14.0 ANTICIPATED DIRECT AND CUMULATIVE IMPACTS

14.1 Criteria for the Assessment of Impacts

The evaluation of potential impacts must be balanced against legal requirements and applicable national (or international standards) where national standards have not yet been developed. Notwithstanding this, the assessment of impact significance often involves interpretation and the application of the judgement of the assessor. In this ES the following are considered guiding factors in assessing significance.

- the relative importance of the environmental resource in question i.e. national, regional, or local importance;
- whether environmental quality will be impaired or enhanced i.e. an adverse or beneficial impact;
- whether the environmental impact will be direct (such as land-take) or indirect (such as polluted run-off entering watercourses);
- the scale of the change e.g. the area of land, number of people affected and the degree of change from existing conditions;
- the scale of change resulting from cumulative impacts;
- whether the effect is permanent or temporary and, if the latter, its duration, and
- the degree of mitigation that may be achieved through design.

Compared to other elements of the exploration phase, e.g. drilling and the exploitation phase, the seismic phase is relatively low impact. The impact of this operation on the general environment is cumulatively small and transient with most systems recuperating fully within a relatively short space of time. The main concern and the most serious impact is not so much from what the activity will do to the environment as to where it will take place. Most of the activities associated with this project will occur within a National Park which under this designation is afforded one of the highest level of protection within the national

protected areas system. This is compounded and magnified by the recent declaration of the park as a Ramsar Site (i.e. a site of international importance). It follows that any negative environmental impacts occurring in this area will be viewed in a far more unfavorable light than if it was occurring within the same types of ecosystem elsewhere.

The challenge of implementing these proposals is to find an acceptable level of change that will strike the necessary balance between the need to develop and the need to protect vital environmental processes. Also important is the nature and scope of the proposals and their potential to unravel the social fabric and lifestyles of the people in the area within which they are based. Petroleum developments in particular are often the focus of community opposition because of their capacity, if not managed properly, to degrade the environment on which local people depend.

The impacts of this development will be felt mainly in the areas of physical alterations to the ecosystems within the park. The effects of the seismic phase in such areas as solid and liquid waste disposal, water resources, energy generation, transportation and heritage resources will be smaller and easily reversible and amenable to mitigation. it is incumbent on the developer to reduce all impacts to their lowest possible level, or negate them entirely if the situation allows. The developer will be aided in this undertaking by the impacts and mitigation discussion in the relevant sections of this report and summarized in the tables below. These cover the aspects of project activities which have been identified by the DoE as liable to produce significant environmental impacts among others.

The process is taken one step further with outlines for a monitoring regime (Environmental Action Plan) in **Chapter 16.** which will further protect the physical and biological resources within the project area by prompting the developer to go one step further by actively gauging and measuring the impacts of his development in the operational and post operational era. This monitoring program will constitute the defining litmus test to see whether the developer's mitigation measures are working or whether they need to be modified or replaced entirely. The environmental compliance plan to be prepared for the developer by the DoE (if necessary) will set out further measures deemed necessary by the environmental community to maintain this pristine and sensitive site from undue environmental violation.

It is the view of the project's environmental advisors that if best management practices are incorporated throughout the stages of project implementation and if mitigation measures contained elsewhere in this report and below are implemented, then the level of impacts will be within acceptable limits and will not place an unbearable stress to the area's ecosystem to the detriment of man and the areas life support systems. As always, the ultimate hope is that this project will become a model for others, demonstrating that economic gains and social advancement is possible without sacrificing important environmental principles.

14.1.1 Summary of Direct and Indirect Impacts

Table 14.1 summarizes the main environmental impacts associated with the proposed seismic stage while **Table 14.2** gives the main socio-economic impacts.

Table 14.1: Matrix of potential direct and cumulative environmental impacts plus residual impact ratings.

Topic Area	Specific Area	No.	Description of Impact	Impact	Probability (L, M, H)	Geographical level of importance of issue			Contextual Importance (L, M, H)	Time-scale (ST, MT, LT) Reversibility (R/IR) Type of impact (D / ID)	Mitigation Available	Residual Significance
						L	R	N				
Physical Environment	Geology and soils	1	Vehicular activity along trails, cutlines and access roads may cause soil compaction/rutting and damage to soil structure.	Adverse	M	✓			L	ST/MT, R, D	✓	Minor
		2	Line clearance and vegetation removal will expose soil to increased erosion locally	Adverse	M	✓			L	ST/MT, R, D	✓	Minor
		3	Potential for spilt fuel, oil and other materials to contaminate soil from generators and transport equipment.	Adverse	L	✓			L	ST/MT, R, D	✓	Minor
		4	Temporary losses of existing land use to compounds and working areas.	Adverse	H	✓			L	ST, R, D	✓	Minor
	Surface Water	5	Potential for spilt fuel, oil and other materials to pollute watercourses accidentally or as a result of vandalism.	Adverse	M	✓			L	ST, R, D	✓	Minor
		6	Increased turbidity resulting from sediment	Adverse	M	✓			L	ST, R, D	✓	Minor

