

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

POWER AND TRANSMISSION DEVELOPMENT DIVISION

CIVIL INVESTIGATIONS BRANCH

**JERVIS BAY
NUCLEAR POWER STATION PROJECT
INVESTIGATIONS
AT SITE J.S1-SCOTTISH ROCKS**

OFFICIAL USE ONLY

JUNE, 1970

Part 1 of this Report has been prepared by
J.P. MacGregor, Engineering Geologist.

Part 2 of the Report has been prepared by
A.N. Lamb, Engineer.

Part 3 of the Report has been prepared by
C.K. McKimmon, Engineer.

**C.G. Coulter
Engineer**

We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche.

SUMMARY

This Report presents the results of foundation and hydrographic investigations carried out in 1969 within an area (designated Site J.S1) close to Scottish Rocks on the southern side of Jervis Bay to determine the suitability of this area for siting a 500 MW nuclear power station. During the course of the investigations, the decision was made to adopt an alternative site in the area of Murray's Beach (designated Site J.S2) and the work on the Scottish Rocks site was curtailed.

Sufficient drilling and geophysical work was completed at the Scottish Rocks site to permit the preparation of a contour plan of rock surface levels and selection of the most favourable area for siting the station having regard for foundation conditions. Sufficient hydrographic work was carried out to show that a satisfactory cooling water system could be developed economically.

On the basis of the results obtained, a schematic station layout was prepared and is shown on Figure 11.

CONTENTS

	<u>Page</u>
INTRODUCTION	5
<u>PART 1 - GEOLOGICAL INVESTIGATIONS</u>	
1. TOPOGRAPHY	7
2. REGIONAL GEOLOGY	7
3. PREVIOUS INVESTIGATIONS	7
4. PRESENT INVESTIGATIONS	9
4.1 Geological Mapping	9
4.2 Auger Drilling and Cone Testing	9
4.3 Diamond Drilling	9
4.4 Geophysical Surveys	9
4.41 Seismic Survey	9
4.42 Sparker Survey	9
4.5 Laboratory Testing	9
5. GENERAL GEOLOGY	10
5.1 Overburden	10
5.2 Bedrock	10
5.3 Structure	11
6. ENGINEERING PROPERTIES OF MATERIALS	11
6.1 Sand	11
6.2 Sandstone	11
7. LEVEL OF SOUND BEDROCK	12
8. CONCLUSIONS	13
9. REFERENCES	14
<u>PART 2 - HYDROGRAPHIC INVESTIGATIONS</u>	
1. INTRODUCTION	15
2. HYDROGRAPHIC SURVEY	15
3. TIDES	16
4. WATER LEVELS ON SCOTTISH ROCKS	16
5. CURRENTS	16
5.1 Description of Observations	16
5.2 Results of Observations	16
5.3 Conclusions	18
<u>PART 3 - SITE LAYOUT</u>	
	20

APPENDICES

APPENDIX A	Bedrock Topography in South-Eastern Jervis Bay
" B	Laboratory Testing of Samples
" C	Summary of Drilling
" D	Geological Logs of Drill Holes
" E	Report on Hydrographic Survey - Darling Road, Jervis Bay
" F	Water Research Laboratory Waves on Jervis Bay - Progress Report No. 1
" G	Water Research Laboratory Waves on Jervis Bay - Progress Report No. 2

FIGURES

		<u>Dwg. No.</u>
FIGURE 1	Site J.S1 - Scottish Rocks - Location	C.I. 2568
" 2	Foundation Investigation Contours of Bedrock	C.I. 2533
" 3	Geological Map of Scottish Rocks	C.I. 2567
" 4	Tidal Observations in Jervis Bay at Captain's Wharf, July 1969 to February 1970	C.I. 2312
" 5	Sketch of Kites used in Current Survey	C.I. 1688
" 6	Current Observations, 7th July, 1969	C.I. 1681
" 7	Current Observations, Morning 8th July, 1969	C.I. 1682
" 8	Current Observations, 8th - 10th July, 1969	C.I. 1683
" 9	Current Observations, 9th - 10th July, 1969	C.I. 1684
" 10	Tides - 7th - 10th July, 1969	C.I. 1685
" 11	Layout for 1 x 500 MW	C.I. 2672

INTRODUCTION

In June, 1969, the Australian Atomic Energy Commission sought the assistance of the Electricity Commission of New South Wales to investigate sites suitable for the construction of a 500 MW nuclear power station in Commonwealth Territory on the south-eastern shores of Jervis Bay.

Two areas were selected for detailed examination following a site inspection by officers from both Commissions. The areas selected were:

1. An area about one and a half miles east of the Naval College adjacent to and between two rock promontories named Bristol Point and Scottish Rocks (see Figure 1). This site has been designated J.S1.
2. An area immediately west of Governor Head behind Murray's Beach. This site has been designated J.S2.

In order to prove the feasibility of these two sites, it has been necessary to carry out geological and hydrographic investigations to give preliminary information on the levels of suitable foundation materials, water depths and the characteristics of water movements in the bay to assist in the design of the cooling water system.

As Site J.S1 seemed to have several advantages, the first stages of the field work were concentrated in this area. However, at a later stage, the Murray's Beach site (J.S2) was adopted and the field investigations were transferred to that area.

This report gives the results of the field work carried out on the Scottish Rocks site prior to the decision to adopt Murray's Beach site.

The work was carried out by a number of authorities as follows.

Maps of Jervis Bay Commonwealth Territory to a scale of 400 ft. to 1 in. with 10 ft. contours were made available by the Commonwealth Department of the Interior.

Drilling was carried out for the Electricity Commission of New South Wales by contract drillers.

Seismic surveys were carried out by the Bureau of Mineral Resources.

Surveys for the seismic work were made by a Commonwealth Department of the Interior Surveyor.

Geophysical "sparker" surveys of the floor of Jervis Bay North of Bristol Point and Scottish Rocks were carried out by staff from the Geology School, University of N.S.W.

The Water Research Laboratory of the University of N.S.W. prepared estimates of wave statistics for the site using wind data collated by the Electricity Commission at Tallawarra and the Navy at the Jervis Bay air field.

Staff from H.M.A.S. Creswell operated the tide recorder installed at the Naval College and an ONO current meter.

Electricity Commission of N.S.W. officers installed the tide gauge and measured currents in the bay using drag floats.

The overall programme was directed by officers from the Australian Atomic Energy Commission and the Electricity Commission of N.S.W.

JERVIS BAY NUCLEAR POWER STATION PROJECT
INVESTIGATIONS AT SITE J.S1 SCOTTISH ROCKS

PART 1 - GEOLOGICAL INVESTIGATIONS

1. TOPOGRAPHY

The area investigated for a possible power station location is approximately rectangular in shape, about 6,000 ft. (1,800 metres) long in an east-west direction and extending about 1,500 ft. (460 metres) inland from the beach. (See Figure 2) The shore consists of two rocky headlands - Bristol Point and Scottish Rocks - separated by a sandy beach. To the south of the beach behind a low ridge of sand lies a narrow swampy coastal strip and then irregular hillocks rise to a maximum height of 150 ft. (46 metres) above sea level. The rocks are covered by sand with numerous trees and in places dense undergrowth.

2. REGIONAL GEOLOGY

The rocks underlying the sands on Bherwerre Peninsula are quartz rich sandstones and silty sandstones belonging to the Permian Conjola Formation. The general geological succession in the region is given in Table 1 (Reference 1). The sandstones forming the Bherwerre Peninsula are gently folded about a south-east trending anticlinal axis which is modified close to the coast by a north-easterly trending anticlinal structure (Reference 2).

3. PREVIOUS INVESTIGATIONS

The geology of the Australian Commonwealth Territory, Jervis Bay, has been investigated by Perry and Dickins (Reference 3) and Jackson (Reference 4). Perry and Dickins recorded sandstone dipping to the north-west at 4° at Bristol Point, and dipping to the west at 10° at Scottish Rocks. Jackson records sandstone dipping to the north-west at 5° at Bristol Point but records no direction for Scottish Rocks.

Both authors mention extensive deposits of white sand south of the beach.

TABLE 1

Regional Geological Succession
in the South of the Sydney Basin

PERMIAN	{	ILLAWARRA COAL MEASURES	Berry Formation	1,565 ft. (478 m.)	Siltstone and Sandstone
		Nowra Sandstone	455 ft. (139 m.)	Quartz Sandstone	
		Wandawandrian Siltstone	544 ft. (166 m.)	Silty Sandstone and Siltstone	
		SHOALHAVEN GROUP	Conjola Formation	1,400 ft. (430 m.)	Quartz Sandstone, Siltstone and Conglomerate
		Yadboro Conglomerate	590 ft. (180 m.)	Conglomerate and Sandstone	
		Pidgeon House Creek Siltstone	160 ft. (49 m.)	Siltstones, Shales and Sandstones	
	CLYDE COAL MEASURES		136 ft. (41.5 m.)	Sandstone, Siltstone, Shale and Coal	
		Unconformity			
ORDOVICIAN		Highly folded metamorphosed siltstone and sandstone.			

4. PRESENT INVESTIGATIONS

4.1 GEOLOGICAL MAPPING

Apart from the exposures at Bristol Point and Scottish Rocks no outcrops of bedrock have been located within the area under investigation. As part of a detailed geological investigation of the Governor Head area, D. Dyer from the Electricity Commission of N.S.W., has mapped the rock outcrops at Scottish Rocks (see Figure 3).

4.2 AUGER DRILLING AND CONE TESTING

A total of 40 four-inch diameter flight auger holes were drilled to refusal using a Gemco trailer-mounted drilling rig. Three cone penetration tests to refusal were carried out using a trailer-mounted dutch cone. This work is summarised in Appendix C, and detailed drill logs are given in Appendix D. Disturbed samples from the auger drilling are held at the Commission's Leichhardt Laboratory.

4.3 DIAMOND DRILLING

In order to determine the nature of the bedrock and its properties, four diamond drill holes were sunk to depths ranging from 83 to 100 ft. (25 to 30 metres) below ground level. These holes are summarised in Appendix C and detailed logs are given in Appendix D. Cores are stored at the Commission's Leichhardt Laboratory and colour photographs of the cores are held by the Civil Investigations Branch, Power and Transmission Development Division.

4.4 GEOPHYSICAL SURVEYS

4.41 Seismic Survey

A seismic survey of the area under investigation was carried out by the Bureau of Mineral Resources. The results of this survey are included in B.M.R. Record 1969/146 (Reference 5).

4.42 Sparker Survey

A sparker survey of the materials underlying the floor of Jervis Bay immediately north of the Scottish Rocks-Bristol Point area was carried out by Carter, Albani and Johnson of the University of N.S.W. Their results are included as Appendix A of this Report.

4.5 LABORATORY TESTING

Mechanical sieve analyses have been carried out on three bulk samples of sand from Site J.S1. Also, moisture content determinations have been carried out on disturbed samples of sand from the auger drilling.

Core samples from the diamond drilling have been subjected to accelerated weathering tests and the determination of ultimate strength under unconfined compression by the laboratory of the Sydney Metropolitan Water, Sewerage and Drainage Board. The Bureau of Mineral Resources has tested samples for sonic velocity and specific gravity. The results of the laboratory testing are given in Appendix B.

5. GENERAL GEOLOGY

5.1 OVERBURDEN

The auger drilling has shown that the area is covered with sand ranging in depth from 8 ft. (2.4 metres) to more than 108 ft. (33 metres). The sand of the surface is dark grey, containing humus and is sometimes overlain by a thin swampy organic clay layer.

In shallow holes, the colour of the sand in depth changes either to light grey and the material grades into weathered light grey sandstone, or the colour changes to dark brown and the material grades into weathered brown sandstone. In the areas of deeper sand, beneath the grey surface layer the sand changes in colour to light brown and then often back to grey before weathered sandstone is reached.

The drilling has shown that, whereas the sand in the eastern, western and southern sections of the area averages 16 ft. (4.9 metres) in thickness, in an area west of Scottish Rocks, the depth of sand exceeds 108 ft. (33 metres) and the tree covered ridges in this area represent old sand dunes.

5.2 BEDROCK

The exposures at Bristol Point and Scottish Rocks and the cores from the diamond drilling show that the bedrock underlying the sand is mainly a grey quartz rich sandstone. When fresh, the sandstone is a light to medium grey, moderately hard and moderately strong to strong. It is coarse-grained with some pebbles of quartz and rock fragments in a matrix which contains some silt. When weathered, the sandstone changes in colour to a dark grey and becomes weak and moderately soft. The matrix often alters to clay. There are several thin siltstone bands within the sandstone.

In Holes J.S1/D3 and D4, the grey sandstone is overlain by a white to buff coloured, coarse-grained quartz sandstone which contains a low content of silty matrix.

5.3 STRUCTURE

The bedding in the sandstone is not well-defined and it is necessary to look carefully for evidence of lithological changes, such as the presence of pebble bands, to give an indication of the attitude of the rocks. Examination of the exposures on the shore at Scottish Rocks (see Figure 3) indicates that the bedding in this area dips to the NNW at between 5° and 10° . This corresponds with measurements made on Bristol Point. In the drill cores, poorly-developed bedding at between 0° and 5° to the horizontal was observed in each hole.

The strong NNE trending alignment of exposures at Scottish Rocks (see Figure 3) is controlled by a well-developed set of joints which dip to the west at 30° to 45° . These joints are cut by a set of vertical joints which strike WNW. The drill cores contain fractures parallel to the bedding and occasional joints at 70° to 90° to the horizontal. There is no evidence of faulting in the area under investigation.

6. ENGINEERING PROPERTIES OF MATERIALS

6.1 SAND

The mechanical analysis of three sand samples from Site J.S1 shows that the sands are almost identical in grain size distribution, i.e., a fine to medium grained, poorly graded sand with a uniformity coefficient of 1.7 (see Figure B1). Moisture content determinations of disturbed samples from the drill holes (Table B1) gave moisture contents of less than 10% for clean sand, and ranging from 11% to 25% for silty sand. Weathered sandstone gave moisture contents from 17% to 20%. Provided that the clean sand is mixed with well-graded, coarse aggregate, it should be suitable for use in high strength concrete.

6.2 SANDSTONE

Unconfined compression testing of twelve drilling core samples of slightly weathered to fresh sandstone gave strengths ranging from 2840 p.s.i. (19.6 N/mm^2) to 17,430 p.s.i. (120.2 N/mm^2) with the exception of Sample J.S1/D4/C5 which failed along an incipient joint plane at 1,950 p.s.i. (13.4 N/mm^2). See Table B1.

Sonic velocities ranging from 5,300 to 11,350 ft. per second (1,615 - 3,460 m./sec.) were obtained from six samples of slightly weathered to fresh sandstone and four samples of fresh sandstone withstood 250 cycles of simulated weathering without deterioration.

Unconfined compression testing of two samples of moderately weathered sandstone gave values of 590 p.s.i. (4.1 N/mm^2) and 1,540 p.s.i. (10.6 N/mm^2). Both samples broke up after 67 cycles of simulated weathering. Two samples of moderately weathered sandstone gave sonic velocities of 3,280 and 4,050 ft. per second (1,000 and 1,235 m./sec.).

Testing was attempted on two samples of highly weathered bedrock but one broke down during preparation. The other failed in unconfined compression under a load of 1,150 p.s.i. (7.9 N/mm^2).

Fresh sandstone should be capable of carrying loads in excess of 25 tons per square foot (2.3 N/mm^2), without appreciable settlement. The testing on the moderately weathered sandstone indicated that it would be suitable for loads up to 10 tons per square foot (0.9 N/mm^2) and it is probable that 5 tons per square foot (0.5 N/mm^2) loading could be founded on highly weathered sandstone.

7. LEVEL OF SOUND BEDROCK

Examination of the drilling cores indicates that the materials present can be divided into four groups which are:

Loose to moderately dense sand;
Dense sand to completely weathered sandstone;
Highly to moderately weathered sandstone;
Slightly weathered to fresh sandstone.

The seismic survey (Reference 5) showed that the materials could be divided into several groups by velocity, i.e., 1,000 to 1,200 ft. per second (300-350 m./sec.), 1,800 to 2,000 ft. per second (550-600 m./sec.), 3,000 to 5,500 ft. per second (900-1,700 m./sec.), 6,000 to 8,500 ft. per second (1,800-2,600 m./sec.), and 10,000 to 13,000 ft. per second (3,000-4,000 m./sec.).

The marine sparker survey has divided the materials below the floor of Jarvis Bay into unconsolidated deposits, partially consolidated deposits, and bedrock (Appendix A). There is a reasonably good correlation between these divisions as set out below in Table 2:

TABLE 2

Drill Core	Seismic ft. per second	Sparker	Compressive Strength p.s.i.
Loose to moderately dense sand	1,000 - 1,200	Unconsolidated deposits	-
Dense sand to completely weathered sandstone	1,800 - 2,000	Partially consolidated deposits	-
Highly to moderately weathered sandstone	3,000 - 5,500	} Bedrock	500 - 1,500
Slightly weathered to fresh sandstone	6,000 - 8,500		2,800 - 8,000
	10,000 - 13,000		10,000 - 17,000

The thickness of highly weathered to moderately weathered bedrock in the drill core averages 10 ft. and by assuming that a similar depth of weathered material occurs beneath Jervis Bay, it has been found that it is possible to combine the various methods to produce a contour plan of sound bedrock, i.e., slightly weathered to fresh sandstone with a seismic velocity higher than 6,000 ft. per second (1,800 m./sec.).

The results of the combination of the auger and diamond drilling, sparker and seismic surveys are shown in Figure 2.

8. CONCLUSIONS

1. The geological and geophysical survey of Site J.S1 - Scottish Rocks, has shown that beneath a surface layer of sand bedrock is composed essentially of quartz-rich sandstone.
2. The sand is poorly graded, fine to medium grained and ranges in thickness up to 108 ft. (33 metres). In places it represents former sand dunes.
3. The sandstone dips at a low angle to the north-north west. It is cut by at least two distinct sets of joints. No evidence of faulting can be observed.
4. Fresh sandstone is considered to be capable of supporting loads in excess of 25 tons per square foot (2.3 N/mm^2) without appreciable settlement. It is overlain by an average thickness of ten feet (3 metres) of moderately weathered sandstone - capable of supporting 10 tons per square foot (0.9 N/mm^2) - and highly weathered sandstone strong enough for loadings up to 5 tons per square foot (0.5 N/mm^2).
5. By combining the geological and geophysical surveys, it has been possible to determine the approximate level of sound bedrock throughout the area under investigation. This work shows that:
 - (a) At the western end of the area, behind Bristol Rocks, fresh bedrock rises rapidly south of the beach to 30 ft. (9 metres) above mean sea level.
 - (b) In the centre of the area, there is an infilled valley containing a depth of over 100 ft. (30 metres) of sand with the top of sound bedrock below sea level as far as 2,000 ft. (600 metres) south of the beach.
 - (c) In the eastern part of the area, south of Scottish Rocks, the top of sound bedrock is located within 10 ft. (3 metres) of sea level over an area of about 1,500 ft. (450 metres) by 800 ft. (250 metres). This area would be a suitable site for a power station.

9. REFERENCES

1. "The Geology of New South Wales"; G.H. PACKHAM, 1969; Geological Society of Australia.
2. "Investigation of the Structural Geology of Eastern Bherwerre Peninsula"; J.P. MacGREGOR, 1970; Power and Transmission Development, Report No. C.I. 44.
3. "Report on a Geological Survey of Commonwealth Territory, Jervis Bay"; W.J. PERRY and J.M. DICKINS, 1952. Bureau of Mineral Resources Record No. 1952/88.
4. "Engineering Geology and Economic Resources of Commonwealth Territory, Jervis Bay"; M.J. JACKSON, 1969. Bureau of Mineral Resources Record No. 1969/88.
5. "Jervis Bay Reconnaissance Seismic Survey"; A.C.T. 1969; F.J. TAYLOR, 1969; Bureau of Mineral Resources Record No. 1969/146.

JERVIS BAY NUCLEAR POWER STATION PROJECT
INVESTIGATIONS AT SITE J.S1 SCOTTISH ROCKS

PART 2 - HYDROGRAPHIC INVESTIGATIONS

1. INTRODUCTION

Factors to be considered in the design of power station cooling water systems which draw water from and discharge water to natural water bodies include:

- (i) Depths of water (hydrographic survey);
- (ii) The range of water levels normally experienced at the site (waves and tides);
- (iii) Extreme water levels at the site (waves, tides, storm surge seiches and tsunamis);
- (iv) The velocities and directions of natural water currents;
- (v) Recirculation of heated water for infall and outfall arrangements;
- (vi) The efficacy of skimmers to prevent recirculation of heated water.

Before the decision had been made to adopt the Murray's Beach (J.S2) site, some work had been carried out on (i), (ii), (iii) and (iv) above for the Scottish Rocks (J.S1) site. This section of the report sets out details of this work.

2. HYDROGRAPHIC SURVEY

Admiralty charts prepared in 1894 and 1958 are available for Jervis Bay to a scale of 1 to 18,300 and 1 to 37,500 respectively.

The charts indicate that water depths should be adequate for cooling purposes in the area adjacent to Scottish Rocks. However, the chart scales were not suitable for detailed investigations and arrangements were made to have a hydrographic survey made by Amalgamated Decca Surveys Pty. Ltd. The Company's report, which includes a plan showing the soundings made, is given as Appendix E. The soundings on Plan No. ADS 249/3 are given in feet and are based on a datum 11 ft. (3.3 metres) below the top of the south-west concrete pile of the crane support, eastward of the Royal Australian Navy jetty. The datum used for the hydrographic survey has subsequently been established as being 2.52 ft. (0.77 metres) below standard datum by the Lands Department surveyors.

3. TIDES

A Bristol recorder with a weekly chart was installed on the end of Captain's Wharf near the Royal Australian Naval Station early in July, 1969, and this instrument is still in operation at the time of writing. The water levels recorded by the tide gauge are shown in Figure 4, with a period, July, 1969, to the start of March, 1970. There are some gaps in the records because of difficulties in obtaining a reader to change the chart on a continuous basis. Up till the end of October, 1969, charts were changed by Lt. Commander Pullar of the Naval Station. Since that date charts have been changed by engineers and scientists from the Atomic Energy and Electricity Commissions. The zero on the tide gauge is -3.96 ft. (1.20 metres) on St. Georges Basin datum which is approximately 0.7 ft. (0.21 metres) above standard datum. In other words approximately 3.26 ft. (0.99 metres) on the tide gauge is standard datum and from the tidal records, standard datum is shown to be very close to mean sea level in the bay. Mean sea level was established from the tidal records by considering five periods each of a lunar month when records were fairly complete.

4. WATER LEVELS ON SCOTTISH ROCKS

To obtain design data for the Scottish Rocks Power Station site, the Electricity Commission requested the Water Research Laboratory to prepare wave data for Jervis Bay for this site. A Progress Report No. 1 from the Water Research Laboratory dated 21st August, 1969, is included as Appendix F. This report presents the frequency of occurrence of locally generated waves. The maximum significant wave height forecast was 2 ft. (0.6 metres) with a wave period of three seconds. This report was based on modified Tallawarra wind records.

Further work was carried out and subsequently reported in Progress Report No. 2 of 12th November, 1969, to indicate the design wave height for the proposed Scottish Rocks site as determined by refracted ocean waves. These detailed wave refraction studies indicated that the maximum significant wave height was 7.3 ft. (2.3 metres). However, as the Scottish Rocks site is well protected from ocean waves, waves exceeding 3 ft. (1.0 metres) would only occur 0.3% of the time. Progress Report No. 2 is included as Appendix G.

5. CURRENTS

5.1 DESCRIPTION OF OBSERVATIONS

During the period 7th-10th July, 1969, current observations were carried out in the South Jervis Bay area off Scottish Rocks and between Bristol Point and Hole in the Wall, where it is proposed to locate the power station. These observations were carried out in order to determine:

- (a) The existence of any wind or tide induced currents at this site; and
- (b) If any such currents existed, to determine their direction and magnitude.

Two types of underwater "kites" were used. They were a 3 ft. (0.9 metres) plastic surfaced cube with a steel framework and no top or bottom surfaces, and a four vaned sheet metal kite standing 3 ft. (0.9 metres) high and 3 ft. (0.9 metres) diagonally. The cube was supported in the water by a 9" (0.2 metres) diameter polyurethane foam ball and the vaned kite was held afloat by two 2-gallon drums (Figure 5). Four kites were set at a depth of 6 ft. (1.8 metres) and two at a 20 ft. (6.1 metres) depth. Because of the large surface area underwater compared with the area above water, it was expected that the effect of wind would be small compared with the forces of drift currents acting on these large areas.

Wind speed and direction are recorded on a Dines anemograph installed at the R.A.N. airfield, Jervis Bay, 10 metres above ground level. The airfield is approximately 200 ft. (60 metres) above sea level and situated about 2 miles (1.6 kilometres) to the south-west of Bristol Point. Tidal data has been recorded on a standard Bristol recorder, pressure type, which, with a staff gauge, was installed on the Captain's Wharf, Captain's Point on 4th July, 1969.

Fixing the position of a float was carried out from a boat using a sextant or prismatic compass sighting to three of the points on the shore whose position is known.

Float tracks resulting from plotting observed positions of floats and joining the plotted points by straight lines are shown on Figures 6 to 9. The wind records and tidal information are tabulated on these figures, and Figure 6 shows the tide chart for 7th-10th July, 1969.

An ONO current meter which recorded current direction and speed was borrowed from the Navy and installed initially at a location shown on Figure 2. It was anchored by a heavy weight on the bottom and supported by a 20-gallon drum below the water surface so that the meter was between 5 (1.5 metres) and 10 ft. (3.0 metres) below the water surface depending on the state of the tide. Although no precise results were obtained from the meter at the location shown in Figure 6, mainly because the currents were insufficient to make the meter stream in the direction of the current, the chart did show evidence of some current on Thursday, 3rd July.

During the four days of float tracking, the weather conditions were generally very calm with the days fine and sunny and nights cold, clear and generally still. In the area of float tracking, the water surface was glassy at times and waves on the bay were hardly discernible although a very slight swell was breaking on the beaches. At other times a small chop resulted from wind speeds of up to 9 m.p.h. (7.2 kilometres/hour) as recorded at the air strip.

5.2 RESULTS OF OBSERVATIONS(i) 7th July, 1969 Refer to Figure 6

Two 6 ft. (1.8 metres) floats moved at about 13 ft. per minute (3.9 metres/minute) under the influence of wind and there is no evidence of any tidal movement at all or no evidence of a drift westwards along the beach as a result of the light north-east winds which reached 9 m.p.h. (7.2 kilometres/hr.) at times. Local reports have suggested that strong north-east winds cause a westward drift current along the beach but no evidence of this was observed with the moderate winds during the period of the survey.

(ii) Morning, 8th July, 1969 Refer to Figure 7

The two 6 ft. (1.8 metres) floats moved with velocities of 9.0 (2.7 metres) and 10.5 ft. (3.2 metres) per minute, a north-west wind was blowing and the tide was coming in during the period of observations. Although the wind speed was light, the float moved in the direction of the wind and appeared to be unaffected by any tidal influence.

(iii) Afternoon, 8th July, 1969 Refer to Figure 8

A float at 20 ft. (6.1 metres) depth (No. 1) moved with an average velocity of 6.7 ft. (2.2 metres) per minute in a direction not the same as the wind direction. This suggests the presence of either a very weak tidal drift or a drift current at 20 ft. (6.1 metres) depth in a different direction to the surface drift current.

Also, on 8th-9th July, a 6 ft. (1.8 metres) float (No. 4) moved 700 ft. (213 metres) north-west in 16 hours, 34 minutes, from 1,643 hours despite a light west wind during the night. No clear explanation is available for this movement.

Also on the night of 8th-9th July, and also overnight between 9th and 10th July.

(iv) 9th July to 10th July, 1969 Refer to Figures 8 and 9

During the period between 1,700 hours on 9th July to about 0930 hours on 10th July, there was insufficient wind recorded at the airfield to register a velocity or to show a change of direction. However, during this same period, all floats moved in a north-westerly direction. Float No. 4 moved at an average velocity of about 3.8 ft. (1.1 metres) per minute and Float No. 5 (with its kite at the greater depth) had an average velocity of 3.0 ft. (0.9 metres) per minute during its movement.

This may be an indication of a very slow drift current which moves to the north-west.

5.3 CONCLUSIONS

1. From the ONO current chart of 3rd July, it may be concluded that the drift floats were in fact recording a drift of water and not merely drifting as under the influence of the weak force exerted by the wind on the float and flag above the water surface.

2. The area between Bristol Point and Hole in the Wall was a very quiescent area as regards drift currents. In most instances, the floats moved in the direction of the surface wind and this was thought to be a wind induced drift. The state of the tide seemed to have little effect on the current drift.
3. During the four days of float tracking winds from every direction were not encountered. However, for the conditions that were experienced, the floats drifted away from the area between Scottish Rocks and the Hole in the Wall, except in the case of a north-west wind. This suggests that an arrangement whereby hot water was discharged between Scottish Rocks and Bristol Point and cold water was drawn at depth via a canal located between Scottish Rocks and Hole in the Wall could be a favourable arrangement.
4. The most important conclusions from this work are the very low drift velocities observed. These low drift velocities suggest that with light winds hot water discharged from a power station would have an adequate time to cool on the surface of the bay before moving into the circulating water inlet canal if an arrangement of discharging the hot water at the surface and withdrawing the cold water at a depth of 25-30 ft. (7.6 - 9.1 metres) were adopted. It is considered that such an arrangement would prevent direct recirculation under currents set up by the pumping of water through the power station itself.

JERVIS BAY NUCLEAR POWER STATION PROJECT
INVESTIGATIONS AT SITE J.S1 SCOTTISH ROCKS

PART 3 - SITE LAYOUT

A site layout drawing has been prepared for a single 500 MWe unit located to the east of Scottish Rocks (see Figure 11) where the foundation conditions are favourable. This layout assumes that:

- (i) A basement level of R.L. 15 would provide adequate freeboard above the combined effects of waves and tsunamis; and
- (ii) The preferred alignment of the access road, transmission lines and water supply pipeline is similar to the alignments adopted for the Murray's Feach site.

The circulating water system is shown with the infall on the western side of Scottish Rocks and the outfall on the eastern side. Because of inadequate hydrographic data on currents in Jervis Bay, it is not known that this is the optimum direction of flow for thermal diffusion but there is an economic advantage for the conduits with this arrangement. Because of the proximity of the infall to the outfall, it would be necessary for the infall conduit to have a skimmer or alternatively to extend the infall as a closed conduit from a submerged intake in the bay so that adequate cooling of the circulating water would be achieved. A further alternative would be to increase the separation of the conduits by extending the outfall eastwards along the beach.

Provision has been made in the arrangement for basic works areas for contractors, areas for construction offices and an observation point with road access for the public.

The switchyard and transmission line arrangement provides for two 330 kV lines, and construction power would be from a 33 kV transmission line.

Water supply would be from the Shoalhaven Shire system extended with a pipeline along the access road alignment and feeding the twin 1,000,000 gallon reservoirs shown.

APPENDIX A

BEDROCK TOPOGRAPHY IN SOUTH-EASTERN JERVIS BAY

by

A.N. Carter, A.D. Albani and B.D. Johnson

Introduction

This report is based on portion of larger study of Jervis Bay begun by A.N. Carter and A.D. Albani in May, 1968, and continued in August, 1969. The area described in this report lies between Captain's Point (the Royal Australian Naval College) and Bowen Island. The determinations for the remainder of Jervis Bay are not yet as fully worked out as for the area described in this report, but are currently being worked upon. The investigation has been planned to provide determinations of the configuration of the surface of the bedrock underlying Jervis Bay and also the thicknesses of unconsolidated sediment and water overlying it. The data were collected aboard a small ship at sea, using an oceanographical instrument of the "seismic reflection profiler" type, known as the Hydrosonde and made by Huntec Ltd. of Canada.

The Hydrosonde Operation

The Hydrosonde system consists of an ship-borne apparatus built to discharge a high-voltage electric spark in the water and a hydrophone and recorder to receive and record the impulses generated by the discharge of the spark, both directly and also those reflected by various interfaces below the ship. In simplified form, the "received" impulses principally represent those reflected by the sea-bottom and the soft sediment - bedrock interface. Layers of different materials within the body of soft sediment may return separate reflections of impulses and lithological, stratigraphical or structural discontinuities within the bedrock may also act as reflecting horizons and be represented on the record.

The ship carrying the Hydrosonde was directed along a number of straight traverse lines previously planned. These are shown on the accompanying map. The time duration of each traverse was accurately recorded and the ship and two shore-based theodolite stations were continually in contact by radio, enabling the ship's position to be accurately determined by intersecting theodolite bearings. By these methods, the Hydrosonde record was related to the terrain as accurately as it is possible to do so. The Hydrosonde record always reveals the sea-bottom clearly; deeply reflecting horizons are always somewhat less distinct than the sea-bottom, but in this area, two deeper reflecting levels could be seen, namely a continuous junction of incompletely consolidated material and bedrock and, intermittently, the top of an intercalation of a deposit between the superficial sediments and the bedrock. This deposit is not known to the authors as an outcropping formation. Since this material is identified here by its geophysical properties as recorded by the Hydrosonde, its detailed nature is uncertain and it may consist of a deposit of marine or coastal sands (and possibly clay) plus some weathered bedrock. Its thickness is greater than would be expected if it were entirely weathered bedrock, as far as can be judged from outcrops.

Other details shown by the Hydrosonde record are interpreted as small faults (near the middle of traverse A) and as bedding planes within the bedrock (near the eastern ends of traverses A, D and E). The capacity of the Hydrosonde to detect bedrock structures is not great, so the absence of bedrock structures from other parts of the sections should not be taken to mean that they are not present - merely that we gained no information about them.

Map and Sections

Two larger documents accompany this report:

- (a) A map showing the shore and soundings made by Amalgamated Decca Surveys on which our traverses, identifying letters and numbered survey control points are shown in red; and
- (b) A drawing of five sections along the traverses, at the same horizontal scale as the map (1:4800) and with a vertical scale of 100 ft. to an inch. The sections show the water layer, the unconsolidated superficial deposits (yellow); the deeper partially consolidated deposits (orange) and the bedrock (brown).

Interpretation of Sections

Section A

The Hydrosonde record showed two structures interpreted as small faults near the middle of traverse A. These are an isolated occurrence, as no similar structures were shown elsewhere. West of control mark 3, a distinct valley in the bedrock surface can be seen. Westerly-dipping structures, apparently bedding planes, can be seen in the record near the eastern end of Section A.

Section B

In the south-western portion of section (i.e., SW of control mark 3) shows the same valley in the bedrock surface that was mentioned in Section A, though traverse B appears to have crossed this valley more obliquely than traverse A.

Section C

This section shows an undulating bedrock surface, with a broad shallow depression in the bedrock surface in its south-eastern half. This bedrock surface depression lies to the south of a similar broad shallow depression in the bedrock surface shown on Section A.

Section D

This section shows outcropping rock at its western end (Bristol Point) and a distinct and quite steep-sided valley near the mid-point of the traverse (i.e., north-west of Scottish Rocks). Westerly-dipping structures can again be seen in the bedrock near the eastern end of the traverse - these are interpreted as bedding planes in the bedrock.

Section E

Section E shows a distinct valley in the bedrock surface west of control mark 12 and also, quite extensively, reflections from what are interpreted as bedding planes. These change from a westerly dip west of control mark 13, to an easterly dip north-east of control mark 10, suggesting an anticlinal axis lying between these two marks.

General Interpretations.

The sections show four features of significance:

- (i) A broad, shallow valley in the bedrock surface between Captain's Point and Bristol Point, deepening northerly.
- (ii) A distinct and quite narrow valley in the bedrock surface between Bristol Point and Scottish Rocks, deepening northerly.

(It may be noted that the landward continuation of this valley has its axis passing approximately through bores 2, 6 and 7.) (A2, A6, A7).
- (iii) A platform of rock containing minor depressions covered by a thin layer of sediment, extending out from the shore and beneath the sea, between Scottish Rocks and "The Hole in the Wall" (Beacon 5).
- (iv) An anticline in the bedrock with its axis crossing the coastline just south of Beacon 5 and extending north-westerly from there.

