crosses the south-west Gobustan concession which has been licensed to Commonwealth Oil and Gas. This concession is currently non-operational. The proposed development programme includes the rehabilitation and drilling of several hundred wells across the area. The schedule for this work is subject to appropriate financing.

#### 13.3.2.5 The Northern Caspian oil fields and the CPC pipeline

Whereas the Shah Deniz and ACG projects originate from Southern Caspian offshore fields, significant hydrocarbon production also occurs in the Northern section of the Caspian, in Kazakhstan and Russia. Existing oil fields such as the onshore Tengiz facilities in Kazakhstan and large offshore fields both in Kazakhstan and Russia have the capacity to increase the current oil and gas production in the region by an order of magnitude.

In 1999, total liquids production from the Tengiz field increased to 214,000bpd. The expectation is to grow this production to 700,000bpd by 2010. Tengiz crude is transported by a variety of means, including pipeline, rail and barge. Principal destinations include the Black Sea ports of Odessa, Feodosia and Batumi. Crude production exported by railcar reached 161,000bpd in 1999 (77% of the total production).

Currently Kazakhstan exports oil through the region of interest of this study by shipping oil to Azerbaijan and subsequently transporting it by rail through Azerbaijan and Georgia to the Back Sea port of Batumi. These exports amount to approximately 100,000bpd and exit the Trans Caucasian belt through the Bosphorus Strait in oil tankers.

The operators of the Tengiz oil field have recently commissioned the CPC (Caspian Pipeline Consortium) pipeline that, at full capacity, will have the ability to transport approximately 1,500,000bpd. The CPC pipeline terminates at Novorossiysk on the Black Sea, from where crude oil is either shipped to markets via the Bosphorus Strait or piped to European refineries through Central European pipeline systems. It is expected that the CPC pipeline will be used for export from other oil fields in the Northern Caspian, currently in their early stages of development.

#### 13.3.2.6 The Blue Stream gas pipeline

The Blue Stream gas pipeline is a gas export system from Russia to Turkey that is currently under construction. The project consists of the construction of a sub-sea pipeline through the Black Sea with the aim of providing Turkey with an additional supply of natural gas to meet the expected increased demand for power generation.

#### 13.3.2.7 Minor projects

Several more modest oil and gas projects are also being developed in the region, associated with the development of onshore fields in Azerbaijan, Georgia, and Southern Russia and the related transportation and utilisation of the produced fluids. From publicly available sources it is estimated that the overall contribution of the minor projects to the flow of hydrocarbons in the region is less than 5% of the main flows described in the previous Sections.

Other potential projects, yet to reach the detailed planning stage, include the development of a crude oil refinery in Supsa and of offshore hydrocarbon deposits in the Black Sea.

#### 13.3.2.8 Summary of hydrocarbons flow in the Trans-Caucasian belt

Table 13-1 below summarises the main developments taking place in the region and the associated flows of hydrocarbons through the Trans-Caucasian belt, when all identified projects will be at peak capacity (approximately 2011).

Project name	Crude oil	Natural gas			
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	(bpd)	(billion m <sup>3</sup> /year)
Shah Deniz/SCP	54,000 a	8.2
ACG	1,100,000	14
Tengiz	700,000	Not known
Other Northern Caspian oil and gas fields	800,000	Not known
Blue Stream		16
Minor projects	250,000	0.5

<sup>a</sup> Condensate separated from the gas.

The above summary does not include oil and gas production from offshore Turkmenistan or Iran, nor the onshore production from Turkmenistan and Uzbekistan that flows to Iran. Figures for current oil and gas imports into Turkey and refined products import through the Black Sea are also not included.

#### 13.3.2.9 Non oil and gas projects

There are a number of non-oil and gas industry developments proposed over the next few years that are of relevance to a consideration of cumulative impacts with the BTC pipeline.

These include an EU-funded transport corridor project, TRACECA, which aims to connect Europe with Asia via nine trans-Balkan highways. A new East-West road, running roughly parallel to the existing Baku-Tbilisi highway, but in some places replacing it, is currently under construction as part of this project. This road is commonly referred to as the 'Silk Road'. In early 2002 construction of the Silk Road was yet to reach Kazi-Magomed (corresponding to approximately KP52 of the BTC pipeline).

The TRACECA project also includes improved and new-built railway between Baku and Tbilisi, the schedule for which is not clear at present. The proposed route of the railway and the Silk Road are shown on Figure 13-5.

# 13.4 EVALUATION OF REGIONAL ACTIVITIES

On a regional scale the main temporal and spatial cumulative impacts relevant to the construction of the BTC pipeline relate to the expansion of the Sangachal Terminal, the construction of the SCP and construction of the Silk Road.

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Figure 13-5 Other existing and proposed projects in the vicinity of the BTC pipeline

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# 13.5 NATIONAL LEVEL CUMULATIVE IMPACTS

Projects relevant to a national level assessment of cumulative impacts include the following:

- Operation of the proposed BTC pipeline facilities
- Operation of the proposed SCP facilities
- Operation of the WREP
- ACG full phase development (including operation of Sangachal Terminal)
- Existing industrial emissions within Azerbaijan

A description of each of these projects can be found in 13.3.2.

# 13.5.1 National level cumulative impacts – environmental

# 13.5.1.1 Air quality (potentially local, national and transboundary cumulative impacts)

National level environmental impacts are restricted to those related to air emissions.

The potential for a cumulative impact upon air quality arises from:

- Operation of the proposed BTC pipeline facilities
- Operation of the proposed SCP facilities
- Operation of the WREP
- Operation of the Sangachal Terminal
- Existing industrial emissions within Azerbaijan

Current baseline data for air quality at the proposed BTC pump station is based on the monitoring undertaken for the BTC project, (Section 8, Environmental Baseline and Parts 3 and 4 of the Technical Appendix). Baseline data for the Sangachal area and two of the WREP pump stations are taken from the AIOC Air Quality Survey, undertaken by BP in 2000.

# **13.5.2 Global Cumulative Impacts – environmental**

#### 13.5.2.1 Climate - Greenhouse gases

The BTC pipeline, SCP and Sangachal Terminal greenhouse gas emissions (GHGs) need to be considered in a cumulative context.

There will be varying amounts of total GHG emissions from the projects listed above, depending upon the phase of each projects development. It is anticipated that the maximum total GHG emissions will occur when the Sangachal Terminal, the BTC pipeline and the SCP are operational. It is likely that this scenario will occur approximately two to three years after the completion of the BTC pipeline. Table 13-2 shows the estimated contributions of the three projects in comparison to the projected total GHG emissions from Azerbaijan for 2005 (the latest year for which predicted emissions are available) The cumulative GHG emissions in 2005 will be approximately 0.7% of the predicted total for Azerbaijan in 2005, constituting a **Low** level impact.

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SOURCE	EMISSION (TONNE PER YEAR)		GWP (TONNE CO <sub>2</sub> EQUIVALENT PER YEAR)
		CH <sub>4</sub>	
BTC pipeline operation	220,000	32	221,000
Sangachal operation (2005)	275,000	25	276,000
SCP construction	0	4	84
Total	495,000	61	496,000
National Inventory Forecast 2000	41,544,000	1,253,000	68,818,000
% BTC pipeline operation and SCP construction to 2000 emissions	1.2	0.0	0.7

Table 13-2 Estimated contributions of GHGs by the BTC pipeline, Sangachal Terminal and SCP
projects by comparison with projected national emissions in Azerbaijan (2005)

Note: All figures are estimates only, with significant uncertainty

The above scenario represents the worst case currently anticipated. Annual GHG emissions from operation of the BTC pipeline are approximately 1.5 times higher than those estimated for its construction. Operational emissions from the SCP are negligible by comparison to its construction. The BTC pipeline will be operational from 2005, however pump station PS A2, which is the primary source of operational emissions, will not be fully operational until 2008. Thus, construction of the SCP and full operation of the BTC pipeline will not coincide and this scenario has not been considered.

It can be seen from the above that the relative contribution of project activities is, as a worst case, relatively small for a major infrastructure development in Azerbaijan.

# 13.5.3 Transboundary impacts

Transboundary impacts are impacts that affect the natural environment and/or socio-economic conditions outside of the country in which project activities are proposed to occur. Potential transboundary impacts are not necessarily limited to those countries that directly neighbour the project's host countries and can effect countries or areas some distance away.

Atmospheric emissions are considered to be the only potential transboundary impact of the BTC pipeline and related projects.

Throughout the duration of the project, several activities will had to the release of a number of potentially polluting gases to the atmosphere. These gases have a number of potential effects upon the environment (see Section 10, Environmental Impacts and Mitigation) including potential transboundary impacts:

- Acid deposition (wet and dry)
- Deterioration of air quality (directly or indirectly)

The potential for gases to give rise to transboundary impacts is dependent upon the residence time, the behaviour of the gas once released to the atmosphere and the distance the pollutant travels from its source. For the majority of gases, the residence time (or atmospheric lifetime) in the atmosphere following release is only one or two days. The distance that such gases may travel and the direction in which they travel is primarily related to meteorological conditions, in particular wind speed and direction.

#### 13.5.3.1 Acidification

 $NO_x$  and  $SO_x$  may undergo transformation in the atmosphere to acidic compounds (eg nitric and sulphuric acids) potentially leading to acid rain deposition. These transformations represent important removal mechanisms for these compounds from the atmosphere, however, their presence may lead to the formation of 'acid rain'. Acid rain has historically being shown to lead to stress of ecosystems and damage to structures, particularly those constructed of limestone.

The BTC pipeline facilities are anticipated to lead to the generation of 1,374 tonnes per year of  $NO_x$  and 198 tonnes per year of  $SO_2$  during peak export. These represent 1.2% and 0.4% of the 1994 Azerbaijan national inventory, the latest year for which data is available. If SCP gas becomes available these predicted annual emissions of NOx and  $SO_2$  would be significantly reduced.

It is not anticipated that the potentially acidifying compounds from the BTC project will lead to any noticeable stress upon sensitive transboundary ecosystems downwind of the proposed developments sites.

In addition, project design reduces the contribution to acidifying gases through using low NOx technology to meet international standards for  $NO_x$ , and through the use of fuels with low sulphur content (less than 0.2% for liquid fuel, and negligible for SCP gas).

#### 13.5.3.2 Human health impacts

Increased concentrations of  $NO_2$  and  $SO_2$  at ground level can also have an impact on human health. Mean tropospheric lifetimes for  $NO_x$  and  $SO_x$  are 1.5 and 16 days respectively. Hence, a fraction of  $NO_x$  and  $SO_x$  emitted to the atmosphere may persist in the atmosphere and be transported up to distances of a few hundred kilometres from the point of release in a single day. This would be sufficient for these gases to enter the atmosphere of neighbouring countries, such as Georgia. The direction and distance that such gases are transported is heavily dependent on meteorological conditions, in particular wind speed and direction.

The concentrations of these gases are not anticipated to be sufficient to cause impacts on human health in neighbouring countries, because the concentrations will be small following dispersion. Therefore transboundary impacts to human health from atmospheric emissions as a result BTC pipeline operation are deemed to be negligible.

# 13.6 ROUTE LEVEL CUMULATIVE IMPACTS

The previous Sections of this ESIA have only addressed the impacts associated with the construction of the BTC pipeline at a local evel. However, the pipeline is being constructed in close proximity to existing and future projects including:

- The WREP
- The Sangachal Terminal and the landfall of the ACG and Shah Deniz offshore pipelines
- The Silk Road and Railway
- SCP in the following year (Scenario 1)
- SCP, after a delay of two to four years (Scenario 2) or more than four years (Scenario 3)
- BP environment and community investment projects (discussed in Section 13.7)

The base case scenario for the BTC and SCP projects assumes that SCP will be built in the year after BTC (Scenario 1).

The cumulative impacts in the following sections are assessed against the baseline conditions described in Sections 8 and 9. Where there is sufficient knowledge about the other projects, the same significance criteria and ranking system have been used as for the BTC project alone, in line with the definitions of the levels of residual impacts in Section 7. However where there is less project definition it has been deemed inappropriate to apply these significance criteria, and professional judgement has been used.

Construction of the BTC and SCP projects has been integrated, thus minimising the potential for any negative cumulative impacts from the outset, as compared to developing the two projects in isolation. One of the key aspects of this has concerned the routing of the pipeline, where it has been possible to select a route that can be used for both BTC and SCP.

It has been determined that construction of the two pipelines will run sequentially. There are a number of reasons why it is not practical or desirable to construct both pipelines simultaneously, including:

- The need for a much wider construction corridor, so increasing habitat disturbance
- The requirement for mobilization of twice as much equipment
- The significant threat to the delivery of both projects in the required timescales
- The need to pre-invest in SCP as the pipeline is not required to be operational until 2005, when Shah Deniz gas becomes available

Table 13-4 provides an indication of the types of cumulative environmental impacts that could occur as a result of the BTC pipeline being constructed in proximity to the other projects listed above.

Aspect	BTC pipeline along the existing WREP	BTC pipeline and Sangachal Terminal development	BTC pipeline and SCP	BTC pipeline and the Silk Road/ Railway
		ENVIRONMENTAL		
Air quality				
Noise				
Soils				
Geology				
Hydrology				
Landscape				
Archaeology				
Ecology				
Traffic				
Use of natural				
resources				
SOCIO-ECONOMIC				
Wealth and				
employment				
Infrastructure				

Table 13-3 Cumulative environmental impacts of the BTC pipeline with other projects in the area

#### BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA

		-	-	
Aspect	BTC pipeline along the existing WREP	BTC pipeline and Sangachal Terminal development	BTC pipeline and SCP	BTC pipeline and the Silk Road/ Railway
Land and land				
based				
livelihoods				
Community				
relations				
Nuisance				

The key cumulative impacts are highlighted in the above table by shading. Those cumulative impacts which have been assessed as the most significant, (**Medium** or **High**) are denoted by a yellow cell. The cumulative impacts are discussed in more detail, by issue, in the following Sections. Where there is no shading, the assessment has concluded that cumulative impacts are not likely to occur.

# 13.6.1 Air quality

Construction of the BTC pipeline, extension of the Sangachal Terminal and construction of landfall pipelines will result in a localised reduction of air quality over a short period, due to increased construction vehicle and equipment exhaust emissions. There will also be localised increases in dust generation, which could lead to cumulative impacts on areas used for grazing downwind of the terminal area.

During operation there will be minimal emissions from the BTC pipeline in the vicinity of the terminal, and hence the cumulative impacts upon air quality will be Low. One of the more significant emissions sources during operation is the head pump station for BTC, which is within the fenceline of the Sangachal Terminal. This has been assessed as part of the ACG Phase 1 ESIA.

Construction of the SCP following construction of the BTC pipeline will result in an extended period over which combustion emissions from vehicle exhausts are increased along the pipeline route.

With regard to dust emissions, construction of the SCP at any stage will produce localised cumulative impacts on crop yield. Construction of the SCP in the year following BTC pipeline construction is likely to cause a cumulative impact of a higher magnitude but over a shorter period to that incurred if SCP construction were to be delayed. If there was a delay to the construction of the SCP additional vehicle and dust emissions would result from the increased activities required to reinstate the working width, then topsoil strip it again immediately prior to SCP construction.

During the operational life of the SCP, atmospheric emissions from associated pipeline facilities such as block valves will add to those produced by the BTC facilities. It should be noted that block valves on both pipelines are generally expected to use mains power for for their electrical requirements, with diesel generators used for back-up power. Cumulative impacts during operation are anticipated to be **Low**.

The construction of the Silk Road will produce air emissions from the operation of various types of construction plant. The road is being built in sections, and current construction progress indicates that it is possible that the construction operations for both the BTC pipeline and the Silk

Road will occur in the same general vicinity at some point in time. In this event there may be a localised, short-term reduction in air quality. There will also be localised increases in dust generation, which may lead to a short-term cumulative impacts on crop yields and bees at some locations. Significance is assessed as **Low**.

# 13.6.2 Noise

During construction of the Sangachal Terminal, the offshore pipelines landfall and the BTC pipeline localised increases of noise in the vicinity of the Sangachal Terminal could result in a short-term cumulative effect on local people (for example sheep herders). This is regarded as being of **Low** to **Medium** significance.

Construction operations will only occur in a particular section of the pipeline route for a relatively short period, and while it is possible that noise receptors are subject to construction noise in two consecutive years, the actual time over which noise is heard will be relatively short. In the event that construction of the SCP is delayed, there will be a slight increase in the total time period over which noise is generated by the construction work (caused by the extra reinstatement and topsoil stripping), however this is not considered to be a significant cumulative impact.

If the BTC pipeline is operational when the SCP is constructed, then in areas around the pumping and pigging stations there will be a cumulative noise impact of **Low** magnitude.

The construction of the Silk Road will produce noise from the operation of various types of construction plant. As described above, there are potential interactions between BTC and the Silk Road project, however, the significance of any potential cumulative noise impact is **Low**.

# 13.6.3 Soils

Construction of the BTC pipeline, Sangachal Terminal and the offshore pipelines landfall will result in an increased area where soils are disturbed and exposed to wind erosion in the Gobustan semi-desert environment. This is considered to be a cumulative impact of **Low** significance.

If the SCP were built in the year following the BTC pipeline, there would be a cumulative impact of two consecutive years construction activity on the soils of the central section of the construction corridor. This could potentially impact upon soil structure and lead to increased wind erosion.

If there is more than 12 months between construction of the two pipelines then topsoil will be replaced, soils stabilised and interim reinstatement carried out, immediately following installation of the BTC pipeline. Approximately 60% of the reinstated ROW would then be re-exposed before installation of the SCP. While the overall period of bare soil exposure would be decreased in this scenario, cumulative impacts to the soil would result from reinstatement and then re-stripping of soils in the joint construction area.

This would impact upon soil structure and contribute to windblown dust and erosion. The structure of the soils in the 'badlands' is such that localised cumulative impacts could be **High**, however in other areas the degree of impact would be much reduced to **Low** to **Medium** as the soils have a more consolidated structure.

Topsoil degradation would be reduced significantly if construction of the SCP in Gobustan were to take place shortly after BTC.
In order to reduce the cumulative impacts of crossing erodible soils on certain narrow ridges SCP will be laid at the same time as the BTC pipeline. This will be the base case for the Mud Volcano Ridge and is being considered for the Tovuzchay, Azrinchay and Hasansu ridges. Use of dual lay will eliminate the need for repeated disturbance to these areas. In the case of the mud volcano ridge the separation between the pipelines will be minimised, therefore reducing the area which will be impacted.

## 13.6.4 Geology

Throughout the majority of the BTC and SCP routes the pipelines are constructed in soils overlying rock. The construction of both pipelines will therefore have a minimal impact upon the solid geology along the route.

However, the crossings of the Shamkir and Kura Rivers by both pipelines are located close to areas of aggregate extraction. Once the pipelines are laid, there may need to be a restriction upon the depth to which extraction can take place in the Shamkir River, despite the deep burial of the pipeline. The cumulative impact upon economic geology has been assessed as **Low** significance.

## 13.6.5 Hydrology and hydrogeology

Banks of river crossings will be stabilised and/or reinstated immediately after the BTC pipeline construction to reduce erosion to the bank structure as far as possible. In the case of the Hasansu and the Kura West River crossings consideration is being given to laying the pipelines simultaneously. This would eliminate the need for repeated disturbance to these areas, and would mean lower overall impact than if two pipelines were constructed separately and can be considered a mitigation of the cumulative impact.

Given the mitigation measures which will be adopted, cumulative impacts to hydrology from construction of the SCP in either the year following the BTC pipeline or at a later date are assessed as **Low**. However, this would rise to **Medium** at the Hasansu and Kura West Rivers if dual lay is not implemented.

Any impacts caused by an increased demand on local water resources (in terms of water usage at camps etc) from pipeline construction, will be increased by the construction of two pipelines. However, the volumes of water required are likely to be small and therefore the impact is assessed as being of Low significance.

Construction of the Silk Road could result in the release of suspended sediments at watercourse crossings, which would cause turbidity, and in worst cases some reduction in the oxygen content of the water. In the event that the same watercourse was being crossed by the Silk Road and BTC projects the downstream areas of the watercourse may suffer cumulatively from the addition of two suspended sediment loads.

## 13.6.6 Landscape

The BTC AGIs and particularly the pump station will be in addition to the existing WREP AGIs. Access routes installed to allow construction traffic to reach the ROW and new AGIs may be retained after construction, and these too will add to the impact on the landscape along the route. The BTC AGIs are generally distinct from the WREP AGIs. However, through routing the BTC pipeline adjacent to the WREP, the visual impacts of the pipeline corridor itself are retained within an existing disturbed landscape. Visual impacts arising from BTC proximity to WREP are regarded as being of **Low** significance.

During the construction of the BTC pipeline, there will inevitably be associated short term cumulative impacts to the landscape in the area around the Sangachal Terminal. Impacts to the landscape from construction of the BTC pipeline will last for a much shorter time than those impacts to the landscape from the presence of the Sangachal Terminal, but will be cumulative during the construction period due to the greater area disturbed and are assessed as being of **Low** significance.

The ROW required for construction of each pipeline is 32m. To reduce the area impacted by construction works, it is intended that part of the 32m width for the BTC pipeline is also used as a construction area for the SCP. While the total construction corridor required for both pipelines is 44m, which is greater than for a single pipeline, it does represent an approximate 30% reduction in the width that would normally be required to construct two pipelines separately.

Landscape impacts during construction of both pipelines will result from exposure of top and subsoil in areas of the route, which are normally covered with vegetation. The period over which the central 20m of the ROW is exposed will be extended from a number of weeks or months in a single pipeline installation scenario, to a period of up to 12 months before interim reinstatement is adopted.

There will be a period after reinstatement during which vegetation is recovering and is likely to appear different to the surrounding area, however, this will reduce over a few years and has therefore been categorised generally as a **Low** cumulative visual impact. In areas where vegetation re-establishment is slow, such as the Gobustan semi-desert, this may increase to **Low** to **Medium**.

The BTC pipeline will be laid along the top of some ridges. To lay two pipelines the graded construction width along the top of the ridge will be greater than for one pipeline, the cumulative impact being assessed as Low due to sympathetic profiling of the ridges.

The ROW will be reduced in certain areas to further reduce the cumulative visual impact from the two pipelines. Dual lay within a restricted ROW is proposed for the Mud Volcano Ridge. The ridges approaching the Azrin and Tovuz Rivers, these rivers themselves, and the Hasansu River crossing are also being considered for dual lay.

