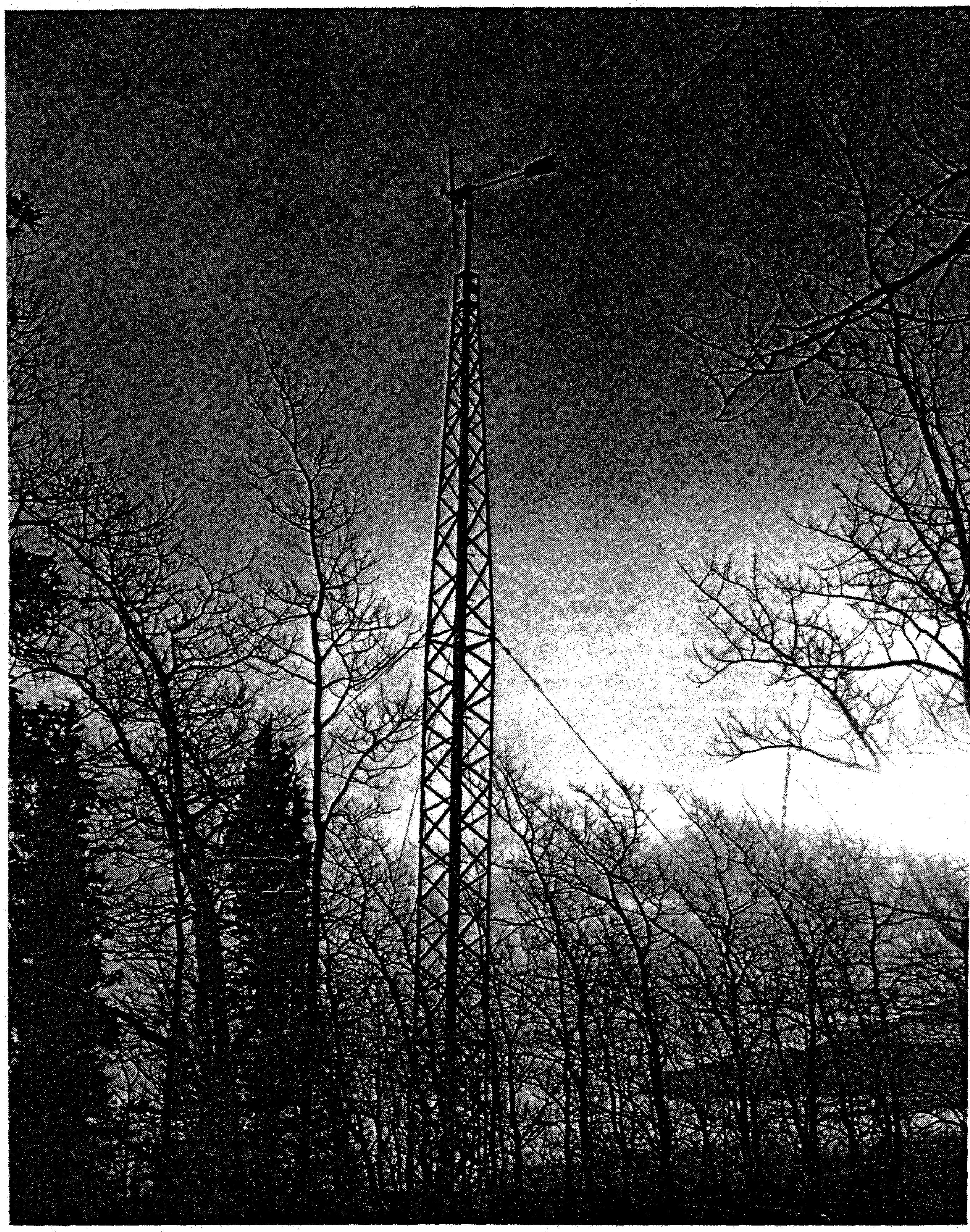
Remote Wind Generator

CREDA is a program which has been jointly funded by Energy, Mines and Resources, Canada and the Yukon Government, Department of Economic Development and Tourism. For more information or copies of reports contact the Energy and Mines Branch, Yukon Government, Box 2703, Whitehorse, Y1A 2C6.



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1. FOREWORD

The availability of secure and affordable energy supplies is a subject of national concern. Our primary energy sources are becoming more costly and less accessible. However, Canada has both the resources and technical expertise needed to develop renewable and alternative sources of energy.

The governments of Yukon and Canada have entered into a Conservation and Renewable Energy Demonstration Agreement as one means of pursuing this end. Cost shared by the territorial and federal governments, CREDA has a budget of $3.3 million and is dedicated to the development and demonstration of conservation and renewable energy technologies.

The objectives of CREDA are:

- To develop and demonstrate promising new technologies, which, when widely adopted, will exploit renewable resources, conserve energy and/or
  use energy more efficiently.
- To develop broad public awareness of the potential of renewable energy and conservation technology.
- To provide opportunities for the commercial application of the technologies.
- To create economic spin-off benefits for manufacturing, industry and commerce.
- To create employment in new or existing energy-related industries.

The wind energy project reported on in the following pages is an attempt to demonstrate the feasibility of installing a wind generator to charge batteries which supply electrical energy for a radio, stereo, mobile radio-telephone and some lights for a house in a remote location with no access to an interconnected grid. It is a renewable source of energy and can replace the use of expensive diesel fuel in a generator. The project will help increase the awareness of the potential of renewable energy in remote locations.

2. EXECUTIVE SUMMARY

In order to supply electricity to a remote residence near Haines Junction, Yukon, a 200 watt, 12 volt wind generator was mounted on a 18.3 m steel tower, placing it above the turbulence zone of the surrounding trees. The generator maintains the charge in two 6 volt nickel-cadmium batteries which in turn are connected to household circuits. Low voltage items such as television, stereo, some lights and a mobile radio-telephone are run from the batteries. By using a renewable form of energy, the need for a diesel generator, which would consume approximately 6.8 litre of diesel per day, is eliminated.

The wind generator system began operation in August 1984 and has proven to be a reliable source of power, which was previously unavailable in the remote location. It is a clean and efficient system, suitable to the limited electrical demands of the proponent.

3. Résumé pour l'exécutif

Dans le but de fournir de l'électricité à une résidence isolée, située près de Haines Junction au Yukon, on a procédé à l'installation d'une génératrice actionnée par le vent. Cette génératrice, d'une capacité de 200 watts et fournissant une tension de 12 volts, a été installée en haut d'une tour en acier de 18,3 m, soit au-dessus de la zone de turbulence des arbres avoisinants. La génératrice maintient la charge de deux accumulateurs au nickel-cadmium de 6 volts chacun sur lesquels sont branchés les différents circuits de la maison. Certains articles fonctionnant à basse tension, tels le téléviseur, le système de son, quelques lampes et un radio-téléphone portatif, sont branchés sur ces accumulateurs. En utilisant une forme d'énergie renouvelable, on a éliminé le besoin d'avoir recours à une génératrice au gas-oil qui consommerait environ 6,8 litres de carburant quotidiennement.

Le système en question a commencé à fonctionner en août 1984 et s'est averé une source d'énergie fiable, ce qui n'existait pas auparavant dans cet endroit isolé. C'est un système propre et efficace qui convient bien aux besoins en électricité limités du propriétaire.

4. INTRODUCTION

Mr. B. Liddle, in conjunction with the Canada/Yukon Conservation and Renewable Energy Demonstration program installed a wind generator to supply power for limited electrical needs in a remote site residence. A 220 watt, 12 volt generator was mounted on a steel tower, and is connected to two 6 volt batteries. The generator maintains the charge in the batteries which are connected to the household circuits. The electrical energy provided replaces propane lights.