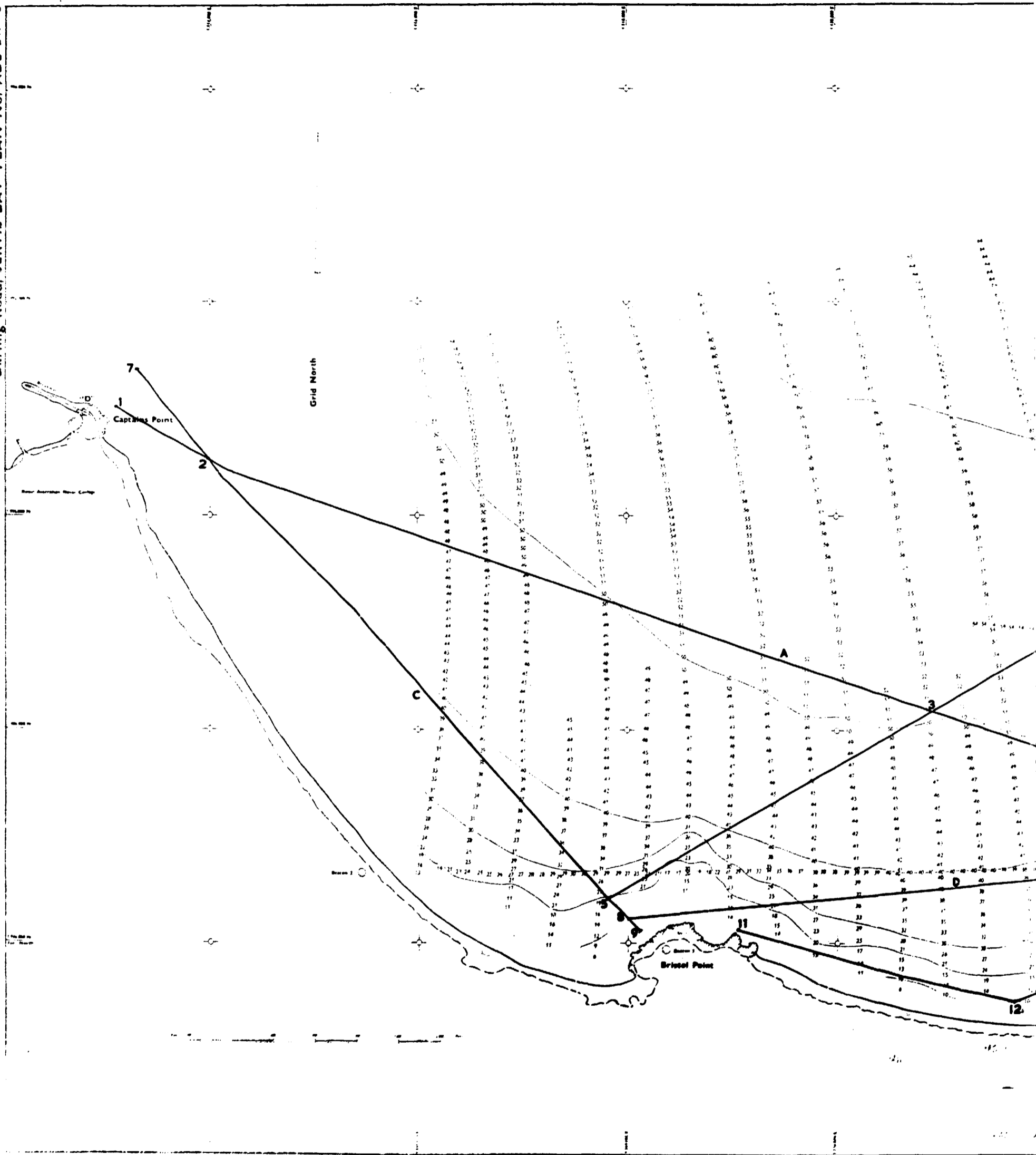
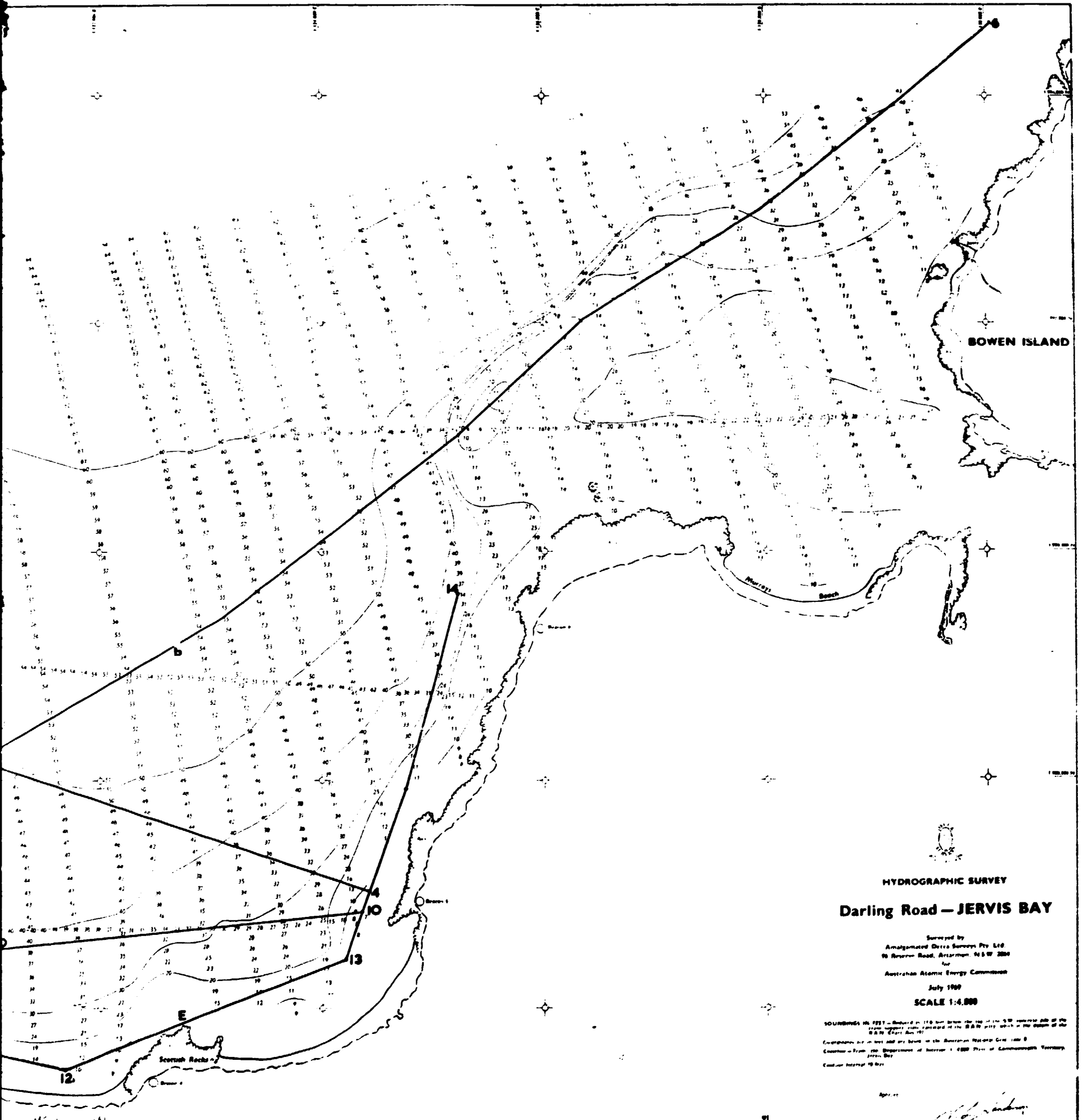


FIG. A 1

SECTION 1



BOWEN ISLAND

HYDROGRAPHIC SURVEY

Darling Road — JERVIS BAY

Surveyed by
Amalgamated Geosurvey Pty Ltd
76 Reserve Road, Artarmon, NSW 2058
for
Australian Atomic Energy Commission
July 1969
SCALE 1:4,000

SOUNDINGS IN FEET - Reduced to 110 feet above the top of the 1950 datum of the
mean high water level of the B.A.W. pier which is the datum of the
B.A.W. Chart No. 10
Coordinates are in 1958 and are based on the Australian National Grid Zone B
Controlled by the Department of Interior, 1, 488 Pitt Street, Commonwealth Territory,
Jervis Bay
Contour Interval 10 feet

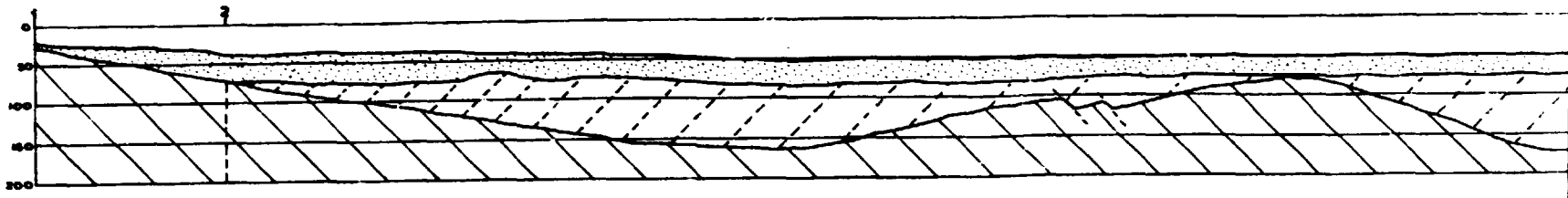
FIG. A1

FOR CROSS-SECTIONS SEE DWS CI. 1030
REF DWS. PLAN NO. ADS 249/S
CI. 1799

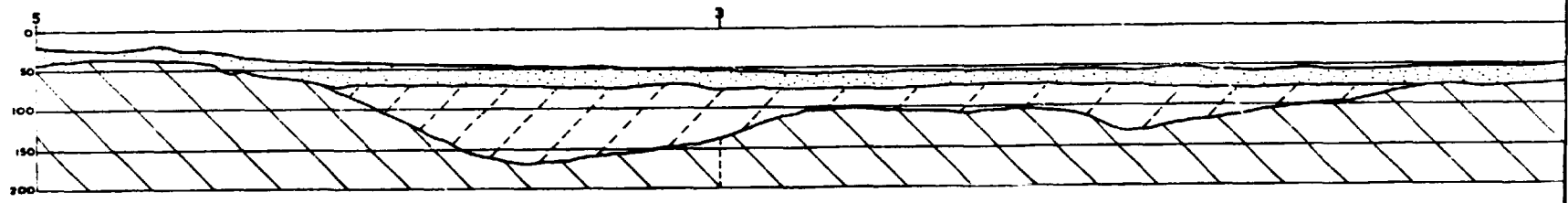
THE ELECTRICITY COMMISSION OF NEW SOUTH WALES POWER DEVELOPMENT DIVISION			
DRN.	T. 464	APPROVED DATE	
TOD.	T. 464	<i>[Signature]</i> 1969	
CHD.	P. 1799	CI. 1031	
JERVIS BAY PROJECT MARINE GEOPHYSICAL SURVEY LOCATION OF CROSS-SECTIONS			

SECTION 2

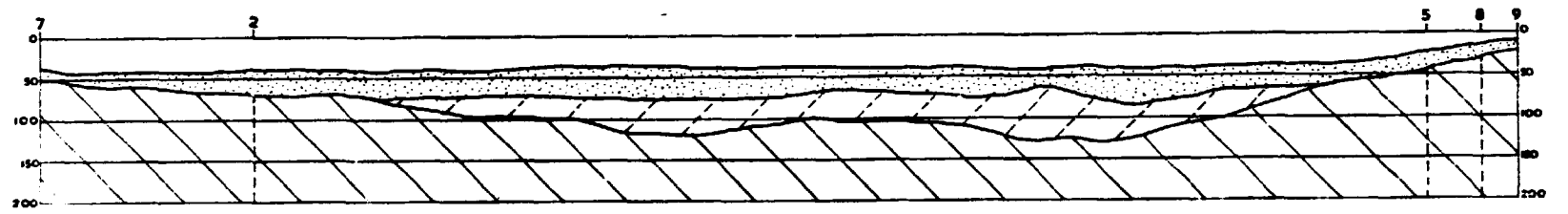
SECTION A



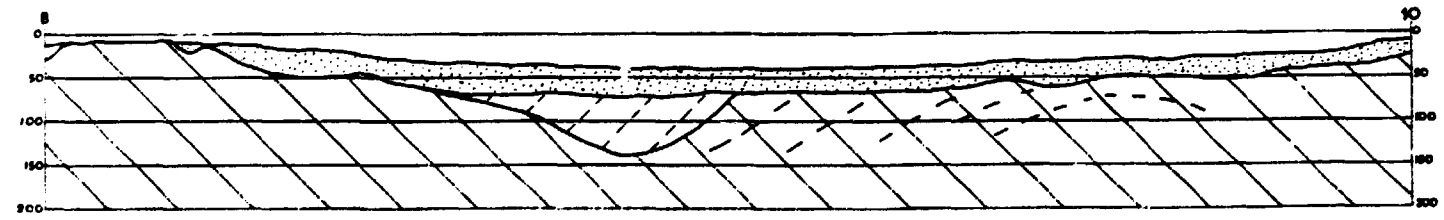
SECTION B



SECTION C



SECTION D



SECTION E

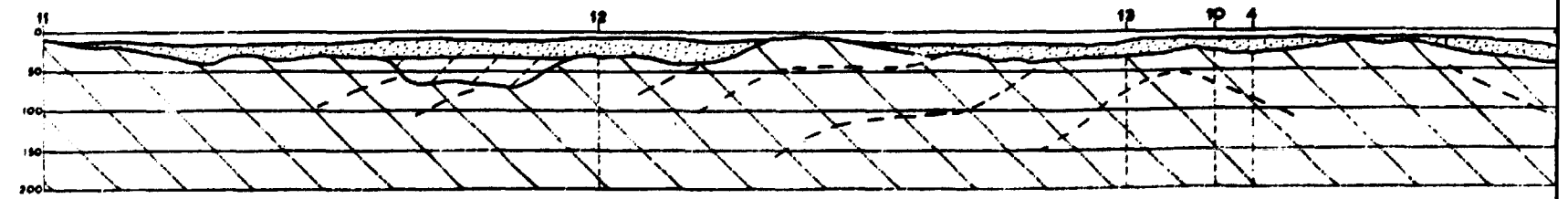
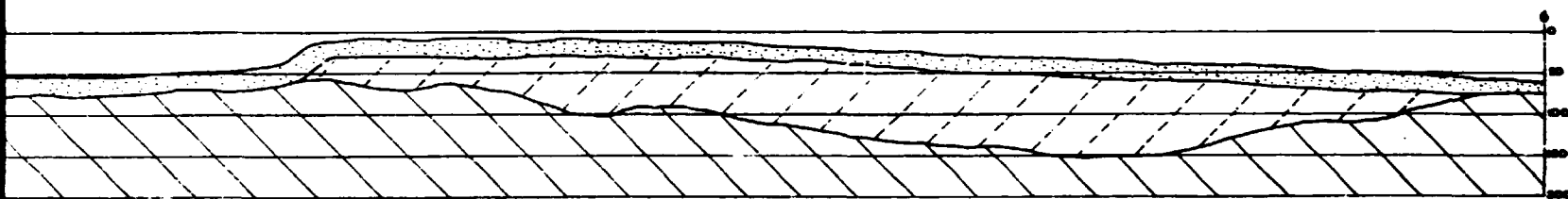
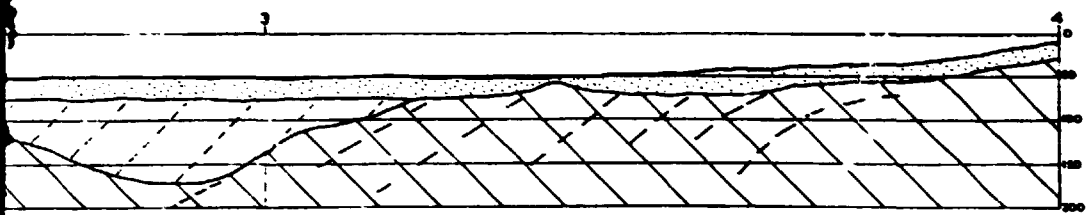


FIG. A 2

SECTION 1



LEGEND



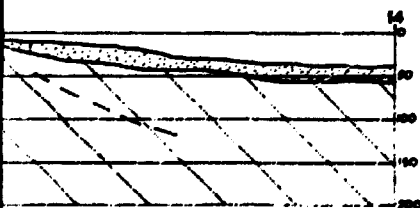
UNCONSOLIDATED DEPOSITS (SAND & CLAY)



PARTIALLY CONSOLIDATED DEPOSITS



BEDROCK FULLY CONSOLIDATED SANDSTONE (CORIOLA FORMATION)



SECTION 2

FOR LOCATION OF CROSS-SECTIONS SEE DRG. C.I. 1831

FIG. A2

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES POWER DEVELOPMENT DIVISION			
JERVIS BAY PROJECT		DRAWN BY DATE C.I. 1830	
DRN.	T.D.V.		
TCD.	T.D.V.		
CRD.	P.M.P.	MARINE GEOPHYSICAL SURVEY CROSS-SECTIONS	

APPENDIX B

LABORATORY TESTING OF SAMPLES

1. Mechanical sieve analysis of three bulk samples was carried out by the Leichhardt Laboratory of the Electricity Commission. The results are given in Figure B1.
2. Moisture contents of all disturbed samples from the auger drilling were determined by Leichhardt Laboratory. The location of these samples is given in Appendices C and D and the results are given in Table B1.
3. The determination of the ultimate strength of typical rock samples under unconfined compression was carried out by the Crown Street Laboratory of the Metropolitan Water Sewerage and Drainage Board. This laboratory also tested several samples for resistance to simulated accelerated weathering. The results of this work are given in Table B2.
4. The engineering geophysical laboratory of the Bureau of Mineral Resources determined the sonic velocity and also the specific gravity of several typical samples of diamond drill core. These results are given in Table B2.

TABLE B1

JERVIS BAY, SITE J.S1 - SCOTTISH ROCKS

MOISTURE CONTENTS

Drill Hole	Sample No.								
	D1	D2	D3	D4	D5	D6	D7	D8	D9
J.S1/A1	3	9	6	25	17				
J.S1/A2	6	7	8	17	18	20			
J.S1/A3	4	7	4	9					
J.S1/A4		4							
J.S1/A5	7	8	17	19	23	19			
J.S1/A6	1	3	5	12	16				
J.S1/A7	1	7	5	5	5	4	5	5	17
J.S1/A8	20	11	16	28					
J.S1/A9	21	25	24						
J.S1/A10	21	21							
J.S1/A11	18	21	21						
J.S1/A12	9	13	8	14	20				
J.S1/A13	7	11	7	16	17				
J.S1/A14	7	14	16	25					
J.S1/A15	17	23	17						
J.S1/A16	17	19	15						
J.S1/A17	5	7	6	16	16	18			
J.S1/A18	17	27	22	19	20				
J.S1/A19	5	9	7	11	12	15			
J.S1/A20	4	7	5	4	16	14			
J.S1/A21	4	8	5	15	15				
J.S1/A22	4	7	5	3					
J.S1/A23	6	4	8	19	18	16			
J.S1/A25	14	10							
J.S1/A26	7	8	4	16	14				
J.S1/A27	5	11	9						
J.S1/A30	23	14	9						
J.S1/A31	5	6	4	17					
J.S1/A32	25	18							
J.S1/A33	6	8	18	17					
J.S1/A34	6	6	6	16	17				
J.S1/A35	10	13	17	16					
J.S1/A36	6	15	10	17	18				
J.S1/A37	17	14	19						
J.S1/A38	3	7	4	1	11				
J.S1/A39	7	7	7	19					
J.S1/A40	6	6	5	13	15				
J.S1/A41	25	17							

TABLE B2

JERVIS BAY, SITE J.S1 - RESULTS OF ROCK TESTING

Sample No.	Depth		Description	Unconfined Compression		Sonic Velocity		Weathering (cycles)	Specific Gravity
	Feet	Metres		p.s.i.	N/mm ²	Ft./sec.	Metres/sec.		
J.S1/D1/C1	27.0-27.7	8.2- 8.4	MW sandstone	-	-	4,050	1,234.4	-	2.23
J.S1/D1/C2	36.6-37.1	11.2-11.3	F sandstone	-	-	8,850	2,697.5	-	2.35
J.S1/D1/C3	61.3-61.9	18.7-18.9	F sandstone	-	-	11,350	3,459.5	-	2.44
J.S1/D1/C4	32.2-32.9	9.8-10.0	MW sandstone	590	4.1	-	-	Failed at 67	-
J.S1/D1/C5	44.7-45.4	13.6-13.8	F sandstone	4,990	34.4	-	-	250 without loss	-
J.S1/D1/C6	60.7-61.3	18.5-18.7	F sandstone	8,320	57.4	-	-	250 without loss	-
J.S1/D1/C7	69.2-69.9	21.1-21.3	F sandstone	9,740	67.2	-	-	-	-
J.S1/D3/C1	24.3-24.7	7.4- 7.5	MW sandstone	-	-	3,280	999.7	-	2.27
J.S1/D3/C2	28.0-29.1	8.5- 8.9	F sandstone	-	-	8,650	2,636.5	-	2.39
J.S1/D3/C3	52.3-53.2	15.9-16.2	F sandstone	-	-	9,960	3,035.8	-	2.41
J.S1/D3/C4	29.5-30.2	9.0- 9.2	F sandstone	7,880	54.3	-	-	250 without loss	-
J.S1/D3/C5	46.6-47.4	14.2-14.4	F sandstone	6,070	41.9	-	-	-	-
J.S1/D3/C6	88.0-88.6	26.8-27.0	F sandstone	17,430	120.2	-	-	-	-
J.S1/D4/C1	18.4-18.9	5.6- 5.8	HW sandstone	-	-	-	-	-	2.26
J.S1/D4/C2	24.0-24.9	7.3- 7.6	SW sandstone	-	-	5,300	1,615.4	-	2.32
J.S1/D4/C3	75.0-75.9	22.9-23.1	F sandstone	-	-	10,600	3,230.9	-	2.45
J.S1/D4/C4	19.0-19.4	5.8- 5.9	HW sandstone	1,150	7.9	-	-	-	-
J.S1/D4/C5	29.8-30.4	9.1- 9.3	F sandstone	1,950	13.4	-	-	250 without loss	-
J.S1/D4/C6	40.9-41.4	12.5-12.6	F sandstone	7,230	49.9	-	-	-	-
J.S1/D4/C7	56.0-56.5	17.1-17.2	F sandstone	5,490	37.9	-	-	-	-
J.S1/D4/C8	69.6-70.1	21.2-21.4	F sandstone	12,830	88.5	-	-	-	-
J.S1/D6/C1	65.4-66.1	19.9-20.1	MW sandstone	1,540	10.6	-	-	Failed at 66	-
J.S1/D6/C2	68.1-68.8	20.8-21.0	SW sandstone	2,840	19.6	-	-	-	-
J.S1/D6/C3	80.1-80.7	24.4-24.6	F sandstone	7,220	49.8	-	-	-	-

Notes: HW - Highly Weathered; MW - Moderately Weathered; SW - Slightly Weathered; F - Fresh

APPENDIX C

SUMMARY OF DRILLING

HOLE NO.	DATE	COORDINATES		GROUND LEVEL	DEPTH	LOCATION PLAN NO.	DRILL LOG NO.	SAMP-LES	FILM	FIELD TESTS	LABORATORY TESTS	OLD NO.
		EAST	NORTH								ROCK	SOIL
J S 1/A 1	6/69	373991	661661	11.6	27.6	CI 1702	CI1703	D				
J S 1/A 2	6/69	373796	661680	10.2	75.0	CI 1702	CI1704	D				
J S 1/A 3	6/69	374027	661407	94.0	77.0	CI 1702	CI1705	D				
J S 1/A 4	6/69	373891	661527	94.1	108.0	CI 1702	CI1706	D				
J S 1/A 5	6/69	373511	661357	74.0	23.0	CI 1702	CI1707	D				
J S 1/A 6	6/69	373855	661365	3.6	72.0	CI 1702	CI1708	D				
J S 1/A 7	6/69	373855	661186	61.1	74.0	CI 1702	CI1709	D				
J S 1/A 8	6/69	373162	661480	72.4	16.0	CI 1702	CI1710	D				
J S 1/A 9	6/69	373240	661693	27.8	18.0	CI 1702	CI1711	D				
J S 1/A 10	7/69	373139	661381	83.0	20.0	CI 1702	CI1712	D				
J S 1/A 11	7/69	373049	661185	96.4	24.0	CI 1702	CI1713	D				
J S 1/A 12	7/69	372871	661655	74.4	29.0	CI 1702	CI1714	D				
J S 1/A 13	7/69	372951	661775	58.0	20.0	CI 1702	CI1715	D				
J S 1/A 14	7/69	372951	661883	40.0	22.0	CI 1702	CI1716	D				
J S 1/A 15	7/69	372854	661524	58.4	19.0	CI 1702	CI1717	D				
J S 1/A 16	7/69	372828	661350	64.2	10.0	CI 1702	CI1718	D				
J S 1/A 17	7/69	373350	661387	91.0	35.0	CI 1702	CI1719	D				
J S 1/A 18	7/69	373176	661194	105.6	35.0	CI 1702	CI1720	D				
J S 1/A 19	7/69	373447	661522	72.0	35.0	CI 1702	CI1721	D				
J S 1/A 20	7/69	373496	661699	55.2	73.0	CI 1702	CI1722	D				
J S 1/A 21	7/69	373461	661203	105.3	29.0	CI 1702	CI1723	D				
J S 1/A 22	6/69	373725	661501	94.0	108.0	CI 1702	CI1724	D				
J S 1/A 23	7/69	374205	661432	56.0	23.0	CI 1702	CI1725	D				
J S 1/A 25	7/69	374202	661692	29.1	11.0	CI 1702	CI1726	D				
J S 1/A 26	7/69	374455	661390	71.6	28.0	CI 1702	CI1727	D				
J S 1/A 27	7/69	374284	661384	70.7	11.0	CI 1702	CI1728	D				
J S 1/A 28	7/69	374123	661453	54.9	20.0	CI 1702	CI1729	D				
J S 1/A 29	7/69	374141	661571	38.1	17.0	CI 1702	CI1730	D				
J S 1/A 30	7/69	374258	661606	37.1	11.0	CI 1702	CI1731	D				
J S 1/A 31	7/69	374574	661790	22.6	45.0	CI 1702	CI1732	D				

LEGEND:

Samples:
C - Core
D - Disturbed
U - Undisturbed

Film:
C - Colour
B - Black and White
M - Microfilm

Field Tests:
W - Water Pressure
P - Soil Permeability
S - Standard Penetration
V - Vane Shear

Laboratory Tests on Rock:
W - Accelerated Weathering
U - Unconfined Compression
P - Petrography
X - X-Ray
S - Swelling
L - Leaching
V - Sonic Velocity

Laboratory Tests on Soil:
W - Moisture Content
G - Specific Gravity
S - Grain Size Distribution
A - Atterberg Limits
C - Compaction
S - Shear Testing
C - Consolidation

HOLE NO.	DATE	COORDINATES EAST NORTH	GROUND LEVEL	DEPTH	LOCATION PLAN NO.	DRILL LOG NO.	SAMP- LES	FILM	FIELD TESTS	LABORATORY ROCK	LABORATORY SOIL	OLD NO.
J S 1/A 32	7/69	374300 661761	28.6	14.0	CI 1702	CI1733	D					
J S 1/A 33	7/69	374448 661741	26.7	26.0	CI 1702	CI1734	D					
J S 1/A 34	7/69	374543 661676	35.7	31.0	CI 1702	CI1735	D					
J S 1/A 35	7/69	374572 661564	34.2	19.0	CI 1702	CI1736	D					
J S 1/A 36	7/69	374545 661457	46.0	22.0	CI 1702	CI1737	D					
J S 1/A 37	7/69	374476 661572	36.7	16.0	CI 1702	CI1738	D					
J S 1/A 38	7/69	373987 661192	69.6	26.0	CI 1702	CI1739	D					
J S 1/A 39	7/69	373029 661521	96.8	29.0	CI 1702	CI1740	D					
J S 1/A 40	7/69	373000 661703	67.6	21.0	CI 1702	CI1741	D					
J S 1/A 41	7/69	372483 661788	6.1	6.0	CI 1702	CI1742	D					
J S 1/C 1	6/69	373991 661661	11.8	12.0	CI 1702	CI1743			C			
J S 1/C 2	6/69	373793 661686	10.2	32.0	CI 1702	CI1744			C			
J S 1/C 3	6/69	374027 661487	94.0	31.0	CI 1702	CI1745			C	WU		
J S 1/D 1	8/69	374482 661475	50.7	91.3	CI 1702	CI1746	C	C	V	WU	G	
J S 1/D 2	8/69	373853 661385	43.8	94.0	CI 1702	CI1747	C	C	V	WU	G	
J S 1/D 3	8/69	373182 661480	72.4	99.5	CI 1702	CI1748	C	C	V	WU	G	
J S 1/D 4	8/69	374755 661587	55.6	83.0	CI 1702	CI1749	C	C		WU		

LEGEND:

Samples:
 C - Core
 D - Disturbed
 U - Undisturbed
Film:
 C - Colour
 B - Black and White
 M - Microfilm

Field Tests:

W - Water Pressure
 P - Soil Permeability
 S - Standard Penetration
 V - Vane Shear

Laboratory Tests on Rock:

W - Accelerated Weathering
 U - Unconfined Compression
 P - Petrography
 X - X-Ray
 S - Swelling
 L - Leaching
 V - Sonic Velocity

Laboratory Tests on Soil:

W - Moisture Content
 G - Specific Gravity
 S - Grain Size Distribution
 A - Atterberg Limits
 C - Compaction
 S - Shear Testing
 C - Consolidation

APPENDIX D

GEOLOGICAL LOGS OF DRILL HOLES

EXPLANATION OF SEMI-QUANTITATIVE DESCRIPTIVE TERMS
USED ON GEOLOGICAL LOGS

Rock Weathering

Completely Weathered (CW)	Completely decomposed in situ, but still possessing a recognisable rock fabric.
Highly Weathered (HW)	Weakened to the extent that pieces of dry drill core can be broken across joint blocks and bedding and crumbled by hand.
Moderately Weathered (MW)	Considerable evidence of weathering such as deep staining with limonite throughout; drill cores of rock types which are strong when fresh cannot be broken across joints and bedding by hand; strength intermediate between highly weathered and fresh rock.
Slightly Weathered (SW)	Distinct evidence of weathering throughout the rock, such as some limonite staining; but its strength approaches that of fresh rock.
Fresh (F)	Unweathered.

Rock Strength

Weak	Easily broken by hand; often crumbles.
Moderately Weak	Broken by hand with difficulty.
Moderately Strong	Cannot be broken by hand but can be broken by one blow with a hammer.
Strong	Requires several blows with a hammer before breaking.

Rock Hardness

Soft	Can be easily scratched by fingernail.
Moderately Soft	Deep scratch with penknife.
Moderately Hard	Shallow scratch with penknife.
Hard	Penknife unable to scratch core.

DRILL HOLES



AUGER HOLE



HAND AUGER



PERCUSSION & ROTARY DRILL HOLE



DIAMOND DRILL HOLE



COMBINED AUGER & DIAMOND DRILL HOLE



HOLE AT ANGLE OF 45°
TO HORIZONTAL

EXPLORATORY TRENCHES & PITS



TRENCH



PIT

THE ELECTRICITY COMMISSION OF N.S.W.
POWER DEVELOPMENT DIVISION

DRN	M.H.	SITE INVESTIGATIONS STANDARD SYMBOLS	APPROVED	DATE
TCD	F.N.G.		<i>[Signature]</i>	6/11/68
CKD	P.M.G.		C.I. 766	

SOIL TYPES

- ORGANIC SOIL
- CLAY
- SILT
- SAND
- GRAVEL
- COBBLES, BOULDERS
- SAND, CLAYEY
- CLAY, SILTY
- UNDISTURBED SOIL SAMPLE TAKEN
- DISTURBED SOIL SAMPLE TAKEN
- 25:11:67

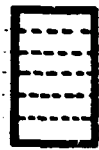
WATER TABLE AT GIVEN DATE

**THE ELECTRICITY COMMISSION OF N.S.W.
POWER DEVELOPMENT DIVISION**

DRN	MH.	SITE INVESTIGATIONS SOILS STANDARD SYMBOLS	APPROVED <i>[Signature]</i>	DATE 6/11/68	
TCD	P.N.G.		C.I. 767		
CKD	P.M.P.G.				



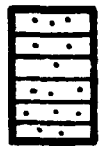
COAL



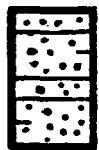
CLAYSTONE



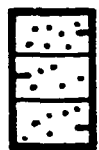
SHALE



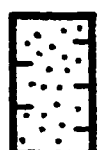
SILTSTONE



SANDY SILTSTONE



SILTY SANDSTONE



SANDSTONE



PEBBLY SANDSTONE



CONGLOMERATE



ACID IGNEOUS VEIN



BASIC IGNEOUS VEIN



SHEAR ZONE



JOINT

THE ELECTRICITY COMMISSION OF N.S.W.
POWER DEVELOPMENT DIVISION

DRN	M.H.
TCD	F.N.G.
CKD	C.M.P.G.

STANDARD GEOLOGICAL SYMBOLS
USED ON GRAPHIC LOGS

APPROVED *[Signature]* DATE 6/11/68

C.I.768

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 373991 Ground R.L. 11.8 Size of Bit: 4"
 N 661661
 Location Plan Reference: C.I. 1702 Date Drilled: 27. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5	D1		SAND, dark grey with humus and roots SAND, light grey, clean, fine-grained.		5
10	D2		SAND, light grey, clean, medium to coarse grained.		10
15	D3		SAND, light grey, medium to coarse grained, gritty.		15
20	D4		SAND, light grey, saturated, medium to coarse grained, slight silt and weak clay content. Slight auger resistance.	18.0	20
25	D5		WEATHERED SANDSTONE, light grey, weak, with occasional layers of gravel, subangular to rounded, grading from grit to about 1/2".		25
30			Auger refusal at 27'6".		30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1703
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Genco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 373793 Ground R.L. 10.2 Size of Bit: 4"
 N 661680
 Location Plan Reference: C.I. 1702 Date Drilled: 27. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5			SAND, dark grey, with humus and roots.		5
10	D1		SAND, grey, fine to medium grained with occasional thin bands of old vegetation horizons.		10
15	D2		SAND, light grey, medium to coarse grained.		15
20					20
25	D3		SAND, light brown, medium to coarse grained with abundant grit inclusion.		25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; ED - Bulk Disturbed

Logged by J. Close

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES


LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco

Location: Station Contractor: Unidrill

Co-ordinates: E _____ N _____ Ground R.L. _____ Size of Bit: 4"

Location Plan Reference: C.I. 1702 Date Drilled: 26. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
35					35
40					40
45	D4		SAND, fine to medium grained, light brown, saturated.		45
50					50
55					55
60					60

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES




LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Genco

Location: Station Contractor: Unidrill

Co-ordinates: E _____ Ground R.L. _____ Size of Bit: 4"
N _____

Location Plan Reference: C.I. 1702 Date Drilled: 27. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
65	D5		SAND, grey, fine to medium grained silty, saturated, with a weak clay binder.		65
70			WEATHERED SANDSTONE, grey, weak, with alternating layers of soft silty sandy clay.		70
75			Auger refused on sandstone at 75 ft.		75
80					80
85					85
90					90

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1704

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Genco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 374027 Ground R.L. 94.0 Size of Bit: 4"
 N 661407
 Location Plan Reference: C.I. 1702 Date Drilled: 27. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5	D1		SAND, mottled grey, fine to medium grained with humus and roots.		5
10	D2		SAND, brown, fine to medium grained.		10
15					15
20			SAND, brown, fine to medium grained.		20
25					25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; ED - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1705
 Sheet 1 of 3

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jarvis Bay Rig Type: Genco

Location: Station Contractor: Unidrill

Co-ordinates: E - 374027 Ground R.L. 94.0 Size of Bit: 4"
 N - 661407

Location Plan Reference: C.I. 1702 Date Drilled: 27. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
35					35
40					40
45			SAND, brown, fine to medium grained.		45
50					50
55					55
60					60



Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1705

THE ELECTRICITY COMMISSION OF NEW SOUTH WALESLOG OF OVERBURDENProject: Jervis Bay Rig Type: CemcoLocation: Station Contractor: UnidrillCo-ordinates: E 374027 Ground R.L. 94.0 Size of Bit: 4"
N 661407Location Plan Reference: C.I. 1702 Date Drilled: 27. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
65	D3		SAND, brown, fine to medium grained.		65
70					70
75	D4		SANDSTONE, light grey, weathered, slight clay content.		75
80			Auger refused at 77.0 on sandstone.		80
85					85
90					90

Note: Logs shall include information on:







- (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
- (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.Logged by J. Close

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 373691 Ground R.L. 94.1 Size of Bit: 4"
 N 661527
 Location Plan Reference: C.I. 1702 Date Drilled: 28. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5	D1		SAND, grey, fine to medium grained with humus and roots. SAND, brown, fine to medium grained.		5
10					10
15					15
20					20
25					25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed

Logged by J. Close

DWG. NO. C.I. 1706
 Sheet 1. of 4

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERSIGHT

Project: Jervis Bay Rig Type: Gemco

Location: Station Contractor: Unidrill

Co-ordinates: E 373891 Ground R.L. 94.1 Size of Bit: 4"
 N 661527

Location Plan Reference: C.I. 1702 Date Drilled: 23. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
35				35
40				40
45		SAND, light brown fine to medium grained.		45
50				50
55				55
60				60

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jarvis Bay Rig Type: Genco

Location: Station Contractor: Unidrill

Co-ordinates: E 373891 Ground R.L. 94.1 Size of Bit: 4"
 N 664527

Location Plan Reference: C.I. 1702 Date Drilled: 28. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
65					65
70					70
75			SAND, light brown, fine to medium grained.		75
80					80
85					85
90					90

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Genco

Location: Station Contractor: Unidrill

Co-ordinates: E 373891 Ground R.L. 94.1 Size of Bit: 4"
 N 661527

Location Plan Reference: C.I. 1702 Date Drilled: 28. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
95					95
100	D2		SAND, light brown, fine to medium grained, becoming saturated towards bottom.		100
105					105
110		105'	Limit of machine		110
115					115
120					120

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.







Sampling Method: U - Undisturbed; D - Disturbed; ED - Bulk Disturbed.