The new AGIs associated with the SCP, which only consist of five block valve stations, will be in addition to the structures associated with BTC pipeline and WREP. This will only marginally increase the level of visual impact, and therefore the cumulative landscape impacts are still classified as **Low**.

Construction access routes will be installed for the BTC pipeline. If SCP construction is to follow, these will be left in place, and no new SCP access roads will be required. This can be considered a favourable cumulative visual impact from the construction of the two pipelines along the same route.

### 13.6.7 Archaeology

The BTC pipeline will pass through areas with the potential to contain significant archaeology. By following the line of the WREP for the majority of its route, the archaeological potential is better understood and potential impacts from the BTC pipeline have been reduced. This is a beneficial consequence of the BTC pipeline following Sections of the WREP route.

As the BTC pipeline and SCP will be built within the same construction corridor all preconstruction archaeological excavation work will be of direct relevance to both projects. The number of potential archaeological deposits impacted by pipeline construction is minimised through parallel alignment of the two pipelines.

## 13.6.8 Ecology

Most habitats will have recovered completely from construction of the WREP, while others such as the slower growing semi-desert habitats have not yet fully recovered. Construction of BTC in these areas will have a cumulative impact in terms of habitat loss. In certain areas such as Gobustan, and the Korchay and Shamkir re-routes the BTC pipeline route does not follow the WREP and therefore in these areas there is not a cumulative impact. Generally the cumulative impact is regarded as being of **Low** significance. The proposed reinstatement mitigation for the BTC pipeline is far more stringent than that employed for WREP.

The Sangachal Terminal area is within the Gobustan semi-desert which is considered to be a fragile environment within Azerbaijan. The habitats in the immediate vicinity of the terminal have been disturbed both by construction and operation of the terminal and by other anthropogenic causes.

It is likely that the additional disturbance caused by the construction of the BTC pipeline will have a cumulative effect, regarded as being of **Medium** to **High** significance.

Construction of the BTC pipeline and SCP within a combined construction corridor will result in a significant reduction in the cumulative impacts to ecology along the route than would be the case if they were constructed in completely separate working widths.

However, the 20m section of the BTC ROW used for SCP will not be reinstated if SCP closely follows BTC. The viability of the seeds of some plant species in the stripped soil from this section may deteriorate during this interim period, and when the strip is reinstated recovery of the habitats may be slower than for BTC alone.

Impacts to the seedbank in areas such as Gobustan where the soil is thin and the habitat fragile are classified as **High** to **Medium**.

In the case of fauna, (particularly the spur-thighed tortoise and ground nesting birds) the disruption of two consecutive breeding seasons as a result of sequential construction of the BTC pipeline and SCP gives rise to a greater cumulative impact than the disruption of a single season.

Species whose breeding cycle might otherwise be affected for two consecutive years may benefit from a delay in SCP construction.

The disturbance to riverbanks and beds as a result of BTC and SCP construction is likely to result in cumulative impacts to aquatic flora and fauna through increased sediment disturbance. These impacts will be similar in nature to those described in Section 10 (ecological impacts), which are categorised as **Low**, but will be of greater duration.

The construction of BTC and the Silk Road may create a cumulative impact upon some faunal species by increasing the area of permanent habitat loss and duration of the disturbance. However, except for a few crossing points, the geographical area of disturbance will be different.

## 13.6.9 Traffic

Cumulative impacts of noise and emissions are addressed in previous Sections.

BTC pipeline construction and Sangachal Terminal works will both result in extra plant and personnel vehicles on the roads local to Sangachal. Local traffic flow may be subject to disruption from both projects when the BTC pipeline spread is in the Sangachal area, with a corresponding impact upon safety. This is regarded as being of **Medium** significance.

Construction of the SCP in the year immediately following BTC will result in cumulative impacts in the form of an additional period during which construction vehicles are using the road networks. This will extend the period of disruption to the normal flow of traffic.

If the SCP is not constructed immediately following the BTC pipeline, impacts from SCP traffic will be delayed and may be reduced if the construction of the Silk Road has progressed in the interim period and vehicles are able to use this facility. However, this benefit may be offset by the need for demobilisation and remobilisation of construction teams. For whichever construction scenario takes place the cumulative impacts on traffic are assessed to be **Medium**.

The construction contractor is required to leave roads in at least their 'as found' condition following the construction of the BTC pipeline and SCP. The cumulative impact on the state of the roads is therefore negligible.

From the current rate of progress on the Silk Road, it is likely that there will be areas along the BTC pipeline route where pipeline and road construction occur at the same time. At such locations there will be elevated levels of traffic from both projects, which will result in cumulative impacts to the normal flow of traffic, and resultant increased likelihood of accidents.

In areas along the BTC pipeline route where the Silk Road has already been improved, this will probably result in safer transport of personnel and equipment.

### 13.6.10 Use of natural resources

Local natural resources used by the projects will include aggregate and water. Access roads will be required at a number of points along the BTC pipeline route, and these will be constructed of local aggregate. As the SCP will be built in close proximity to the BTC pipeline these access roads will be retained after BTC pipeline construction and re-used for SCP construction. The associated cumulative impact is thus minimised.

The cumulative impact will be a small volume of additional aggregate used for maintenance of the access roads constructed for the BTC pipeline. The additional impact of the SCP construction on top of the impact created by BTC pipeline construction will be **Low**. However there will also be a beneficial socio-economic cumulative impact from the purchase of additional local aggregate.

With regard to the use of water along the pipeline construction spreads, cumulative impacts are discussed in Section 13.6.5.

The construction of the Silk Road is likely to produce a high demand on quarries along the route for various grades of aggregate, similar to those required for BTC access routes, and it may be that in some areas demand for the materials is too high for local quarries to cater for. In this case it would be necessary to bring in aggregates from further afield, resulting in increased traffic. The combined requirements of the Silk Road and the BTC pipeline for aggregates may result in a short-term local shortage of material for other users and/or higher prices.

## 13.6.11 Employment

80% of the communities surveyed indicated that some inhabitants had construction experience from the WREP. This provides a more highly skilled workforce available for the construction of BTC pipeline than would otherwise be the case. Hence the cumulative impact is positive.

Competition for workers between the BTC pipeline and the Sangachal Terminal, in conjunction with other projects, could result in a temporary shortage of suitably skilled labour in Azerbaijan. This could reduce the local content of BTC pipeline employment (a negative cumulative effect) and/or push up local wages, a benefical socio-economic effect for local communities. However, given the anticipated employment needs of the BTC project, the significance of this impact is considered to be low. The projects will also contribute further to the development of a greater skills base within the local population, contributing to the overall long-term development of the economy.

Competition will also be greater for the provision of local goods and services. This could both push up the price of supplies, and encourage international contractors to source abroad thus reducing the cumulative economic benefits for Azerbaijan. The creation of the BP Enterprise Centre in Baku to encourage local operators to bid for supply contracts will go someway towards offsetting a potential move to source entirely from abroad and assist local suppliers in managing their supply to more than one project. Requirements in the ITT for contractors to maximise local sourcing will also offset moves to source abroad. The significance of the cumulative impact for Azerbaijan is generally positive. For the construction contractor, it may be result in a Low impact.

The combined effect of the BTC pipeline and SCP should be to generally double the inflow of cash into the local economies along the pipeline corridor. This will be achieved through: doubling the length of/number of opportunities for employment for unskilled and semi-skilled labour; doubling the opportunities for the provision of goods and services, and doubling the knock-on effect of having salaried workers living and working close to local villages. In addition, workers who have experience of two projects are more attractive to future employers than workers with experience of one only; opportunities for training and learning new skills for those employed are extended; and, confidence levels are increased (which may encourage some out-migration in search of future employment). Overall these will be a combined positive impact on the state of the local economy.

In the case of training, the knowledge that the second project is following may encourage contractors to train more local skilled and semi-skilled workers, and provide greater overall investment in training for all local workers.

### 13.6.12 Land and land-based livelihoods

Consultation indicated that a small percentage of landowners felt a level of dissatisfaction with the land acquisition process for the WREP, including concerns over land titles and compensation arrangements. This could potentially result in a greater degree of hostility towards the BTC pipeline and the land acquisition process, although these concerns have been fully integrated and addressed into the preliminary land acquisition process for BTC.

Effective implementation of the land compensation plan outlined in the RAP will go a long way towards avoiding similar problems for BTC, and should mitigate any cumulative impacts for the

BTC pipeline land acquisition process resulting from prior experience of the WREP.

There is no anticipated cumulative impact on land and land based livelihoods between BTC and Sangachal Terminal, given the nature of the land and livelihoods in this area. Nomadic herders that use the area will be kept fully informed of project plans.

Cumulative impacts of the SCP and BTC pipeline in terms of land are more complicated. On the one hand, the effect of planning the two projects in parallel will result in reduced impacts had the alternative been to run the two pipelines independently of one another. On the other hand, the effect of constructing SCP after the BTC pipeline will result in some of the land (ie the 20m middle strip) being out of production for at least one if not two or three seasons longer than would have otherwise been necessary. This will result in longer-term impacts for individuals affected by the temporary land take.

Clearly, the greater the gap between the construction of the two pipelines, the greater the impact on the local community if access to the land remains restricted between the two construction periods.

However, the compensation measures outlined in the RAP will ensure that appropriate compensation is calculated to take into account the longer duration of the impact. Hence, there should be no longer term impact on the livelihoods of those affected. The significance of this cumulative impact is therefore **Low**.

The Silk Road construction will require the permanent acquisition of land, and there is the potential that the land-owners and users affected by this project will also be affected by the BTC project. A cumulative impact of BTC and the Silk Road project will result if the land acquisition process used for the Silk Road fails to appropriately compensate hand owners and land users. This will increase hostility to any projects, including the BTC pipeline and SCP projects, where land must be acquired.

The land acquisition and compensation process outlined in the RAP will effectively mitigate issues in relation to the BTC pipeline and SCP only, but will go some way into defining responsibility for the different projects and therefore reducing the possibility of false blame. The cumulative impact should therefore be **Low**.

### 13.6.13 Infrastructure

Consultation also indicated that a small percentage of consultees felt a level of dissatisfaction with the condition that some of the roads used for WREP construction were left in, once the pipeline was completed. Some communities were concerned that their infrastructure had been severely degraded as a result. The mitigation measures outlined in Section 11.5 (Infrastructure, Services and Natural Resources, and Section 11.6 (Community Relations and Management of Construction Workers) have been designed to minimize construction related impacts.

More development projects running in parallel will put greater stress on local infrastructure particularly roads. The transport management plan will be developed to ensure that the cumulative impact of BTC and terminal operations upon the road network of Sangachal is minimised. Cumulative impact upon other services, including water and electricity, will also be managed.

The effect of two pipelines will result in an increased duration of minor disruptions to infrastructure, for example in terms of temporary road closures, the demand on telecommunications services and use of roads. The mitigation measures outlined in Section 11.5

(Infrastructure, Services and Natural Resources) and Section 11.6 (Community Relations and Management of Construction Workers) have been designed to minimize impacts, and therefore the significance of this impact is low.

With a number of projects being constructed in one region, as with BTC and the Silk Road, it may be difficult to determine which project is primarily responsible for any damage to roads or properties occurring during construction. It is conceivable that the BTC pipeline could be blamed for damage to roads actually caused by other projects, causing difficulties both in terms of compensation and relationships with local communities.

The significance of the cumulative impact will depend on whether or not the two projects coincide in location and in time. If they do, the cumulative impact could, in the short term, be of medium significance, unless it can be effectively mitigated through the community relations programme and liaison with the Silk Road construction management.

### 13.6.14 Community relations

Communities with previous experience of the WREP construction were generally positive about the idea of having opportunities to profit from a second and possibly third period of pipeline construction. Hence, the cumulative impact of BTC pipeline and the WREP together should be positive.

Increased numbers of foreign workers will result, gradually, in increased exposure of local communities to foreigners. Greater numbers arising in one area as a result of more than one project, for example BTC and Sangachal Terminal, will increase the rate of change. This can be positive where relations with the local community are good, and negative where there are existing difficulties in that relationship. This issue will be managed through the Community Relations Programme outlined in Section 11.6 and supplemented through cooperation between the community relations teams for the BTC and terminal projects. Hence, the cumulative impact is expected to be **Low**.

A pro-active community relations strategy has been developed to manage community concerns resulting from the BTC pipeline and SCP (Section 11.6.). This will provide the opportunity to revise mitigation measures if required, before the commencement of the SCP construction, based on experience of BTC construction, thus helping minimise any negative cumulative impacts. If the local communities see direct benefits from the BTC pipeline, the cumulative impact for SCP construction should be positive.

If community relations for the BTC pipeline are well managed, but those of any parallel project are not, the repercussions for community relations between construction workers and local communities in general will be affected. Hence, it will be critical for community relations officers to liaise with any parallel project teams where possible.

### 13.6.15 Safety

70% of communities surveyed had direct experience of WREP construction. Hence, those communities are prepared for the temporary disruption associated with pipeline construction, and are aware of the relevant safety issues. Therefore the cumulative impact should be **Low**.

The increasing volume of hydrocarbons transported throughout the region increases the possibility of an oil spill and/or gas explosion, although the likelihood of these events will be extremely low and will be minimised by the adoption of modern safety technologies, practices,

and transportation systems. State of the art contingency plans will also minimise the effects of an oil spill or an accidental release of gas in the highly unlikely event that it will occur. Hence, there is no significant cumulative impact.

When considering SCP, additional duration of exposure to pipeline construction sites, including open trenches and construction-related traffic, increases the opportunities for accidents within the local community. The mitigation measures outlined in Section 11, Social Impacts and Mitigation, are designed to reduce the risk of accidents during construction and operation. In addition, the risk for SCP should be lower than for the BTC pipeline as the level of awareness of the potential dangers within the local community should already have been raised. Hence, the cumulative impact should be Low.

Construction and the related risks to safety due to the Silk Road project are expected to be short term close to any one community and therefore it is not anticipated that the cumulative impacts of the Silk Road and BTC projects will be significant.

### 13.7 BTC PIPELINE AND ENVIRONMENTAL AND COMMUNITY INVESTMENT

### 13.7.1 Environmental Investment Plan

### 13.7.1.1 Background

Significant efforts have been taken to avoid areas of high biodiversity, primarily through route selection and careful siting of AGIs (as detailed in Section 4, Project Alternatives and Section 5, Project Description). It is recognised, however that there will be some unavoidable potential impacts on natural habitats. In line with the project policies and to meet the requirements of the World Bank Group on Natural Habitats (Operation Policy 4.04 June 2001), extensive direct mitigation measures aimed at the removal or reduction of potential adverse impacts on natural habitats or their functions have been developed and will be implemented during the project execution. These include measures to restrict conversion (narrowing the ROW in sensitive areas), and for strategic species retention (translocation of rare species) among others (detailed in Section 10, Environmental Impacts and Mitigation). Additionally, re-instatement practices will also ensure that effects on natural habitats are minimised through adherence to erosion control and bio-restoration standards (See Part 5 of the Technical Appendices for a summary of reinstatement strategy).

In addition to the above direct mitigation and management measures, an Environmental Investment Plan (EIP) is being developed in order to go beyond direct mitigation to meet BTC Cos commitment to maintaining and, where appropriate, enhancing biodiversity.

### 13.7.1.2 Objectives of the EIP

In recognition of the global importance of the regions biodiversity, the aim of the EIP is to enhance biodiversity management and/or protection primarily through investments in offset projects.

### 13.7.1.3 Types of environmental investment

Although still in the development stage, it is likely that the EIP will focus on the following areas:

- **Protected areas and species:** The objectives of the EIP will be consistent with those of State protected area development objectives and will explore mutually compatible opportunities with relevant government agencies
- Areas of high ecological significance outside protected areas: not all of Azerbaijan's biodiversity resources are contained within the protected areas system. Other areas of high ecological value will also be considered for initiatives under the EIP. Notably, semi-desert habitat protection in Gobustan will be considered in the light of proposals to establish the Gobustan National Park
- **Capacity Building for Biodiversity Management:** BTC Co will consider projects that build capacity for biodiversity priority-setting, conservation planning, policy development, and environmental awareness raising in Azerbaijan. This is in recognition of the fact that lack of ecological information and/or its inadequate use is one of the main challenges to biodiversity conservation in the country, and that increased capacity in this area would benefit natural resource managers, planners, policy-makers, scientists, educators, and the public

#### 13.7.1.4 Criteria

The EIP is being developed and will be implemented according to the following principles:

- **Impact:** projects will deliver tangible benefits and, as a minimum, address the 'no net loss' principle
- **Sustainability:** whether short-term or long-term in nature, projects will be designed to deliver lasting benefits
- **Linkages:** where applicable, projects will take into consideration the biodiversity priorities of Azerbaijan. In order to facilitate the success and sustainability of the EIP, linkages will also be sought with the Community Investment Programme
- **Prevention of duplication:** in selecting projects, every effort will be made to avoid duplicating the efforts of other companies, international and local agencies or Government departments; opportunities to leverage existing programmes or projects and co-operate with existing organizations will be sought
- **Participation:** projects will take into account the views, roles and rights of NGOs and relevant local communities. The needs of local communities in particular will be considered and balanced with the goal of enhancing biodiversity
- **Partnerships:** projects will encourage the development of partnerships between BTC Co and a wide range of organisations/civil society
- Monitoring and Evaluation: projects will have a strong monitoring and evaluation component in order to ensure lessons are learned and taken into account for existing or future projects. Clear targets and measurements of success for the projects will be identified
- **Transparency:** programmes and projects will be transparent and be open to internal and external scrutiny to allow potential beneficiaries, NGOs and government departments to understand the approach

#### 13.7.1.5 Timeframe

The development of the EIP is being undertaken through consultation with stakeholders to gain an understanding of issues/areas of concern where input would be most valuable. The intention is

that potential programmes or projects are developed and implemented in conjunction with relevant stakeholder bodies. Identification of potential partners is underway.

Implementation of the EIP will follow BP's business processes and control procedures for managing project performance and cost.

The programme will be publicised in more detail later in 2002, once feedback on the ESIA has been received and further consultation with authorities, NGOs and affected communities has taken place. It is expected that actual investments will begin in late 2002 or early 2003.

#### 13.7.1.6 Community investment programme

The objective of the community investment programme is to have a positive impact on communities most affected by construction activities by providing direct benefits, engaging with, and adding value, to local communities in a sustainable way. The community investment programme will go beyond the social impact mitigation measures described in the ESIA and move towards BP's goal of having a positive influence in the areas in which BP operates.

There will be two types of community investment projects:

- **Sustainable development projects,** which will be larger scale and longer term in duration and will take place primarily in communities that are directly affected by pipeline activities but may be extended to nearby towns or villages
- Local community projects, which are relatively small in scale and duration but respond to an immediate need in those communities that are directly affected by the construction activities

Potential projects will be developed through discussions with the communities themselves, NGOs, international development agencies and government. These discussions will ensure that the programme is not duplicating effort, and allows the company to gain from the experience of NGOs and identify potential implementation partners. Potential projects will be selected on the basis of criteria drawn from international community investment best practice and local experience.

Hence, at the route level, the cumulative effects of the pipeline construction and the community investment activities on the standard of living and quality of life of the local communities will be positive.

### 13.7.2 Unplanned events

During the type of construction projects discussed above there exists the potential for accidental events to occur. In the vicinity of the ROW such events include spillage of fuel. The more projects there are, the higher the chance of a spillage occurring. Impacts and mitigation measures described in Sections 10, Environmental Impacts and Mitigation, and 12, Residual Impacts, cover the potential impacts from accidental events.

Perhaps the major cumulative impact would result from an accidental event during operation of the BTC pipeline. The presence of the SCP in relatively close proximity to the BTC pipeline presents a risk, albeit extremely low, of a source of ignition. An explosion occurring in the SCP could result in rupture of the BTC pipeline with subsequent release of large volumes of oil. The impacts and mitigation measures which would be employed in the event of such a release of oil are discussed in Section 10, Environmental Impacts and Mitigation.

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# 14. MANAGEMENT AND MONITORING

## 14.1. INTRODUCTION

BTC Co's approach to Environmental and Social Management is to apply the key principles of environmental and social protection to all activities for which it is the Operator. These principles include:

- Prior assessment of environmental and social impact
- Minimisation of potential impact through design and other mitigation controls
- Monitoring of effectiveness of controls
- Auditing of performance

This section of the ESIA document highlights how these principles have been applied to the proposed BTC pipeline project. It identifies how all the commitments made in this ESIA will be translated into actions in the field and includes a schedule for implementing the actions, through identifying key roles and responsibilities.

The BP Environmental policy (see Section 6) and the BTC Statement of Social Objectives (Figure 14.1) provide a framework for the project as a whole, and particularly for the management and monitoring plans.

#### BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA

#### Table 14-1 BTC Statement of Social Objectives

The BTC Project is committed to delivering mutual benefits to communities along the pipeline route and to establishing long-term relationships with these communities, during both the construction and operational phases. We will:

- Minimise potential negative social impacts through identification and mitigation, in particular via a social impact assessment
- Publish regular updates on the environmental and social aspects of the project, and conduct regular dialogue with interested organisations
- Maintain regular contact with communities along the pipeline route through a team of Community Liaison Officers (CLOs) prior to, during and following the construction period
- Compensate for damage to land and property in a legal, transparent and ethical manner that respects the interests of those involved
- Manage expectations on employment opportunities by providing information on the level and duration of employment requirements
- Seek opportunities to increase employment of country nationals, and in particular those in villages along the pipeline route, subject to availability of appropriate skills
- Establish recruitment procedures that are transparent, public and open to all regardless of ethnicity, religion or gender
- Provide periodic training to enhance the skills and capacity of both employees and contractors
- Draw up procedures and management plans for all construction camps, in relation to contacts with local communities
- Provide periodic training on liaison with local communities to all staff employed by the BTC project and contractors
- Establish a community investment programme that delivers mutual benefits to BTC CO and communities along the pipeline route
- Seek opportunities for communities to mutually benefit from the activities undertaken, and infrastructure required, by the project.

## 14.2. ENVIRONMENTAL MANAGEMENT SYSTEM

The principal tool that will be employed to coordinate and review the environmental and social performance of the project will be the BTC Environmental Management System (EMS). Social issues will also be addressed within the EMS.