As the remote location is approximately 25 km south of Haines Junction, Yukon, and is used as a residence and for the business location of Kluane Adventures from April to September, there is a need for an inexpensive and reliable source of power. The site for the project is ideal as the nearby mountain ranges and valleys help create windy conditions in the area on a consistent basis. It is located close to the Kathleen Lake Lodge and the Kluane National Park Campground at Kathleen Lake, and is both visible and accessible from the Haines Highway.

The application of a wind generator system means the proponent is able to use a renewable source of energy rather than an expensive non-renewable source in a fuel generator.

5. SYSTEM DESCRIPTION

5.1 Technical Details

The wind electric battery charger used in the project is a Wincharger, model number 1222H, which is a well-know, technically proven system and has been commercially available for years. It is the most efficient and practical means of providing wind electric power in remote locations where a limited amount of 12 volt electricity is required.

The wind charger has a 200 watt, 12 volt generator, which is connected to two 6 volt, 230 ampere hour, nickel-cadmium batteries. It starts charging in a 11 km/hour breeze and reaches its maximum charge of 14 amperes in a wind velocity of 37 km/hour. The two six foot propellers have a speed range of 270-900 RPM. The propeller begins charging the batteries at 260 RPM which corresponds to a generator speed of 260 RPM and a wind speed of 11 km/hour. Governing speed is reached at 700 RPM, which corresponds to a generator speed of 700 RPM and a wind speed of 37 km/hour.

At wind speeds in excess of 37 km/hour the air-brake governor flaps open automatically and spread the wind away from the propellors. The governor also acts as a fly wheel to maintain even propellor speed and eliminate vibrations in gusty wind conditions.

The following table gives the average usable kWh per month:

Average Wind Speed km/h	Average kWh per month
16	20
19	26
22	30

As the proponent is not asking for a lot of electrical energy from the system, only planning to use the system to operate a radio, stereo, mobile radio-telephone and a few lights, the wind generator is sufficient for his needs.

5.2 Installation

The generator was erected on top of a 16.5 metre (m) steel tower. As there was no suitable flat piece of land with proper clearance around the tower, the larger tower was used instead of the 6.0 m tower which comes with the wind charger. The extra height keeps it above the turbulence zone of the surrounding trees.

Due to the sometimes gusty and irrational wind conditions, special care was taken to ensure that the tower support was strong. Damaging winds of 96 kph have been known in the area. The tower was attached to a concrete base 1.5 m x 1.5 m x 1.5 m, with four supporting guy wires, each secured to 0.76 cubic metre of concrete buried six feet.

The tower is located on a hill approximately 18.0 m from the main dwelling. An electrical cable extends from the generator to a battery house, which is attached to the main dwelling. The control panel and voltage regulator are also located in the battery house.

6. PERFORMANCE

The system will be operated on a seasonal basis only, from April to September. It began operation in August 1984 and performed well during that fall. The proponent was able to use electricity consistent with his expectations.

The apparatus has withstood strong winds to date with no sign of strain. The cable brake running down the centre of the tower is kept "on" except during proper conditions. The risk of sudden high winds precludes the system's operation when no one is in residence.

The generator part requires a minimum of maintenance. The Wincharger's heavy duty, 4 pole 7½" diameter generators are built for long life and low maintenance. The ball bearings are greased and sealed. The enclosed collector ring provides complete protection against dust, frost and ice.

The batteries, however, do need to be checked regularly for the charge level. They should not be allowed to drop their charge or freeze during cold weather. They should be stored fully charged in a warm place when not in use.

The life of the system is open-ended, although major maintenance to the generator may be expected after 15 years of operation.

7. BUDGET REVIEW

	Budget
Wind Charger	$ 795.00
Batteries	424.00
Tower	150.00
Voltage Regulator	50.00
Shipping	150.00
Miscellaneous Hardware	252.00
Labour	500.00
	$2,321.00

Wind Charger	$ 854.00
Batteries	300.00
Tower Assembly	250.00
Tower Installation	400.00
Voltage Regulator	110.00
Cement	150.00
Wire	102.00
Shipping	116.56
Labour	118.50
	$2,410.06

Although the proponent initially submitted an estimate cost of $1,300, it was later revised to $2,300 to include freight, labour, and miscellaneous hardware. The actual cost of $2,400 was very close to the revised estimate. Costs were kept to a minimum through volunteer labour or local labour at a nominal cost. The tower itself was salvaged from scrap metal.

8. ECONOMIC BENEFITS

The economic benefits are best evaluated by looking at the alternatives. One consideration as an alternative was a diesel generator which would be left running all the time but would supply much more power. It was estimated that such a generator would have a daily fuel consumption of about 6.8 litres and, at $.45 litre, the cost of running it for the seven month season would be $640. With an initial cost of about $1,000 for the generator, it would take two years to equal the cost of the wind charger. Thereafter the wind charger becomes a money-saving proposition. Although the seasonal operating costs of a diesel generator are not that high, fuel costs are subject to inflation.

A second alternative is a gasoline generator used on an occasional basis. A small 600 watt generator running 10 hours per week would consume 150 litres per seven month season, for about $80. Assuming an initial cost of $600, and an annual inflation rate of eight percent on maintenance and operating costs, it would take eight to ten years to equal the cost of the wind generator.

It is difficult to give an accurate comparison of the wind generator to a hypothetical situation as there are other factors involved, such as number of batteries required, or whether a battery charger would be used. A battery charger used in conjunction with a fuel generator run on an occasional basis is the most efficient way to use a fuel generator.

However, the most important point is that the wind charger is the most suitable and efficient system for the proponent's situation. It is clean, free of continual operating and maintenance costs, and it delivers the required energy to suit the needs of the proponent. A fuel generator could not be used efficiently to supply the small amount of power needed. It would have on-going costs, would require more maintenance and the handling and storage of non-renewable fuels. The reliability, convenience and quietness of the wind charger are also benefits.

9. POTENTIAL FOR REPLICATION

A similar small electrical wind energy system is very practical for anyone with a cabin or home in a remote location where electricity would otherwise be unavailable. The system has an optimum wind speed requirement of 11 to 37 km/hr, which is probably easily met in many places.

Wind power generation and storage technology is relatively well-established for small and medium scale units (less than 50 kW) outside of Yukon. For example, over 30 wind turbines in the 1 - 10 kW range have been operating in the bush regions of Alaska over the past six years. Some technical problems such as blade icing, lubrication freeze-ups and storm damage have been largely overcome. However, longer term reliability has yet to be established.[1]

The most common use of wind energy in Canada is small capacity (200 W to 2 kW) windmills which provide electricity for situations similar to the one described in this project, i.e. limited use and remote locations. Larger windmills can provide the full electrical load for a home or community or feed into a grid, but, because of fluctuations in wind energy over time, it is necessary to have stand-by sources such as a diesel generator, storage batteries or grid connection.