Logged by J. Close

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Genco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 373501 Ground R.L. 74.0 Size of Bit: 4"
 N 661357
 Location Plan Reference: C.I. 1702 Date Drilled: 23. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
-	D1		LOAM, dark grey, silty, very sandy with roots.		-
5	D2		SAND grey, fine to medium grained, silty.		5
10	D3		SAND, dark brown, fine to medium grained, silty, saturated.		10
15	D4		SAND, brown, fine to medium grained silty, saturated.		15
18	D5		SAND, light brown, fine to medium grained, silty, saturated.		18
20	D6		SANDSTONE, light grey and brown, highly weathered.		20
23			Auger refusal at 23'		23
25					25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.







Logged by J. Close

DWG. NO. C.I. 1707
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 373853 Ground R.L. 43.6 Size of Bit: 4"
 N 661335
 Location Plan Reference: C.J. 1702 Date Drilled: 30. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5	D1		SAND, light grey, fine to medium grained, silty.		5
10					10
15					15
20					20
25					25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.J. 1702
 Sheet 1 of 3

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco

Location: Station Contractor: Unidrill

Co-ordinates: E 373853 Ground R.L. 43.8 Size of Bit: 4"
N 661385

Location Plan Reference: C.I. 1702 Date Drilled: 30. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
35					35
40	D2		SAND, light brown, fine to medium grained.		40
45					45
50					50
55					55
60					60

Note: Logs shall include information on:

- (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
- (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

D/G. NO. C.I. 1703
Sheet 2 of 3

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Cenco

Location: Station Contractor: Unidrill

Co-ordinates: E 373853 Ground R.L. 43.8 Size of Bit: 4"
N 661385

Location Plan Reference: C.I. 1702 Date Drilled: 30. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
	D3		SAND, brown, fine to medium grained slightly gritty, saturated.		
65	D4		SAND, light brown, fine to medium grained, gritty, saturated.		65
			68'		
70	D5		SANDSTONE, mottled brown, weak, highly weathered.		70
			72'		
75			Auger refusal at 72'		75
80					80
85					85
90					90

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; ED - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1708
 Sheet 3 of 3

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Genco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 373855 Ground R.L. 61.1 Size of Bit: 4"
 N 661186

Location Plan Reference: C.I. 1702 Date Drilled: 30. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5	D1		SAND, grey, fine to medium grained, silty.		5
	D2		SAND, dark brown, fine to medium grained, with silt and humus.		
10	E3		SAND, brown, fine to medium grained.		10
15	D4		SAND, light grey and brown, fine to medium grained.		15
20	D5		SAND, medium grey, fine to medium grained.		20
25					25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1702
 Sheet 1. of 3.

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: GencoLocation: Station Contractor: UnidrillCo-ordinates: E 372855 Ground R.L. 61.1 Size of Bit: 4"
N 661136Location Plan Reference: C.I. 1702 Date Drilled: 30. 6. 69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
35	D6		SAND, light brown, fine to medium grained, saturated.		35
40	D7		SAND Grey and brown, fine to medium grained saturated.		40
45					45
50	D8		SAND, light brown, fine to medium grained, saturated.		50
55					55
60					60

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1709
 Sheet 2 of 3

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OWNERSHIP

Project: Jervis Bay Rig Type: Gemco

Location: Station Contractor: Unidrill

Co-ordinates: E 373855 Ground R.L. 61.1 Size of Bit: 4"
 N 661186

Location Plan Reference: C.I. 1702 Date Drilled: 30. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
65	D9		SAND, grey, fine to medium grained, gritty, saturated.		65
70					70
			SANDSTONE, mottled brown, weak highly weathered.		
75			Auger refusal at 74'		75
80					80
85					85
90					90

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; ED - Bulk Disturbed.

Logged by J. Close

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco

Location: Station Contractor: Unidrill

Co-ordinates: E 373182 Ground R.L. 72.4 Size of Bit: 4"
 N 661430

Location Plan Reference: C.I. 1702 Date Drilled: 30. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5	D1		SAND, brown, fine grained, saturated, silty, lateritic.		—
7	D2		SAND, reddish brown, silty, gritty, some loam.		5
11	D3		CLAY, brown, soft, saturated, silty, very sandy, few nodules of laterite.		10
16	D4		SANDSTONE, grey and brown, weak, highly weathered.		15
20			Auger refusal at 16'		20
25					25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.


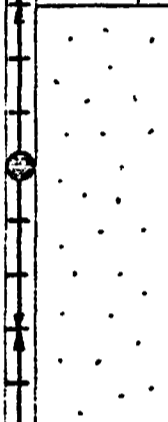
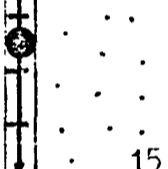
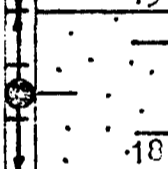
Sampling Method: U - Undisturbed; D - Disturbed; ED - Bulk Disturbed.

Logged by J. Close

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Genco
 Location: Station Contractor: Unidril
 Co-ordinates: E 373246 Ground R.L. 27.8 Size of Bit: 4"
N 661693
 Location Plan Reference: C.I. 1702 Date Drilled: 30. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
	No sample.		SAND, dark grey, fine grained, saturated, silty, with humus.		—
5	D1		SAND, dark brown, fine grained, saturated, silty.		5
10	D2		SAND, grey and brown, fine grained, saturated, silty.		10
15	D3		SANDSTONE, grey and brown, weak, highly weathered.		15
20			Auger refusal at 18'		20
25					25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1711
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 373135 Ground R.L. 83.0 Size of Bit: 4"
 N 661381
 Location Plan Reference: C.I. 1702 Date Drilled: 1. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5			SAND, grey and brown, fine grained, very silty, slightly clayey, saturated.		5
10					10
15					15
19'					
20			SANDSTONE, grey brown, weak, highly weathered.		20
20'			Auger refusal at 20'		
25					25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; ED - Bulk Disturbed

Logged by J. Close

DWG. NO. C.I. 1712
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jarvis Bay Rig Type: Genco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 375049 Ground R.L. 96.4 Size of Bit: 4"
 N 661185
 Location Plan Reference: C.I. 1702 Date Drilled: 1. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5	D1		SAND, brown, fine grained, saturated, silty.		5
10			CLAY, grey, soft to firm, very silty, sandy, saturated.		10
15	D2				
20	D3		CLAY, firm to stiff, silty, sandy, very moist.		20
23'			SANDSTONE, grey weak, highly weathered.		
24'			Auger refusal at 24'		
25					25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close
 DWG. NO. C.I. 1713
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay

Rig Type: Genco

Location: Station

Contractor: Unidrill

Co-ordinates: E 372371
N 667635

Ground R.L. 74.4 Size of Bit: 4"

Location Plan Reference: C.I. 1702 Date Drilled: 1. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
	D1	4'	SAND, grey, fine-grained, silty with humus.		
5	D2	6'	LOAM dark brown, very sandy with roots.		5
10	D3		SAND, brown, fine to medium grained.		10
15					15
20			SAND, light brown, fine to medium grained - saturated.		20
25					25
	D4	28'			
	D5	29'	SANDSTONE, grey and brown, highly weathered		
30			Auger refusal at 29'		30

Note: Logs shall include information on:

- (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
- (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; ED - Bulk Disturbed

Logged by J. Close

DWG. NO. C.I. 1714
Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 372931 Ground R.L. 58.4 Size of Bit: 4"
 N 501775
 Location Plan Reference: C.I. 1702 Date Drilled: 1. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
2'	D1		SAND, dark grey, fine-grained, silty with roots and humus.		
5'	D2		SAND, brown, fine to medium grained, silty.		5
10'	D3		SAND, medium brown, fine to medium grained, silty, saturated.		10
15'			SAND, light brown, very silty, fine to medium grained, saturated, lateritic.		15
18'			SANDSTONE, reddish brown, weak, highly weathered with layers of laterite.		20
20'			Auger refusal at 20'		25
25'					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed

Logged by J. Close

DWG. NO. C.I. 1705
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 372851 Ground R.L. 40.9 Size of Bit: 4"
 N 661883
 Location Plan Reference: C.I. 1702 Date Drilled: 1. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5	D1		SAND, dark brown, fine-grained, silty.		5
10	D2		SAND, grey and brown, fine to medium grained, silty.		10
15			SAND, brown, silty, slightly clayey, saturated.		15
20	D3		SANDSTONE, brown, weak, highly weathered.		20
25	D4		Auger refusal at 22'		25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed

Logged by J. Close

DWG. NO. C.I. 1716
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES


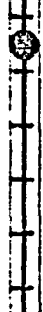


LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Genco

Location: Station Contractor: Unidrill

Co-ordinates: E 502401 Ground R.L. 50.4 Size of Bit: 4"
N 081924

Location Plan Reference: C.I. 1702 Date Drilled: 1. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5	D1		SAND, grey, fine-grained, silty, saturated.		5
10			SAND, light grey, fine to medium grained, very silty, saturated.		10
15	D2				15
	D3		SANDSTONE, brown and grey, weak, highly weathered.		
20			Auger refusal at 19'		20
25					25
30					30

Note: Logs shall include information on:

- (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
- (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; KD - Bulk Disturbed.

Logged by J. Close

D.W. NO. C.I. 1717
Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay

Rig Type: Genco

Location: Station

Contractor: Unidrill

Co-ordinates: E 372828
N 661350

Ground R.L. 64.2

Size of Bit: 4"

Location Plan Reference: C.I. 1702

Date Drilled: 1. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
			SAND, grey, silty, slightly clayey, saturated.		
D1					
5			SAND, dark grey, fine to medium grained, silty, saturated.		5
D2		8'			
D3		10'	SANDSTONE, grey, weak, highly weathered.		10
10			Auger refusal at 10'		
15					15
20					20
25					25
30					30

Note: Logs shall include information on:

- (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
- (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1718
Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 373348 Ground R.L. 91.0 Size of Bit: 4"
 N 661387
 Location Plan Reference: C.I. 1702 Date Drilled: 2. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
	D1		SAND, grey, fine to medium-grained.		—
5	D2		SAND, brown, fine to medium-grained with weakly cemented modules throughout.		5 —
10			SAND, yellowish brown, fine to medium-grained.		10 —
15	D3		SAND, light brown and grey, fine to medium-grained.		15 —
20			SAND, light brown and grey, fine to medium-grained.		20 —
25	D4		SAND, light brown and grey, fine to medium-grained.		25 —
30			SAND, light brown and grey, fine to medium-grained.		30 —

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1719
 Sheet 1 of 2

THE RECREATION COMMISSION OF NEW SOUTH WALES

LOG OF OVERBOREN

Project: Jervis Bay Rig Type: Genco

Location: Station Contractor: Unidrill

Co-ordinates: E 373348 Ground R.L. 21.0 Size of Bit: 4"
N 331307

Location Plan Reference: C.I. 1702 Date Drilled: 2. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
	D5	31'	SAND, grey, fine-grained, silty, slightly clayey, saturated.		
			SANDSTONE, light grey and brown, weak, highly weathered.		
35	D6	35'			35
			Auger refusal at 35'		
40					40
45					45
50					50
55					55
60					60

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.






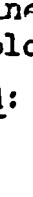

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 373176 Ground R.L. 105.8 Size of Bit: 4"
 N 661194
 Location Plan Reference: C.I. 1702 Date Drilled: 1. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5			SAND, brown, silty, fine-grained, saturated.		5
10	D1				10
15					15
20			SAND, grey and brown, very silty, slightly clayey, saturated.		20
23	D2				
25	D3		CLAY, grey, soft, silty, saturated.		25
26					
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1720
 Sheet 1. of 2.

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES




LOG OF OVERSIDDEN

Project: Jervis Bay Rig Type: Genco

Location: Station Contractor: Unidrill

Co-ordinates: E 373176 Ground R.L. 105.8 Size of Bit: 4"
 N 661194

Location Plan Reference: C.I. 1702 Date Drilled: 1. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Flows
	D4		SAND, grey, silty, clayey, saturated.		--
			SANDSTONE, grey, weak, decomposed.		--
35	D5		Auger refusal at 35'		35 --
40					40 --
45					45 --
50					50 --
55					55 --
60					60 --

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1720

Sheet 2 of 2

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco

Location: Station Contractor: Unidrill

Co-ordinates: E 373447 Ground R.L. 72.0 Size of Bit: 4"
 N 661522

Location Plan Reference: C.I. 1702 Date Drilled: 2. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
			SAND, grey, fine to medium-grained.		
5	D1	4'			5
			SAND, dark brown, fine to medium grained, with weakly cemented modules.		
10	D2				10
			SAND, light brown, fine to medium-grained.		
15	D3				15
			SAND, brown, fine to medium-grained.		
25	D4	26'			25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed

Logged by J. Close

DWG. NO. C.I. 1721
 Sheet 1 of 2

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF GUNBERDEN

Project: Jervis Bay Rig Type: Gemco

Location: Station Contractor: Unidrill

Co-ordinates: E 373447 Ground R.L. 72.0 Size of Bit: 4"
 N 661522

Location Plan Reference: C.I. 1702 Date Drilled: 2. 7. 69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
	D5	31'	SAND, light grey, fine to medium grained, very silty.		--
			SANDSTONE, grey, weak, gritty, highly weathered.		--
35	D6	35'	Auger refusal at 35'		35
40					40
45					45
50					50
55					55
60					60

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unigrill
 Co-ordinates: E 373496 Ground R.L. 55.2 Size of Bit: 4"
 N 661699
 Location Plan Reference: C.I. 1702 Date Drilled: 2. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
	D1	3'	SAND, dark grey; silty, fine to medium-grained.		-
5	D2		SAND, dark brown, silty, fine to medium-grained with humus and roots.		5
10			SAND, varying shades of brown, fine to medium-grained.		10
15	D3				15
20					20
25					25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; ED - Bulk Disturbed.

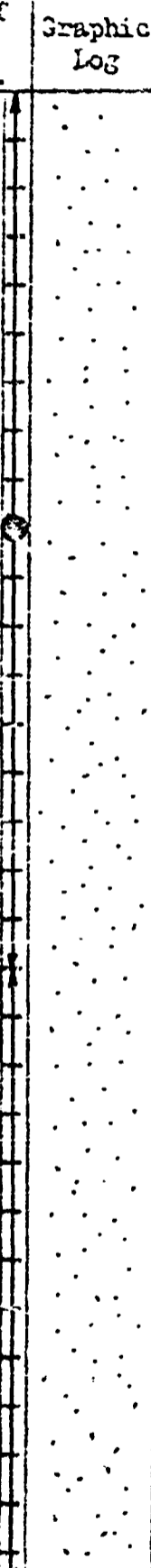
Logged by J. Close

DWG. NO. C.I. 1722
 Sheet 1 of 3

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: GencoLocation: Station Contractor: UnidmillCo-ordinates: E 373496 Ground R.L. 55.2 Size of Bit: 4"
N 661699Location Plan Reference: C.I. 1702 Date Drilled: 2. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
35			SAND, brown, fine to medium-grained.		35
40					40
45	D4				45
50					50
55					55
60					60

Note: Logs shall include information on:

- Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
- Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.Logged by J. CloseDWG. NO. C.I. 1722Sheet 2 of 3

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES



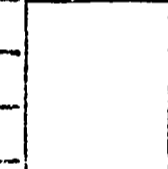
LOG OF GYNEBUDEN

Project: Jervis Bay Rig Type: Genco

Location: Station Contractor: Unidrill

Co-ordinates: E 373496 Ground R.L. 55.2 Size of Bit: 4"
 N 661699

Location Plan Reference: C.I. 1702 Date Drilled: 2. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
65			SAND, light brown and grey, silty, saturated, fine to medium-grained.		65
70	D5		SANDSTONE, light grey and brown, weak, highly weathered.		70
75	D6		Auger refusal at 73'		75
80					80
85					85
90					90

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; ED - Bulk Disturbed.

Logged by J. Close

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco

Location: Station Contractor: Unidrill

Co-ordinates: E 373461 Ground R.L. Size of Bit: 4"
N 661203

Location Plan Reference: C.I. 1702 Date Drilled: 2. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5	D1	5'	SAND, grey, fine to medium-grained, silty, with humus.		5
10	D2		SAND, dark brown, fine to medium grained, very silty.		10
15	D3		SAND, brown, fine to medium-grained.		15
20			SAND, light brown, medium to coarse grained, silty, saturated.		20
25	D4	24'	SANDSTONE, light grey and brown, weak, highly weathered.		25
30	D5	29'			30
			Auger refusal at 29'		

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; ED - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1723
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Genco
 Location: Station Contractor: Unidri11
 Co-ordinates: E 373725 Ground R.L. 94.0 Size of Bit: 4"
 N 661501
 Location Plan Reference: C.I. 1702 Date Drilled: 28. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5	D1		SAND, grey, fine to medium-grained, with humus.		5
10	D2		SAND, dark brown, fine to medium grained, silty.		10
15					15
20			SAND, brown, fine to medium-grained.		20
25	D3				25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; ED - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1724
 Sheet 1 of 4

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco

Location: Station Contractor: Unidrill

Co-ordinates: E 373725 Ground R.L. 94.0 Size of Bit: 4"
 N 661501

Location Plan Reference: C.I. 1702 Date Drilled: 28. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
35					35
40					40
45			SAND, light brown, fine to medium-grained.		45
50					50
55					55
60					60

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1724

Sheet 2 of 4

THE EMPLOYMENT COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco

Location: Station Contractor: Unidrill

Co-ordinates: E 373725 Ground R.L. 94.0 Size of Bit: 4"
 N 661501

Location Plan Reference: C.I. 1702 Date Drilled: 28. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
65					65
70					70
75					75
80			SAND, light brown, fine to medium-grained.		80
85					85
90					90

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1724
 Sheet 3 of 4

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco

Location: Station Contractor: Unidrill

Co-ordinates: E 373725 Ground R.I. 94.0 Size of Bit: 4"
 N 661501

Location Plan Reference: C.I. 1702 Date Drilled: 28. 6.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
95			SAND, light brown, fine to medium-grained, becoming saturated towards bottom.		95
100					100
105					
	D4	103'			
110			Limit of machine		110
115					115
120					120

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 374205 Ground R.L. 56.0 Size of Bit: 4"
 N 661432
 Location Plan Reference: C.I. 1702 Date Drilled: 2. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
D1			SAND, dark grey, fine to medium grained with roots and humus.		
D2			SAND, grey, fine to medium-grained.		
5					5
D3			SAND, dark grey, fine to medium grained, with roots.		
10					10
D4			SAND, grey, saturated, fine to medium-grained, silty.		
15					15
D5			SAND, light grey, some brown, fine grained, very silty.		
20					20
D6			SANDSTONE, light grey and brown, weak, highly weathered.		
25					25
			Auger refusal at 23'		
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed

Logged by J. Close

DWG. NO. C.I. 1725
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 374202 Ground R.L. 29.1 Size of Bit: 4"
 N 661692
 Location Plan Reference: C.I. 1702 Date Drilled: 4. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
—	D1	●	SAND, dark grey and brown, silty, fine to medium grained with humus		—
5	D2	●	SAND, mottled brown, medium to coarse grained, silty, gritty		5
10	D3	●	SANDSTONE, light grey and brown, weak, highly weathered		10
15			Auger refusal at 11'		15
20					20
25					25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.






Logged by J. Close

DWG. NO. C.I. 1726
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 374455 Ground R.L. 71.6 Size of Bit: 4"
 N 061390
 Location Plan Reference: C.I. 1702 Date Drilled: 3. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
	D1		SAND, grey, fine to medium grained with humus		-
			3'		-
5	D2		SAND, dark brown, fine to medium grained, with cemented nodules		5 -
10					10 -
15	D3		SAND, brown, fine to medium grained		15 -
20					20 -
25	D4		SAND, light brown, fine to medium grained, silty, saturated		25 -
			25'		25 -
	D5		SANDSTONE, light grey, fine to medium grained, silty, gritty		-
			28'		-
30			Auger refusal at 28'		30 -

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1727
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 374284 Ground R.L. 70.7 Size of Bit: 4"
 N 661384

Location Plan Reference: C.I. 1702 Date Drilled: 4. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
	D1		SAND, grey, fine to medium grained, silty		-
			3'		-
5	D2		SAND, dark brown, fine to medium grained with humus		5 -
			8'		-
10	D3		SANDSTONE, light grey and brown, weak, weathered		10 -
			11'		-
			Auger refusal at 11'		-
15					15 -
20					20 -
25					25 -
30					30 -

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1728
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Camco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 374123 Ground R.L. 54.9 Size of Bit: 4"
 N 661453
 Location Plan Reference: C.I. 1702 Date Drilled: 16. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5					5
10	D1	●	Dark Brown, medium-grained SAND. Small amount of organic material and no clay.		10
15	D2	●	Light brown (with patches of darker brown) medium-grained quartz SAND.		15
20	D3	●	White to off-white with some brown patches clayey SAND. Probably disturbed C.W. sandstone.		20
			Auger refusal at 20ft.		
25					25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed

Logged by J. Close

DWG. NO. C.I. 1729
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Genco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 374141 Ground R.L. 38.1 Size of Bit: 4"
 N 661571
 Location Plan Reference: C.I. 1702 Date Drilled: 16. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5					5
10					10
15	D2 D3		White to dark brown, medium-grained clayey quartz SAND. Probably disturbed C.W. sandstone. Off-white clayey quartz SAND, medium to fine-grained. Bands of limonite stained clayey SAND. Disturbed C.W. sandstone.		15
20			Auger refusal at 17 ft.		20
25					25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DRG. NO. C.I. 1730

Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 374258 Ground R.L. 37.1 Size of Bit: 4"
 N 661606
 Location Plan Reference: C.I. 1702 Date Drilled:

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5			SAND, dark brown, fine to medium grained, silty, peaty, saturated with roots SAND, grey and brown, medium to coarse grained, very silty		5
10			SANDSTONE, light grey and brown, alternating soft and firm layers, weak, weathered		10
15			Auger refusal at 11'		15
20					20
25					25
30					30

Note: Logs shall include information on:

- (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
- (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method. U - Undisturbed, D - Disturbed; BU - Bulk Undisturbed.



Logged by J. Close

DWG. NO. C.I. 1731
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervic Bay Rig Type: Genco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 374574 Ground R.L. 22.6 Size of Bit: 4"
 N 631790
 Location Plan Reference: C.I. 1702 Date Drilled: 7. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5	D1		SAND, grey, fine to medium grained, silty		5
10	D2		SAND, dark brown, fine to medium grained, silty		10
15					15
20					20
25					25
30					30

Note: Logs shall include information on:

- (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, consistency.
- (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; ED - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1732
 Sheet 1 of 2

THE MARINE RESEARCH COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Genco
 Location: Station Contractor: Unigrill
 Co-ordinates: E 374574 Ground R.L. 22.6 Size of Bit: 4"
 N 661750
 Location Plan Reference: C.I. 1702 Date Drilled: 7. 7. 69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
35			SAND, mottled brown, fine to medium grained, gritty, pebbly, saturated		35
40			SANDSTONE, dark grey and brown, silty, pebbly, weak, highly weathered		40
45			Auger refusal at 45'		45
50					50
55					55
60					60

Note: Logs shall include information on:

- (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour density.
- (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

Dwg. No. C.I. 1732

Sheet 2 of 2

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 374390 Ground R.L. 20.6 Size of Bit: 4"
 N 661761
 Location Plan Reference: C.I. 1702 Date Drilled: 7. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5	D1		SAND, dark brown, fine to medium grained, very silty, with roots and humus, few cemented nodules, saturated		5
10	D2		SANDSTONE, light grey, silty, weak, weathered		10
15			Auger refusal at 14'		15
20					20
25					25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1733
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 374448 Ground R.L. 26.7 Size of Bit: 4"
 N 661741
 Location Plan Reference: C.I. 1702 Date Drilled: 7. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5	D1		SAND, dark grey, fine to medium grained, silty, with cemented nodules		5
10	D2		SAND, dark brown, fine to medium grained, very silty, with humus		10
15	D3		SAND, brown, fine to coarse grained, gritty, saturated		15
25	D4		SANDSTONE, light grey and brown, silty, weak, highly weathered		25
30			Auger refusal at 26'		30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; ED - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1734
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 334543 Ground R.L. 35.7 Size of Bit: 4"
 N 651676
 Location Plan Reference: C.I. 1702 Date Drilled: 4. 7. 69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
	D1	3'	SAND, dark grey, fine to medium grained with roots and humus		
5	D2		SAND, dark brown, fine to medium grained, slightly gritty		5
10					10
	D3	26'	SAND, brown, fine to medium grained		15
15					
20	D4		SAND, light brown, fine to medium grained, silty, gritty, saturated		20
25					25
	D5		SANDSTONE, grey, fine grained, very silty		
30			Auger refusal at 31'		30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close
 DWG. NO. C.I. 1735
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 374572 Ground R.L. 34.2 Size of Bit: 4"
 N 661564
 Location Plan Reference: C.I. 1702 Date Drilled: 4. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5	D1		SAND, grey, fine to medium grained, with humus and roots		5
10	D2		SAND, dark brown, fine to medium grained, silty		10
15	D3		SAND, brown, fine to medium grained, slightly gritty, saturated		15
19	D4		SANDSTONE, light grey, silty, weak, highly weathered		19
20			Auger refusal at 19'		20
25					25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed

Logged by J. Close

DWG. NO. C.I. 1736
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES






LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Geooco

Location: Station Contractor: Unidrill

Co-ordinates: E 374545 Ground R.L. 48.0 Size of Bit: 4"
N 661457

Location Plan Reference: G.I. 1702 Date Drilled:

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
	D1		SAND, grey, fine to medium grained		-
			2'		
5	D2		SAND, brown, fine to medium grained, slightly silty		5 -
10	D3		SAND, grey and brown, fine to medium grained		10 -
15	D4		SAND, brown, fine to medium grained, saturated		15 -
20			20'		20 -
	D5		SANDSTONE, light grey and brown, weak, weathered		
			22'		
25			Auger refusal at 22'		25 -
30					30 -

Note: Logs shall include information on:

- (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
- (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. G.I. 1737
Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 574476 Ground R.L. 36.7 Size of Bit: 4"
 N 661572
 Location Plan Reference: C.I. 1702 Date Drilled: 7. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5	D1		SAND, dark grey, silty, fine to medium grained, with roots and humus		5
10	D2		SAND, dark grey, medium to coarse grained, gritty, saturated, very silty		10
15	D3		SANDSTONE, dark grey, very silty, very weak, highly weathered		15
20			Anger refusal at 16'		20
25					25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1738
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 373987 Ground R.L. 69.6 Size of Bit: 4"
 N 661122
 Location Plan Reference: C.I. 1702 Date Drilled: 7. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
	D1	3'	SAND, grey, fine to medium grained		
5	D2		SAND, dark brown, silty, fine to medium grained, with humus		5
10	D3	23'	SAND, brown, fine to medium grained		10
15	D4		SAND, light brown, fine to medium grained		15
20	D5	26'	SANDSTONE, light grey and brown, very weak, highly weathered		20
25			Auger refusal at 26'		25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed

Logged by J. Close

DWG. NO. C.I. 1739
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Genco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 373029 Ground R.L. 96.8 Size of Bit: 4"
 N 661521
 Location Plan Reference: S.I. 1702 Date Drilled: 7. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
	D1	3'	SAND, light grey, fine to medium grained		
5	D2		SAND, dark brown, silty, fine to medium grained, with humus		5
10		26'			10
15	D3		SAND, light brown, fine to medium grained, gritty		15
20		29'			20
25	D4		SANDSTONE, reddish brown, fine to medium grained, silty, gritty, lateritic		25
30			Auger refusal at 29'		30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed

Logged by J. Close

DWG. NO. S.I. 1740

Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 373000 Ground R.L. 67.6 Size of Bit: 4"
 N 351703
 Location Plan Reference: C.I. 1702 Date Drilled: 7. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
	D1	2'	SAND, light grey, fine to medium grained		
5	D2		SAND, brown, fine to medium grained		5
10	D3		SAND, light brown, fine to medium grained		10
15	D4		SAND, brown, fine to medium grained		15
		19'			
20	D5	21'	SANDSTONE, yellow brown, very weak, highly weathered		20
25			Auger refusal at 21'		25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1741
 Sheet 1 of 1

THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

LOG OF OVERBURDEN

Project: Jervis Bay Rig Type: Gemco
 Location: Station Contractor: Unidrill
 Co-ordinates: E 372483 Ground R.L. 6.1 Size of Bit: 4"
 N 661788
 Location Plan Reference: C.I. 1702 Date Drilled: 8. 7.69

Depth	Type of Sample and No.	Graphic Log	Description	Water Level	No. of Blows
5			SAND, dark grey to black, silty, fine grained with humus, saturated		5
			SANDSTONE, light grey and brown, firm, weathered		
10			Auger refusal at 6'		10
15					15
20					20
25					25
30					30

Note: Logs shall include information on:
 (a) Coarse-grained soils - particle size and distribution, grading, particle shape, colour, density.
 (b) Fine-grained soils - plasticity, sensitivity, structure, colour, consistency.

Sampling Method: U - Undisturbed; D - Disturbed; BD - Bulk Disturbed.

Logged by J. Close

DWG. NO. C.I. 1742
 Sheet 1 of 1

BENTON CONE PENETRATION DATA

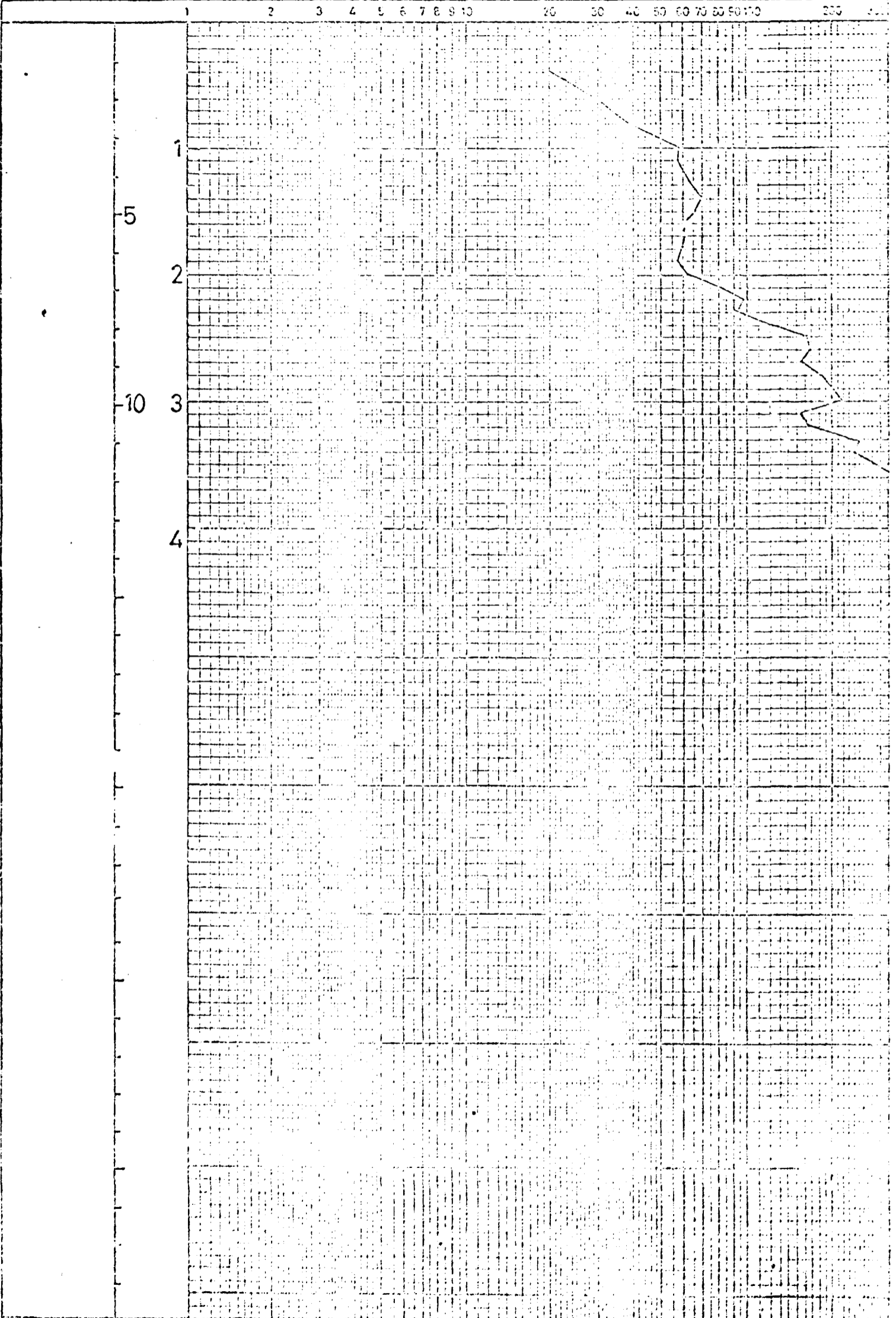
CLIENT ELECTRICITY COMMISSION OF NSW
PROJECT Proposed Nuclear Power Station
LOCATION Jarvis Bay

DATE OF SOUNDING 13-6-69
R.L. SURFACE 11.8
VERT. SCALE 1in=1metre.
JOB NO. 2775

REMARKS DEPTH 373991
561661

Feet
Metres

CONE PRESSURE kg/cm^2



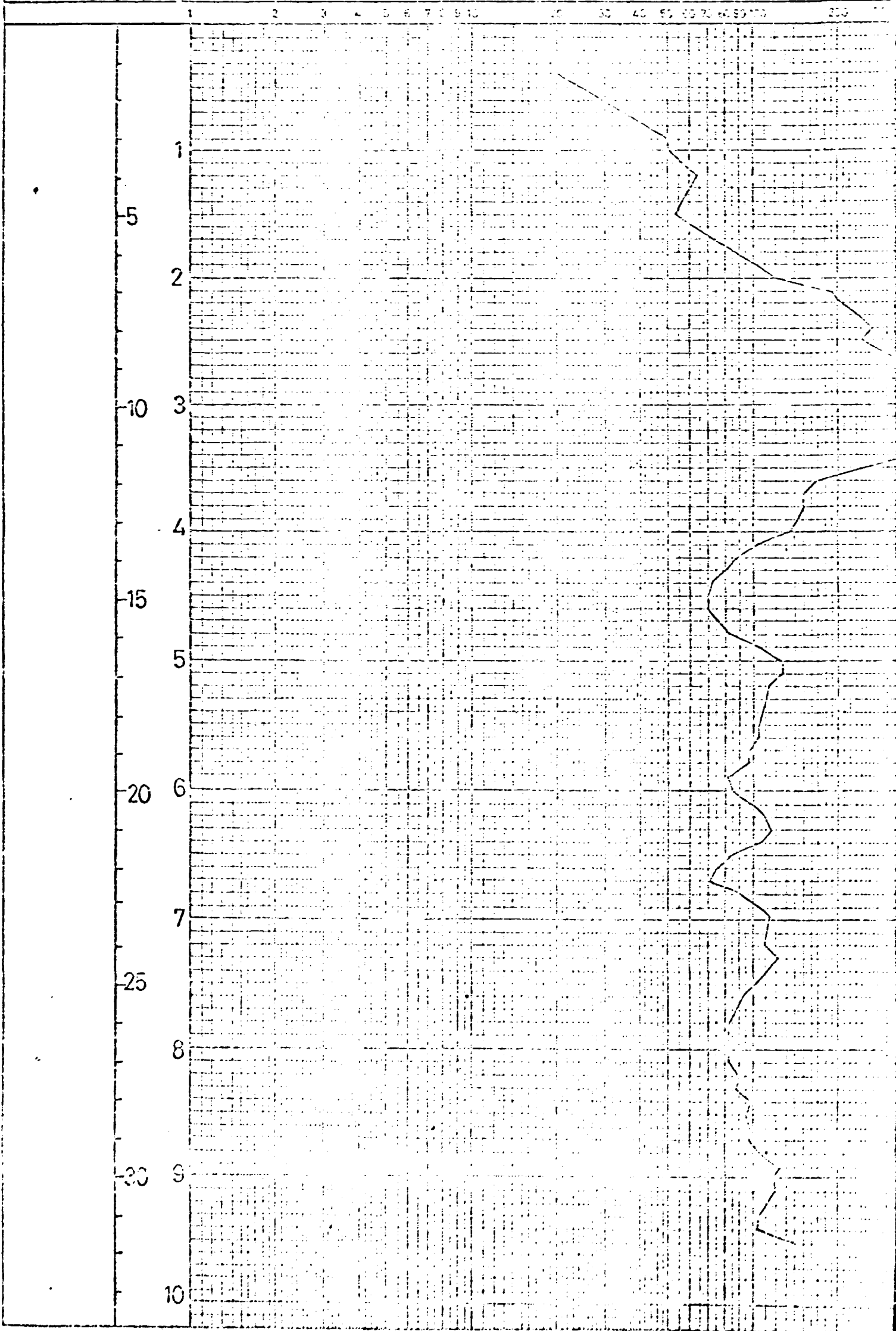
C.I. 1793

CLIENT ELECTRICITY COMMISSION OF N.S.W.
PROJECT Proposed Nuclear Power Station
LOCATION Jervis Bay

DATE OF SOUNDING 18-6-69
R.L. SURFACE 10.2
VERT. SCALE 1in = 1metre
JOB NO. 2775

REMARKS DEPTH
Feet Metres
373793
651680

CONCRETE PRESSURE (KG/CM²)