For construction phase, the EMS will be developed at two levels:

- An EMS developed by the construction contractor aimed at managing the environmental and social aspects of construction, within which there will be a series of environment and social management plans for each different issue area
- An overarching EMS developed by the Project principally aimed at providing assurance that the construction contractor is complying with the environmental and social requirements defined by the Project, including those specified in this ESIA. Key elements include: development and dissemination of a project specific environmental and social policy; development and implementation of environmental and social

management plans; and ongoing monitoring and development of each element of the EMS through a programme of regular review and continual improvement

BTC Co will establish a resource structure for the management of environmental and social issues during the construction and operation of the BTC project. One possible organisation structure is shown below. This organisation is indicative of the level of resources that will be devoted to the management of environmental and social issues, but has not been finalised.





For operational phase, the Project will develop a specific operational EMS.

### 14.1.1 Overview of Environmental & Social Management Plans

The effective implementation of the EMS is based on the development and implementation of a number of environmental and social plans.

A summary of the environmental and social plans is presented in Table 14-1. The plans are described in terms of their purpose and objectives, anticipated date for completion, and the

responsible party (either BTC Co or the Construction Contractor) for development and implementation of the plan.

In some cases draft plans have already been developed and included in the appendices for reference. These include the Reinstatement Summary Plan and the Cultural Heritage Management Plan. Whilst the BTC Project has developed these draft Plans, it is largely the responsibility of the construction contractor to effectively implement them. BTC Co will maintain a strong audit and overview role to ensure that the construction contractor implements the requirements of the Plans appropriately and effectively.

In other cases, measures for inclusion in the plans have been partially developed and must be finalised in conjunction with the construction contractor. The "frameworks" for these plans have been provided in this section and detail the objectives, principles, standards to be met, resources and general requirements. These frameworks include the: Community Safety Management Plan; Community Liaison Management Plan; Construction Camp Management Plan; Infrastructure and Services Management Plan; Procurement and Supply Management Plan; Employment and Training Management Plan; Resettlement Action Plan; Waste Management Plan; Pollution Prevention Management Plan; Transport Management Plan. Additional draft measures that have been developed based on the ESIA mitigation measures will be provided to the construction contractor to include in the development of the full plan.

BTC Co will review and approve these plans following their development by the construction contractor. The construction contractor is then responsible for their implementation with BTC Co maintaining a strong overview and monitoring role.

A number of plans will be fully developed prior to operations phase and include the Emergency Response Plan and Oil Spill Response Plan.

Plan Name	Text Reference	Purpose and	Date for Completion	Responsibility for Plan
		Plan	completion	Implementation
Community Safety Management Plan	Section 14.3.1	Outlines specific actions for the construction contractor & BTC Co to ensure safety of communities along the route	A framework plan has been developed. The Construction contractor is to build on this framework and finalise the plan prior to construction. A similar plan will be drawn up by BTC Co for the operations phase.	Construction contractor is responsible for development and implementation of the Community Safety Management Plan for construction phase, based upon the framework provided in this section. BTC Co responsible for development and implementation of the Plan during operations phase.
Community Liaison Management Plan	Section 14.3.2	Outlines specific actions for the construction contractor and BTC Co to ensure positive community relations	A framework plan has been developed (Section 14.3.2). The Construction contractor is to build on the framework and finalise Plan prior to construction.	The Construction contractor is responsible for development and implementation of the final Plan for construction phase, based upon the framework provided in this section. BTC Co responsible for development and implementation of the Plan during operations phase
Construction Camp Management Plan	Section 14.3.2	Ensure effective management of construction camp with regards to community relations and other potential impacts of the camps (eg on natural resources, roads etc).	This plan is negotiated during bid proposal stage. A framework plan has been developed in this Section (14.3.2). The Construction contractor will build on this framework and finalise the Plan prior to construction	The Construction contractor is responsible for development and implementation of the final Plan for construction phase, based upon the framework provided in this section

Plan Name Text Reference Purpose and		Purpose and	Date for	Responsibility for Plan	
		Objectives of	Completion	Development and	
		Plan		Implementation	
Infrastructure and Services Management Plan	Section 14.3.3	Sets out specific actions for the construction contractor and BTC Co, to minimise the disruption & negative impact associated with infrastructure, natural resources, households and community assets eg, land, roads, irrigation, etc	A framework plan has been developed within this Section. The Construction contractor is to build on the framework and finalise the Plan prior to construction.	The Construction contractor is responsible for the development and implementation of the Plan for construction phase based upon framework provided here in this section BTC Co responsible for development and implementation of the Plan during operations phase.	
Employment and Training Management Plan	Section 14.3.4	Sets out specific actions for the construction contractor and BTC Co to ensure opportunities for local employment are maximised and that there is a fair distribution of jobs. The Plan also aims to manage the skills development and training process to ensure local communities can benefit from this project in the longer term.	A framework plan has been developed in this section. The Construction Contractor is to build on the framework and finalise the Plan prior to construction.	The Construction Contractor is responsible for the development and implementation of the Plan based upon the framework provided here in this section. BTC Co responsible for development and implementation of the Plan during operations phase.	

Plan Name Text Reference Purpose and Objectives of		Date for Completion	Responsibility for Plan Development and	
		Plan		Implementation
Procurement and Supply Management Plan	Section 14.3.5	Sets our specific actions for the construction contractor and BTC co to ensure opportunities for sourcing goods and services from local and national businesses is maximised.	This plan is negotiated during bid proposal stage. A framework plan has been developed in this Section (14.3.5). The Construction contractor will build on this framework and finalise the Plan prior to construction	The Construction Contractor is responsible for the development and implementation of the Plan based upon the framework provided here in this section.
Transport Management Plan	Section 14.3.6	Sets out specific actions for construction contractor to properly manage traffic and it's potential impacts, including safety and accidents.	A framework plan has been developed in this Section. The Construction Contractor is to build on the framework and finalise the Plan prior to construction.	The Construction Contractor is responsible for the development and implementation of the Plan during construction phase based upon the framework provided here in this section. BTC Co is responsible for development and implementation of the Plan during operations phase.
Resettlement Action Plan	Section 14.3.7	Sets out the principles, process and specific actions related to land acquisition and compensation. s	Prior to construction.	BTC Co to develop and implement Plan
Cultural Heritage Management Plan	Section 14.3.8	Outlines strategy and actions to avoid and/ or minimise project impacts to archaeological and historic monument sites	Draft plan provided in Part 2 of the Baseline Reports Appendices	Construction contractor to implement requirements of draft plan. BTC Co. to monitor implementation of the plan.

Plan Name	Plan Name Text Reference Purpose and Objectives of		Date for Completion	Responsibility for Plan Development and
		Plan		Implementation
Re- instatement Summary Plan	Section 14.3.9 Part 5 of the Technical Appendices	This Summary outlines the actions that contractor will take to implement the Reinstatement Specification (a contractual document) and achieve the reinstatement targets for erosion control and bio- restoration.	The Reinstatement Specification has been completed and provided to potential Construction Contractors. A summary of this specification, the Reinstatement Summary Plan is provided in Part 5 of the Technical Appendices	The Construction contractor is responsible for development of the final reinstatement Plan, including method statements describing how the requirements of reinstatement specification will be implemented
Pollution Prevention Management Plan	Section 14.3.10	Sets out specific actions for the Construction Contractor and BTC Co to ensure that polluting emissions and disturbance are be prevented or mitigated	A framework plan has been developed in this Section. The Construction Contractor is to build on the framework and finalise the Plan prior to construction	The Construction Contractor is responsible for the development and implementation of the Plan based upon the framework provided in this section. BTC Co is responsible for development and implementation of the Plan during operations phase.

Plan Name	Text Reference	Purpose and Objectives of Plan	Date for Completion	Responsibility for Plan Development and Implementation
Waste Management Plan	Section 14.3.11	Outlines specific actions for the construction contractor and BTC Co to ensure that best practice waste management procedures are implemented.	Within six months of Construction Contractor mobilisation and three months before construction starts A framework plan has been developed in this section. The Construction Contractor is to build on the framework and finalise the Plan prior to construction	The Construction Contractor is responsible for the development and implementation of the Plan for construction phase, based upon the framework provided here in this section. BTC Co is responsible for development and implementation of the Plan during operations phase.
Emergency Response Plan	Section 14.3.12	Sets out specific actions for construction contractor and BTC Co to ensure that incidents, including fire and those involving spillage of chemicals or oil, are properly managed during both construction and operation	A framework plan has been developed in this Section. The Construction Contractor is to build on the framework and finalise the Plan prior to construction.	The Construction Contractor is responsible for the development and implementation of the Plan during construction phase based upon the framework provided here in this section. BTC Co is responsible for development and implementation of the Plan during operations phase.
Oil Spill Response Plan	Section 14.3.12 Part 7 of the Technical Appendices.	Provides guidelines for responding to incidents involving oil spills	A Framework has been completed and is provided as Part 7 of the Technical Appendices. The Final version will be prepared prior to operations commencing	BTC Co is responsible for development and implementation of the Plan for operations phase

The following sections describe the objectives, accountability, and resources required for the various plans in more detail.

## 14.3. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLANS

### 14.3.1. Community safety management plan

#### 14.3.1.1. Introduction

Project health and safety will be managed in accordance with BTC Co's HSE Policy as outlined in Section 6. The following framework addresses specific safety aspects only in so far as they have an impact on communities (as well as livestock) and external 3<sup>rd</sup> parties and has been developed through the ESIA process. The construction contractor will then be responsible for the development of the full Community Safety Management Plan. The final plans prepared by the contractor will require review and approval by BTC Co. There will be an overlap between this plan and many of the other management plans, particularly the Infrastructure and Services Management Plan.

### 14.3.1.2. Objectives and targets

The following community safety objectives have been defined:

- To ensure the safety of community members is not affected by pipeline construction or operation
- To generate safety awareness in local communities to ensure they are pro-active in managing their own safety with regard to the pipeline
- To minimise the spread of diseases in local communities, particularly HIV/AIDS and other STDs

In line with these objectives, specific targets will be set and negotiated with the construction contractor. For example, a target is likely to be set around ensuring no major health or safety incidents affecting community members.

#### 14.3.1.3. Accountability

The BTC Construction Manager will be accountable for providing assurance during the construction phase that the above objectives and agreed targets are met. The construction contractor will have primary responsibility for the implementation of the measures during the construction phase. Accountability during the operations phase will be with the BTC Co Operations Manager.

#### 14.3.1.4. Reporting

The construction contractor will report to the BTC Co Health and Safety manager on a regular basis. These reports will advise BTC Co on the projects performance against a range of health and safety metrics, including health and safety training; tool box talks, health screening, incidents, etc. Any incidents concerning community members will be reported. Major health

and safety incidents such as fatalities or serious accidents will be reported to BTC Co immediately.

The BTC Co Health and Safety manager will have responsibility for monitoring activities during both construction and operation.

#### 14.3.1.5. Resources

The contractor's community liaison team and construction engineers, with the assistance of the BTC Co community relations team, will implement community safety measures. The engineers will assist with technical details and on specific construction measures. These measures are in addition to the project general health and safety requirements and standards.

### 14.3.2. Community Relations Plans

This section relates to two plans which both have a community relations focus:

- Community Liaison Management Plan
- Construction Camp Management Plan

#### 14.3.2.1. Introduction

The Community Liaison Management Plan and Construction Camp Management Plan are a critical element of effective social impacts management. For any project of this size, there is potential for unexpected situations to arise that will need to be resolved if relationships between communities, the construction contractor and ultimately BTC Co are to remain positive and mutually beneficial. The focus of this plan will be the successful management of the construction workers and construction camps in terms of their interface with the community. However, it will also include community liaison measures for the operational phase of the pipeline. The Construction Camp Management Plan will also include measures that relate to other social impacts such as management of local infrastructure and natural resources.

#### 14.3.2.2. Objectives

The overarching objective for the community liaison and community relations teams is to build a positive, non-dependent relationship between the project participants and the local communities. This will be the basis of strong relationships during the operational period. These relationships should be based on open communication and mutual respect.

The Objectives of the Community Liaison Management Plan and Construction Camp Management Plan are to define actions, responsibility and timing in order to:

- To provide communities affected by the project with regular information on the progress of work and the implications for these communities
- To inform the BTC Co project team and contractors of any community related issues that may impact on construction
- To monitor implementation of mitigation measures and the impact of construction via direct monitoring and feedback
- To identify any significant new issues that may arise during the construction period
- To manage any disputes between the Project Participants/contractor and communities

• To assist in identifying opportunities for construction activities to deliver benefits to local communities

In line with these objectives, specific targets will be set and negotiated with the construction contractor.

In addition to these objectives, the Construction Camp Management Plan aims to manage workers housed in camps and will include a Code of Conduct, Camp Rules and an outline of camp training as well as specific measures such as camp security and limits on worker movements at night time.

#### 14.3.2.3. Accountability

The Construction Contractor community liaison team and a BTC Co community relation team will be appointed. As a minimum, the teams will be established as follows (Table 14-4), although the exact make up and numbers will be based on the construction schedule defined by the contractor, following award of contract:

Company	Management	Spread 1	Spread 2 <sup>(1)</sup>	Construction Camps	Total
Construction contractor Community Liaison Team		1	1	2	4
BTC Co Community Relations Team	1	0	0	4 (Supervisors – also responsible for Community Investment)	5

Fable 14-4	Community	Liaison	Teams
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The BTC Co Project Manager will be accountable for ensuring that the above objectives are met and may set additional targets in these areas as an incentive to implementation of the various measures.

The construction contractor will have primary responsibility for community liaison, and will be the first point of contact with affected communities. This will be achieved by allocating specific responsibilities to staff, and by a team of dedicated Community Liaison Officers (CLOs), one of whom will be designated as the Lead CLO. This individual will have overall responsibility for the following:

- Implementation of the Community Liaison Management Plan and the community outreach aspects of the Construction Camp Management Plan and Transport Management Plan.
- Training of all contractor staff with community liaison responsibilities.
- Communication with communities affected by the project.
- Provision of weekly and monthly reports to BTC Co
- Management of CLOs to carry out roles listed below.

<sup>(1)</sup> If only one spread is used, only 1 pipeline spread CLO will be necessary.

The construction teams in each spread will be working along an approximately 15-kilometre length at any one time. One CLO will therefore be required on each spread to liaise with communities along the pipeline route. Their role will be to:

- Meet community leaders and speak at community meetings prior to arrival of construction teams in a given locality, to inform them of the nature and length of activities in their area
- Hold fortnightly (or as required) meetings with leaders and communities while construction teams are present in their area
- Liaise with the contractor staff who have responsibility for community liaison in each work team
- Provide a focus for negotiation and resolution of specific disputes with communities if / when they arise, using the dispute resolution procedure
- Provide weekly updates to the contractor BTC Co Community Relations Manager
- Liaise with the management of the spread team on major issues arising, and provide feedback to communities on responses to these issues

There will also be CLOs working in the construction camps, and they will have responsibilities for community liaison.

- Hold regular meetings with communities throughout the lifetime of the camp
- Support implementation of the Construction Camp Management Plan (to be developed by the construction contractor for bid proposal and agreed through contract negotiations
- Advise the lead CLO, and construction camp management, on changes required to the Construction Camp Management Plan
- Meet with communities close to smaller camps and AGIs on a monthly basis, and advise contractor management, and the lead CLO on issues arising from these meetings
- Produce fortnightly reports on implementation of the camp management plan, specific incidents, and action taken to address community concerns

Further detail on the roles and responsibilities of the Contractor's liaison team and the BTC Co Community Relations Team can be found in the PCDP (Part 8 of the Technical Appendices).

### 14.3.2.4. Reporting

The reporting structure is as outlined above with weekly and fortnightly reports submitted by the CLO team to the BTC Co community relations team.

### 14.3.3. Infrastructure and services management plan

### 14.3.3.1. Introduction

The Infrastructure and Services Management Plan will set out the specific actions required to minimise the disruption and negative impacts for all communities services and infrastructure. This includes actions to minimise disruption to infrastructure and natural resources, as well as measures to avoid damage to household and community assets such as land, houses, roads, irrigation networks, etc. Many of the actions within the Infrastructure and Services Management Plan are continuous, ie, they will need to be implemented with each new community or settlement along the route. This framework plan provided below has been developed during the

ESIA process. A more detailed plan will be developed by the Construction Contractor, incorporating the requirements of the framework plan below. The final Plan will be require review and approval by BTC Co.

### 14.3.3.2. Objectives

The objectives of the plan are to define actions, responsibility and timing in order to:

- To minimise damage to community and household assets from the construction process
- To ensure 'No Net Loss' to community infrastructure, services and natural resources as a result of construction and operation

In line with these objectives, specific targets will be set and negotiated with the construction contractor.

### 14.3.3.3. Accountability

BTC Co will be accountable for ensuring that the above objectives are met. The construction contractor will have primary responsibility for implementation during construction, but the responsibility will fall back to BTC Co during operation. The Community Liaison team will have additional responsibility for the implementation of some of the measures.

#### 14.3.3.4. Monitoring and review

BTC Co will have responsibility for monitoring activities during both construction and operation.

### 14.3.3.5. Resources

It is proposed that the engineering teams for the construction contractor and BTC Co will be able to implement measures detailed within the Infrastructure and Services Management Plan with the assistance of the community liaison team employed for the project. Community liaison staff will be able to advise communities of any measures that are proposed and seek feedback where necessary on their implementation, either to advise the engineers on modifications needed, or to provide a report to BTC Co on the effectiveness of measures in minimising the social and economic impacts.

### 14.3.4. Employment and training management plan

#### 14.3.4.1. Introduction

The Employment Management Plan is vital to maximising the opportunities for local employment and ensuring a fair distribution of jobs to communities along the route. The plan will also include measures to manage the training to be provided to local workers. The construction contractor is responsible for preparation and implementation of the final Employment and Training Management Plan, and will incorporate the requirements of the framework as described below. The final plan will require review and approval by BTC Co.

#### 14.3.4.2. Objectives

The objectives of the plan are to define actions, responsibility and timing in order to:

- Maximise local employment in skilled, semi skilled and unskilled categories during construction and operation of the BTC pipeline, where practical, without compromising safety
- Ensure that unskilled jobs are filled from pipeline affected communities
- Ensure a fair distribution of jobs between pipeline affected communities along the route
- Provide a fair and transparent recruitment process
- Enhance the local skills base through training provided during employment

#### 14.3.4.3. Accountability

The BTC Co team will be accountable for ensuring that the above objectives are met and will set targets in these areas. The construction contractor will have primary responsibility for the implementation of these measures during construction, but the responsibility will fall back to BTC Co during operation.

#### 14.3.4.4. Monitoring and review

BTC Co will have responsibility for monitoring activities during both construction and operation.

#### 14.3.4.5. Resources

It is proposed that existing staff resources for the construction contractor and BTC Co will be able to implement these measures with the assistance of the community liaison team employed for the project. This team will be able to help the construction contractor to run employment recruitment at district level (eg, through district level recruitment centres). BTC Co will also need to supply a member of staff during local level recruitment along the route to act as an independent figure monitoring the fairness of the recruitment process.

### 14.3.5. Procurement and supply management plan

#### 14.3.5.1. Introduction

BTC Co aim to maximise the quantity of goods and services that are supplied by both local and national businesses to the project and to promote the efficient use of resources. This will be contingent on whether local suppliers can offer sufficient quality and reliability and can meet the stringent standards. This Plan will help BTC Co and the Construction Contractor to identify goods and services that will be suitable to local suppliers and to implement measures designed to improve the capacity of local businesses to respond to these opportunities. The plan will build on existing BTC Co supplier programmes (eg, supplier seminars).

#### 14.3.5.2. Objectives

The objectives of the plan are to define actions, responsibility and timing in order to:

• Promote opportunities for local sourcing of goods and services

- Build capacity of local suppliers to meet contracting opportunities
- To promote the efficient and sustainable use of natural resources
- Minimise the procurement and storage of potentially hazardous materials
- Promote the adoption of good environmental and social practices by suppliers

#### 14.3.5.3. Accountability

The BTC Co team will be accountable for ensuring that the above objectives are met and will set targets in these areas. The construction contractor will have primary responsibility for the implementation of these measures during construction, but the responsibility will fall back to BTC Co during operation.

#### 14.3.5.4. Monitoring and review

BTC Co will have responsibility for monitoring activities during both construction and operation.

#### 14.3.5.5. Resources

Existing procurement resources within the construction contractor will be able to implement the Procurement and Supply Management Plan with the assistance of the community liaison team and the BTC Co team managing existing supplier programmes.

### 14.3.6. Transport management plan

#### 14.3.6.1. Introduction

The Transport Management Plan is required in order to minimise the negative impacts and enhance any positive impacts, due to project-related traffic (both rail and road) on all communities affected by construction and subsequent operation of the BTC pipeline. This includes actions to minimise disruption to the existing road infrastructure, communities adjacent to the road network and natural resources, as well as measures to avoid damage to household and community assets such as land, houses, irrigation networks, etc. Many of the actions within the plan are continuous, ie, they will need to be implemented along the route.

The Construction Contractor is responsible for preparation and implementation of a Transport Management Plan. A framework relevant to social and environmental aspects associated with transport activities is presented below. The requirements of the framework will be incorporated into the final Plan prepared by the Construction Contractor. The Plan is required to be reviewed and approved by BTC Co.

#### 14.3.6.2. Objectives of plan

The following social and environmental objectives have been developed in relation to assist transport management:

• To provide communities affected by traffic (both rail and road) from the BTC project with sufficient information on the effects of the project-specific traffic and the opportunity to resolve traffic related complaints

- To ensure limitations on the size, number, frequency and timing of project-related vehicles on specific roads are set to minimise negative impacts on communities and the surrounding environment
- To control hazards associated with project-related traffic through project speed limits, driver training, journey management and appropriate signage
- To reduce impacts on the environment through effective emissions control, high standards of vehicle maintenance, adherence to relevant standards including noise emissions and defined working hours
- To review the effectiveness of the Transport Management Plan and revise the mitigation measures employed, if necessary

In order to achieve these objectives the Plan will address, as a minimum, the following:

- Vehicle sizes and schedule of movements
- Vehicle standards (axle weights, noise limits, etc)
- National traffic procedures
- Local traffic procedures
- Mobilisation/demobilisation of heavy equipment
- Description on the transport of pipe
- Liaison with local communities
- Management of transport contractors
- Management and resolution of traffic -related complaints
- Access confined to demarcated working areas
- Road capacities and define approved routes for specific categories of vehicle
- Strict enforcement of project speed limits
- Driver environmental and safety awareness training
- Journey management planning
- Effective maintenance to minimise vehicle emissions & fuel consumption
- Warning signs at road crossings
- Ensure a high standard of vehicle maintenance
- Regular maintenance of plant and equipment to meet relevant standards
- Use of silencers
- Defined working hours
- Responsible use of vehicles
- Procedure for informing local residents of noisy activities

#### 14.3.6.3. Accountability

Prior to commencing any site work, the Contractor will develop a project-specific Transport Management that will cover both contractor and BTC Co transportation during construction. The Contractor's performance will be monitored by the BTC Co Project Manager or delegate.

