

# Princess Petroleum



# TREATY

## Belize Energy, LTD

Princess Petroleum / Treaty Belize Energy Environmental Compliance Project  
Independence Village Exploration Wells  
EIA Report  
July 2011

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This report presents the results of an Environmental Impact Assessment (EIA) of proposals to drill an exploratory well and appraisal wells for Princess Petroleum / Treaty Belize Energy's petroleum prospect to the West of Independence Village. The EIA has been prepared in accordance with the Environmental Impact Assessment Regulations No. 107 of 1999 and the Terms of Reference agreed with the Belize Department of Environment. The EIA shows that there should be little and short-term adverse impact on the natural environment and minimal disruption to the local communities during construction and operation, with the advantage of short-term benefits through the procurement of local goods and services. An Environmental Management Plan and Disaster Management Plan are outlined for the proposed exploratory works.

# Table of Contents

Executive Summary.....	11
1 Introduction .....	17
1.1 Background .....	17
1.2 Project Justification.....	17
1.3 The Need for an Environmental Impact.....	18
1.4 The Contents and Structure of this Report.....	18
2 Policy, Legal and Administrative Framework.....	19
2.1 Introduction .....	19
2.2 The EIA Process .....	19
2.3 Legal Framework.....	20
2.4 Administration .....	22
2.5 International and Regional Environmental Agreements .....	23
3 Description of the Proposed Project.....	24
3.1 Project Location .....	24
3.2 Project Plans.....	24
3.3 Activities/Facilities Proposed in the Plans Above .....	25
3.4 Processes involved in the exploratory drilling operations.....	26
3.4.1 Construction.....	26
3.4.2 Operation .....	27
3.4.3 De-commissioning.....	27
3.4.4 Alternatives Considered.....	28
3.5 Outline of the overall management structure anticipated for the proposed activities. ....	28
4 Existing Baseline Conditions .....	29
4.1 Introduction .....	29
4.2 The Physical and Social Environment .....	29
4.2.1 Topography .....	29
4.2.2 Zone of influence in relation to protected areas, surrounding villages and communities, etc.....	30
4.2.3 Climate, Hydrology and Meteorology.....	31
4.2.4 Geology and Soils.....	32
4.2.5 Presence of Hydrocarbons in the Soils .....	33
4.2.6 Hydrology, Drainage & Hydrogeology .....	33
4.3 Habitats, Flora and Fauna .....	33
4.4 People and Communities.....	35

4.4.1	Population and Settlement .....	35
4.4.2	Land use. ....	35
4.4.3	Local Plans and Planning Policy.....	35
4.4.5	Transportation and Access.....	35
4.5	Cultural Heritage and Archaeology.....	36
4.6	Air Quality .....	36
4.7	Noise .....	36
5	Environmental Impact Assessment.....	37
5.1	Introduction .....	37
5.2	Overview Potential Impacts.....	37
5.3	The Physical Environment.....	39
5.3.1	Climate .....	39
5.3.2	Soils, Contaminated Land and Hydrogeology .....	39
5.3.3	Hydrology, Water Quality and Drainage.....	41
5.4	Habitats, Flora and Fauna .....	42
5.4.1	Methodology Adopted.....	42
5.4.2	Effects of Proposals (during construction, operation and decommissioning).....	42
5.4.3	Mitigation or Management Proposed .....	43
5.5	People and Communities.....	43
5.5.1	Methodology Adopted.....	43
5.5.2	Summary of Any Consultation .....	43
5.5.3	Population and Settlement .....	43
5.5.4	Land Use, Landscape and Visual .....	44
5.5.5	Socio-Economics .....	44
5.5.6	Transportation & Access .....	45
5.6	Cultural Heritage and Archaeology.....	46
5.6.1	Methodology Adopted.....	46
5.6.2	Summary of Any Consultation .....	46
5.6.3	Effects of Proposed Project (during Construction, Operation and Decommissioning) .....	46
5.6.4	Mitigation or Management Proposed .....	46
5.6.5	Residual Impact and Conclusion .....	46
5.7	Air quality.....	46
5.7.1	Introduction .....	46
5.7.2	Assessment Methodology.....	47

5.7.3	Effects of Proposed Project (during Construction, Operation and Decommissioning .....	47
5.7.4	Mitigation or Management Proposed .....	49
5.7.5	Residual Impact and Conclusions.....	49
5.8	Noise .....	49
5.8.1	Methodology Adopted.....	49
5.8.2	Effects of Proposed Project (during Construction, Operation and Decommissioning) .....	49
5.8.3	Mitigation or Management Proposed .....	50
5.8.4	Residual Impact and Conclusion .....	50
5.9	Cumulative Impacts .....	50
5.10	Limitations of the EIA.....	50
5.10.1	Soils, Contamination and Wastes .....	50
5.10.2	Air Quality .....	50
5.11	Summary of Conclusions.....	51
5.11.1	Soils, Contamination and Wastes .....	51
5.11.2	Air Quality .....	51
6	Environmental Management Plan .....	52
6.1	Introduction .....	52
6.2	Administrative Arrangements.....	52
6.2.1	Roles and Responsibilities.....	52
6.2.2	Formal Management System.....	52
6.2.3	Environmental Training.....	53
6.2.4	Environmental Incident Reporting.....	53
6.2.5	EMP Review .....	53
6.3	Management Plan.....	53
6.4	Monitoring Plan .....	54
6.5	Waste Management .....	55
6.6	Water Quality.....	55
6.7	Air Quality .....	55
6.8	Cultural Heritage and Archaeology.....	56
6.9	Environmental, Pollution Control and H&S Training Needs .....	56
6.10	Public Consultation and Disclosure.....	56
6.11	Implementation of the EMP .....	56
7	Consultation.....	62
7.1	Introduction .....	62

7.2	Regulatory Authorities .....	62
7.3	Public Consultation and Information Dissemination .....	62
8	Disaster Management Plan .....	63
8.1	Introduction .....	63
8.2	Disaster Management.....	63
8.2.1	Plan Definition.....	63
8.3	Risks and Response Requirements .....	63
8.3.1	Purpose .....	63
8.3.2	General.....	63
8.3.3	Emergency Response Organization .....	64

## **Appendices:**

- A Environmental Checklist
- B Cultural Heritage and Archaeological Assessment

## **List of Tables:**

- 3.1 Coordinates of the proposed exploratory wells
- 5.1 Summary of potential environmental impacts
- 5.2 Noise (threshold) Levels from Schedule 2 of the EPA, 2003
- 6.1 Summary Environmental Management Plan

## **List of Figures:**

- 3.1 Photograph of the rig proposed for the exploratory drilling
- 4.1 Rainfall isohyets in the project area
- 4.2 Photograph showing the habitat at proposed well No. 1 site
- 8.3 PPTBE's Chain of Command for Emergency Response for Drilling Sites

## **List of Maps:**

- 3.1 Location of the proposed exploratory wells
- 4.1 Topography in the project area
- 4.2 Location of ground water pump serving Independence Village
- 4.3 Ecosystems in the project area

## List of Abbreviations

ASL	Above Sea Level
BEnCo	Belize Environmental Consultancies Limited
BNEL	Belize Natural Energy Limited
BERDS	Biodiversity and Environmental Resource Data System for Belize
BOP	Blow-Out-Preventer
BRE	Building Research Establishment
BTEX	Benzene, Toluene, Ethyl Benzene and Xylenes
C <sub>2</sub> H <sub>6</sub>	Ethane
C <sub>3</sub> H <sub>8</sub>	Propane
CCTV	Closed-Circuit Television
CH <sub>4</sub>	Methane
CITES	Convention on International Trade in Endangered Species of wild fauna and flora
CO	Carbon monoxide
CO <sub>2</sub>	Carbon dioxide
CZMAI	Coastal Zone Management Authority & Institute
DMP	Disaster Management Plan
DoE	Department of the Environment
DoS	Department of Survey
EC	Environmental Checklist
ECP	Environmental Compliance Plan
EIA	Environmental impact assessment
EMP	Environmental management plan
FD	Forest Department
GHGs	Greenhouse Gases
GIS	Geographical Information System
GoB	Government of Belize
GPD	Geology and Petroleum Department
H <sub>2</sub> O	Water (vapour)
H <sub>2</sub> S	Hydrogen sulphide
HGV	Heavy Goods Vehicles
IEE	Initial Environmental Evaluation
Lands	Lands and Surveys Department
LUA	Land Utilization Authority

MAF	Ministry of Agriculture and Fisheries
MAWP	Maximum Allowable Working Pressure
MNREI	Ministry of Natural Resources, Local Government and the Environment and Industry
MoT	Ministry of Tourism
NAAQS	National Ambient Air Quality Standards of the United States
NEAC	National Environment Appraisal Committee
NGO	Non-government organization
OBM	Oil-Based Mud
NICH	National Institute of Culture and History
N <sub>2</sub> O	Nitrous oxide
NO <sub>2</sub>	Nitrogen dioxide
NO <sub>x</sub>	Nitrogen oxides
PHD	Public Health Department
PICs	Products of Incompatible Combustion
PLC	Phase Loop Controller
PMD	Paul Marriott Drilling
PP	Princess Petroleum
PPTBE	Princess Petroleum / Treaty Belize Energy
PPAH	Pollution Prevention and Abatement Handbook
PPE	Personal protective equipment
PSA	Profit Sharing Agreement
SEMP	Site Environmental Management Plan
SI	Statutory Instrument
SO <sub>2</sub>	Sulphur dioxide
Sox	Sulphur oxides
UK	United Kingdom
US	United States
VOCs	Volatile Organic Compounds
WHO	World Health Organization

### List of Units

Bbl	Barrel
Bpd	Barrels per day
Km	Kilometer

Ppb	Parts per billion
Psi	Pounds per square inch
kW	Kilowatt
rpm	Revolutions per minute
V	Volt
Hz	Hertz
btu/cuft	British thermal unit per cubic foot
ft	Foot/feet
m	Meter
Kn	Kilo Newton
°C	Celsius
Mm	Millimeter
Cm	Centimeter
dB(A)	‘A-weighted’ decibels, the (A) suffix indicating that the measured level has been modified to allow for this response.
LAeq,x-hours	This is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period. It is the commonly used descriptor for many forms of environmental noise including construction noise and noise from industrial premises.

### Unit Conversions

1 cm	= 0.3937 in
1 in	= 2.54 cm
1 m	= 3.2808 ft
1 ft	= 0.3048 m
1 km	= 0.6214 mile
1 mile	= 1.6093 km
1 ha	= 2.471 acres
1 acre	= 0.4047 ha
1 liter	= 0.2642 US gal
1 US gal	= 3.7854 liters
1 liter	= 0.22 UK gal
1 UK gal	= 4.546 liters

# Executive Summary

## Introduction

Princess Petroleum / Treaty Belize Energy (PPTBE) in cooperation with the Government of Belize (GoB) is developing the infrastructure to facilitate the commercialization of the oil resource assets of Belize. PPTBE's operations in Belize to extract and deliver the crude oil to market include exploration activities. This report presents the results of an Environmental Impact Assessment (EIA) of the project proposed by PPTBE to drill a petroleum exploration well and appraisal wells to the west of Independence Village. The Environmental Protection Act 1992 legally established the Department of Environment (DoE), which is charged with a wide range of responsibilities. These include the guidance of development by industry, the encouragement of the adoption of environmentally friendly technology, the control of pollution, the requests for and administration of the EIA process, and the sustainable use of the natural resources and the environment.

This document is prepared following the Terms of Reference (ToR) agreed with the Department of Environment (DoE) and follows the guidelines for the preparation of an EIA published by the DoE and is based on the EIA Regulations, 1995, and the Environmental Protection Act, 1992, revised 2003. PP signed a Production Sharing Agreement (PSA) with the GoB on 12 October, 2007, to conduct petroleum operations within a concession area in the Southern portion of the country. The PSA gives PP the authority to conduct petroleum exploration operations. As such, PP is tasked to explore for and locate and develop petroleum resources within its concession area. Its exploration efforts have identified the Independence Village area as a petroleum prospect

It is anticipated; that if hydrocarbons are trapped in the Independence Village prospects it will be high gravity oil with minimal H<sub>2</sub>S and minor associated gas.

## Project Description and Alternatives Considered

The project proposed by PPTBE is for the drilling of one exploration oil and gas well and the possible drilling of up to four appraisal wells. The proposed exploratory well, as well as the appraisal wells, would be located along a line approximately 8 miles west of Independence Village, Stann Creek District, Belize. The exploration well would be the one to be drilled first. The other well sites have been identified for appraisal purposes should the exploration well be successful.

PP has an agreement with the GoB to undertake operations which include the exploration, development, extraction, and production as well as transportation, storage and sales of petroleum within the concession area in the Southern portion of the country. "Do Nothing" would not be a viable alternative if PP is to continue with the exploration for petroleum under their concession. Subsequent to seismic analysis, the drilling of exploratory and appraisal wells is the only way to confirm the presence of hydrocarbons, and - if found – determine their composition, thickness and pressure in the potential petroleum resources at the Independence Village prospect. Hence, there are no other alternatives to exploratory drilling if the petroleum prospect at the Independence Village location is to be determined.

The proposed exploratory and subsequent appraisal wells would require:

- Development and upgrades to access roads to the site for drilling and supply vehicles and plant
- A temporary site to set-up the drill pad and undertake exploratory drilling and associated site-support operations
- Site accommodation and security for personnel, vehicles and plant

- Power and other utilities
- Storage facilities
- Testing facilities
- Waste storage and disposal facilities.

The processes to meet these requirements may be broken down into three phases, construction, operation and decommissioning for the consideration of environmental impacts. Subsequent to describing the proposed project and its background, this report presents the results of the EIA using the following structure:

- A description of the baseline environmental conditions
- The environmental impact assessment, proposals for mitigation and conclusions
- An environmental management plan for controlling the occurrence of adverse environmental impacts during the phases of construction, operation and decommissioning
- A summary of consultation with regulatory authorities and local communities
- A disaster management plan for controlling the occurrence of adverse human health & safety impacts during construction, operation and decommissioning.

## **Public Consultation**

Meetings with representatives of the DoE and other Departments have been ongoing since PPTBE started to consider the exploration of the proposed Independence Village sites (and will continue to elaborate the detailed requirements for works at the sites), and - more recently - consultation has begun with the local community at Independence Village. Further meetings between PPTBE and the community are needed to foster a better working relationship, keep the community informed and to formalize more detail arrangements with regards to PPTBE operations within the community prior to and throughout construction, operation and decommissioning.

## **Environmental Impact Assessment**

The EIA considers the potential impacts of the scheme on a topic by topic basis covering the physical environment; habitats, flora and fauna; impacts on people and communities, and environmental quality (air quality and noise). The main environmental impacts during construction and operation are as follows:

### *Beneficial impacts:*

- If successful, the exploration wells may provide another viable opportunity to improve the exploitation of oil reserves by PPTBE and GoB.
- There are short term benefits to the local community in Independence Village from temporary employment opportunities associated with construction and decommissioning, and the provision of goods and services during these and operation of the site.
- There are long term benefits to the local community in Independence Village from the long term employment of employees needed to maintain the site after the well is completed.

### *Adverse impacts:*

- A number of potentially adverse impacts have been identified during the construction, operation and decommissioning phases. Most of these have been assessed as not significant or of low significance. Some of these impacts are a direct consequence of the construction and/or operational activities, (e.g. noise) while others would only arise in the event of an accident, (e.g. spillage). Most of these impacts can be avoided or reduced through risk management, mitigation measures and good working practices. Those which have been assessed as of medium or high significance – “Soils, Contamination and Wastes” and “Air Quality” - are considered further below, though these are considered mitigable, or manageable or the probability of an adverse impact may be low.

*Non-significant issues:*

- No significant impacts are anticipated on: habitats, flora and fauna.

***Soils, Contamination and Wastes***

In regard to contamination and waste issues, it is considered that the main risk associated with the proposed project will be in relation to groundwater, which in the project area is considered to be susceptible to pollution. It is considered that the proposed exploratory well construction, which will include a steel casing, will be cemented ('grouted') in place to seal off aquifer units and will mitigate the potential for contaminants associated with drilling fluids entering groundwater. Nevertheless, mitigation measures should be adopted to ensure that no contamination enters groundwater. In particular, care should be taken to avoid contaminant spills and soil contamination arising from inappropriate disposal of drilling and other wastes. Wastes should be kept to a minimum and any wastes that do arise need to be managed and safely stored on site before disposal to an appropriate waste facility in accordance with local regulatory requirements. Site staff should be appropriately trained and monitored in order to ensure observance of the appropriate procedures for wastes management, storage and disposal. Procedures and monitoring are outlined in the Environmental Management Plan (EMP).

***Air Quality***

With respect to emissions to air, there are likely to be dust emissions during site clearance and construction, methane (CH<sub>4</sub>) and hydrogen sulphide (H<sub>2</sub>S) emissions during drilling, and carbon dioxide (CO<sub>2</sub>) and volatile organic chemical (VOCs) emissions during flaring. However, due to the short term nature of the activities, air quality standards are unlikely to be exceeded outside the boundary of PPTBE's operations at the proposed sites. Air pollutants disperse rapidly with distance therefore there is likely to be a negligible impact on the nearby community of Independence Village or any other community.

**Conclusion**

The exploration and appraisals wells proposed to the west of Independence Village are considered to be a suitable development as the sites are not environmentally sensitive, they are sufficiently remote from potential receptors in the local community and the works proposed are localized and short term in duration. An environmental management plan has been prepared to control the potential and actual adverse impacts associated with the construction, operation and decommissioning of the works. It is considered that through good site management and monitoring, the management of environmental risks and health and safety management, the potential adverse impacts can be mitigated to acceptable levels.

**Environmental Management Plan**

The Environmental Management Plan (EMP) sets out how the potential adverse environmental impacts will be managed, prevented and/or mitigated, and monitored during construction, operation and decommissioning of the exploratory and appraisal well sites proposed to the west of Independence Village, in order to minimize effects on the environment and local communities. A copy of the summary table from the EMP is provided at the end of the Executive Summary.

Implementation of the EMP is the responsibility of PPTBE. The EMP will be reviewed periodically by senior PPTBE management, and updated as necessary to reflect changes in legal requirements, changes in construction or operational methods, or to address recommendations to improve the plan.