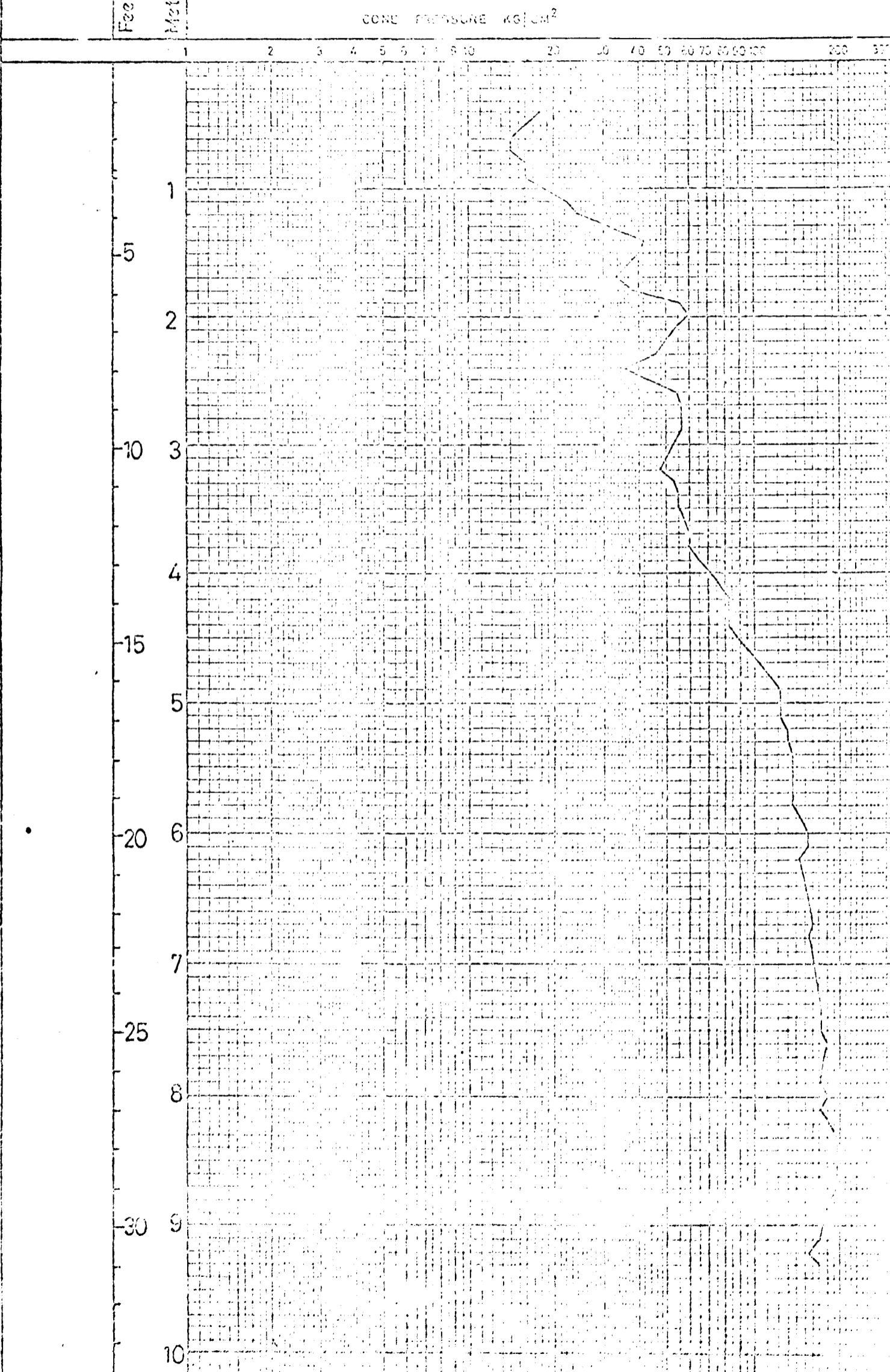
44-17-69

COFFEY & HOLDEN CONSULTANTS ENGINEERS PTY. LTD. 105/103
 DUTCH CONE PENETRATION DATA

CLIENT ELECTRICITY COMMISSION OF N.S.W.
 PROJECT Proposed Nuclear Power Station
 LOCATION Jervis Bay

DATE OF SOUNDING. 20-6-69
 R.L. SURFACE 94.0
 VERT. SCALE 1in = 1metre
 JOB NO. 2775

REMARKS DEPTH 374027
 661407



20-6-69

ROCK TYPE (DEGREE OF WEATHERING)	DESCRIPTION (LITHOLOGY, COLOUR, STRENGTH, HARDNESS ETC)	GRAPHIC LOG	DEPTH IN FEET	FRACTURE LOG	STRUCTURE (DIPS, SHALS, BEINGS, FAULTS, CRUMPLED ZONES)	WATER PRESSURE TEST (DEPTH OF COLLARS FOR MIN PER FT)
	NO CORE		5			
SAND	C.W. GREY SANDSTONE 17.0 TO 17.3 WITH SOME LIMONITE.	HC	15		15.9 TO 17.0 STRIPPED SANDSTONE.	
		HC	20.2			
C.W. SANDSTONE	DARK GREY, WEAK AND MOD. SOFT. MED. TO COARSE GRAINED WITH CLAYEY MATRIX.		22.5		NO JOINTS. LENGTHS .1 TO .5.	
C.W. SILTSTONE	DARK GREY, WEAK AND SOFT. IN ONE LENGTH.		24.0		NO JOINTS. MRS GREASY FEEL.	
C.W. SANDSTONE	AS FOR 20.2 TO 22.5. 24.0 TO 24.5 M.W. SANDSTONE 24.9 TO 26.1 DISINTEGRATED.		26.3		24.2 JOINT AT 75° TO 80° 26.3 SLIGHT GRINDING.	
M.W. SANDSTONE	DARK GREY, MOD. HARD AND MOD. WEAK TO WEAK. MED. GRAIN SIZE.		28.2		26.9 JOINT AT 0° LENGTHS .4 TO 1.3.	
C.W. SILTSTONE	AS FOR 22.5 TO 24.0 LENGTHS .6		29.8		JOINTS AT 0° TO 10° SPACED .6. 29.4 TO 29.6 CLAY SEAM.	
C TO M.W. SANDSTONE	AS FOR 20.2 TO 22.5 30.2 TO 30.6 DISINTEGRATED TED.		30.8		29.9 & 30.9 JOINTS AT 30°. 11.4 31.1 TO 31.3.	
M.W. SANDSTONE	DARK TO MED. GREY, MOD. HARD, MOD. STRONG. MED. GRAINED LENGTHS .1 TO 1.2. AVERAGE .3		34.1		REDDING AT 0° 31.9 } JOINTS AT 0° 32.2 } 31.7 PEBBLE OF PEARLITE .1.	
S.W. TO F SANDSTONE	GREY (MED. TO LIGHT). MOD. HARD AND MOD. STRONG. COARSE GRAINED WITH SOME PEBBLES OF QUARTZ AND ROCK FRAGMENTS TO .2. LENGTHS GENERALLY .4 TO 1.4, MOSTLY .6 TO .8 QUARTZ GRAINS IN A SILTY MATRIX 45.4, 34.9, 46.3 & 49.5 PEBBLY BANDS 49.4 TO 49.9 JOINT AT 90° WHICH HAS CAUSED SLIGHT WEATHERING. SOME PEBBLES HAVE BEEN REMOVED.		45		31.5 TO 35.9 } JOINTS 30.3 (SPACED) } AT 75° TO 43.5 } 80° 47.5 } 49.7 } 37.3 } JOINTS 41.2 } AT 42.1 (CLAY CONTACT) } 0° TO 10° 43.8 (CLAY SEAM } .05 THICK) 49.8 JOINT AT 85°	

DRILL TYPE FOR B.40
 FEED HYDRAULIC
 CORE BARREL TYPE
 TRIPPER TYPE
 DRILLER GEORGE TOTT
 COMMENCED 30-6-69
 COMPLETED 6-7-69
 LOGGED BY J.R.D.
 VERTICAL SCALE 1"=5'

NOTES
 FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are blocked in
 BEDDING & JOINT PLANES - Angles are measured relative to a plane normal to core axis.

WATER PRESSURE TESTS
 PACKING TYPE
 SUPPLY LINE
 VERTICAL SCALE
 THESE GIVES ARE GIVEN
 UNLESS THEY ARE
 OTHERWISE SPECIFIED BY
 THE LOGGERS IN 1969
 DWG NO. C.I. 1804

GEOLOGICAL LOG OF DRILL HOLE

LOG TYPE (DEPTH OF WEATHERING)	DESCRIPTION (LITHOLOGY, COLOUR, STRENGTH, HARDNESS ETC)	GRAPHIC LOG	DEPTH (FEET)	FRACTURE LOG	STRATIGRAPHY (ZONES, VEINS, BEDS, FOLDS, UNCONFORMITIES)	WATER RECORDS (DATE OF SAMPLING, DEPTH, METHOD)
SW TO F SANDSTONE	RS FOR 54.1 TO 50.0. 50.0 TO 50.4 SLIGHTLY WEATHERED. LENGTHS .1 TO 1.0, MOSTLY .5 TO .8. 53.2 TO 53.7 PERBLES 54.9 TO 55.2 CAVITIES TO .01.		55		JOINTS AT 0° TO 10°, SPACED .2 TO 1.2, MOSTLY .5 TO .8 50.0 JOINT AT 5°, SILTY COATING. 55.0 TO 55.2 JOINT AT 90°	
SANDSTONE	RS FOR 54.1 TO 56.8. QUARRIES 57.6 TO 57.9. LENGTHS .1 TO .4.		56.8		WEATHERING FLAG, JOINT	
F SANDSTONE	RS FOR 54.1 TO 56.8. QUARRIES 57.6 TO 57.9. LENGTHS .1 TO .4.		57.6		JOINTS AT 0° TO 10° SPACED .3 TO .5.	
S-17-W SANDSTONE	SLIGHTLY DISINTEGRATED.		59.4		50.0 PERBLES, JOINTS AT 0° SPACED .5 TO 2.5, AVERAGE 1.0	
F SANDSTONE	RS FOR 54.1 TO 50.0 LENGTHS .2 TO 1.3, MOSTLY .5 TO .8. MOD. STRONG TO STRONG. 60.0 TO 60.1 } 63.7 } PERALY 67.6 } BANDS. 69.8 } 71.4 } 72.0 } 81.1 }		60		JOINTS AT 0°, SPACED .5 TO 2.5, AVERAGE 1.0 90.5 JOINT AT 90°	
	69.1 TO 69.15 SILTSTONE BED AT 0°		65			
	72.3 TO 72.4 BLACK SILTSTONE AT 5° WITH THIN VENEER OF CLAY AT BASE OF SILTSTONE.		70			
	77.0 BLACK SILTSTONE AT 0°, .03 THICK.		75			
	77.1 SOME CAVITIES.		80			
	79.3 SLIGHTLY GROUND.		85			
			90			
	91.3					
	END OF HOLE					

DRILL TYPE: LOG 2 90
 FEED: HYDRAULIC
 CORE BARREL TYPE: TRIPLE TUBE
 COLLAR GROUND TEST COMMENCED: 12-6-69
 COMPLETED: 6-7-69
 LOGGED BY: J. B. D.
 VERTICAL SCALE: 1" = 1'

NOTES
 FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are blocked in.
 BEDDING & JOINT PLANES - Angles are measured relative to a plane normal to core axis.

VERTICAL SCALE
 DRAWING NO. CI. 1804

GEOLOGICAL LOG OF DRILL HOLE

ROCK TYPE (DETAILED DESCRIPTION)	DESCRIPTION (LITHOLOGY, COLOR, STRENGTH, HARDNESS, ETC.)	GRAPHIC LOG	DEPTH OF CORE (FEET)	STRUCTURES (JOINTS, VENS, BEAMS, FAULTS, GRAINED BODIES)	WATER PRESSURE TEST (IF CALIBRATED, IN BAR OR PSI)
	NO CORE		0 - 22.0		
N.W. QUARTZ SANDSTONE	WHITE TO LIGHT BUFF, MOD. HARD AND MOD. WEAK TO MOD. STRONG. COARSE GRAINED QUARTZ GRAINS. 26.1 TO 26.5 DISINTEGRATED.	NC	22.0 - 25.0	JOINTS AT 45° SPACED .5 TO 1.0. BEDDING AT 0°. GRINDS EASILY WHITE, IS IN LENGTHS .1 TO .6	
S.W. SANDSTONE	LIMONITE STAINED, MOD. HARD TO MOD. STRONG. LENGTHS .5 TO .8		25.0 - 27.1	27.1 JOINT AT 80° 27.9 JOINT AT 0°	
F QUARTZ SANDSTONE	WHITE TO BUFF WHERE LIMONITE STAINING OCCURS, HARD TO MOD. HARD AND MOD. STRONG. LENGTHS .7 TO 2.6, AVERAGE 1.0 COARSE GRAINED QUARTZ CRYSTALS. 34.2 TO 34.5 } N.W. 38.7 TO 38.9 }		27.1 - 39.4	LIMONITE STAINED JOINTS AT 0° TO 10° SPACED .8 TO 2.6. 34.8 JOINT AT 80°. LIMONITE STAINED. BEDDING AT 0° TO 5°	
F SANDSTONE	LIGHT TO MEDIUM GREY, MOD. HARD TO HARD AND MOD. STRONG. COARSE TO MEDIUM GRAINED QUARTZ GRAINS WITH SOME SILTY MATRIX. IS GENERALLY IN LONG LENGTHS TO 2.8. 43.6 TO 43.8 DISINTEGRATED, CAUSED BY WEATHERING ALONG JOINTS AT 0° AND 75°.		39.4 - 49.0	39.6 JOINT AT 0° WITH CLAY CORTING TO .01 THICK. 43.0 } JOINTS AT 45° 43.5 } 47.9 JOINT AT 0° WITH SOME SILTY CORTING.	

9-7-68

DRILL TYPE: FOX B NO.
 FEED: HYDRAULIC
 CORE BARREL TYPE: TRIPLE TUBE
 DRILLER: CRONIN
 COMMENCED: 2-7-68
 COMPLETED: 10-7-68
 LOGGED BY: D.R.D.
 VERTICAL SCALE: 1" = 5'

NOTES
 FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are marked in BEDDING & JOINT PLANES - Angles are measured relative to a plane normal to core axis.

WATER PRESSURE TESTS
 WATER PRESSURE TEST
 VERTICAL SCALE
 DRAWN BY: CL 1605

PROVISIONAL LOG OF DRILL HOLE

ROCK TYPE DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY COLOUR, STRENGTH, NATURAL ETC	GRAPHIC LOG	DEPTH IN FEET	FRAC. LOG	STRUCTURES JOINTS, VEINS, SLIPS, FOLIATION, CRACKS, ETC.	WATER SAMPLES NO. LOCATION DATE
SANDSTONE	RS FOR 37.9 TO 50.0 LENGTHS GENERALLY FROM .6 TO 3.2, AVERAGE 1.0 TO 1.5 65.4 TO 65.7 WEATHERED AWAY ALONG JOINTS. 73.8 TO 74.0 DISINTEGRATED BECAUSE OF WEATHERING ALONG JOINT. 75.4 TO 75.5 } PEBBLES 73.95 TO 74.05 } OF QUARTZ AND ROCK FRAGMENTS TO .05. SEVERAL CAVITIES THROUGH OUT HOLE TO .03 DIA. OCCASIONAL PHENOCRYSTS OF FELDSPAR		55 60 65 70 75 80 85 90		MASSIVE SANDSTONE, CONTACT WITH PER- SILY BANDS AT 0° JOINTS AT 60° TO 90° BETWEEN: 54.7 - 55.1 63.7 - 63.9 68.5 - 68.8 69.2 - 69.9 71.5 - 71.8 72.0 - 73.9 (2 JOINTS SPACED .2) 74.3 - 74.9 77.5 - 78.6 82.2 - 83.6 45.0 TO 51.0 AND } JOINTS 57.0 TO 58.0 } AT 45° SPACED .2 TO 1.8 77.0 TO 78.0 JOINTS AT 0° TO 10°, SPACED .5 TO 2.0 77.6 JOINT AT 0°, CLAY COATED 90.1 JOINT AT 0° WITH OF BLACK SILTSTONE INFILL.	
	END OF HOLE		95			

DRILL TYPE FOX 840
 FEED HYDRAULIC
 CORE WARE TYPE
TRIPLE TAKE
 DRILLER GEORGE YOST
 COMMENCED 7-1-69
 COMPLETED 10-7-69
 LOGGED BY D.R.D.
 VERTICAL SCALE 1"=5'

NOTES
 FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are blocked in.
 BEDDING & JOINT PLANES - Angles are measured relative to a plane normal to core axis.

WATER SAMPLES TESTS
 SAMPLE NO. _____
 SUPPLY LINE _____
 VERTICAL SCALE _____
 DWG. NO. CI 1805

GEOLOGICAL LOG OF DRILL HOLE

ROCK TYPE (NOMENCLATURE)	DESCRIPTION (COLOR, STRENGTH, HARDNESS ETC.)	GRAINIC LOG	DEPTH & SIZE % OF CORE	FRAC. LOG	JOINTS (DIP, VEIN, SLIP, FAULTS CRACKED ETC.)	OTHER FEATURES (TYPE OF GLAUCONITE, etc.)
	NO CORE					
			17.5			
H.W. SANDSTONE	OFF-WHITE TO BUFF, MOD. HARD AND MOD. WEAR. W. COARSE GRAINED QUARTZ WITH SACCHAROIDAL TEXTURE. LENGTHS .2 TO .6		20		JOINTS AT 0°, SPACED .2 TO 1.0. 20.3 JOINT AT 40° 21.0 TO 21.3 JOINT AT 80° 21.0 JOINT AT 0°, CLAY INFILLED.	
H.W. SANDSTONE	OFF-WHITE TO BUFF, MOD. HARD TO HARD, MOD WEAR. LENGTHS .2 TO .9		24.2		22.4 } LIMONITE STAINED 22.7 } JOINTS AT 0° 23.7 }	
S.W. SANDSTONE	OFF-WHITE, MOD. HARD AND MOD. STRONG. LENGTHS .3 TO .5		25.0		25.8 JOINT AT 0° } CLAY 25.7 JOINT AT 45° } COATED	
H.W. SANDSTONE	AS FOR 17.5 TO 22.0 25.0 TO 25.5 DISINTEGRATED INTO QUARTZ GRAINS. 28.0				BROKEN AT ABOUT 0° SPACED .1 TO .3	
F SANDSTONE	LIGHT GREY, MOD. HARD AND MOD. STRONG. LENGTHS .8 TO 1.7 WITH SOME SHORTER LENGTHS. MEDIUM TO COARSE GRAINED QUARTZ SANDSTONE		32.1		28.4 } JOINTS AT 0° TO 5° 28.6 } 30.4 }	
H.W. CLAYEY SANDSTONE	GREY, MOD WEAR AND MOD. SOFT 33.2 TO 33.4 NO CORE		35.4		32.1 JOINT AT 45°, CLAY COATED. 32.2 TO 33.5 DISINTEGRATED, GRABBING AT 23.2	
SW TO F SANDSTONE	LIGHT TO MEDIUM GREY, MOD. HARD AND MOD. STRONG. LENGTHS .3 TO 1.2, AVERAGE .6 TO .8. MEDIUM GRAINED QUARTZ SANDSTONE WITH SOME SILTY MATRIX. 39.7 TO 40.8 H.W. AND SLIGHTLY CARBONACEOUS.		40.8		32.7 JOINT AT 45° 34.2 } 37.1 } JOINTS AT 0° TO 5° 39.5 } 40.3 } 40.8 } 41.6 } 41.7 } 44.9 }	
SW PEBBLY SANDSTONE	LIGHT GREEN, MOD HARD AND MOD. STRONG. QUARTZ PEBBLES TO .05. H.W. PEBBLES 45.0 TO 45.1, 47.2 TO 47.3		45.1		BEDDING AT 0° TO 5° MEDIUM GRAINED SANDSTONE 45.9 TO 46.7 WEATHERING ALONG JOINTS AT 0° AT 45.9, 46.1, 46.8 & 47.2. DISINTEGRATED AT 45.9, 46.2 TO 46.3	
F SANDSTONE	AS FOR 28.0 TO 32.1 IN ONE LENGTH.				SLIGHT WEATHERING ALONG DISINTEGRATED JOINT AT 20° AT 49.1	

DRILL TYPE: PDX 240
 FEED: HYDRAULIC
 CORE BARREL TYPE: SINGLE TRAP
 DRILLING METHOD: DOWN THE HOLE
 LOG NO.: 11-2-61
 COMPLETED: 15-7-61
 LOGGED BY: D.R.D.
 VERTICAL SCALE: 1" = 5'

NOTES
 FRACTURE LOG - Number of fracture per foot of core. Zones of core loss are blocked in.
 BEDDING & JOINT PLANES - Any are measured relative to a plane normal to core axis.

WATER LOG TESTS
 PRESSURE TEST
 SAMPLE LOGS
 VERTICAL SCALE

GEOLOGICAL LOG OF DRILL HOLE

ROCK TYPE (OR DEGREE OF WEATHERING)	DESCRIPTION (LITHOLOGY, COLOR, STRENGTH, HARDNESS ETC)	DEPTH (FEET)	DEPTH (METERS)	STRUCTURE (JOINTS, FOLDS, FRACTURES, ETC)	WATER PRESSURE (FEET OF WATER)
F SANDSTONE	RS ABOVE. MEDIUM GRAIN SIZE. LENGTHS .3 TO 1.8	55.0	55.0	53.1 WEATHERING HARD JOINT AT 30° SOME COARSE GRAINED PEBBLES OF QUARTZ TO .01 ASSOCIATED WITH JOINT	
H.W. SANDSTONE	RS FOR 55.0 TO 91.8	55.0	55.0		
F SANDSTONE	RS FOR 57.9 TO 55.0 HARD CRYSTALS .6 TO 1.2 MEDIUM TO COARSE GRAIN SIZE. 60.5 TO 61.1 COARSE GRAIN- ED BED, SW. FACING JOINT AT 0° 62.2 TO 62.4 PEBBLY.	65.6	65.6	56.4 } JOINT AT 10° 57.8 } 58.6 } 62.2 } 58.3 } JOINT AT 45° 60.0 }	
H.W. SANDSTONE	RS FOR 55.0 TO 80.0	65.6	65.6	61.2, 66.8 JOINT AT 0°	
F SANDSTONE	GREY, HARD AND MOD. STRONG TO STRONG. LENGTHS .4 TO 1.3 AVERAGE .6 TO .8 88.3 GRINDING. 81.5 TO 82.2 } 87.7 TO 88.1 } H.W. 91.6 TO 92.2 } 96.5 TO 97.1 PEBBLY	73.4 73.6	73.4 73.6	JOINTS AT 0° TO 10° SPACING .5 TO 2.5 82.0 } 83.4 } JOINTS AT 30° 92.4 } 94.2 } 92.6 TO 93.3 } JOINTS AT 98.7 TO 99.5 } 80° TO 85°	
		99.5	99.5		

DRILL TYPE FOR 740
FIELD HYDRAULIC
CORE BARREL TYPE
SERIAL TUBE
DRILLER GARDNER TEST
COMMENCED 11-7-61
COMPLETED 15-7-61
LOGGED BY P.B.P.
VERTICAL SCALE 1:25

NOTES
FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are bracketed in
BEDDING & JOINT PLANES - Angles are measured relative to a plane normal to core axis.

TESTS
WATER TESTS
LOGS
VERTICAL SCALE
DWS No. C.I. 1806

ROCK TYPE (CLASS OF WEATHERING, LITHOLOGY, COLOR, STRENGTH, HARDNESS, ETC.)	DESCRIPTION	GRAIN LOG	DEPTH OF CORE IN FEET	FRAC. LOG	DEPTH OF CORE IN FEET	TESTS
	<i>NO CORE</i>		5 10 15 20 25 30 35 40 45			
<i>C.W. SHALLOW</i>	<i>GREY, WEAK AND MOD. SOFT</i>	<i>N.C.</i>				

21-7-69

DRILL TYP. *FOX P. 10*
 TYP. *HYDRAULIC*
 CORE BARREL TYPE *TRIPLE TUBE*
 DRILLER *GADWIN T.S.L.*
 COMM. NO. *15-7-69*
 COMPLETED *23-7-69*
 LOGGED BY *M.R.P.*
 VERTICAL SCALE *1"=5'*

NOTES
 FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are blocked in
 BEDDING & JOINT PLANES - Angles are measured relative to a plane normal to core axis.

FIGURES GIVEN ARE GAUGE PRESSURES UNLESS SPECIFIED ARE INDICATED OTHERWISE BY BLACKENED SPACES

DWG NO. **C.I. 1807**

GEOLOGICAL LOG OF DRILL HOLE

ROCK TYPE (ESTIMATE OF WEATHERING)	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS ETC.	GRAIN SIZE	DEPTH & SIZE IN FEET	FRAC. LOG	STRUCTURES JOINTS, VEINS, FOLDS, FOLTS, CRUSHED ZONES	WATER PRESSURE TEST (PSI OR BAR PER METRE)
NW SANDSTONE	DARK GREY, MOD. HARD AND MOD. WEAK TO WEAK LENGTHS .1 TO .4 WITH EVIDENCE OF CRUSHING		53.0		JOINTS AT 10° AT 50.4 50.9 & 51.8 51.5 JOINT AT 80° 52.6 TO 53.0 NO CORE	
NW SANDSTONE	DARK GREY, MOD. HARD AND MOD. WEAK. LENGTHS .3 TO 1.1		55.0		55.4 AND 54.9 JOINTS AT 10°	
CW SANDSTONE	DARK GREY, SOFT AND WEAK. MEDIUM AND UNIFORM GRAIN SIZE. LENGTHS .3 TO 1.1 54.4 TO 60.5 DECOMPOSED SILTSTONE. 57.8 TO 58.2 BROKEN AND WASHED AWAY		62.5		61.8 TO 61.9 NO CORE. 60.8 TO 61.8 BROKEN INTO .2 TO .3 PIECES. 58.9 TO 59.4 IN DISCS. SOME CLAY BINDER IN SANDSTONE.	
CLAY	DARK GREY TO BLACK, WEAK AND SOFT. HIGHLY PLASTIC.		64.6		LENGTHS .5 TO .7 64.4 JOINT AT 0°	
NW SANDSTONE	AS FOR 53.0 TO 55.0. MOD. WEAK TO MOD. STRONG. LENGTHS .3 TO .4 MEDIUM GRAIN SIZE		67.4		66.4 JOINT AT 0° WITH .03 CLAY INFILLING. 66.9, 67.2, 67.4 JOINTS AT 0° TO 10°	
SW SANDSTONE	MEDIUM TO LIGHT GREY, MOD. HARD AND MOD. WEAK TO MOD. STRONG. MEDIUM GRAINED WITH ZONES OF PEBBLES OF QUARTZ TO .05 IN DIA. LENGTHS .4 TO 1.9, AVE- RAGE 1.0 TO 1.5. 77.9 QUARTZ PEBBLE .1		81.0		70.8 71.3 72.4 75.6 76.6 78.3 (CLAY COATED) 79.1 82.7 JOINTS AT 0° TO 10° 69.1 TO 69.6 } JOINTS AT 70.8 TO 71.3 } 0° TO 85° 77.0 TO 79.7 } 79.2 CRUSHED ZONE AT 0°, .03 THICK.	
END OF HOLE						

DRILL TYPE FOX B-40
 FREQ. HYDRAULIC
 CORE BARREL TYPE...
 TROOP 1481
 DRILLER BEHND INST.
 COMMENCED 27-7-58
 COMPLETED 27-7-58
 LOGGED BY P. K. D.
 VERTICAL SCALE 1" = 5'

NOTES
 FRACURE LOG - Number of fractures per foot of core. Class of core loss are marked in
 BEDDING & JOINT PLANES - Angles are measured relative to a plane normal to core axis

WATER PRESSURE TEST
 PRESSURE IN PSI
 DEPTH IN FEET
 VERTICAL SCALE

APPENDIX E

REPORT ON HYDROGRAPHIC SURVEY

DARLING ROAD, JERVIS BAY

REPORT ON HYDROGRAPHIC SURVEY

DARLING ROAD, JERVIS BAY

prepared for:

AUSTRALIAN ATOMIC ENERGY COMMISSION

ADS.249

24th July, 1969

HYDROGRAPHIC SURVEY - DARLING ROAD, JERVIS BAY

REPORT OF SURVEY

CONTENTS

Page

1	Introduction
i	Equipment Used
1	Geodetic Control
1	Horizontal Control of Soundings
1	Coastline
2	Sounding Datum
2	Weather Conditions
2	General Remarks

Appendix

1	List of Co-ordinates
2	Plan ADS.249/3

HYDROGRAPHIC SURVEY - DARLING ROAD, JERVIS BAY

REPORT OF SURVEY

INTRODUCTION

A hydrographic survey was carried out in accordance with instructions given by the Power Development Division of the Electricity Commission of New South Wales on behalf of the Australian Atomic Energy Commission.

Following a reconnaissance on Friday 4th July 1969, the survey was carried out between 9th July and 12th July 1969.

The results of the survey are shown on Plan ADS.249/3 attached as Appendix 2.

EQUIPMENT

Soundings were taken by an Atlas-Survey Echosounder AN6014, a high quality measuring apparatus that meets the special requirements of hydrographic surveying. The echo sounder was adjusted to the prevailing water conditions by calibration with a bar check before and after the sounding runs were carried out.

A Decca Hi-Fix Chain, Wild T2 Theodolite, Sounding Sextants, Station Pointer and portable radios were employed to provide accurate position fixing.

GEODETTIC CONTROL

The survey was controlled by co-ordinated points supplied by the Hydrographic Service R.A.N. Co-ordinates are in feet and are based on the Australian Transverse Mercator Grid Zone 8. A list of co-ordinates is attached as Appendix 1.

HORIZONTAL CONTROL OF SOUNDINGS

A Decca Hi-Fix Chain was established with the Master Station at Point Perpendicular and one Slave Station at Captain's Point. This provided a hyperbolic pattern covering the area with the lanes lying in a suitable direction to control the sounding boat.

The pattern was calibrated by sextant resections based on Beacons 2, 3, 4, 5 and 6.

Fixation was obtained by running the boat along lane values to give the correct distance between sounding lines, with a theodolite observer set up at Captain's Point to intersect the Hi-Fix Antenna on the boat at each fix. Fixes were called at regular intervals by the theodolite observer or on demand from the boat.

COASTLINE

The coastline shown has been taken directly from the Department of Interior 1:4800 Plans of Commonwealth Territory, Jervis Bay. These Plans are on the same scale and based on the same grid system as the Hydrographic Survey.

SOUNDING DATUM

The soundings have been reduced to the same datum as the R.A.N. Chart AUS 193. This datum is 11.0 feet below the top of the S.W. concrete pile of the crane support close eastward of the R.A.N. Jetty.

Zero of the tide pole and automatic tide gauge established by the Electricity Commission of N.S.W. adjacent to the swimming pool of the R.A.N. College, is 0.7 feet below the sounding datum.

WEATHER CONDITIONS

Conditions whilst the sounding runs were carried out were as good as could be expected in July. The wind speed was never greater than 10 knots and generally a calm sea prevailed. There was still an ocean swell of about 1 to 2 feet. No time was lost because of weather.

GENERAL REMARKS

The soundings were run as close to the shore as it was prudent to take a 30 foot boat.

In accordance with the survey instructions no interlines or examinations were carried out. Consequently shoaler water than shown on the plans could exist. Boulders abound off the rocky points and are dangerous to boats without local knowledge.

In the western area where the sea bed is regular and deep the lines were opened out to approximately 800 feet.



N. L. SANDERSON O.B.E.

Assoc. I.S. (Aust.)

AMALGAMATED DECCA SURVEYS PTY. LTD.

LIST OF TRANSVERSE MERCATOR CO-ORDINATES, ZONE 8
(Converted to feet)

	<u>Station</u>	<u>Easting</u>	<u>Northing</u>
L.	Point Perpendicular Lighthouse	1,141,613.1	2,001,166.8
D.	Breakwater (Captain's Point)	1,112,785.8	1,990,969.5

SECONDARY STATIONS - FIXED BY INTERSECTION

No. 2	Beacon	1,115,460.3	1,986,658.8
No. 3	Beacon	1,118,367.6	1,985,941.8
No. 4	Beacon	1,122,473.1	1,985,345.7
No. 5	Beacon	1,124,875.5	1,986,936.9
No. 6	Beacon	1,125,956.4	1,989,326.1

Darling Road, JERVIS BAY PLAN No. ADS 249 / 3

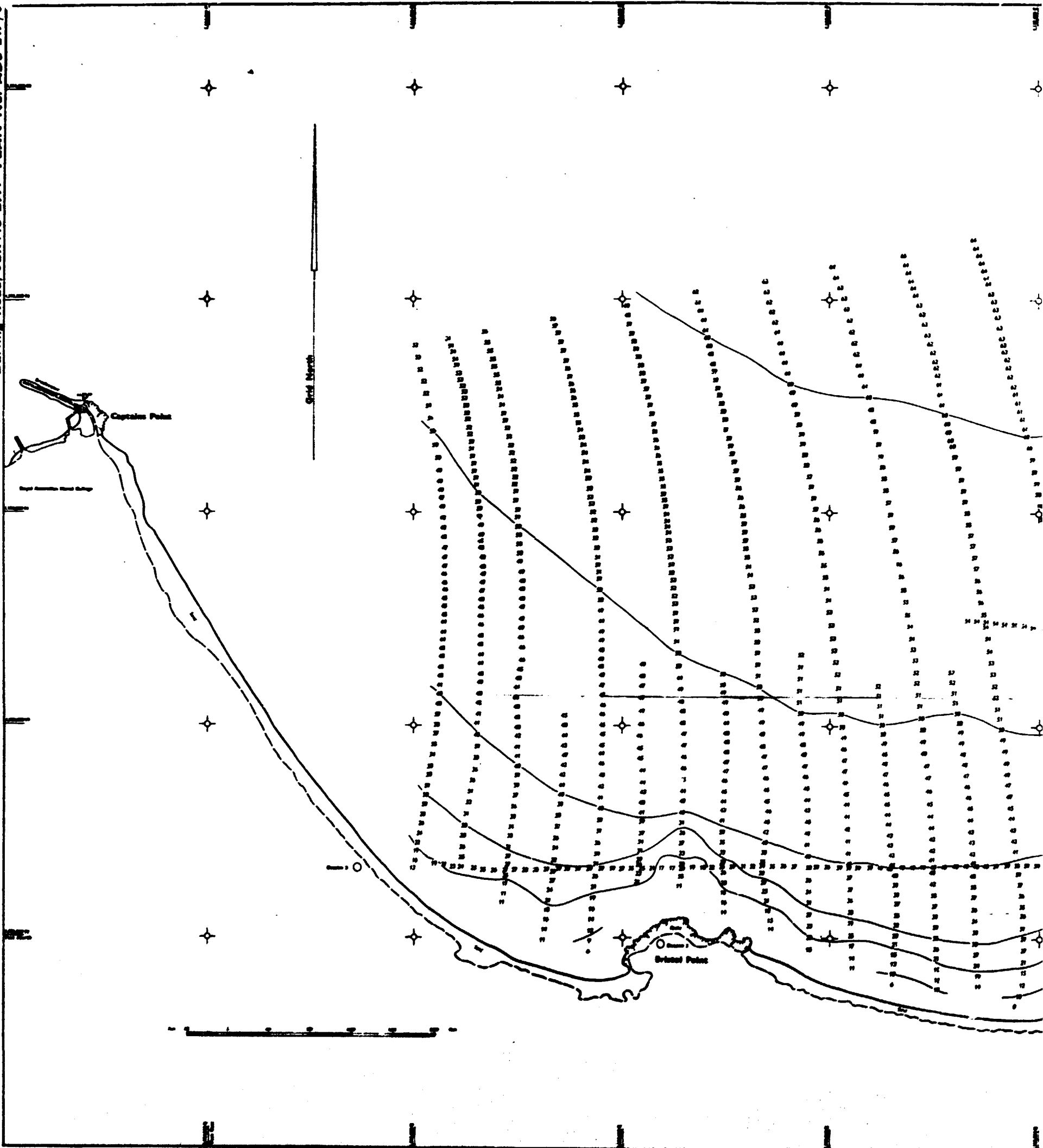
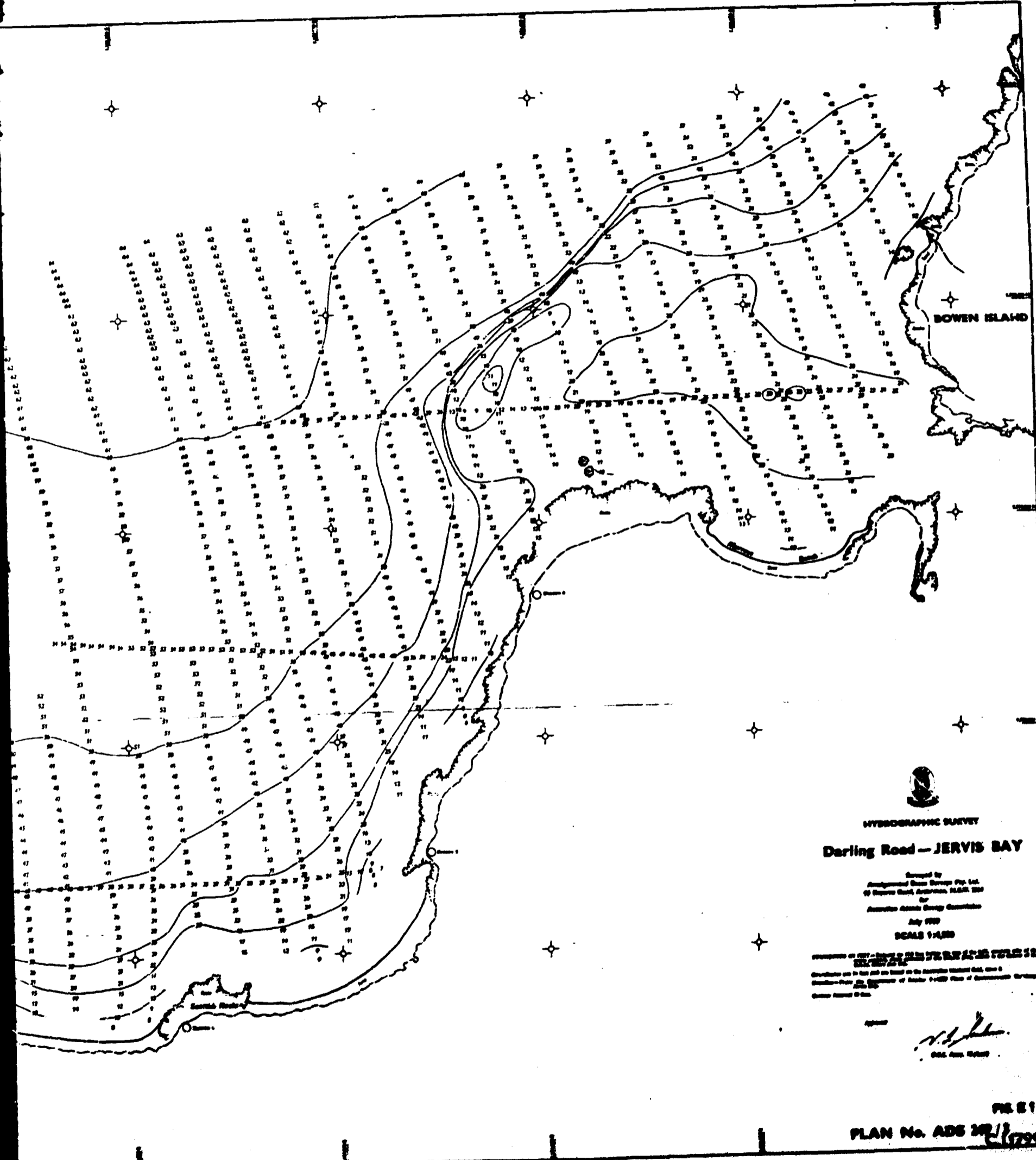


Fig. E1

SECTION 1



HYDROGRAPHIC SURVEY
Darling Road - JERVIS BAY

Surveyed by
 Australasian Steam Navigation Co. Ltd.
 100 Victoria Road, Adelaide, S.A. 5000
 for
 Australian Admiralty Hydrographic Service
 July 1959
 SCALE 1:400

PROVISIONAL CHART - THIS CHART IS NOT TO BE USED FOR NAVIGATION
 UNLESS THE USER HAS BEEN ADVISED BY THE CHART PUBLISHER
 OF THE LATEST INFORMATION CONCERNING THE CHART AND THE
 CHART PUBLISHER'S OFFICE HAS BEEN ADVISED OF ANY CHANGES
 TO THE CHART.