#### 14.3.6.4. Monitoring & review

The Construction Contractor will prepare weekly reports presenting the monitoring of compliance with the Transport Management Plan. The BTC Co Project Manager or his delegate will audit the activities of the Contractor at least every six months.

#### 14.3.6.5. Resources

The Contractor will be responsible for the Transport Management Plan. Additional resources may be required in complex situations and these will be provided by the Contractor. This situation may arise in situations where community liaison is a particularly requirement. In this case the resources identified in the community relations plans (Section 14.3.2 above) will be employed.

### 14.3.7. Resettlement action plan

A Resettlement Action Plan is currently being produced (see summary in Section 11.4) and will be released as a public document in third quarter 2002. It will define the following:

- Indicators and performance measures that will be used in conjunction with objectives defined below to assess progress and the effectiveness of Resettlement Action Plan mitigation actions.
- Monitoring activities to be taken by the Project (internal monitoring)
- Monitoring activities to be undertaken by an independent third party (external monitoring)
- Reporting requirements
- Monitoring schedule (frequency and duration of monitoring activities)

Monitoring activities are an important aspect of this Plan. The monitoring will help keep stakeholders informed of BTC Co's performance with respect to delivery of the commitments and actions described in the Plan.

### 14.3.7.1. Objectives

Objectives of the plan are:

- Timely and effective delivery of the commitments and actions described in the Resettlement Action Plan
- Disbursement of compensation in accordance with agreements
- Affected lands are adequately reinstated for appropriate use
- Effective delivery of measures to offset any adverse project impacts on land use, income levels or productivity
- Pre-project living standards and income levels are sustainably restored.
- That grievances expressed by project affected people are followed up and, where necessary, corrective action is implemented
- Monitor any dispute that cannot be resolved by the grievance system as it progresses
- That project affected people understand the resettlement process and their rights and avenues for complaint
- Any cases of hardship are identified and, where necessary, additional support is provided

### 14.3.7.2. Accountability

BTC Co will have overall responsibility for ensuring that resettlement commitments are met and that other parties (involved government agencies, construction contractor, other project staff, consultants) fully understand their roles and responsibilities.

#### 14.3.7.3. Monitoring and review

BTC Co will have overall responsibility for monitoring implementation of the Resettlement Action Plan. Mechanisms for independent third party review are presently being discussed with IFIs. Detailed monitoring arrangements will be described in the forthcoming Resettlement Action Plan.

#### 14.3.7.4. Resources

Resources and budgets for land acquisition and resettlement monitoring will be outlined in the Resettlement Action Plan. To implement monitoring, the project will draw on some or all of the following:

- BTC Co's community liaison staff and land acquisition team
- Construction contractor's community liaison staff
- In-country NGOs
- Third party resettlement specialists

### 14.3.8. Cultural heritage management plan

#### 14.3.8.1. Introduction

A draft Cultural Heritage Management Plan has been drawn up as part of this ESIA (Part 2 Baseline Reports of the Appendices) and will be implemented by the Contractor in order to minimise the negative impacts and enhance any positive impacts due to construction of the BTC pipeline. The plan builds on work completed and ongoing as part of the ESIA process. For example initial baseline surveys along the proposed BTC pipeline route have highlighted significant archaeological sites.

Local alterations to the route line or width of the working corridor have been incorporated throughout the design programme and further modifications are likely to be made in the future.

#### 14.3.8.2. Objectives

The following are the objectives of the Cultural Heritage Management Plan:

- Conservation during the lifetime of the BTC pipeline project, protection of sites in the vicinity of construction activities wherever required, provision of access tracks
- Pre-Construction, agree minor re-routes where possible
- During Construction, undertake archaeological digs

In order to address these objectives the Cultural Heritage Management Plan will address as a minimum the following:

- Training for Contractor staff
- Protection of sites in the vicinity of construction activities by demarcation fences
- Protect of sites through ensuring access tracks to new or existing facilities are carefully sited
- Respect the cultural heritage of the areas in which work is carried out.

- Mechanism for agreeing stopping work in the encountering a potential archaeological site during ROW clearance or excavation activities
- Mechanism for agreeing minor re-routes where possible
- Mechanism for agreeing "skipping" sections
- Identify sites requiring further investigation
- Complete all digs during the construction phase wherever possible

#### 14.3.8.3. Accountability

BP is employing research teams consisting of specialist contractors to implement the different phases of the Cultural Heritage Management Plan (Part 2 Baseline Reports of the Appendices).

#### 14.3.8.4. Reporting

A report will be prepared prior to the start of construction in any new length of activity detailing the specific Cultural Heritage Management Plan activities to be employed. In order to ensure that the Cultural Heritage Management Plan is effective and reduces unnecessary delays to construction activity to a minimum there will be clear lines of communication between the Cultural Heritage Management Plan contractors (Part 2 Baseline Reports of the Appendices) and the BTC Project Manager or his delegate and weekly reporting of compliance with the Plan.

The BTC Co Project Manager or his delegate will audit the activities of the Plan contractors at least every 6 months.

#### 14.3.8.5. Resources

The Cultural Heritage Management Plan contractors will be responsible for the plan. Additional resources may be required in complex situations and these will be provided by the BTC Co.

### 14.3.9. Reinstatement Summary Plan

#### 14.3.9.1. Introduction

A summary of the reinstatement specification, the Reinstatement Summary plan is presented at Part 5 of the Technical Appendices. This specification is the document that outlines, in a contractual sense, the principles and the targets for erosion control and bio-restoration. The contractor will develop additional specific methods statements and procedures that will detail how the goals outlined in the specification will be met and incorporate these to develop a final Reinstatement Management Plan.

#### 14.3.9.2. Objectives

The Reinstatement Management Plan will outline actions, responsibilities and timing in order to:

- Protect top soil
- Stabilize the ROW
- Restore faunal and floral habitats
- Dispose of spoil appropriately
- Avoid impacts due to side slope cuts

#### 14.3.9.3. Accountability

The final Reinstatement Management Plan, including Method Statements, Inspection Plans and Record Portfolios for all erosion control and reinstatement works will be produced by the Contractor for approval by the BTC Co Project Manager. The Contractor is responsible for the implementation and audit of the effectiveness of the Plan. The Contractor's performance will be monitored by the BTC Co Project Manager, or delegate, on at least a monthly basis.

#### 14.3.9.4. Reporting

A report will be prepared prior to the start of construction in any new area. The report will detail the specific reinstatement activities for that area. A report will be prepared on completion of construction activity in the area and annually thereafter or until reinstatement is agreed to be complete by the BTC Co Project Manager or his delegate.

#### 14.3.9.5. Resources

The Contractor will be responsible for implementation of the Plan. Additional resources may be required in complex situations and these will also be provided by the Contractor.

### 14.3.10. Pollution prevention management plan

#### 14.3.10.1. Introduction

The contractor will develop a Pollution Prevention Management Plan. It will detail the manner by which polluting emissions and disturbance associated with the project are to be prevented or mitigated. A framework for the plan is provided below. The final plan prepared by the contractor, incorporating the requirements of the framework below, and will require review and approval by BTC Co.

#### 14.3.10.2. Objectives of plan

The following are the objectives of the Pollution Prevention Management Plan:

- To identify potential pollutants
- To provide proposals for bunding and lining of storage areas
- To provide procedures for transporting, handling, storing, using and disposing of pollutants
- To provide procedures for training and competence of operators
- To provide refuelling procedures
- To provide solid and waste water management
- To describe the proposed measures to prevent spillages and pollution to land and water
- To provide spatial and temporal constraints required adjacent to watercourses, etc
- To Protect local water supplies
- To provide source and discharge procedures for hydrostatic test waters
- To provide procedures for the control of noise pollution
- To provide procedures for the control of dust and mud
- To address transport disturbance
- To provide procedures to control of blasting operations

• To provide a list of pollution control equipment

A key aspect to be covered within the Pollution Prevention Management Plan is the management of hazardous waste material. Whilst it is not anticipated that significant amounts of hazardous waste materials will be generated, specific procedures to address hazardous materials will be developed.

At a minimum, the procedures specific to hazardous materials will include measures to ensure that:

- The physical and chemical properties of the materials are understood and that appropriate measures are in place to mitigate the hazards posed by them both to humans and the environment (eg, segregation of potentially reactive materials, maintenance of hazardous materials logs, provision of Material Safety Data Sheets for all stored materials)
- The volumes of hazardous materials purchased and stored by the project at any one time is minimised
- The design of fuel and hazardous material storage areas includes measures designed to minimise the potential for spillages and to ensure that spillages can be contained (eg, fuel tanks will be provided within concrete-lined, bunded containment areas, hazardous material storage areas will be furnished with a dedicated surface water drainage system that is isolated from the general storm water system)
- Diesel fuel day tanks have adequately sized vent lines terminating in the open air and at an elevation where overfilling will not cause tank rupture
- Temporary tanks and fixed engines are provided with a properly drained drip tray
- Discharge lines from all tanks are fitted with shut off devices capable of being operated from a safe position, ie outside the area where the tank is located
- Accessible level indicators are fitted to the storage tanks
- There is no storage of hazardous materials in flood plains or within 30m of a watercourse
- Storage of hazardous materials in areas of known groundwater vulnerability is avoided
- Storage of hazardous materials is in designated hazardous storage areas

#### 14.3.10.3. Accountability

Prior to commencing any site work, the Construction Contractor will develop the Pollution Prevention Management Plan. The Contractor is responsible for the implementation and audit of the effectiveness of the plan. The Contractor's performance will be monitored by the BTC Co Project Manager or delegate.

#### 14.3.10.4. Monitoring & review

A report will be prepared prior to the start of any construction detailing the specific pollution prevention management measures.

Weekly reports will present the monitoring of compliance with the Pollution Prevention Management Plan. These reports will be prepared by the Contractor for submission to the BTC Co Project Manager or delegate. The BTC Co Project Manager or his delegate will audit the activities at least every six months.

#### 14.3.10.5. Resources

Additional resources may be required in complex situations and these will be provided by the BTC Co. This situation may arise where community liaison is a particularly requirement.

### 14.3.11. Waste management plan

#### 14.3.11.1. Introduction

Waste management plans will be developed for both the construction and operational phases of the project.

The construction contractor will be required to develop a construction specific waste management plan prior to the start of the construction work.

Upon completion of the commissioning phase, the Operations Waste Management Plan will be required.

It is expected that the operator will adopt some of the third party agreements made by the construction contractor as long-term disposal routes. It is also anticipated and that some or all of the waste handling/treatment/disposal facilities established during construction will be adopted for operational use.

#### 14.3.11.2. Objectives of plan

The following are the objectives of the Waste Management Plan:

- To provide a consolidated summary of the various regulations and restrictions governing the generation, handling, treatment and disposal of wastes generated during the construction/commissioning phases of the project
- To provide any permitting requirements for waste treatment or disposal
- To provide detailed method statements for each element of the waste management handling, treatment and disposal process
- To identify any third party agreements for waste transfer or handling
- To provide proposals to audit waste management operations
- To identify responsible use of materials to minimise waste
- To specify requirements for monitoring of compliance with the plan to reduce visual impact from waste site
- To enforce strict duty of care on the project managers and the contractors
- To establish secure waste storage in defined areas away from watercourses, drains and aquifers and secure from vermin
- To prohibit of uncontrolled burning or burial waste
- To identify the requirements for the environmental review of potential landfill & incinerator sites including site selection & proposed operation mode
- To provide monitoring and auditing procedures
- To identify provisions for inert waste
- To ensure that all potential subsoil disposal sites and disposal plans are subject to an environmental review and an environmental risk assessment prior to their adoption

• To provide procedures for offsite disposal or long term storage of contaminated material

#### 14.3.11.3. Accountability

Ultimate responsibility for correct waste disposal lies firmly with BTC Co. and in this role it will ensure that:

- Project contractor (s) have adequate training and follow stipulated waste management procedures for minimising, handling and storing waste
- Waste disposal contractor(s) use facilities for treatment and disposal of waste that meet acceptable standards
- Audits are carried out to ensure these are achieved

#### 14.3.11.4. Monitoring & review

The waste management plans will be monitored prior to the start of construction and monthly thereafter. During operational activities, the waste management plan review will be an integrated part of the EMS and will regularly audited throughout the year.

#### 14.3.11.5. Resources

Detailed waste management procedures will be put in place including the requirement for consignment notes giving an accurate description of the waste. Consignment notes follow wastes to the ultimate disposal site/operator and provide an auditable trail. All personnel employed at the project facilities will receive formal waste management awareness training, particularly regarding the correct waste segregation, storage and labelling procedures and potential recycling of waste.

### 14.3.12. Oil spill and emergency response plans

#### 14.3.12.1. Introduction

Emergency and Oil Spill Response Plans will be required for both construction and operational phases.

For construction, an Oil Spill and Emergency Response Plans must be drawn up and implemented by the Contractor in order to minimise the negative impacts due to potential oil spills and incidents during construction.

The operational Oil Spill Response Framework is contained in Part 7 of the Technical Appendices.

These plans will seek to minimise the risk of all oil spills, accidents and incidents during construction and subsequent operation of the BTC pipeline. The plans will address contingency planning, training, and specific procedures to address accidents and incidents.

#### 14.3.12.2. Objectives

#### Construction Phase

The following are the objectives of the Construction Oil Spill and Emergency Response Plans:

- Provide guidelines for responding to an incident involving a significant spillage of fuel/hydrocarbons
- Outline basic principles involved in a spill site assessment
- Provide guidance for selecting appropriate response procedures depending on the characteristics of the area in which the spill has occurred

In order to address these objectives the Construction Oil Spill and Emergency Response Plan will include as a minimum the following:

- Site assessments in terms of their environmental sensitivities
- Identification of potential accidents and incidents
- Identify types of environmental incidents and near misses
- Include a Contingency plan identifying material, personnel and contact numbers
- Procedures to be followed during an incident response
- Emergency response training for all construction crews
- Releases to the atmosphere, eg, techniques for isolating the source
- Spillage on land: small spillage (less than 50 L), eg,
  - Techniques for isolating the source
  - Use of absorbent material to mop up spill
  - Appropriate disposal of contaminated soil
  - Incident reporting
- Spillage on land: larger spillage (more than 50 L), eg,
  - Techniques for isolating the source
  - Containment of the spread of the spill using sand bags
  - Excavation of trenches down hill of spill to intercept groundwater with absorbent material in trench
  - Appropriate disposal of contaminated material
  - Incident reporting
- Spillage into water, eg,
  - Techniques for isolating the source
  - Deployment of a boom downstream of the spillage and spanning the entire watercourse
  - Angling of the boom to direct pollutant to one of the banks
  - Use of floating absorbent and/or skimmers to remove the pollutant
  - Removal of contaminated material from site in accordance with statutory regulations
- Procedures to dispose of contaminated material
- Procedures for investigating actions undertaken

The construction Oil Spill and Emergency Response Plans will include procedures for incident reporting. In all cases an incident report shall be issued within 48 hours of the incident. For significant cases (eg, in excess of 50 L of hydrocarbon) the incident shall be reported immediately. The Contractor will comply with the reporting requirements of the local or national authorities.

#### **Operational Phase**

The objectives of the Operational Emergency Response Plan are to define:

• Emergencies and their reporting
- Organisational structure and ensure effective interfacing with stakeholders
- Procedures
- Resources
- Training

In order to address these objectives the Operational Emergency Response Plan will include as a minimum the following:

- Definition of an emergency
- Identification, initial reporting and classification of emergencies
- The Emergency Response organisation and management structure
- Interfaces with authorities, affected third party organisations and the public
- Emergency Response resources (manpower and equipment, etc)
- Responsibilities of Emergency Response personnel
- Specific procedures to be followed, including evacuation
- Training requirements for assigned emergency personnel
- Procedures for testing, reviewing and updating the plans and procedures

#### Operational Oil Spill Response Plan

A detailed risk assessment has been undertaken for the BTC oil pipeline project by BP (see Section 10). An operational Oil Spill Response Framework has been prepared and is included as Part 7 of the Technical Appendices.

The objectives of the operational Oil Spill Response Plan are to:

- Control a release, which may arise from a fault in the operation of the pipeline and associated facilities
- Minimise the volume of such releases, when they do occur, by securing the source in the most appropriate way
- Minimise the extent of movement of the released oil spill from the source, by timely containment
- Minimise the environmental impact of primary releases by timely containment and recovery response
- Maximise the effectiveness of the recovery response through the selection of both the appropriate equipment and the technique to be employed. This will be based on the knowledge of the relevant properties of the oil and the changes in their properties arising from the ambient conditions into which they are released and the sea and land conditions and morphologies onto which they are released
- Maximise the effectiveness of the response through trained and competent, operational and response teams

### 14.3.12.3. Accountability

Prior to commencing any site work, the Contractor will develop construction Oil Spill and Emergency Response Plans. The Contractor is responsible for the implementation and audit of the effectiveness of these. The Contractor's performance will be monitored by the BTC Co Project Manager or his delegate.

During operation the BTC Co will be responsible for the Operational Emergency Response Plan and Operational Oil Spill Response Plan.

### 14.3.12.4. Reporting

Monthly reports will present the monitoring of compliance with the Oil Spill and Emergency Response Plan. These reports will be prepared by the Contractor for submission to the BTC Co Project Manager or his delegate. The BTC Co Project Manager or his delegate will audit the activities of the Contractor's Community Liaison Team at least every six months.

#### 14.3.12.5. Resources

The Contractor will be responsible for the Construction Oil Spill and Emergency Response Plan. Additional resources may be required in complex situations and the Contractor will provide these.

The BTC Co Project Manager or his delegate will be responsible for the Operational Emergency Procedures Plan and Operational Oil Spill Response Plan.

### 14.4. CONSTRUCTION AND OPERATION PHASE MONITORING

### 14.1.2 Construction phase monitoring

This section presents the different monitoring activities that will be undertaken throughout the construction activities. Monitoring is an important element of the overall EMS, encouraging implementation of the agreed measures and providing information on their effectiveness. Where mitigation measures are not effective, they will be reviewed and alternative strategies put in place.

### 14.4.1.1. Key performance indicators

Key Performance indicators will be set for both environmental and social management of key issues. These will be discussed and set with contractors during bid negotiations and will be integral to BTC Co's monitoring of the contractor's environmental and social management performance. Positive financial incentives may be attached to the achievement of these.

### 14.4.1.2. Actions and Responsibilities

BTC Co monitoring and assurance activities will be mainly associated with oversight and audit of the construction contractors and the construction process following the review and approval of the contractor's method statements. In this role BTC Co will be assisted as required by experienced consultants, independent third parties, and inspection companies.

BTC Co activities will consist of the following:

- Spot-check verification of contractors' own monitoring procedures
- Audits and compliance reviews of environmental and social elements of the contract (including the ESIA).

# 14.4.2. Construction phase monitoring

Table 14-7 presents environmental monitoring activities for generic impacts & their associated specific mitigation measures on the ROW, as set out in Section 10.

Monitoring of social impacts mitigation (both on the ROW and in local communities) as set out in Section 11, are outlined in Table 14-10.

Where monitoring highlights that mitigation measures are ineffective or have not been fully complied with BTC Co will immediately discuss with the contractor the following:

- Steps required to ensure compliance with overall objectives
- Feasibility of mitigation measure, including cost effectiveness, so that more appropriate measures can be agreed if necessary
- Whether the impact has already been fully mitigated

Aspect	Mitigation Procedure	Monitoring Action	Responsibility	Timing
A1 Use of raw materials & natural resources	Development and implementation of procurement, supply and waste management	Review and approval of the contractors Procurement and Supply Management Plan and Waste Management Plan	BTC Co.	Pre-construction
	procedures	Routine monitoring, documentation and review of procurement and waste management processes	Contractors	Throughout construction period
		Spot checks on procurement and waste management processes	BTC Co	Throughout construction period
A2 Loss of habitat	Development and implementation of: • Environmental management	Review and approval of the contractors management plans, detailed construction method statements and reinstatement plan	BTC Co.	Pre-construction
	<ul> <li>Construction method statements (including clearance)</li> </ul>	Routine monitoring, documentation and review of application of mitigation measures	Contractors	Throughout construction period
	<ul> <li>Transport Management (including route selection)</li> </ul>	Spot checks on the contractors performance	BTC Co	Throughout construction period
	Reinstatement Plan	Spot checks on completion of all necessary pre-construction	BTC Co.	Pre-construction
	Additional ecological surveys and translocation programmes	assessments and development of mitigation actions for sensitive sites		
	) -	Routine monitoring of species translocation programmes	BTC Co	Pre-construction and during construction in sensitive areas

		y Timing	Pre-construction					Throughout	construction period		Throughout	construction period	Pre-construction				Pre-construction				Throughout	construction period		Throughout	construction period	
		Responsibilit	BTC Co.					Contractors			BTC Co		BTC Co.				BTC Co.				Contractors			BTC Co		
BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA	7 Environmental Monitoring Activities	Monitoring Action	Review and approval of the contractors	Transport management plan, Infrastructure and Services	Management Plan, Community Liaison	Management Plan, Community Safety	Management Plan and Procurement and Supply Management Plan	Routine monitoring, documentation and	review of application of mitigation	measures	Spot checks on the contractors	performance	Spot checks on completion of all	necessary pre-construction	assessments and development of	mitigation actions for sensitive sites	Review and approval of the contractors	Employment and Training Management	Plan and detailed construction method	statements	Routine monitoring, documentation and	review of application of mitigation	measures	Spot checks on the contractors	performance	
	Table 14-	Mitigation Procedure	Mitigation measures to be	formulated in conjunction with local rail operators	-												Ensure adequate ventilation and	dispersion of vapours	Ensure welding is undertaken by	appropriately trained personnel						
		Aspect	A3 Rail Movements														A4 Metal vapour	emissions								

		BTC PIPELINE ESIA		
		FINAL ESIA		
	I able 14-/	Environmental Monitoring Activities		
Aspect	Mitigation Procedure	Monitoring Action	Responsibility	Timing
A7 Potential for	Development and	Review and approval of the contractors	BTC Co.	Pre-construction
accidental spillage	implementation of specific	Pollution Prevention Management Plan,		
of hazardous	procedures for hazardous	Employment and Training Management		
materials (eg	materials management	Plan, Transport Management Plan,		
lubrication fluids,	Minimisation of acquisition and	Procurement and Supply Management		
oils, paints, diesel	storage of hazardous materials	Plan, Waste Management Plan,		
etc).	Training of personnel in safe use	Emergency Response plan, Oil Spill		
	& handling of hazardous	Response Plan and construction		
	materials	method statements		
	Provision of appropriate spill	Recording and regular review of	Contractors	Throughout
	response equipment and spill	incidents and near misses		construction period
	response training	Routine monitoring, documentation and	Contractors	Throughout
	Kapid response in event of	review of training, procurement, storage		construction period
	spillage	and waste management processes		
	-	Spot checks on contractor performance	BTC Co	Throughout
		and record keeping		construction period
		Routine review of incident and near		
		miss data.		