PPTBE has prepared an emergency response plan, which includes safety and environmental aspects of the site operation and this has been adapted to provide a Disaster Management Plan (DMP) as required by the ToR..

**Summary Environmental Management Plan**

Parameters	Potential Adverse Environmental / Social Impacts	Proposed Mitigation Measures	Residual Impact	Implementation Issues			
				Phase	Responsibility	Monitoring	Training Needs
<i>Physical Environment</i>							
<b>Climate</b>	Emission of GHGs during construction & operation	Maintain HGV fleet, plant, equipment. Minimize haulage distances. Switch off engines when not in use.	Minimize emissions of GHGs.	III to V	PPTBE	Air quality monitoring during the exploratory works	Induction talks/ toolbox talks to workers on good site practice
<b>Topography, Soils, Geology &amp; Hydrogeology</b>	Requirement for aggregate / earth	Abstract resources at sites to avoid import of material. Balance cut and fill on site to maximize use of resources and avoid wastage. Limited import of aggregate for drill pad from local quarries.	Not Significant. Good use of resources on or near sites.	III	PPTBE	Site supervision	None
	Soil erosion & slumping	Design temporary site drainage if needed. Limit vegetation clearance to working areas. Upgrade access roads to limit susceptibility to erosion & design with drainage.	Not significant. Small area potentially affected. No sedimentation off site.	I to III	PPTBE	Site supervision	None
	Pollution as a result of leakages from pipe work, storage tanks or operation e.g. refueling	All operations designed to comply with environmental good practice combined with regular maintenance.	Not Significant	II to V	Operator / Contractor	Daily observations of plant and operations	Toolbox talks to workers on good site practice
<b>Hydrology &amp; Drainage</b>	Increased storm water runoff and entrainment of sediment, oil-contaminated sediment, and litter.	Avoid aggregate stockpiles on site. Compact earthworks, road base, etc. Re vegetate bare soil in landscaping areas prior to start of wet season	Not significant since the site area is small & works short term in duration.	III to V	PPTBE	Site supervision	Toolbox talks to workers on good site practice
	Increased storm water from higher area of impermeable surfaces and entrained of sediment and oil contaminated sediments.	Design & install road drainage for access roads.	Not significant.	I to V	PPTBE	Site supervision	None

<b>Ecology &amp; Nature Conservation</b>	Loss of valuable habitat or species of conservation value.	None. The sites are of low conservation value & small area, the works highly localized & short term in duration.	Not significant	NA	NA	NA	NA
<b>People &amp; Communities</b>							
<b>Disruption</b>	Dust during construction & decommissioning	Suppress dust using water bowsers. Avoid double handling of spoil. Compact and re-vegetate earthworks. Wheel wash facilities on exit from site. Speed limit on vehicles on earth roads. Minimize height of stockpiles and surround the hoardings. Storage of cement in enclosed areas	No significant impact on Buena Vista as too distant. Possible nuisance for staff working on site.	III, V	PPTBE	Daily monitoring of onsite activities.	Toolbox talks to workers on good site practice
	Emissions from construction plant & vehicles.	Maintain all vehicles, plant and equipment. Switch plant off when not in use.	Not significant.	III	PPTBE	Daily monitoring of onsite activities.	Toolbox talks to workers on good site practice.
	Flaring of associated gas (if any)	None	Not significant due to the short duration of exploration works.	IV	NA	NA	NA
<b>Noise</b>	Noise impact on local receivers during construction & decommissioning	Select working methods and program to reduce noise. Use quieter equipment. Maintain and appropriately silence plant & equipment. Switch off when not in use. Position noisy equipment behind physical barriers. Direct noise emissions away from sensitive locations. Handle materials in a way which minimizes noise. Set audible warning systems to minimum legal.	Not significant.	III, V	Operator / Contractor	Operator / Contractor	Toolbox talks to workers on good site practice.
	Control of noise during operation phase	Maintain equipment. Use quiet plant. Set warning systems to minimum legal settings.	No significant impact on Independence Village. Low impact on workers at the site	IV	PPTBE	Monitor noise levels especially during start up conditions, night time & noisy activities.	Toolbox talks on noise mitigation measures
	Noise & Vibration -Health & safety of	Prepare a risk assessment, and health & safety plan for the	Minimize hazards to work force by	III, V	Contractor	Contractor	Toolbox talks on noise mitigation measures

	workforce during construction & decommissioning	construction phase. Provide appropriate PPE to all employees. Limit the time employees spend in noisy environments.	foreseeing potential risks and reducing them.				
	Noise & Vibration -Health & safety of workforce during site Operation	Prepare a risk assessment and health & safety plan for the operational phase. Provide appropriate PPE to all employees	Low	IV	PPTBE	PPTBE	Toolbox talks on noise mitigation measures
<b>Water Quality</b>	Pollution by construction & operational activities, including accidental spillages.	Prepare & implement an adequate site environmental management plan (SEMP).	Low level nuisance during construction, but no long term impacts	III to V	PPTBE contractor to prepare SEMF	Compliance with SEMF.	Toolbox talks on SEMF Procedures.
<b>Waste Management</b>	Disposal of construction & exploration drilling wastes.	Control of disposal of construction wastes through a SEMF.	Low level nuisance during construction, but no long term impacts	III to V	PPTBE contractor to prepare SEMF	Compliance with SEMF.	Toolbox talks on SEMF Procedures.

Phases: I = Design; II = Pre-Construction; III = Construction; IV = Operation; V = Decommissioning.

# **1 Introduction**

## **1.1 Background**

The discovery of oil in Belize in 2005 is the first success in exploratory operations in Belize that began in the 1950s. The Spanish Lookout Field (estimated at 40 million Barrels of which an estimated 11 million Barrels are recoverable) was discovered by Belize Natural Energy Ltd (BNE) in 2005. PPTBE in cooperation with the Government of Belize (GoB) is progressing in developing the infrastructure to facilitate the commercialization of more petroleum assets. PPTBE's operations in Belize to extract and deliver the crude oil to market are:

### **1. Exploration and Exploratory Drilling**

### **2. Field (Production Well) Installation(s)**

### **3. Bulk Storage of Crude oil.**

### **4. Transportation. (Road/Pipeline/Sea Transport)**

### **5. Processing/Refining (in Country or Abroad)**

PPTBE commissioned BRW Consulting Group to undertake an Environmental Checklist (EC) as part of an Initial Environmental Evaluation, to identify the principal environmental issues and sensitive receptors within their Concession area. The EC establishes baseline data and a framework, with objectives and criteria derived from the identification of these environmental issues. These data and framework can be used to carry out further environmental evaluations of a number of strategic options for PPTBE's operations, including: exploration; production; storage; transportation; and processing.

This approach is elaborated further in the EC document, which provides an overview of the environment of Belize with respect to PP's Concession area and – in conjunction with the data in the Baseline Review collated for the EC and supplementary data collected for this Environmental Impact Assessment – provides the context for undertaking this assessment.

The focus of the assessment in this report is the project proposed by PPTBE to drill a petroleum exploration well and appraisal wells to the west of Independence Village, as one strategic option for PPTBE's operations.

## **1.2 Project Justification**

PP signed a Production Sharing Agreement (PSA) with the Government of Belize (GoB) 12 October, 2007 to conduct petroleum operations within a concession area in the Southern portion of the country. This PSA gives PP the authority to conduct petroleum exploration operations, within an assigned contract area. These petroleum operations include the exploration for, development, extraction, and production as well as transportation, storage and sales of petroleum within the concession area. As such, PPTBE is tasked to explore for and locate and develop petroleum resources within its concession area. Its exploration efforts have identified the Independence Village area (also known as the Independence Village drilling site) as a petroleum prospect.

The Independence Village prospect is located along the Stann Creek District's Southern boundary immediately west of Independence Village. The prospect is based on several independent seismic analyses that concur on the location of the prospect.

It is anticipated that if hydrocarbons are trapped in the Independence Village structure, it will be high gravity oil with minimal H<sub>2</sub>S and minor associated gas.

The seismic assessment indicates a promising geological structure at this location. Subsequent to such an assessment, the drilling of exploratory and appraisal wells is the only way to gather the information needed to confirm the presence of hydrocarbons, and - if found - their composition, thickness and pressure to confirm the viability of the potential petroleum resources at the Independence Village prospect. Section 3 provides a description of PPTBE's proposed project to drill the exploratory and appraisal wells required to gather the above information.

### **1.3            *The Need for an Environmental Impact Assessment***

Under the Belize Environmental Impact Assessment Regulations 1995 (SI No. 107 of 1995) , an environmental impact assessment (EIA) is mandatory for the petroleum sector (“oil exploration, oil production and oil refining) and energy sector (industrial installation for carrying gas... for the transmission of electrical energy by overhead...cables”).

This report addresses the needs identified by the DoE in their Environmental Checklist (EC) (see Appendix A) for the Environmental Impact Assessment (EIA), and Environmental and Disaster Management Plans (EMP and DMP) for the exploration wells proposed near Independence Village. The legal basis and regulatory framework for the EIA is described further in Section 2. The EIA, EMP and DMP should be updated if the purpose of the wells changes from exploration to production.

### **1.4            *The Contents and Structure of this Report***

The content of the report is set out as follows:

- Section 1 – background to the project, report structure and relationship with the EC agreed with the DoE
- Section 2 – a review of the policy, legal and administrative framework governing EIA and oil exploration in Belize
- Section 3 – a description of PPTBE's proposed project together with discussion of alternatives
- Section 4 – a description of the baseline conditions
- Section 5 – the environmental impact assessment, proposals for mitigation and conclusions
- Section 6 – an environmental management plan for controlling the occurrence of adverse environmental impacts during construction, operation and de-commissioning
- Section 7 – a summary of consultations with regulatory authorities and local communities
- Section 8 – a disaster management plan for controlling the occurrence of adverse human health & safety impacts during construction, operation and de-commissioning

## **2 Policy, Legal and Administrative Framework**

### **2.1 Introduction**

The Government of Belize (GoB) is committed to the long term development of the country through “the sustainable and rational use of our natural resources.” New investment projects, as well as the expansion of existing development projects, are actively encouraged by the Government. The need for development of the country must be balanced against the need to preserve and enhance our natural resources.

The GoB through its Department of Environment (DoE) vets these projects to make an initial assessment of the environmental risk associated with this project. Depending on factors such as project size, project type, and location these project may or may not be required to carry out an Environmental Impact Assessment (EIA). The EIA process is summarized in Section 2.2.

To accomplish this process the GoB has established laws, regulations, guidelines and standards that govern the sustainable use and exploitation of its natural resources. The laws, regulations and guidelines relevant to this project are summarized in Section 2.3. These laws and regulations are implemented by Government Departments with the support of funding agencies, Non-Governmental Organizations (NGOs) and local communities through monitoring, management or active participation. The responsibilities of these Departments with respect to the environment are summarized in Section 2.4. Belize has formal and informal agreements with the NGO community for the assistance in the management of its natural resources.

Agencies involved in environmental protection include the Department of Environment (DoE), the Coastal Zone Management Authority & Institute (CZMAI), the Land Utilization Authority (LUA), the Geology and Petroleum Department (GPD), the Forest Department, the Fisheries Department, and the Public Health Department (PHD).

### **2.2 The EIA Process**

The EIA Regulation was enacted in 1992. The EIA process of Belize is comprehensive, but requires financial sustainability measures in order to ensure its continued improvement and effectiveness. The EIA process contains elements that are typically used in the region. The EIA process includes the following standard stages: (i) screening; (ii) scoping; (iii) baseline studies; (iv) public consultation; (v) review process; and (vi) preparation of an environmental management system.

This project was required to conduct an EIA, in accordance with Schedule 1 of the EIA Regulations, 1995. This document is prepared following the DoE’s Terms of Reference (ToR), the specifics of which have been agreed with them for the project proposed by BNE, and a copy of which is provided in Appendix A. The ToR follows the guidelines for the Preparation of an EIA published by the DoE and is based on the EIA Regulations, 1995, and the Environmental Protection Act, 1992, revised 2003.

The Environmental Checklist (EC) identified specific environmental issues for each of the planning areas and the findings of this assessment formed the basis for the ToR for the current EIA.

In Belize, the National Environmental Appraisal Committee (NEAC) is the legal agency responsible for the vetting of EIAs, and heads the EIA process. The Chairman of the NEAC is the Chief Environmental Officer, who is also the head of the Department of Environment (DoE), Ministry of Natural Resources, Local Government and the Environment (MNREI).

Since its inception as a Department, in 1989, the DoE, through the enactment of various legislations, has played an important role in Belize's development. One of the most important legislations implemented by the DoE that guides development is the EIA Regulations, 1995.

The EIA process in Belize is a well-structured process despite its relatively new implementation. The process is a typical EIA process with the key components being typical of EIA processes of the region. It consists of an initial conceptual stage of project design, a screening phase (to determine if an EIA is needed), a scoping phase (to determine the scope of the EIA, if one is needed), and an EIA preparation stage, a vetting stage and follow-up activities (to ensure that any requirements identified by the EIA are satisfied). The phase of preparation of the EIA includes processes typical of EIAs in the region; and includes establishment of an environmental baseline, description of the proposed project, identification of and prediction of potential impacts, identification of mitigation measures, evaluation of project alternatives, and selection of the preferred alternative, resource assessment and the preparation of an Environmental Management Plan (EMP) to identify any mitigating and monitoring measures to be implemented.

The EIA process also calls for various levels of public consultation. This includes meetings with key stakeholders in order to get their views and inputs, local community consultations, the publishing of a notice in a local newspaper advertising the location and dates when the EIA document will be made available to the public for two weeks. Whenever the NEAC determines necessary, then a formal public hearing at a community near the proposed site may be required as another form of consultation. A decision on the various levels of consultation is made by the NEAC after due consideration of the local context of the project site, the pre-existing conditions, the magnitude and significance of the impacts, among other factors. During the process of evaluation of the EIA, the NEAC may conduct site visits and interviews with key stakeholders as part of the consultation process.

At the final stage of approval, the DoE requires the project owner (“developer”) to sign an Environmental Compliance Plan (ECP), a legal document to which the developer needs to adhere. This document is legally binding and contains the mitigation measures, stages of development, and technology to be utilized during the various phases of the project. It also makes provisions for monitoring and enforcement of the conditions agreed to and provisions for failure to implement the agreement.

### **2.3            *Legal Framework***

The principal legislation that deals with environmental protection is the Environmental Protection Act. This Act, promulgated in 1992 and revised in 2003, establishes the DoE and gives it the responsibility and authority for the protection of the environment, including human health. Other Acts and Regulations also affect the development of this project in that they deal with issues such as mangrove protection, land subdivision, coastal protection, water abstraction, and road construction among others. There is no separate legislation at present addressing human health and safety, though this is to be promulgated by the GoB in the near future.

The principal legislation having direct or indirect bearing on the project is therefore the following.

#### ***The Environmental Protection Act (No. 22 of 1992 and Chapter 328 of revised***

***Editions 2000 and 2003)***. The Belize Environmental Protection Act (EPA) relates to the preservation, protection and improvement of the environment, the rational use of our natural resources, and the control of pollution. This Act was passed into Legislation in 1992 (No. 22 of 1992). Under this Act and its Subsidiary Regulations several areas of paramount concern are being addressed. This includes effluent discharge, pollution control, regulation of development through the use of environmental impact assessment, decrease in use of ozone depleting substances as well as persistent organic pollutant. In the context of our level of development as well as relatively small size the Act has allowed government to address the issue of environmental protection in consultation with other sectors including environmental groups, community organizations, developers and investors. The 2003 revision of the Act consolidates: The Environmental Protection Act (1992); the Environmental Impact Assessment (EIA) Regulations

(1995); the Environmental Protection (Effluent Limitations) Regulations; and Pollution Regulations (1996); these are identified below. Under the EIA Regulations in the Act, oil exploration is listed as a Schedule 1 project, which requires an EIA to be completed.

***Environmental Impact Assessment Regulations No.107 of 1995*** .These regulations were enacted in 1995. They form the basis for determining which projects require the conduct of an EIA. Its regulations govern the type and size of development that requires an EIA, as well as detailing the EIA process. Under these Regulations the National Environmental Appraisal Committee (NEAC) which vets the EIA is established. This project is subject to this regulation and requires the preparation of an EIA.

***Pollution Regulations SI No. 56 of 1996***. This addresses issues of air, water and soil pollution, including noise pollution. Part III – 6 (1) deals generally with the emission of contaminants into the air where no person shall cause, allow or permit contaminants to be emitted or discharged either directly or indirectly into the air from any source. Part X 31 (c & d) deals with pollution of land generally that could be harmful, or potentially harmful to animals, birds, wildlife, plants or vegetation. The DoE is responsible for the enforcement of these Regulations (since made Act in the EPA, 2003, above).

***The Public Health Act (No. 40 of 2000)***.The Public Health Act authorizes the Ministry of Health and Sports, to issue regulations to prevent, control, or reduce contamination of the air, soil or water, and prohibits improper disposal of medical or infectious wastes.

***The Mines and Minerals Act (Chapter 226 of revised edition 2000)***. The extraction of all non-renewable resources except petroleum is regulated by the Mines and Minerals Act (1988). The government owns all minerals under public and private lands, and, minerals are reserved from all future grants of state lands. The Act provides for licenses and royalties for the taking of minerals, and prohibits the pollution of any river, stream or watercourse.

***Petroleum Act (Chapter 225 of revised edition 2000 + 225s: subsidiary laws of October 2003)***. Describes all aspects of oil exploration and exploitation including licenses, fees etc. The government owns all oil and gas under public and private lands, and these are reserved from all future grants of state lands.

***The Land Utilization Act (Chapter 188 of revised edition 2000)***. The Land Utilization Act, under which the Land Utilization Authority of the Ministry of Natural Resources, Local Government and the Environment (MNREI) is established, provides for measures to govern the use and development of land, and introduces measures for the conservation of land and watersheds. This Act governs the subdivision of private lands and the construction of jetties on coastal areas.