1. Marvin Shaffer and Associates Ltd., Yukon Energy Inventory and Utilization Review, 1983.

TABLE 1

Mean Monthly and Annual Wind Speed (km/hr) and Prevailing Direction

Station	Period of Record	Station Elevation	Anemometer Elevation	Mean Wind Speed and Prevailing Direction												
				Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann.
Aishihik A.	1955-80	966	11.3	5.8 S	8.3 S	8.9 S	10.9 S	14.0 S	12.1 S	11.4 S	10.8 S	10.6 S	11.1 S	8.6 NNE	6.8 S	9.9 S
Beaver Creek	1969-80	663	10.1	1.9 S	2.6 S	4.1 S	5.6 NW	6.2 NW	5.8 NW	4.9 NW	4.7 NW	4.4 NW	3.5 NW	2.4 S	1.8 S	4.0 NW
Burwash A.	1966-80	799	10.1	7.1 WNW	10.5 WNW	10.3 WNW	15.5 ESE	16.2 ESE	13.7 ESE	12.6 ESE	12.5 ESE	14.4 SE	15.2 WNW	11.4 WNW	8.5 WNW	12.3 ESE
Dawson	1955-80	320	13.4	5.2 SW	7.0 SW	7.2 SW	8.4 N	7.6 N	6.5 SW	5.9 SW	5.5 SW	5.8 SW	8.1 N	6.4 SW	6.1 SW	6.6 SW
Dawson A.	1976-80	369	11.0	1.5 ENE	1.7 SW	3.6 E	5.9 E	6.8 E	5.4 WSW	4.1 SW	4.2 E	4.3 ENE	3.2 E	2.0 ENE	2.0 SW	3.7 E
Faro	1972-80	694	10.1	5.2 SE	6.2 SE	7.9 SE	9.2 SE	9.8 SE	9.8 SE	9.3 NW	7.6 NW	7.7 SE	8.0 SE	6.1 SE	5.4 SE	7.7 SE
Haines Junction	1963-80	599	10.1	4.1 NE	5.5 NE	6.3 NW	7.8 NW	9.2 SW	9.3 SW	7.7 NW	6.7 NW	5.6 NW	5.2 NE	4.7 NE	4.2 NE	6.4 SW
Kluane Lake	1974-80	786	10.1	6.0 SE	7.8 SW	8.4 SW	9.6 SW	9.3 SW	8.9 SW	8.2 SW	9.4 SW	9.9 E	9.9 SE	11.0 SE	8.4 E	8.9 SW
Mayo	1955-80	504	10.1	2.6 N	5.8 NE	7.5 NE	8.6 NE	7.9 NE	6.6 SW	5.4 SW	5.0 NE	6.1 NE	7.1 NE	4.4 NE	4.0 NE	5.9 NE
Mayo A	1963-80	504	10.1	4.0 N	6.0 N	8.8 N	8.8 N	7.8 N	5.7 N	4.3 N	4.3 N	6.1 N	9.7 N	5.2 NNE	4.5 N	6.3 N
Snag A	1955-80	587	10.1	2.2 E	3.8 E	5.7 NW	7.4 NW	8.3 NW	7.8 NW	6.7 NW	6.2 E	6.3 NW	5.8 NW	3.7 NW	2.6 SW	5.5 NW
Teslin A	1955-80	705	10.1	5.2 E	6.3 E	7.1 E	8.2 S	8.9 S	8.9 S	8.7 S	7.9 S	7.8 NE	9.3 NE	8.9 ENE	6.6 ENE	7.8 E
Watson Lake A.	1955-80	689	10.1	3.9 WNW	5.5 W	8.6 ESE	10.9 ESE	11.4 W	11.4 W	10.5 W	9.6 W	9.7 ESE	10.1 ESE	5.8 WNW	4.1 WNW	8.5 W
Whitehorse A	1955-80	703	10.1	12.9 SSE	14.9 SSE	14.3 SSE	14.3 SE	14.4 SE	12.8 SE	12.4 SE	12.4 SE	13.8 SSE	16.4 SSE	15.7 S	14.5 S	14.1 SSE

It is impossible to meaningfully define and estimate the total energy potential of wind energy in the Yukon. There are a number of factors affecting the electrical energy potential from a given wind generation site.[2] Most important is the average wind speed and the frequency with which certain wind speeds are attained. Wind speed and frequency determine the potential of a site. Prevailing wind direction is more important in site selection than in determining the potential of a site.

However, various sets of data are available from different sources. Table 1 gives data from the Atmospheric Environment Service on mean monthly and annual wind speed direction and frequency for 14 sites around the Yukon from 1955 to 1980. The Alberta Research Council developed data, shown in Tables 2 and 3, for four Yukon sites from 1967 to 1976 on wind speed and frequency, and the potential energy estimates. A third set of data was taken through the G nada/Yukon CREDA on two demonstration locations, Destruction Bay and Old Crow. This was done for a one or two year period. Appendix A shows data collected at Destruction Bay by a Wind Histogram Recorder. No results are available for Old Crow; the equipment has been turned over to Yukon Electrical Co. Ltd.

To summarize the wind data charts, only three sites have average annual wind speeds of about 10 km/hr or more - Aishihik, Whitehorse and Burwash Landing. The average wind speed for these locations are on the lower end of range considered suitable for wind power generation. Generally the

2. Ibid.

TABLE 2

Wind Frequency for Selected Yukon Locations (1967-76)

Percent of time when wind speed greater than V.

Wind Speed (v)	Location: Whitehorse	Dawson	Watson Lake	Burwash
5	74.1	50.4	47.6	62.7
10	56.7	20.3	26.9	46.0
15	39.5	11.4	15.9	33.9
20	24.4	4.9	9.0	22.1
25	11.6	2.5	4.0	13.0
30	4.1	0.7	1.5	6.6
35	1.1	0.1	0.4	3.1
40	0.4	0.0	0.1	1.6
45	0.1	0.0	0.0	0.8
50	0.0	0.0	0.0	0.4
55	0.0	0.0	0.0	0.2
60	0.0	0.0	0.0	0.1
Average Wind Speed (km/hr)	13.0	6.8	7.5	11.6

TABLE 3

Mean Wind Energy From All Directions by Month 1967-76: Selected Yukon Locations

(MJ/m^2 of rotor area)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Whitehorse	126.9	174.8	124.2	116.0	112.7	74.5	69.7	72.7	115.6	143.9	174.4	157.0	1462.3
Dawson	25.7	56.8	45.3	58.3	63.4	20.1	18.4	16.9	21.4	47.5	30.0	35.5	412.4
Watson Lake	18.5	25.4	53.9	70.6	75.6	75.3	58.3	47.2	58.7	62.1	18.3	12.8	576.7
Burwash	63.8	129.2	102.6	225.5	218.4	126.3	109.7	115.7	164.6	184.4	153.7	140.1	1734.8

southwestern Yukon, which is exposed to southerly winds, has the best potential. The winter months tend to be less windy, although the drop in energy availability is not as great as it would be with solar energy.

Electrical service tariffs are given in Table 4 for communities which have wind speed data and which have the most potential for wind generation. In communities where electrical rates are high a wind generation system could well be a viable option.

Although the data given does not lead one to believe that the potential is great for wind energy systems there are a some points which must be kept in mind. Wind power is a reliable source of energy in remote locations where electricity would otherwise be unavailable. Its value in these situations cannot be underestimated. Wind power can be used in conjunction with the grid system whereby diesel generators could supply what the wind cannot. A wind system can assist a diesel generator in two ways: (a) mechanical load-sharing whereby the wind turbine helps turn the shaft of the diesel engine, reducing the amount of fuel consumed; or (b) electrical load-sharing whereby the wind turbine generates electricity which supplements that generated by the diesel. A Toronto Island project demonstrated that the mechanical load-sharing can save more diesel fuel than electrical load-sharing. Wind energy is a renewable source of energy and its use, even on a limited scale, can help foster self-reliance and reduce our dependence on expensive non-renewable diesel fuels.