	Table 14-	7 Environmental Monitoring Activities		
Aspect	Mitigation Procedure	Monitoring Action	Responsibility	Timing
A8 Production &	Provision of waste treatment	Review and approval of the contractors	BTC Co.	Pre-construction
disposal of solid &	facilities, control of liquid waste	Procurement and Supply Management		
liquid waste	generation and disposal in	Plan, Pollution Prevention Management		
	accordance with project	Plan, Construction Camp Management		
	standards. Training of project	Plan and Waste Management Plan		
	workers and visitors to project	Routine monitoring, documentation and	Contractors	Throughout
	sites.	review of procurement, materials		construction period
		management and waste management		
		processes		
		Routine monitoring of effluent	Contractors	Throughout
		discharges and atmospheric emissions		construction period
		from incineration plant		
		Spot checks on procurement and waste	BTC Co	Throughout
		management processes		construction period
		Routine review of discharge monitoring		
		data		
A9 Production of	Provision of waste water and	Review and approval of the contractors	BTC Co.	Pre-construction
black and	sewage treatment facilities,	Pollution Prevention Management Plan,		
greywater	control of liquid waste generation	Construction Camp Management Plan		
	and disposal in accordance with	and Waste Management Plan		
	project standards. Training of	Routine monitoring, documentation and	Contractors	Throughout
	project workers and visitors to	review of pollution prevention, training		construction period
	project sites.	and waste management processes		
		Routine monitoring of effluent	Contractors	Throughout
		discharges and atmospheric emissions		construction period
		Irom incineration plant		
		Spot checks on pollution prevention,	BTC Co	Throughout
		training and waste management		construction period
		processes		
		Routine review of discharge monitoring		
		data		

	Table 14-	7 Environmental Monitoring Activities		
Aspect	Mitigation Procedure	Monitoring Action	Responsibility	Timing
A8/A9 Disposal of	Risk assessment to be	Review and approval of the contractors	BTC Co.	Pre-construction
liquid wastes/water	undertaken before any chemical	Pollution Prevention Management Plan,		
	additives are used in hydrotest	Procurement and Supply Management		
(Hydrotest Specific	water	Plan, Waste Management Plan,		
Measures)	Controlled discharge of water to	Infrastructure and Services		
	reduce soil erosion	Management Plan and detailed		
	Testing and treatment of water	construction method statements		
	before discharge	Routine monitoring, documentation and	Contractors	Throughout
	Responsible disposal of waste	review of application of mitigation		construction period
	water, no disposal of	measures		
	Incompatible water in areas of	Spot checks on the contractors	BTC Co	Throughout
	groundwarer of surface warer	nerformance	) ) -	construction period
	vuinerability			
A8/9 Disposal of	Waste water treatment facility at	Review and approval of environmental	BTC Co.	Prior to Operational
waste	pump station	management and monitoring	management	Period
(During Operations)	Environmental review of	procedures for operations	team/third parties	
	permanent waste disposal	Routine monitoring and review of waste	BTC Co.	Throughout
	arrangements	and wastewater discharges during		Operational Period
		operations		
		Spot checks on BTC Co performance	BTC Co.	Throughout
			management	Operational period
			realinuin paries	

Aspect	Table 14-7 Mitigation Procedure	7 Environmental Monitoring Activities Monitoring Action	Responsibility	Timing
A10 Disturbance of	Vehicle movements confined to	Review and approval of the contractors	Contractor	Throughout
vegetation	Provision of environmental	Infrastructure and Services		
	training to drivers and plant	Management Plan, Community Liaison		
	operators Community linicon to discourses	Management Plan and Community		
	local use of ROW as road	Routine monitoring documentation and	Contractors	Throughout
	Common access routes to be	review of traffic management and		construction period
	used for BTC pipeline, SCP and	community liaison processes		
	WREP were practical	Spot checks on traffic management,	BTC Co	Throughout
	I rattic movements to be nreceded by an assessment of	training and community liaison		construction period
	cround conditions	processes.		
	grouna conations	Routine review of access route condition and adherence to defined		
		access routes.		
A11 Vehicle	<ul> <li>Selection of appropriate</li> </ul>	Review and approval of the contractors	BTC Co.	Pre-construction
movements	routes for vehicles using	Transport Management Plan,		
	public road network and	Infrastructure and Services		
	project access roads	Management Plan and Employment		
	<ul> <li>Provision of environmental</li> </ul>	ang iraining wanagement Plan		
	training for vehicle drivers	Routine monitoring, documentation and	Contractors	Throughout
	and equipment operators	review of traffic management and		construction period
	<ul> <li>Control of operational</li> </ul>	training processes		
	speeds and operating times	Collection and review of incident and	Contractors	Throughout
	<ul> <li>Maintenance of vehicles and</li> </ul>	near miss data		construction period
	plant	Spot checks on procurement and waste	BTC Co	Throughout
		management processes		construction period
		Routine review of incident and near		
		miss renorts		

		Timing	Pre-construction	Throughout construction period	Throughout construction period	Pre-construction	Pre-construction	Throughout construction period	Throughout construction period	Pre-construction
		Responsibility	BTC Co.	Contractors	BTC Co	BTC Co.	BTC Co.	Contractors	BTC Co	BTC Co.
BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA	7 Environmental Monitoring Activities	Monitoring Action	Review and approval of the contractors management plans, detailed construction method statements and Reinstatement Plan	Routine monitoring, documentation and review of application of mitigation measures	Spot checks on the contractors performance	Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites	Review and approval of the contractors Transport management plan, Pollution Prevention Management Plan, detailed construction method statements and Reinstatement Plan	Routine monitoring, documentation and review of application of mitigation measures	Spot checks on the contractors performance	Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites
	Table 14-7	Mitigation Procedure	<ul> <li>Protection of soil storage areas from vehicle movements</li> <li>Protection of soil surface in</li> </ul>	<ul> <li>areas of soft ground</li> <li>Provision of appropriate drainage and regular</li> </ul>	regrading		<ul> <li>Access limited to demarcated ROW and specified access roads.</li> <li>Strict enforcement of project speed limits</li> </ul>	<ul> <li>Reinstatement as early as practical</li> <li>Damping down of ROW</li> <li>Identification of areas of particularly sensitive</li> </ul>	receptors (eg, villages or crops)	
		Aspect	A12 Soil compaction				A13 Dust generation			

		BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA		
	Table 14-	7 Environmental Monitoring Activities		
Aspect	Mitigation Procedure	Monitoring Action	Responsibility	Timing
A14 Combustion gases (CO <sub>2</sub> , CO, NO <sub>2</sub> , NO, SO <sub>2</sub> , PM, CH <sub>4</sub> , VOCS)	<ul> <li>Maintenance of all vehicles and plant to meet relevant international standards and manufacturer's recommendations</li> <li>Monitoring of vehicle and</li> </ul>	Review and approval of the contractors Transport management plan, Pollution Prevention Management Plan, Construction Camp Management Plan and detailed construction method statements	BTC Co.	Pre-construction
	<ul> <li>plant emissions</li> <li>Optimisation of plant running time (where appropriate)</li> </ul>	Routine monitoring, documentation and revi ew of application of mitigation measures	Contractors	Throughout construction period
		Routine monitoring of atmospheric emissions from major fixed plant (eg, incinerators)	Contractors	Throughout construction period
		Spot checks on the contractors performance Routine review of discharge monitoring data	BTC Co	Throughout construction period
A7 Fuel & oil leaks	<ul> <li>Ensure a high standard of vehicle maintenance</li> <li>Use only designated fuel storage methods and refuelling procedures</li> <li>Ensure oil spill response equipment is available and</li> </ul>	Review and approval of the contractors Pollution Prevention Management Plan, Employment and Training Management Plan, Transport Management Plan, Emergency Response plan, Oil Spill Response Plan and construction method statements	BTC Co.	Pre-construction
	emergency response training is provided	Recording and regular review of incidents and near misses	Contractors	Throughout construction period
		Routine monitoring, documentation and review of training, procurement, storage and waste management processes	Contractors	Throughout construction period
		Spot checks on contractor performance and record keeping Routine review of incident and near miss data.	BTC Co	Throughout construction period

Aspect	Mitigation Procedure	Monitoring Action	Responsibility	Timing
A16 Noise	<ul> <li>Control of vehicle and plant</li> </ul>	Review and approval of the contractors	BTC Co.	Pre-construction
emissions	noise generation	Transport management plan,		
	<ul> <li>Control of operating hours</li> </ul>	Construction Camp Management Plan,		
	<ul> <li>Appropriate selection and</li> </ul>	Pollution Prevention Management Plan,		
	maintenance of plant,	Infrastructure and Services		
	vehicles and access routes	Management Plan, Community Liaison		
	<ul> <li>Appropriate selection of</li> </ul>	Management Plan, Procurement and		
	construction techniques	Supply Management Plan and detailed		
	<ul> <li>Community liaison</li> </ul>	construction method statements.		
	<ul> <li>Ensure environmental</li> </ul>	Routine monitoring, documentation and	Contractors	Throughout
	considerations are	review of application of mitigation		construction period
	incorporated into the siting	measures		
	and design of camps	Spot checks on the contractors	BTC Co	Throughout
	<ul> <li>Implement workforce</li> </ul>	performance		construction period
	education with respect to	Spot checks on completion of all	BTC Co.	Pre-construction
	minimising disruptive	necessary pre-construction		
	activities. Incorporate into	assessments and development of		
	the project induction training	mitigation actions for sensitive sites		
	<ul> <li>Implementation of camp</li> </ul>			
	rules including restrictions			
	on noisy activities	- - - - - - -		- -
A16 Noise	<ul> <li>Monitoring of emissions</li> </ul>	Keview and approval of environmental	BIC Co.	
emissions	<ul> <li>Maintenance of plant to</li> </ul>	management and monitoring	management	Period
(During Operations)	ensure compliance with	procedures for operations	team/tnirg parties	
	project noise limits	Routine monitoring and review of	BTC Co.	Throughout
		emissions from combustion plant during		Operational Period
		operations		
		Spot checks on BTC Co performance	BTC Co.	Throughout
			management team/third_narties	Operational period

		BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA		
	Table 14-	7 Environmental Monitoring Activities		
Aspect	Mitigation Procedure	Monitoring Action	Responsibility	Timing
A17 Abstraction of Ground Water	<ul> <li>Sampling and analysis of water from existing boreholes</li> <li>Adherence to national and local licensing policy for abstractions</li> </ul>	Review and approval of the contractors Pollution Prevention Management Plan, Infrastructure and Services Management Plan, Community Liaison Management Plan and detailed construction method statements	BTC Co.	Pre-construction
	<ul> <li>Test-pumping of new abstractions and monitoring of impacts on existing</li> </ul>	Routine monitoring, documentation and review of application of mitigation measures	Contractors	Throughout construction period
	<ul> <li>abstractions</li> <li>Monitoring of water levels in wellands</li> </ul>	Spot checks on the contractors performance	BTC Co	Throughout construction period
		Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites	BTC Co.	Pre-construction
A18 Disruption of drainage / irrigation channels	<ul> <li>Undertake pre-construction surveys of irrigation and drainage systems as necessary to identify existing systems and devise temporary replacement</li> </ul>	Review and approval of the contractors Infrastructure and Services Management Plan, Community Liaison Management Plan, Reinstatement Plan and detailed construction method statements	BTC Co.	Pre-construction
	<ul> <li>measures if required,</li> <li>Undertake liaison with land owners/land occupiers/land</li> </ul>	Routine monitoring, documentation and review of application of mitigation measures	Contractors	Throughout construction period
	<ul> <li>users</li> <li>Include provisions for drainage/irrigation</li> </ul>	Spot checks on the contractors performance	BTC Co	Throughout construction period
	management	Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites	BTC Co.	Pre-construction

	Table 14-	-7 Environmental Monitoring Activities		
Aspect	Mitigation Procedure	Monitoring Action	Responsibility	Timing
A19 Soil erosion	<ul> <li>Implementation of erosion</li> </ul>	Review and approval of the contractors	BTC Co.	Pre-construction
	control measures	Pollution Prevention Management Plan,		
	<ul> <li>Compaction of soil stack</li> </ul>	Reinstatement Plan and detailed		
	surface to minimise erosion	construction method statements (with		
	<ul> <li>Preparation &amp;</li> </ul>	specific attention to those concerning		
	implementation of approved	river crossings)		
	crossing methods	Routine monitoring, documentation and	Contractors	Throughout
	)	review of application of mitigation		construction period
		measures		
		Spot checks on the contractors	BTC Co	Throughout
		performance		construction period
		Spot checks on completion of all	BTC Co.	Pre-construction
		necessary pre-construction		
		assessments and development of		
		mitigation actions for sensitive sites		

Table 14.7 Environmental Monitoring Activities           Aspect         Mitigation Procedure         Monitoring Action         Responsion           A20 Disturbance of environmental monitoring Action         Aspect         Monitoring Action         Responsion           A20 Disturbance of environmental monitoring Action         Environmental approval of the contractors         BTC Co           archaeological         management of cultural         Review and approval of the contractors         BTC Co           undertake pre-construction         Undertake pre-construction         detailed construction method         Contract           undertake pre-construction         tetalieled construction method         Employment and Training Plan and         Contract           undertake pre-construction         detailed construction method         Environmethod         Employment and           undertake pre-construction         detailed construction method         Environmethod         Environmethod           undertake pre-construction         terview of application of mitigation         Encol         Environmentation and           undertake pre-construction         terview of application of mitigation         Encol         Environmentation           undertake pre-construction         terview of application of mitigation         Environmentation         Environmentand           envice of the contractors					
Aspect         Mitigation Procedure         Monitoring Action         Responsion           A20 Disturbance of archaeological <ul></ul>		Table 14-	7 Environmental Monitoring Activities		
A20 Disturbance of <ul> <li>Ensure appropriate</li> <li>management of cultural Heritage Management Plan, heritage</li> <li>management of cultural Heritage Management Plan, heritage</li> <li>Undertake pre-construction</li> <li>Undertake pre-construction</li> <li>Undertake pre-construction</li> <li>Method</li> <li>Statements</li> <li>Cultural Heritage Management Plan, heritage</li> <li>Undertake pre-construction</li> <li>Undertake pre-construction</li> <li>Method</li> <li>Statements</li> <li>Routine monitoring, documentation and contraction statements</li> <li>Implement a programme of masures</li> <li>Implement a programme of masures</li> <li>Implement a programme of measures</li> <li>Ensure that issues of action of application of mitigation</li> <li>Ensure that issues of action and evelopment of mitigation</li> <li>A21 Loss of soil</li> <li>Ensure appropriate segregation, assessments and development of mitigation</li> <li>Ensure appropriate segregation, assessments and development of reinstatement of striped soil</li> <li>Routine monitoring, documentation and contractors</li> <li>BTC Construction assessments and development of mitigation actions for sensitive sites</li> <li>Structure and reproval of statement of striped soil</li> <li>Review of application of mitigation</li> <li>Routine monitoring, documentation and contractors</li> <li>BTC Construction</li> <li>Review of application of mitigation</li> <li>Routine monitoring, documentation and contractors</li> <li>Routine monitoring, documentation and contractors</li> <li>Routine monitoring, documentation and contractors</li></ul>	Aspect	Mitigation Procedure	Monitoring Action	Responsibility	Timing
archaeological       management of cultural Heritage Management Plan, heritage       cultural Heritage Management Plan, heritage         • Undertake pre-construction neritage       • Undertake pre-construction works to evaluate & record known/suspected sites       Employment and Training Plan and detailed construction method works to evaluate & record known/suspected sites         • Implement a programme of archaeological surveillance during the clearance of the ROW and ancillary sites       Routine monitoring, documentation and review of application of mitigation archaeological surveillance         • Implement a programme of archaeological surveillance       Routine monitoring, documentation and contract         • Implement a programme of archaeological surveillance       Routine monitoring, documentation and contract         • Ensure that issues of archaeological surveillance       Spot checks on completion of all archaeological surveise         • Ensure that issues of archaeological surveise       Spot checks on completion of all archaeological surveise         • A21 Loss of soil       Ensure appropriate segregation, fertility         • Review and approval of the contractors       BTC Co archaeological surveise         • A21 Loss of soil       Ensure appropriate segregation, fertility         • Review of application of mitigation atrility       Contractors         • Review of application of mitigation are included in induction storage, management and construction method statements and review of application of mitigation	A20 Disturbance of	<ul> <li>Ensure appropriate</li> </ul>	Review and approval of the contractors	BTC Co.	Pre-construction
remains     heritage     Employment and Training Plan and works to evaluate & reconstruction method works to evaluate & recond known/suspected sites     Employment and Training Plan and detailed construction method statements          • Undertake pre-construction known/suspected sites <ul> <li>unplement a programme of archaeological surveillance</li> <li>e Ensure that issues of archaeological awareness</li> <li>e Ensure that issues</li> <li>e Ensure that issues&lt;</li></ul>	archaeological	management of cultural	Cultural Heritage Management Plan,		
<ul> <li>Undertake pre-construction works to evaluate &amp; record works to evaluate &amp; record known/suspected sites known/suspected sites known/suspected sites known/suspected sites known/suspected sites archaeological surveillance during the clearance of the ROW and ancillary sites ROW and ancillary sites archaeological suverellance archaeological awareness archaeological awarenes archaeological awareness archaeological awareness archaeological awarenes archaeological awarenes archaeological awarenes archaeological awarenes archaeological awareness archaeological</li></ul>	remains	heritage	Employment and Training Plan and		
works to evaluate & record known/suspected sites       statements       contract         howm/suspected sites       Routine monitoring, documentation and contract inplement a programme of archaeological surveillance during the clearance of the Rout and ancilary sites       Routine monitoring, documentation and Contract inplement a programme of archaeological surveillance during the clearance of the Rout and ancilary sites            • Implement a programme of archaeological surveillance during the clearance of the Rout and ancilary sites          Four clearance of the Rout and ancilary sites            • Ensure that issues of archaeological awareness are included in induction training.           Four clearance of the contractors          BTC Con the contractors            • A21 Loss of soil          Ensure appropriate segregation, training.           Spot checks on completion of all and the contractors          BTC Con the contractors            A21 Loss of soil          Ensure appropriate segregation, training.           Assessments and development of mitigation actions for sensitive sites             A21 Loss of soil          Ensure appropriate segregation, training action and evalue of and the contractors           BTC Con the contractors             A21 Loss of soil          Ensure appropriate segregation, the contractors           BTC Con the contractors             A21 Loss of soil          Ensure approval of the contractors		<ul> <li>Undertake pre-construction</li> </ul>	detailed construction method		
Known/suspected sites       Routine monitoring, documentation and contraction of mitigation         Implement a programme of archaeological surveillance       Implement a programme of archaeological surveillance         Implement a programme of archaeological surveillance       Spot checks on the contractors       BTC Co         ROW and ancillary sites       Ensure that issues of archaeological awareness       Spot checks on the contractors       BTC Co         ROW and ancillary sites       Ensure that issues of archaeological awareness       Spot checks on completion of all       BTC Co         archaeological awareness       erview of application actions for sensitive sites       BTC Co         A21 Loss of soil       Ensure appropriate segregation, training.       Review and approval of the contractors       BTC Co         A21 Loss of soil       Ensure appropriate segregation, terview and approval of the contractors       BTC Co       Management plans, detailed         Retility       reinstatement of stripped soil       Review and approval of the contractors       BTC Co         Retility       reinstatement of stripped soil       Review of application of mitigation       Contractors         Retility       reinstatement of stripped soil       Review of application of mitigation       Contractors         Retility       reinstatement of stripped soil       Review of application of mitigation       Contractors		works to evaluate & record	statements		
<ul> <li>Implement a programme of archaeological surveillance during the clearance of the ROW and ancillary sites archaeological surveillance during the clearance of the ROW and ancillary sites archaeological surveillance archaeological surveillance Brow of application of mitigation actions for contractors BTC Contractors of the contractors archaeological awareness archaeological awarenes archaeological archaeological awarenes archaeological averaeological averaeologicalaveraeological averaeological averaeological averaeologicalave</li></ul>		known/suspected sites	Routine monitoring, documentation and	Contractors	Throughout
archaeological surveillance     measures       during the clearance of the ROW and ancillary sites     Spot checks on the contractors     BTC Co       a Ensure that issues of archaeological awareness are included in induction training.     Spot checks on completion of all     BTC Co       A21 Loss of soil     Ensure appropriate segregation, structure and fertility     Ensure appropriate segregation, reinstatement of stripped soil     Review and approval of the contractors     BTC Co       A21 Loss of soil     Ensure appropriate segregation, structure and fertility     Review and approval of the contractors     BTC Co       Routine monitoring, documentation and fertility     Review of application of mitigation measures     BTC Co		<ul> <li>Implement a programme of</li> </ul>	review of application of mitigation		construction period
during the clearance of the ROW and ancillary sites       Spot checks on the contractors       BTC Co         e       Ensure that issues of archaeological awareness       Spot checks on completion of all sperformance       BTC Co         •       Ensure that issues of archaeological awareness       Spot checks on completion of all sperformance       BTC Co         •       Ensure appropriate segregation, training.       Spot checks on completion of all archaeological awareness       BTC Co         A21 Loss of soil       Ensure appropriate segregation, structure and tertility       Review and approval of the contractors       BTC Co         A21 Loss of soil       Ensure appropriate segregation, structure and tertility       Review and approval of the contractors       BTC Co         Review of application actions for sensitive sites       Management plans, detailed       Encore       BTC Co         Review of application of mitigation measures       Routine monitoring, documentation and measures       Contractors       BTC Co         Spot checks on the contractors       BTC Co       Deformance       BTC Co       Deformance       BTC Co		archaeological surveillance	measures		
ROW and ancillary sites       performance         • Ensure that issues of       spot checks on completion of all         • Ensure that issues of       spot checks on completion of all         archaeological awareness       spot checks on completion         A21 Loss of soil       Ensure appropriate segregation, training actions for sensitive sites         A21 Loss of soil       Ensure appropriate segregation, training action actions for contractors         storage, management and statement plan       construction method statements and construction method statements and teristatement Plan         Reinstatement of stripped soil       Review of application of mitigation         review of application of mitigation       measures         Bactoriac       BTC Co         partormance       partormance		during the clearance of the	Spot checks on the contractors	BTC Co	Throughout
Ensure that issues of archaeological awareness are included in induction training. A21 Loss of soil Ensure appropriate segregation, structure and fertility     reinstatement of stripped soil Review and approval of the contractors mitgation actions for sensitive sites mitgation and contractors measures Spot checks on the contractors BTC Co		ROW and ancillary sites	performance		construction period
archaeological awareness       Spot checks on completion of all       BTC Co         are included in induction       are included in induction       BTC Co         are included in induction       are sessary pre-construction       BTC Co         training.       assessments and development of       BTC Co         A21 Loss of soil       Ensure appropriate segregation,       Review and approval of the contractors       BTC Co         structure and       storage, management and       management plans, detailed       Enc Co         structure and       reinstatement of stripped soil       Review of application of mitigation       Enistatement plans, detailed         fertility       reinstatement of stripped soil       Routine monitoring, documentation and contractors       Enistatement plan         Routine monitoring, documentation and       review of application of mitigation       Measures       Enistation         measures       Spot checks on the contractors       BTC Co       Derformance       Derformance		<ul> <li>Ensure that issues of</li> </ul>	-		
are included in induction       are included in induction         training.       training.         A21 Loss of soil       Ensure appropriate segregation, structure and stores in the second approval of the contractors         BTC Co       mitigation actions for sensitive sites         A21 Loss of soil       Ensure appropriate segregation, structure and stores in the second approval of the contractors         BTC Co       mitigation actions for sensitive sites         structure and       storage, management and management plans, detailed         fertility       reinstatement of stripped soil         Review of application of mitigation       Routine monitoring, documentation and contracters         measures       Spot checks on the contractors       BTC Co		archaeological awareness	Spot checks on completion of all	BTC Co.	Pre-construction
training.       training.         training.       assessments and development of mitigation actions for sensitive sites         A21 Loss of soil       Ensure appropriate segregation, storage, management and storage, management and construction method statement of stripped soil         Review and approval of the contractors       BTC Co         structure and       storage, management and construction method statements and reinstatement of stripped soil         Review of application of mitigation       Review of application of mitigation         measures       Spot checks on the contractors       BTC Co		are included in induction	necessary pre-construction		
A21 Loss of soil       Ensure appropriate segregation, structure and structure and storage, management and structure and storage, management and reinstatement of stripped soil       Management plans, detailed       BTC Co         Review and approval of the contractors       BTC Co       BTC Co       BTC Co         structure and stripped, reinstatement of stripped soil       Review and approval of the contractors       BTC Co         Retrility       reinstatement of stripped soil       Review of application of mitigation       Contractors         Review of application of mitigation       measures       Spot checks on the contractors       BTC Co		training.	assessments and development of		
A21 Loss of soil       Ensure appropriate segregation, storage, management and structure and storage, management and management plans, detailed       BTC Co         structure and fertility       reinstatement of stripped soil       construction method statements and contraction method statements and review of application of mitigation       BTC Co         Review of application of mitigation       Review of application of mitigation       BTC Co         Review of application of mitigation       Review of application of mitigation       BTC Co         Result       Spot checks on the contractors       BTC Co			mitigation actions for sensitive sites		
structure and fertility     storage, management and reinstatement of stripped soil     management plans, detailed       fertility     reinstatement of stripped soil     construction method statements and Reinstatement Plan       Routine monitoring, documentation and review of application of mitigation     Contractors       Spot checks on the contractors     BTC Contractors	A21 Loss of soil	Ensure appropriate segregation,	Review and approval of the contractors	BTC Co.	Pre-construction
fertility         reinstatement of stripped soil         construction method statements and Reinstatement Plan           Routine monitoring, documentation and review of application of mitigation         Contractors           Browners         Spot checks on the contractors           Browners         Derformance	structure and	storage, management and	management plans, detailed		
Reinstatement Plan         Routine monitoring, documentation and Contracted in the contraction of mitigation         measures         Spot checks on the contractors         Derformance	fertility	reinstatement of stripped soil	construction method statements and		
Routine monitoring, documentation and Contracreview of application of mitigation         measures         Spot checks on the contractors         Derformance			Reinstatement Plan		
review of application of mitigation measures Spot checks on the contractors BTC Co performance			Routine monitoring, documentation and	Contractors	Throughout
measures Spot checks on the contractors BTC Co performance			review of application of mitigation		construction period
Spot checks on the contractors BTC Co			measures		
performance			Spot checks on the contractors	BTC Co	Throughout
			performance		construction period