[Signature]
 20th Nov 1959

PS 81
 PLAN No. ADS 282/1799

SECTION 2

APPENDIX F

WATER RESEARCH LABORATORY

WAVES ON JERVIS BAY - PROGRESS REPORT NO. 1

The University of New South Wales

WATER RESEARCH LABORATORY

Project No. 31.258.77 - The Electricity Commission of New South Wales.
Waves on Jervis Bay. Progress Report No. 1.

Report by P. B. Stone

Date: 21.8.69.

S U M M A R Y

The proposed site for the power station at Jervis Bay is well protected by Bowen Island and Point Perpendicular against ocean waves.

This report presents the frequency data for locally generated waves. Modified Tallawarra wind records were used as no suitable local wind records were available. The frequencies are based on hourly wind speed readings and should not be used for studies implying other time bases (e.g. daily). The maximum significant wave height is 2 feet with a wave period of 3 seconds.

Further work is proposed on wave refraction and the comparison of Jervis Bay and Tallawarra winds.

Note: This is an internal progress report and the recommendations and conclusions based on test results to date may be subject to alteration following further investigations.

Table of Contents

	<u>Page No.</u>
1. Introduction	1.
2. Ocean Waves	1.
3. Wind Records	1.
3.1 Jervis Bay	1.
3.2 Point Perpendicular	1.
3.3 Naval Air Station, Nowra	1.
3.4 Tallawarra	1.
4. Adjustment of Wind Records	2.
4.1 Effect of Surface Roughness	2.
4.2 Assembly of Wind Data	2.
5. Hindcasting	5.
5.1 Effective Fetch	5.
5.2 Hindcasting Table	5.
5.3 Wave Frequencies	6.
6. Conclusions and Recommendations	6.
6.1 Wave Heights	6.
6.2 Effect of Wave Period	6/7.

List of Figures

Figure 1.	Locality Plan and Wave Refraction	CE.D - 7772
Figure 2.	Tallawarra Location	CE.E - 7793
Figure 3.	Effective Fetch	CE.E - 7794
Figure 4.	Wave Frequencies - Spring	CE.E - 7795
Figure 5.	" " - Summer	CE.E - 7796
Figure 6.	" " - Autumn	CE.E - 7797
Figure 7.	" " - Winter	CE.E - 7798
Figure 8.	" " - Annual	CE.E - 7799
Figure 9.	" " - Total	CE.E - 7800

List of Tables

Table 1.	Wind Frequencies 1966-68 - Spring
Table 2.	" " " " - Summer
Table 3.	" " " " - Autumn
Table 4.	" " " " - Winter
Table 5.	" " " " - Annual
Table 6.	Hindcasting Table - Jervis Bay
Table 7.	Wave Periods

1. Introduction

To obtain design data for a proposed power station on the shore of Jervis Bay, the Electricity Commission of N.S.W. requested the Water Research Laboratory to prepare wave data for the site shown in figure 1.

2. Ocean Waves

The possibility of ocean waves penetrating to the site was checked by constructing a wave refraction diagram (figure 1). This demonstrates the protection afforded by Bowen Island against waves from the East. The refraction coefficient for this direction is less than 0.2. With direction of approach north of east Point Perpendicular will offer protection and for approach directions south of east the refraction coefficient will decrease rapidly. So, ocean waves will have negligible effect at the power station site. There remains local waves generated by winds blown over Jervis Bay.

3. Wind Records

Wind recording stations in the area are Jervis Bay, Point Perpendicular, Naval Air Station Nowra and Tallawarra.

3.1 Jervis Bay

These records were not available when this study was commenced.

3.2 Point Perpendicular

This station does not have an anemometer, the wind being estimated by lighthouse staff.

3.3 Naval Air Station, Nowra.

This station is equipped with an anemometer.

However, in discussions with Electricity Commission personnel the staff of the air station point out that the anemometer was subject to quite strong local topographical effects. For this reason this station was not used.

3.4 Tallawarra

Records from Tallawarra have been analysed for mean hourly wind speed and direction and these results were readily available for the years 1966-1968 incl. The anemometer at Tallawarra is 35 miles north of Jervis Bay at the same distance from the coast as the major ~~position~~ portion of Jervis Bay. Hence, land sea breeze effects as recorded at Tallawarra will be the same as these effects over Jervis Bay. Because they are only 35 miles apart the two areas will be subject to almost the same large scale meteorological influences. The Tallawarra station is located in flat country near the edge of Lake Illawarra. The escarpment is 5 miles to the west and will not have a sheltering effect although there may be some small influence from katabatic winds.

The only allowance made in these calculations was that which accounted for the differing roughness of land and water.

At Jervis Bay there may be some sheltering by Beecroft Peninsula yet this will be small as heights do not exceed 300 ft.

1. Adjustment of Wind Records.4.1 Effect of Surface Roughness

The Beach Erosion Board (1962) gives relationships between wind speeds as recorded by an anemometer in an expanse of land (U_{LAND}) and wind speeds over adjacent water (U_{WATER}) in terms of the fetch distance over the water.

Figure 2 shows the location of the Tallawarra anemometer in relation to Lake Illawarra. From this it was deduced that the wind recorded at Tallawarra from the four directions needed in hindcasting are:

NE	N	NW	W
$1 \frac{1}{4} U_{LAND}$	U_{LAND}	U_{LAND}	U_{LAND}

From the fetch lengths at Jervis Bay the following winds are required for hindcasting:

NE	N	NW	W
$1 \frac{1}{4} U_{LAND}$	$1 \frac{1}{4} U_{LAND}$	$1 \frac{1}{4} U_{LAND}$	$1.1 U_{LAND}$

This gave factors by which the Tallawarra records were to be multiplied to give wind speeds over Jervis Bay. These were:

NE	N	NW	W
1.0	1.25	1.25	1.1

4.2 Assembly of Wind Data

The Tallawarra records as obtained from the computer output gave cumulative wind frequencies by wind direction for each season for each of the years 1966, 1967 and 1968.

Also recorded were frequency of calms and frequency of missing readings. These records were cumulated to give a 3 year record using the equation

$$f = \frac{f_1 + f_2 + f_3}{k}$$

$$\text{where } k = \frac{300 - m_1 - m_2 - m_3}{100}$$

f_1	=	frequency 1966
f_2	=	frequency 1967
f_3	=	frequency 1968
m_1	=	percentage of missing readings 1966
m_2	=	" " " " 1967
m_3	=	" " " " 1968

E.C. JERVIS BAY

TABLE 3

Combined Autumns of '66, '67 and '68		CALMS: 5.1%						
WIND SPEED (MPH)	WIND FREQUENCIES - %							
	N	NE	E	SE	S	SW	W	NW
0 to 5	3.2	0.4	1.6	0.4	1.8	10.6	9.9	1.8
5 to 10	4.2	1.0	4.1	0.7	1.8	7.7	7.8	3.1
10 to 15	1.4	2.1	4.6	0.9	4.3	4.3	4.1	0.6
15 to 20		1.7	0.8	0.4	2.8	1.6	1.8	0.1
20 to 25		0.4		0.1	1.3	0.2	0.8	
25 to 30					0.4	0.1	0.1	
30 to 35					0.1			
35 to 40					0.2			

TABLE 4

Combined Winters of '66, '67 and '68		CALMS: 14.4%						
0 to 15	2.2	0.5	1.5	0.5	2.2	6.5	4.9	1.7
5 to 10	2.4	0.6	2.2	0.5	2.4	9.1	7.9	2.3
10 to 15	0.9	0.8	1.1	1.1	4.1	6.8	5.8	0.9
15 to 20	0.2	0.2	0.7	0.5	1.9	3.5	3.0	0.3
20 to 25		0	0.4	0.1	0.8	0.9	2.1	0
25 to 30			0.1	0	0.3	0.5	0.8	
30 to 35				0.1		0.1	0.1	
35 to 40						0		

TABLE 5

ANNUAL	CALMS: 9.0%							
WIND SPEED (M. P. H.)	WIND FREQUENCIES							
	N	NE	E	SE	S	SW	W	NW
0 to 5	3.1	0.5	1.8	0.5	2.2	7.1	5.8	1.6
5 to 10	3.5	1.1	3.8	0.9	2.9	6.7	5.6	2.0
10 to 15	1.5	1.7	4.6	1.6	5.4	3.9	3.8	0.8
15 to 20	0.3	1.6	1.4	0.9	3.6	1.8	1.9	0.2
20 to 25	0	1.1	0.4	0.2	1.9	0.5	1.2	
25 to 30		0.4	0.1	0	0.5	0.2	0.3	
30 to 35				0	0.1	0	0	
35 to 40					0.0			

5. Hindcasting

5.1 Effective Fetch

The effective fetch to the power station site was calculated from the method in Beach Erosion Board (1962), namely:

$$F_{EFF} = \frac{1}{13.5} \sum_{-42^{\circ}}^{+42^{\circ}} R \cos^2 \theta$$

where R is the radial distance to the far shore
 θ is the angle between R and the wind direction
 and increments of 6° in θ are used.

The effective fetches so calculated are shown in figure 3. This shows that only winds from W, NW, N and NE will generate waves at the power station.

5.2 Hindcasting Table

A hindcasting table was prepared from data available in BEB(1962). This table was designed for application directly to Tallawarra winds, adjustment having been made for the wind factors listed in section 4. For instance, the wave height of 2.47 ft. listed for NW wind of 25 m.p.h. is actually the wave height caused by a $25 \times 1 \frac{1}{4}$ m.p.h. wind, allowing the Tallawarra winds to be used without modification. A similar table was prepared for wave period. These are tabulated as follows:-

TABLE 6

WIND DIRECTION		N	NE	W	NW
EFFECTIVE FETCH		6.65 miles	2.75 miles	0.35 miles	3.70 miles
WAVE HEIGHT (FT.)	5				
TIME WIND HAS TO BLOW (MIN)	10	1.25/122	0.64/72	0.26/16	0.93/80
	15	1.90/102	0.98/60	0.42/13	1.44/67
	20	2.55/90	1.32/53	0.55/12	1.93/59
FOR	25	3.20/81	1.70/48	0.71/10 $\frac{1}{2}$	2.47/53
WIND SPEEDS (M.P.H.)	30	4.0/75	2.07/45	0.85/9.6	3.0/50
	35	4.7/70	2.44/42	1.10/90	3.6/47

TABLE 7

WAVE PERIODS

WIND DIRECTION		N	NE	W	NW
EFFECTIVE FETCH		6.65 miles	2.75 miles	0.35 miles	3.70 miles
WAVE HEIGHT (FT.)	5				
WAVE PERIOD (SEC.)	10	1.25/2.52	0.64/1.78	0.26/1.05	0.93/2.15
	15	1.90/3.10	0.98/2.15	0.42/1.25	1.44/2.55
	20	2.55/3.40	1.32/2.42	0.55/1.43	1.93/2.90
FOR	25	3.20/3.76	1.70/2.68	0.71/1.56	2.47/3.20
WIND SPEEDS (M.P.H.)	30	4.00/4.04	2.07/2.90	0.85/1.70	3.0/3.50
	35	4.70/4.40	2.44/3.10	1.10/1.82	3.6/3.70

5.3 Wave Frequencies

The hindcasting tables 6 and 7 were then applied to the wind frequency tables 1 to 5 to give wave frequency and the results plotted on figures 4 to 7 incl. These show the percentage of time during which a given wave height was equalled or exceeded from a particular direction during a particular season. Figure 8 presents the wave height results on an annual basis. On each graph are shown two values of wave period.

6. Conclusions and Recommendations6.1 Wave Heights

The maximum significant wave height forecast was 2 feet with a period of about 3 seconds. This means that the largest wave, which is approximate twice the significant wave, will be 4 feet.

6.2 Effect of Wave Period

While in terms of wave height the locally generated waves will be far more important than refracted ocean waves it may be that for some

purposes the longer period of ocean waves (10 seconds) may increase their relative importance. It is proposed, as time permits, to further investigate the effects of wave refraction.

6.3 Alternative Methods of Presentation

As presented in figures 4 to 8 the occurrence of given wave heights are allotted a frequency based on hourly wave hindcasting. There may be other methods of presentation that would be more desirable for particular projects. For instance, in a shipping study, it may be more realistic to know the number of days on which a given wave height is equalled or exceeded. This will be greater (possibly twice as great) as would be obtained from the frequency figures, but would require a further analysis of the raw wind data.

6.4 Jervis Bay Wind Records.

One year of records from Jervis Bay is currently being processed and this will be compared with the records for the same period from Tallawarra. This work will not be completed for some weeks and will be reported separately.

Reference: Beach Erosion Board: T.M. 132 Waves in Inland Reservoirs
1962.

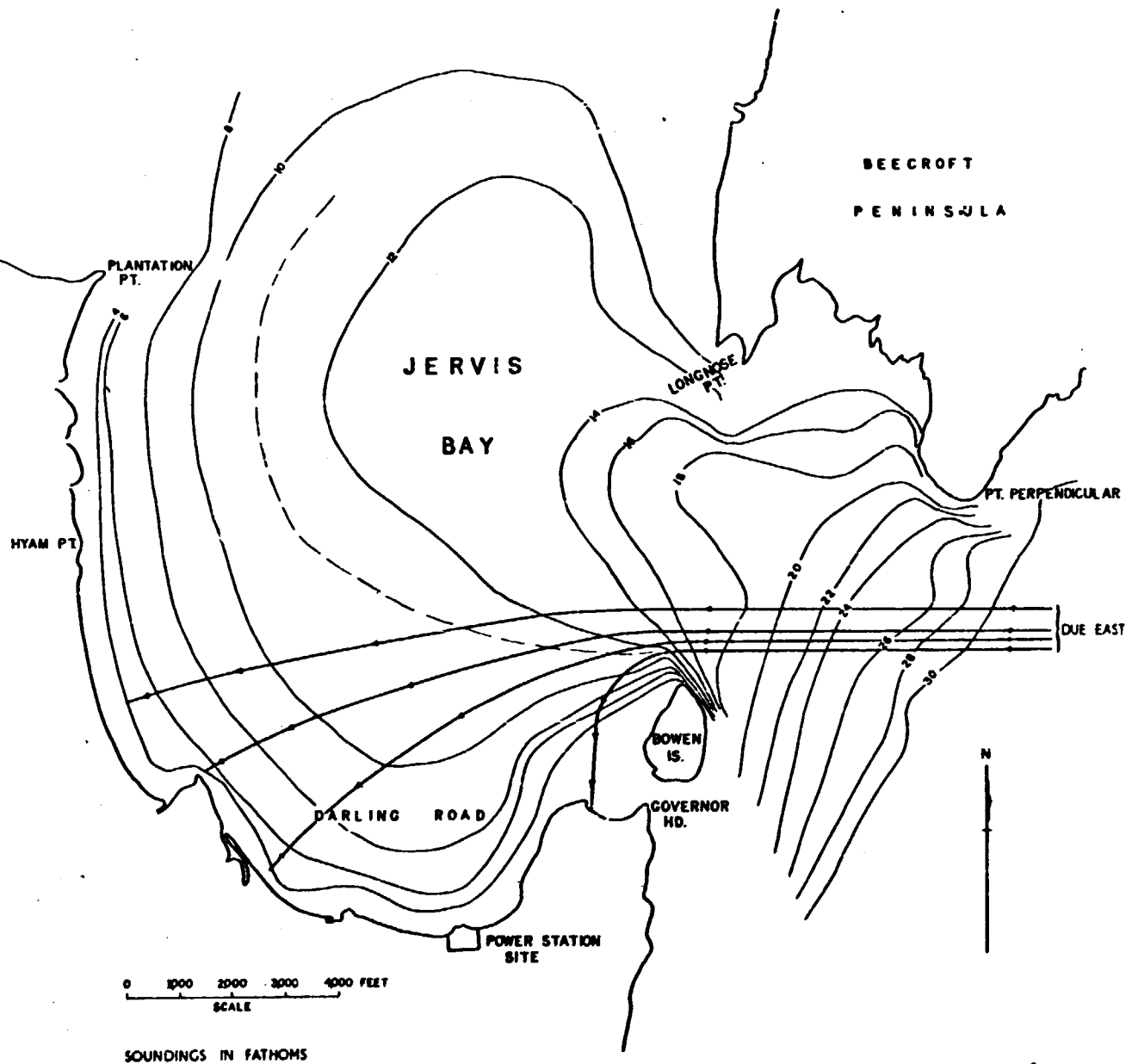


FIGURE 1: JERVIS BAY - WAVE REFRACTION DIAGRAM & LOCALITY PLAN
10 SEC. WAVES FROM EAST

65-D-1772

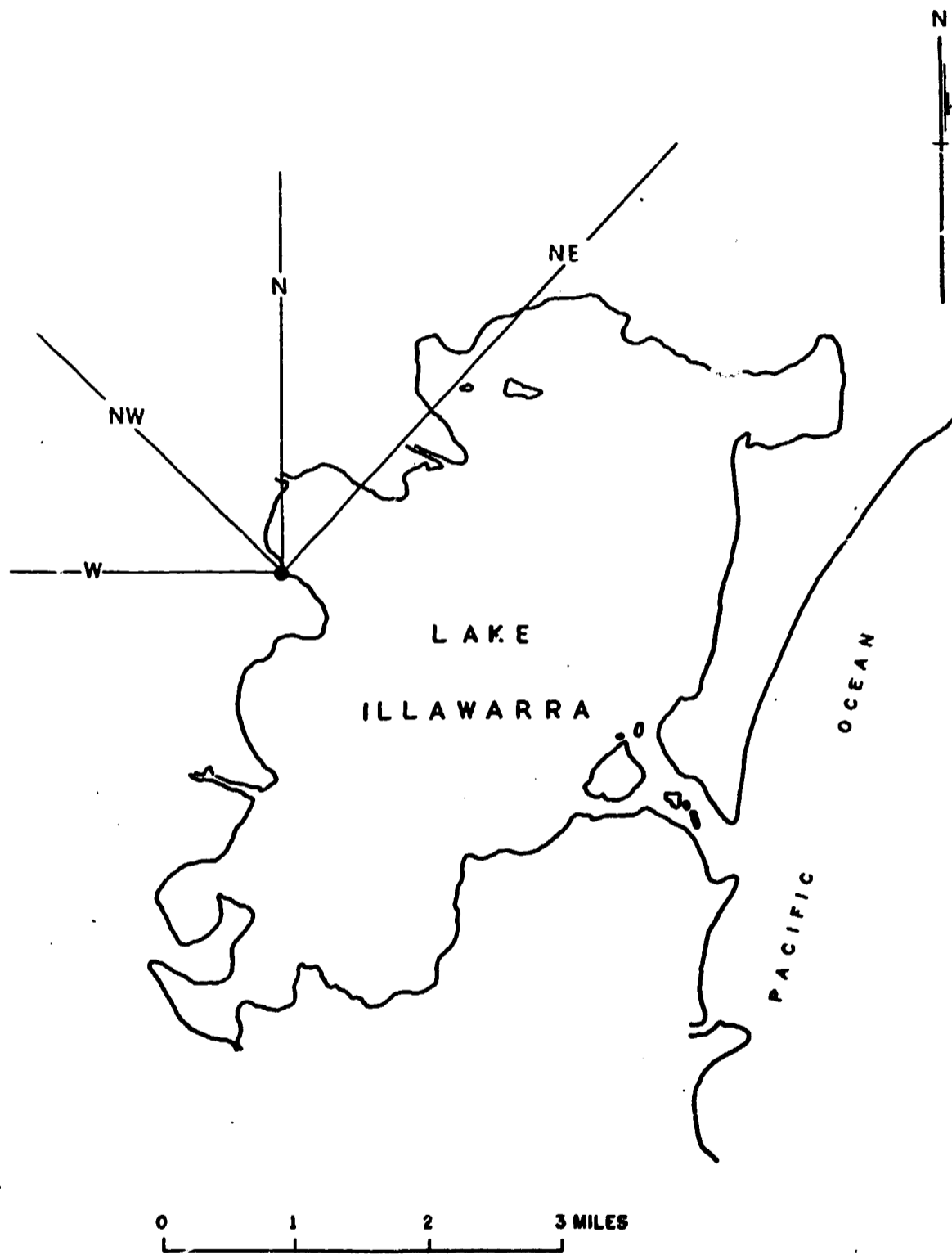


FIGURE 2: LOCATION - TALLAWARRA ANEMOMETER

CE - E - 7793

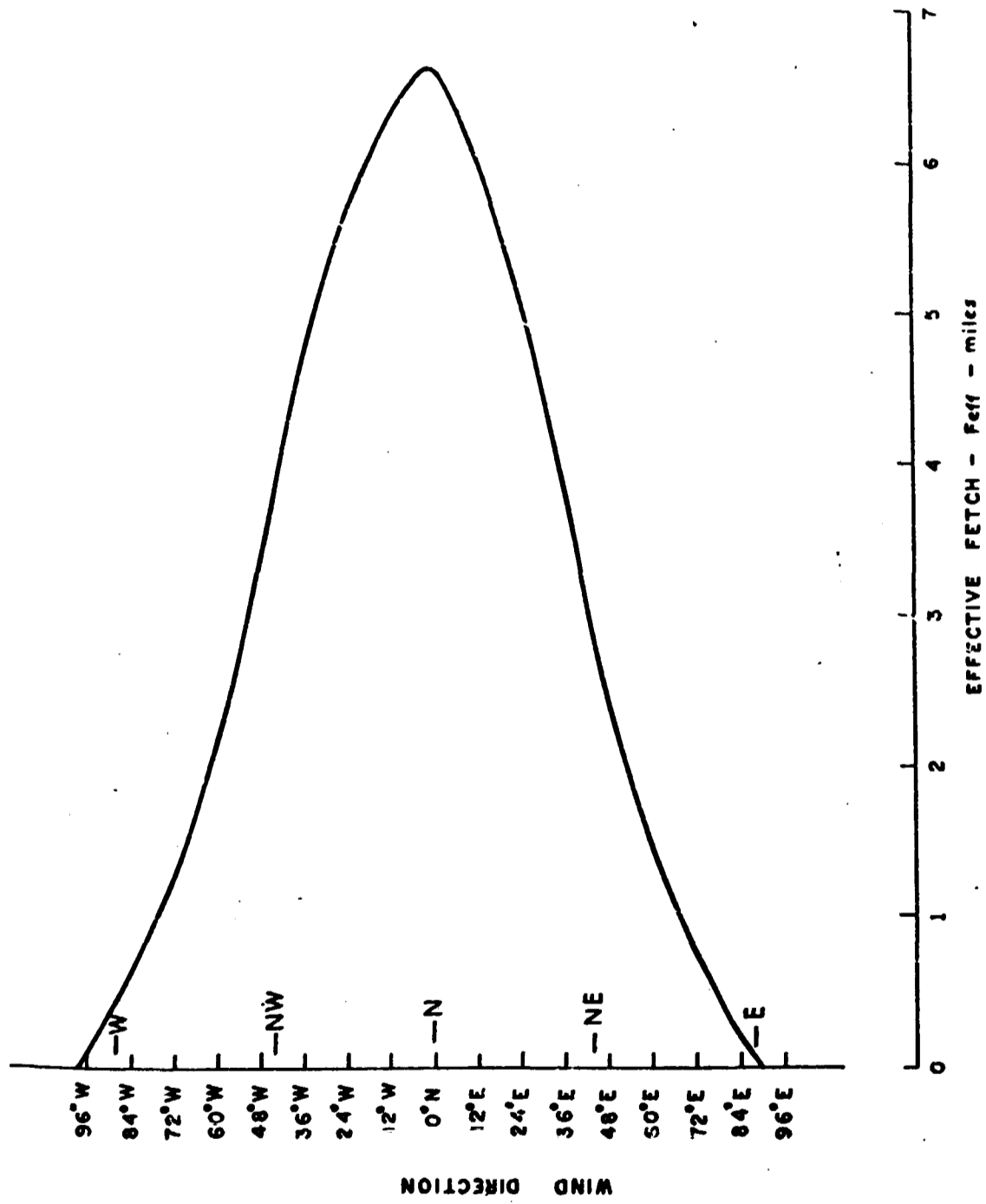


FIGURE 3: EFFECTIVE FETCH

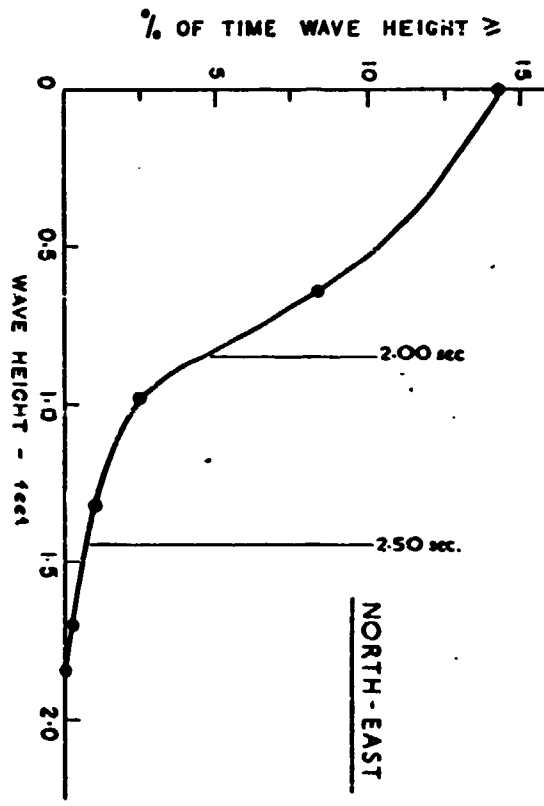
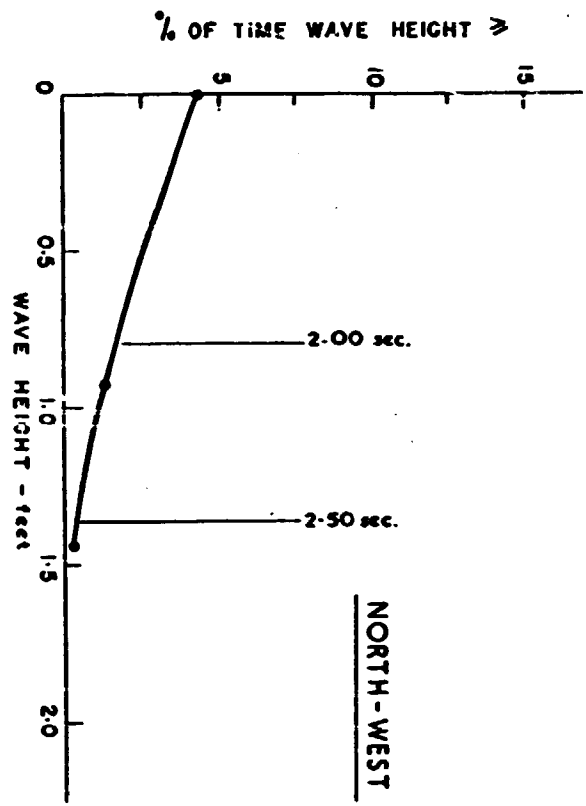
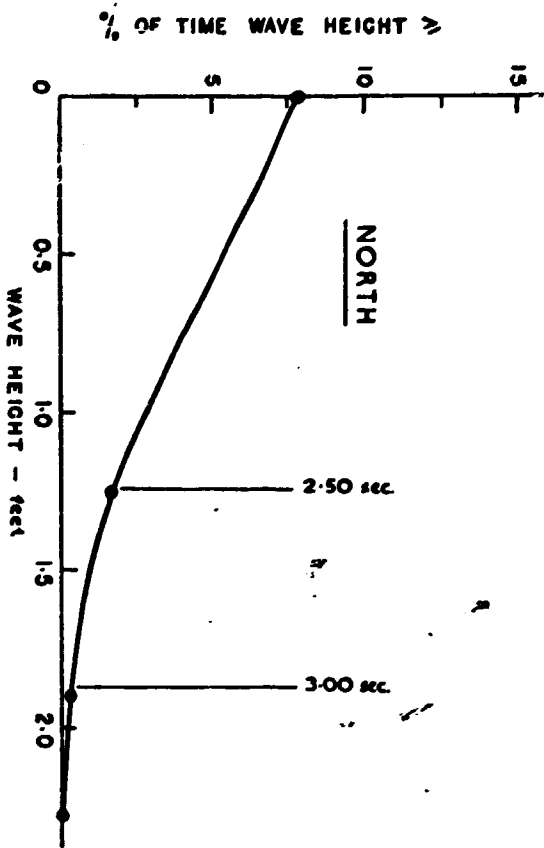
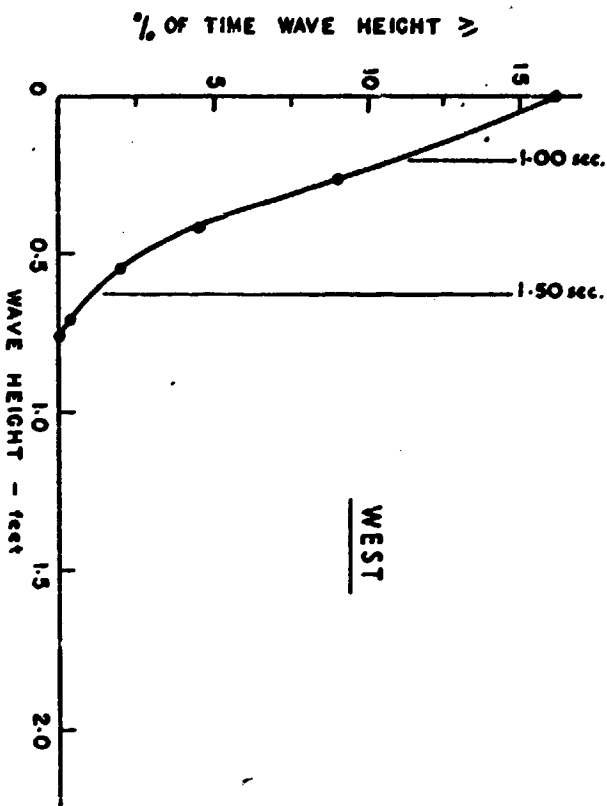


FIGURE 4: WAVE FREQUENCIES - SPRING

CE-E-7795

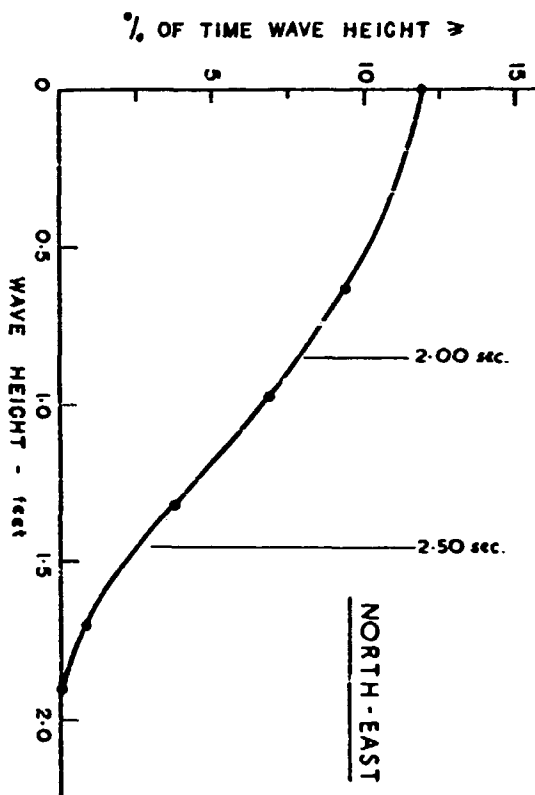
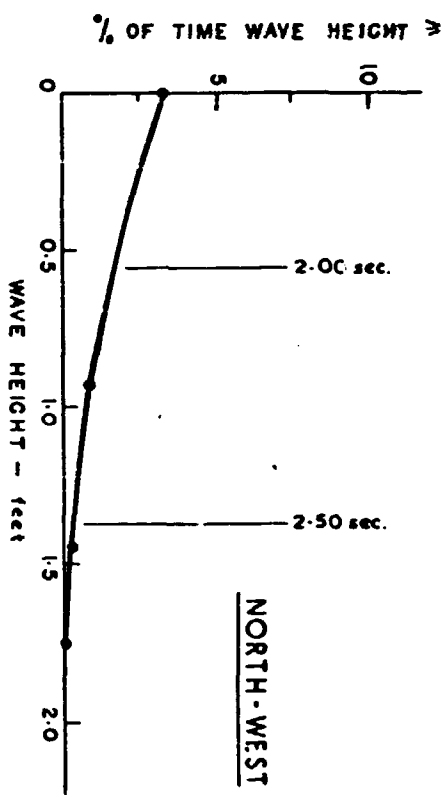
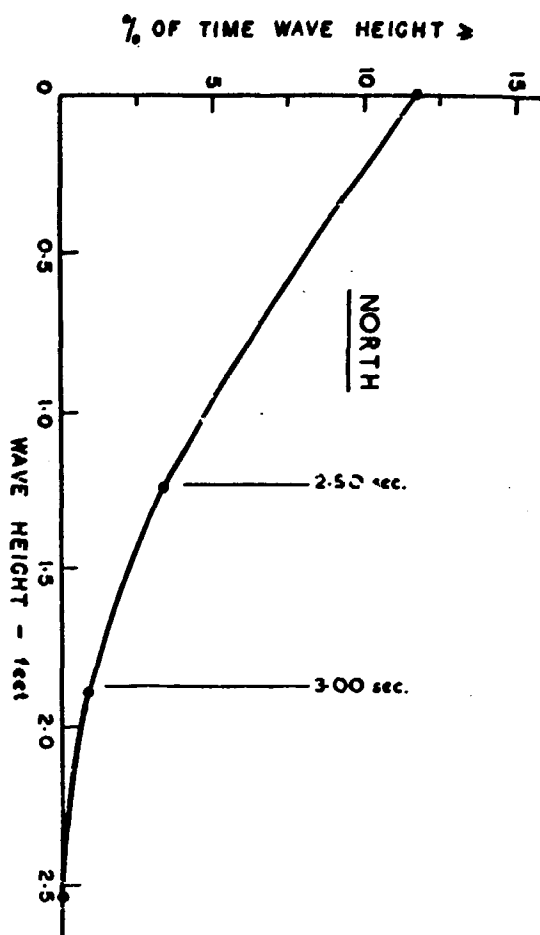
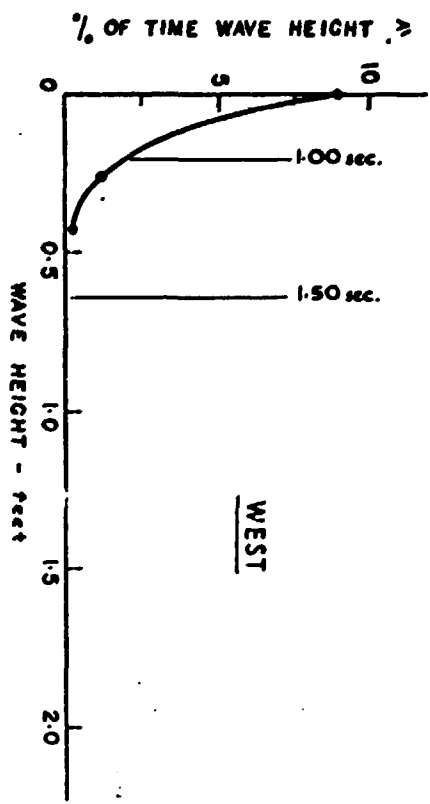


