

# **ORCA SAND & GRAVEL LTD.**

## *Sound Assessment - Trail Bay*

M09187 A01

OCTOBER 2004

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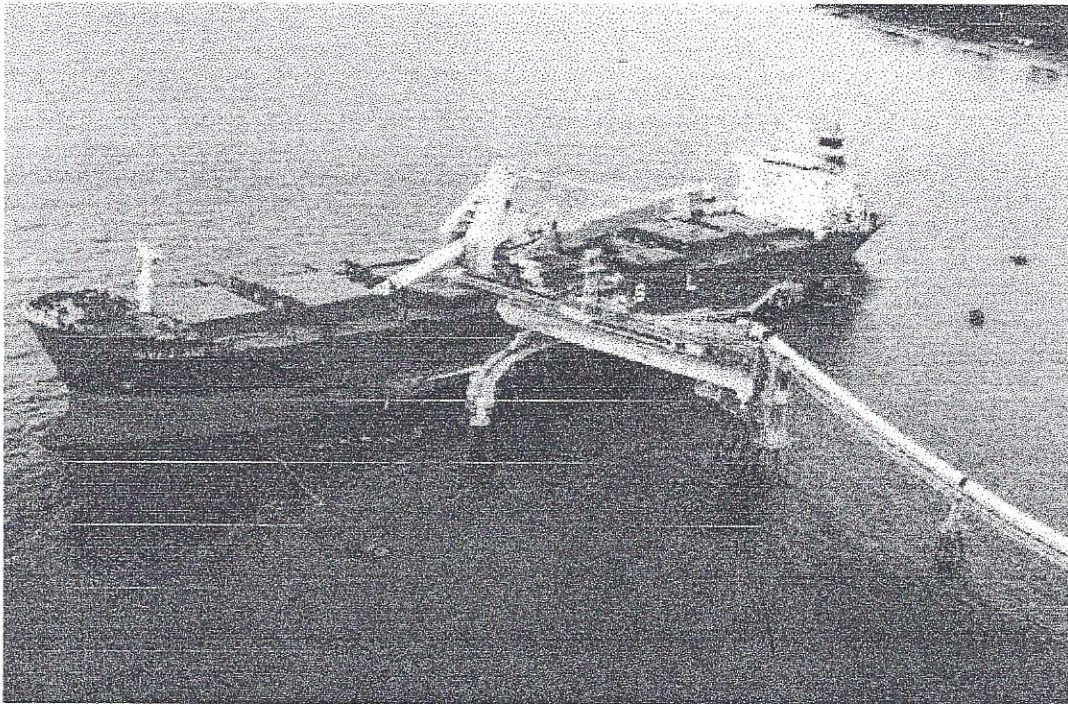
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## 1. INTRODUCTION