TABLE 4

ELECTRICAL SERVICE TARIFFS

Residential Rate c/kWh

kWh	Whitehorse	Haines Junction	Destruction Bay & Burwash Ldg.	Champagne/Aishihik	Old Crow
0 - 200	7.2	15.1	27.2	15.1	All kWh
201 - 500	6.7	14.0	24.7	14.0	40.3
501+	6.3	10.7	19.3	10.7	

Commercial Rates c/kWh

kWh	Whitehorse	Haines Junction	Destruction Bay & Burwash Ldg.	Champagne/Aishihik	Old Crow
0 - 200	8.6	22.3	26.0	--	All kWh
201 - 400	7.5	17.9	23.0	--	50.7
401+	6.3	14.7	18.3	--	

For commercial users total energy charges are based on kW demand at an instantaneous moment. The bill is determined by the peak kW demand registered on the meter multiplied by the number of kWh used in a month. In fact, very few commercial users go beyond the 201 - 400 kWh rate.

10. CONCLUSIONS

The wind charger system is a clean, dependable source of energy. It requires very little in the way of maintenance and eliminates the problems of supplying and storing fuels. It is free from air or noise pollution. Its capacity can be increased easily by additional batteries to increase amp-hour capacity or by installing a larger generator head.

At present there are no wind energy systems in the entire Kluane area, yet this section of the Yukon is notoriously windy. It is hoped that the successful demonstration of this practical system will encourage others in remote locations to install a wind energy system and thereby invest in a sound ecological answer to energy needs.

Electrical power produced by wind, an inexhaustible, non-polluting and free energy source, is a potentially cost-competitive alternative for many remote locations.

Appendix A

Introduction

This site report is an extract from the T E S Limited monthly report submitted to the Scientific Authority at the N.R.C., and covers work performed at T E S Limited during the period from January 31, 1983 to February 28, 1983.

Data included is that received at T E S Limited prior to February 15, 1983. Sites are considered to be behind schedule if by the cut off date of the mid month, T E S Limited has not received data up to the previous mid month. In these cases a site report will not be generated. Data received prior to February 15 is included in this report.

Destruction Bay, Yukon

CUT IN WIND SPEED 6.60
CUT OUT WIND SPEED 15.65

YEAR: 1983

APPROX MONTH OF RECORD	TOTAL TIME IN PERIOD HR	AVERAGE WIND SPEED M/S	K	ESTIMATED PERFORMANCE (NO DOWN TIME): AVAIL. WIND ENERGY BETZ LIMIT KW-HR	ESTIMATED PERFORMANCE (NO DOWN TIME): EST. GEN. TIME HR	ESTIMATED PERFORMANCE (NO DOWN TIME): EST. OUTPUT ENERGY KW-HR	ACTUAL PERFORMANCE: DOWN TIME HR	ACTUAL PERFORMANCE: STOP TIME HR	ACTUAL PERFORMANCE: IDLE TIME HR	ACTUAL PERFORMANCE: ACTUAL GEN. TIME HR	ACTUAL PERFORMANCE: ACTUAL INPUT ENERGY KW-HR	ACTUAL PERFORMANCE: ACTUAL OUTPUT ENERGY KW-HR	ESTIMATED OUTPUT ENERGY FROM GENERATE ONLY HISTOGRAM DATA KW-HR	ACTUAL OUTPUT % OF AVAIL. WIND ENERGY %	ACTUAL OUTPUT % OF EST. OUTPUT ENERGY NO DOWN TIME %	ACTUAL GEN % OF EST. GEN. TIME %	DOWN TIME % OF TOTAL TIME PERIOD %	ESTIMATED OUTPUT ENERGY NO DOWN TIME NO CUTOUT WIND SPEED KW-HR
JAN.*1	661.9	3.1	1.08	7522	92.7	1557.6												1818.9
FEB.																		
MAR.																		
APR.																		
MAY																		
JUNE																		
JULY																		
AUG.																		
SEPT.																		
OCT.																		
NOV.																		
DEC.																		

Notes: *1 Period of December 16, 1982 to January 19, 1983 - Total time short 7.5 days.

Destruction Bay, Yukon

CUT IN WIND SPEED 6.60
CUT OUT WIND SPEED 15.65

YEAR: 1982				ESTIMATED PERFORMANCE (NO DOWN TIME)			ACTUAL PERFORMANCE						ESTIMATED OUTPUT ENERGY FROM GENERATE ONLY HISTOGRAM DATA	ACTUAL OUTPUT % OF AVAIL. WIND ENERGY	ACTUAL OUTPUT % OF EST. OUTPUT ENERGY NO DOWN TIME	ACTUAL GEN % OF EST. GEN. TIME	DOWN TIME % OF TOTAL TIME PERIOD	ESTIMATED OUTPUT ENERGY NO DOWN TIME NO CUTOUT WIND SPEED
APPROX MONTH OF RECORD	TOTAL TIME IN PERIOD HR	AVERAGE WIND SPEED M/S	K	AVAIL. WIND ENERGY BETZ LIMIT KW-HR	EST. GEN. TIME HR	EST. OUTPUT ENERGY KW-HR	DOWN TIME HR	STOP TIME HR	IDLE TIME HR	ACTUAL GEN. TIME HR	ACTUAL INPUT ENERGY KW-HR	ACTUAL OUTPUT ENERGY KW-HR	KW-HR	%	%	%	%	KW-HR
JAN.*2	647.5	4.1	.89	14530	126.1	2211.0												3184.6
FEB.*1																		
MAR.	1825.6	3.4	1.39	14592	309.9	3354.7												3479.2
APR.	427.0	6.0	1.50	12332	170.1	2423.9												2871.4
MAY	769.1	6.5	1.84	21966	356.5	5402.5												6010.8
JUNE	550.5	5.8	1.69	12376	212.8	2845.1												3181.5
JULY	705.2	7.2	2.31	24505	391.3	6733.4												7205.5
AUG.*3																		
SEPT.*4	1506.0	5.3	1.39	30388	443.7	6007.9												7158.8
OCT. *5	644.9	6.6	1.67	19527	236.3	4514.3												5435.7
NOV.	836.1	5.6	1.58	16988	288.0	3564.9												4108.8
DEC.	697.4	3.9	1.18	10333	118.7	2290.6												2578.9

NOTES:
*1 The data for this month is included in March
*2 Data missing 5 days - recorder must have been zeroed on December 23, 1981
*3 Data included in September data
*4 Includes data from August
*5 Period of September 17 to October 15

MONTHLY AVERAGE WIND SPEED
AND WEIBULL PARAMETER "K"
AS CALCULATED FROM CONTINUOUSLY
RUNNING WIND HISTOGRAM RECORDER

SITE NAME: Destruction Bay

YEAR: 1983

APPROXIMATE MONTH OF RECORD	TOTAL TIME IN PERIOD HOURS	AVERAGE WIND SPEED M/S	WEIBULL PARAMETER "K"
January *1	661.9	3.1	1.08
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			
YEAR			

Notes: *1 Total time short by 7.5 days.