Topic Area	Specific Area	No.	Description of Impact	Impact	Probability (L, M, H)	Geographical level of importance of issue			Contextual Importance (L, M, H)	Time-scale (ST, MT, LT) Reversibility (R/IR) Type of impact (D / ID)	Mitigation Available	Residual Significance
						L	R	N				
			entering watercourses.									
		7	Potential for non-inert wastes being deposited in the site creating a leachate which would enter surface waters.	Adverse	L	✓			M	MT, R, D	✓	Moderate/ Indeterminate
		8	The constant use of cutlines by work crews can cause compaction and create mud pools affecting the aesthetics of the site	Adverse	L	✓			L	MT, R, ID	✓	Minor
	Groundwater	9	The operation, maintenance and refuelling of plant and vehicles on site may cause ground contamination and lead to the pollution of ground water.	Adverse	L	✓			L	ST, IR, ID	✓	Minor
		10	Potential for residue from blasting to enter underground springs and leach into drinking water supplies	Adverse	L	✓			M	MT/IR/D	✓	Moderate/ Indeterminate
	Air Quality	11	Potential for reduced air quality due to exhaust fumes from vehicles and plant on site and	Adverse	H	✓			L	ST, R, D	✓	Minor

Topic Area	Specific Area	No.	Description of Impact	Impact	Probability (L, M, H)	Geographical level of importance of issue			Contextual Importance (L, M, H)	Time-scale (ST, MT, LT) Reversibility (R/IR) Type of impact (D / ID)	Mitigation Available	Residual Significance
						L	R	N				
			along access routes.									
		12	Potential for dust generation during movement of vehicles, handling and storage of materials and operational work on site.	Adverse	H	✓			L	ST, R, ID	✓	Minor
	Noise and Vibration	13	Potential for noise and vibration disturbance during the transportation of plant and material.	Adverse	H	✓			L	ST, R, ID	✓	Minor
		14	Increase in noise in vicinity of blasting areas affecting local residents.	Adverse	H	✓			H	MT, R, D	✓	Major
Ecology and Nature Conservation	Habitats	15	Accessing the cutlines could lead to the temporary loss of or damage to areas of terrestrial habitat including trees, wetlands and streams.	Adverse	H	✓			M	ST, R, D	✓	Minor
		16	Impacts on water quality from sedimentation could have the potential to damage aquatic habitats .	Adverse	L	✓			M	MT, IR, ID	✓	Moderate

Topic Area	Specific Area	No.	Description of Impact	Impact	Probability (L, M, H)	Geographical level of importance of issue			Contextual Importance (L, M, H)	Time-scale (ST, MT, LT) Reversibility (R/IR) Type of impact (D / ID)	Mitigation Available	Residual Significance
						L	R	N				
		17	A pollution incident e.g. from fuel storage tanks on the boats could result in damage to terrestrial and aquatic habitats.	Adverse	L	✓			L	ST, IR, ID	✓	Minor
		18	Airborne dust may lead to the build up of materials on leaves and a reduction in plant productivity.	Adverse	M	✓			L	ST, R, ID	✓	Minor
		19	Potential for colonisation of area by invasive plant species either naturally or via importation of soil to site.	Adverse	M	✓			M	MT, R, ID	✓	Minor
		20	Potential for cutlines to be used as access route into park by poachers.	Adverse	M	✓			L	LT, R, ID		Minor
	Aquatic species	21	Fish in the rivers and creeks may be damaged or disturbed as a result of suspended sediment,	Adverse	L	✓			M	MT, R, D/ID	✓	Moderate
		22	Impacts on aquatic invertebrates in the rivers and streams may have secondary	Adverse	L	✓			M	ST, R, ID	✓	Moderate

