

# Mackenzie Valley Environmental Impact Review Board

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<b>Date:</b>	May 16 <sup>28</sup> , 2001	<b>Pages:</b>	2 17 including this page
<b>To:</b>	Peter Campbell	<b>FAX:</b>	(604) 688-2043
<b>NOTES:</b>	<p>Hi Peter,</p> <p>Here is the cumulative effects portions from an EA Report I just received from Paramount Resources for their Liard East Drilling Project. I haven't even read it yet I am not making any claims about the quality but it looks O.K. and should give you ideas for your EA.</p> <p>Hope it helps,</p> <p style="text-align: right;">Joe Acorn</p>		

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## 14. SOCIO-ECONOMICS

This section of the report is in response to Section 4.14 of the Terms of Reference.

### 14.1 General

Socio-economic impacts were described as positive in the Environmental Impact Assessment for the Fort Liard Exploratory Drilling Project (Golder Associates and WOES 1997). That report discussed Paramount's commitment to developing a mutually beneficial relationship with the Fort Liard Band Council, its members and contractors.

Throughout the Project planning, Paramount has consulted with the community leaders and members of Fort Liard on the Project components (see Section 5 of this report). The consultation program has identified the following potential impacts, both positive and negative, that may occur as a result of the proposed Project:

- Employment and contracting opportunities for northerners and northern businesses;
- Increased interaction with the communities;
- Short-term increased utilization of existing businesses and services;
- Continued accessibility to hunting and gathering areas for traditional land users;
- Short-term increased demands on local construction capabilities and skilled labour resources;
- Population increases in the region in the short term; and,
- Potential minimal impact to traditional land uses such as trapping, hunting, fishing and gathering.

When all these factors are combined, it is predicted that overall socio-economic effects are positive and sub-regional, but short term, low in magnitude and considered to be not significant.

Paramount will continue to provide the necessary follow-up for the Project, through meetings with the northern stakeholders and the community of Fort Liard. Qualified local businesses (e.g., ADK Holdings) will be invited to bid on available contracts.

The issues of greatest significance to residents of potentially affected communities have been determined through review of historical socio-economic trends and through the public consultation program. Key issues with this type of project typically include: sustainable economic diversification; enhancement of local capacity; environmental protection; and retention of traditional skills and values.

Paramount intends to maximize the positive benefits that may accrue from the Project and eliminate or at least mitigate any adverse impacts. Paramount will do this through their commitment to the principles of fair and equal employment and training opportunities. This commitment will promote fairness in employment opportunities and avoid employment practices, which result in employment barriers. Northern businesses will be contracted to provide project-related goods and services whenever possible on the basis of availability, reliability, qualified personnel and cost competitiveness. Paramount will make every reasonable effort to notify local communities and companies about available procurement opportunities. Paramount intends to track the number of jobs provided to northerners and the number of contracts and the total dollar value provided to northern businesses to ensure that local and regional skills are recognized and retained for future consideration.

Paramount retains the services of primary contractors, who in-turn, create the local employment opportunities. Paramount expects their primary contractors to adhere to the Benefit Plan principles. Table 14-1 reflects the drilling and evaluation of each well.

Based on Paramount's dialogue with northern communities and businesses in the area, we anticipate the following northern services may be available to this Project:

- Camps and catering;
- Heavy equipment and operators for wellsite and access road construction;
- Fuel supply and distribution;
- General trucking;
- Welding;
- Air transportation;
- Personnel for rigs;

- Environmental Services;
- Motel, restaurant, general store services;
- Equipment rentals; and,
- Slashing crews.

**Table 14-1  
Estimated Total Potential Employment to Drill and Evaluate One Well**

Project Activity	Avg. No. of Persons	No. of Days	Details
Helicopter service for surveying	0.5	1	Provides helicopter service for Paramount, community representatives and survey crews to locate and survey access routes, roads and wellsite.
Survey crew and slashers	4	1	Survey access routes and wellsite.
1 Camp	3	60	Supply and maintain camp, complete with all catering and grocery transportation during drilling and evaluation.
Access and wellsite construction and maintenance	4	5	Provide construction equipment and manpower to build access roads and wellsite. Maintain access as required, clean up wellsites as required. May include: slashing, power saws (clearing), equipment operator (tractor, skidder, hoe, excavator), general labour, welder, and truck driver.
Diesel fuel supply	1	1	Dispatch diesel fuel and transport to location as required: dispatcher and truck driver.
Trucking	1	1	General trucking services.
Drilling	6	40	Rig crew for drilling operations.
Completion	6	10	Rig crew for completion of the well.
Flow testing	5	14	Monitor flow rates and pressures; manage fluid volumes; manage flow testing safety.