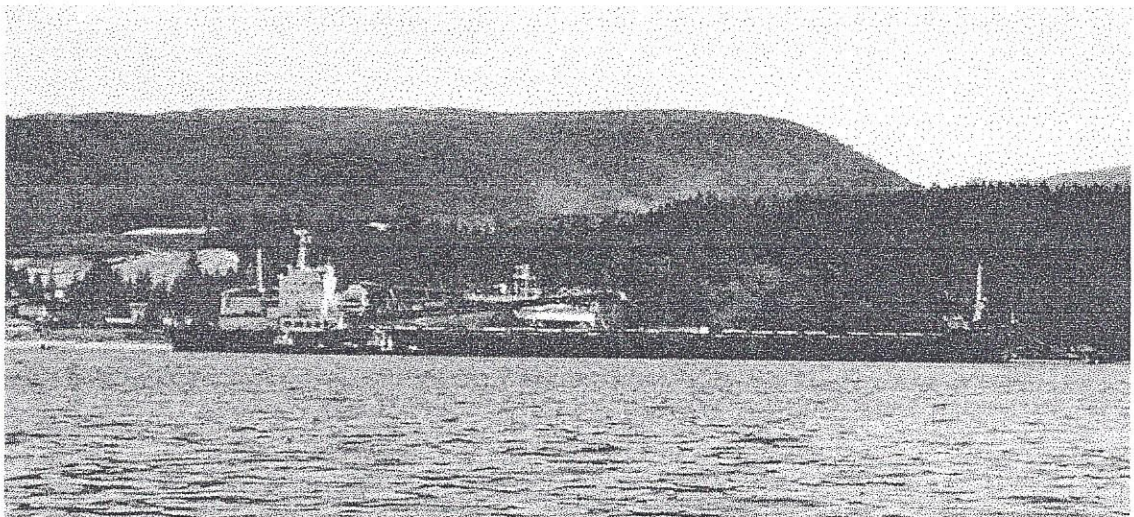
This report presents an assessment of sound levels produced at a sand and gravel loading facility in Trail Bay, at Sechelt, BC (shown in Figure 1). This study was carried out to aid in the prediction of sound levels that can be expected as a result of the proposed Orca Sand & Gravel Project (the Project), located to the west of Port McNeill at the north end of Vancouver Island, BC, and is part of the Environmental Impact Assessment that is being carried out to assess the potential impacts of the proposed Project. The Project will consist of a 4 Mt/a to 6Mt/a sand and gravel operation that will process sand and gravel products over a period of approximately 30 years. Movement of product to marketplace is planned to be by ship, loaded at a proposed facility in Broughton Strait. Depending on production rates, a ship every 10 days up to every 4 days will be required.



**Figure 1** Sand and Gravel Loading Facility at Trail Bay

The sound survey at Sechelt consisted of airborne sound level measurements taken on April 20, 2004 (background measurements) and from April 27 to 29, 2004, while the Panamax class 'Nelvana' was at berth (Figure 2). The purpose of the exercise was to:

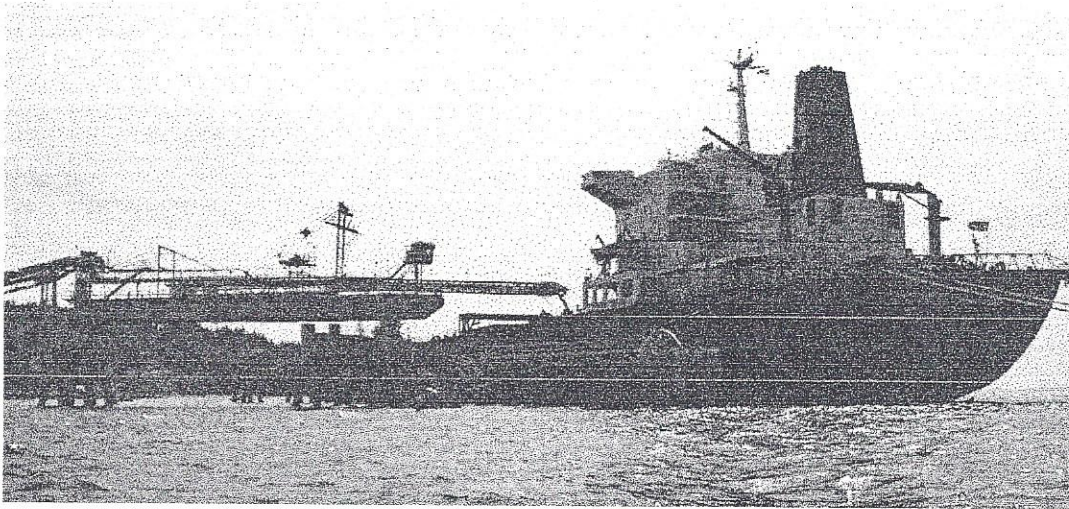
- Provide a visual illustration of the magnitude, range and attenuation of sound level produced by the ship loading facility; and
- Interpolate how sound will be perceived in the vicinity of the proposed Orca Sand & Gravel Project.