Table 14.7 Environmental Monitoring Activities           Aspect         Mitigation Procedure         Monitoring Action         Responsibility         Timing           A22 Loss of <ul></ul>					
Aspect         Mitigation Procedure         Monitoring Action         Responsibility         Timing           A22 Loss of viability of soil seed         • Underate an envinonmental review of the route to identify areas where pre- construction seed of ontargement plan         Monitoring Action         Review and approval of the contractors viability of soil seed         Pre-construction preview of statement Plan           hank         areas where pre- construction seed of onthe surveiting of seed from surveiting of seed from surveiting areas and/or the surveiting of seed from proventer         Reinstatement Plan         Pre-construction construction seed out surveiting of seed from construction and contractors         Pre-construction preview of proventer           Figure appropriate stabilishment of nucsery         Reinstatement Plan         Reinstatement Plan         Contractors         Throughout           Figure appropriate suppropriate management and segregation, storage, management of management of segregation, storage, management of segregation, storage, management of management of segregation, storage, management of management of migration actions for sensitive sites         Fre-construction performance           A33 Impeded         Ensure that gaps are left in secssary pre-construction arimals, and onversite herds         BTC Co.         Pre-construction performance           A33 Impeded         Ensure gaps in weided arimals, and onversite herds         Ensure part gaps are left in secssary pre-construction assessary pre-construction assessary pre-construction be allow passage of domestic eristatement Plan, detailed arings ar critica		Table 14-7	7 Environmental Monitoring Activities		
A22 Loss of viability of soil seed and bank     Undertake an environmental review of the route to identify many arread in the serve of the route to identify many set on surrouction seed collection.     Review and approval of the contractors meany review of the route to identify many set on surrounding areas and/or stabilishment of nursery     Pre-construction Reinistatement Plan       A movesting of seeds from surrounding areas and/or surrounding areas and/or stabilishment of nursery     Routine monitoring, documentation and construction measures     Throughout       Performance     Routine monitoring, documentation and construction setabilishment of nursery     Routine monitoring, documentation and construction measures     Throughout       Performance     Routine monitoring, documentation and construction measures     EFC Co.     Throughout       Performance     Spot checks on the contractors     BTC Co.     Pre-construction construction measures       A33 Impeded     Ensure appropriate soil stacks at strategic     Spot checks on completion of all migation actions for sensitive sites     Pre-construction measures       A33 Impeded     Ensure that gaps are left in movement of wild     Review and development of migation actions for sensitive sites     Pre-construction measures       A33 Impeded     Ensure that gaps are left in movement of wild     Review and development of migation actions for sensitive sites     Pre-construction measures       A33 Impeded     Ensure that gaps in welden     Review and development of migation actions for sensitice sites     Pre-construction measures <th>Aspect</th> <th>Mitigation Procedure</th> <th>Monitoring Action</th> <th>Responsibility</th> <th>Timing</th>	Aspect	Mitigation Procedure	Monitoring Action	Responsibility	Timing
viability of soil seed       review of the route to identify management plans, detailed construction seed solection. Relaxisticement plans areas where areas and/or the review of application of mitigation       Contractors       Throughout construction and contractors         narvesting of seeds from areas and/or the contractors       Ensure appropriate series dout settle out establishment of nursey.       Spot checks on the contractors       Encore truction to construction and construction terrators       Encore truction terrators         233 Impeded       Ensure that gaps are left in another of while and evelopment of mitigation actions for sensitive sites and domestic herds       Spot checks on completion of all and the contractors       Pre-construction terrators         A23 Impeded       Ensure that gaps are left in assessments and development of mitigation actions for sensitive sites and locations to assessments and development of mitigation actions for sensitive sites and allow passage of domestic herds       Ensure that gaps are left in thrastructure and Services       Pre-construct and the contractors and contractors and construction terrators and domestic herds         A23 Impeded       Ensure that gaps are left in assessments and domestic herds       Ensure that gaps are left in assessments and development of an on the contractors and contractors a	A22 Loss of	Undertake an environmental	Review and approval of the contractors	BTC Co.	Pre-construction
bank         construction method statement and construction seed collection.         construction method statement and harvesting of seeds from surrounding areas and/or the surrounding areas areas surrounding areas areas surrounding areas areas surrounding areas areas surrounding areas are areas surrounding areas areas areas surrounding areas areas surrounding areas areas areas areas areas areas areas areas areas areas areas areas areas areas areas areas arimats, and arimats, and but areas areas areas arimats, and arimats, and but areas areas areas arimats, and arimats, and but areas areas areas arimats, and but areas areas areas areas areas areas areas areas arimats, and but areas areas areas areas areas areas areas areas areas areas areas areas a	viability of soil seed	review of the route to identify	management plans, detailed		
Answer       Ensistatement Plan         narvesting of seads from       Routine monitoring, documentation and Contractors       Throughout         narvesting of seads from       Routine monitoring, documentation and Contractors       Throughout         surrounding areas and/or the rest out       Spot checks on the contractors       BTC Co       Throughout         establishment of nursery       Spot checks on the contractors       BTC Co       Throughout         estaplishment of nursery       Spot checks on completion of all       BTC Co       Pre-construct         ensagement and       Spot checks on completion of all       BTC Co       Pre-construct         anaragement and       Spot checks on completion of all       BTC Co       Pre-construct         A23 Impeded       Ensure that gaps are left in       Revise and development of       Pre-construct         animals, and       Inclusion management Plan,       Infractuction actions for sensitive sites       Pre-construct         animals, and       Inclusion method statements and       Infractuction actions for sensitive sites       Pre-construct         animals, and       Inclusion of mitigation actions for contractors       BTC Co.       Pre-construct         animals, and       Inclusion actions for sensitive sites       Infractuction actions for sensitive sites       Inte-construct         an	bank	areas where pre-	construction method statements and		
Answesting of seeds from surrounding areas and/or the monitoring, documentation and surrounding areas and/or the serview of application of mitigation establishment of nursery segregation, storage, management and segregation, storage, management and reinstatement of topsoil       Routine monitoring, documentation and spot checks on the contractors       BTC Co       Throughout         Coops should be carried out segregation, storage, management and reinstatement of topsoil       Spot checks on completion of all spot checks on completion of all sessessments and development of mitigation actions for sensitive sites       BTC Co       Pre-construct         A33 Impeded       Ensure that gaps are left in reinstatement of wild       Ensure that gaps are left in sessessments and development of mitigation actions for sensitive sites       BTC Co.       Pre-construct         A33 Impeded       Ensure that gaps are left in reinstatement of wild       Ensure that gaps are left in sessessments and development of mitigation actions for sensitive sites       Pre-construct         A33 Impeded       Ensure that gaps are left in review of approval of the contractors       BTC Co.       Pre-construct         A33 Impeded       Ensure that gaps are left in review of approval of the contractors       BTC Co.       Pre-construct         A33 Impeded       Ensure that gaps are left in review of approval of the contractors       BTC Co.       Pre-construct         A33 Impeded       Ensure that gaps are left in review of approval of the contractors       BTC Co.       Pre-construct		construction seed collection,	Reinstatement Plan		
All of the carried out the carried on the carried out the carried on the carried out the carried on the carried out the carried of the carried out the carried		harvesting of seeds from	Routine monitoring, documentation and	Contractors	Throughout
Assume and of unresry crops should be carried out service appropriate     measures     measures       error should be carried out service appropriate     Ensure appropriate     Ensure appropriate     construction       egregation, storage, management and remistatement of topsoil     Spot checks on completion of all     BTC Co.     Pre-construct       ananagement and remistatement of topsoil     Spot checks on completion of all     BTC Co.     Pre-construct       A33 Impeded     Ensure that gaps are left in movement of wild     Spot checks on contractors     BTC Co.     Pre-construct       anovement of wild     is stacks at strategic     Community Liaison Management Plan,     Intractructure and Services     Intractruction       animals, and     locations     Leave gaps in welded     Management Plan,     Intractruction actions for sensitive sites       animals, and     locations     Leave gaps in welded     Community Laision actions for sensitive sites     Throughout       animals, and     locations     Intractructure and Services     Management Plan,     Intractruction       animals, and     locations     Leave gaps in welded     Community Laision     Intractructors     Throughout       animals, and     locations     locations     Management Plan,     Intractors     Throughout       animals, and     locations     constructin     Contractors     Throughout		surrounding areas and/or the	review of application of mitigation		construction period
crops should be carried out       Spot checks on the contractors       BTC Co       Throughout         ensure appropriate       Ensure appropriate       Spot checks on completion of all       BTC Co       Throughout         ensure appropriate       Spot checks on completion of all       BTC Co.       Pre-construct         nanagement and       Spot checks on completion of all       BTC Co.       Pre-construct         reinstatement of       necessary pre-construction       assessments and development of       mitigation actions for sensitive sites         A23 Impeded       ensure that gaps are left in       Review and approval of the contractors       BTC Co.       Pre-construct         animals, and       locations       soil stacks at strategic       Community Liaison Management Plan,       Pre-construct         animals, and       locations       Infrastructure and Services       BTC Co.       Pre-construct         animals, and       locations to       community Liaison Management Plan,       Infrastructure and Services       Infrastructure and Services         animals, and       locations to       construction method statements and       elow passage of domestic       Routine monitoring, documentation and       construction         allow passage of domestic       Routine monitoring, documentation and       Contractors       Throughout         herd		establishment of nursery	measures		
<ul> <li>Ensure appropriate performance</li> <li>Ensure appropriate and segregation, storage, management and reinstatement of topsoil reinstatement of topsoil</li> <li>Spot checks on completion of all BTC Co.</li> <li>Pre-construction</li> <li>Revealed</li> <li>Ensure that gaps are left in sessesments and development of mitigation actions for sensitive sites</li> <li>A23 Impeded</li> <li>Ensure that gaps are left in Review and approval of the contractors</li> <li>BTC Co.</li> <li>Pre-construct</li> <li>Revealed</li> <li>Ensure that gaps are left in Review and approval of the contractors</li> <li>BTC Co.</li> <li>Pre-construct</li> <li>Revealed</li> <li>Ensure that gaps are left in Review and approval of the contractors</li> <li>BTC Co.</li> <li>Pre-construct</li> <li>Revealed</li> <li>Ensure that gaps are left in Review and approval of the contractors</li> <li>BTC Co.</li> <li>Pre-construct</li> <li>Revealed</li> <li>Reveale</li></ul>		crops should be carried out	Spot checks on the contractors	BTC Co	Throughout
Algorithment     Spot checks on completion of all remanagement and reinstatement of topsoil reinstatement of topsoil reinstatement of the construction reinstatement of the construction reinstatement of mitigation actions for sensitive sites     Pre-construction accessary and between access at strategic construction method statement Plan, locations accessed acccessed accessed accessed accessed accessed accessed accessed accc		<ul> <li>Ensure appropriate</li> <li>segregation storage</li> </ul>	performance		construction period
management and reinstatement of topsoil       Spot checks on completion of all       BTC Co.       Pre-construction         A23 Impeded       e       Ensure that gaps are left in movement of wild       Bassessments and development of mitigation actions for sensitive sites       BTC Co.       Pre-construct         A23 Impeded       e       Ensure that gaps are left in soil stacks at strategic       Infigation actions for sensitive sites       BTC Co.       Pre-construct         A23 Impeded       e       Ensure that gaps are left in soil stacks at strategic       Review and approval of the contractors       BTC Co.       Pre-construct         animals, and domestic herds       e       Leave gaps in welded       Community Liaison Management Plan, locations       Infrastructure and Services       Pre-construct         animals, and domestic herds       Leave gaps in welded       Community Liaison Management Plan, locations to astrings at critical locations to astruction from the contractors <td< th=""><th></th><td>208108411011, 2101480,</td><td></td><td></td><td></td></td<>		208108411011, 2101480,			
Ternstatement of topsoil       necessary pre-construction         A23 Impeded       Ensure that gaps are left in       assessments and development of mitigation actions for sensitive sites         A23 Impeded       Ensure that gaps are left in       assessments and development of mitigation actions for sensitive sites         A23 Impeded       Ensure that gaps are left in       Review and approval of the contractors       BTC Co.       Pre-construct         movement of wild       soil stacks at strategic       Infrastructure and Services       BTC Co.       Pre-construct         animals, and       Leave gaps in welded       Management Plan, detailed       Eaver gaps in welded       Routine monitoring, documentation and       Construction for mitigation         Minimise interval between       Routine monitoring, documentation and contractors       BTC Co       Throughout         welding and ditching       Routine monitoring, documentation and construction for mitigation       Eaver gaps in the contractors       BTC Co       Throughout		management and	Spot checks on completion of all	BTC Co.	Pre-construction
A23 Impeded       Ensure that gaps are left in mitigation actions for sensitive sites         A23 Impeded       Ensure that gaps are left in mitigation actions for sensitive sites         A23 Impeded       Ensure that gaps are left in movement of wild         animals, and domestic herds       Eave gaps in welded         Actions       Community Liaison Management Plan, last and locations         Actions       Community Liaison Management Plan, last and locations to locations to animals, and atrings at critical locations to allow passage of domestic herds         Actions       Leave gaps in welded         Actings at critical locations to allow passage of domestic herds       Management Plan, detailed         Actings at critical locations to allow passage of domestic herds       Routine monitoring, documentation and contractors         Acting and ditching       Minimise interval between welding and ditching       Routine monitoring, documentation and construction preview of application of mitigation         Actions       Spot checks on the contractors       BTC Co       Throughout construction preview for the contractors		reinstatement of topsoil	necessary pre-construction		
A23 Impeded       Ensure that gaps are left in movement of wild novement of wild soil stacks at strategic locations animals, and domestic herds       Ensure that gaps are left in soil stacks at strategic locations soil stacks at strategic locations animals, and domestic herds       Ensure that gaps are left in soil stacks at strategic locations soil stacks at strategic locations are not wild non-stic herds       Ensure that gaps are left in soil stacks at strategic locations soil stacks at strategic locations to locations at critical locations to allow passage of domestic herds       Review and approval of the contractors locations at strategic locations to locations at critical locations to allow passage of domestic herds       Management Plan, detailed construction method statements and low passage of domestic herds       Management Plan, detailed construction and contractors       Throughout construction plan, detailed construction plan, detailed statements and method statements and low passage of domestic herds       Reinstatement Plan       Throughout construction plan         •       Minimise interval between welding and ditching and ditching and ditching performance       Routine contractors       BTC Co       Throughout construction plan         •       Minimise interval between welding and ditching performance       Exercise on the contractors       Co       Throughout construction plan         •       Minimise interval between welding and ditching performance       Exercise on the contractors       Co       Throughout construction performance         •       Minimise interval between performance       Exercise on the contractors       Exercise cons			assessments and development of		
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Spot checks on the contractors BTC Co Throughout performance construction performance		welding and ditching	measures		
performance construction p			Spot checks on the contractors	BTC Co	Throughout
			performance		construction period

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	Table 14-	-7 Environmental Monitoring Activities		
Aspect	Mitigation Procedure	Monitoring Action	Responsibility	Timing
A26 Disposal of surplus subsoil	Ensure that the generation of surplus soil is minimised and that disposal is	Review and approval of the contractors Waste Management Plan, Reinstatement Plan and detailed	BTC Co.	Pre-construction
	<ul> <li>conducted appropriately</li> <li>Ensure that any potential subsoil disposal sites and disposal plans are subject to an environmental review</li> </ul>	construction method statements Routine monitoring, documentation and review of application of mitigation measures	Contractors	Throughout construction period
	prior to their adoption	Spot checks on the contractors performance	BTC Co	Throughout construction period
		Spot checks on completion of all necessary additional assessments and development of appropriate mitigation	BTC Co.	Pre-construction
A27 Altered drainage	<ul> <li>Ensure appropriate consolidation of backfill</li> <li>Implementation of erosion</li> </ul>	actions Review and approval of the contractors Reinstatement Plan, Infrastructure and Services Management Plan and	BTC Co.	Pre-construction
	control measures	detailed construction method statements		
		Routine monitoring, documentation and review of application of mitigation	Contractors	Throughout construction period
		measures Spot checks on the contractors	BTC Co	Throughout
		heriorillarice		COLISE ACTION DELIGO

	Tahle 14.	.7 Environmental Monitoring Activities		
Aspect	Mitigation Procedure	Monitoring Action	Responsibility	Timing
A28 Disturbance of known/unknown contaminated land	<ul> <li>Avoid construction in areas of known or suspected contamination as far as is</li> </ul>	Review and approval of the contractors Pollution Prevention Management Plan, Waste Management Plan,	BTC Co.	Pre-construction
	<ul> <li>Ensure that where</li> </ul>	Reinstatement Plan and detailed construction method statements		
	contaminated land is	Routine monitoring, documentation and	Contractors	Throughout
	encountered it is effectively managed	review of application of mitigation measures		construction period
	1	Spot checks on the contractors	BTC Co	Throughout
		performance		construction period
		Spot checks on completion of all	BTC Co.	Pre-construction
		necessary additional assessments and		
		development of appropriate mitigation		
		actions		
A 23 Disposal of	Ensure that trench-water	Review and approval of the contractors	BTC Co.	Pre-construction
irencii=waler	disposal is undertaken in an appropriate manner	Poliuuon Prevenuon Management Plan, Wasta Managament Plan		
		Reinstatement Plan and detailed		
		construction method statements		
		Routine monitoring, documentation and	Contractors	Throughout
		review of application of mitigation measures		construction period
		Crot checke on the contractors	DTO	Throughout
		spot cnecks on the contractors performance		r nrougnout construction period