#### 14.2 Health during Drilling and Well Evaluation

As the workforce for the Project will be housed in a self-contained camp facility, it is expected that there will be limited impacts on the local or regional health infrastructure. Paramount will not tolerate any form of illicit drug or alcohol use by anyone while engaged in field operations. Paramount will have staff trained in first aid on the Project. In the case of emergency, those requiring intensive medical care will be airlifted to Fort Liard or elsewhere as appropriate for treatment.

The design of the Project mitigates human health impacts from air emissions by meeting all applicable regulatory requirements for emissions to the atmosphere. The flaring is part of the mitigation strategy, as it burns the gases (e.g., H<sub>2</sub>S).

The chemical concentrations necessary to affect respiration based on human studies indicate that short-term SO<sub>2</sub> levels in excess of 780 µg/m<sup>3</sup> are required for odours to be detectable and levels of 2,600 µg/m<sup>3</sup> are required to begin to affect health individuals (Patty 1963; Stacy et al. 1978). Longer term exposures of 300 µg/m<sup>3</sup> over 24-hours may begin to affect mortality of populations (Martin and Bradley 1960) while exposures less than 125 µg/m<sup>3</sup> over 24-hours show no mortality effects (Mazumdar and Sussman 1983).

The modelling predicts that the well evaluations will result in ground concentrations that meet the NT standards, which are well below the harmful limits, and therefore no impacts to human health are predicted. Further, Paramount will comply with the AEUB Guide 60 to ensure maximum safety for workers.

#### **14.3 Social Services and Infrastructure during Drilling and Well Evaluation**

The self-contained character of the work camp, the limited employment opportunities available to unskilled labour, and the short duration of the Project make it unlikely that the Project will have any discernible impact on demand for social services in the regional communities.

Impacts on existing municipal transportation and community infrastructure as a result of the Project are expected to be negligible. Because the entire Project workforce will be housed in camps within the Project area, impacts on community housing and accommodation are expected to be negligible.

#### **14.4 Indirect and Cumulative Socio-economic Impacts**

Should the subject wells be brought onto production, the Project would produce indirect socio-economic impacts such as increased territorial and federal revenues from personal employment and business taxes and royalties on any petroleum product sold. The monetary value of these has not been estimated to date.

Other indirect effects could include socio-cultural changes. However, as a short-term project with a comparatively low capital value, Paramount's proposed Project and subsequent potential development is expected to have few socio-cultural effects. This is because, generally speaking, socio-cultural effects build gradually over a considerable period. A transition among Aboriginal people from reliance on traditional economic activities such as hunting or trapping to those associated with wage employment would be one example; a shift to a permanent, ingrained attitude of on-the-job safety would be another. Socio-cultural changes are also more pronounced in locales where many large-scale development projects occur during a brief period of time.

#### **14.5 Predicted Residual Impact to Socio-economics**

The community of Fort Liard has exhibited positive growth, in response to their pro-active efforts to identify business opportunities, and to supply the oil and gas industry with equipment and services in the Fort Liard area. This business, primarily through Beaver Enterprises, has grown with the increased oil and gas activity in the area.

Paramount intends to utilize northern labour and business contractors as much as practical to meet the demands of the Project. In the case of drilling success, positive socio-economic impacts arising during subsequent projects may include direct employment and business opportunities, skills enhancement through training, and additional revenue to all levels of government through royalties and taxes.

The remote location of the proposed development area, the brevity of the construction phase, and the establishment of an on-site camp for workers will mean that the Project will have a negligible impact on existing local and regional physical infrastructure and social services. Paramount, through planning and due diligence will make every reasonable effort to minimize environmental disturbance during drilling and evaluation programs, and encourage and promote the local economy. The potential residual impact related to increased employment is considered to be positive, regional, short-term, low in magnitude, can be reversed in the short-term, likely to occur, and considered to be not significant.

## 17. CUMULATIVE IMPACTS

This section of the report is in response to Section 4.17 of the Terms of Reference.

For this response, the document *Addressing Cumulative Environmental Effects in Environmental Assessment under the Mackenzie Valley Resource Management Act* (Interim Guide, September 2000), was reviewed and used for direction. Further, the cumulative effects assessment includes cumulative impacts where impacts on biological receptors such as vegetation and wildlife are identified as a result of well evaluation testing (flaring) and/or venting.