**Figure 2 The Nelvana at Berth at Trail Bay, April 27, 2004**

The facility and operations at Trail Bay (Figure 1) are similar to those proposed for the Project and consist of an elevated trestle from shore out to the shiploader, a distance of approximately 250 m. The trestle carries the covered conveyor and pedestrian walkway. A large pile-supported concrete platform supports the quadrant shiploader. Sand and gravel falls from the conveyor into a hold of the ship and the pivoting structure moves the conveyor between holds. Figure 3 shows the 'Nelvana' as loading was proceeding. The Nelvana is a 5-hold bulk carrier, approximately 250 m long. Panamax class vessels, such

as the 'Nelvana', berth at three dolphins (large structures with rubber fenders placed in line and spaced out along the berth face). A total of four mooring buoys are located at the ends of the berth to secure the ship.



**Figure 3 Loading the Nelvana with Sand and Gravel, April 27, 2004**

Background sound levels at the Trail Bay site were taken on April 20, 2004 during a time when the shiploader facility was not in operation. The bulk carrier vessel, the Nelvana, (Figure 2) was loaded with sand and gravel from April 27 to 29, 2004 during which time sound levels were generated by loading, ship movement, ship operations and tug boats.

## 2. METHODOLOGY

Acoustic measurements were made from a 30-foot aluminum boat at numerous locations in Trail Bay and from the shoreline, at distances of between 50 m and 2000 m from the loading facility. During sound measurements, the engine of the aluminum boat was not operating. GPS positions were maintained at each measurement location and distances and bearings to the loading facility were measured and recorded using a laser range finder with a range of 1500 m. Sound levels were measured using a Checkmate Type II SPL meter (CM140). These meters have a range of 30 to 130 dB, an accuracy of +/- 1.5 dB, resolution of 0.1 dB and A and C frequency weightings. Weather conditions were measured using a Kestrel 4000 pocket weather tracker. At each location, the following procedure was carried out:

- Position, distance, bearing and inclination (taken with the range finder) were recorded;
- GPS position recorded;
- A photograph taken;
- Weather station details recorded (including average and maximum wind speed, temperature, humidity and barometric pressure);
- Air sound levels in three directions (approximately west, north and east) were recorded at 1.5 m above water surface;
- Details of loading progress recorded; and
- Boat was moved to a new location.

### 3. SOUND LEVEL MEASUREMENTS

#### 3.1 Baseline Sound Level Measurements

Baseline measurements were taken on April 20, 2004, during which time the loading facility and conveyors were not in operation and no vessels were tied to the mooring buoys. Measurements were taken between 12:00 and 15:00. Weather was windy with wave heights in the bay, outside of protected areas, up to 0.6 m and average wind speeds ranging from 1 to 4 m/s with maximum wind speeds ranging from 3 to 6 m/s. Air temperature was an average 22.2 degrees Celsius. Additional baseline readings were also taken after the departure of the ship on April 29, 2004, during which time the weather was clear and calm with wind speeds ranging from 0 to 1 m/s and temperatures ranging from 12.7 to 16.7 degrees Celsius. In total 20 background measurements were taken. Averages are presented in **Table 1**. The average background sound level ranged in value from 39.7 and 54.3 dBA.

**Table 1 Average Background Sound Levels**

Date	Conditions	# of Readings	Range (dBA)	Average Background Sound Level (dBA)
April 20, 2004	Windy, choppy	11	52.3 - 54.3	53
April 29, 2004	Calm	7	39.7 - 48.8	45

#### 3.2 Loading Sound Level Measurements

Measurements of sound level from the loading facility during normal operations were collected on April 27 to 29, 2004. Over the measurement period, weather varied significantly, from poor conditions with high wind (up to a maximum of 7 m/s) to flat conditions with no winds. Wind direction from the west to northwest. Weather conditions from selected times throughout the measurement event are presented in **Table 2**, with data shown at approximate 1 to 1.5 hour periods.