FIGURE 5: WAVE FREQUENCIES - SUMMER

CE-E-7796

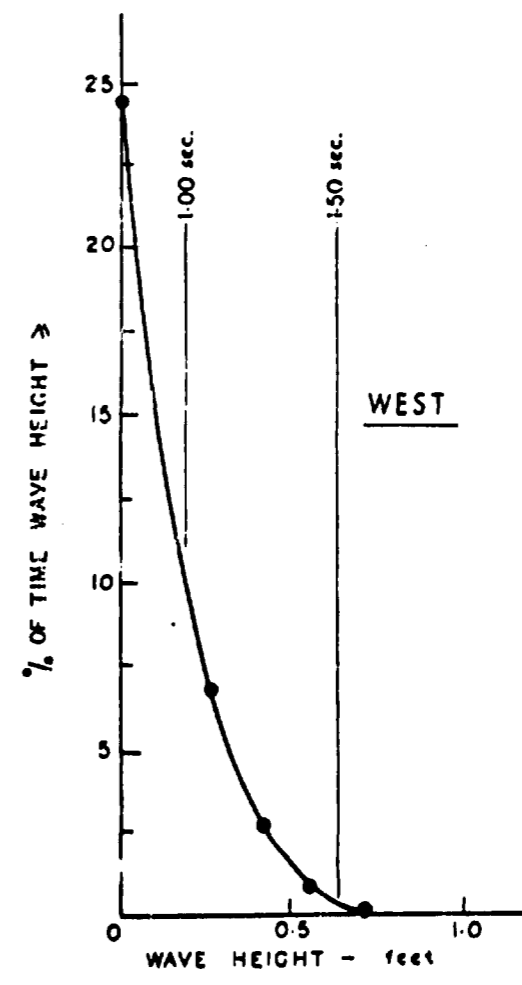
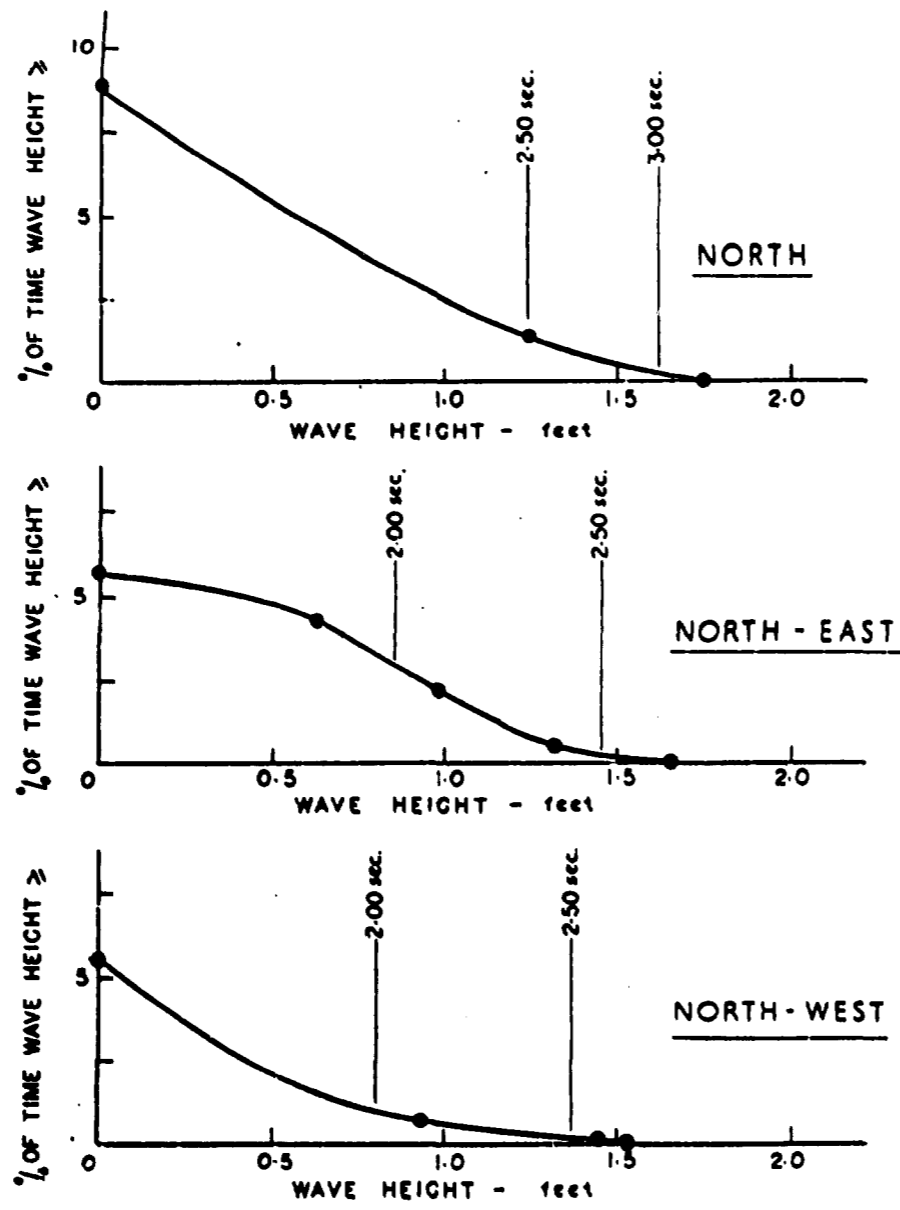


FIGURE 6: WAVE FREQUENCIES - AUTUMN

CE-E-7797

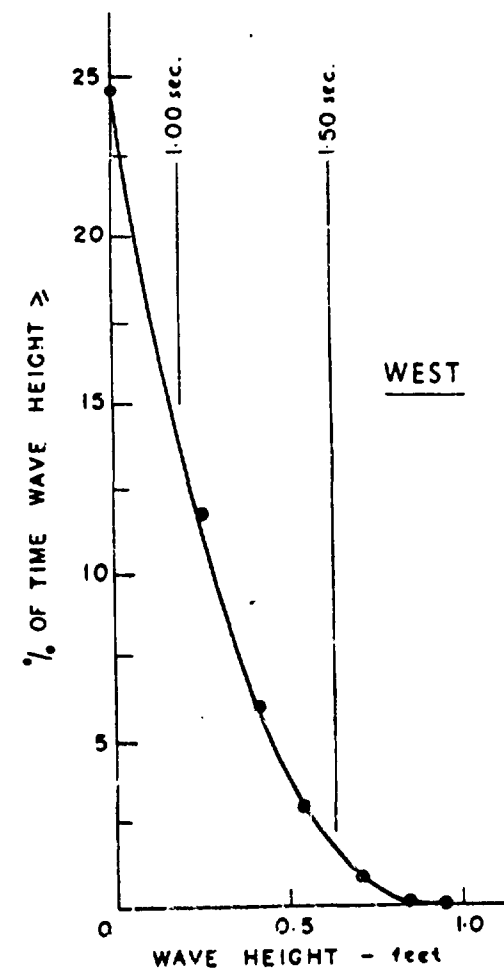
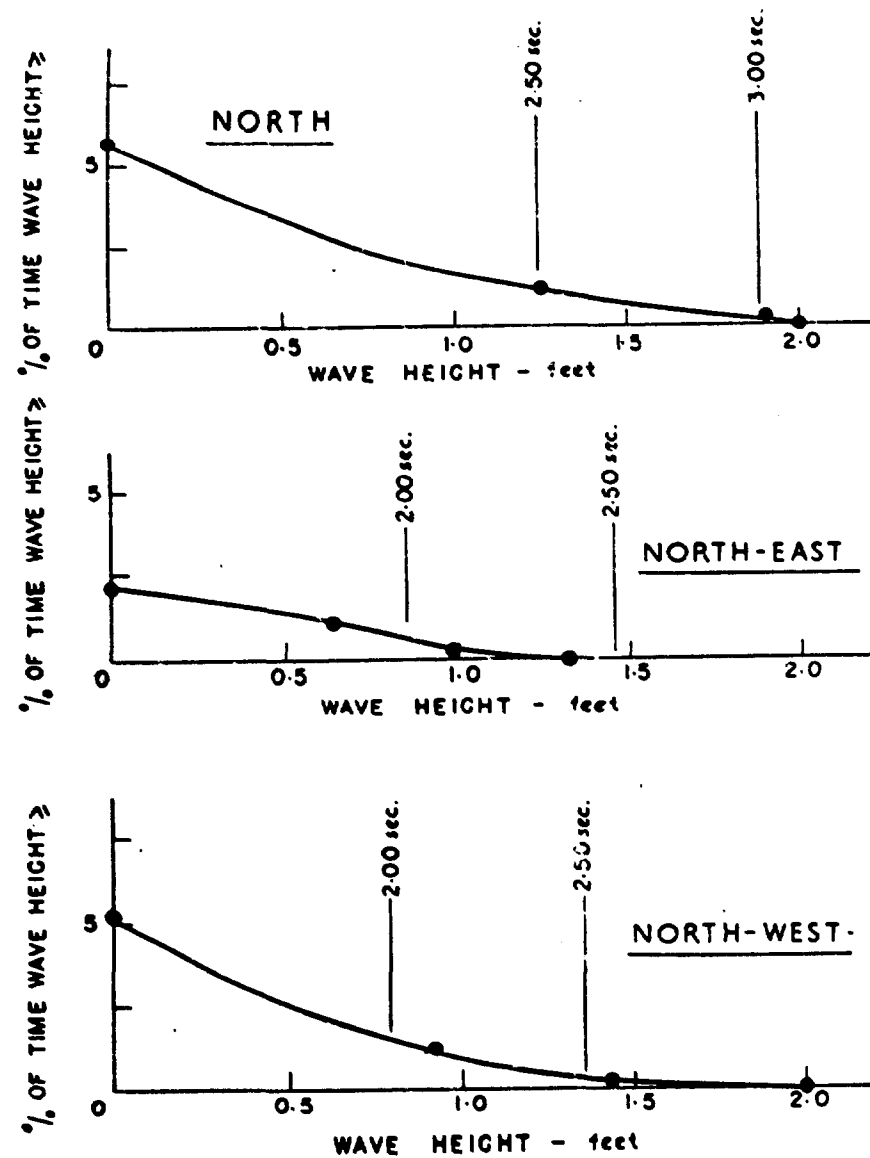


FIGURE 7: WAVE FREQUENCIES - WINTER

CE-E-7798

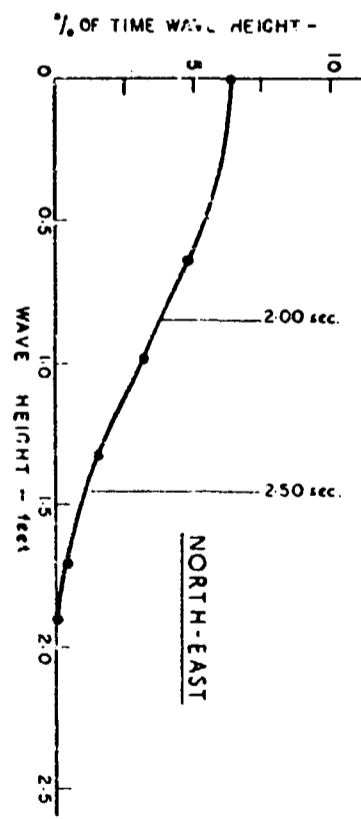
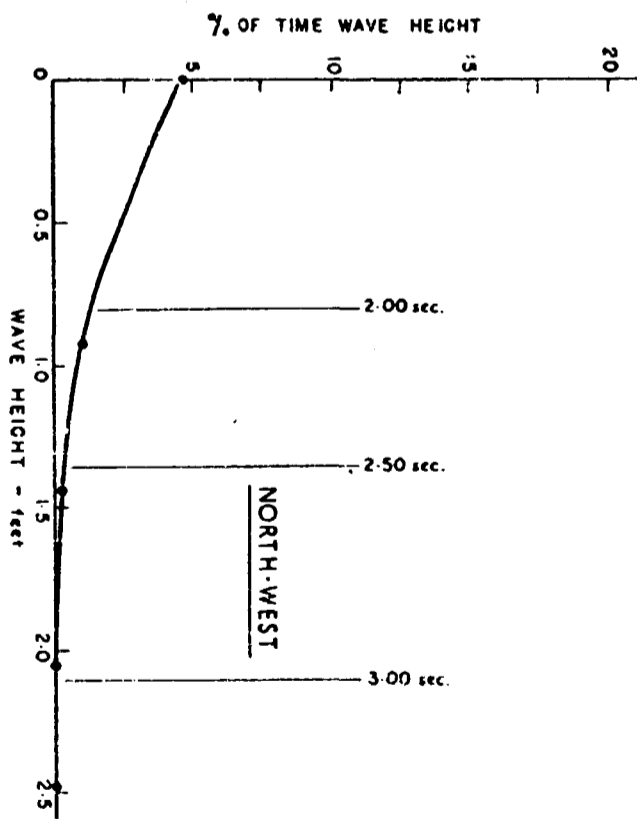
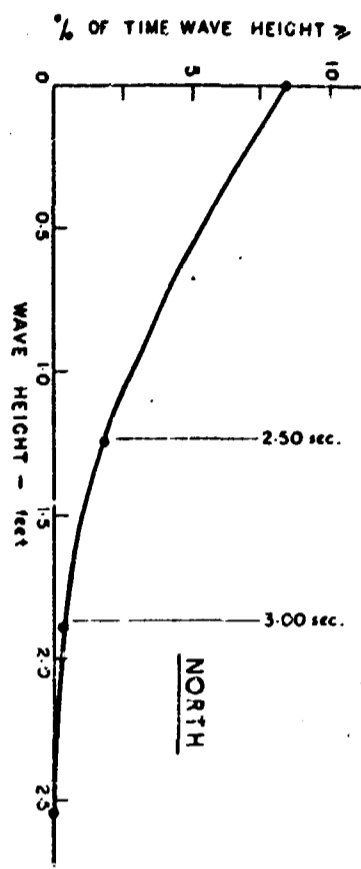
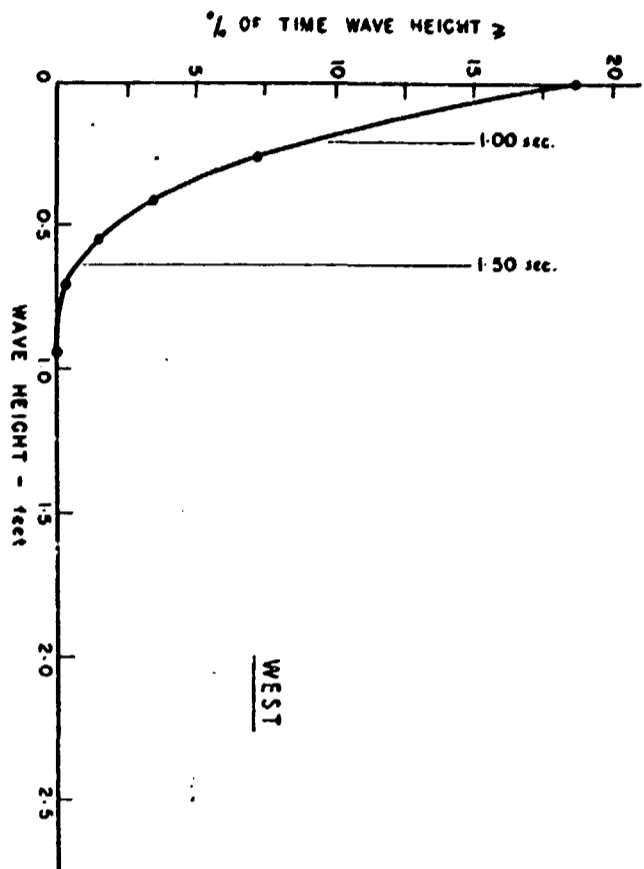


FIGURE 8: WAVE FREQUENCIES - ANNUAL

CE-E-7799

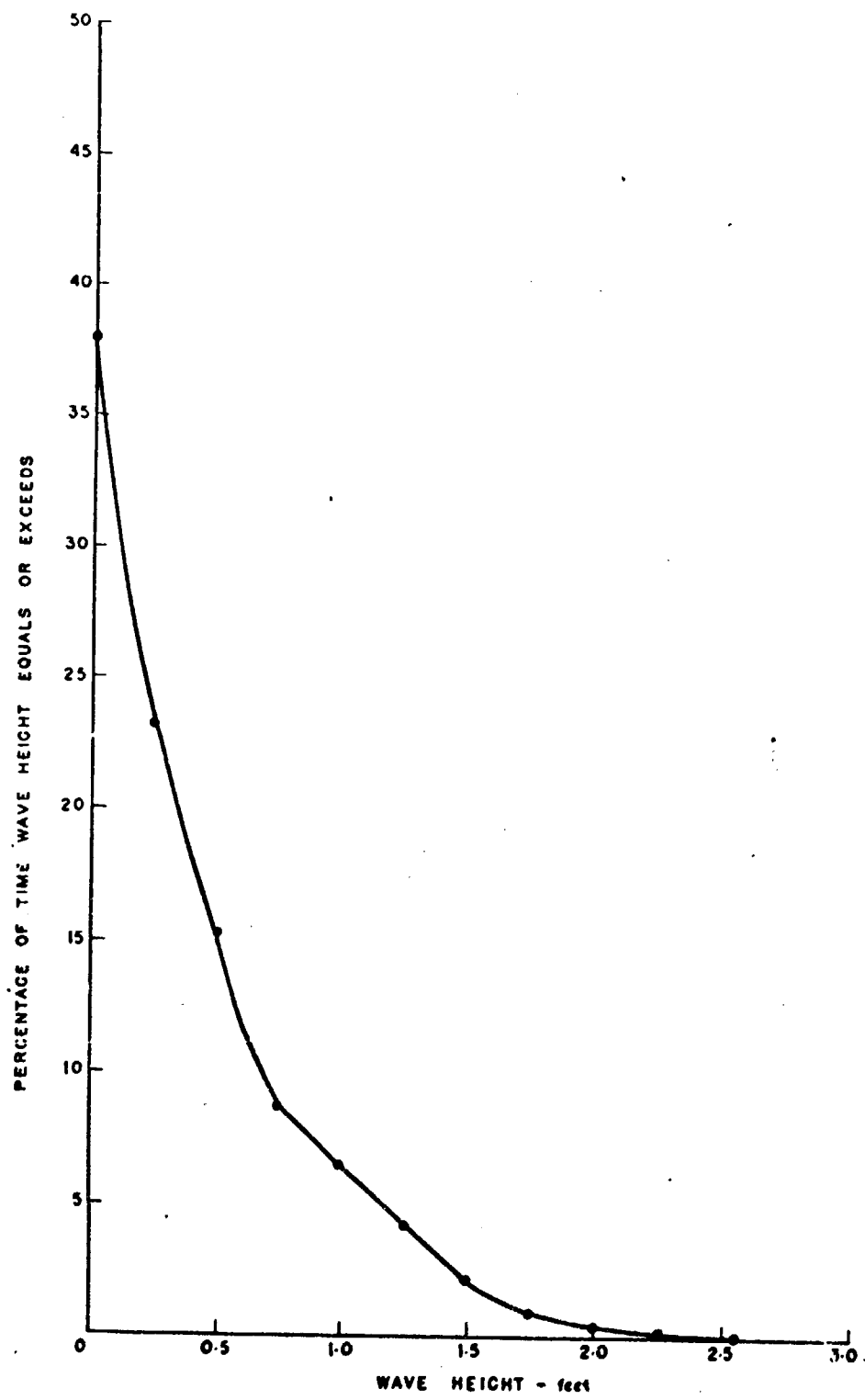


FIGURE 9: WAVE FREQUENCIES - TOTAL

CE-E-7800

APPENDIX G

WATER RESEARCH LABORATORY

WAVES ON JERVIS BAY - PROGRESS REPORT NO. 2

The University of New South Wales
WATER RESEARCH LABORATORY.

Waves on Jervis Bay - Progress Report No.2 - Project No. 31-258-77.

Report by D.L. Wilkinson
2nd June, 1970.

Summary

Detailed wave refraction studies indicate the design wave height for the proposed site of the power station at Jervis Bay is determined by refracted ocean waves. The maximum significant wave height was 7.3 ft. The proposed site is, however, well protected from ocean waves, and waves exceeding 2.5 ft. would only occur 0.5 pc. of the time.

Modified Tallawarra wind data were found to underestimate wind wave heights, particularly from the north. Wind waves in excess of 2.5 ft. could be expected 4.7 pc. of the time.

1. Introduction

In the previous progress report (No. 1, 21.8.69) wave frequencies were calculated for the proposed site of the power station at Jervis Bay. Three years of suitably adjusted wind records from Tallawarra power station were used to hindcast these waves.

Since publication of the above report, wind records from Jervis Bay have been made available. These records cover the period March 1968 to February 1969. In this report wind data for the power station site from the Jervis Bay and Tallawarra wind records for the same year (1968-69) are compared. Secondly, the annual data for Tallawarra derived for the year 1968-69 are compared with the mean of three years records. This was done in order to establish the reliability of 1968-69 records in predicting mean annual wind behaviour.

Thirdly a detailed analysis is made of ocean wave penetration into Jervis Bay. Refracted and diffracted ocean wave statistics are determined for the proposed site of the power station.

2. Wind Generated Waves

2.1 Wind Records

Wind frequency data for the anemometer station shown in Fig.7 have become available since the publication of Progress Report No.1.

Wind conditions at the proposed site of the power station and at the anemometer station will differ due to differences in the local boundary roughness. The Beach Erosion Board in their technical memorandum 132 "Waves in Inland Reservoirs", give an experimentally derived relationship between wind speed over land and average wind speed over water, as a function of fetch length. The anemometer is sufficiently far inland to act as a wind over land recorder. It is necessary, therefore, to adjust wind records taken at the anemometer station before applying them to the fetch area in Jervis Bay.

Fetch distances for winds at the power station were measured and from these the ratio of wind speed over the fetch area U_1 to wind speed at the anemometer station U_2 were calculated using plate 29 in the above references.

Wind Direction	0°	45°	90°	135°	180°	225°	270°	315°
$\frac{U_1}{U_2}$	1.3	1.3	1.0	1.0	1.0	1.0	1.1	1.3

Comparison of Wind Climates for Jervis Bay, as predicted from 1968 Jervis Bay and Tallawarra data .

Wind statistics for the proposed site of the Jervis Bay power station are shown in Figure 1. Wind frequencies for these graphs were calculated using 1968 wind records from Tallawarra and Jervis Bay. Both sets of data were adjusted as described previously to allow for surface roughness. They have also been adjusted to allow for missing readings (18%) as described in Progress Report No. 1. It can be seen the wind climates predicted from both sets of data are very similar for all directions except 0°, 45°, 90° and 225°. For wave hindcasting, only wind speeds in excess of 10 m.p.h. are significant, so that only waves generated by winds from 0° and 90° are poorly predicted from Tallawarra data. The proposed site is sheltered from wind waves from 90°.

Comparison of 1968 Tallawarra Wind Frequencies with the Mean Annual Frequency

Figure 2 gives a comparison of the wind climates for the proposed site calculated for 1968 Tallawarra data and the mean of 1966, 1967 and 1968 Tallawarra data. Wind frequencies for 1968 were equivalent to the mean of 1966, 1967 and 1968 for all directions except 180° and 270°. The Jervis Bay data of 1968 would deviate from its mean in the same proportion. As the 180° and 270° wind frequencies for the 1968 Tallawarra and Jervis Bay data were the same the means will also be the same and are therefore given by the mean Tallawarra curve in Figure 2.

2.2 The Annual Wind Climate

The annual wind climate, for wind from all directions is shown in Figure 3. This figure was calculated by multiplying the 1968 Jervis Bay wind records by the ratio of the mean 1966, 1967 and 1968 Tallawarra data to the 1968 Tallawarra data, for each wind direction. The summation of the wind frequencies for each direction gives the mean annual wind climate for the site of the proposed power station at Jervis Bay.

2.3 Wind Wave Frequencies

The annual wind wave statistics at the proposed site of the power station were calculated from the adjusted Jervis Bay anemometer records using the technique described in Progress Report No. 1.

The 1968 Jervis Bay wind speeds for a given direction and frequency were multiplied by the ratio of mean Tallawarra speed to 1968 speed for the same frequency and direction. This gives a better estimate of the mean Jervis Bay wind climate. It was found this ratio was close to unity

for the possible directions of wave approach at the proposed site. Adjustment of wind records in this way is valid since the weather systems acting at Tallawarra and Jervis Bay are essentially the same, modified only by local topography.

Wave frequencies for the proposed Jervis Bay site are shown in Figure 4 for the four possible wave directions. The wave frequencies calculated in Progress Report No. 1 using 3 years of Tallawarra data are also given. It can be seen the Tallawarra data underestimates wave heights in Jervis Bay.

The total wave climate for waves from all directions is plotted in Figure 5. This figure was obtained by summing the frequencies for waves from the four possible directions of approach. Significant wave heights in excess of 2.5 ft. can be expected 5% of the time. The maximum significant wave height for wind generated waves in Jervis Bay is 3.5 ft.

3. Ocean Waves

Refraction will cause ocean waves to penetrate to the site of the proposed power station at Jervis Bay. However, wave energy entering Jervis Bay is spread over a relatively large area and wave heights are considerably reduced. Wave refraction diagrams (Figs. 6, 7, 8 and 9) were constructed for waves with a period of 10 seconds, from 75° , 90° , 105° and 120° respectively. A wave period of 10 seconds was chosen, as this is a typical period for large ocean swells. Wave height coefficients were calculated from these diagrams, for each of the above directions. A further wave height coefficient was determined for waves diffracting around Point Perpendicular. The method used for calculating this coefficient was that of Penny and Price (1944, 1952) and tabulated by Wiegel (1962).

A plot of wave height coefficient against bearing is given in Figure 10. It can be seen from this figure and the preceding figures that Bowen Island and Point Perpendicular afford excellent protection to the proposed site from ocean waves.

3.1 Refracted Wave Heights

A plot of significant wave height against the percentage of time this height will be exceeded, is given in Figure 11. Refracted ocean waves with a significant height in excess of 2 ft. can be expected 1 pc. of the time. The maximum wave height experienced at the site between 1950 and 1965 is 7.3 ft.

3.2 Wave Periods

The period of ocean waves arriving at Jervis Bay lie in the range 7 to 18 seconds. However, the larger waves lie in a narrow band with periods from 10 to 13 seconds. There is negligible change in the wave height coefficient for waves within this period range.

The offshore wave data used to compile the above graph was made available by the Public Works Department of New South Wales. 16 years of meteorological records were used by the Public Works Department to hindcast ocean waves offshore from Shellharbour.

Shellharbour and Jervis Bay are only 35 miles apart. Therefore ocean wave statistics at both places are the same.

4. Conclusions

4.1 Wind Frequencies

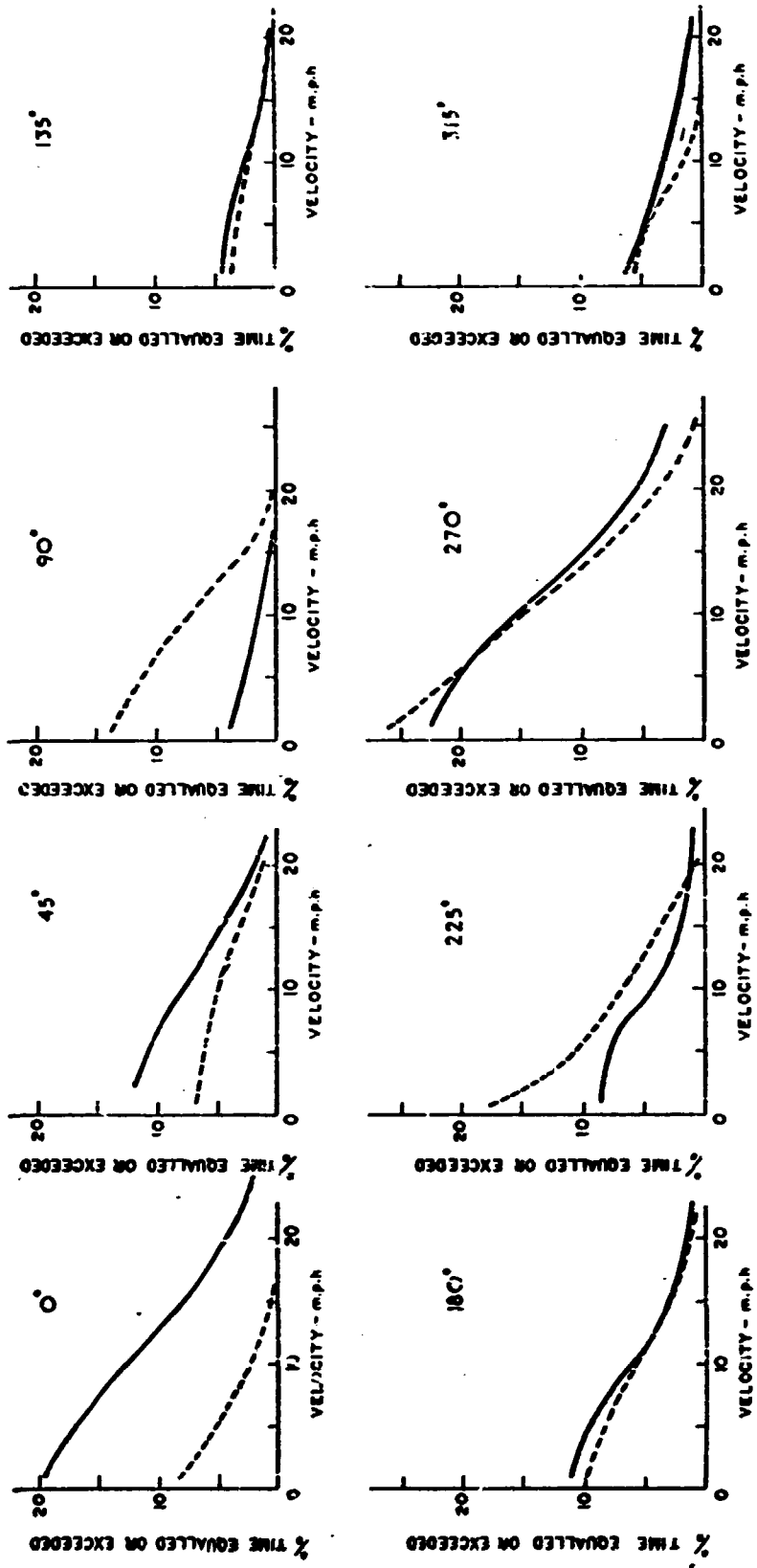
Wind frequencies at Jervis Bay (Figure 1) were reasonably estimated from Tallawarra wind data in Progress Report No. 1, for all directions except 000° and 090° . Wind frequencies for these directions were underestimated and overestimated respectively. The annual wind climate for winds from all directions (Figure 3) indicates wind speeds in excess of 25 m.p.h. can be expected 1/6 pc. of the time.

4.2 Wind Generated Waves

Wind waves account for most of the wave action at wave heights of less than 2.5 ft. in Jervis Bay. Waves exceeding this height can be expected 5.3% of the time, of which 4.7% are wind waves and 0.6% are ocean swell waves. The maximum height of the wind generated waves is 3.5 ft.

4.3 Ocean Waves

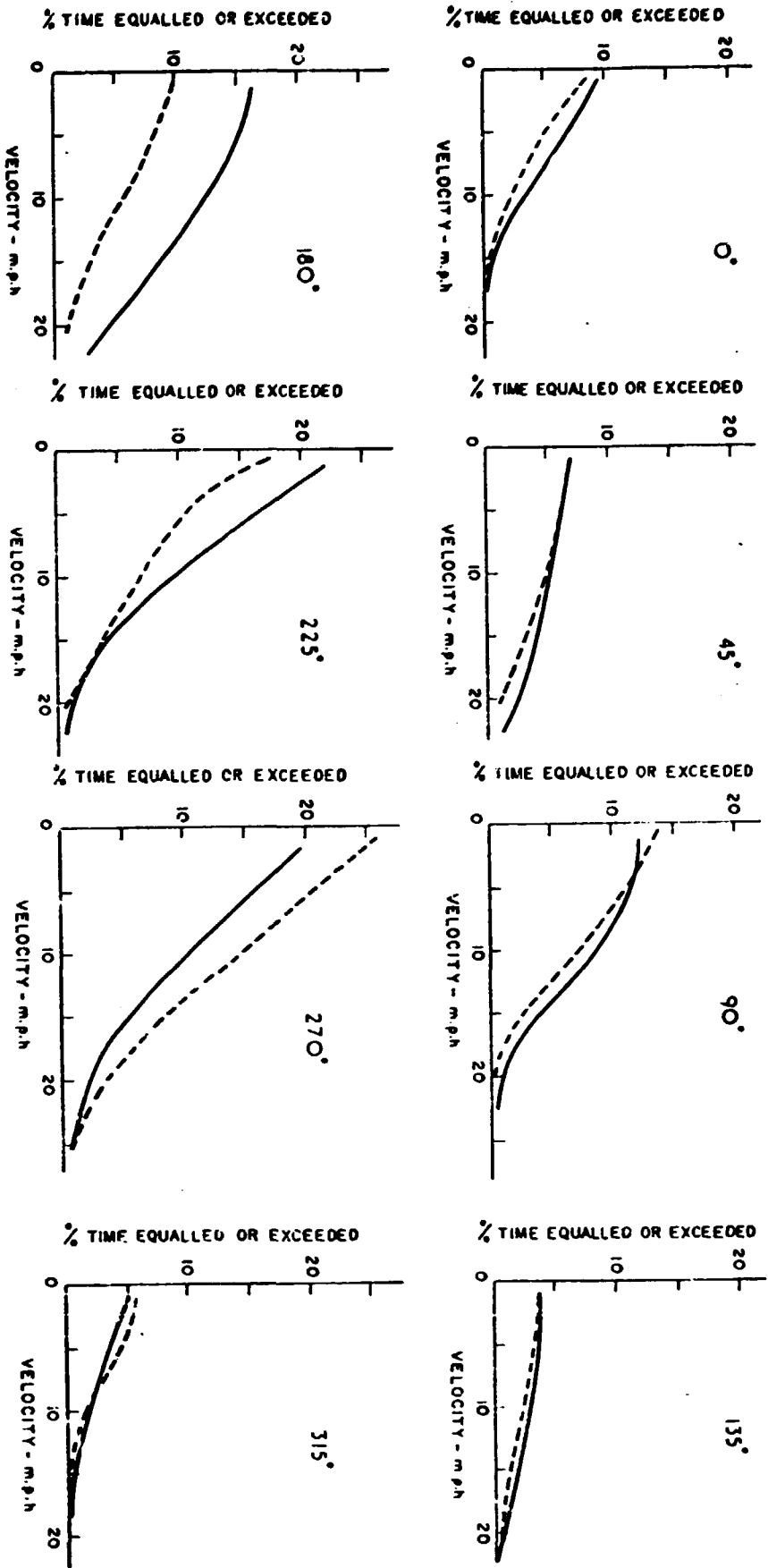
Contrary to the conclusions of Progress Report No. 1, it is refracted ocean waves which determine the design height for waves in Jervis Bay. The maximum significant wave height for refracted ocean waves during the period 1950 to 1965 was 7.3 ft. Refracted ocean waves with heights exceeding 3 ft. can be expected 0.3 pc. of the time.