***The National Lands Act (Chapter 191 of revised edition 2000)***. According to the National Lands Act, “National Lands” means all lands and sea bed, other than reserved forest within the meaning of the Forest Act, including cays, and parts thereof not already located or granted, and includes any land which has been, or may hereafter become escheated to or otherwise acquired by Government of Belize. These lands are classified as town lands, suburban lands, rural (including pastoral lands), mineral lands and beach lands. The Minister responsible is empowered to appoint a National Lands Advisory Committee to advise him generally on matters relating to land.

***The Forests (Protection of Mangroves) Regulations (SI 52 of 1989)***. These regulations prohibit any “alteration” of mangroves on any land except with a permit. Alteration means cutting and defoliating, but does not include selective trimming.

***The Wildlife Protection Act (Chapter 220 of revised edition 2000)***. The Wildlife Protection Act controls the conservation, and use of protected species. It also empowers the Forest Department to pass regulations that govern Princess Petroleum / Treaty Belize Energy Environmental Compliance Project

the management of endangered flora and fauna. Under this Act “Endangered Species” may not be kept in captivity unless so approved by the Forest Department. All species listed as endangered by CITES are protected in Belize.

***National Parks Systems Act, No. 5 of 1981(Sec. 2,) and Ch 215 of 2000 Revised Edition.*** Under Section 3 of the Act wildlife sanctuary means “any area reserved as a nature conservation reserve in accordance with the provision of Section 3 for the protection of nationally significant species, groups of species, biotic communities or physical features of the environment requiring specific human manipulation for their perpetuation.”

***Ancient Monuments and Antiquities Act. Chapter 330 of 2000 Revised Edition.*** Under section (4) of the Ancient Monuments and Antiquities Act, all ancient monuments and antiquities however situate, whether upon any land or in any river, stream or watercourse, or under territorial waters of the country, and whether or not before the date of the commencement of this Act in private ownership, possession, custody or control, shall absolutely vest in the Government. Under section (12), if any person finds any ancient monument or antiquity he shall within fourteen days of such findings report the details of the findings to the Minister.

***Institute of Culture and History (Amendment) Act (No. 20 of 2003).*** This act empowers the Institute of Archaeology to carry out research, interpretation and the protection of the Archaeological Heritage of Belize. The ownership of all ancient monuments and antiquities shall rest in the Institute of Archaeology, Government of Belize.

***Belize Tourist Board Act SI 275 of 2000.*** The Belize Tourist Board Act establishes the Belize Tourist Board with wide responsibilities for the promotion of tourism in Belize. Apart from being charged with the development of the tourism industry, the Belize Tourist Board also has the responsibility to foster understanding within Belize of the importance of environmental protection and pollution control and the conservation of natural resources.

***Solid Waste Management Authority Act SI 224 of 2000 .*** Under the Act, the Authority shall devise ways and means for the efficient collection and disposal of solid waste employing modern methods and techniques and exploring the possibility of recycling waste materials. Under the Act “construction waste material” includes building materials from construction, alteration and remodeling building or structure of any kind, such as lumber, concrete, steel roofing, etc.

## **2.4 Administration**

Some of the key agencies responsible for environmental protection and natural resources management are the **Ministry of Natural Resources and the Environment (MNREI)**, the Ministry of Agriculture and Fisheries (MAF), the Ministry of Health, and the Ministry of Tourism. These Ministries are empowered by legislation which governs the use of the natural resources and environment.

The MNREI is one of the largest Ministries of the Government of Belize. It includes the DoE, the Geology and Petroleum Department (GPD), Forest Department (FD), Lands and Surveys Department (Lands), Land Utilization Authority (LUA), and the Land Valuation Department, Department of the Environment. Among these departments are also various important sections such as the Conservation Division of the Forest Department.

The Environmental Protection Act 1992 legally established the **Department of Environment (DoE)**, which is charged with a wide range of responsibilities. These include the guidance of development by industry, the encouragement of the adoption of environmentally friendly technology, the control of pollution, the requests for and administration of the EIA process, and the sustainable use of the natural resources and the environment.

The **Geology and Petroleum Department** is responsible for most aspects of oil and gas exploration and exploitation. The **Forest Department** is responsible for the approval of mangrove alteration permits, and for implementation of the Wildlife Protection Act, 1981. The Forest Department is also the enforcing agency for the Princess Petroleum / Treaty Belize Energy Environmental Compliance Project

Wildlife Protection Act.

The **Public Health Department** of the **Ministry of Health** is responsible for overseeing a wide range of public health matters including the on-site sanitary working conditions of projects and developments, sewage systems, safety of and within buildings.

The **National Institute of Culture and History (NICH)** houses the **Institute of Archaeology**, which is responsible for the administration of the archaeology countrywide. The Institute of Archaeology monitors all ongoing archaeological projects in Belize and issues permits for site work. The Institute is also responsible for all aspects involving any ancient Maya remains, artifacts and structures as well as any other item of historical significance. Any findings have to be reported to this department. Removal of artifacts or disturbance of sites is illegal without written permission of this Department.

## **2.5            *International and Regional Environmental Agreements***

Belize is a signatory to several international and regional environmental conventions and agreements. The Government Departments which serve as the focal points for observance of Belize's commitment to these conventions and agreements are identified below, for those which are relevant to this project:

**International Plant Protection Convention (14/05/87).** The focal point for this in Belize is the Plant Protection Division of Ministry of Agriculture and Fisheries.

**Convention on Wetlands of International Importance. (Ramsar Convention 26/02/98).** Focal point: Forest Department.

**Convention concerning the protection of the World Cultural and Natural Heritage (06/11/90):** Focal point: NICH.

**Convention on Biological Diversity (1992).** Focal point: Forest Department.

### 3 Description of the Proposed Project

#### 3.1 Project Location

The proposed project is a petroleum exploration operation under a Production Sharing Agreement (PSA) signed with the Government of Belize (GoB). The project proposed by PPTBE is for the drilling of one exploration oil and gas well and the possible drilling of up to four appraisal wells.

The proposed exploratory well No. 1, as well as the appraisal wells, would be located 8 miles west of the village of Independence Village, Stann Creek District, Belize (See Map 3.1). These locations are identified in Map 3.1 and Table 3.1, below. Map 3.1 and Table 3.1 are indicative only of the locations. The precise locations to the west of Independence Village are subject to change based on the initial findings and progressive findings from the proposed exploratory well and appraisal wells.

**Table 3.1 Coordinates of the proposed exploratory wells**

Well No.	Longitude	Latitude	Depth
1	16° 31' 49.437"	88° 30' 17.047"	1200'
2	16° 31' 47.639" (10 ft. West)	88° 30' 13.728"	1500'

Currently, the exploration well site is the one listed as well No. 1 and would be the one to be drilled first. The other well sites have been identified for appraisal purposes should the exploration well be successful. The elevation of the proposed wells varies from 85 to 107 m Above Sea Level (ASL).

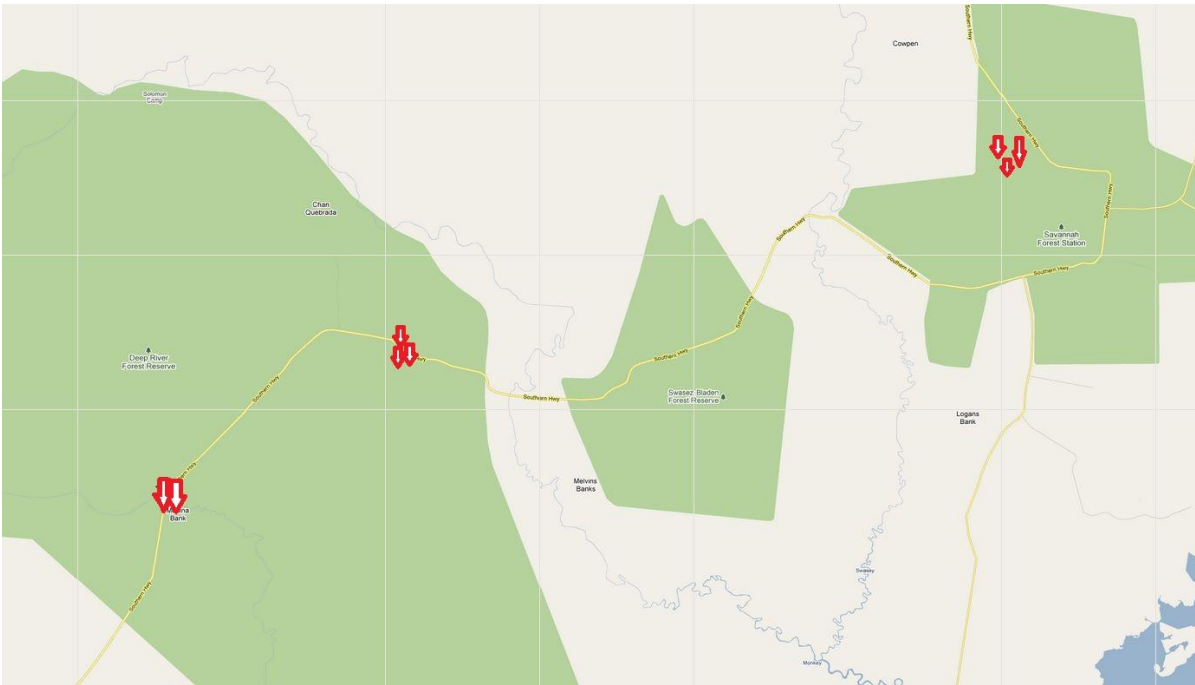
It is anticipated that if hydrocarbons are trapped in the Independence Village prospect it will be similar: high gravity oil with minimal H<sub>2</sub>S and minor associated gas.

#### 3.2 Project Plans

The sites of proposed wells in Table 3.1 and shown in Map 3.1 are all located on private properties, the landowners for which PPTBE has contact details.

The site is easily accessible from the Southern Highway using a gravel Road which intersects the Southern Highway. This access road is an unpaved gravel road (see Map 3.1). This road will be maintained and repaired as needed. Further access roads would not be developed until needed.

#### Map 3.1 Location of the proposed exploratory wells



### **3.3 Activities/Facilities Proposed in the Plans Above**

The project proposed by PPTBE involves the repairing or maintaining the access road of approximately 1000 meters to the drill site for the exploration well, with the relevant consent of respective land owners for the drill site location and through whose property the road passes. It also involves the clearing of less than two acres of land and the building of a 50 by 80 yards drill pad, on flat-lying land, for each well site. The drill rig will be the same for the exploration well and the appraisal wells, as shown in the figure 3.1.

**Figure 3.1 Photograph of the rig proposed for the drilling**



The drill rig will be placed on the drill pad throughout the drilling and testing process. If there is no discovery of potential commercial interest after the drilling of the exploration well, then remediation of the drill site will be carried out on completion of the drilling and testing operations. The site will be returned to its original condition once requested by the landowner, in which case all filling or construction stones will be removed and used to repair roads close to site.

If the discovery is of potential commercial interest and the appraisal wells are required then the project may range over an area of approximately 1100 acres, though the facilities developed would cover in total much less than 1% of this area. Please see Map 3.1 for details of possible locations of the exploratory and appraisal wells, roads and proposed aerial coverage of the project.

### *3.4 Processes involved in the exploratory drilling operations*

In summary, the proposed exploratory and subsequent appraisal wells would require:

- A site to set-up the drill pad and undertake exploratory drilling and associated site-support operations;
- Access to the site for drilling and supply vehicles and plant;
- Site accommodation (personnel, vehicles and plant);
- Power and other utilities;
- Storage facilities;
- Testing facilities; and
- Waste storage and disposal facilities.

The processes to meet these requirements may be broken down into three phases – construction, operation and decommissioning – as described in Sections 3.4.1 to 3.4.3, below:

#### *3.4.1 Construction*

This phase involves the processes required to arrange access to the site and set-up the drill pad, exploratory and appraisal wells and associated site infrastructure, in readiness to undertake drilling.

Drill pad construction will involve the spreading and compacting of 12 inches of stones topped with two layers of compacted gravel. The approximate amount of material required will be 1000 cubic meters.

Road work will involve the repairing a gravel road to facilitate access for larger vehicles to the exploration well. No importation of material for filling is expected for this upgrade as material in place will be utilized. However, if during the repair process, it is determined that some material is needed it will be obtained from nearby quarries.

Road work for access to the sites for the appraisal wells, if necessary, is expected to be similar to that for the exploration well.

Temporary accommodations for personnel, parking for vehicles and plant, testing and storage facilities to be set up on site.

A mobile diesel generator would provide electrical energy on site. Water would be brought to the site by tanker and wastewater / effluent would be tankered away from the site. Cellular telephones would be used for Princess Petroleum / Treaty Belize Energy Environmental Compliance Project

communications, and portable toilets and appropriate waste /garbage disposal bins will be utilized.

### 3.4.2 *Operation*

This phase involves the processes required to run and maintain the exploratory wells and associated site infrastructure.

Energy is required to power the living accommodations, and the office for the well unit, the site office and site security office. When oil wells produce small amounts of associated gas, such as during evaluation testing, it is uneconomical to collect and compress the gas for energy production purposes, in such situations the gas is burnt in a controlled way known as flaring rather than used for energy generation. As there is no electricity currently available at the proposed sites and limited scope for renewable energy, the energy will be provided by a diesel generator. The drilling rig produces power with its own diesel engines. Diesel fuel will be transported to site by diesel truck that will remain on site throughout the operations. Electricity will be provided on site by the generator for the seven weeks' long drilling and testing operations.

Water would be brought to the site by tanker and wastewater / effluent would be tankered away from the site to an appropriate, registered facility. Cellular telephones would be used for communications, and portable toilets and appropriate waste /garbage disposal bins will be utilized. As no fixed telecommunication service is available at the sites, cellular telephones would be used for communications. Portable toilets and refuse /garbage disposal bins will be utilized for personnel and office wastes. Drilling wastes and effluents would be managed as below .

The exploration drilling process will involve installation of a casing in the borehole as well as a 'Blow-Out-Preventer' (BOP). It also involves a drilling fluid program and cementing program. Inspection for safety of the drilling equipment; training in emergency procedures for the drilling operation. The appraisal process of the operations will involve programs for coring, mud logging, DST and electronic logs.

All drilling fluids to be utilized will be contained in above ground steel circulation tanks. Utilized drill fluid along with rock cuttings will be collected in a sump on site that is lined with bentonite (clay). Any drilling fluid that is left over from the operations will be collected and recycled through a dewatering unit.

For the exploratory well the drill rig will be equipped with a BOP to control any pressure build-up in the well bore. No abnormal pressure is expected in this 1200 feet deep well, which is very shallow by oil exploration standards. Past history of oil and gas exploration in Belize indicates that the potential hydrocarbon reservoirs are always under-pressured, not over-pressured. For example the Belmopan Eagle -1 well has a well-head pressure of 70 psi. The drill rig will be equipped with a BOP rated at 3000psi.

### 3.4.3 *De-commissioning*

This phase involves the processes required to plug the exploratory well, remove associated site infrastructure and wastes, withdraw from site and restore the site to good condition. Should the exploratory well and subsequent appraisal wells at a site be successful and the purpose of the site change from "exploration" to "development and production", the decommissioning phase would be postponed as the site would subsequently progress – after updating the EIA, EMP and DMP - to development and production.

After testing is completed and if there is a discovery that is commercially viable, the drill pad footprint will be reduced to a surface needed for production installation and well work over. If unsuccessful, the drill pad will be restored to its original state; however, the original drill pad can be left in its expanded state at the landowner's request.

### 3.4.4 *Alternatives Considered*

PPTBE has an agreement with the GoB to undertake operations which include the exploration, development, extraction, and production as well as transportation, storage and sales of petroleum within the concession area in the Southern portion of the country, as introduced in Section 1.2.

Hence, to “Do Nothing” would not be a viable alternative if PPTBE are to continue with the exploration for petroleum under their concession.

Exploration efforts to date, including seismic testing, have identified the Independence Village area as a petroleum prospect. This is located west of Independence Village and the Southern Highway in the Cayo District of Belize. Subsequent to the seismic analysis, the drilling of exploratory and appraisal wells is the only way to confirm the presence of hydrocarbons, and - if found – determine their composition, thickness and pressure in the potential petroleum resources at the Independence Village prospect.

Hence, there are no other alternatives to exploratory drilling if the petroleum prospect at the Independence Village location is to be confirmed.

### 3.5 *Outline of the overall management structure anticipated for the proposed activities.*

The overall management structure for the activities for the proposed exploratory wells is outlined below:

- PP President: Hamdi Karagozoglu, with overall responsibility for the proposed project
- Drilling contractor: Treaty Energy Drilling
- Mud contractor: Horizon
- Mud logging Contractor: Horizon Well Logging
- Cementing / grouting contractor: Tucker Energy Services
- Electric logging Contractor: Horizon
- Company man: Brian Luczywo
- Engineering: Brian Luczywo

## **4 Existing Baseline Conditions**

### **4.1 Introduction**

The existing baseline conditions describe the current condition of the sites and their surrounding environment. These were identified through:

- Reviewing the existing information and data, including published maps, and information available from the Environmental Checklist (EC) and baseline data in its appendices
- Reconnaissance site visits
- Field surveys for:
  - Habitats, flora and fauna
  - Archaeology
  - Air quality data from monitoring by PPTBE
- Consultation with the local community in Independence Village

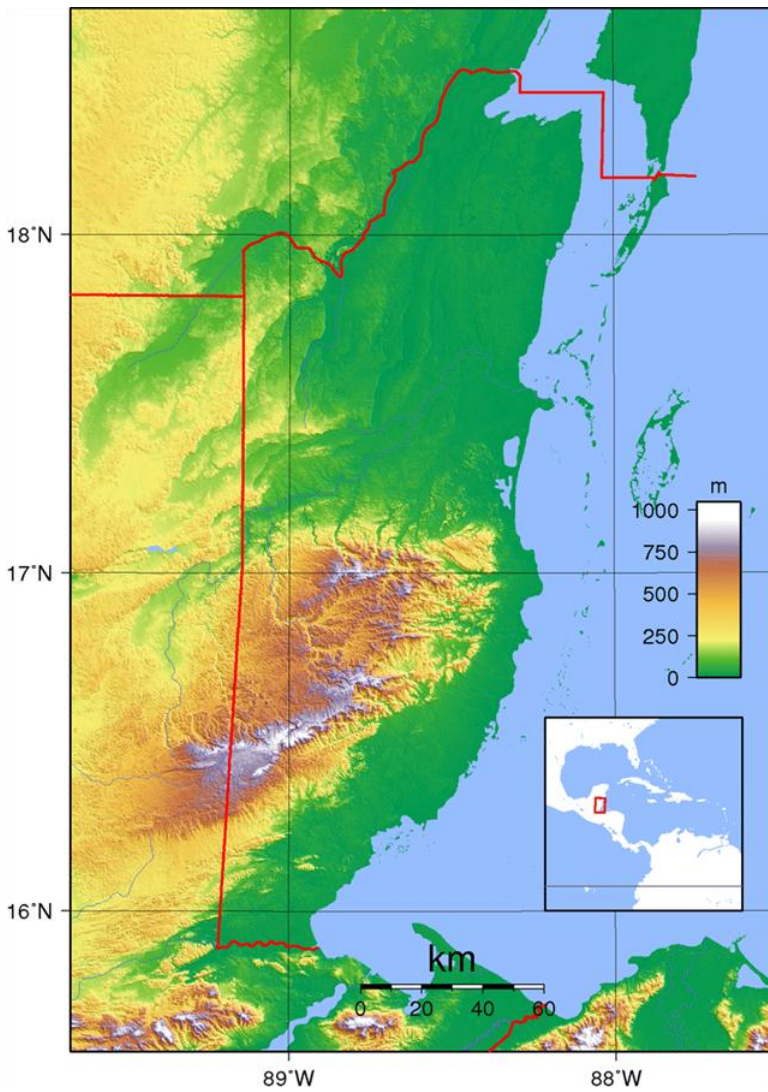
Sections 3.1 and 3.2 describe the location and setting of the proposed project, whilst Sections 3.3 and 3.4 provide more detail about the proposed project itself, including arrangements for access, set-up, operation and decommissioning of the exploratory and appraisal wells.