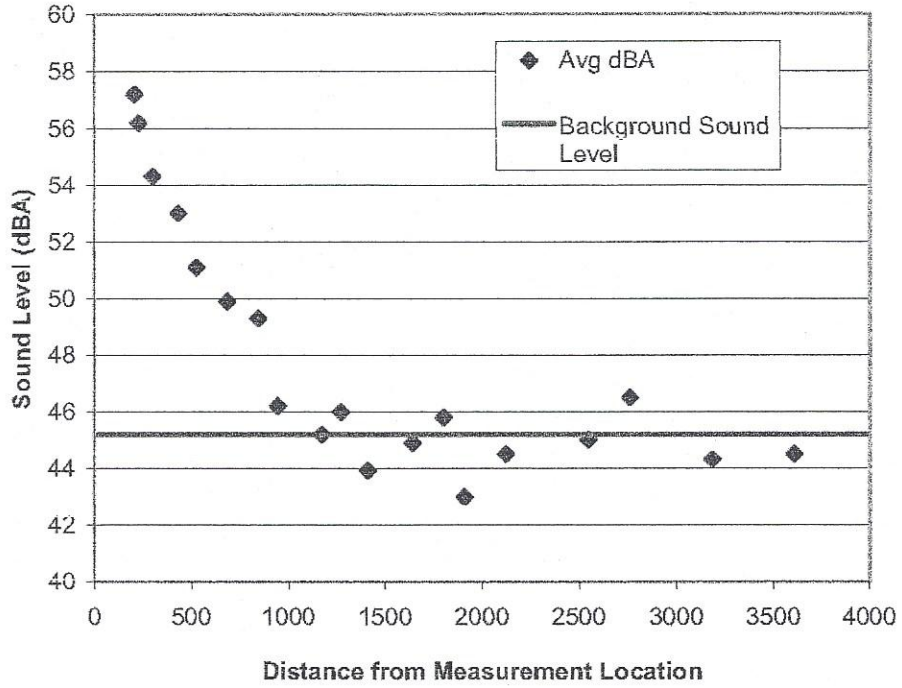


Figure 5 Sound Levels Measured from a Stationary Point as the Nelvana Departed



#### 4. IMPACTS OF SOUND LEVELS

Figure 6 provides two examples of how sound levels in dBA correlate to common sources of noise, and is used to illustrate how the measured sound levels are perceived by the human ear. Table 3 equates sound levels recorded during the survey with the common noise sources shown in Figure 6. In terms of Figure 6, the loudest sounds, which would be heard at approximately 20 m from the active loading facility, are equivalent to a vacuum cleaner at 3 m distance and background noise levels, in this study, are comparable to a quiet urban area.