### 17.1 Spatial and Temporal Boundaries

For the purpose of this cumulative effects assessment, the respective disturbances were considered in relative terms (i.e., the amount of disturbance they would create) to the general region, above that which already exists. The area selected for the cumulative effects assessment is illustrated in Figure 2, and encompasses all components of the Project. In total, this area comprises some 354,716.62 ha of land. Further, this area was considered appropriate in size to capture all the potential impacts that could result from the Project, as well as any related future developments.

The temporal boundaries for the assessment are limited by only considering existing, man-made disturbances that have been approved, and those projects that could potentially occur in the near future.

### 17.2 Existing Disturbance

The nature and extent of human disturbances within the Cumulative Effects Study Area (CESA) were determined through field reconnaissance, historical data file searches (e.g., McElhanney survey data 2001), and interpretation of maps and aerial photographs (Table 17-1).

Disturbance estimates are best approximations based on available data. It is important to note that the disturbances (e.g., seismic lines, winter access, well leases) that are within the Study Area are of varying ages and stages of regeneration. Many of these areas have naturally

revegetated to varying extents, and therefore, currently provide suitable habitat for many wildlife species.

**Table 17-1**  
**Existing and Potential Projects within the Cumulative Effects Study Area for the Liard East Drilling and Well Evaluation Project**

Existing Disturbances	Area (ha)	Potential Projects	Area (ha)
seismic lines/access	1,338.48	Arrowhead 3D seismic	343.82
airstrip (1)	11.89	<b>Subtotal</b>	<b>343.82</b>
temporary camps (7)	1.44	<b>Percentage of study area</b>	<b>0.1%</b>
Paramount leases (7)	15.75		
abandoned wellsites (14)	31.50		
sumps/borrow pits	1.48		
Liard highway	528.39		
demonstration forest	670.00		
access	87.42		
Bovie Lake cabins	5 ha		
		Liard East Project	
		New wells (5)	11.25
		Evaluate 7 existing wells	0.00
		camps	0.42
		sumps	1.96
		habitat lost to flaring impacts	0.00
		<b>Subtotal</b>	<b>13.63</b>
		<b>Percentage of Study Area</b>	<b>0.004%</b>
<b>Total</b>	<b>2,691.35</b>	<b>Total Potential New Disturbance</b>	<b>357.45</b>
<b>Total Cumulative Effects Study Area</b>	<b>354,716.62</b>		<b>354,716.62</b>
<b>Percentage of Cumulative Study Area</b>	<b>0.76%</b>		<b>0.10%</b>



### 17.3 Planned Disturbance

Paramount intends to complete the following new project components (Table 17-1) as part of the drilling and evaluation application:

- Access, prepare, drill and evaluate a new well at either C-51 or G-51 = 2.25 ha of disturbance;
- Access, prepare and construct two campsites = 0.42 ha of disturbance;
- Access, prepare, drill and evaluate a new well at J-54 = 2.25 ha of disturbance;
- Access and use an existing 30 m x 60 m campsite for J-54 = 0.0 ha of disturbance;
- Access to, and evaluation of seven existing wells (P-57, M-23, N-65, N-60, O-15, C-76 and C-02) = 0.0 ha of disturbance
- Proposed borrow pits/sumps = 1.96 ha; and,
- Access, drill and evaluate three new wells at K-74, F-66 and J-76 = 6.75 ha of disturbance.

Electronic recorders will be run into the wells to conduct an evaluation of the reservoir through flow testing. Each of the wells will be flow tested to determine economics of Project development by evaluating reservoir parameters including: permeability, effectiveness of well bore stimulation; well deliverability; and potential reservoir size. The length of the well evaluation is determined by: threshold reserves required for the Project development; and any declining performance seen during well evaluation. During the well evaluation, a portable, temporary flare will be erected on each lease to burn the gas released from the well during the flow test. This is a proven, safe mitigation technique to ignite and safely burn the gases produced during the flow test. Typically, the evaluation will be completed over a two week period, in which the flaring rate varies depending on the evaluation being completed.

The work at the 7 existing wells will not result in any additional disturbance, other than preparing the access and lease (i.e., existing disturbance areas). In total, the Project may result in the clearing/alteration of approximately 13.63 ha of the vegetation within the region, above the current condition. This small amount of disturbance would be located on or adjacent to existing

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disturbance corridors (i.e., on existing seismic lines), and is considered to be not significant within the region.