— Jervis Bay Records (1966)
 - - - - - Tallawarra Records (1966)

FIGURE 1: DIRECTIONAL WIND FREQUENCY CHARTS FOR JERVIS BAY

CE-F-7917



—— Mean Tallowarra Records (1966, 67 and 68)
 - - - - - Tallowarra Records (1968)

FIGURE 2: DIRECTIONAL WIND FREQUENCY CHARTS FOR JERVIS BAY

CE-E-7916

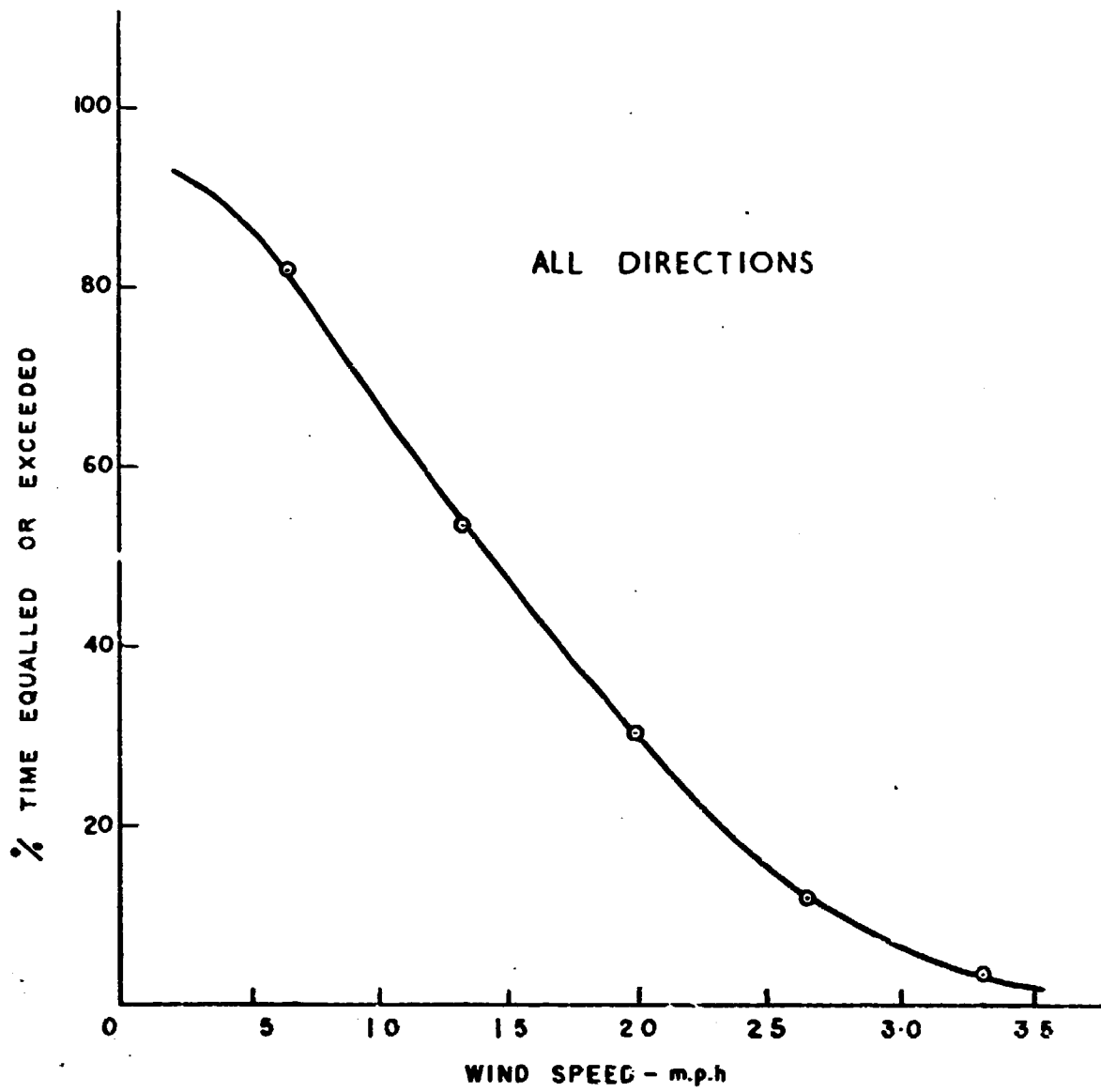


FIGURE 3: ANNUAL WIND CLIMATE FOR
PROPOSED SITE OF POWER STATION-
JERVIS BAY

CE-E-7919

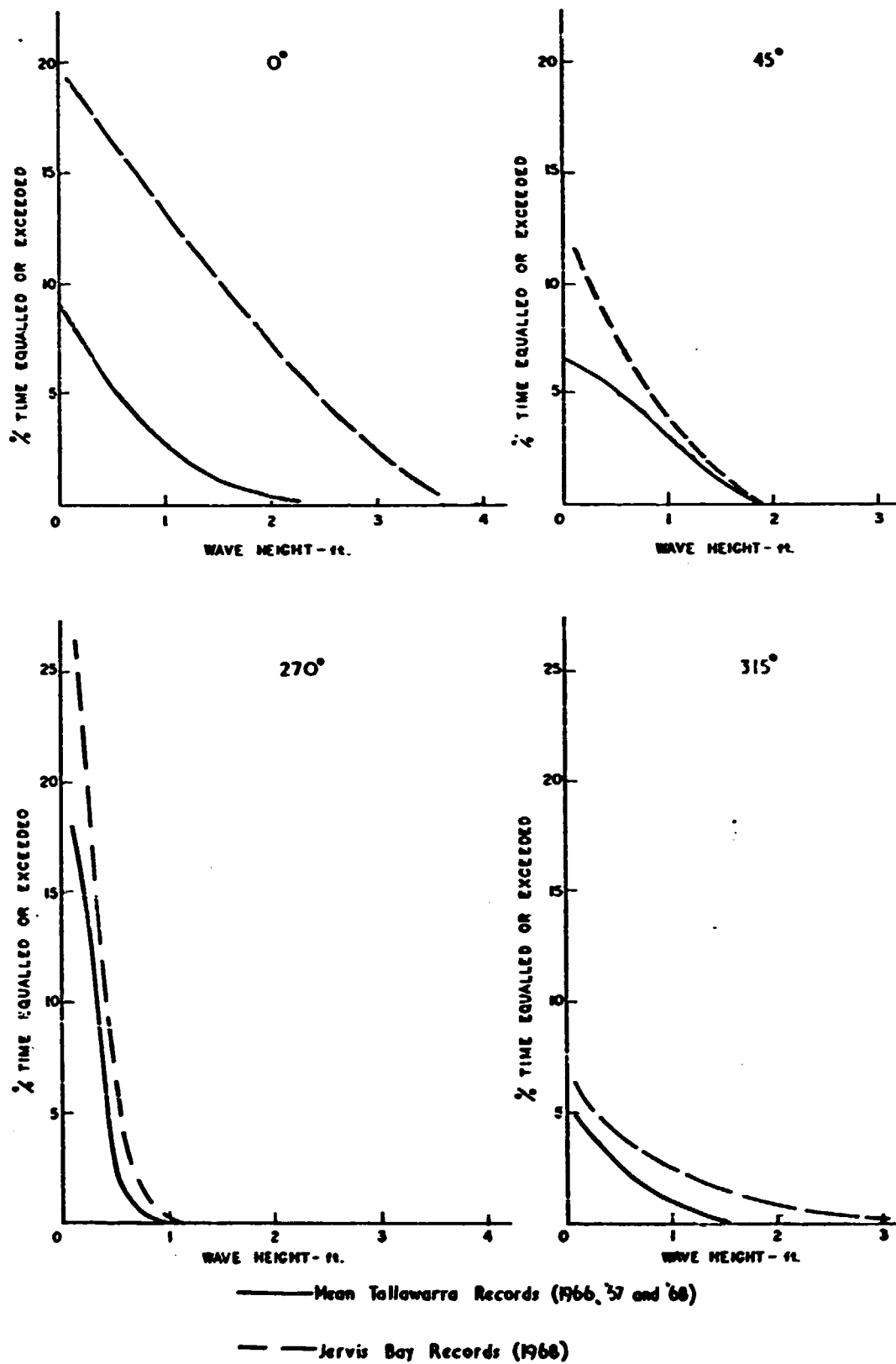


FIGURE 4: ANNUAL WIND-WAVE FREQUENCY CHARTS FOR JERVIS BAY
 CE-E-7920

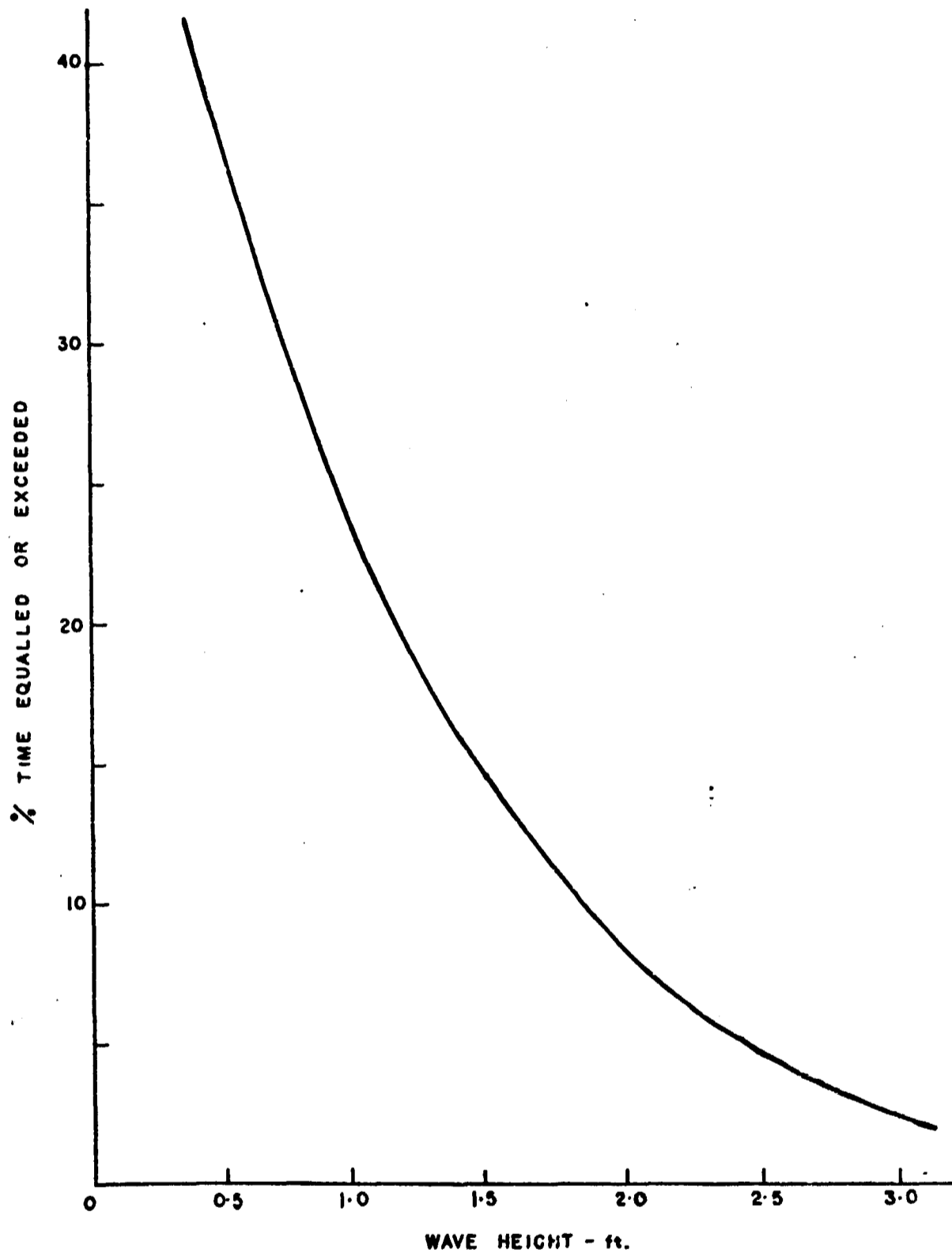


FIGURE 5: ANNUAL WIND-WAVE CLIMATE - JERVIS BAY

CE-E-7921

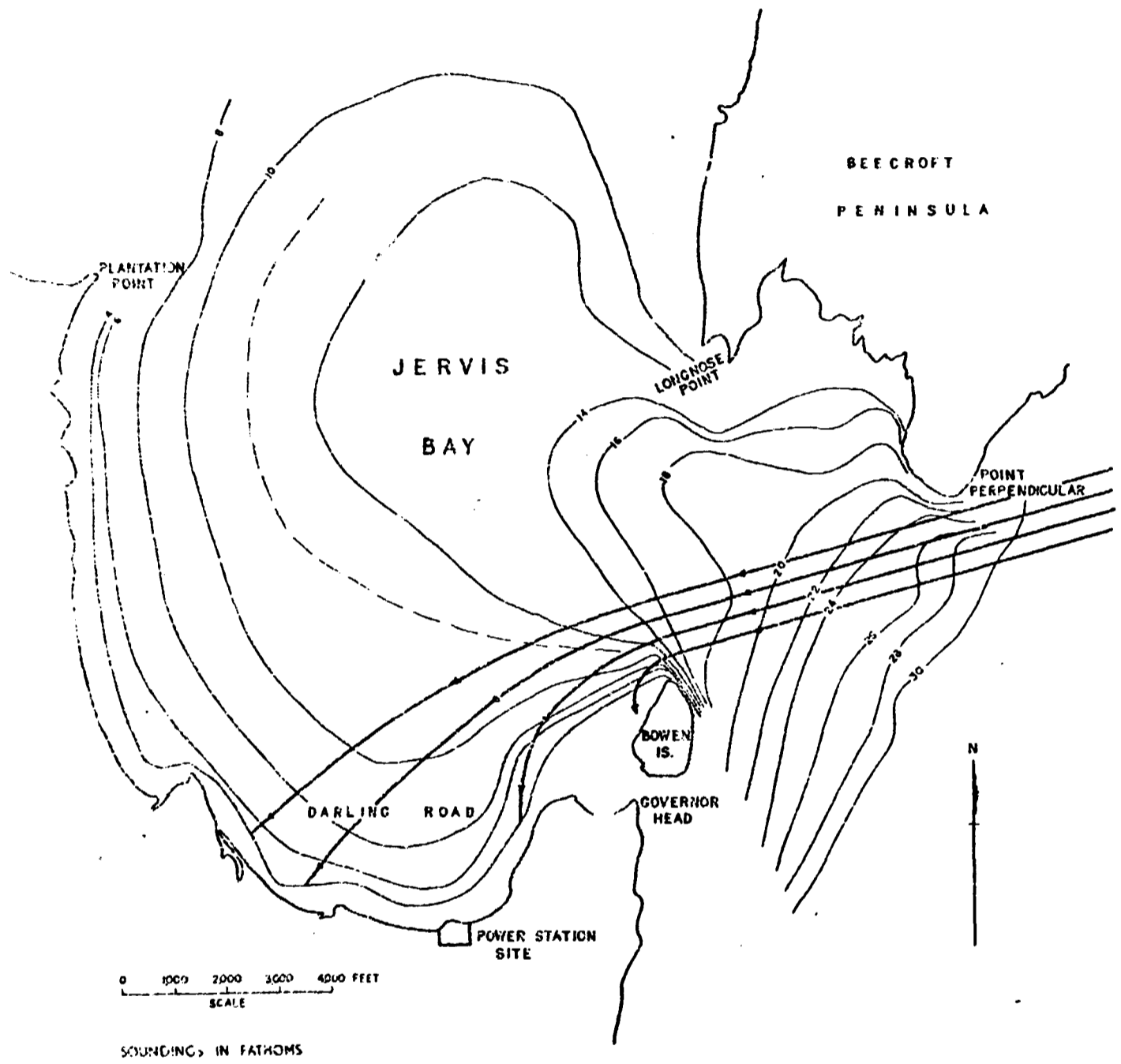


FIGURE 6: JERVIS BAY - WAVE REFRACTION DIAGRAM

10 SEC. WAVES FROM 75°

CE-D-7831

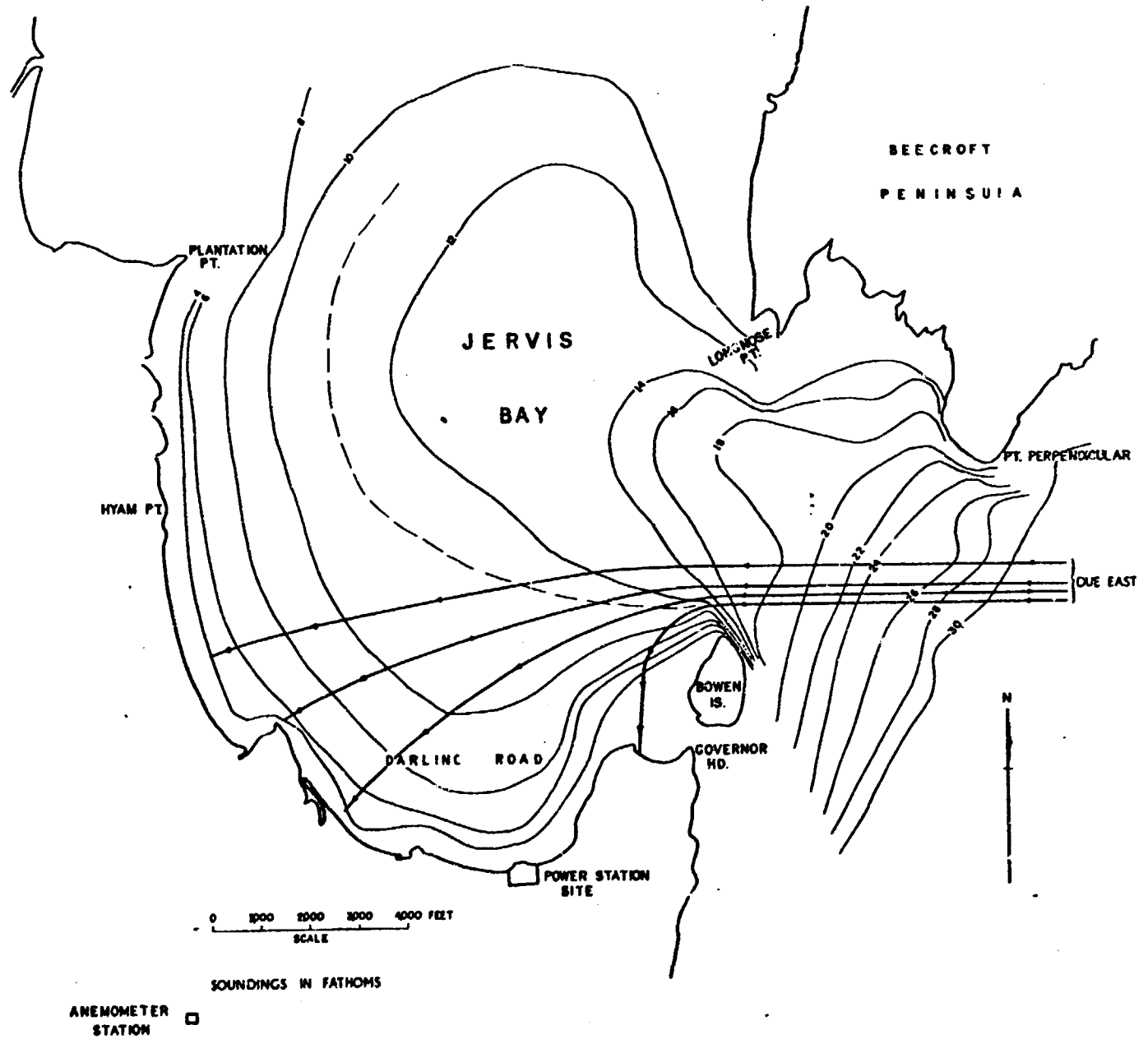


FIGURE 7: JERVIS BAY - WAVE REFRACTION DIAGRAM & LOCALITY PLAN

10 SEC. WAVES FROM 90°

CE-D-7772

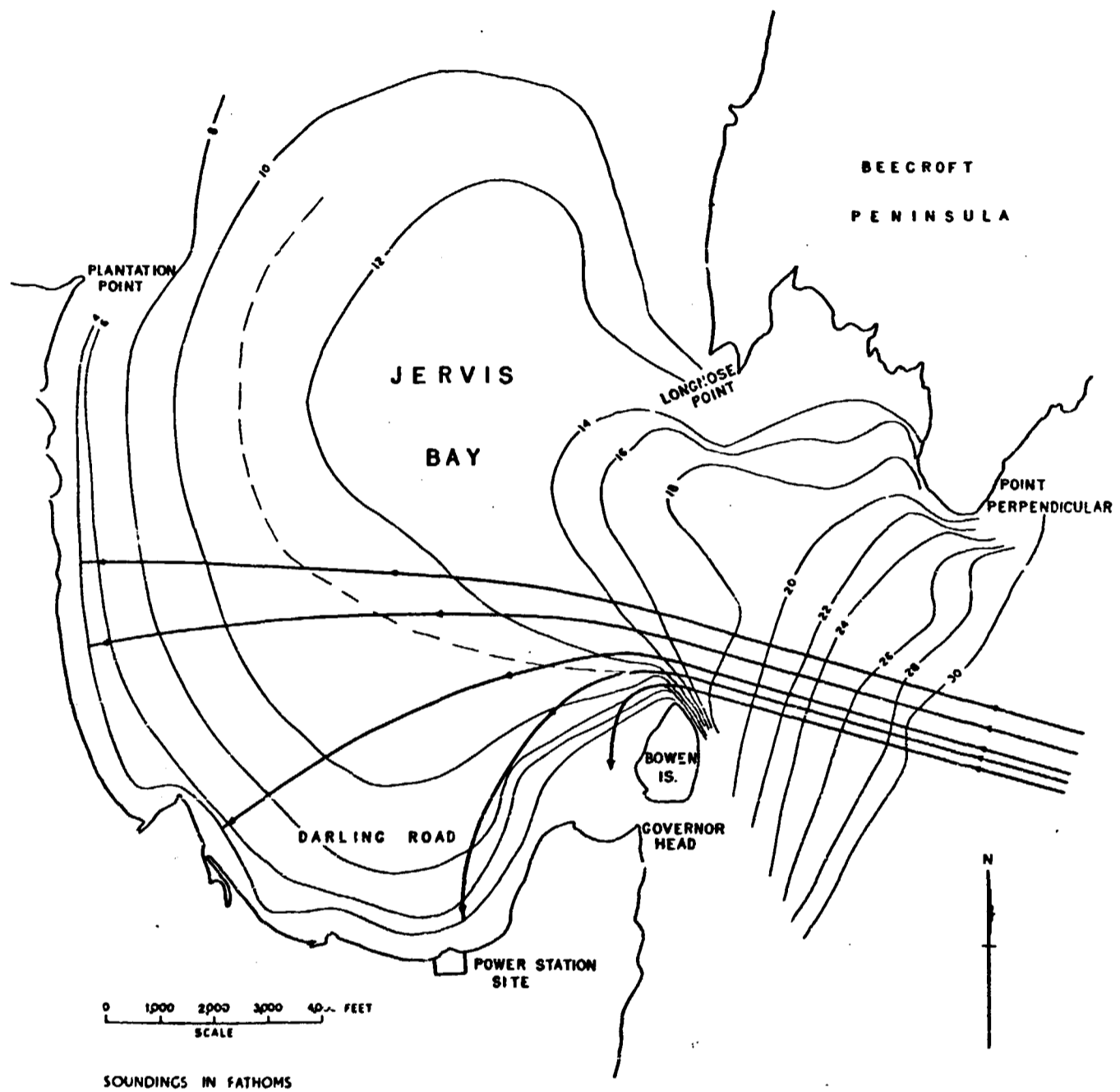


FIGURE 8: JERVIS BAY - WAVE REFRACTION DIAGRAM

10 SEC. WAVES FROM 105°

CE- D- 7832

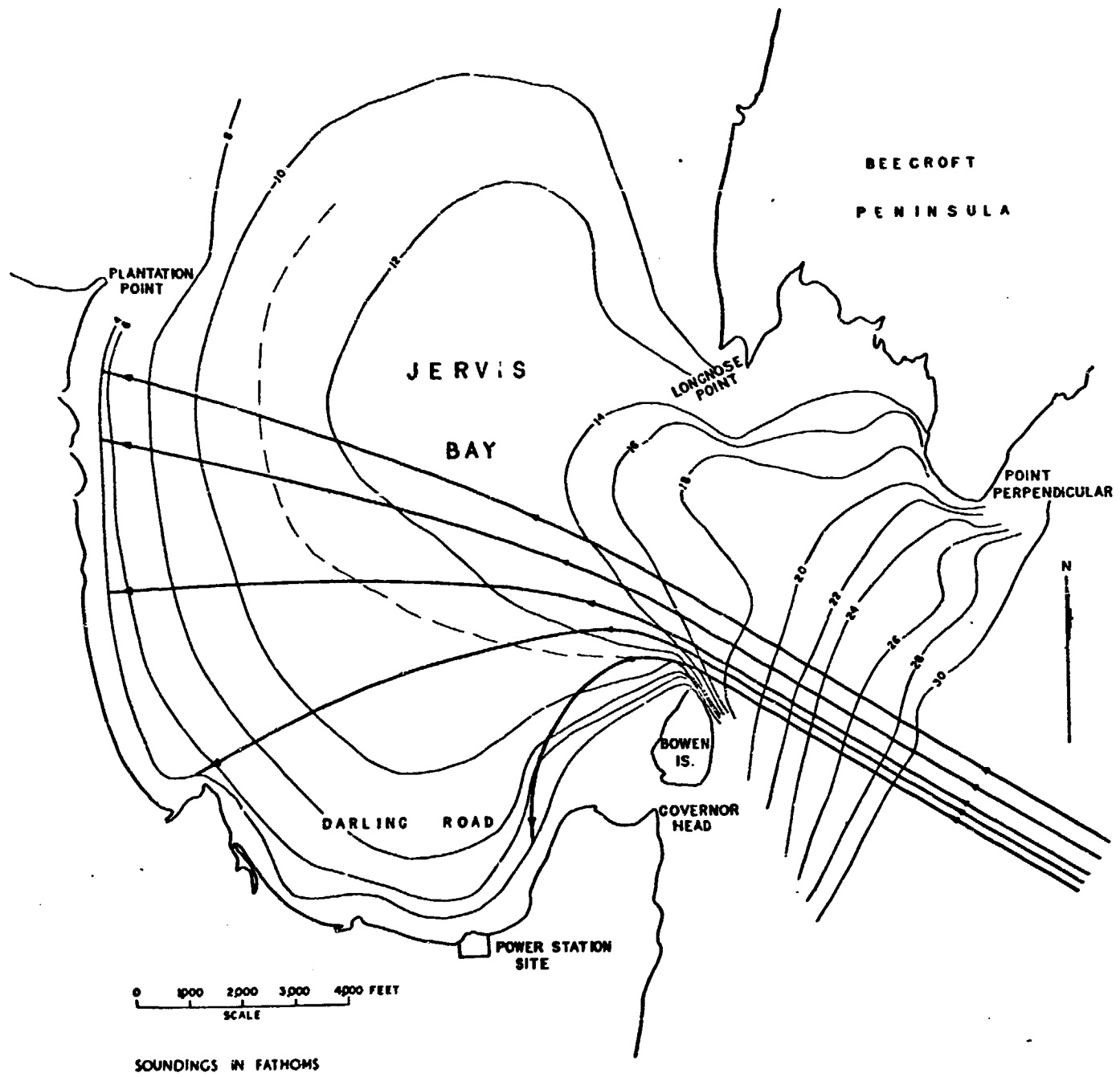


FIGURE 9 : JERVIS BAY - WAVE REFRACTION DIAGRAM
10 SEC. WAVES FROM 120°

CE-D-7833

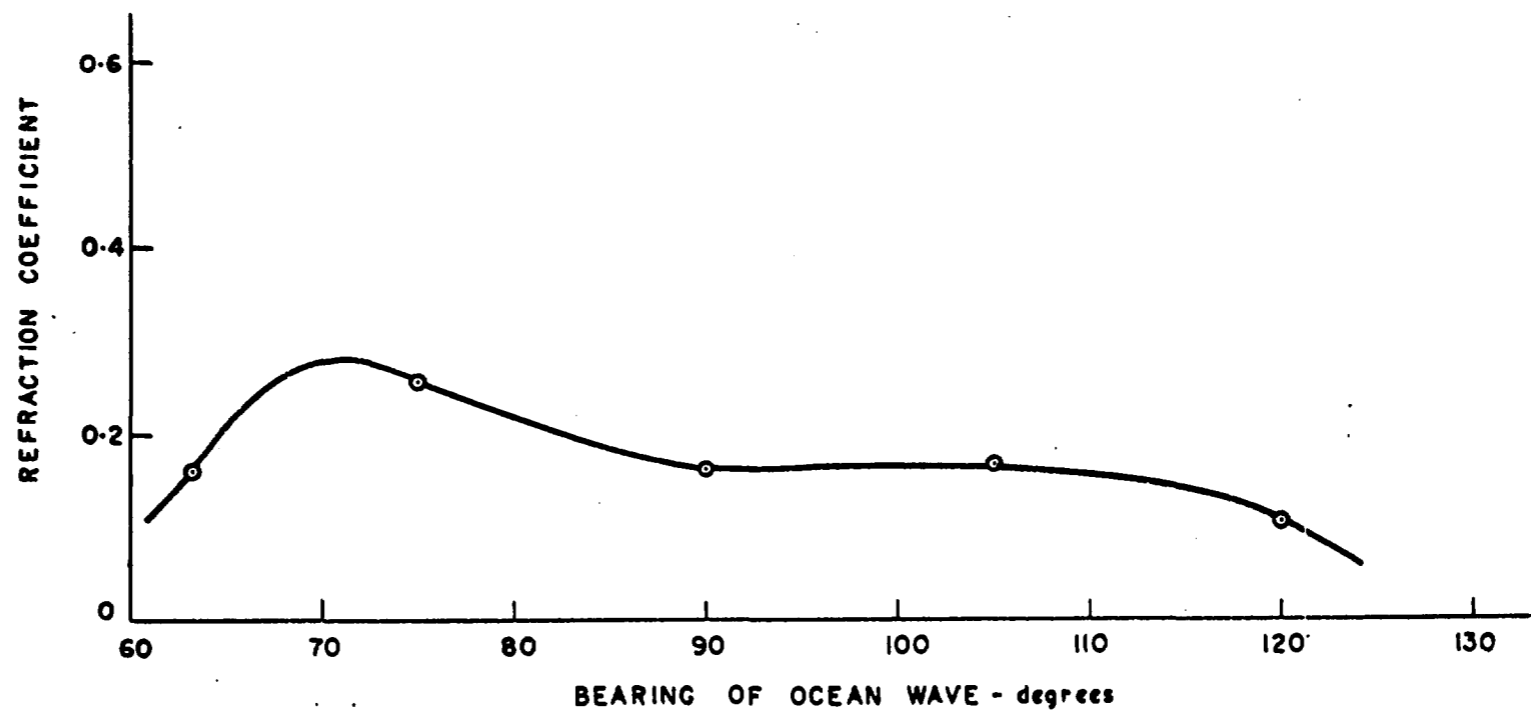


FIGURE 10: WAVE HEIGHT COEFFICIENTS FOR POWER STATION SITE
AT JERVIS BAY

CE-E-7922

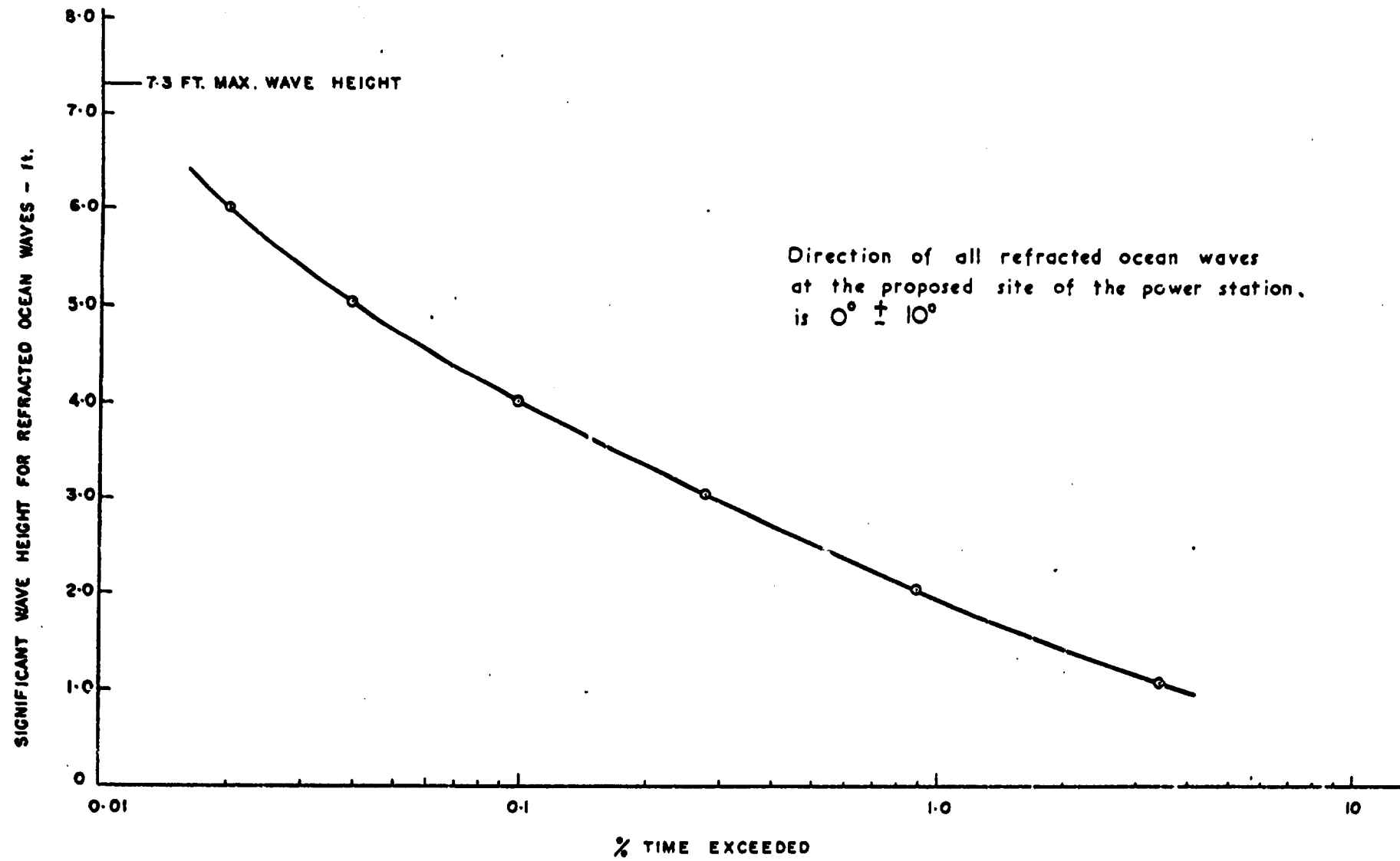
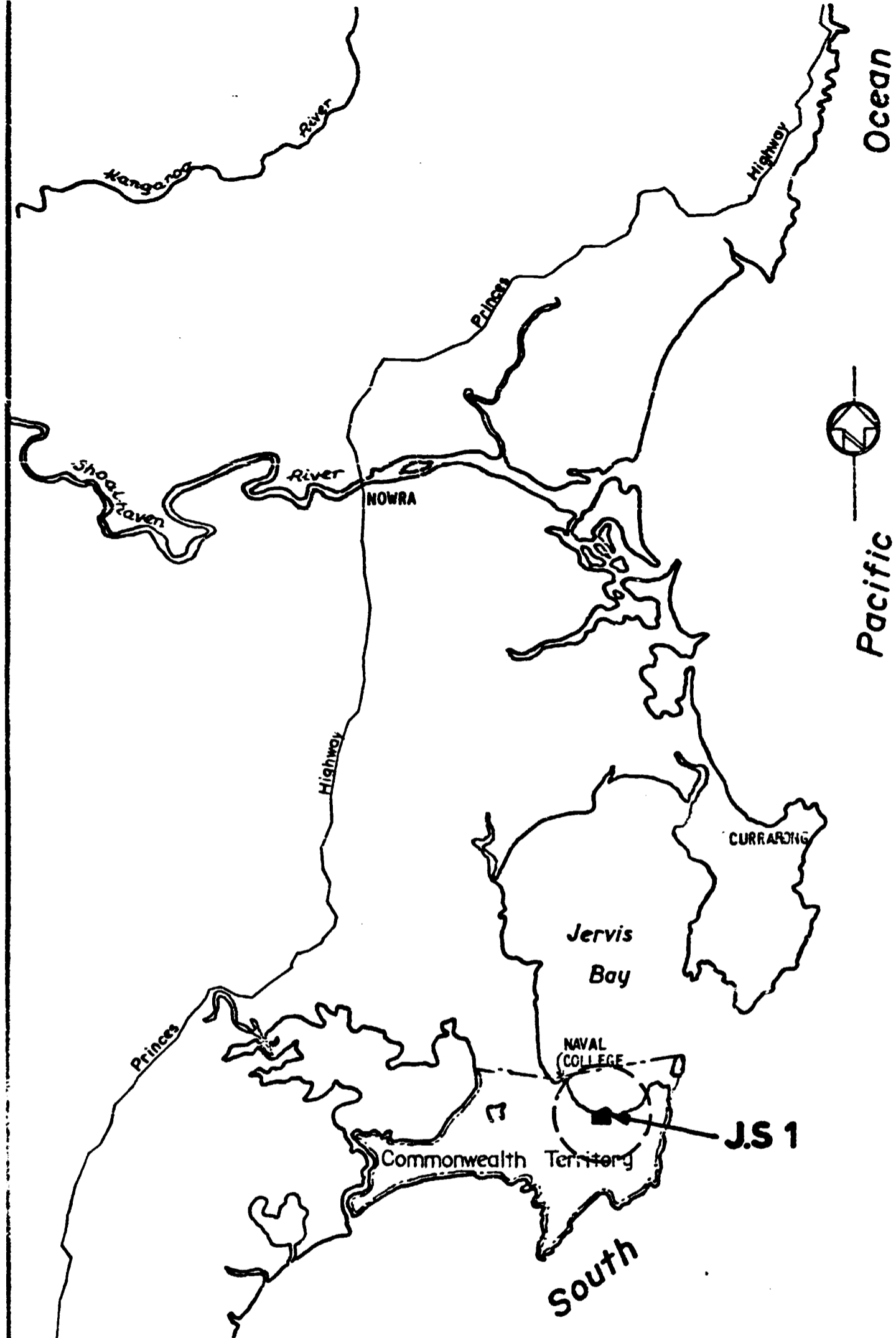