### **4.2 The Physical and Social Environment**

#### **4.2.1 Topography**

The project site is located approximately 8 miles west of Independence Village along the southern border of the Stann Creek district. This area is characterized by flat plains. The locations of proposed wells vary from 85 to 107 m ASL.

#### **Map 4.1 Topography in Belize**



The entire area is very well drained, with no flood risk to the sites themselves for the proposed exploratory wells, but note Section 4.2.2 about the potential for hurricane-related flooding.

**4.2.2** *Zone of influence in relation to protected areas, surrounding villages and communities, etc*

The proposed project area is not in any protected area. The closest village is Independence Village, about 8 miles to the east of proposed exploration wells; see Map 4.2, below. Independence Village is served by a ground water pump, the location for which is shown in the map below and lies downhill from the proposed sites for the exploratory wells..

**Map 4.2 Location of Independence Village relative to exploration well No. 1**



#### 4.2.3 *Climate, Hydrology and Meteorology*

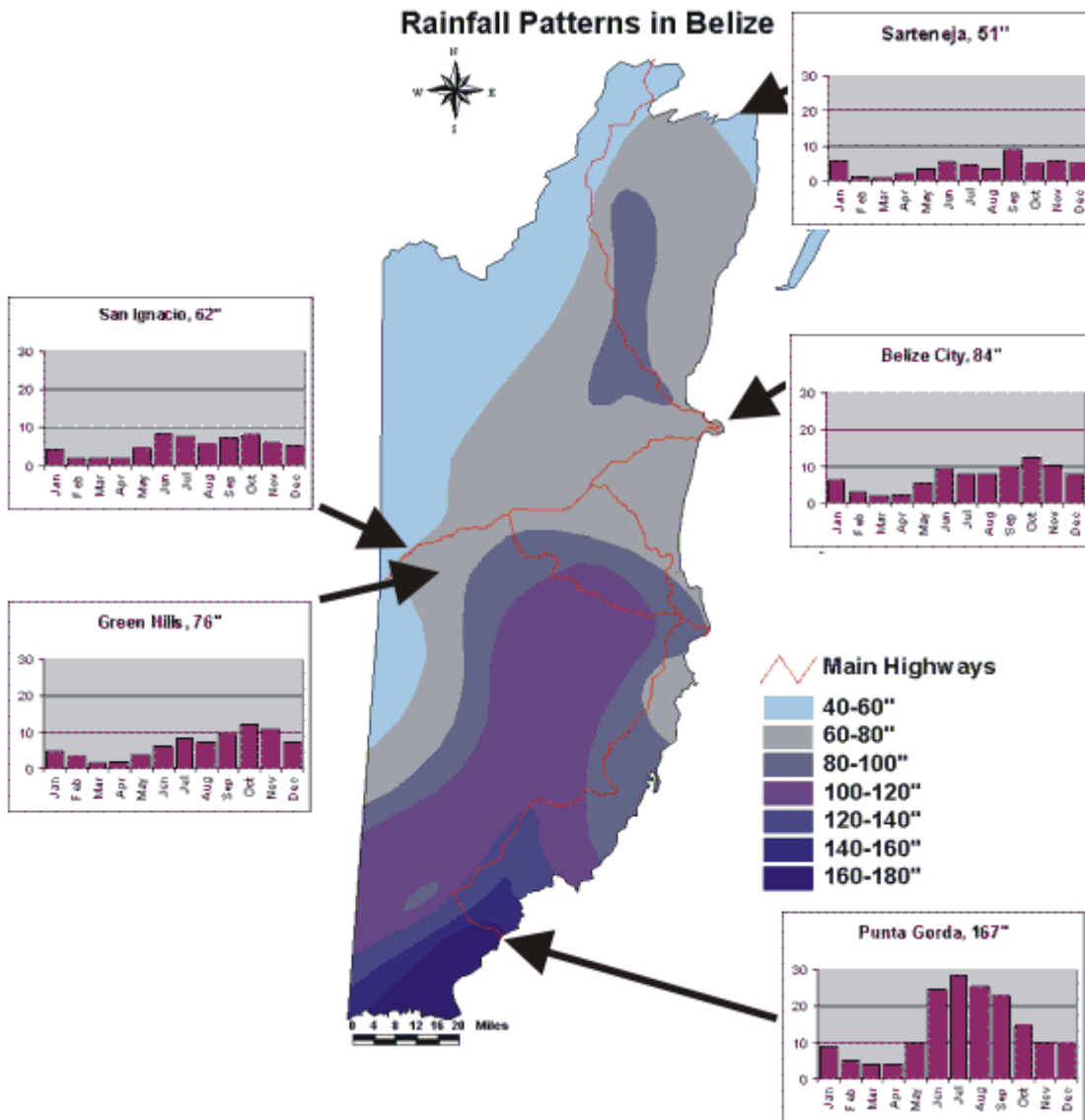
According to the Meteorological Department, the project falls in the zones of 60” to 80” (1500 to 2000 mm) rainfall per annum; see Fig 4.1. Driest months are February to April, and July is the wettest month. Most rainfall in Belize results from two major weather phenomena: tropical systems (tropical waves, tropical storms and hurricanes) in the period June to November; and “northers” (cold, north-east airflows originating in Continental North America) in the period October to February.

No permanent streams exist in the proposed project area. Along the road, there are deep surface water drainage channels that carry water after exceptionally heavy rains.

The general wind pattern is that of east-south-easterly winds during the dry season (February to April), eastern winds in the rainy season and occasional northerly winds during the winter months. In the period March to June the average wind speed is highest but the average wind-speed inland is considerably lower than along coastal areas, where dry season wind speeds range from 10 to 24 km/hr.

Hurricanes and tropical storms present the main environmental hazard with potential to affect the project area with high winds and flooding. On average, a hurricane affects central Belize every 16 years. Not all of these hurricanes do extensive damage, but there is at least an appreciable amount of wind-throw and breakage of tree crowns. Most impact comes from rainfall which can be substantial and lead to widespread flooding. This flooding is not likely to have a direct effect on the project site (see Section 4.2.7 about hydrology and drainage) but may affect main access arteries such as the Southern Highway. However, there is a low likelihood that the access roads and highways will be an extended period of time.

**Figure 4.1 Rainfall patterns in Belize**



#### 4.2.4 Geology and Soils

This area is characterized by flat plains. Map 4.3 (below) shows the soil types in the project area. The soils on these plains are generally richer and absorb moisture quickly.

The whole Independence Village Project area is overlying limestone. As a consequence of the limestone bedrock, most soils are formed under continuous lime enrichment.

The agricultural value of the soils in the area of interest varies from good to medium. The high agricultural value is an artifact of the flatness of much of the terrain. Relevant to the geology is the Production Sharing Agreement (PSA) that PP signed with the GoB on 12 October, 2007. This PSA gives PP the authority to conduct petroleum exploration operations within an assigned contract area. PP at the time of signing the PSA had to commit to a minimum work and expenditure obligations for the entire exploration period.

Apart from exploration activities, other terms and conditions are stipulated under the PSA that is regulated by the Geology and Petroleum Department (GPD), under the Ministry of Natural Resources and the Environment and Industry (MNREI). Being the regulator, the GPD can at any time invoke the 'termination' clause as outlined in the

PSA, if the GoB determines that PP is not fulfilling its requirements under any terms of the PSA

If any notice for termination is issued to PP, other regulatory authorities through which PP as the contractor may need to operate, will also be notified, e.g. DoE.

#### **4.2.5**            *Presence of Hydrocarbons in the Soils*

We selected this particular site after conducting several independent studies which concluded that this site holds vast amounts of shallow hydrocarbons. We have employed the use of several different technologies to pin point the locations of our exploratory wells, and extremely optimistic for the size of this anomaly.

#### **4.2.6**            *Hydrology, Drainage & Hydrogeology*

There are no surface waters that directly impinge on the project area. The site is located approximately 5 kilometers from the Swasey River and 4.5 kilometers from Big Creek. However, there is a road surface water drainage channel near the site that we will be using extra precautionary measures to protect.

### **4.3**                *Habitats, Flora and Fauna*

The development of a drilling site and access roads are the only expected impacts on plants and animals. This will require the clearing of small plants, but we will not have to remove any trees. The area is an open field that will require minimal excavation.

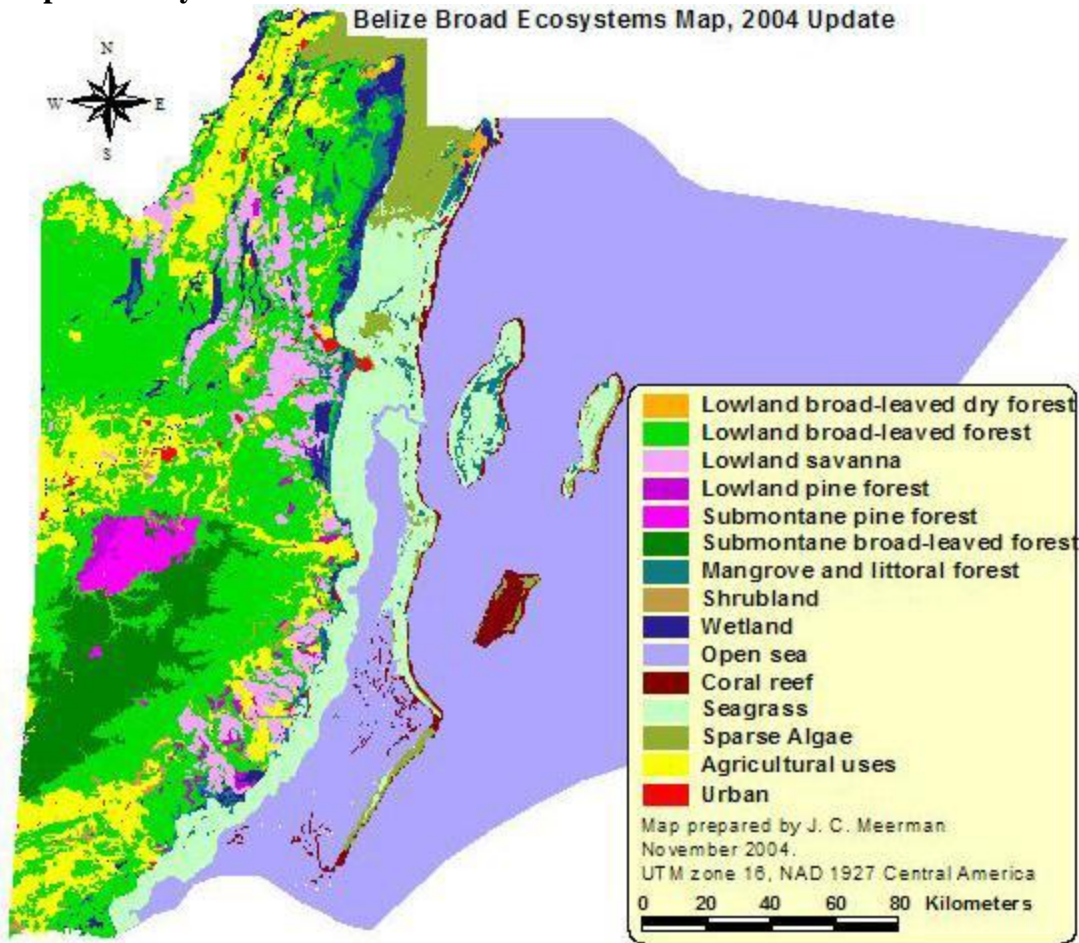
Very few animal species were noted and the flora appeared typical for plains.

Much of the project area has been heavily impacted by human activities. Large portions of the project area are now covered by grass and small shrubs. The biodiversity value of this grass is particularly low. None of the species encountered are particularly rare or of special conservation value.

**Figure 4.2 Photograph showing the habitat at proposed well No. 1**



## Map 4.3 Ecosystems in the Belize



### 4.4 *People and Communities*

#### 4.4.1 *Population and Settlement*

The village of Independence Village is the only nearby community. The village lies at a distance of about 8 miles from proposed well site No. 1. The next nearest community is Mango Creek, which is approximately 9 miles from the well site.

#### 4.4.2 *Land use.*

The proposed Independence Village project site is currently a vacant field. It is not currently being utilized for any reason. The area surrounding the current project area is not developed or in the process of being developed.

#### 4.4.3 *Local Plans and Planning Policy*

No local plans are available or planning policy with specific relevance to Independence Village. However, consultation has been undertaken with the local community and is summarized in Section 5.5 and detailed in Section 7 on public consultation.

#### 4.4.4 *Transportation and Access*

The site is easily accessible from the Southern Highway using the gravel road which intersects the Southern Highway. From the gravel road, access is easily made to exploration well No. 1 due to its close proximity to the road. This access road is an unpaved gravel road; see Map 3.1. The sites for the proposed appraisal wells will need

a temporary road developed that will be approximately 200 meters long. This single temporary road will pass by both proposed well sites.

The gravel road is in a great condition. It is wide, with no evidence of significant erosion. It was well designed with sloping sides to direct water flow to excellent surface drainage channels on both sides of the road.

#### **4.5 Cultural Heritage and Archaeology**

Archaeological field surveys by an approved archaeologist have been commissioned by PPTBE, and the findings are due to be reported shortly. The cultural heritage and archaeological findings and assessment should be included in Appendix B and linked to the relevant sections of this report.

#### **4.6 Air Quality**

With respect to emissions to air, there are likely to be dust emissions during site clearance, methane (CH<sub>4</sub>) and hydrogen sulphide (H<sub>2</sub>S) emissions during drilling, and carbon dioxide (CO<sub>2</sub>) and volatile organic chemical (VOCs) emissions during flaring. However, due to the short term nature of the activities, air quality standards are unlikely to be exceeded outside the boundary of Princess Petroleum / Treaty Belize Energy's operations at the proposed sites. Air pollutants disperse rapidly with distance therefore there is likely to be a negligible impact on plants and animals in the area.

#### **4.7 Noise**

The proposed exploratory well No. 1, as well as the appraisal wells, would be located approximately 8 miles to the west of the village of Independence Village. This village contains the nearest potentially sensitive residential noise receptors, with the nearest other community at Mango Creek, 9 miles to the west.

The proposed exploratory and appraisal well sites are situated along a more or less straight line, just north of the Stann Creek District's southern border. During reconnaissance visits to the proposed development site and surrounding area, observations were made regarding the typical nature of the existing noise climate. It was noted that the key sources of existing noise included road traffic and wildlife.

Although no measured noise level data are available, it is considered that due to the rural nature of the area, baseline noise levels at potentially the most sensitive residential properties/receptors located away from busy main roads and significant area noise sources are typically in the region of 35 to 50dB LAeq, 16-hours and LAeq, 8-hours during daytime and night-time periods respectively.

## 5 Environmental Impact Assessment

### 5.1 Introduction

The purpose of this section of the document is to present the findings of the Environmental Impact Assessment (EIA). Within each environmental topic area the following information is provided:

- Summary of any consultation
- Effects of the proposals (during construction, operation and decommissioning)
- Mitigation or management proposed
- Residual impact and conclusion

The aim of this section is to quantify the effects of the proposals (described in Section 3 on the project description) on the environment (described in Section 4 on the environmental baseline). This includes, for example, the following considerations, local and trans-boundary effects of emissions to air, local effects of emissions to water, local and long range effects from deposition to land of airborne emissions.

This section also deals with the risk of impacts from the consequences of accidents, the effects of noise on local receptors as well as the visual impacts associated with operation of the process and the effects of odor emissions on local receptors and to appraise the effects of waste hazard and disposal.

### 5.2 Overview Potential Impacts

Table 5.1 below summarizes the potential impacts identified in the following sections and categorizes them as:

- Either beneficial (+) or adverse (-);
- Type: Direct (D), Indirect (I) or Secondary (S);
- Duration: Instantaneous (I), Short term (S), Medium (M) or Long (L) term;
- Frequency: Single event (S), Periodic (P) or Random (R);
- Scale: Local (L), Regional (R), National (N) or International (I);
- Potential for the impact to be Mitigated or not (Yes = Y, No = N, Partially =P; Not Applicable = NA)
- Probability of occurrence, Low (L), Medium (M) or High (H); and
- Significance: Not Significant (NS), or of Low (L), Medium (M) or High (H) significance.