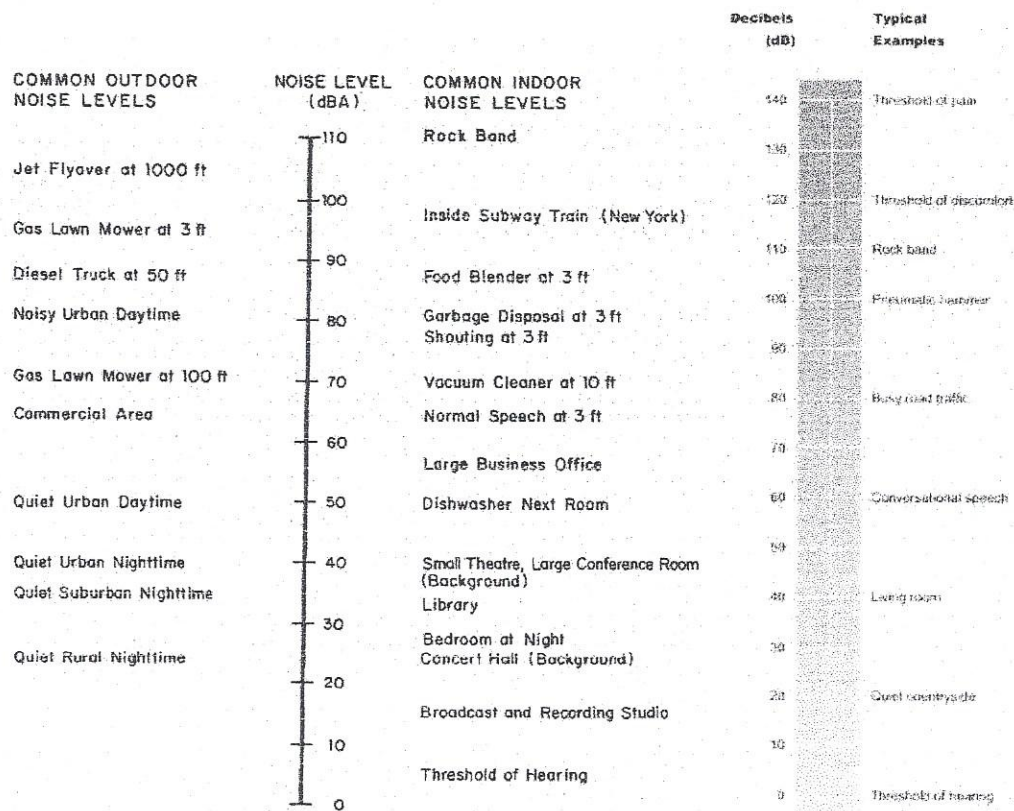


Figure 6 Common Sound Sources and Levels

**Table 3 Some Recorded and Equivalent Sound Levels**

	Back-ground		~20 m from Source		500 m from Source		1000 m from Source	
	Level (dBA)	Equivalent To <sup>1</sup>	Level (dBA)	Equivalent To <sup>1</sup>	Level (dBA)	Equivalent To <sup>1</sup>	Level (dBA)	Equivalent To <sup>1</sup>
Background Level <sup>2</sup> (from calm and windier days)	45	Quiet urban area Dishwasher in next room	-	-	-	-	-	-
Shiploading <sup>3</sup>	53	-	70	Vacuum cleaner at 3 m	60	Conversational speech	58	Large business office/ conversational speech
Ship Departure <sup>4</sup>	-	-	-60	Conversational speech	52	Dishwasher in next room	47	Quiet urban area - daytime

<sup>1</sup> Taken from Figure 6

<sup>2</sup> Taken from Table 1

<sup>3</sup> Taken from Figure 4

<sup>4</sup> Taken from Figure 5

## 5. COMPARISON OF TRAIL BAY TO BROUGHTON STRAIT

A similar loadout facility, designed to accommodate the same class of ship, is proposed for the Orca Sand & Gravel Project at Port McNeill, BC. The ship loading facility would be located in Broughton Strait, north west of Port McNeill as shown in Figure 7. As weather conditions (winds) are comparable in Broughton Strait and Trail Bay, it is reasonable to compare these two locations. Figure 7 shows the maximum distance of attenuation of sound to background levels, as taken from the contour map in Figure 4, superimposed on the proposed loading facility in Broughton Strait. As seen in Figure 7, it is not expected that sound generated by loading activities will exceed background levels at any of the following receptor locations:

- Campground at the mouth of the Cluxewe River, 2.5 km from source;
- Lighthouse at Pulteney Point, 2.0 km from source;
- Lady Ellen Point, 3.8 km from source; and
- Port McNeill Inlet (and town), 2.2+ km from source.

People on shore, depending on the path of the ship as it approaches and leaves the area, may perceive sound levels slightly above background. Assuming the ship is traveling no closer to shore than 700 m, average perceived sound levels would be 50 dBA at the most. During calm conditions, i.e. times when background sound levels are low, the ship would be heard slightly above background. During rougher conditions, i.e. winds and/or rain, ship passage would not likely be heard. If vessels moving through Broughton Strait are not required to be accompanied by tugboats, sound levels may be lower than presented here.



**LEGEND:**

AIRBOURNE SOUND LEVELS FROM SHIPLOADING OPERATIONS ARE EXPECTED TO ATTENUATE TO THE CALM WEATHER BACKGROUND LEVEL OF 45DBA. (ASSESSED FROM MEASUREMENTS AT SECHLET, TRAIL BAY OPERATIONS).