	Table 14-	7 Environmental Monitoring Activities		
Aspect	Mitigation Procedure	Monitoring Action	Responsibility	Timing
A30 Public & animal safety	<ul> <li>Erection of warning barriers where significant risk to public and livestock exists</li> <li>Installation of soft plugs in dich with sloped edges to</li> </ul>	Review and approval of the contractors Community Safety Management Plan, Infrastructure and Services Management Plan, Reinstatement Plan and detailed construction method	BTC Co.	Pre-construction
		Routine monitoring, documentation and review of application of mitigation measures	Contractors	Throughout construction period
		Spot checks on the contractors performance	BTC Co	Throughout construction period
A42 Discharge of ground water	Ensure that groundwater disposal is undertaken in accordance with the Construction Environmental Management Plan	Review and approval of the contractors Pollution Prevention Management Plan, Waste Management Plan, Reinstatement Plan and detailed construction method statements	BTC Co.	Pre-construction
	<ul> <li>Filter discharge if contains visible suspended solids</li> <li>Use of appropriate</li> </ul>	Routine monitoring, documentation and review of application of mitigation measures	Contractors	Throughout construction period
	measures to minimise scour at the discharge point	Spot checks on the contractors performance	BTC Co	Throughout construction period

Aspect	Table 14-: Mitigation Procedure	7 Environmental Monitoring Activities Monitoring Action	Responsibility	Timing
A34 Partial road closure	<ul> <li>Use non-open trench crossing techniques for major roads</li> <li>Minimise duration of closure of roads and provide temporary access where necessary</li> </ul>	Review and approval of the contractors Transport Management Plan, Infrastructure and Services Management Plan, Community Safety Management Plan, Community Liaison Management Plan, Reinstatement Plan and detailed construction method statements	BTC Co.	Pre-construction
	<ul> <li>trench to maintain access</li> <li>Institute temporary traffic</li> <li>control, where necessary</li> </ul>	Routine monitoring, documentation and review of application of mitigation measures	Contractors	Throughout construction period
	<ul> <li>Undertake community consultation</li> </ul>	Spot checks on the contractors performance	BTC Co	Throughout construction period
A35 Sediment release	<ul> <li>Avoid open cut river crossings on spawning rivers (the West Kura and the Hasansu) between early October and late June</li> </ul>	Review and approval of the contractors Pollution Prevention Management Plan, Emergency Response Plan, Reinstatement Plan and detailed construction method statements	BTC Co.	Pre-construction
	<ul> <li>Include environmental considerations in the selection of crossing design</li> </ul>	Routine monitoring, documentation and review of application of mitigation measures	Contractors	Throughout construction period
	and choice of methodology	Spot checks on the contractors performance	BTC Co	Throughout construction period

Aspect	Table 14- Mitigation Procedure	-7 Environmental Monitoring Activities Monitoring Action	Responsibility	Timing
A36 Modified river flow	Provide flow management mechanisms at watercourse crossings	Review and approval of the contractors Infrastructure and Services Management Plan, Community Liaison Management Plan, Reinstatement Plan and detailed construction method statements	BTC Co.	Pre-construction
		Routine monitoring, documentation and review of application of mitigation measures	Contractors	Throughout construction period
		Spot checks on the contractors performance	BTC Co	Throughout construction period
		Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites	BTC Co.	Pre-construction
A37 Impeded fish migration	<ul> <li>If river is dammed, undertake an environmental review to identify key</li> </ul>	Review and approval of the contractors Reinstatement Plan and detailed construction method statements	BTC Co.	Pre-construction
	<ul> <li>sensitivities for the fish</li> <li>population.</li> <li>Include environmental</li> <li>considerations in the</li> </ul>	Routine monitoring, documentation and review of application of mitigation measures	Contractors	Throughout construction period
	<ul> <li>scheduling of the crossing.</li> <li>Include provisions for fish canture and release on far</li> </ul>	Spot checks on the contractors performance	BTC Co	Throughout construction period
	<ul> <li>A more and a more any any flow interruptions</li> </ul>	Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites	BTC Co.	Pre-construction

	Table 14-	7 Environmental Monitoring Activities		
Aspect	Mitigation Procedure	Monitoring Action	Responsibility	Timing
A41 Potential for	<ul> <li>Adequate geotechnical</li> </ul>	Review and approval of the contractors	BTC Co.	Pre-construction
drilling fluid	survey work conducted	Pollution Prevention Management Plan,		
breakout/spillage	during design	Emergency Response Plan, Waste		
(During HDD)	<ul> <li>Risk assessment to be</li> </ul>	Management Plan and detailed		
	undertaken before drilling in	construction method statements		
	vicinity of sensitive surface	Routine monitoring, documentation and	Contractors	Throughout
	waters	review of application of mitigation		construction period
	<ul> <li>Storage of drilling muds in</li> </ul>	measures		
	bunded area	Spot checks on the contractors	BTC Co	Throughout
	<ul> <li>Avoid use of toxic chemicals</li> </ul>	performance		construction period
	in drilling fluid	Spot checks on completion of all	BTC Co.	Pre-construction
		necessary pre-construction		
		assessments and development of		
		mitigation actions for sensitive sites		
A38 Vented and	<ul> <li>Ongoing environmental</li> </ul>	Review and approval of environmental	BTC Co.	Prior to Operational
fugitive emissions	review of design with	management and monitoring	management	Period
of gas (when/if	objective of minimising	procedures for operations	team/third parties	
pump station is gas	emissions	Routine monitoring and review of	BTC Co.	Throughout
powered)	<ul> <li>Operational procedures</li> </ul>	emissions from combustion plant during		Operational Period
	including requirements for	operations		
	maintenance and monitoring	Spot checks on BTC Co performance	BTC Co.	Throughout
	of fugitive emissions		management	Operational period
			team/third parties	
A39 Future change	Risk assessment to be	Review and approval of any proposed	BTC Co	As Required
to oil inventory	undertaken before any	alterations to crude oil supply		Throughout
	significant changes to oil			Operational Period
	inventory			
A40 Oil spill	<ul> <li>Implementation of Oil Spill</li> </ul>	Review and approval of oil spill	BTC Co.	Prior to Operational
	Response Plan	response management and monitoring procedures for operations	management team/third parties	Period
			ובמווו/ווווח המווובא	

	Table 14-	7 Environmental Monitoring Activities		
Aspect	Mitigation Procedure	Monitoring Action	Responsibility	Timing
	<ul> <li>Provision of oil spill</li> </ul>	Routine monitoring and review of oil	BTC Co.	Throughout
	<ul><li>response training</li><li>Provision of oil spill</li></ul>	spill preparedness, training, equipment suitability and response team		Operational Period
	response equipment	coordination		
	<ul> <li>Pipeline surveillance and leak detection</li> </ul>	Routine monitoring of pipeline integrity and flow	BTC Co.	Throughout Operational period
		Spot checks on BTC Co performance	BTC Co.	Throughout
			management team/third parties	Operational period
A44 Loss of	<ul> <li>Reinstatement of boundaries</li> </ul>	Review and approval of the contractors	Contractor	Throughout
boundaries	following construction	Infrastructure and Services		Construction Period
	<ul> <li>Ensure consultation with</li> </ul>	Management Plan, Community Liaison		
	landowners, occupiers and	Management Plan and Reinstatement		
	users	Plan		
		Routine monitoring, documentation and	Contractors	Throughout
		review of traffic management and		construction period
		community liaison processes		
		Spot checks on community liaison	BTC Co	Throughout
		processes.		construction period
		Routine review of access route		
		condition and adherence to defined		
		access routes.		

	Table 14-10 Social monitoring plan during con	truction	
Mitigation Measure	Monitoring Action	Responsibility for Monitoring	Frequency/Timing
DURING CONSTRUCTION			
Community Relations			
Community Grievance Process	Spot follow up of complaints recorded in complaints register to assess whether process has been carried out correctly.	BTC Co Community Relations Team	Monthly
General Community Relations Management	<ol> <li>Random attendance at community meetings:</li> <li>Preliminary meetings – to assess whether appropriate information is being provided to communities and whether sufficient information collected from communities in order to ensure mitigation will be carried out effectively (eg road documentation process, identification of bee owners, etc)</li> <li>Meetings during construction in vicinity of village to assess whether complaints and issues are being dealt with effectively and to gauge the feelings of community members towards the project spot monitoring on whether liaison with informal communities (eg. construction process have been consulted with. (Check for written construction process have been consulted with. (Check for written</li> </ol>	BTC Co Community Relations Team	Meeting each month for communities along pipeline route. Bi-monthly for community meetings at construction camp affected locations. Bi-monthly for informal communities along route.
	reports of meetings, talk with these communities informally to ask whether they have been consulted)		
Worker induction training (by CLOs)	Review induction training materials Review induction training course	BTC Co Community Relations Team	Before implementation of training. Once during main recruitment period along route, once more during any secondary recruitment drives further along route.

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	Table 14-10 Social monitoring plan during cons	truction	
Mitigation Measure	Monitoring Action	Responsibility for Monitoring	Frequency/Timing
Construction Camp Disciplinary Procedures	Review HR Records, disciplinary log books etc at construction camps to ensure that construction camp rules are being implemented effectively, the extent to which there are infringements of the rules, and the effectiveness of community liaison following any incident.	BTC Co Community Relations Team	Once two months after a camp is in operation. If major issues are found, then review one month later, until issues are being managed satisfactorily. If issues found in first review are minor, monitor each 3-4 months during operational lifetime.
General Review of Community Relations Mitigation Measures	Monitor any changes to community relations mitigation measures via: formal review meetings with CLO team Acceptance of formal requests for changes to measures where appropriate Spot checks to identify where mitigation has changed but has not been notified to BTC Co via general review of mitigation activities	BTC Co Community Relations Team	Every month for first three months and then on a six monthly basis or as needed Monthly at construction camps and at construction sites on ROW
Construction Implementation of general construction mitigation measures	<ul> <li>Spot checks at ROW, construction sites and affected communities to ensure mitigation measures are being implemented. This will look specifically at: <ul> <li>Implementation of measures to avoid disruption to infrastructural services such as telecoms, electricity, gas and water.</li> <li>Implementation of community safety measures (fencing near residential areas, fencing on public trench crossings, warning lights and warning signs at open areas of trench)</li> <li>Suitable diversions are in place where necessary</li> <li>Dust and noise mitigation measures are provided as appropriate</li> </ul> </li> </ul>	BTC Co – Engineering Project Manager and BTC Co Community Relations Team	Monthly for first 3 months. If implementation of mitigation measures is proceeding appropriately, reduce monitoring to bi- monthly with review of written activity reports submitted on a weekly basis.

	Table 14-10 Social monitoring plan during con	truction	
Mitigation Measure	Monitoring Action	Responsibility for Monitoring	Frequency/Timing
	<ul> <li>Activity is taking place only within approved construction areas and these approved areas are clearly de-marcated</li> <li>Sediment prevention measures are in place as appropriate Quality of repair work done on any damaged property (eg houses, fencing, irrigation channels, etc) is acceptable to BTC CO and has been agreed as acceptable with property owner. With housing compare repaired state with documentation from pre-construction assessment</li> <li>Equipment secured appropriately over night and night security and storage measures are being implemented (eg organic waste removed, night watchmen employed, lighting over open trench)</li> </ul>		
Traffic Management Plan	See Environmental monitoring measures		
Additional project sites	Verify that appropriate social impact assessment and consultation has been completed for any additional sites to be used by project (eg. waste sites, aggregate sites, additional camps or pipe yards.) Review documentation of community consultation data as appropriate.	BTC Co Community Relations Team and Environmental Management Team	As needed.
Community consultation on roads	Spot monitoring of community consultation and documentation re construction of new roads and quality of existing roads	BTC Co Community Relations Team	In two to three locations during in first two to three months of construction process. If implementation of measures is considered insufficient, continue to monitor two to three communities on a bi- monthly basis. If implementation is satisfactory, spot monitor two to three communities on a six monthly basis.

	Table 14-10 Social monitoring plan during con	truction	
Mitigation Measure	Monitoring Action	Responsibility for Monitoring	Frequency/Timing
Condition of roads	Routine monitoring standard of roads being used during construction process (as identified in the TMP) against initial documentation	BTC Co – Engineering Project Manager	Monthly for first three months. If implementation of mitigation measures outlined in Section 11 is proceeding appropriately, reduce monitoring to bi- monthly with review of written activity reports submitted on a weekly basis.
Use of Power and Water resources by project	Review monthly power and water reports to assess whether they are within guidelines set out in ESIA and spot monitor at construction camps during construction/AGIs (during operation) to verify data being reported.	BTC Co Community Relations Team in conjunction with Engineering Project Manager	Monthly review of reports six monthly spot reviews. If resource usage is considerably over guidelines, monitor every two months until usage is within acceptable norms.
Local Sourcing Health and Safetv	Review of purchasing arrangements against local sourcing plan and targets/KPIs set during bid negotiations	BTC Co Community Relations Manager	Bi-monthly
Community safety	Spot monitoring of health and safety incidence rates for community members and full review of any serious incidents.	BTC Co Health and Safety manager	Monthly
	Spot monitoring of community traffic safety meetings		Two to three times in first four months and if training is seen as acceptable, revert to once every six months. If training is not of sufficient quality then continue at two to three every four months.
General safety	Spot monitoring of implementation of safety measures during	BTC Co – Engineering	Monthly for first three

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	Table 14-10 Social monitoring plan during con	truction	
Mitigation Measure	Monitoring Action	Responsibility for Monitoring	Frequency/Timing
measures during construction	construction as outlined in 'Implementation of general construction mitigation measures', General Construction Impacts section above.	Project Manager	months. If implementation of mitigation measures is proceeding appropriately, reduce monitoring to bi- monthly with review of written activity reports submitted on a weekly basis.
Health and safety training	Monitor HR records to ensure training is provided to all workers and spot monitor all courses (general health and safety, safe driving training, job specific health and safety) provided to ensure training is adequate	BTC Co Health and Safety Manager	
Employment			
Recruitment targets	Monitor monthly recruitment targets through monthly reports from construction contractor	BTC Co Community Relations Team	Monthly
Recruitment process	Assess construction contractor's recruitment strategy for effectiveness at ensuring reasonable geographic spread before recruitment begins Validation of appropriate identification system Review job descriptions to be provided at recruitment centres to ensure accurate and adequate information is provided.	Independent third party, eg. NGO BTC Co Community Relations Team	Pre-construction Pre-construction and as new job descriptions are developed.
Inequities in recruitment process	Independent person to oversee all recruitment in addition to BTC Co person Sample monitoring of recruitment days	BTC Co Community Relations Team Independent third party, eg. NGO	All major recruitment days Presence at two to three of monitoring days in initial recruitment round
Working Conditions	Sample audits of Constructor's HR documentation recording working conditions for all workers. This should include inspection of records of hours worked, wages paid, disciplinary actions taken, etc.	BTC Co Human Resources and Community Relations Teams	Once in first three months. If conditions meet local legal requirements and international standards, spot review

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	Table 14-10 Social monitoring plan during cons	struction	
Mitigation	Monitoring Action	Responsibility for	Frequency/Timing
Measure		Monitoring	
			standards have not been
			met, spot review every
			one-two months until
			standards are reached.

# 14.4.3. Operational phase monitoring

The following table (Table 14-13) presents the operational monitoring plan and uses the same approach as employed for construction activities.

otor	Location of Impact ROW	Potential Impact Release of	Mitigation	Responsibility for Implementation
	AGIs	sediments as a result of scour around pipe Discharge of sanitary waste water to water courses	signs of instability. This will be undertaken as part of pipeline surveillance. Discharges of treated effluent from permanently manned facilities will be monitored regularly.	Operator Operator
	AGIs	Spill of fuel or liquid waste and contamination of groundwater	Integrity of secondary containment for all petroleum containing tanks at Pump stations and valves to be monitored monthly.	Operator
	Row	Soil erosion and habitat deterioration	Ongoing inspection and maintenance of drainage control and erosion control features. This would be undertaken during operation as part of pipeline inspection No vehicular access on reinstated ROW other than in case of emergency. This will be achieved by gates / restricted access and appropriate signs. Illegal access to the ROW will be discouraged by means of placing obstructions, such as fencing, large stones, logs, etc. along key locations of reinstated ROW. Maintenance of reinstated areas and areas damaged by third party vehicular access or by emergency access. Damaged areas will be identified through pipeline surveillance undertaken by horse or foot on a weekly basis.	Operator

			Table 14-13 Operational Phase Monitoring	
Receptor	Location of Impact	Potential Impact	Mitigation	Responsibility for Implementation
	AGIs	Noise disturbance	Noise suppression technologies for pump station drivers and valves generators will be adopted. Techniques will include buffer zones such as re-forested areas or screening rows. In addition, periodic noise monitoring will be undertaken to determine the effectiveness of such measures	Operator Specialist Ecological/Noise Contractor
	AGIs	Visual disturbance	Suitable lighting will be adopted (vertical diffusion lighting) to minimise glow effect of pump stations (particularly PSG2) at night. Specialist Ecological/Lighting Contractor	Operator Specialist Ecological/Lighting Contractor
Noise	AGIs	Noise nuisance	Noise evaluation will be undertaken if new dwellings or built up structures which are constructed within 500m of project pump stations and IPSs.	Operator Specialist Noise Contractor
Air Quality	AGIs	Emissions and nuisance	Emissions monitoring of combustion plant on an annual basis for NO <sub>x</sub> SO <sub>2</sub> , CO, and particulate matter will be undertaken All combustion plant to operate on CTD (or equivalent) with a maximum sulphur content of 0.2%. Combustion plant to be dual-fuelled and will operate on natural gas as soon as practicable when an appropriate source becomes available.	Operator Specialist air consultants and operators
Contamination of land	AGIs	Spills and leaks	Refer to oil spill and emergency response plan	Operator
Soil	AGIs	Spills and leaks	Integrity of secondary containment for all petroleum containing tanks at Pump stations and valves to be monitored monthly.	Operator

			Table 14-13 Operational Phase Monitoring	
Receptor	Location of Impact	Potential Impact	Mitigation	Responsibility for Implementation
Landscape and visual intrusion	AGIs	Degradation of landscape over time	Grass, shrubs and trees planting will be used, where practicable, to screen the AGIs and associated access roads. These planting plans will be integrated at the design stage for major AGIs (pump stations and IPSs) and at construction stage for other AGIs. Screening will be subject to ongoing monitoring. Other mitigation measures applicable to all AGIs are: Within the perimeter of the AGI, buildings and facilities will be interspersed with open grass cover and where practicable, shrubs and trees; Built structures, fences and gates will be painted using colours	Operator
			Springatinetic to the surrounding environment, Site lighting (where applicable) will be designed and located to reduce offsite glare to a minimum, and minimise the impact on visual amenity at night, having regard to security and safety requirements.	
Heritage and Archaeology	ROW	Contamination as a result of spills	Implement oil spill and emergency plan	Operator
Community Relations – General	ROW and facilities	Resentment towards pipeline	Random presence at community meetings	Operator 6 monthly
Community Relations – Infrastructure	ROW and Facilities	Hostility towards pipeline	Publication of power draw figures	Operator, Monthly
Local employment	ROW and Facilities	Local employment is maximised	Monitor local employment figures and report on website	Operator, 6 monthly

### 14.4.4. Institutional monitoring

It is likely that the BTC Project will seek international finance. This ESIA will be submitted to the IFC for their review and approval.

It is likely that the IFC will also take a role in checking the implementation of commitments made in the ESIA. This may include audit and reviews during both construction and operations phases.

### 14.4.5. Monitoring of the EMS

The environmental management of the project will be continually subjected to assurance review through a series of internal and external audits. The EMS for both construction and operation phases must be meet ISO 14001 requirements. Hence, audits of the EMS will be conducted against the requirements of this standard, as well as the requirements contained within this section as relevant. These will be recorded and reported and corrective actions issued for any non-compliance.

As noted in the section above, the Construction Contractor is responsible for development and implementation of an EMS, including the requirements and framework plans specified in this ESIA. BTC Co will review and approve the final plans. BTC Co's principal role will be one of assurance that the Construction Contractor is effectively implementing mitigation measures and management plans.
## **OVERALL PROJECT ASSESSMENT**

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	15.3	Socio-Economic Project Assessment	15-4

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# 15 OVERALL PROJECT ASSESSMENT

### 15.1 INTRODUCTION

The ESIA process has identified those BTC project activities, which could impact on existing environmental and social conditions, and has provided an evaluation of the extent of these impacts. Mitigation plans have been developed for these impacts with the purpose of maximizing positive benefits and to minimise or remove any negative impacts. The most valuable tool in this process has been the analysis of the extensive environmental and social surveys and consultations undertaken over the last two years.

The BTC project delivers a major environmental benefit, enabling ACG crude to be exported from the Caspian without increasing volumes shipped through the busy Bosphorus Straits. Turkey has been selected as the most suitable export destination, as it is the nearest country to Azerbaijan with access to the open market via the Mediterranean Sea. Georgia has been selected as the intermediate transit country.

Alternative transportation modes are evaluated in the ESIA and a pipeline has been selected as the lowest risk option. Alternative pipeline routes are also evaluated. In Azerbaijan, the studies focused on confirming the suitability of the existing Western Route Export Pipeline (WREP) corridor as a common alignment for the BTC pipeline and SCP, thus avoiding opening a second or third energy transportation corridor, and minimising land-take. This route also follows the main infrastructure corridor for road and railways to Tbilisi and avoids all nationally and internationally designated environmentally sensitive areas. The route has also been selected to avoid densely populated areas, thus avoiding social and economic impacts on communities.