Potential Impact	+/-	Type	Duration	Frequency	Scale	Mitigable	Probability	Significance
<b>Construction Phase</b>								
Soil contamination	-	D	I, S	R	L	Y	L	L, M
Ground water contamination	-	D	M, L	R	L	Y	L	H
Ground water contamination	-	I	M, L	R	R	Y	L	M
Surface water contamination	-	S	I, S	R	L	Y	L	L
Dust	-	D	S	R	L	P	M	L
GHG emissions	-	D	S	R	L	P	H	L
Noise	-	D	I, S	P, R	L	P	H	L
Socio-Economic	+	D	S	P	L	NA	M	M
Land use, Landscape and views	-	D	S	S	L	N	H	NS
<b>Operational Phase</b>								
Soil contamination	-	D	I, S	R	L	Y	L	L, M
Ground water contamination	-	D	M, L	R	L	Y	L	H
Ground water contamination	-	I	M, L	R	R	Y	L	M
Surface water contamination	-	S	I, S	R	L	Y	L	L, M
Emissions to air during drilling	-	D	S	S	L	N	L	NS
Emissions to air during flaring	-	D	S	S	L	N	H	L
GHG emissions	-	D	S	S	L	P	H	L
Noise	-	D	I, S	P	L	P	H	L
Socio-Economic	+	D	S	P	L	NA	M	L
Land use, Landscape and views	-	D	S	S	L	N	H	NS
<b>De-commissioning</b>								
Soil contamination	-	D	I, S	R	L	Y	L	L, M
Ground water contamination	-	D	M, L	R	L	Y	L	H
Ground water contamination	-	I	M, L	R	R	Y	L	M
Surface water contamination	-	S	I, S	R	L	Y	L	L
Dust	-	D	ST	P	L	P	M	L
GHG emissions	-	D	S	P	L	P	H	L
Noise	-	D	I, S	P, R	L	P	H	L
Socio-Economic	+	D	S	P	L	NA	L	L
Land use, Landscape and views	+	D	L	S	L	NA	L	L

## 5.3 The Physical Environment

### 5.3.1 *Climate*

(a) **Methodology Adopted** Climate change is an internationally recognized problem, which has been attributed to the increase in emissions of greenhouse gases (GHGs). The main naturally occurring GHGs are water vapor (H<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O). This section considers the potential GHG emissions associated with the construction and operation of the Independence Village exploration wells.

Impacts on climate change are dependent on the total amount of pollution in the atmosphere, rather than concentrations at particular locations. This assessment is based on a qualitative review of the proposed exploration work at Independence Village with regard to potential for emissions of GHGs generated on site. There are no standards against which to evaluate changes in GHG emissions. However Belize is committed under the Kyoto Protocol to reduce GHG emissions.

(b) **Effects of Proposed Project (during Construction, Operation and Decommissioning)**

During construction, the main potential source of GHGs is emissions of CO<sub>2</sub> from construction vehicles and plant. The volumes involved will be small, given the small numbers of construction vehicles and the small scale of the facility.

The following potential sources of GHGs for the Independence Village exploration wells have been considered:

- Construction, operation and decommissioning of the works may cause a change in road vehicle movements, and therefore vehicular emissions of CO<sub>2</sub>
- Flaring would result in CO<sub>2</sub> emissions and possibly CH emissions; and
- The temporary sites will require electrical energy generation for operation, which would result in emissions of CO<sub>2</sub>.

(c) **Mitigation or Management Proposed**

Vehicles and plant should be maintained and switched off when not needed, to ensure emissions to atmosphere are minimized.

(d) **Residual Impact and Conclusion**

Given the relatively limited extent and short term duration of the proposed operation, no significant impacts are anticipated.

### 5.3.2 *Soils, Contaminated Land and Hydrogeology*

(a) **Methodology Adopted**

The methodology adopted in addressing the impacts of these aspects of the physical environment is a generic one focusing on a range of issues that typically need to be considered in association with onshore exploration drilling. It is considered that such an approach is adequate to raise awareness of potential problems and provide general guidance as to how to deal with them should they occur. As in every situation where environmental pollution might arise, the best approach is to adopt an appropriate good housekeeping strategy that will ensure that pollution incidents are avoided.

## (b) Effects of Proposed Project (during Construction, Operation and Decommissioning)

Given the relatively limited extent of the proposed project, the risk of a significant impact due to extensive soil contamination is considered low. None of the soils on the proposed sites are used for agriculture or other human activities. Any risk that might be present will be further reduced by simple mitigation measures based on good site practice as outlined below. The main sources of soils contamination during the proposed project will be:

- Spills – fuel, drilling chemicals
- Wastes generated during drilling
- Domestic and sewage wastes

The construction phase of the project would include formation of access roads where required and a pad to accommodate the drilling rig and associated support services. These would typically include workforce accommodation, mess facilities, vehicle and machine maintenance and parking areas, fuel handling and storage areas, and provision for the collection, treatment and disposal of wastes.

While the formation of a pad to accommodate the drilling rig may affect drainage and give rise to increased runoff, by itself is unlikely to give rise to potentially significant soil contamination. Potentially more significant sources of possible soil contamination during the construction phase include vehicle maintenance and parking areas, fuel handling and storage areas, and any sewage, sanitary and domestic waste associated living areas.

During the operational phase of the proposed project, in which drilling to confirm the presence of hydrocarbons and the thickness and internal pressure of any reservoir takes place, a number of potential sources of possible soil contamination exist.

Typical drilling rig modules include a derrick, drilling mud handling equipment, power generators, cementing equipment and tanks for fuel and water. Possible sources of contamination during the drilling phase will include water-based drilling fluids and associated cuttings; cementing wastes; well completion, work over and stimulation fluids; and production testing wastes. These wastes will be predominantly aqueous although hydrocarbons may be present.

A further waste stream commonly associated with drilling operations is that derived from cuttings contaminated with oil-based drilling fluids. Oil-based drilling fluids are normally formulated with mineral oils and synthetic oils in order to reduce their pollution potential in case of accidental spillage. They are usually treated and re-circulated for repeated use and do not therefore usually constitute a direct waste stream unless severely contaminated with water or fine solids. Other wastes generated during the operational phase will include domestic and sewage wastes in addition to small quantities of solid waste such as construction materials (pallets, wood, etc), oily rags, fuel storage containers and other refuse.

If exploration drilling at well No. 1 proves successful, up to four additional appraisal wells will be developed. The potential waste streams and associated contamination risks will be the same as before.

## (c) Mitigation or Management Proposed

One of the main sources of potential soil contamination will be wastes associated with drilling operations. In the past relatively little attention has been paid to these wastes although it is now recognized that they may require careful handling, particularly in areas where the water environment (including groundwater) might be considered particularly sensitive. But while soil contamination may have an indirect impact on the water environment, the soil environment is an important receptor in its own right since even if it is thin and of little agricultural value it forms

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an essential part of any ecosystem.

During the proposed project, any risk of soil contamination will be mitigated by ensuring that the risk of fuel or other chemical spill is minimized and that where significant spills do occur they are contained and the affected area remediated as appropriate. In particular it will be appropriate to ensure fuel and chemicals brought onto site are appropriately and securely stored. In particular, storage containers should possess sufficient structural integrity to ensure that they should not burst and where possible secondary containment should be provided. An emergency protocol to deal with large significant spills should be in place before operations commence.

Any wastes generated during the project, including drilling wastes and any contaminated soil, will need to be disposed of to an appropriate facility off-site. Neither dumping nor on-site incineration are considered appropriate.

Non-toxic water-based drilling mud is preferable to oil-based mud (OBM), the use of which should be minimized. If OBM is required for operational reasons, down-hole disposal of surplus and contaminated OBM should be considered; if this is not possible, OBM should be treated as a hazardous waste and containerized and disposed of to an appropriate facility off-site. Neither OBM nor other contaminated liquids should be disposed of within the project area.

Sewage will be removed off site and disposed of by the licensed service contractor. Other solid wastes generated during the project, such as fuel containers and domestic waste or general garbage, should be carried off site for disposal.

#### (c) Residual Impact and Conclusion

Given the relatively limited extent of the proposed operation, significant impacts due to contamination are not anticipated. Nonetheless, care will be exercised to avoid any residual impact arising from soil contamination.

The main sources of potential soil contamination are spills of fuel or chemicals used in drilling and disposal of wastes generated. Mitigation measures include good-housekeeping procedures such as appropriate storage for fuels, waste minimization and off-site disposal (landfill) of wastes generated. Where these measures are adhered to, no residual impact due to contaminated soil is anticipated.

#### 5.3.3 *Hydrology, Water Quality and Drainage*

The proposed project area's groundwater is likely to be highly vulnerable to pollution. As has been noted in connection with soil contamination in Section 5.3.3, the relatively limited scope of the proposed project will ensure that significant water quality impacts are unlikely. Nevertheless, given sensitivity of the aquifer within the project area, care should be exercised to mitigate even the low level risk.

There are no surface waters that directly impinge on the project area although there are a number of ephemeral streams in the vicinity. The nearest permanent waterway is the Swasey River, which is located approximately 4.5km to the west of the proposed site for Well No. 1.

#### (a) Effects of Proposed Project (during Construction, Operation and Decommissioning)

During all phases of the proposed project, significant direct impacts on water courses are unlikely since all relevant water courses are located at some distance from the project area. Direct impacts on groundwater will be limited to potential contamination of the freshwater aquifer by drilling mud and other fluids, which may themselves become contaminated with hydrocarbons, during the drilling process. Drilling mud may also enter groundwater if it is re-circulated via unlined pits.

Indirect impacts on groundwater would be those arising from potential soil contamination due to spills and inappropriate waste disposal. While it is considered that contaminated groundwater may not significantly impact watercourses in the vicinity of the site, nor, in the short term at least, even the water supply well at nearby villages, contamination of the aquifer may impact their longer term development.

(b) Mitigation or Management Proposed

Contamination of the water environment, particularly if groundwater is impacted, can be a significant matter and difficult to remediate. Good-housekeeping and pollution prevention is therefore particularly important in respect of groundwater.

Two potential risks to groundwater have been identified: direct groundwater contamination arising due to drilling mud and other fluids entering the aquifer during drilling; and indirect contamination due to contaminated soils.

Direct contamination of groundwater is readily avoided by constructing the well in such a way as to seal each aquifer and geological unit as the well is advanced. Under the present proposals, the well will be advanced inside a steel casing which will be cemented in place as drilling proceeds.

Measures for mitigating any risk to groundwater due to contaminated soils will be the same as those discussed in Section 5.3.3(b).

(c) Residual Impact and Conclusion

The aquifer below the site is considered to be particularly vulnerable to pollution although given the relatively limited extent of the proposed operation, the risk of an adverse impact on groundwater is considered to be low. Nonetheless, particular care will be exercised to ensure that even limited water quality deterioration does not occur.

Principal potential sources of groundwater contamination are direct sources such as spills and contaminants introduced to the aquifer during drilling and indirect sources arising from soil contamination. Mitigation measures include good-housekeeping procedures such as appropriate storage for fuels, waste minimization and off-site disposal (landfill) of wastes generated and appropriate well construction to ensure that potable fresh water aquifers are sealed to prevent contaminant ingress.

There are no surface waters that impinge on the project area.

## **5.4 Habitats, Flora and Fauna**

### **5.4.1 Methodology Adopted**

The EC for the PPTBE activities identifies that the project planning area has been impacted by the population pressure and associated developments.

There are still isolated fragments of forest left, such as is the case on the current project site, but these have lost connection with larger expanses of forest and no longer function as high-biodiversity reservoirs. To verify this, multiple field visits were conducted during the 2011

### **5.4.2 Effects of Proposals (during construction, operation and decommissioning)**

None of the species encountered are rare or of conservation value and the biodiversity value of the area is low, and little different in character to surrounding areas. Although mangrove vegetation is found within the project site, only a small percentage of this vegetation type will be temporarily cut back without altering it permanently.

Some clearing of vegetation will be required. A drilling platform may require the clearing of less than about 2 acres. At site No. 1 this will be mostly shrubs. On the other sites this will be just a few Caribbean Pine trees which has been impacted by fires in the past but still maintains a principal cover. If drilling of site No. 1 is successful, the additional drill sites need to be cleared (less than 2 acres each).

#### **5.4.3**            *Mitigation or Management Proposed*

None of the species encountered are rare or of conservation value. Consequently no mitigation measures (during any of the stages) will be required to protect endangered species. No specific measures are needed in the EMP to protect flora and fauna due to site clearance. Mitigation measures should focus on broader environmental issues such as effluent management, prevention and cleanup of any spillages, waste management, erosion, etc.

#### **5.4.4**            *Residual Impact and Conclusion*

No significant adverse residual impacts are anticipated.

### **5.5**                ***People and Communities***

#### **5.5.1**            *Methodology Adopted*

The EIA Regulations of 1995 stipulate that an EIA report is to contain a report on public hearings (if any). The Terms of Reference for this EIA states: “The EIA will consult and report on the views and concerns of directly affected stakeholders such as nearby communities, local NGOs and relevant government departments/agencies regarding the development of the project”.

In the case of the Independence Village’ an exploratory drilling proposal, the section of the public most directly affected by the proposed drilling activities is the community of Independence Village.

For this reason, PPTBE met with the Independence Village and discussed their plans for the development of these wells and the infrastructure required to operate them.

#### **5.5.2**            *Summary of Any Consultation*

The Village Council including invited guests and local politicians had no major issues with the oil exploration and exploitation as a whole. However, they expressed that they would like us to use as many of local citizens as possible during our operations.

There are no protected areas in the direct vicinity, nor are there specific NGOs active in the area.

#### **5.5.3**            *Population and Settlement*

##### **(a)**    Methodology Adopted

The assessment of impacts on local communities is based on an qualitative appreciation of construction and operational activities of the development and a consultation with the local community (see Section 7).

##### **(b)**    Effects of Proposed Project (during Construction, Operation and Decommissioning)

Construction activities can cause disruption to local communities due to interference between activities on site and the nearby communities, and between construction traffic with local traffic and pedestrians on access routes and haulage routes. Impacts from dust, air quality emissions and noise are considered in Section 5.7.

The direct effects of the proposed exploratory drilling on the community of Independence Village are likely to be minimal.

Although the risk of contamination of the water in the village is minimal, it is nonetheless of some concern and clearly a main concern for Independence Village community.

In addition, there is some potential for increased run-off and siltation affecting the storm drain that channels run-off water from the gravel road.

(c) Mitigation or Management Proposed

The mitigation and management proposed are described below with respect to transport and access, and Sections 5.3, 5.7 and 5.8 on water quality, air quality and noise.

(d) Residual Impact and Conclusion

The residual impacts and conclusions are described below with respect to transport and access, and Sections 5.3, 5.7 and 5.8 on water quality, air quality and noise.

5.5.4 *Land Use, Landscape and Visual*

(a) Effects of Proposed Project (during Construction, Operation and Decommissioning)

The proposed drilling sites currently do have a designated use. There is some unregulated logging and cutting of leaf and other building materials. The accentuated terrain has prevented conventional land uses such as agriculture and housing development.

Should the exploratory drilling move into an exploitation phase, i.e. production, the land use will then shift into a semi-industrial use.

(b) Mitigation or Management Proposed

No mitigation or management is proposed with respect to this given the remoteness of the site, and the localized and the temporary nature of the works.

(c) Residual Impact and Conclusion

No significant adverse residual impacts are anticipated.

5.5.5 *Socio-Economics*

(a) Effects of Proposed Project (during Construction, Operation and Decommissioning)

The effects of the proposed exploratory drilling will have little impact on the socio-economic development of Independence Village, as they are localized and short term in nature. There is a demand for jobs in the village, but the amount and quality of jobs provided by the exploration activities will be minimal and of short duration. There may be some short term benefit in terms of purchase of goods and services needed by the works and personnel working there.

During construction and decommissioning, there may be a need for temporary labor for the upgrading of access roads and preparation / clearance of the sites, which may create some temporary employment.

(b) Mitigation or Management Proposed

As there are no significant adverse impacts, no mitigation is proposed, though it is recommended that if temporary employment is being sought by members of the local community, they are given the opportunity to benefit from such employment.

(c) Residual Impact and Conclusion

No significant adverse or positive residual impacts are anticipated.

5.5.6 *Transportation & Access*

(a) Effects of Proposed Project (during Construction, Operation and Decommissioning)

At present transport infrastructure in Independence Village is developed.

The sites are currently accessible using a well maintained gravel road that is found in the area. Further access roads are not planned at present, but approximately 2 to 3km of minor road upgrading or construction would be needed if exploration well No. 1 is successful and access is needed to the other sites for the proposed appraisal wells.

The gravel road is in great condition. It is wide, straight, well designed, and maintained. Furthermore, this road is not a very busy road.

The proposals are likely to result in a short term increase in traffic volume on the roads in the vicinity of Independence Village, which is likely to impact on the noise and air quality of the area. Although there will be a short term increase in noise levels, the community of Independence Village are used to constant traffic noise from the Southern Highway and an increase in traffic is unlikely to adversely impact on the existing situation.

With an increase in road vehicles, the potential for a pollution event from diesel or oil leaking and being transported offsite in surface runoff will increase in the short term.

(b) Mitigation or Management Proposed

To prevent the further dilapidation of the roads, both should be inspected and if needed upgraded where relevant prior to and during the construction works proposed, to ensure that they do not present a health and safety issue and are capable of bearing the increased loads from the vehicles used. The gravel road where it meets the pad site for well site No. 1 is also likely to require vegetation clearance and widening to improve access to the site.

To prevent further erosion of the access road which is quite steep, drainage and erosion protection measures should be incorporated into the road during upgrading works. These may include use of drainage channels and culverts to enhance drainage, and geotextiles membrane through which vegetation could grow to aid ground stability and reduce erosion.

To minimize an impact on air quality, all vehicles, plant and other machinery should be maintained according to manufacturers' instructions, correct fuel mixtures should be used and engines should be switched off during periods of prolonged inactivity. Furthermore, to limit any potential disturbance, the movement of large vehicles should be controlled and allowed at certain times of the day only. The proposed works are short term and highly localized. Hence they are unlikely to need monitoring of air quality and noise levels.

If the drilling of well site No. 1 is successful, the additional drill sites for appraisal wells will need to be connected by a road.. This road may reach a length of approximately 2 to 3km. Road construction work to establish road access to the proposed well sites may disrupt the present drainage system of the road resulting in deteriorating road surfaces in and around the village. Although this will not be an issue for the current proposals, any upgrading of the Princess Petroleum / Treaty Belize Energy Environmental Compliance Project

roads should take these future potential impacts into account.