Topic Area	Specific Area	No.	Description of Impact	Impact	Probability (L, M, H)	Geographical level of importance of issue			Contextual Importance (L, M, H)	Time-scale (ST, MT, LT) Reversibility (R/IR) Type of impact (D / ID)	Mitigation Available	Residual Significance
						L	R	N				
			impacts on fish, birds and higher up the food chain.									
	Birds	23	Site activity and associated noise and vibration as a result of operational work could disturb bird populations, potentially in the breeding season, within and close to the site.	Adverse	M	✓		✓	L	ST, R, ID	✓	Minor
		24	Operational work may result in the loss of food plants and nesting cover for birds.	Adverse	H	✓			M	MT, R, ID	✓	Moderate
	Mammals	25	Operational work may result in the loss of food sources, cover and habitat for mammals.	Adverse	H	✓	✓		M	MT, R, ID	✓	Moderate
		26	Site activity and associated noise and vibration may disturb local mammal populations	Adverse	H	✓	✓		M	ST, R, D	✓	Minor
Human Environment	Socio-economic	27	There will be a temporary loss of land for agricultural use and crops during the seismic phase.	Adverse	H	✓			L	ST, R, D	No	Minor
	Traffic	28	There will be an	Adverse	H	✓			M	ST, R, ID	✓	Minor

Topic Area	Specific Area	No.	Description of Impact	Impact	Probability (L, M, H)	Geographical level of importance of issue			Contextual Importance (L, M, H)	Time-scale (ST, MT, LT) Reversibility (R/IR) Type of impact (D / ID)	Mitigation Available	Residual Significance
						L	R	N				
	and Transport		increase in noise and vibration resulting from operational traffic.									
		29	During the transportation of workers and equipment minor road damage is likely.	Adverse	M	✓			L	ST, R, ID	✓	Minor
		30	During the operation of the seismic study there will be an increase in traffic on roads leading to the site.	Adverse	H	✓			L	MT/R/ID	✓	Minor
	Amenity and Recreation	31	Cutlines into the park will negatively impact visitor appreciation of the site.	Adverse	L	✓			M	MT, R, ID	✓	Minor
	Site designation	32	The proposed use of the National Park may impact its future designation as a national park and make fund raising more difficult for park managment	Adverse	L	✓			M	MT, IR, ID	✓	Moderate
	Cultural and Archaeological Heritage	33	Where areas are to be cleared there may be effects on unknown archaeological remains.	Adverse	L	✓			L	MT/LT, IR, D	✓	Minor

14.2 Anticipated Direct and Cumulative Social Impacts

Table 14.2 summarizes the main social impacts and proposed mitigative measures to alleviate them.

Table 14.2: Main social impacts associated with seismic phase.

Activities and Conditions	Potential Impacts	Comments by Consultants	Residual Impacts Magnitude Direction/Duration/ Scope
Post Construction of Seismic Transect Lines and Seismic Activities	- Impact of cut lines on farmlands within Reservation	- Farmers should be identified and compensated based on long term land use, types of crops to be affected as well for projected economic income from loss of land use and cash crops over time.	- High/positive/months/local
	- Impact of cut lines on farmlands and other activities within national lands, leases lands and private properties	- Farmers should be compensated based on existing long term land use, types of crops to be affected as well for projected economic income from loss of land use and cash crops over time. These individuals should be contacted and/or a written notice be sent to them prior to commencement of cut lines within the respective areas.	- High/positive/months/local
		- Based on the level of use, albeit subsistence use, these farmers will need to be consulted.	- High/negative/months/local
	- Impact on organic farming within the STNP	- The Company should consult with the Forest Department to determine new forest licenses approved areas.	- Low/no change/months/local
	- Impact of cut lines and seismic activities on other industries and development activities in the primary and secondary areas (e. g. logging operations, petty permits)	- Petty permits holders approved should avoid proposed cut line areas.	- Low/no change/months/local
	- Provision of construction access by seismic crew within national and communal lands and private property	- Access into these areas should first be obtained from relevant parties or through consultations with relevant authorities and local grass roots organizations and NGOs.	- Medium/positive/months/local
		- Redeveloping relationships with past farmers who had signed the approval form.	- High/positive/decade/local/long
		- Prior to commencement of seismic activities, public	- High/positive/decade/local

		notices must be sent to all villagers, private land owners and relevant parties to advise of project schedules in the various areas	
Post Operational Activities	- Set up and operation of camps	- Temporary base camps or roaming camps to be set up should be sited away from communities so as not to disrupt communities' social and cultural customs	- Low/no change/months/local/ long
	- Increased population movement during seismic phase	- Increased population movement should be restricted to seismic areas	- Medium/no change/months/local
	- Increased vehicular movement during seismic phase	- Employed drivers should be advised of cultural customs in daily uses of the roads; all vehicular activities should be scheduled in advance.	- Medium/negative/months/local
		- Properly designed safety measures should be installed to ensure safety and efficiency for road users to and through the area.	- High/positive/decades/local/long
	- Disturbance or impact on existing roads by increased activities and vehicular traffic	- Roads be rehabilitated to ensure that increased vehicular activities do not adversely impact existing road conditions	- High/Negative/months/local
	- Transportation of materials and equipment during	- Equipment, materials, and supplies to be transported be covered to ensure safety of vehicular movement and safety through communities.	- High/negative/months/local
		- Vehicles transporting materials and equipment planned in advance so as not to coincide with daily population movement	- High/positive/months/local/long
		- Any requirements for use of local resources should be planned in advance and the required permits obtained.	- High/positive/months/local/long
		- All other requirements not available within the communities should be obtained from Punta Gorda or the	High/positive/months/local/long