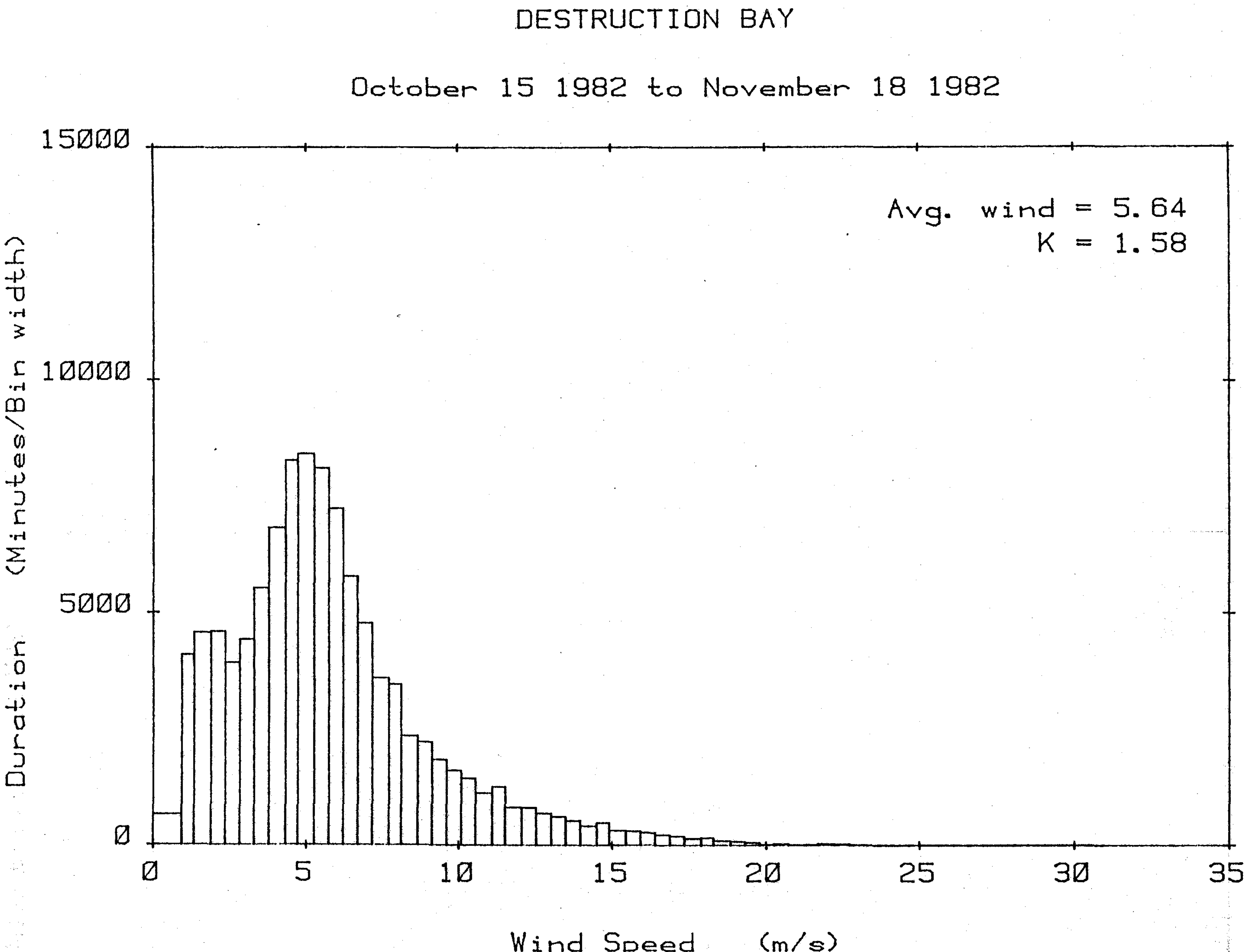
MONTHLY AVERAGE WIND SPEED
AND WEIBULL PARAMETER "K"
AS CALCULATED FROM CONTINUOUSLY
RUNNING WIND HISTOGRAM RECORDER