All site personnel and drivers to and from the site should be given an environmental induction and be made aware of the risk of oil and diesel spills and trained in the procedures for dealing with potential pollution events. Spill kits should be kept readily available on site.

The Environmental Management Plan (EMP) should be updated prior to commencement of the proposed works, to cover local traffic management issues, such as speed limits, delivery hours, securely covered loads and arrangements for vehicle washing (primarily to ensure no contaminated washings enter local watercourses, but also to minimize nuisance in local communities of dust and muddy wheels). This information should be incorporated into the working practices for the site and companies used for the transport of materials to and from the site.

(c) Residual Impact and Conclusion

No significant residual impacts are anticipated.

## **5.6 Cultural Heritage and Archaeology**

### *5.6.1 Methodology Adopted*

Archaeological Summary to be inserted prior to NEAC meeting.

### *5.6.2 Summary of Any Consultation*

Archaeological Summary to be inserted prior to NEAC meeting

### *5.6.3 Effects of Proposed Project (during Construction, Operation and Decommissioning)*

Archaeological Summary to be inserted prior to NEAC meeting

### *5.6.4 Mitigation or Management Proposed*

Archaeological Summary to be inserted prior to NEAC meeting

### *5.6.5 Residual Impact and Conclusion*

Archaeological Summary to be inserted prior to NEAC meeting

## **5.7 Air quality**

### *5.7.1 Introduction*

This section considers the potential air quality issues associated with the proposed exploratory wells near Independence Village. Local air quality is primarily of concern to human health and is assessed by comparing ground level concentrations of pollutants to human health based criteria.

There is the potential for impacts to occur from emissions to air during the construction and operation of the proposals. The following potential impacts have been considered:

- Preparatory activities during the construction phase may give rise to dust, which if unmitigated could cause nuisance when it forms a noticeable deposit on a surface or causes disruption when suspended in the air;
- There may be extra vehicle movements, and therefore vehicular emissions that could be significant in terms of local air quality;
- The drilling rig and on site generators could emit pollutants of concern to air quality; and

- Flaring/venting of the associated gas during well testing could be significant in terms of odor and air quality.

### 5.7.2 *Assessment Methodology*

This assessment has considered air quality in the vicinity of the proposed exploratory wells and at the nearest residential properties including the Independence Village. The general wind pattern is that of east-south-easterly winds during the dry season (February to April), eastern winds in the rainy season and occasional northerly winds during the winter months. Highest pollutant concentrations are usually found downwind of the source with the pollutant being dispersed with distance. The site boundary is normally representative of the highest pollutant concentrations outside of PPTBE's operations.

The assessment has made a review of construction and operational activities and made an assessment of the likely emissions (including dust and odor) and impacts on local air quality.

Belizean Air Quality Standards together with US National Ambient Air Quality Standards (which are thought to be more representative of international best practice) have been taken to apply to all locations outside the boundary of the PPTBE operations (as specified in the Pollution Regulations).

Air quality legislation in Belize is covered by the Environmental Protection Pollution Regulations (the 'Pollution Regulations'), which form a section of the Environment Protection Act Chapter 328, Revised Edition 2003. There is some ambiguity in the Pollution Regulations over emissions standards (which define maximum allowable mass emissions of a source per unit time) and air quality standards (which define a maximum allowable concentration in the ambient air).

The Pollution Regulations do not specify an averaging duration for the air quality standards, which is an integral part of air quality monitoring; neither does it specify whether the standards are set for the protection of human health or for the protection of the environment. However the Pollution Regulations do state that "*No person shall cause the ground level concentration outside the boundaries of his operation to exceed the limits specified.*"

The US has National Ambient Air Quality Standards (NAAQS) for pollutants considered to be harmful to public health and the environment. Primary Standards are set to protect public health; secondary standards are set to protect public welfare including the damage to animals, crops vegetation and buildings. National Ambient Air Quality Standards have been set for six principal pollutants called "criteria" pollutants.

The BTEX (Benzene, Toluene, Ethyl Benzene and Xylenes) compounds are not covered by Belizean or US legislation despite the fact that benzene is a recognized genotoxic human carcinogen. World Health Organization Guidelines state that benzene is carcinogenic to humans and no safe level of exposure can be recommended.

### 5.7.3 *Effects of Proposed Project (during Construction, Operation and Decommissioning)*

Preparatory activities such as site clearance, arranging access and vehicle movements could raise dust which is predominantly composed of large particles which do not penetrate far into the respiratory system. Health effects are therefore minimal. Dust has a far greater potential to cause nuisance. Generally, dust is only a cause of nuisance when it forms a noticeable deposit on a surface or causes disruption when suspended in the air. Larger particles (generally those over 30 microns in diameter) emitted to the air by activities at or very close to ground level will tend to settle at source. Smaller particles will tend to travel over greater distances before being deposited.

Dust issues are usually confined to within 150 m of the activity. As well site locations are greater than 8 miles away from the nearest properties in Independence Village there are unlikely to be dust issues from preparation of the drilling sites. There is expected to be an increase in traffic along the gravel road but the road is paved through Independence Village so nuisance dust isn't predicted to be an issue.

In terms of vehicle movements, for petrol and diesel vehicles the pollutants Volatile Organic Compounds (VOCs), carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>) and fine particulates (PM) are normally regarded as being of most concern to human health and are usually restricted legally through vehicle exhaust emissions standards and air quality standards.

The proposed exploration wells are predicted to increase vehicle movements from the Southern Highway along gravel road through Independence Village. Baseline monitoring indicates that existing pollution concentrations are very low and the predicted traffic increases would not cause an exceedence of air quality standards.

The drilling rig and on site electricity generation will be powered by diesel engines so again the pollutants of most concern are VOCs, CO, NO and PM. Drilling will take place on average for 24 hours a day over a 10 day period. The electricity generator is relatively small operating at 55 kW on single phase and 100 kW on 3-phase. The drilling rig and electricity generation are expected to have no impact on air quality at properties in Independence Village due to the relatively short duration of operation and mitigation through distance. The drilling rig and electricity generators are not expected to cause exceedences of air quality standards outside the boundary of PPTBE operations.

Gas is released when crude oil is brought to the surface. This is known as solution gas or associated gas and is mainly a blend of hydrocarbons. When oil wells produce small amounts of associated gas, such as during exploration, it is often uneconomical to collect and compress the gas for energy production purposes, in such situations the gas is burnt in a controlled way known as flaring.

The primary constituents are methane, ethane and propane. The next largest components are heavier hydrocarbons and then nitrogen. The gas is “sweet” i.e. there is negligible sulphur content. It is anticipated that the proposed exploration wells will be of a similar composition.

During drilling there are expected to be small emissions of gas (primarily methane), these will be carefully monitored via a monitor on the well head but are expected to be minimal. The gas is expected to have a negligible impact on local air quality outside the boundary of PPTBE’s operations. Hydrogen sulphide (H<sub>2</sub>S) emissions are expected to be negligible; however H<sub>2</sub>S will also be carefully monitored during drilling. Exposure of PPTBE employees to H<sub>2</sub>S and CH<sub>4</sub> will be minimized following the procedures set out in the Disaster Management Plan (DMP); see Section 7.

If a well is tested the associated gas will be flared rather than vented. Well testing normally takes place over a 24 hour period. When the gas is flared, a number of different combustion products are formed. If the efficiency of the burn is very high (> 99%), the main products of combustion are N<sub>2</sub>O, carbon dioxide (CO<sub>2</sub>) and water. However, rarely are such conditions met during routine flaring. Instead, the combustion efficiency typically ranges from 65 to 95%. Under these conditions, CO remains the major product of combustion; however, a number of minor chemicals also may be formed, which are collectively referred to as ‘Products of Incomplete Combustion’ (PICs). These PICs can include unburned hydrocarbons and altered hydrocarbons (i.e. VOCs) and particulate matter (i.e., soot and ash). Studies indicate that most of these minor chemicals are bound up in the soot emitted from the flares.

The exact chemical make-up of flaring emissions is not constant and is difficult, if not impossible, to predict. It should be noted that the PICs found in flare emissions are not unique, but rather these same chemicals are produced from the burning of virtually any organic material, including wood, gasoline, diesel fuel, tobacco, waxes, plastics, paper, trash, etc. Natural sources of PICs include forest fires and grass fires. A major source of man-made PICs is automobile exhaust. Other common sources include oil or natural gas-fired furnaces, outdoor barbeques, wood-burning stoves and fireplaces, gasoline-powered yard equipment, etc.

Flaring does not cause exceedences of air quality standards outside the boundary of the PPTBE operations. The short duration of the monitoring and the distance of the wells from nearby properties (>8 miles) suggests that flaring will have a no impact of air quality at properties in Independence Village.

**5.7.4 Mitigation or Management Proposed**

Vehicles and plant will be maintained in accordance with appropriate legislation or manufacturer’s recommendations to ensure emissions to atmosphere are minimized.

During testing of a well the associated gas will be flared rather than vented (reducing emissions of greenhouse gases) and flaring will be kept to a minimum.

**5.7.5 Residual Impact and Conclusions**

There are not expected to be significant emissions to air during the construction, operation or decommissioning of the proposed exploratory wells near Independence Village. Air quality standards are not predicted to be exceeded outside the boundary of PPTBE operations and there will be a no impact on air quality at properties in Independence Village or any other community.

There are not expected to be any emissions to air following the capping of the wells after exploration is complete.

**5.8 Noise**

**5.8.1 Methodology Adopted**

The impact of noise on sensitive receptors in and around Independence Village is based on a review of the likely activities during construction, operation and decommissioning, identification of potential receptors, qualitative assessments of the generation and attenuation of noise and impact on receptors.

**5.8.2 Effects of Proposed Project (during Construction, Operation and Decommissioning)**

Noise impacts associated with the preparatory works, exploratory drilling and the occasional additional vehicle would be localized, short-term and typically arising at least 8 miles distance from the nearest noise-sensitive area, Independence Village. It is not expected that in Independence Village an increase in noise levels (dB(A) and durations) due to the works would exceed the day time threshold levels for a residential building in Schedule 2 of the Environmental Protection Act (EPA), 2003; see Table 5.3 below.

<b>Table 5.3 Noise (threshold) Levels from Schedule 2 of the EPA, 2003 Noise level (dB(A), residential building.</b>		
<b>Noise duration</b>	<b>Day</b>	<b>Night</b>
More than 9 hours	60	45
More than 3 hours & less than 9 hours	70	45
More than 30 minutes	75	45
More than 15 minutes & less than 1 hour	80	50
More than 10 minutes & less than 30 minutes	80	50
More than 5 minutes & less than 15 minutes	85	60
More than 2 minutes & less than 5 minutes	95	65
Less than 10 minutes	95	70
Less than 2 minutes	100	
Noise from infrequent (less than 4 times per week) explosions	109	

The noise generated by the occasional additional vehicle and the construction and drilling works should be similar to noise from other traffic using the roads – particularly the Southern Highway - and similar to other construction Princess Petroleum / Treaty Belize Energy Environmental Compliance Project

works, and should not result in significant impacts on the environment and nearest community, Independence Village. There should be no significant impact on wildlife as Section 4.3 identifies no species of conservation concern.

### **5.8.3**            *Mitigation or Management Proposed*

No mitigation is anticipated to be required for the works, as it is not expected that an increase in noise levels in Independence Village due to such works would exceed any threshold levels.

### **5.8.4**            *Residual Impact and Conclusion*

Once the exploratory works have been completed, there should be no residual noise and hence no residual impact from the proposed works.

## **5.9**                *Cumulative Impacts*

The works proposed are very localized and short term for the proposed exploration well No. 1 and no significant cumulative impacts are anticipated for the local community and environment. If well No. 1 is successful the construction and operation of up to four more appraisal wells this would factor up the potential impacts depending on the number of sites developed. However, each site is relatively remote and localized and short-term in duration and the potential adverse impacts would be spread over a wider area, though the beneficial socio economic impacts may be extended for a longer period as the additional sites are developed. The upgrading of the access roads may enhance access to where these coincide with properties and enhance their value for landowners.

Cumulative potential impacts should be adequately mitigated by good working practices on site, particularly with respect to planning and minimizing unnecessary vehicle movements, switching off vehicles and plant when not in use, prevention and response to spillages, waste and effluents management, drainage and erosion

Consequently, the in-combination adverse effects of construction and operational activities at Independence Village are considered are low and may provide low and short term socio-economic benefits to the Independence Village.

## **5.10**             *Limitations of the EIA*

This section focuses only on the gaps in knowledge for the most significant potential impacts. Where there are uncertainties in the data or assessment methodologies, we do not consider that these are of a nature materially to change our assessment of the potential impacts of the project on the environment and local community.

### **5.10.1**          *Soils, Contamination and Wastes*

Section 5.3 of the EIA discusses the risk of potential contamination of soil, groundwater and surface water. It is based on the information available and desk-based research relating to the anticipated ground conditions and is therefore rather general in its scope. There is therefore a degree of uncertainty in relation to the precise geological and hydrogeological details of the project area. Similarly, the assumed operational details of the proposed project are generic to onshore oil exploration and the precise local details may be different from those outlined. Given these uncertainties, the mitigation measures outlined in Section 5.3 are also generic and hence have been based on conservative assumptions, to err on the safe side. Where there are significant deviations from the anticipated operations outlined in this report, it may be necessary to revisit some of the assumptions made and refine the mitigation measures to be consistent with the precise nature of the works for the exploration wells.

### **5.10.2**          *Air Quality*

The air quality assessment has addressed the impacts of short-term flaring (approximately 24 hours). Long term flaring would increase emissions to air of greenhouse gases and pollutants of concern to human health and, hence, this is outside the scope of the EIA for exploratory wells, though should be addressed in terms of acute effects in the Disaster Management Plan (DMP) in Section 8.

## 5.11 *Summary of Conclusions*

Table 5.2 presents a summary of the environmental impacts during construction and operation. The main points to note are:

### **Beneficial impacts:**

- If successful, the exploration wells may provide another viable opportunity to improve the exploitation of oil reserves by PPTBE and GoB.
- There are low, short term benefits to the local community in Independence Village from temporary employment opportunities associated with construction and decommissioning, and the provision of goods and services during these and operation of the site.

### **Adverse impacts:**

- A number of potentially adverse impacts have been identified during the construction, operation and decommissioning phases. Most of these have been assessed as not significant or of low significance. Some of these impacts are a direct consequence of the construction and/or operational activities, (e.g. noise) while others would only arise in the event of an accident, (e.g. spillage). Most of these impacts can be avoided or reduced through risk management, mitigation measures and good working practices. Those which have been assessed as of medium or high significance are considered further in Sections 5.11.1 and 5.11.2 below, though these are considered mitigable and/or manageable or the probability may be low.
- Non significant issues:
- No significant impacts are anticipated on: habitats, flora and fauna.

#### 5.11.1 *Soils, Contamination and Wastes*

In regard to contamination and waste issues, it is considered that the main risk associated with the proposed project will be in relation to groundwater, which in the project area is considered to be vulnerable to pollution. However, due to the limited scale and duration of the project a significant adverse impact is not anticipated. Nevertheless, mitigation measures should be adopted to ensure that no contamination enters groundwater. In particular, care should be taken to avoid contaminant spills and soil contamination arising from inappropriate disposal of drilling and other wastes. Wastes should be kept to a minimum and any wastes that do arise need to be managed and safely stored on site before disposal to an appropriate waste facility in accordance with local regulatory requirements. Site staff should be appropriately trained and monitored in order to ensure observance of the appropriate procedures for wastes management, storage and disposal. Procedures and monitoring are outlined in the Environmental Management Plan (EMP) in Sections 6.

It is considered that the proposed exploratory well construction, which will include a steel casing which will be cemented ('grouted') in place to seal off aquifer units, will mitigate the potential of contaminants associated with drilling entering groundwater.

#### 5.11.2 *Air Quality*

With respect to emissions to air, there are likely to be dust emissions during site clearance, methane (CH<sub>4</sub>) and hydrogen sulphide (H<sub>2</sub>S) emissions during drilling, and carbon dioxide (CO<sub>2</sub>) and volatile organic chemical (VOCs) emissions during flaring. However, due to the short term nature of the activities, air quality standards are unlikely to be exceeded outside the boundary of PPTBE's operations at the proposed sites. Air pollutants disperse rapidly with distance therefore there is likely to be a negligible impact on the nearby community of Independence Village or any other community.

## **6 Environmental Management Plan**

### **6.1 Introduction**

The Environmental Management Plan (EMP) in this section sets out how the potential adverse environmental impacts will be managed, prevented and/or mitigated, and monitored during construction, operation and decommissioning of the exploratory and appraisal well sites proposed to the west of Independence Village, in order to minimize effects on the environment and local communities.

### **6.2 Administrative Arrangements**

#### **6.2.1 Roles and Responsibilities**

PPTBE will specify roles, competencies and staff to carry out environmental responsibilities and monitoring as outlined in this document.

PPTBE will retain overall responsibility for the construction, operation and decommissioning of the exploratory and appraisal wells proposed to the west of Independence Village and related works, i.e. upgrades to access roads. Hereafter, referred to as the “proposed exploration works”.

All PPTBE employees, field staff, and subcontractors have responsibility for environmental management and mitigation, as well as their safety as well as that of their colleagues, subcontractors and the general public with respect to proposed exploration works near Independence Village.

The overall management structure for the activities for the proposed exploratory wells is outlined below:

- PP President: Hamdi Karagozoglu, with overall responsibility for the proposed project
- Drilling contractor: Treaty Energy Drilling
- Mud contractor: Horizon
- Mud logging Contractor: Horizon Well Logging
- Cementing / grouting contractor: Tucker Energy Services
- Electric logging Contractor: Horizon
- Company man: Brian Luczywo
- Engineering: Brian Luczywo

In addition to PPTBE, the sub-contractors are subject to environmental compliance under the laws of Belize and should price their Bills of Quantities to comply with environmental standards and regulations of Belize.