#### 17.4 Potential Future Developments

The Project is a continuation of an exploratory program. Part of this program may require a return to any or all of the 7 existing wells for further evaluation; this would require no new access, no clearing and no grading, except potentially at the turn-around area at the well head.

Depending on the drilling success, but outside of this application, Paramount could potentially construct a pipeline within the region. However, as this could be several years in the future, and no route exists, this potential project has not been included in the cumulative effects assessment. The pipeline and associated facilities would be the subject of a separate application made to the MVLWB and the NEB.

The Arrowhead 3D seismic program has been approved by the MVLWB (MV2001B0009, March 1, 2001) and the NEB (letter dated March 13, 2001 from Mr. T. Baker). The amount of new disturbance for this 3D program is 343.82 ha. The land use area is based on the following seismic parameters. The source and receiver lines will be laid out at 500 m intervals. All existing lines have been used where feasible. The source lines are those that are subjected to the energy source (vibrators), while the receiver lines are utilized to lay out the geophones to collect the data and relay it to the recorder. Paramount has committed to using minimal line widths and avoidance cutting to limit disturbance. The source lines will be cleared to a 6 m width for storage of slash, snow, and safety reasons, while the receiver lines will typically be cleared to a width of 4 m. For safety evacuation and to provide access to the source lines for the vibrators, every 3<sup>rd</sup> or 4<sup>th</sup> receiver line would be cleared to a 6 m width. In sensitive area (e.g., river banks, steep slopes), no source lines will be cut and receiver lines will be hand cut to a maximum of 1.5 m in width to facilitate safe foot traffic.

Inquiries to the regulatory agencies (e.g., John Korec, NEB, pers. comm. 2001) indicated that there were no other known projects approved or planned to occur within the CESA at the time of writing this report. Due to confidentiality issues, it is possible that some projects may be planned within the area, but this information is not public at this time.

As appropriate, these developments, including the potential impacts of flaring to the environment, have been considered in the cumulative effects assessment (Table 17-1).

### **17.5 Total Existing and Potential Disturbance**

The CESA is shown on Figure 2. Within the CESA of 354,716.62 ha it was estimated that 2,691.35 ha (0.76%) of the CESA are currently disturbed (Table 17-1). The Drilling and Evaluation Project will result in the clearing of approximately 13.63 ha (0.004%) of vegetation within the CESA. Based on the predictions of the air quality assessment (i.e., NT air standards will be met), the habitat alteration (including surface water quality) or vegetation loss resulting from flaring during well evaluation is predicted to be zero. Other potential projects may create an additional 343.82 ha of disturbance (0.1%) within the CESA. The work at the 7 existing wells is not expected to result in any additional disturbance.

The total disturbance (existing plus known potential) within the CESA would be projected to be 3,048.80 ha (0.86%), if all projects proceeded.

### **17.6 Impact Analysis for Cumulative Effects**

#### **Disturbance to Vegetation/Wildlife Habitat**

As the emissions released during the well evaluations will meet NT standards, and no impacts are predicted to vegetation, the flaring is predicted to have no cumulative effects to vegetation/wildlife habitat.

The Project is predicted to result in an incremental increase in disturbance/alteration of approximately 13.63 ha of vegetation/wildlife habitat within the region. In addition to the alteration/loss of vegetation and habitat, fragmentation of habitat would be expected to increase over the current condition (e.g., related to the lease clearing), although only slightly, as existing disturbance corridor use was maximized. The magnitude of the resultant impact would be dependent on the species of wildlife considered, but predicted to be minimal.

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A cumulative effect related to habitat alteration would be predicted as it relates to the additional clearing required for the completion of the Arrowhead 3D program. The alteration of habitat, and the resulting fragmentation resulting from the completion of the 3D seismic programs would be minimized by using avoidance clearing (i.e., low impact seismic) and existing cutlines, as much as possible. Avoidance clearing provides limited disturbance to the existing forest cover by weaving the line through the forest to avoid trees and to minimize the number cut. Further, this limits the line-of-sight distance created, which provides an increased level of protection for wildlife over traditional straight seismic lines.

Because the access routes follow existing seismic cutlines, and no clearing will be required for completing and testing the 7 existing wells, the amount of new cutlines that would result in additional fragmentation was minimized to the extent practical. The width of the existing right-of-way (approximately 6 - 10 m) is not expected to hinder caribou movement throughout the region, as the rights-of-way would likely only be encountered sporadically during the animal's movements. Further, Dyer (1999) found that seismic lines were not barriers to caribou movements, while actively used roads acted as semi-permeable barriers to caribou movements.