The overall route selection and project design philosophy is based on the following principles:

- Avoidance of impact through careful design and route selection are key. Maximum potential to avoid impacts can be achieved in the early project design stages through careful pipeline routing
- Potential impacts have been minimised through route optimization where the pipeline cannot avoid passing through areas of environmental, cultural or social sensitivity
- Direct mitigation measures have been developed and incorporated into the design and construction process
- Environmental and Community Investment Plans will be developed to offset any unavoidable high or medium residual impacts. The principle of 'no net loss' is applied
- Furthermore, where possible, the intent is to deliver a sustainable benefit to communities and the environment as a result of the BTC project
- Extensive consultation with potentially impacted communities, NGOs, scientists and other interested stakeholders has been key to the impact assessment process and development of avoidance, minimization, mitigation and compensation measures

### 15.2 ENVIRONMENTAL PROJECT ASSESSMENT

The assessment shows that the majority of impacts will be associated with the construction phase. Potential construction impacts will be mitigated through the implementation of good construction practice, management plans, and through the application of localised measures to protect specific or sensitive receptors.

The main high and medium significance residual environmental impacts associated with construction and operation of the BTC project in Azerbaijan and illustrated in Figure 15-1 are:

- An estimated 10-12 year period for complete habitat recovery for the construction corridor through the Gobustan desert area following reinstatement
- Localised habitat loss, and visual intrusion in the sensitive Gobustan desert area, resulting from the upgrade of an existing access road
- Soil degradation and increased susceptibility to erosion in localised areas of the Gobustan desert, Mud Volcano Ridge and badlands northwest of Ganja
- Landscape modification where the pipeline is to be constructed along narrow ridges in the Gobustan (Mud Volcano Ridge), Tovuz and Hasansu areas
- Short term generation and deposition of dust in the immediate vicinity of the construction works
- Generation of short term, transitory, construction noise
- Short term impacts due to increased traffic movements through towns and villages
- Unavoidable construction through a short section of the Gobustan Archaeological Reserve
- Short term impacts on water quality, flora and fauna during open-cut construction at the Djeyrankechmes, Hasansu and West Kura Rivers

There is also potential for direct construction impacts upon an Internationally Vulnerable species, *Testudo graeca* (Spur-Thighed Tortoise). Mitigation and offset measures have been developed to address this issue, which themselves can have a positive residual effect (see Section 13, Cumulative Impacts).

Other positive residual environmental impacts associated with the BTC project include:

- Increased knowledge regarding the Azerbaijan environment through the project baseline studies. These data will be shared with the academic community and made public
- Benefits resulting from the contaminated land survey and clean up of identified areas of 3<sup>rd</sup> party pre-existing contamination
- Skills transfer between international and national environmental consultancies and scientists (eg in survey techniques and national ecological knowledge)
- Archaeological investigations before and during construction will result in an increased knowledge of archaeological features along the route, increasing the national archaeological record
- Raising public awareness of environmental issues in Azerbaijan, on an international, national, and community level, through publication of documents and consultation

#### BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA



Figure 15-1 Breakdown of high and medium significance residual impacts by type

The operation of the pipeline will result in limited localised impacts. The most significant direct impact from operation will be the generation of noise and visual intrusion at Pump Station PS-A2 and, to a lesser extent, the visual intrusion of some other AGIs and permanent access roads, particularly in Gobustan.

The potential for unplanned events and the potential consequence of such events on the habitats, rivers and groundwater resources crossed by the pipeline have also been analysed. The assessment shows that the likelihood of any event occurring and the risk of significant impacts resulting, are very low. In the unlikely event of an incident occurring, the impact could be significant depending on the scale of the event, geographical location of the event site, and the local metrological, geographical and hydrological conditions.

Mitigation measures have been adopted to counter the risk of an oil spill on three fronts. Firstly, the design basis of the project includes many features to prevent a leak occurring, including routing around geohazards where possible, increased burial depth and wall thickness in certain locations and pipeline surveillance. Secondly the design also includes many features for early identification of a spill event, including a leak detection system, selected groundwater monitoring and surveillance. Finally, an Oil Spill Response Plan will be developed which will identify resources, responsibilities and equipment necessary for responding to a spill event, in the unlikely event it should occur.

Impacts caused by interaction with other projects in the area were also assessed. The main cumulative impacts result from SCP construction immediately following BTC pipeline

Note: The percentages shown in this pie-chart are for illustrative purposes only; they are based on the professional opinion of the ESIA consultants

construction. This results in an increased duration for many of the construction related impacts and a longer period prior to final reinstatement.

The environmental mitigation measures identified in this ESIA describe how these impacts will be managed throughout the various phases of the project. The proposed mitigation measures have reduced the level of the residual impacts wherever possible to a Low or Beneficial ranking. However there are certain residual impacts that remain Medium or High.

Where practical, options for environmental programmes to offset these High and Medium residual impacts are being developed.

ESIA is an iterative process. Therefore there will be continual effort to increase and further refine knowledge of the environmental and social interactions of the pipeline prior to construction commencing.

The mitigation measures implemented through construction and operations will be monitored and reviewed on a regular basis to ensure they are effective. Alternative measures will be applied if necessary. To ensure that the mitigation measures are implemented in the field requirements have been included within the invitation to tender for construction. Assessment of contractors approach to mitigation will form a significant component of the bid review process.

### 15.3 SOCIO-ECONOMIC PROJECT ASSESSMENT

Consultation revealed that 94% of interviewees in project affected communities are generally positive towards the BTC project, as their perception is that any disruption will be temporary and offset by potential economic benefits both to their community and to Azerbaijan. There will be a number of positive social impacts associated with the BTC project. These include:

- A Community Investment Programme will be developed and implemented in communities adjacent to the pipeline corridor and associated facilities (see Section 13, Cumulative Impacts)
- Direct employment there will be a limited number of opportunities for direct employment on the project, primarily short term jobs during construction, with fewer, longer term, vacancies during operation
- Opportunity for provision of goods and services to the project
- Skills development and training, increasing the employment chances of people after the pipeline construction period
- Enterprise development, a transfer of business knowledge and skills eg internationally recognized standards of HSE, technical, commercial, accountancy, IT etc
- Infrastructure improvement including temporary and permanent upgrade of some roads
- Benefit of the increased knowledge basis of the Azerbaijan social and economic conditions along the pipeline route, through the BTC project baseline studies the data collected will be shared with the academic, aid agency and NGO community
- Skills transfer between international and national consultancies and social data gathering and survey techniques
- Raising public awareness of socio-economic issues in Azerbaijan, on an international, national and community level, through publication of documents and consultation

• Utilisiation in-country of international best practice in relation to land acquisition and compensation

Two of these positive aspects were particularly prominent during consultation, firstly in relation to possible employment opportunities, and secondly in relation to possible expenditure on local goods and services by construction workers.

There was clear evidence, however, of the communities having some expectations which are not achievable. It is therefore important to provide accurate information on these topics in order to avoid potential disappointment. Firstly, the level of anticipated employment is higher in terms both of numbers of jobs to be created and length of employment. An employment strategy has been developed to ensure that local employment levels are maximised as far as practical (see Section 11, Socio-economic Impacts and Mitigation).

Secondly, during preliminary consultation, 30% of villagers living in communities with poor energy supply clearly associated the construction of energy pipelines, with immediate provision of energy to their houses. Thirdly, the majority of the villages along the route have experienced the construction of the WREP. However, the BTC pipeline is of a greater diameter than WREP, and will be followed by SCP construction the following year. Hence, there may be a lack of understanding in the majority of the villages of the level of disruption which pipeline construction may bring, all be it for a limited period. After more than a year of regular consultation these expectations have since been reduced, but will still require careful management in the future.

During consultation, some individuals expressed concerns about pipeline construction, particularly in relation to land compensation and impacts upon local roads. Specific mitigation measures have been developed to address these issues. In addition, concerns were raised about specific aspects of construction and operation such as safety of the pipeline and whether or not the local water supply would be affected by construction or spills.

The mitigation measures outlined in this document, if effectively implemented, should mitigate the majority of these impacts successfully. Measures in relation to employment and local sourcing will go further in ensuring a positive impact spread equitably along the route.

Again, ESIA is an iterative process, and the implementation and effectiveness of the proposed mitigation will be monitored and measures taken to reinforce, adapt or change the mitigation should it be required.

Finally, one of the most crucial of the mitigation measures set out in this document is the approach to community relations. The success of many of the other social and some of the environmental measures rests on the successful implementation of the Community Relations Programme. Management plans have been developed to assist in the formulation of effective community relations by BTC Co and the contractor. These will ensure that people working on the project and with the local communities respect the local way of life and that community concerns and their complaints are dealt with sensitively and in a timely manner.

As an offset for the disruption, which may be experienced in some communities during the construction of the pipeline, BTC Co will implement a Community Investment Programme which will provide small amounts of financing to many communities for priority investment and

sustainable development projects.

To conclude, although there are a few residual concerns relating to the construction of the pipeline which need to be carefully managed through the mitigation measures set out in the ESIA document, it is generally anticipated that both the construction and operation will bring a series of short and long term benefits to the communities. These will focus on employment, provision of goods and services and community investment which will provide longer term benefits to many communities thereby helping to off-set any short term negative impacts.

## CONSULTATION

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# 16 CONSULTATION

This Section summarizes the consultation process that has been conducted at national and local levels as part of the ESIA process. It also outlines the results of that process and how they have been used to shape both the project engineering design and the development of the mitigation measures as outlined in Section 11. Following disclosure, this Section will also contain a summary of the results of disclosure including an indication as to how the comments on the ESIA have been incorporated into the ESIA.

Further details about the process to date, including details of all the organisations consulted at different stages, can be found in the PCDP, Part 8 of the Technical Appendices. The main findings from the village level consultation, have been included in Sections 8 and 9 (Environmental and Socio-Economic Baselines). A detailed explanation of the data collection process for the social baseline has been included in Section 7 (Methodology).

## 16.1 FUNCTION OF CONSULTATION

The aim of consultation is to understand as far as possible how the project will impact stakeholders, and to obtain their ideas and opinions on management of impacts in order to influence project design, implementation and follow-up. It is also an important opportunity for local people to become better informed about planned activities. The project has sought to carry out consultation in line with national regulations, international best practice and BP policies (see Section 6, Regulatory and Policy Framework).

## 16.2 SUMMARY OF CONSULATION

This ESIA is specifically for the BTC pipeline. However, since the SCP is planned for construction in the same corridor, and requires its own ESIA, the consultation process has been combined as far as possible to ensure a consistent and coordinated approach to stakeholders. Hence, the summary of consultation conducted in Azerbaijan for both the BTC and SCP projects, is provided in Table 16.1.

BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA Summary Table 16.1-SCP and BTC Consultation – Azerbaijan

Phase	Type of Consultation	Date	Consultees	Forum	Methodology
Phase 1 (SCP)	Scoping Introductory	October and	National Government Stakeholders NGOs	Meetings	One to one meetings to discuss proposed project
~	Workshops	November 2000	National Stakeholders (Academics and NGOs)	Workshop Focus Group	Presentation and round table discussion
Phase 2 (SCP)	Baseline data collection (1 <sup>st</sup> round)	November and December 2000 and	Village level Consultation with Pipeline Affected Communities. These included the villages on the Azeri-gas line as the refurbishment ontion was still being considered	Interviews	Preliminary meetings with District Authorities Qualitative Interviews (607) with community members Quantitative Interviews (62) with community leaders (total number of interviews included in the final data
Phase 3 (SCP)	Baseline data collection (2 <sup>nd</sup> round) and preliminary development of mitigation measures	March and April 2001	Village level Consultation with Pipeline Affected Communities, following reroutes and identification of villages within the new pipeline corridor	Interviews	Qualitative Interviews (65) with community members Quantitative Interviews (6) with community leaders
Phase 4 (Combined SCP/BTC)	Consultation and baseline data collection	August 2001	Village level consultation in Pipeline Affected Communities	Interviews	Yard and camp specific qualitative interviews (120) with households potentially impacted by a pipe yard, construction camp, or access road. Quantitative interviews (11) with leaders of these communities Herder interviews
Phase 5 (Combined SCP/BTC)	Introduction to BTC. Update on SCP Distribution of	October and November 2001	National NGOs Local NGOs	Workshops in Baku and Ganja	Presentation and discussion. Update on progress of SCP, introduction to BTC and consultation on preliminary ideas for mitigation measures
	combined SCP/BTC information and preliminary check on mitigation measures Additional		Pipeline Affected Communities	Interviews and one to one meetings	All identified communities (83)

CONSULTATIONS DECEMBER 2002 16-2 BTC PIPELINE ESIA AZERBAIJAN FINAL ESIA Summary Table 16.1-SCP and BTC Consultation – Azerbaijan

Phase	Type of	Date	Consultees	Forum	Methodology
	Consultation				
	baseline data collection for newly identified communities (following				
Phase 6 (Combined	Mitigation	December 2001 and	Specialist Organisations	One to one meetings	14 one to one meetings with specialist organisations to consult on developed mitigation measures
SCP/BTC)		January 2002	Pipeline Affected Communities	Village meetings	Informal meetings in all identified communities to consult on the developed mitigation measures
	Additional baseline data collection			Combined SCP/BTC and AGI interviews in 15 communities	72 qualitative interviews with community members in 11 communities (one in each region) concerning the fact that there are now two pipelines instead of just one, and gathering perceptions in relation to the building of an oil pipeline specifically, in addition to
					gas. 35 qualitative interviews with impacted community members in 5 communities concerning the construction of AGIs in their area
			NGOS	Meeting	Presentation and discussion on environmental and participation issues
Phase 7 (Combined SCP/BTC)	Disclosure	April 2002	Environmental NGOs	Field Visit	Fact finding visit to representative sites along the pipeline corridor
		June 2002	National Level Stakeholders Local level Stakeholders (NGOs, Interest Groups)	Public Meetings	3 formal public meetings in Yevlakh, Ganja and Akstafa. Presentation and discussion
			Pipeline Affected Communities		Road show of 10 village meetings at approximately 40 km intervals along the route

CONSULTATIONS DECEMBER 2002 16-3

## 16.3 OUTCOME OF CONSULTATION TO DATE

### 16.3.1 Key issues

Through the analysis of stakeholder perceptions the consultation process identified a number of key issues, including both perceived benefits of the project and concerns. The issues were subsequently categorized and fed into the ESIA process and thence into the project design process with the aim of maximizing the benefits and minimizing the concerns.

Key environmental issues raised include:

- Archaeological sites and cultural reserves
- Protection of water resources (ground and surface waters)
- Ecological protection
- Nature reserves
- Reinstatement

Key socio-economic issues raised were categorized under:

- Employment
- Land Acquisition
- Access to Energy
- Local Infrastructure and Resources
- Community Relations, including relations with construction workers
- Nuisance and Safety

### 16.3.2 Key concerns

Once the key issues had been identified, and the project impacts analysed, mitigation measures were developed to address as many of these issues as possible. Those that could not be addressed directly, such as access to energy, have been addressed indirectly. Details of these measures are outlined Section 14 (Management and Monitoring Plan).

Refining the mitigation measures is an iterative process involving extensive consultation carried out over a period of more than a year. The consultation took the form of:

- discussions with villagers and village leaders both formally through village meetings and informally in one to one interviews at the village level
- workshops with Government and academics in Baku
- meetings with specific departments on issues such as land acquisition
- two sets of workshops with NGOs in Baku and Ganja
- one to one meetings with specialist organisations such as the BP Research and Monitoring Group
- frequent meetings with project engineers to check the feasibility of approaches and ensure feedback from external stakeholders was fed into the project design process

During those meetings, ideas for mitigation were put forward by the project and by stakeholders and gradually refined to produce the set of measures which have been included in this report. A full set of minutes of meetings can be obtained from the project on request.

Recurring themes during consultation at all levels were as follows:

#### 16.1.1.1 Archaeological sites and Cultural Reserves

- the need to conduct pre-construction archaeological investigations
- the need to protect archaeological sites and monuments during the construction of the pipeline
- not to impact upon key features within Cultural Reserves

#### 16.1.1.2 Groundwater

- the need to collect more data on sensitive groundwater resources in the west of Azerbaijan
- the need to protect these sensitive areas

#### 16.1.1.3 Ecology and Nature Reserves

- to avoid impact upon Natural Reserve areas wherever practical
- to collect additional data on the ecology of the pipeline route

#### 16.1.1.4 Reinstatement

- to prevent erosion of the pipeline corridor
- to restore infrastructure, particularly irrigation canals, to their pre-existing condition or better

#### 16.1.1.5 Employment

- the need to recruit locally, from within the pipeline affected communities, as far as practical
- the recruitment process should be fair, equitable and overseen by an independent authority
- consultation threw up various suggestions in relation to how the actual recruitment process should be managed

#### 16.1.1.6 Land Acquisition and Compensation

- the land acquisition process, and procedures for payment of compensation, should be fair and transparent
- there should be sufficient information provided about the process and how it would work in advance of actual land negotiations
- there should be a fair and equitable compensation process for damage to buildings and agricultural infrastructure as a result of construction activities

#### 16.1.1.7 Access to energy

• many villagers clearly had expectations early in the consultation process of increased access to energy arising from the proximity of the pipeline

#### 16.1.1.8 Safety

- concern about the integrity of the pipeline and whether or not villages in proximity to the line would be in danger
- concern that villagers would be injured during construction
- concern that animals might be injured on the ROW

#### 16.1.1.9 Infrastructure

- roads should not be degraded as a result of the movements of pipe and heavy machinery, and that they should be reinstated to at least the standard existing prior to construction
- access should be maintained to grazing lands at all times

#### 16.1.1.10 Construction Camps

- proximity to a camp was seen in a positive light
- most villagers perceived economic benefits, either directly or indirectly, from proximity to a camp
- a small number of people expressed concern about potential increases in noise, dust, crime, and damage to roads

Each of these issues had been addressed either through changes in project design or through the mitigation measures developed during the course of this ESIA process and presented in Section 11.

Consultation, with the local NGO community in particular, demonstrated a real desire on their part to have a participatory role in the ESIA process, through attendance at workshops and meetings, participating in field visits and publishing articles. There is also a strong desire amongst local NGOs to be involved in future community level consultation activities and in monitoring activities during construction and operation.

Additional details of perceptions and attitudes at the village level can be found in the Socio-Economic baseline, Section 9.

### **16.2 ONGOING CONSULTATION**

As outlined above, consultation is an ongoing process which does not stop once the draft ESIA has been put in the public domain in May 2002. Consultation, it continues to be an integral part of the process of design, development and implementation of the pipelines project, of which the ESIA process itself is just a part.

During construction, the consultation process is handled through two mechanisms: firstly, the Community Relations Programme implemented by the Construction Contractor and monitored by BTC Co, as outlined in Section 11; and, secondly, through the monitoring programme implemented by BTC Co and outlined in Section 14, Management and Monitoring Plan. This plan will include consultation on how communities think the mitigation measures are being implemented. During operations, likely to begin in 2005, the consultation process will be handled by BTC Co through the Community Relations Programme outlined in Section 11.

### 16.3.3 Disclosure

This draft of the ESIA document has been prepared specifically for public disclosure and comment. The report will be widely disseminated and will be available for comment for a period of 60 days. Following the 60 day disclosure period all comments received will be incorporated as appropriate into the ESIA, prior to formal submission to the Government.

On May 15th, the draft ESIA is put in the public domain for consultation for a period of 60 days. This involves:

- Full ESIA documents are available in Azerbaijani in:
  - selected libraries, town halls, universities along the route
  - on request from BP at Villa Petrolea
  - on the world wide web at www.caspiandevelopmentandexport.com
- Copies of the Executive Summary in Azerbaijani and English are available in the same locations as the main ESIA and will also be made available to all communities along the corridor during the Road Show
- Community Pamphlets describing the impacts and associated mitigation measures of direct relevance to pipeline affected communities, specifically dealing with their concerns and interests will be available in all pipeline affected communities. They will be distributed to all communities within 2km of the route and within 5km of a construction camp or major AGI, during late May.
- Public Meetings to present the results will be held in Yevlakh, Ganja, and Akstafa during June.
- Community meetings have been proposed in the following districts (villages) during the second half of June: Shamkir (Zeyem, Kechily, Talish); Geranboy (Borsunlu); Agdash (Leki and Amirarh); Ujar (Garaberk and Karadagly); Kurdemir (Sigirly); Hadgiqabul (Mugan). Announcements of exact dates and locations for disclosure will be made through a combination of radio, the press, and on posters throughout the corridor two weeks prior to the meetings.

## 16.3.4 Comments during disclosure

Anyone can comment on the ESIA at any time during the 60 day public disclosure period. All comments should be put on paper and addressed to Villa Petrolea in Baku. Comments can also be made on the worldwideweb at www.caspiandevelopmentandexport.com.

On July 15th, all the comments will be examined according to the process outlined in the PCDP, Part 8 of the Technical Appendices. The ESIA will then be redrafted taking comments into account. The document will be finalized and published during the late summer and its recommendations implemented prior to construction.

### 16.3.5 Results of disclosure

This section will be completed once the results of the disclosure process become available in mid-July, 2002, and included in the final draft.

## ESIA CONTRIBUTORS

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# 17 ESIA CONTRIBUTORS

The preparation of the ESIA has been co-ordinated by AETC on behalf of BTC Co. AETC also prepared the briefing documentation for specialist environmental consultants, as well as a number of the ESIA sections. ERM co-ordinated the socio-economic impact assessment for the project.

Specialist Consultants	Project Role
AES	Report writing and translation
AETC	Environmental Impact Assessment
Air Photo Services	Archaeology Aerial Interpretation
Alan Saunders Associates	Noise
BEC	Traffic Survey Supervision
ERM	Social Impact Assessment
Holymoor Consultancy	Hydrogeology
Hydro Scientific Limited	Hydrology
M & M Impact	IT and Graphics Support
Synergetics	Consultation and Social Baseline
UTT	Translation
WSP	Traffic Survey

#### Table 17-1 List of participants and contributors

In addition, the following Local Institutes and Scientists assisted through the provision of specialist services and advice (see Table 17-2).

Institute	Director
Baku State University (Zoology)	
Institute of Archaeology and Ethnography	Arif Abbasov
Institute of Botany	Vahid.D. Hajiyev
Institute of Erosion and Irrigation	Bahram Aliyev
Institute of Geography	Budag Budagov
Institute of Zoology	Musa Musayev
Other Organisations	
Ministry of Environment and Natural Resources	
Ministry of Culture	
BP Research and Monitoring Group	

Table 17-2 List of local institutes and scientists

The literature reviews used during this study were commissioned by AIOC for the WREP, and therefore are not included in this table.

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18	REFERENCES & BIBLIOGRAPHY	
18.1	1 Electronic References	

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