#### **6.2.2 Formal Management System**

Control of operations in the field should be documented with all work instructions being recorded and filed accordingly, in accordance with PPTBE’s standard operating procedures. Logs and notes of daily activities should be maintained and recorded. These documents should be readily available for audit purposes. Corporate support should be provided to assist field staff in the maintenance of control, environmental awareness and compliance issues. There should be regular interfaces between corporate office support staff, site administration staff and management and a local community representative. This will enable staff to understand the relevant background and practicalities of operations in the field and enhance awareness in the local community.

Environmental procedures should be practical and effective with an emphasis on the use of sustainable techniques for construction and operation where feasible. If not already in place, documentation and systemized procedures should be put in place to identify and plan those operations that are associated with significant environmental Princess Petroleum / Treaty Belize Energy Environmental Compliance Project

impacts. This should include procedures to investigate and evaluate occurrences of non-conformity and to record the results of corrective or preventative action.

Close working relationships should be maintained between the PPTBE personnel responsible for environmental matters and GoB officials in order to streamline communications and complete tasks in the most efficient and timely manner. Records of compliance for legal environmental and other requirements should be available for periodical audit.

### **6.2.3**            *Environmental Training*

All site personnel should have an environmental induction and be aware of the EMP. If the EMP is revised, site personnel should be updated accordingly. Environmental training should include preventative and mitigation measures, and emergency response training as a basic minimum for all PPTBE staff, sub-contractors and visitors on the site of the proposed exploration works. Key personnel should be identified and trained in dealing with any event that has the potential to cause environmental damage. All staff and sub-contractors should be made aware of the aspects relating to their work. A register of this and environmental training should be maintained.

### **6.2.4**            *Environmental Incident Reporting*

An Environmental Incident shall be defined as an occurrence of a failure of an environmental constraint target or the occurrence of an environmental impact that was not previously identified. Failures must be documented in an environmental incident report which also outlines appropriate measures to be put into place to limit the impact. This procedure does not preclude the requirement to report relevant incidents in accordance with the requirements of environmental legislation.

### **6.2.5**            *EMP Review*

The EMP should be reviewed at regular intervals to ensure it is still applicable to the activities being carried out under the project. Reasons for making changes to the EMP should be documented and a copy of the original document should be retained for project records. PPTBE should ensure that their staff and contractors are using the most up-to-date version of the EMP.

## **6.3**                *Management Plan*

Proposals for the mitigation or prevention of potentially adverse impacts are summarized in Table 6.1, with particular elaboration provided in Sections 6.5 to 6.8 (waste, water quality, air quality and archaeology) and Section 8 (Disaster Management Plan). Table 6.1 identifies for each impact, the proposed mitigation measures, the residual impacts, the stage when the mitigation measure has to be implemented, and implementation issues (responsibility, monitoring and training).

Mitigation measures have to be implemented at different stages of the project. These should be revised if the purpose of the site changes from “proposed exploration works” to “production works”. The main measures identified for each phase are summarized below:

#### **Detail:**

- Vegetation and (if present) tree (to limit felling of mature trees) surveys
- Route and specification of access road.
- Optimum layout of site facilities.
- Drainage and pollution control
- Specification of components to meet technical and environmental performance criteria, e.g. BOP pressure, flaring
- Specifications for the drill pad
- Specifications for temporary buildings

**Pre-construction:**

- Community liaison
- Vegetation clearance

**Construction:**

- Program works to avoid the rainy season (if feasible for exploration works)
- Good housekeeping measures on construction sites to control:
  - Air quality, especially dust
  - Construction noise
  - Health and safety
- Procedures and secure storage and handling of materials to avoid cross-contamination, spillages, overflows or discharges to ground and watercourses
- Site access, security
- Vehicle movements, wheel washings / mud, dust and noise
- Waste management

**Operation:**

- Good working procedures and practices to control: Section 4.3 and Appendix A provide a baseline for proposed site No. 1.
- Automated control systems (for the drilling rig)
- Effluents management (segregation, storage and disposal)
- Health and safety
- Operation and maintenance
- Procedures and secure storage and handling of materials to avoid cross-contamination, spillages, overflow or discharge to ground and watercourses
- Site access, security
- Vehicle movements, wheel washings / mud, dust and noise
- Wastes management (segregation, storage and disposal).

**6.4 Monitoring Plan**

Proposals for monitoring are identified in Table 6.1 and are summarized below.

**Construction:**

- Daily site inspections of the access road and site construction activities to observe and record progress of works, implementation of environmental and health and safety mitigation measures, evidence of spills, discharges, damage or litter
- Site supervision to ensure compliance of staff and contractors with site procedures, specifications, technical requirements of contracts

**Operation:**

- Daily inspections of the drilling rig, above ground works, vehicles and other plant at the site
- Noise monitoring during start up, during noisy operations (particularly if at night) and in the event of complaints from the local community
- Air quality monitoring to compare against the base line data, the location and frequency of which may need to be revised depending on initial findings as the works progress
- Daily water quality monitoring of the well serving Independence Village during the exploratory works (parameters to be agreed with PHD)

**Decommissioning:**

- Removal of all structures, buildings, plant and vehicles

- Site supervision during the removal of the plant and associated materials (though note that the base for the drill pad may be left in place, depending on the success or not of the exploration works and agreement with the landowner) to ensure compliance of staff and contractors with site procedures, specifications, technical requirements of contracts
- Clean up and removal of all materials and wastes
- Making good any damages and (if mature trees or vegetation of conservation value were removed) replanting with the appropriate native species
- Visual inspections
- Weekly and subsequently monthly water quality monitoring of the well serving Independence Village (parameters to be agreed with PHD)

## **6.5 Waste Management**

PPTBE will deal with waste in accordance with local regulations. A summary of their proposals for waste management is outlined as follows. Contaminated materials, such as oily rags, contaminated products, or soils are carted to Belize Electricity Limited's remediation site for proper disposal. All other office and domestic type garbage is carted to the public dump. This may include: office waste, e.g. paper, cardboard; food waste; sewage solids pumped from a portable septic tank or portable toilets and disposed of by licensed disposal contractors.

In particular, care should be taken to avoid contaminant spills and soil contamination arising from inappropriate disposal of drilling and other wastes. Wastes should be kept to a minimum and any wastes that do arise need to be managed and safely stored on site before disposal to an appropriate waste facility in accordance with local regulatory requirements. Site staff should be appropriately trained and monitored in order to ensure observance of the appropriate procedures for wastes management, storage and disposal. Procedures and monitoring are outlined in the Environmental Management Plan (EMP) in Sections 6.

## **6.6 Water Quality**

In regard to contamination and waste issues, it is considered that the main risk associated with the proposed project will be in relation to groundwater, which in the project area is considered to be vulnerable to pollution. However, due to the limited scale and duration of the project a significant adverse impact is not anticipated. Nevertheless, mitigation measures should be adopted to ensure that no contamination enters groundwater.

In addition to the considerations about waste in Section 6.5, the proposed exploratory well construction, it is important that exploratory drilling procedures follow best practice in the installation of the steel casing and cementing ('grouting') in place to seal off aquifer units, to mitigate the likelihood of contaminants associated with drilling entering groundwater.

## **6.7 Air Quality**

The emissions to air (be dust during site clearance, methane (CH<sub>4</sub>) and hydrogen sulphide (H<sub>2</sub>S) emissions during drilling, and carbon dioxide (CO<sub>2</sub>) and volatile organic chemical (VOCs) emissions during flaring) are likely to be localized and short term, with air quality standards unlikely to be exceeded outside the boundary of PPTBE's operations at the proposed sites and there is likely to be a negligible impact on the community of Independence Village or any others more distant.

With respect to construction and decommissioning impacts, to limit dust and mud becoming an issue on the gravel road and Southern Highway, wheel washing and water suppression (browsers) to suppress dust should be employed.

Vehicles and plant should be maintained in accordance with appropriate legislation or manufacturer's recommendations to ensure emissions to atmosphere are minimized.

During testing of a well the associated gas will be flared rather than vented (reducing emissions of greenhouse gases) and flaring should be kept to a minimum.

### **6.8 Cultural Heritage and Archaeology**

Archaeological field surveys by an approved archaeologist have been commissioned by PPTBE, and the findings are due to be reported shortly. The cultural heritage and archaeological findings and assessment should be included in Appendix B, with mitigation and monitoring requirements inserted in this section of the EMP and Table 6.1. The Institute of Archaeology monitors all ongoing archaeological projects in Belize and issues permits for site work. Any archaeological findings should be reported to the Institute of Archaeology in the National Institute of Culture and History (NICH). Removal of artifacts or disturbance of sites is illegal without written permission of this department.

### **6.9 Environmental, Pollution Control and H&S Training Needs**

PPTBE operates a training program for their staff including environmental risk, pollution control and health and safety. This includes:

- Induction training for first visit on site.
- ‘Toolbox’ talks relating to specific activities, e.g. site safety; working at heights; bridge constantly under water; truckers (transportation); communication; construction of buildings; well site tidiness; fork lift operation; usage of safety equipment and general safety awareness; vehicle safety; pressure testing; personnel safety in handling of crude oil and pump jacks; training of site employees; fire hazards; sludge treatment procedure and associated dangers; loading and unloading of trucks; emergency procedures; pipeline installation; environmental explosives hazards; pertaining to crude oil and security.
- Pollution control / health and safety and environmental training e.g. oil spill prevention and clean-up operations, use of personal protective equipment (ppe) and first aid
- Training needs relating to operation of specific plant. The manufacturer of respective plant and equipment will provide training relating to the operation, servicing and maintenance of PPTBE plant. Sub-contractors employed for the exploration works to use equipment or undertake specific tasks unfamiliar to PPTBE staff and other site users, will provide training relating their interface with PPTBE and other site users

### **6.10 Public Consultation and Disclosure**

Communications with regulatory authorities and local communities are carried out as required by the regulators.

PPTBE has operated a company policy that wherever information is not commercial, it will where possible be available to the general public. To facilitate this, PPTBE has established a Communication’s Department which is responsible for its public consultation and disclosure. Future plans to meet and fit in with local communities, which are affected by operations, and establish the necessary contacts who will assist in making an environment which is suitable to both parties. PPTBE intends to maintain regular consultation on community social or environmental issues as they arise.

PPTBE maintains communications with the relevant regulatory authorities on issues pertaining to its operations.

### **6.11 Implementation of the EMP**

The EMP will be implemented throughout the proposed exploration works near Independence Village throughout construction, operation and decommissioning.

PPTBE takes full responsibility for the implementation of the EMP. The EMP will be reviewed periodically by senior management, and updated as necessary during the operations to reflect changes in legal requirements, changes in construction or operational methods, or to address recommendations to improve the plan. The implementation of the EMP will be funded by PP.



**Table 6.1 Summary environmental management plan**

Parameters	Potential Adverse Environmental / Social Impacts	Proposed Mitigation Measures	Residual Impact	Implementation Issues			
				Phase	Responsibility	Monitoring	Training Needs
<i>Physical Environment</i>							
<b>Climate</b>	Emission of GHGs during construction & operation	Maintain HGV fleet, plant, equipment. Minimize haulage distances. Switch off engines when not in use.	Minimize emissions of GHGs.	III to V	PP	Air quality monitoring during the exploratory works	Induction talks/ toolbox talks to workers on good site practice
<b>Topography, Soils, Geology &amp; Hydrogeology</b>	Requirement for aggregate / earth	Abstract resources at sites to avoid import of material. Balance cut and fill on site to maximize use of resources and avoid wastage. Limited import of aggregate for drill pad from local quarries.	Not Significant. Good use of resources on or near sites.	III	PP	Site supervision	None
	Soil erosion & slumping	Design temporary site drainage if needed. Limit vegetation clearance to working areas. Upgrade access roads to limit susceptibility to erosion & design with drainage.	Not significant. Small area potentially affected. No sedimentation off site.	I to III	PP	Site supervision	None
	Pollution as a result of leakages from pipe work, storage tanks or operation e.g. refueling	All operations designed to comply with environmental good practice combined with regular maintenance.	Not Significant	II to V	Operator / Contractor	Daily observations of plant and operations	Toolbox talks to workers on good site practice
<b>Hydrology &amp; Drainage</b>	Increased storm water runoff and entrainment of sediment,	Program for construction for the dry season (February to April).	Not significant since the site area is small &	III to V	PP	Site supervision	Toolbox talks to workers on good site practice

	oil-contaminated sediment, and litter.	Avoid aggregate stockpiles on site. Compact earthworks, road base, etc. Re vegetate bare soil in landscaping areas prior to start of wet season	works short term in duration.				
	Increased storm water from higher area of impermeable surfaces and entrained of sediment and oil contaminated sediments.	Design & install road drainage for access roads.	Not significant.	I to V	PP	Site supervision	None
<b>Ecology &amp; Nature Conservation</b>	Loss of valuable habitat or species of conservation value.	None. The sites are of low conservation value & small area, the works highly localized & short term in duration.	Not significant	NA	NA	NA	NA
<b>People &amp; Communities</b>							
<b>Disruption</b>	Dust during construction & decommissioning	Suppress dust using water bowsers. Avoid double handling of spoil. Compact and re-vegetate earthworks. Wheel wash facilities on exit from site. Speed limit on vehicles on earth roads. Minimize height of stockpiles and surround the hoardings. Storage of cement in enclosed areas	No significant impact on Buena Vista as too distant. Possible nuisance for staff working on site.	III, V	PP	Daily monitoring of onsite activities.	Toolbox talks to workers on good site practice
	Emissions from construction plant & vehicles.	Maintain all vehicles, plant and equipment. Switch plant off when	Not significant.	III	PP	Daily monitoring of onsite	Toolbox talks to workers on good site practice.

		not in use.				activities.	
	Flaring of associated gas (if any)	None	Not significant due to the short duration of exploration works.	IV	NA	NA	NA
<b>Noise</b>	Noise impact on local receivers during construction & decommissioning	Select working methods and program to reduce noise. Use quieter equipment. Maintain and appropriately silence plant & equipment. Switch off when not in use. Position noisy equipment behind physical barriers. Direct noise emissions away from sensitive locations. Handle materials in a way which minimizes noise. Set audible warning systems to minimum legal.	Not significant.	III, V	Operator / Contractor	Operator / Contractor	Toolbox talks to workers on good site practice.
	Control of noise during operation phase	Maintain equipment. Use quiet plant. Set warning systems to minimum legal settings.	No significant impact on Independence Village. Low impact on workers at the site	IV	PP	Monitor noise levels especially during start up conditions, night time & noisy activities.	Toolbox talks on noise mitigation measures
	Noise & Vibration -Health & safety of workforce during construction	Prepare a risk assessment, and health & safety plan for the construction phase.	Minimize hazards to work force by foreseeing	III, V	Contractor	Contractor	Toolbox talks on noise mitigation measures

	&decommissioning	Provide appropriate PPE to all employees. Limit the time employees spend in noisy environments.	potential risks and reducing them.				
	Noise & Vibration -Health & safety of workforce during site Operation	Prepare a risk assessment and health & safety plan for the operational phase. Provide appropriate PPE to all employees	Low	IV	PP	PP	Toolbox talks on noise mitigation measures
<b>Water Quality</b>	Pollution by construction & operational activities, including accidental spillages.	Prepare & implement an adequate site environmental management plan (SEMP).	Low level nuisance during construction, but no long term impacts	III to V	PPTBE contractor to prepare SEM	Compliance with SEM.	Toolbox talks on SEM Procedures.
<b>Waste Management</b>	Disposal of construction & exploration drilling wastes.	Control of disposal of construction wastes through a SEM.	Low level nuisance during construction, but no long term impacts	III to V	PPTBE contractor to prepare SEM	Compliance with SEM.	Toolbox talks on SEM Procedures.

## **7 Consultation**

### **7.1 Introduction**

The Environmental Impact Assessment Regulations of 1995 stipulates under section 19 that an EIA report is to contain a report on public hearings (if any). The Terms of Reference for this EIA states: “The EIA will consult and report on the views and concerns of directly affected stakeholders such as nearby communities, local NGOs and relevant government departments/agencies regarding the development of the project.”

### **7.2 Regulatory Authorities**

The proposals for the exploratory drilling have been discussed between PPTBE and the DoE

### **7.3 Public Consultation and Information Dissemination**

There are no protected areas in the direct vicinity, nor are there specific NGO’s active in the area. With respect to the proposed exploratory drilling to the west of Independence Village, the members of the public most directly affected by the proposed drilling activities are likely to be the community of Independence Village.

The EIA should consult and report on the views and concerns of directly affected stakeholders such as nearby communities, local NGOs and relevant government departments/agencies regarding the development of the project.

It is usual for a notice advertising the EIA to be published in a national newspaper and the EIA to be made available for review and comment by members of the public and other interested stakeholders for a period of two weeks, and for these comments to be considered by the DoE / NEAC.

## **8 Disaster Management Plan**

### **8.1 Introduction**

The objective of any Disaster Management Plan (DMP) is to ensure that a single integrated emergency command structure for the site is in place when required. That all risks associated with the emergency occurring are known, so far as is reasonably practicable, and that there is in place, if required, an evacuation plan known to all staff and shared with neighboring entities and organizations. Domino effects need to be assessed for all high risk accidents and finally procedures in place to review and evaluate the incident and its mitigation post occurrence.

### **8.2 Disaster Management**

#### **8.2.1 Plan Definition**

PPTBE already has an established Emergency Response Plan (ERP) for drilling activities which identifies certain risks and response requirements, and is described in Section 8.3, below.

The plan gives guidance as to the handling of incidents and other emergencies; in practice, professional judgment will be needed whilst dealing with each situation. The plan details the arrangements that provide an effective response to all types of foreseeable incident, meeting PPTBE's objective of containing an incident and minimizing loss.

### **8.3 Risks and Response Requirements**

This section describes PPTBE's established Emergency Response Plan (ERP) for drilling activities as it relates to that implemented by the Drilling Contractor PPTBE Emergency Response Plan, Southern Belize concession area, Drilling Activities. Treaty Energy Drilling, LLC is to conduct the drilling operations of the Independence Village prospect for PP.

In addition to the ERP, great emphasis is placed on mitigating risk identified as part of the drilling process and as such relevant safety procedures and practices take place throughout the drilling operation. This includes procedures to maintain the integrity of the Blow-out Preventer (BOP), training and daily safety meeting.