- CLUXEWE RIVER
- ROAD
- SLAND H CHWAY
- POWERLINE

NOT FOR CONSTRUCTION DRAFT

10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

**Polaris**  
 MINERALS CORPORATION

**KLOHN CLIPPEN**

SCALE	0 1000 m
PROJECT	SOUND ASSESSMENT-TRAIL BAY
FILE	PREDICTED ORCA SHIPLOADER ACOUSTIC IMPACT
PROJECT No.	M09157 A01
NO.	7

**Table 2 Recorded Weather Conditions, April 27 to 29, 2004**

Date	Time	Average Wind Speed (m/s)	Temperature (°C)	Relative Humidity (%)	Barometric Pressure (hPa)
April 27, 2004	9:59	1.2	15.8	47.2	1013.6
April 27, 2004	11:27	3.8	16.6	36.2	1013.8
April 27, 2004	12:36	5.6	14.3	36.4	1012.6
April 27, 2004	13:33	4.4	10.7	61.6	1013.5
April 27, 2004	14:32	7.7	12.5	49.5	1012.0
April 27, 2004	16:26	4.3	13.7	45.7	1008.9
April 27, 2004	17:03	5.0	15.1	44.2	1011.2
April 27, 2004	20:40	2.4	13.5	40.6	1014.8
April 28, 2004	10:59	2.2	13.4	44.0	1022.3
April 28, 2004	11:32	4.0	13.6	49.4	1020.1
April 28, 2004	12:18	3.6	14.7	45.6	1021.6
April 29, 2004	8:37	0.5	15.2	47.9	1019.7
April 29, 2004	9:01	0.0	20.6	42.8	1019.8
April 29, 2004	9:28	0.6	19.1	42.6	1019.6
April 29, 2004	10:07	1.0	15.8	45.1	1019.7
April 29, 2004	13:19	0.6	21.4	39.2	1017.4

In addition to measurements taken from the bay, measurement points were also taken along the shoreline. For each measurement point, average sound levels in dBA were calculated and used to create a map with sound isopleths drawn on an air photo of Trail Bay, as presented in Figure 5. In this figure, the 45 dBA isopleth indicates the location where sound from the shiploading operation could not be detected with equipment at hand. In total, 36 points (data from 36 locations) were used to create the contour map. On the basis of this contouring, the maximum distance for sound levels to attenuate to background levels is 1480 m. It should be noted that this distance was established over open water with no attenuating features present such as the heavily wooded foreshore of the Project site.

## 6. SUMMARY AND CONCLUSIONS

The sound assessment conducted for the proposed Orca Sand & Gravel Project concludes that minimal impacts on humans are anticipated as a result of the sand and gravel loading facility in Broughton Strait. Predicted impacts are based on the sound level survey carried out at an existing, and effectively identical, sand and gravel loading facility at Trail Bay, BC, the results of which have been applied to the Broughton Strait location. The main conclusions are summarized as follows:

1. Sound levels due to the sand and gravel loading facility, while in use, will attenuate to calm weather background levels at a distance of 1480 m from source (the shiploader).
2. People at the campground, the lighthouse at Pulteney point, and Lady Ellen point, will not be exposed to sound levels above background due to sound generated by the loading facility.
3. Depending on travel path and weather conditions, sound levels due to ship movement through Broughton Strait may or may not be perceived above background levels from shoreline. Sound levels are not expected to be heard at more than 5 dBA above background.