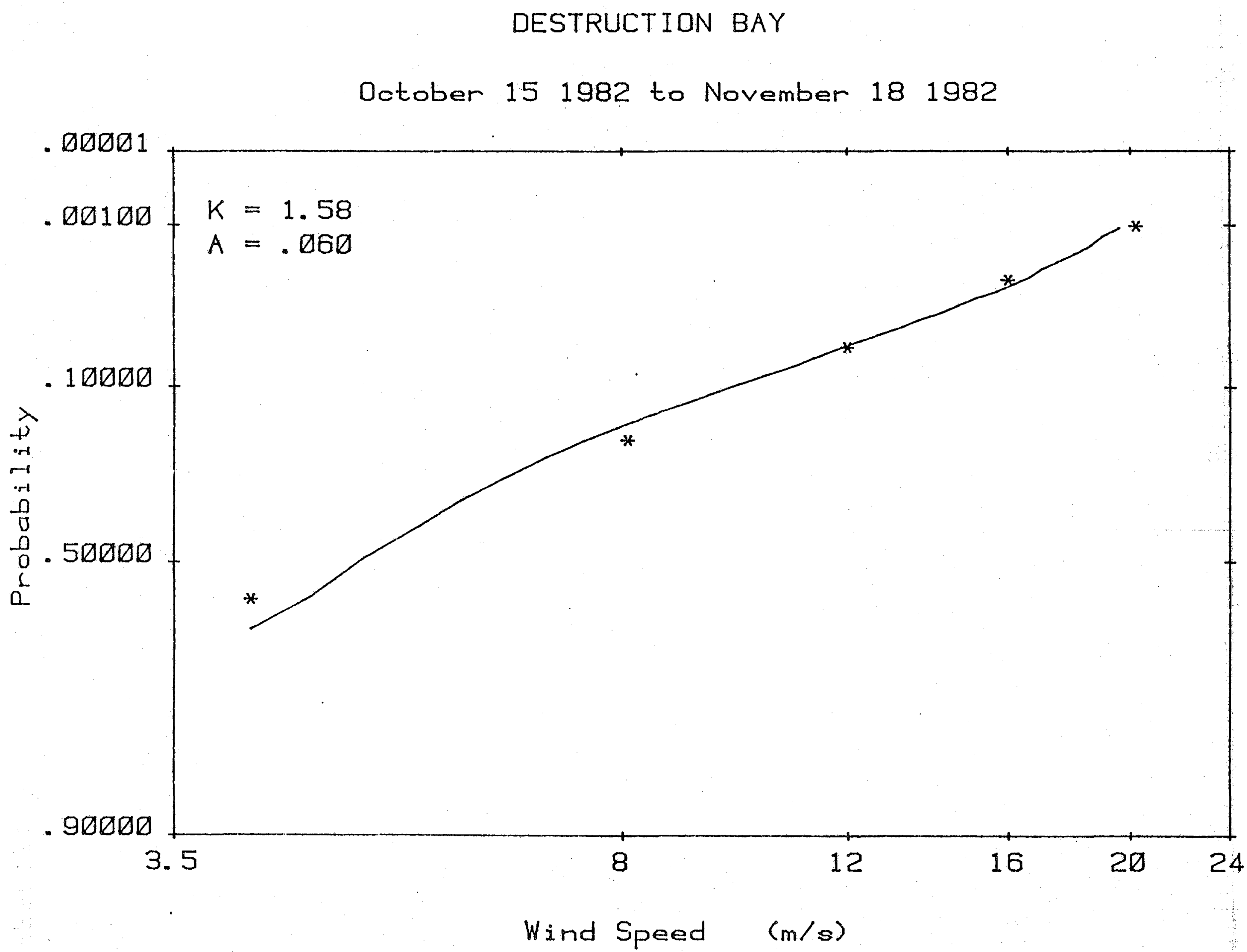
SITE NAME: Destruction Bay

YEAR: 1982

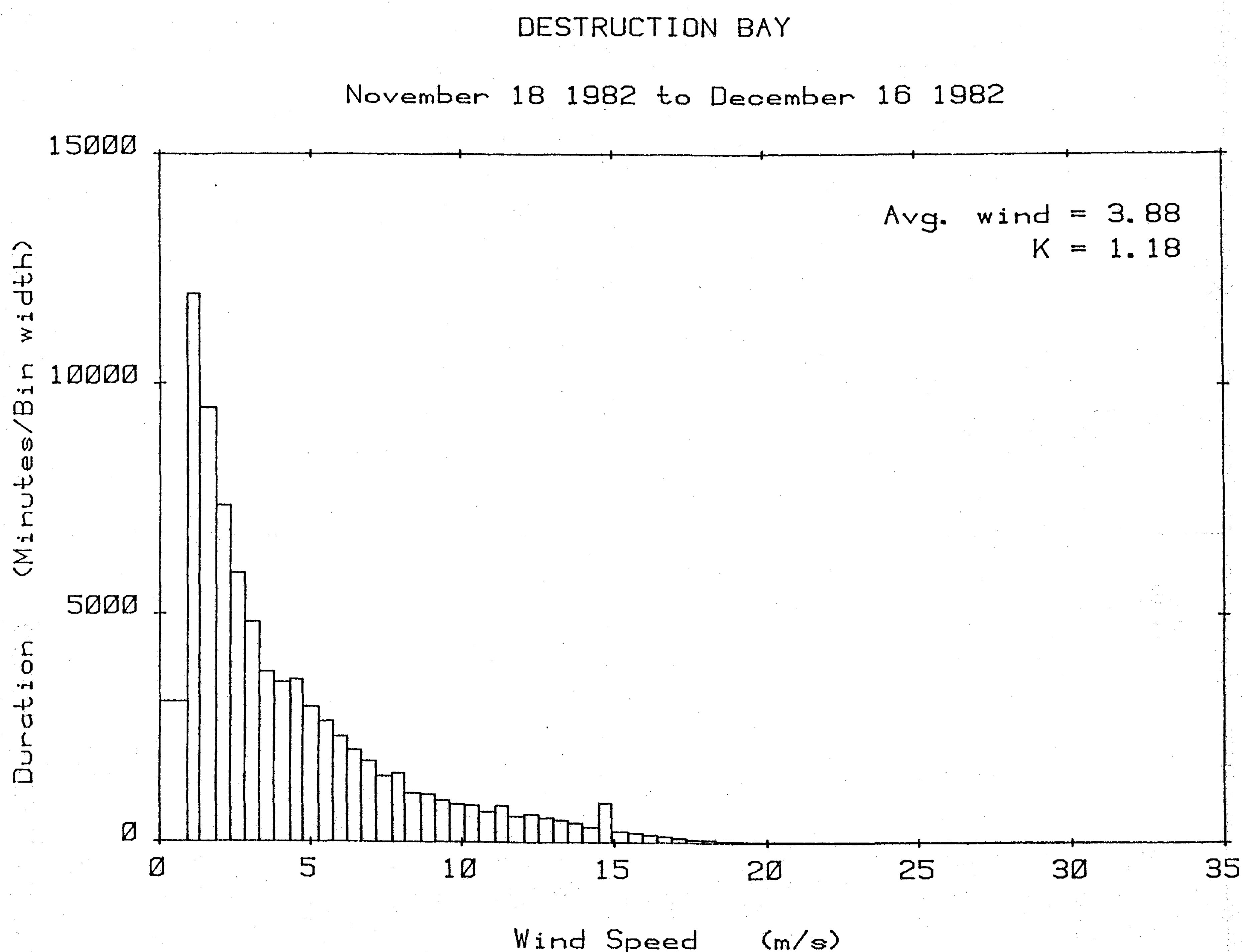
APPROXIMATE MONTH OF RECORD	TOTAL TIME IN PERIOD HOURS	AVERAGE WIND SPEED M/S	WEIBULL PARAMETER "K"
January *2	467.5	4.1	0.89
February *1			
March	1825.6	3.4	1.39
April	427.0	6.0	1.50
May	769.1	6.5	1.84
June	550.5	5.8	1.69
July	705.2	7.2	2.31
August *3			
September *4	1506.0	5.3	1.39
October *5	644.9	6.6	1.67
November	836.1	5.6	1.58
December	697.4	3.9	1.18
YEAR			

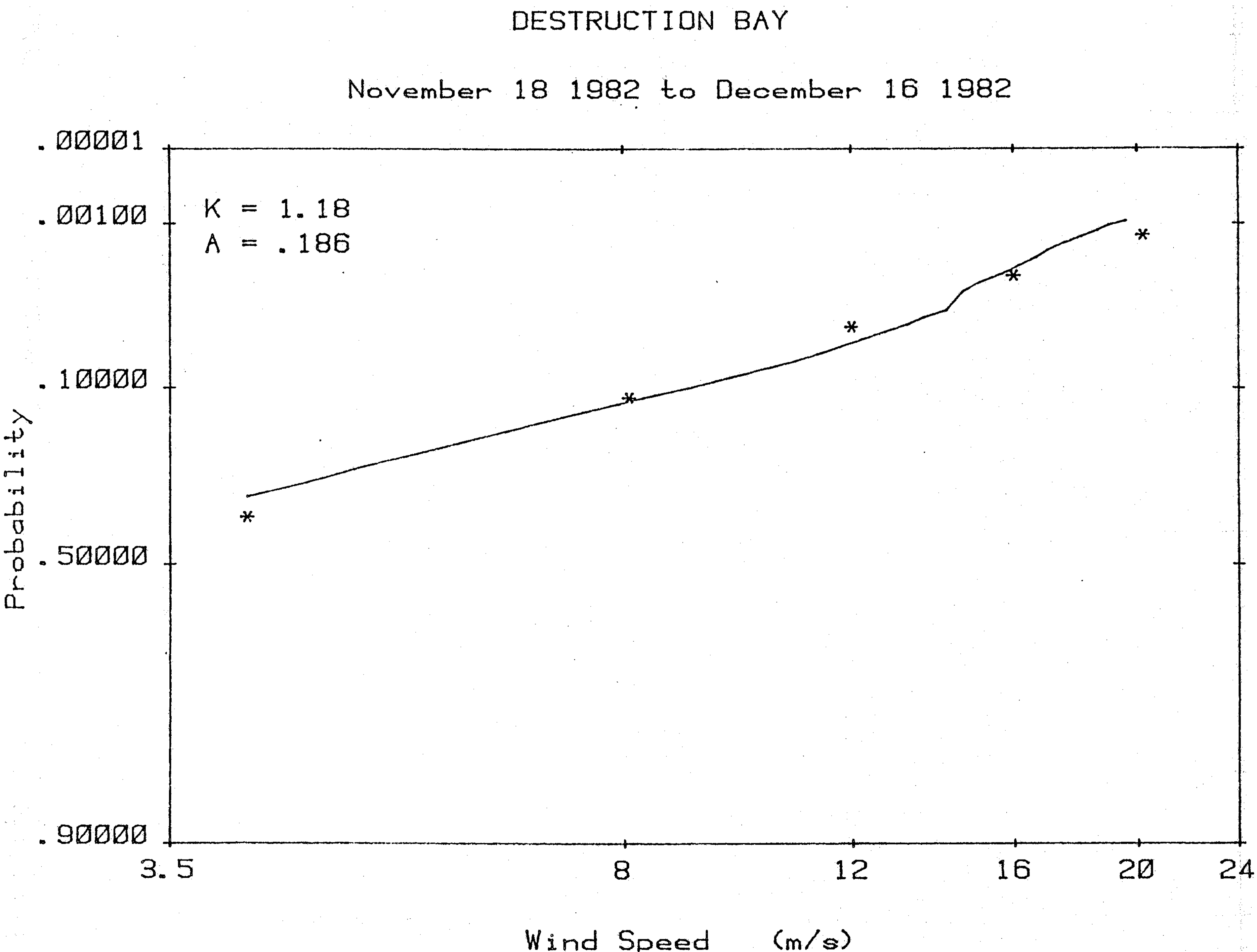
Notes: *1 Data is included in the month of March
*2 Data is missing 5 days in the total time
*3 Data is included in the results for September
*4 Includes data form August
*5 Period of September 17 to October 15