	- Use of local resources (i.e. forest resource, water etc.)	wider region.	- Medium/no change/months/long
		- locals hired should be educated so as not to come back into these open areas to illegally obtain forest products	
		- a monitoring plan should be set up to discourage illegal activities	- High/Positive/decades/long
		- A crew will be designated to clear and rehabilitate the areas	- High/Positive/decades/long
	- Cleaning of seismic cut lines after use by seismic crew	- individual logs designed for each cut line area to record site cleaning and observations	- High/Positive/decades/long
		- Specified trained safety crew utilized for the transport, storage and handling of explosives and detonators	- High/Positive/decades/long
	- Safety of control explosives on nearby villages and villagers	- Specified trained crew designated to check all lines to determine that all control explosives are detonated and/or to remove same from the area.	- High/Positive/decades/long
		- Explosives transported in small quantities only as required; should be stored in special environment under guard prior to immediate use.	- High/Positive/decades/long
		- Only trained personnel should handle explosives exclusively, as legislated under controls and procedures set out for seismic and oil explorations	- High/Positive/decades/long
		- No untrained crew member be allowed to enter into areas, until areas are declared safe.	- High/Positive/decades/long
		- A log be kept to record activities within each cut line	- High/Positive/decades/long
		- Organic waste should be buried at the site with lime treatment; other hard should be classified, packed in bags	- High/Positive/decades/long

		and sent to Punta Gorda for disposal.	- Medium/No change/decades/long
	- Disposal of wastes generated by crew	- Any fuels and lubricants to be utilized should be appropriate containers to prevent leakage.	
		- A control sheet should be filled noting the areas cleaned and restored	- High/Positive/decades/long
		- These areas should be avoided especially during the seismic activity of control explosions and data recording.	- High/Positive/decades/long
		- Villagers advised as to the time frame of scheduled activities within respective areas.	- High/Positive/decades/long
		- Respective farmers compensated for loss of crops during these periods.	- High/Positive/decades/long
		- Alternative access areas be identified and utilized during this period.	- High/Positive/decades/long
	- Access to areas of traditional farm-land during seismic phases	- The Company should include respective monitoring personnel within their scope of work and related activities.	- High/Positive/decades/long
		- These farmers will also need to be identified, consulted and compensated for loss time and crops affected.	- High/Positive/decades/long
		- Care should be taken not to satisfy one community or stakeholder group at the expense of another group.	- High/Positive/decades/long
			- High/Positive/decades/long

	- Impact on adjacent parcels of land to access and construct seismic cut lines		
Current and Proposed Uses in the Area	- decreased economic benefits by traditional users of the area	- Farmers be compensated based on the duration, level and type of farming activity.	- High/Negative/decades/local/long
	- disruption of traditional user activities	- Areas of specific community importance and traditional areas should be avoided as much as possible	- High/Positive/decades/long
	- regulated access and use of traditional areas	- Regulated access to these areas will be for the short term for efficiency of work activity and safety for all users to and through the areas.	- High/Positive/decades/long
Population/ Housing	- Temporary needs for housing at the various sites and at nearby villages	- Camp sites should be sited outside of existing village populations so as not to disrupt social and cultural customs.	- Medium/Positive/months/local/long
		- Community leaders should be advised of proposed temporary camp site(s) in respective areas (if any).	- High/Positive/decades/long
		- All associated camp site facilities should be fully equipped.	- High/Positive/decades/long
	- Increased population density to the area	- New comers or voluntary populations should not be encouraged to settle or stay within these areas displacing existing local populations.	- High/Negative/months/local
		- The Company should provide the necessary accommodations for workers in the area.	- High/Positive/decades/long
	- Increase population activity in the	- Increased security and monitoring by local community based organizations and security personnel as well as the establishment of a physical presence within the STNP	- High/Negative/months/local