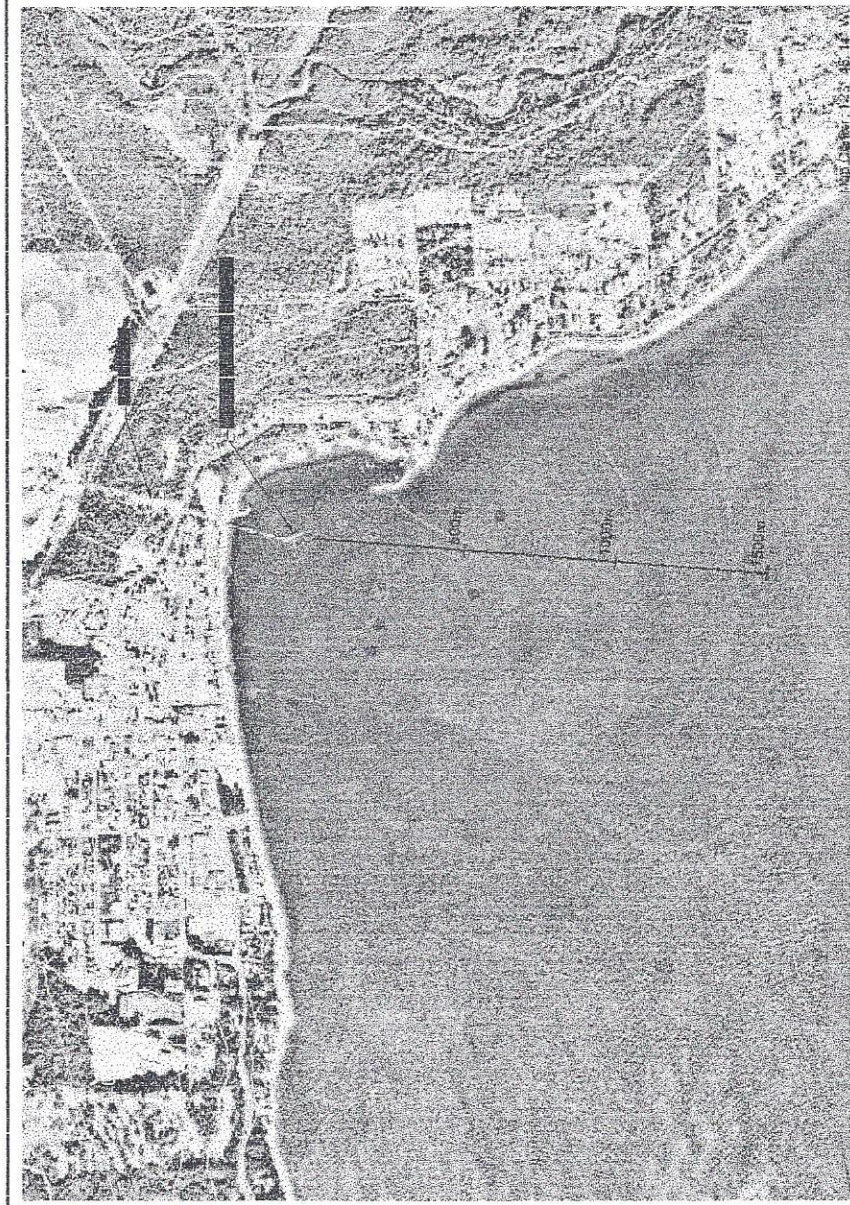
Yours truly,




**KLOHN CRIPPEN CONSULTANTS LTD.**

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Project Manager

TM:dl



- LEGEND**
-  AIRBOURNE SOUND LEVEL DUE TO SHIPLOADING (dBA)
  -  MEASUREMENT POINTS
  -  BACKGROUND MEASUREMENT POINT

- NOTES:**
1. BACKGROUND SOUND LEVEL (MID BAY) IS 45 dBA.
  2. SOUND LEVEL, APPROXIMATELY 20m FROM SOURCE IS 70 dBA.

NOT FOR CONSTRUCTION DRAFT

TO BE READ WITH LOCAL OFFICE REGS AND BYLAW



PROJECT NO. MCF187 A01

DATE: 14/01/2018

SCALE: 1:1000

PROJECT: SOUND ASSESSMENT-TRAIL BAY

TITLE: AIRBOURNE SOUND LEVELS DUE TO SHIPLOADING

### 3.3 Ship Sailing Noise Measurements

Sound level measurements of ship engine noise were obtained, using the procedure outlined in Section 2, as the Nelvana departed the area. The ship was accompanied by two tugboats, but moved completely by its own power. Measurements were taken from an approximately stationary point as the vessel weighed anchor and left the bay. Initially the Nelvana was 665 m northeast of the measurement location and at its closest point was 205 m approximately east. Ranges to the ship were continuously recorded with the laser range finder up to 1500 m, after which distances were estimated using calculated vessel speed estimated from the time/distance/bearing data from the range finder. Maximum and average sound levels were recorded at approximate one-minute intervals.

Figure 5, below, illustrates sound levels generated by ship movement over distance from the observation location. Average sound levels attenuate to a background of 45 dBA when the ship had moved to a distance of approximately 1500 m from the measuring location.