DESTRUCTION BAY
October 15 1982 to November 18 1982
Avg. wind = 5.64
K = 1.58
15000
10000
5000
0
Duration (Minutes/Bin width)
0
5
10
15
20
25
30
35
Wind Speed (m/s)



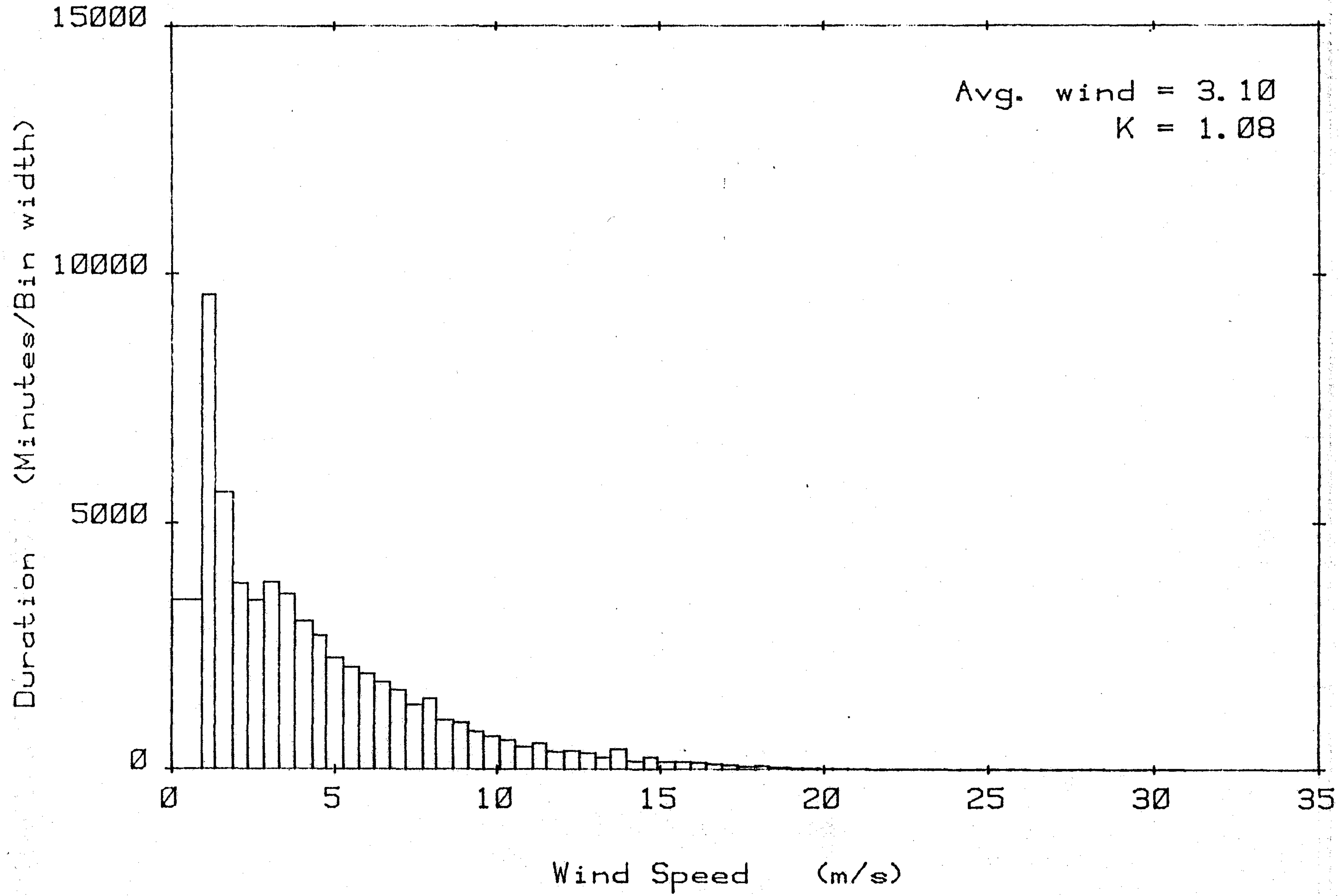
DESTRUCTION BAY
October 15 1982 to November 18 1982
K = 1.58
A = .060
.00001
.00100
.10000
.50000
.90000
Probability
3.5
8
12
16
20
24
Wind Speed (m/s)