	area	and the buffer region of the STNP.	
		- New comers to the area should not be encouraged to settle on adjacent community land or nearby areas.	- High/Positive/decades/long
		- Voluntary and involuntary populations should not be encouraged to settle or stay within these areas displacing subsistence resources utilized by the communities.	- High/Positive/decades/long
	- Pressure on existing resources	- Likewise local communities should be encourage to continue to protect community resources and not to return to open areas to collect or over harvest forest resources and other local resources.	- High/Positive/decades/long
		- The Social Assessment highlights available sources within the various communities from which the Company can access locally available services and products.	- High/Positive/decades/long
	- Demand for services	- Individuals trained to meet some of the basic needs of the project.	- High/Positive/decades/long
		- Local given first consideration to provide required services.	- High/Positive/decades/long
		- Local and/or the local communities should seek access to credit facilities to improve or enhance existing services or open new local entrepreneurial facilities	- High/Positive/decades/long
		- The availability of additional services and products should strengthen local and regional economic benefits and opportunity for business	- High/Positive/decades/long
Socio - Cultural	- impact on existing cultural activities and customs	- Locals should first be considered for employment as they live within the region and will not cause on due stress on existing local systems and community	- High/Positive/decades/long

		populations.	
		- Existing local community based groups and local authorities can also assist in strengthening local social structures, institutions, regulatory systems and community networks.	- High/Positive/decades/long
	- Marginalization of cultural groups and cultural customs	- Local communities should strengthen themselves to deal with current new comers not associated with the project in order that as required, they can also handle disputes and social problems that may be associated with a diversified population.	- High/Negative/decades/local/long
		- The marginalization of minorities and local groups can also be strengthened through existing local institutions, local coordination, and regulatory systems.	- High/Negative/decades/local/long
	- Impact of local communities not involved in the consultation process	- Consultations carried out met its objectives in determining those main issues and concerns from the various communities, stakeholder groups and interests	- High/Negative/decades/local/long
		- Newcomers to the area will need to be educated on the lifestyles and customs of the local communities.	- High/Positive/decades/long
	- Gender related issues	- Community cultures and social environments will need to be respected.	- High/Positive/decades/long
		- New comer groups or worker populations to and around the communities be encouraged to stay outside the village.	- High/Positive/decades/long
		- sites for parking and other activities established away from the communities	- High/Positive/decades/long
		- Newcomer groups establish contact with the community leaders if services from the villages are required.	- High/Positive/decades/long

Socio Economic	- Economic benefits on local communities from employment - increased economic benefits and opportunities for local entrepreneurs	- Economic benefits to the local community will be directly related to spin off of monies earned from employment opportunities. - Resources utilized to upgrade existing local cooperative, small scale livestock, farming activities and other community economic enterprises such as basket making and local artisan enterprises. - Recognized needs and services within the communities to improve local services and products. - Resources utilized to for new entrepreneurial opportunities that can provide for new services that may be required during and after proposed activities - Will strengthening local community institutions and projections towards self sufficiency and a growth economy.	
Social Infrastructural Services/ Education /Health Services	- Pressure on health, sanitary facilities and educational institutions	- The region of propose seismic activity have limited to no infrastructural and institutional facilities, or just barely enough to satisfy the existing populations. As it is, these facilities will need to be strengthened to provide for the existing populations. - No new settlements are expected to occur during this period to put additional pressures on these facilities. - Existing local trained individuals be employed for each of the cut line areas as work is in progress. - Locals can become marginalized if they are not given the opportunities to participate in	-

	- Locals become marginalized in the development process	- Locals can also become marginalized from not receiving employment and training and other opportunities which can strength existing personal and future village needs. - There is also the opportunity for cross cultural exchanges.	
Labor and Employment	- Skilled labor from the area and region not employed	- Skilled laborers from the various villages should first be considered for employment. - Villagers from villages located close to nearby cut lines be employed in associated employment activities . Workers rotated weekly to allow employment opportunities for various village members, thereby encouraging economic spin-offs within the village. - Workers provided with adequate basic facilities such as bathroom, drinking water, and safety equipment. - Workers paid based on skill - Respect for social and cultural customs - Workers allowed to cut lines within respective community limits. - Workers given adequate time to complete tasks and that they are not rushed to work 12 hour days. - The developers and sub-contractors should abide by the labor laws of Belize, and that social security be paid for all workers.	

	- Operation of equipment - Employment opportunities of all labor types	- Workers trained in safety procedures, environmental requirements and involved in development plans. - Skills transfer is an important aspect in village development. - Unskilled locals should be trained in different labor types - Opportunities for long term employment be encouraged to strengthen village' local and regional skills and future opportunities. - Opportunity for skills transfer among and between community groups and new labor types	