Cronin et al. (1994) noted that caribou habitat may be enhanced by linear developments. Incidental sightings of caribou tracks along pipeline rights-of-way during monitoring programs, indicated that the new vegetation produced was being used as a spring and summer forage source, as well as winter travel corridors (Eccles et al. 1985; Eccles and Duncan 1986).

By utilizing existing disturbance corridors, the incremental habitat fragmentation was minimized, and the amount of new edge habitat was limited. Otherwise, fragmentation of mature or climax habitat could have a localized, negative effect on songbirds that depend on such communities. The vegetation communities within the Project region that would be expected to support the highest densities of breeding birds would be mature mixedwoods and dense old growth coniferous stands. By constructing the leases on existing seismic lines, it will limit the potential for negative impacts to songbirds resulting from predation and/or parasitism (e.g., from species such as cowbirds). Conversely, species that utilize early successional communities and/or openings would be favoured, at least over the term that it takes for revegetation to occur. Mixedwood areas with better soil conditions and higher regeneration capabilities would be

expected to revegetate more rapidly than areas with higher moisture contents, such as black spruce bogs, which would affect the length of time impacts would be expected to occur.

The capability of the land within the Project area to regenerate is exhibited by the growth of shrubs and trees noted on previously disturbed areas. The resultant composition of the regenerating vegetation may not exactly match the vegetation that was cleared. However, these regenerating habitat types provide alternate habitat for numerous avian and mammalian species. In regenerating areas, the diversity and population of small mammals may even be higher than natural habitats, due to the availability of food and cover.

Due to the relatively small amount of additional land that will be disturbed during the Project, no significant, long-term, cumulative impacts with respect to wildlife habitat are predicted.

#### **Disturbance to Wildlife**

Cumulative effects related to disturbance (e.g., sound and odours) to wildlife are related to the drilling and well evaluation activity, construction activity and camp operation, and seismic operations all happening at the same time, or consecutively, and in the same general region. As the Project is exploratory in nature, the cumulative effects would primarily be related to increased levels of disturbance above other exploration activities (i.e., seismic, drilling) completed during the winter months in this region of the NT.

A cumulative effect related to disturbance would be predicted to occur, where drilling, well evaluation and/or seismic operations were completed in the same general area, at the same time. The flaring would be expected to add a different visual effect (i.e., the flame), compared to the normal construction and activities related to drilling and construction. However, as some flaring during well evaluations have occurred within the CESA in the past, this disturbance is not completely foreign to the resident wildlife species.

This effect could limit or preclude the use of some of the area by species of wildlife (e.g., moose, caribou), for a short time period, with the zone of impact depending on the spatial separation of the different projects, and the sensitivity of the wildlife species. For example, Dyer (1999) found that caribou use of a 0-100 m buffer along seismic lines was 55.28% of the expected use during

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late winter. Conversely, the use of habitat within the 100-250 m buffer by caribou was 113.78% of expected use during the calving season. It is predicted that the area of effect would be localized, due to the distance between the wells. Dyer (1999) reported that caribou avoidance of wellsites was generally greatest during late winter and calving. His study showed that caribou still used the buffers around the wells, with the level varying with the time of year and the buffer distance. For new wells, caribou use of the 0-250 m buffer around the well was 45.31% of expected use during late winter, but 117.84% of expected use during summer. The 250 m – 500 m buffer around a new well showed caribou use to be 136.22% of expected use during summer, and 108.15% of expected use during late winter.

Dyer (1999) notes that “despite concerns, demographic-effects have generally not been observed as a result of avoidance and displacement (Smith and Cameron 1983; Mercer et al. 1985; Dau and Cameron 1986; Murphy and Curatolo 1987)”. Another consideration, is the timing of the drilling and well evaluations as it relates to habitat use by wildlife. As the construction, drilling and well evaluations will be completed during the winter months when migrant species have left the area, the cumulative effects related to increase noise and light levels would apply only to those species present during the winter months. Typically, the density of overwintering wildlife species is low in this region of the NT, with the most sensitive period being late winter (i.e., related to snow depth and decreased food quantity and quality). During the summer months, migrant bird species will have returned to the Project area, and could be disturbed (noise plus light) when well evaluations were conducted during this period. The increased disturbance is expected to be local, short-term in duration, of low magnitude, can be reversed in the short-term, and predicted to be not significant.