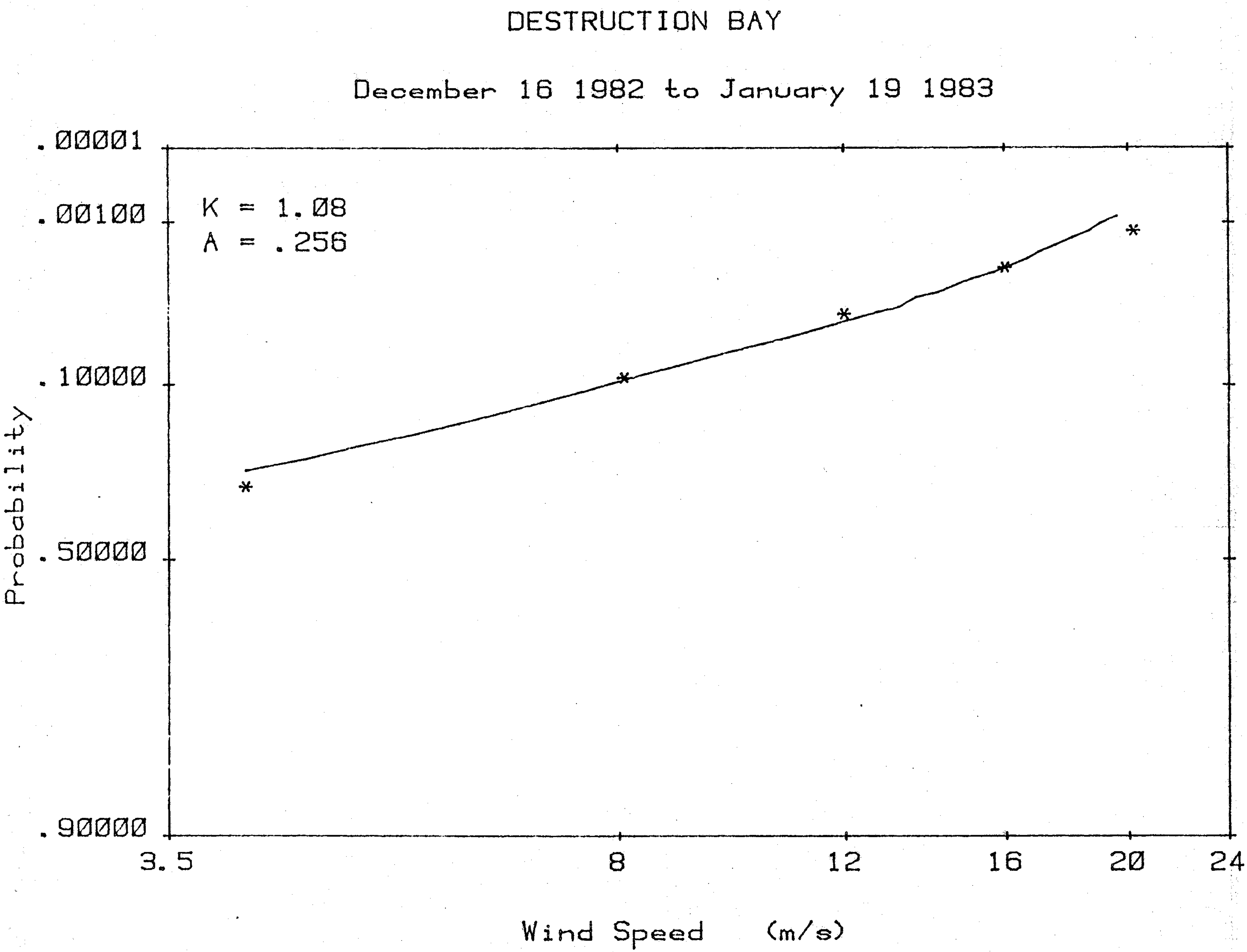

DESTRUCTION BAY
November 18 1982 to December 16 1982
15000
10000
5000
0
Duration (Minutes/Bin width)
Avg. wind = 3.88
K = 1.18
0
5
10
15
20
25
30
35
Wind Speed (m/s)


DESTRUCTION BAY
November 18 1982 to December 16 1982
K = 1.18
A = .186
.00001
.00100
.10000
.50000
.90000
Probability
3.5
8
12
16
20
24
Wind Speed (m/s)

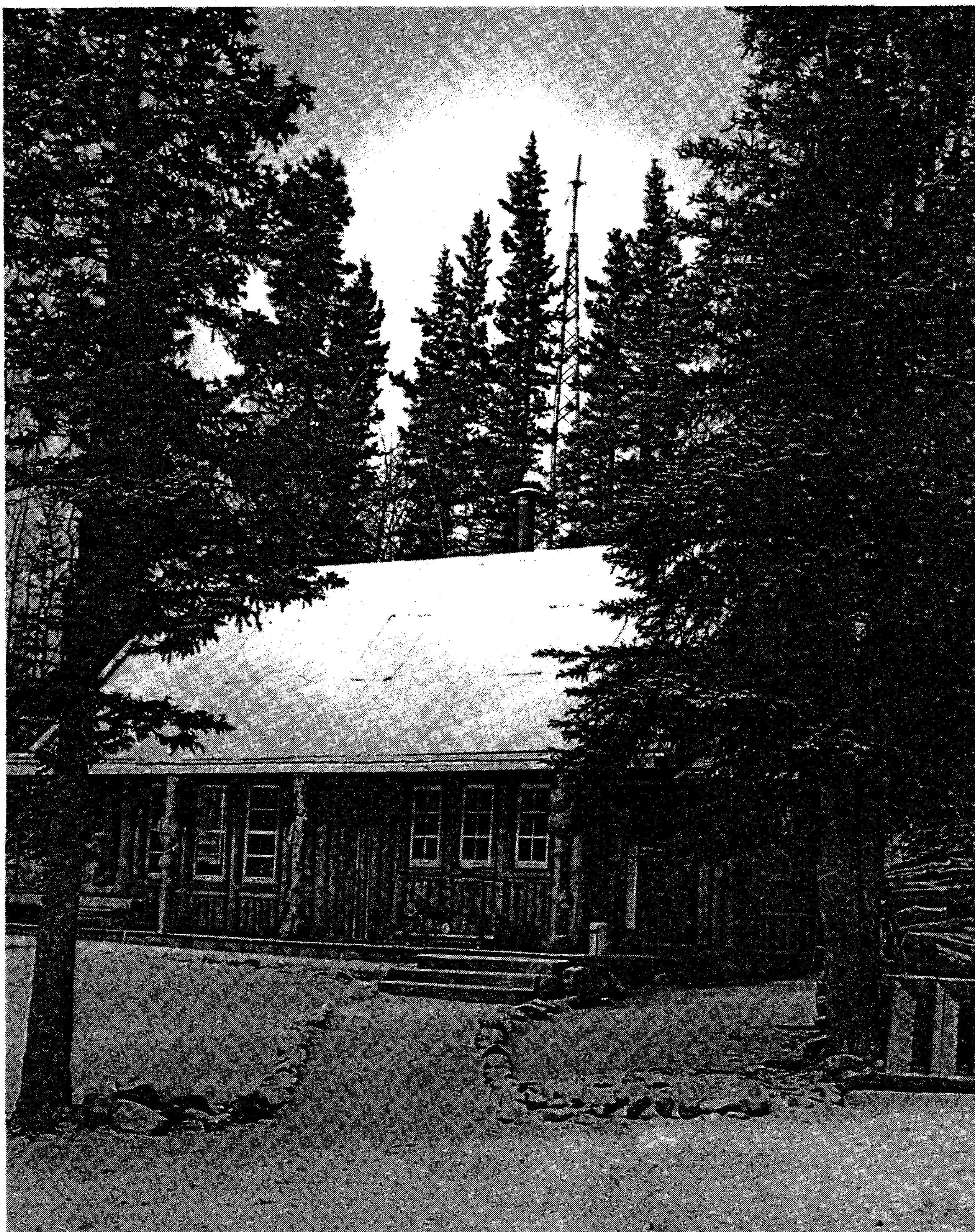
DESTRUCTION BAY

December 16 1982 to January 19 1983





DESTRUCTION BAY
December 16 1982 to January 19 1983
K = 1.08
A = .256
.00001
.00100
.10000
.50000
.90000
Probability
3.5
8
12
16
20
24
Wind Speed (m/s)



Energy, Mines and Resources Canada / Énergie, Mines et Ressources Canada

Yukon
Department of Economic Development and Tourism

REMOTE WIND GENERATOR

Final Project Summary

Canada/Yukon Conservation and Renewable Energy Demonstration Program

Project No. 3766-4-7	**Date:** March, 1985	**Sectors:** Residential
Project Locations: Haines Junction, Yukon	**Technology:** Wind Power	**Jurisdiction:** Yukon
Project Manager: Brent Liddle	**Status:** Complete	**Simple Payback:** 2 years

Purpose:

This project is designed to use wind to provide electrical energy for a remote location summer residence. The wind charger is connected to two batteries, which supply power for small household appliances such as television, stereo, some lights and a mobile radio-telephone.

Description:

A wind electric battery charger was mounted on a 18.3 m steel tower secured in a concrete pad. The wind charger is located 20.0 m from the battery house, adjacent to the residence.

Contributors:

Applicant:	$1,200
Canada/Yukon:	1,200
	$2,400

Demonstrated Benefits:

Using wind as a renewable source of energy, the project eliminates the need to purchase and operate a diesel generated lighting plant, which would use approximately 6.8 litres of fuel per day.

Further Information

Mr. Brent Liddle, Box 5334, Haines Junction, Yukon, (403)634-2251.
Mr. David Arseneault, Information Officer, Energy and Mines Branch, Economic Development & Tourism, Government of Yukon, Box 2703, Whitehorse, Yukon, (403)667-5384.

Economic Analysis:

Cost of wind generator system installed	$2,400.00
Cost of diesel generator (approximately)	1,000.00
Seasonal cost of 6.8 litres of diesel per day @$.454 l	640.00

Technical Details:

A 200 watt, 12 volt wind electric charger is connected to two 6 volt nickel-cadmium batteries. The wind generator was erected on a 18.3 m steel tower, placing it above the turbulence zone of surrounding trees. The generator maintains a charge in the batteries which are connected to household circuits. DC appliances are used, eliminating the need for an inverter to change to AC current.