#### **8.3.1 Purpose**

PPTBE has within its responsibility the safety of its crews and contractor's personnel while on-site. This Emergency Response Plan (ERP) was created in order to meet emergency needs by responding quickly and appropriately to the unusual but potentially devastating effects of an emergency.

The greatest stress for such an event arises from the need for accurate communication in a timely manner. Communication is the most essential function of emergency response. Concurrently, the most problematic aspect of emergency response is that reliable information is usually not forth coming, requiring responders to anticipate and estimate the circumstances under which they are operating. This makes information between involved groups critical and non-routine networks of communication must flow naturally. This plan outlines the structures and means for achieving a coordinated emergency response system, in such a situation. Its focus is upon providing an immediate system for the command, control and coordination of the rig emergency response efforts.

PPTBE Emergency Response Plan, Southern Belize Concession Area, Drilling Activities.

#### **8.3.2 General**

The responses to several different emergencies are addressed as individual occurrences in the following sections. However, it must always be remembered that a single emergency incident could involve one or more of the scenarios at the same time e.g. fire, explosion and injury etc, and that the actions detailed can be applied to a single

or multiple scenario emergencies. These procedures were produced taking into account the recommendations and control measures identified in drilling and completions operational risk assessment and site specific fire and explosion risk assessments in order to satisfy company policy.

### 8.3.3 *Emergency Response Organization*

Princess Petroleum / Treaty Belize Energy's chain of command is shown below

- PP President: Hamdi Karagozoglu, with overall responsibility for the proposed project
- Drilling contractor: Treaty Energy Drilling
- Mud contractor: Horizon
- Mud logging Contractor: Horizon Well Logging
- Cementing / grouting contractor: Tucker Energy Services
- Electric logging Contractor: Horizon
- Company man: Brian Luczywo
- Engineering: Brian Luczywo

### 8.3.4 *Responsibilities*

Should an emergency occur at a PPTBE's drilling operational site, the personnel detailed below shall be responsible for the actions shown below. The actions detailed are applicable to all types of emergencies.

#### **(a) Company Man**

The company man will be responsible during the emergency for:

- A. Being in overall charge of the onsite emergency response.
- B. Contacting and /or calling out such branches of the emergency service e.g. police, ambulance etc. as required to deal with the emergency. Numbers below:  
  
Independence Village Health Center: 5232167  
  
Independence Village Ambulance Service: 5232167  
  
Independence Village Fire Station: 5232200  
  
Independence Village Police Station: 5232022
- B. Informing the PPTBE manager of operations of the emergency and issuing him with regular update as the emergency progresses.
- C. Requesting such assistance and additional recourses, from the PPTBE office as required to deal with the emergency progress.
- D. Working in close co- operation with the emergency services when they arrive on site
- E. In the event of the site being evacuated, setting up an offsite control center in conjunction with the police and advising the BNE office of changes in the telephone numbers etc.

- F. Deciding the details of the emergency to be communicated to the BNE office.
- G. Confirming the results of the muster and ensuring that the PPTBE office has an up to date list of all the personnel on site and details of any casualties.
- H. Advising and assisting the toolpusher in the control of the emergency as necessary.
- I. Maintaining a log of events.
- J. Ensuring, if the site is evacuated that personnel are adequately accommodated and that the PPTBE office is aware of the location.
- K. Being the first point of contact. On site, for civil authorities, government bodies, media etc.
- L. Carrying out any other actions necessary to bring the emergency to a satisfactory conclusion.

**(b) Toolpusher**

The Toolpusher will be responsible during the emergency, for:

- A. Reporting to the Muster Point and conducting emergency response under the direction of the Company man.
- B. Controlling and directing site personnel with fire, rescue and first aid duties
- C. Advising the Company Man of any casualties and missing persons.
- D. Advising the Company Man of the details of the situation, updating him on a regular basis and requesting he obtain emergency services assistance e.g. fire, police etc. as necessary.
- E. Informing the Company Man when the well is secure.
- F. Liaising closely with emergency services team leaders when they arrive on site.
- G. Making the decision to evacuate the site, in consultation with the Company Man.

**(c) Driller**

The Driller will be responsible for:

- A. With the assistance of his crew, making the well secure.
- B. Once the well is secure reporting to the Muster Point, with his crew, and informing the Toolpusher of:
  - 1) The well status
  - 2) Any missing crew members or casualties
- C. Carrying out such emergency duties as detailed by the Toolpusher.

**(d) All Other Personnel**

All other personnel will be responsible for:

A. Reporting to the Muster Point and acting as directed by the Toolpusher.

**8.3.5 Post Emergency Actions**

Once the emergency has been brought a satisfactory and safe conclusion, the Company Man will:

1. Supervise site restoration plans and activities
2. Conduct an onsite incident inquiry and complete:
  - A Company Incident report Form
3. Work in co-operation with any official incident investigation team.
4. Direct any media enquiries to the PPTBE office.

**8.3.6 Specific Emergencies**

This section of the procedures gives a general description of a variety of incidents, which could occur, on a PP operational site and any emergency actions, which may be required in addition to those detailed in Section 4.0 of this procedure.

**(a) Loss of Well Control**

1. General

Loss of well control can result in the uncontrolled discharge of hydrocarbons at surface. This is normally experienced during drilling operations due to unexpectedly encountering high formation pressures. Poor drilling practices can also result in a blowout. Formations pressures in Belize are not normally high, therefore serious loss of well control incidents are highly unlikely.

The continuous expelling of hydrocarbon gases and fluids from the well during loss of control could result in fire and / or explosion, which may be able to be brought under control by onsite and local resources. In the case of a situation, which cannot be controlled in this way, then the assistance of the NEMO service would be required.

2. Emergency Actions

Personnel would take the action detailed below, conditions permitting, in addition to those detailed in 4.0 above.

Make safe as much of the site and equipment as possible without endangering life.

Report to the Muster Point and await further instructions.

**(b) Fire**

1. Emergency Actions.

The actions listed below should be taken, in addition to those detailed in 4.0 above, in the event of a fire:

On Hearing Site General Alarm:

Make safe as much of the site and equipment as possible without compromising the safety of personnel

Report to Muster Point and await further instructions.

On Discovering Fire:

Raise the alarm locally and warn others in area, by shouting “Fire, Fire, Fire”.

Evacuate the immediate area of the fire.

Attempt to fight the fire, using site located firefighting equipment, if this is possible without endangering life.

Report to the Muster Point and await further instructions.

### **(c) Fuel Oil Spillage**

#### **General**

The actions to be taken if discovering a fuel oil spillage onsite are detailed below.

#### **1. Person Discovering Spill**

Identify the source of spillage, and if oil is still flowing close-off source, if possible.

Estimate size and extent of spillage.

Inform Company Man and direct him to the spill site.

#### **2. Other Personnel**

Shutdown equipment.

Report to Muster Point and await instructions.

#### **3. Toolpusher**

Secure the operation.

Supervise the crew to proceed to spill site and assist.

#### **4. Company Man**

Evaluate size and cause of spill, and ensure oil flow is stopped at source, if possible.

Instruct crew to operate well site oil spill contingency supplies.

Isolate any potential ignition sources, and if any danger of fire / explosion send all crew to Muster Point.

Ensure safe storage of recovered oil and oily waste.

Check that site containment facilities (drainage valves to interceptors / bunds etc.) are secured.

Notify the relevant authorities and the Operations Manager if the spillage leaks off site or into waterways etc. Instruct the Toolpusher to supervise cleanup operations.

#### **(d) Escape of Gases**

##### General

This section details the procedures to be followed in the event of a leak of inflammable gases (hydrocarbons) or poisonous Hydrogen Sulphide (H<sub>2</sub>S) gas.

All Company and Contractor personnel will be trained in the potential hazards caused by gas accumulations (including H<sub>2</sub>S) and the use and operation of the monitoring instruments located on site.

Although H<sub>2</sub>S is not normally encountered in the Belize, it is recognized that even relatively low level accumulations can be extremely dangerous.

Significant levels of methane and flammable gases will be detected by mud logging gas detectors as well as H<sub>2</sub>S.

##### (i) Well site response in the event of a gas leak

###### ***1. All personnel:***

###### **In the event of a gas leak the following action will be actions taken:**

Inform the Company Man whether it is methane or H<sub>2</sub>S gas that has been detected. Warn other personnel in the area.

If someone has collapsed, put on Scott Air Pack and attempt to remove them from the area without putting other personnel at risk.

Shutdown and make the equipment safe if possible.

Report to muster point and await further instructions.

###### **On hearing the site alarm:**

Shutdown and make all equipment safe, if possible.

Report to Muster Point and await further instructions.

###### ***2. Driller:***

a. Make the well safe and shutdown equipment.

b. Attempt to rescue any casualties if it is safe to do so.

- c. Attempt to identify source of gas leak and secure if possible.
- d. Ensure the Toolpusher is kept fully informed of the status of the situation.
- e. Report to Muster Point and await further instructions.

### ***3. Toolpusher:***

- a. Ensure drilling crew are taking appropriate action.
- b. Organize search and rescue teams if required.
- c. Ensure fire-fighting equipment is manned.
- d. Confirm with the Company Man that the Fire Brigade and Police have been informed.

### ***4. Company Man***

- a. Contact the Fire Brigade and report on risk of fire, give site location and any personnel missing or requiring rescue.
- b. Establish number of casualties and ensure that proper attention is being paid to missing/injured personnel. Call out ambulance if there are any casualties.
- c. Call the Operations Manager giving details of the situation and issue him with regular updates.
- d. Ensure all well site personnel are aware of the situation and take any actions required.
- e. Liaise with emergency services upon their arrival at the well site, if they have been called out.
- f. Supervise operations to locate source of gas and to secure leak.
- g. Arrange with Toolpusher for evacuation of personnel from well site if required.
- h. Carry out duties in accordance with section 8.3.4 (Responsibilities) above

### **(e) Incident Involving Injury to Personnel**

In the event of there being an incident, on the well site, which results in a person or personnel being injured, the following actions will be taken.

#### **1. Person Finding the Casualty:**

The person finding the casualty or observing the person being injured will:

Contact the Toolpusher immediately, and if possible stay with the victim(s) until he arrives. Only move the injured person(s) before the Toolpusher arrives if they are exposed to further danger. Assist the Toolpusher as requested.

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## **2. Toolpusher:**

Apply first aid as required and move victim(s) to the Muster Point if this can be done without aggravating the injuries.

Instruct one of the assisting personnel to inform the Company Man of the situation.

Request the Company to inform the local Medical Practitioner and / or call an ambulance as appropriate.

If the casualty(ies) need referring to the local Medical Practitioner, pass the details to him/her by telephone and request the Company Man to arrange transport to the surgery.

If the casualty(ies) appears to need immediate hospital treatment, request the Company to call an ambulance and prepare a Casualty Evacuation Form (for each casualty) to pass to the ambulance crew to take to hospital.

Assist the Company Man to complete an Accident/Incident Report as appropriate.

## **3. Company Man:**

Arrange for transport to the local Medical Practitioner or an ambulance, as requested by the Toolpusher.

Call the Police and request that they attend the scene of the accident if appropriate.

Ensure that immediate medical attention is being given to all victims, and organize assistance with communications and other logistics.

Obtain information required for the incident report, including names of injured personnel, injuries, treatment administered, names of witnesses, and details of incident.

Call the Project Operations Manager giving full details of the situation.

After emergency is over, complete the Accident/Incident Report. Take witness statements. Implement the initial incident investigation process.

### *8.3.7 Muster Point, Alarms, Mustering And Site Evacuation*

#### **(a) Muster Point**

The Muster Point will always be located outside the site gate and will be clearly identified.

#### **(b) General Site Alarm**

The rig horn will be used as the general site alarm and activated in the event of a fire, explosion, gas release or any other emergency, which necessitates personnel going to emergency stations/muster. All personnel employed at, or visiting, the well site will be made familiar with, as part of their site orientation and safety briefing, the sound of the alarm.

#### **(c) Mustering**

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In the event of an alarm sounding, unless otherwise instructed by the Company Man, personnel without emergency duties will secure their work site and proceed directly to the Muster Point.

Upon arrival at the Muster Point, during a muster all personnel will report to the Toolpusher who will acknowledge their presence and report any missing personnel to the Company Man. He will attempt to establish the whereabouts of any missing personnel and will ensure everyone at the stations is clear about their duties.

#### **(d) Site Evacuation**

In the event of an emergency being of such severity that it would endanger the safety of any person remaining on site then the Company Man will instruct all personnel to:

Report to the Muster Point

Once accounted for proceed to a pre-determined Site Evacuation Assembly Point and remain there until instructed otherwise.

The Site Evacuation Assembly Point will be identified prior to operations commencing at each site and made known to site personnel and visitors during start-up safety meetings and safety briefings.

The Company Man will instruct certain personnel to alert nearby residents to evacuate their houses if they are in danger.

#### *8.3.8 Emergency Drills*

An emergency drill, involving all site personnel, will be conducted on a weekly basis, in order to ensure that everyone employed on site is fully aware of their individual and collective responsibilities in a real emergency situation.

The results of drills and the response and performance of personnel will be discussed during safety meetings.

#### *8.3.9 Gas Detection*

The gas detection equipment, detailed below will be located on site at all times whilst drilling and/or completions operations are in progress. The locations of the equipment will be marked on the Well Site Plans, which will be in the dog house.

#### **(a) Gas Detection Equipment**

Two multi-sensor gas detectors will be located on the well head. This equipment has the capability to detect methane gas, H<sub>2</sub>S gas and depleted oxygen levels. The detectors are fitted with distinctive alarms for each function and will be operating during all drilling operations.

#### *8.3.10 Fire Fighting Arrangements*

The well site will be equipped with an adequate number of fire extinguishers and they will be clearly marked.

In the event of a major fire on site, which the risk assessment showed would most likely be of a domestic nature, and then the services of the local fire brigade would be called upon.

#### **8.4**                    *Evacuation Strategies*

The evacuation strategies should be extended from those already identified in Section 8.3 to incorporate the other hazards, risks and responses identified in Section 8.2.2. These should include:

- Objectives and Principles including communication strategies
- Staffing levels
- Meeting points / Zoning
- Emergency Equipment
- Evacuation Routes including Neighborhood risks (i.e. local communities)
- Roles and Responsibilities during an evacuation
- Emergency Equipment
- Evacuation Routes
- Roles and Responsibilities during an evacuation, including search and rescue

#### **8.5**                    *Post Disaster Reviews*

Should a disaster occur it is essential that subsequently a Post Disaster Review is undertaken. Comprehensive information about the disaster should be obtained using an incident report. This should form the basis of consultation with the emergency services and other stakeholders, in order to make:

- **Conclusions**, which:
  - emphasize how the knowledge gained from the incident should be shared with others internally and externally;
  - assess how well the any plan/s worked or where improvements could be made;
  - assess the effectiveness of communications program and media involvement and where improvements can be made; and
- **Recommendations**, which:
  - identify and elaborate any actions needed to improve existing operations;
  - identify and elaborate any actions to prevent future occurrences;
  - identify and elaborate any actions to inform affected members of the public of outcomes and findings;
  - provide a timeline to implement the actions, with clear responsibilities and milestones to ensure actions are followed up.

#### **8.6**                    *Hurricane Control Procedures*

This section describes the plan of action to be taken by for the drilling operations in the event a hurricane threatens the area.

### **PLAN OF ACTION FOR THE DIFFERENT PHASES**

#### **Pre-Phase 1**

- 1) If a hurricane threatens during the drilling operation, at the announcement of such potential hurricane treat to Belize, the Company Man will advise the drilling crew of such threat.
- 2) *Drilling Crew* who require any special arrangement to protect their family or personal belonging will make their request during this phase.
- 3) Depending on the site location, sand and gravel will be stored to be used in cases of emergency to repair roads, etc.
- 4) Trees will be limbed and cut where needed
- 5) Loose debris will be removed.

### **Action: Phase 1 - One red flag 72 hours before the hurricane**

- 1) The HS&E Officer or Designate will advise the Company Man of the latest advisory issued by the NEMO.
- 2) The *Company Man or Designate* will suspend all drilling operations and release employees who have no duty to perform during this phase. These employees will be identified before the beginning of the hurricane season.
- 3) The *Toolpusher* will call all vehicles for refueling, oil, etc and will arrange that they be parked at either the Iguana Creek Facility or the Corporate Office. Only vehicles being utilized in the hurricane preparation process will not be parked at this stage.
- 4) *Company Man* will arrange that the temporary office buildings be battened 72 to 48 hours prior to the hurricane and/or moved to a more secure location. The derrick of the rig will be brought down and secured.
- 5) Water tanks will be filled with safe drinking water.
- 6) The portable generator will be secured and its locations noted. After the hurricane, it will be moved to where they are needed.
- 7) *Mud Logging Unit, etc.* will also be secured at this stage.

### **Action: Phase II - 36 hours before the hurricane**

- 1) The *HS&E Officer* will advise the Company Man of the latest advisory by NEMO.
- 2) At the announcement of Phase II, other workers not required for essential services will be released.
- 3) *Company Man* will arrange that radio transmitters be installed at designated 'safe houses'.
- 4) *Safe houses* will be batten down.
- 5) The Toolpusher will ensure that all company vehicles are accounted for, to ascertain availability for use.

### **Action: Phase III - 24 hours prior to the hurricane**

- 1) The *HS&E Officer* will inform the Company Man of the latest advisory of NEMO.
- 2) *Security personnel* shall lock and secure all entrances.
- 3) *Security personnel* will remain at the location. Keys for the entrances will remain with security personnel. Additional keys will be held by the *Company Man* to be used as needed.

### **Action: Phase IV - After the hurricane**

- 1) *Security* measures will be reorganized.
- 2) The Company Man and Toolpusher will meet quickly to assess injuries that will be dealt with immediately. Here the *Toolpusher or Designate* will arrange transportation for the sick and casualties reported to him.
- 3) The *HS&E Officer* will establish contact with the District Branch of NEMO.
- 4) *Company Man* and Toolpusher will assess damage and organize relief and clearing up of the site.
- 5) *Toolpusher* will organize the quickest restoration of areas affected.
- 6) *Company Man* shall report in writing the effects that the hurricane had on the drilling operation to the Manager of Operations and PPTBE's *Chief Executive Officer*.