All activity related to the Project will be completed as quickly as safety allows, and within common disturbance corridors, to the extent feasible. Based on the above discussion, the separation distance between Project components, the short duration of the flaring and the mitigation plans in place, no significant cumulative effects related to disturbance of wildlife are predicted.

### Access

Currently, access within the region is limited to the Liard Highway, winter roads (including trails and seismic lines), or by the use of snow machines, float planes or helicopter. As existing trails will be used, access within the region will remain unchanged from current conditions.

There will be no need to increase or improve the access beyond current levels to complete the well evaluations. Therefore, no significant cumulative effects are predicted, related to increased access for the drilling and well evaluations.

### Air Quality and Emissions

The emissions released into the atmosphere by generators, vehicles and heavy equipment during construction are not expected to significantly increase normal background levels. The only other heavy equipment operation would be related to wells being drilled, seismic exploration, and road maintenance and/or snow removal on the winter access.

During well evaluations, flaring will be used as an efficient and safe means of disposing of produced gases. It is expected that the emissions from the well evaluations will result in ground level concentrations that meet the NT air quality standards for SO<sub>2</sub> and the Alberta Ambient Air Quality Guidelines for NO<sub>2</sub> and products of incomplete combustion. This will ensure protection for the components of the natural environment. As Paramount has completed dispersion modelling to assist them in determining the proper equipment (e.g., stack heights and diameters) to meet the available criteria, no significant cumulative effects are predicted.

The well evaluations for the 7 existing wells will not be completed concurrently with the proposed new wells, but will utilize the same safety and environmental considerations. Therefore, no cumulative effect is predicted. The exploratory wells are dispersed throughout the CESA, which are in-turn located a significant distance away from other regional sources. Therefore, no significant cumulative air effects are predicted.

**Aesthetics**

Considering the short duration of the flaring during well evaluations, the separation distance of the Project components, and the distance from viewing locations, no significant cumulative effects related to aesthetics are predicted.

Construction of the wellsites is predicted to minimally affect the natural aesthetics of the area in a cumulative manner with the proposed Arrowhead 3D seismic program, as each well proceeds. The Project will add approximately 13.63 ha of new disturbance to the area, or an additional 4% of the Arrowhead 3D program. This effect is predicted to diminish over time as revegetation occurs. The brief periods of flaring during the well evaluations would add a different disturbance (i.e., the flare) to the aesthetics of the area, and likely most noticeable during the night and from the air. The effect, or perceived effect on aesthetics that will result from the Project is an individual issue that will vary. Currently, the Project area has clearings from seismic lines, camps and well leases that represent disturbances within the natural vegetation mosaic. When all of the proposed wells are drilled and evaluated, and the seismic is completed, it is predicted that there would be a subjective, minimal increase in the negative impact to the natural aesthetics.

Paramount attempted to limit and concentrate the disturbance with conscientious siting of the wells and use of existing disturbance corridors to the extent practical (existing access will be used). As such, the Project will be obscured by distance, local topography and vegetation from land based view points, such as the Liard Highway or Bovie Lake. Further, natural revegetation on the seismic lines and areas not required for operations will assist in reducing the remaining impacts on aesthetics over time. The cumulative impacts predicted for disturbance to the natural aesthetics of the area are predicted to be not significant.

**Induced Development**

Drilling and well evaluations are not expected to induce development, as Paramount is the primary developer in the area, and as such no cumulative effect in this regard is predicted. However, development within the region will ultimately be controlled by the price of oil and gas, delineation of reserves, an available transportation system, and availability of subsurface



petroleum and natural gas rights. Depending on the success of the exploratory programs, other wells may be drilled, which could be followed by facilities and pipelines. As it is not known what projects could follow, no significant cumulative effects are predicted.

#### **Socio-economics**

Drilling and well evaluations, are expected to have a positive, short-term impact on the regional economy through local employment and purchase of supplies. The resultant cumulative effects related to the incremental increases in jobs and services are predicted to be not significant.

#### **Summary of Cumulative Effects**

Overall, in conjunction with conscientious construction and operation standards, mitigation plans, and emergency response plans, the drilling and well evaluation portion of Paramount's activities in the Liard East Drilling Project will be completed in a manner that minimizes the potential for cumulative effects. All potential residual cumulative effects are predicted to be not significant.