FIGURE II: FREQUENCY OF REFRACTED OCEAN WAVES AT PROPOSED SITE OF POWER STATION - JERVIS BAY

CE-E-7923



MAP REFERENCE:
 MILITARY MAP 'ULLADULLA' - 1:250,000 SERIES

0 1 2 3 4 5 6 7 8 9 10

SCALE - MILES

FIG. 1

THE ELECTRICITY COMMISSION OF N.S.W.
 POWER DEVELOPMENT DIVISION

DRN	C.G.C.	JERVIS BAY PROJECT SITE JS1-SCOTTISH ROCKS LOCATION	APPROVED	DATE
TCD	F.N.G.		<i>L. J. Coulter</i>	28/5/70
CKD	<i>[Signature]</i>		C.I. 2568	

C.I. 2568

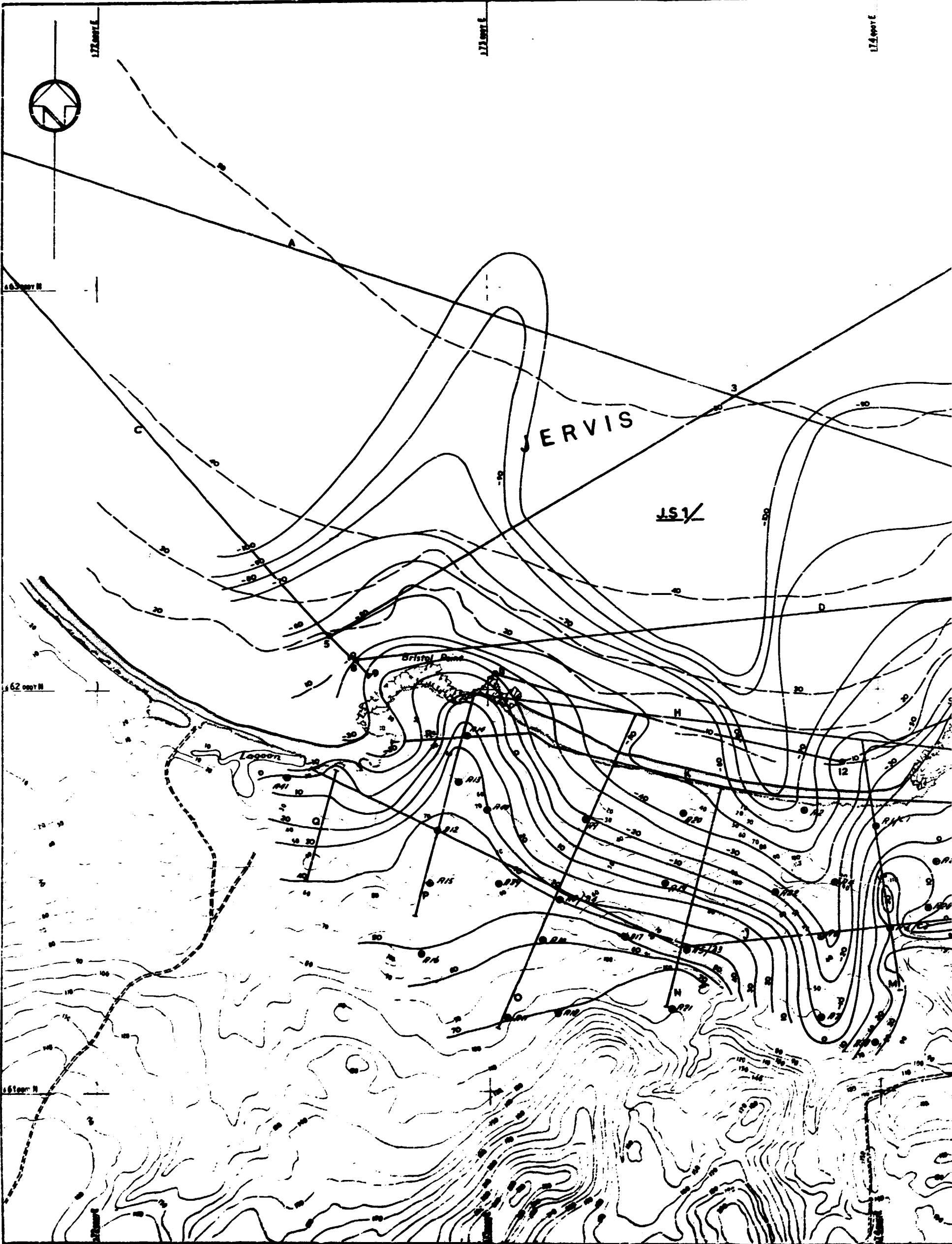
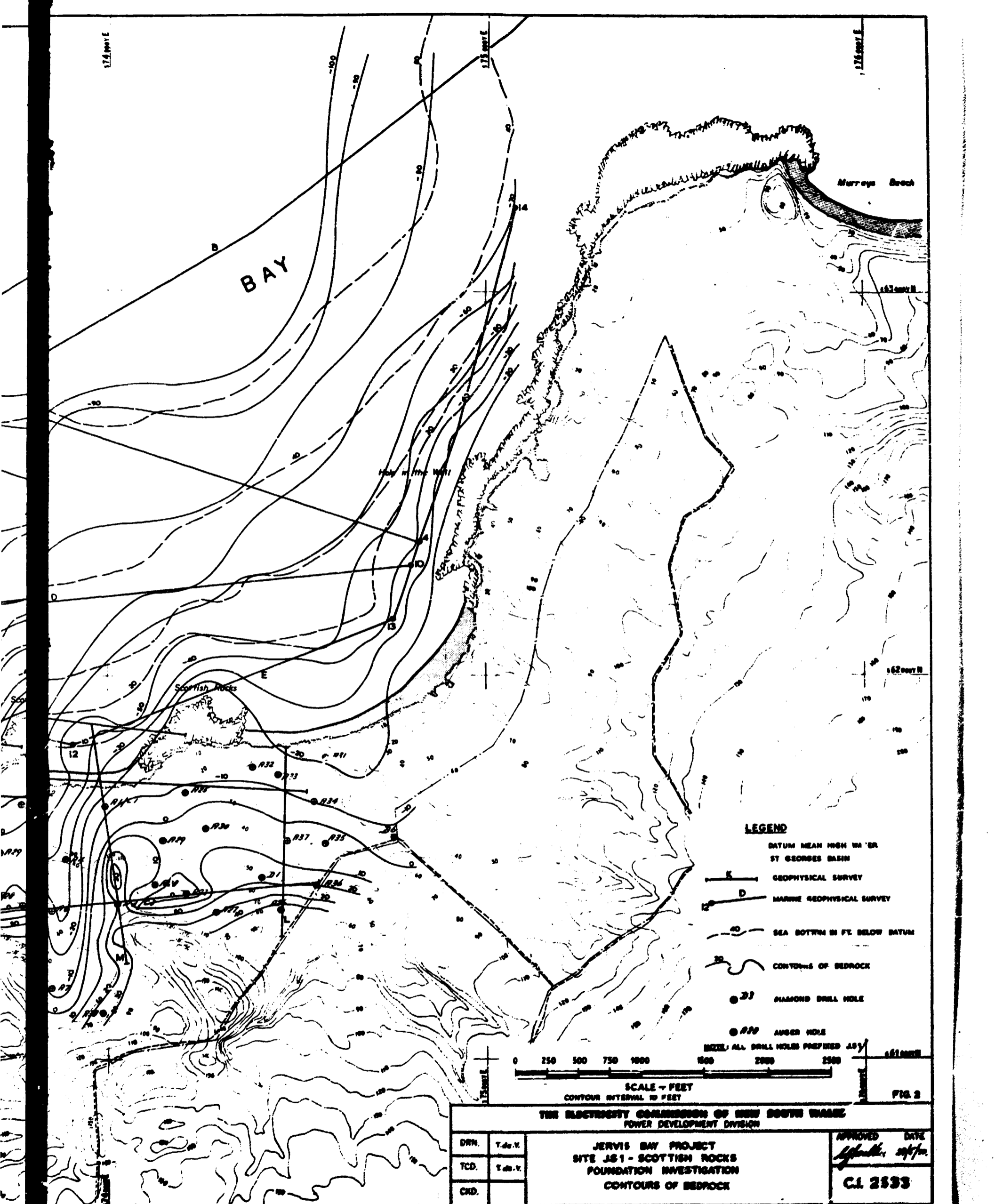
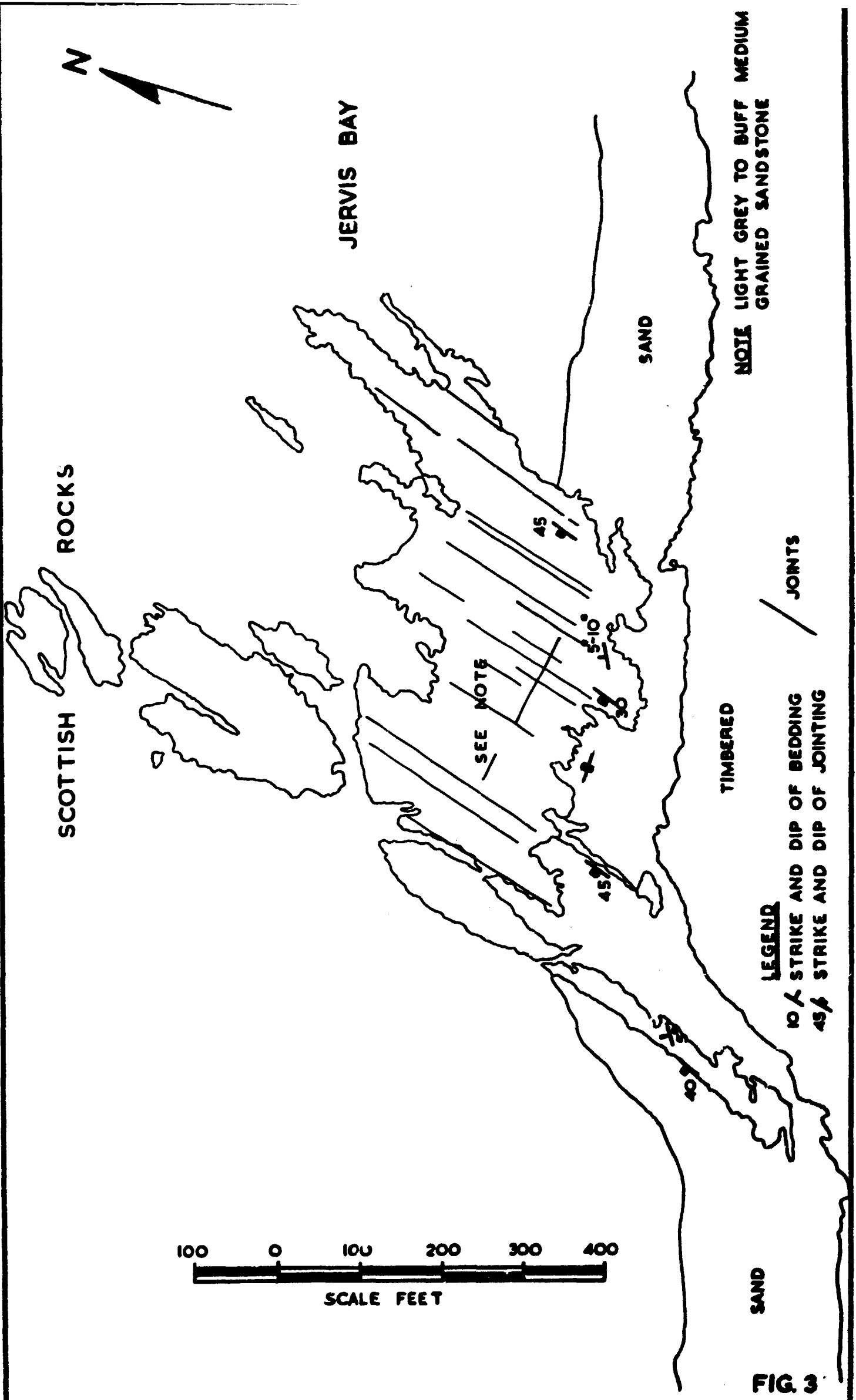


FIG. 2

SECTION 1



SECTION 2



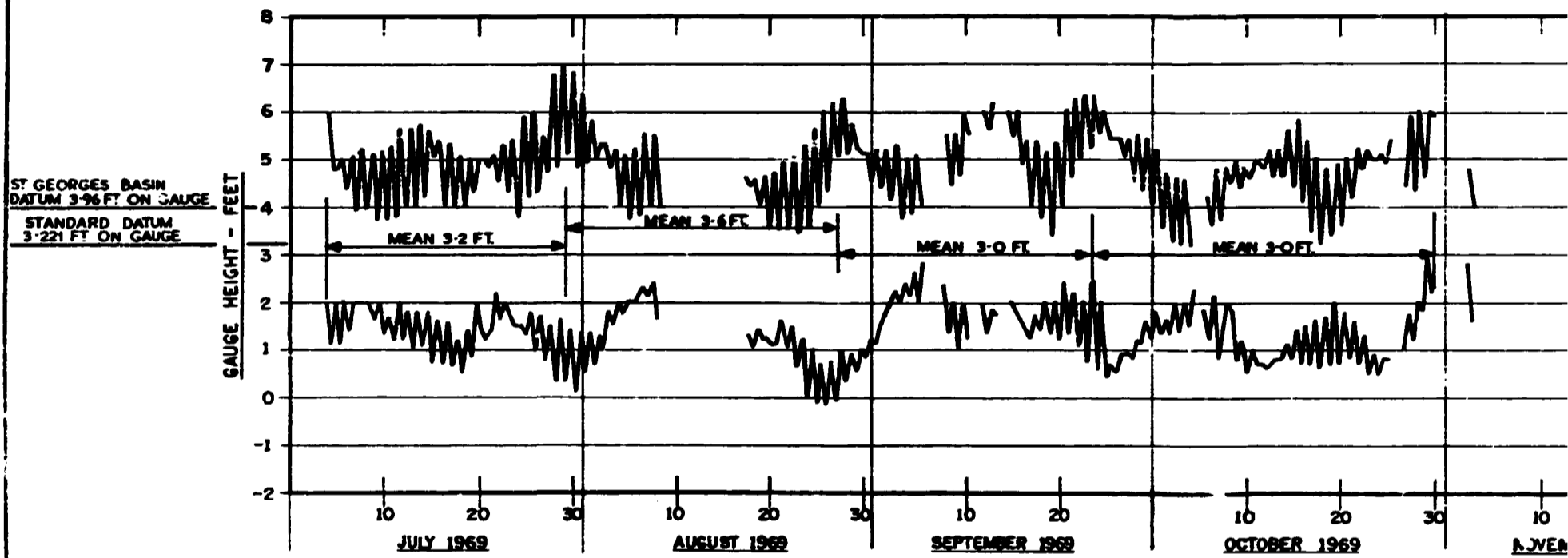
**THE ELECTRICITY COMMISSION OF N.S.W.
POWER DEVELOPMENT DIVISION**

DRN	D.R.D.
TCD	T.de.V.
CKD	<i>[Signature]</i>

**JERVIS BAY PROJECT
GEOLOGICAL MAP OF
SCOTTISH ROCKS**

APPROVED *[Signature]* DATE *2/5/70*

C.I. 2567



SCALES: VERTICAL 1 FOOT = 50 MILLIMETRES.
HORIZONTAL 24 HOURS = 2 MILLIMETRES.

NOTE: 1. TIDE GAUGE IS LOCATED ON THE END OF CAPTAINS WHARF, JERVIS BAY.
2. ZERO ON TIDE GAUGE = - 3.96 FT ON ST. GEORGES BASIN DATUM.
3. LANDS DEPT HAVE ADVISED E.C. SURVEYOR THAT STANDARD DATUM IS 0.739 FEET BELOW ST GEORGES BASIN DATUM. I.E. STANDARD DATUM IS 3.22 FEET ON TIDE GAUGE. (REFER TO MEMO FROM PRINCIPAL SURVEYOR DATED 9:6:70 ON FILE 3663Q.)

FIG. 4

SECTION 1

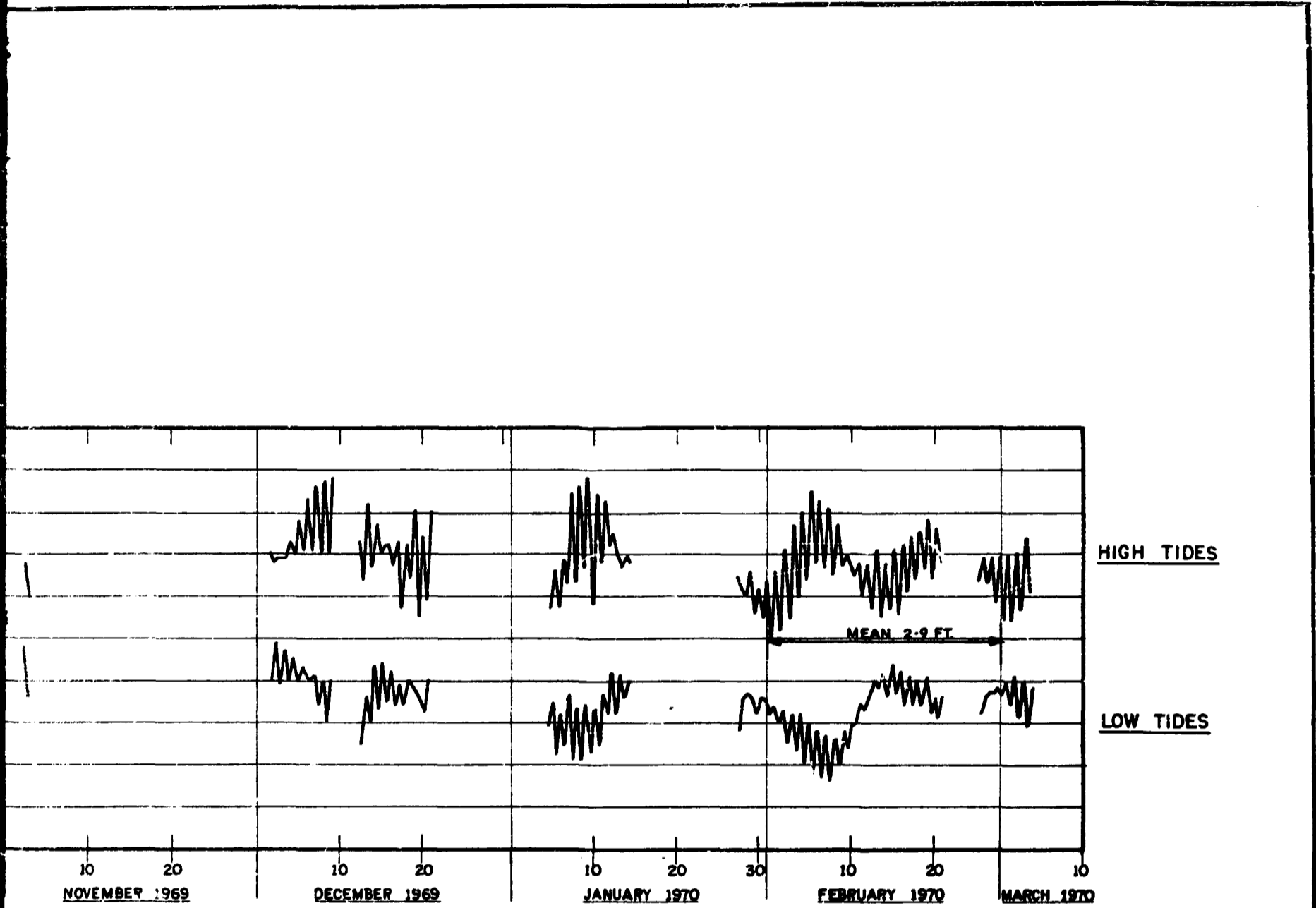
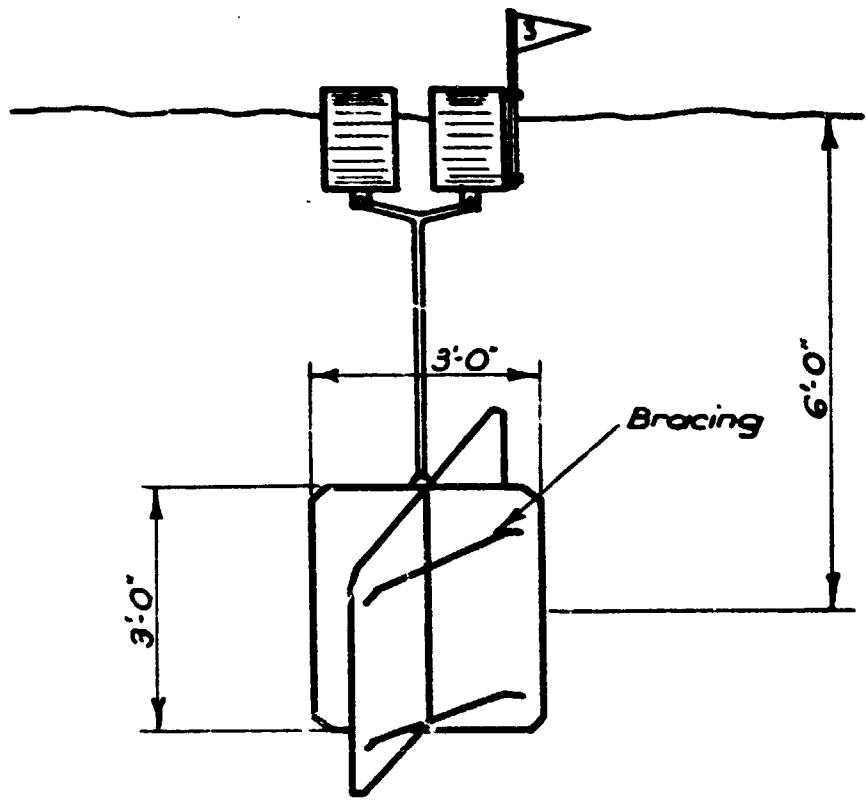


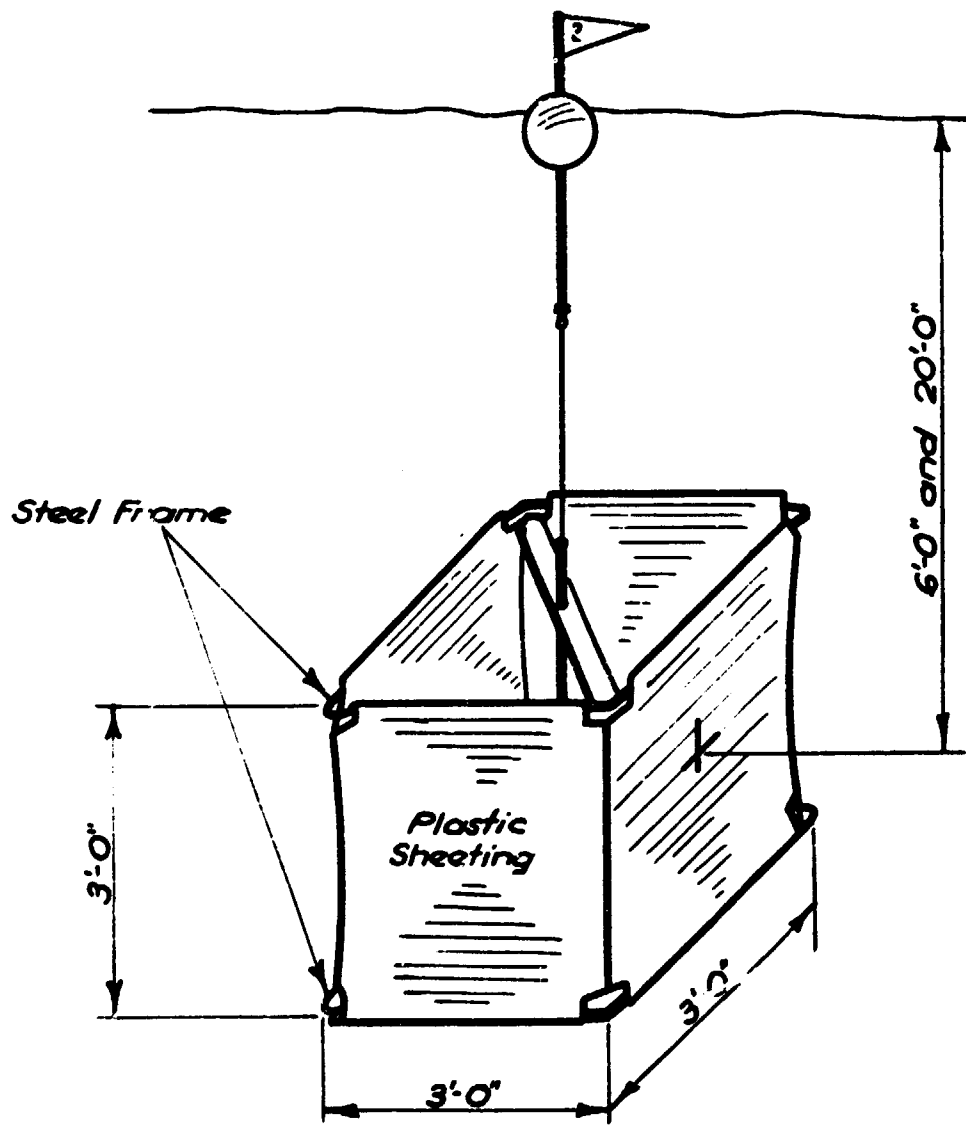
FIG. 4.

THE ELECTRICITY COMMISSION OF N.S.W. POWER DEVELOPMENT DIVISION				
DRN.	D.V.	JERVIS BAY NUCLEAR POWER STATION	APPROVED	DATE
TCL.	F.N.G.		<i>[Signature]</i>	<i>[Date]</i>
CMD.	N.L.			
TIDAL OBSERVATIONS IN JERVIS BAY AT CAPTAINS WHARF JULY 1969 TO FEB. 1970			C.I. 2312	

SECTION 2



(a) METAL VANED KITE



(b) PLASTIC SHEETED BOX KITE

FIG. 5

THE ELECTRICITY COMMISSION OF N.S.W.
POWER DEVELOPMENT DIVISION

DRN	W.W.
TCD	F.N.G.
CKD	N.L.

JERVIS BAY
SKETCH OF KITES USED IN
CURRENT SURVEY

APPROVED
Affaults DATE
29/5/70
C.I. 1688

TIDAL INFORMATION			
DATE	TIME	TIDE	HEIGHT *
7:7:69	0200 hrs.	HIGH	4.14 feet
7:7:69	0815 hrs	LOW	1.45 feet
7:7:69	1445 hrs.	HIGH	4.90 feet
7:7:69	2115 hrs.	LOW	2.10 feet

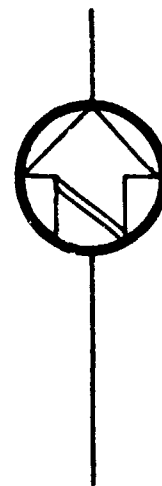
* HEIGHT AS INDICATED BY STAFF GAUGE & BRISTOL RECORDER INSTALLED ON CAPTAIN'S WHARF, CAPTAIN'S POINT.

WIND RECORDS			
DATE	TIME	MEAN SPEED	DIRECTION *
7:7:69	1100 hrs.	9 M.P.H.	340°
7:7:69	1200 hrs.	9 M.P.H.	340°
7:7:69	1300 hrs.	2 M.P.H.	340°
7:7:69	1400 hrs.	9 M.P.H.	30°
7:7:69	1430 hrs.	7 M.P.H.	40°
7:7:69	1500 hrs.	6 M.P.H.	40°
7:7:69	1530 hrs.	6 M.P.H.	40°
7:7:69	1600 hrs.	3 M.P.H.	20°
7:7:69	1615 hrs.	CHANGE OF DIRECTION	
7:7:69	1630 hrs.	0	310°
7:7:69	1700 hrs.	6 M.P.H.	280°
7:7:69	1800 hrs.	7 M.P.H.	280°

* DIRECTION IS GIVEN RELATIVE TO TRUE NORTH

JERVIS

BAY

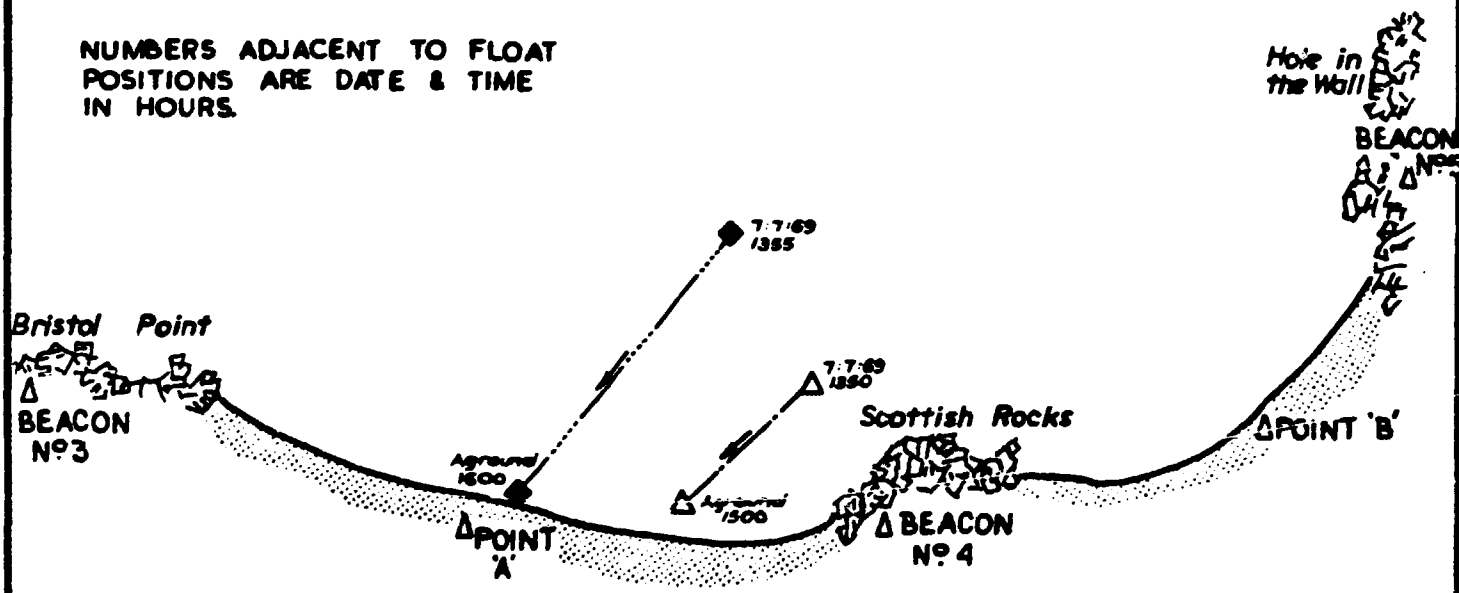


LEGEND:

depth

- ◆ ——— 6 feet - FLOAT NO. 2
- △ ——— 6 feet - FLOAT NO. 9

NUMBERS ADJACENT TO FLOAT POSITIONS ARE DATE & TIME IN HOURS.



NOTES:

1. CONDITIONS CALM, SLIGHT CHOP, SWELL TOO SMALL TO BE OBSERVED.

WIND:

WIND DATA WAS RECORDED BY A DINE'S ANEMOGRAPH INSTALLED AT 10 METRES HEIGHT ON R.A.N. AIRFIELD - JERVIS BAY.

FIG. 6

THE ELECTRICITY COMMISSION OF N.S.W.
POWER DEVELOPMENT DIVISION

DRN	W.W.	JERVIS BAY CURRENT OBSERVATIONS 7:7:69	APPROVED	DATE
TCD	F.N.G.		<i>[Signature]</i>	29/5/70
CKD	N.L.		C.I. 1681	

TIDAL INFORMATION			
DATE	TIME	TIDE	HEIGHT *
8:7:69	0330 hrs	HIGH	3.8 feet
8:7:69	0930 hrs	LOW	2.4 feet
8:7:69	1600 hrs	HIGH	5.0 feet
8:7:69	2230 hrs	LOW	2.1 feet

* HEIGHT AS INDICATED BY STAFF GAUGE & BRISTOL RECORDER INSTALLED ON CAPTAIN'S WHARF, CAPTAIN'S POINT.

WIND RECORDS			
DATE	TIME	MEAN SPEED	DIRECTION *
8:7:69	0830 hrs	7 M.P.H.	265°
8:7:69	0900 hrs	M.P.H.	265°
8:7:69	0930 hrs	5 M.P.H.	260°
8:7:69	1000 hrs	7 M.P.H.	270°
8:7:69	1030 hrs	7 M.P.H.	270°
8:7:69	1100 hrs	CHANGE OF DIRECTION 270°-320°	
8:7:69	1130 hrs	2 M.P.H.	330°
8:7:69	1200 hrs	0	320°
8:7:69	1230 hrs	1 M.P.H.	300°

* DIRECTION GIVEN RELATIVE TO TRUE NORTH.

JERVIS

BAY

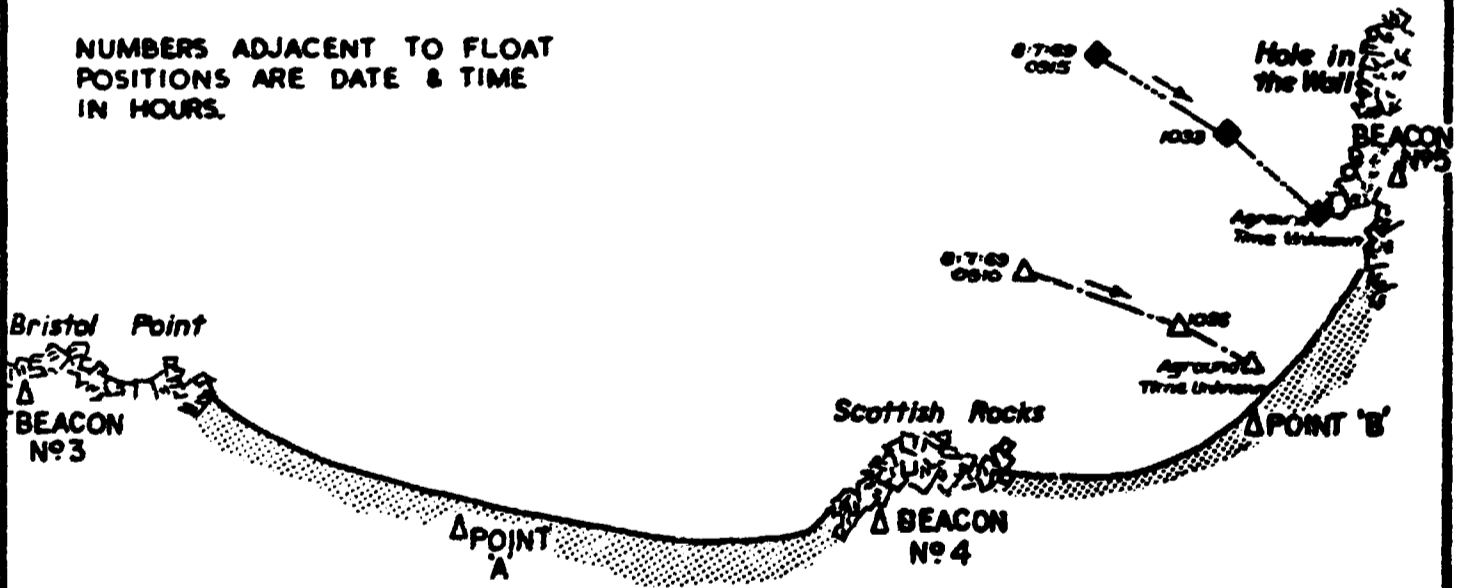


LEGEND:

depth

- ◆----- 6 feet - FLOAT N°2
- △----- 6 feet - FLOAT N°9

NUMBERS ADJACENT TO FLOAT POSITIONS ARE DATE & TIME IN HOURS.



NOTES:

1. CONDITIONS CALM, SLIGHT CHOP SWELL TOO SMALL TO BE OBSERVED.

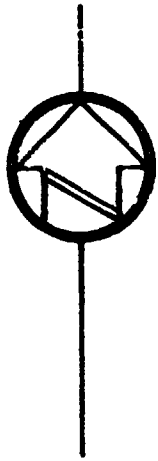
WIND:

WIND DATA WAS RECORDED BY A DINE'S ANEMOGRAPH INSTALLED AT 10 METRES HEIGHT ON R.A.N. AIRFIELD - JERVIS BAY.

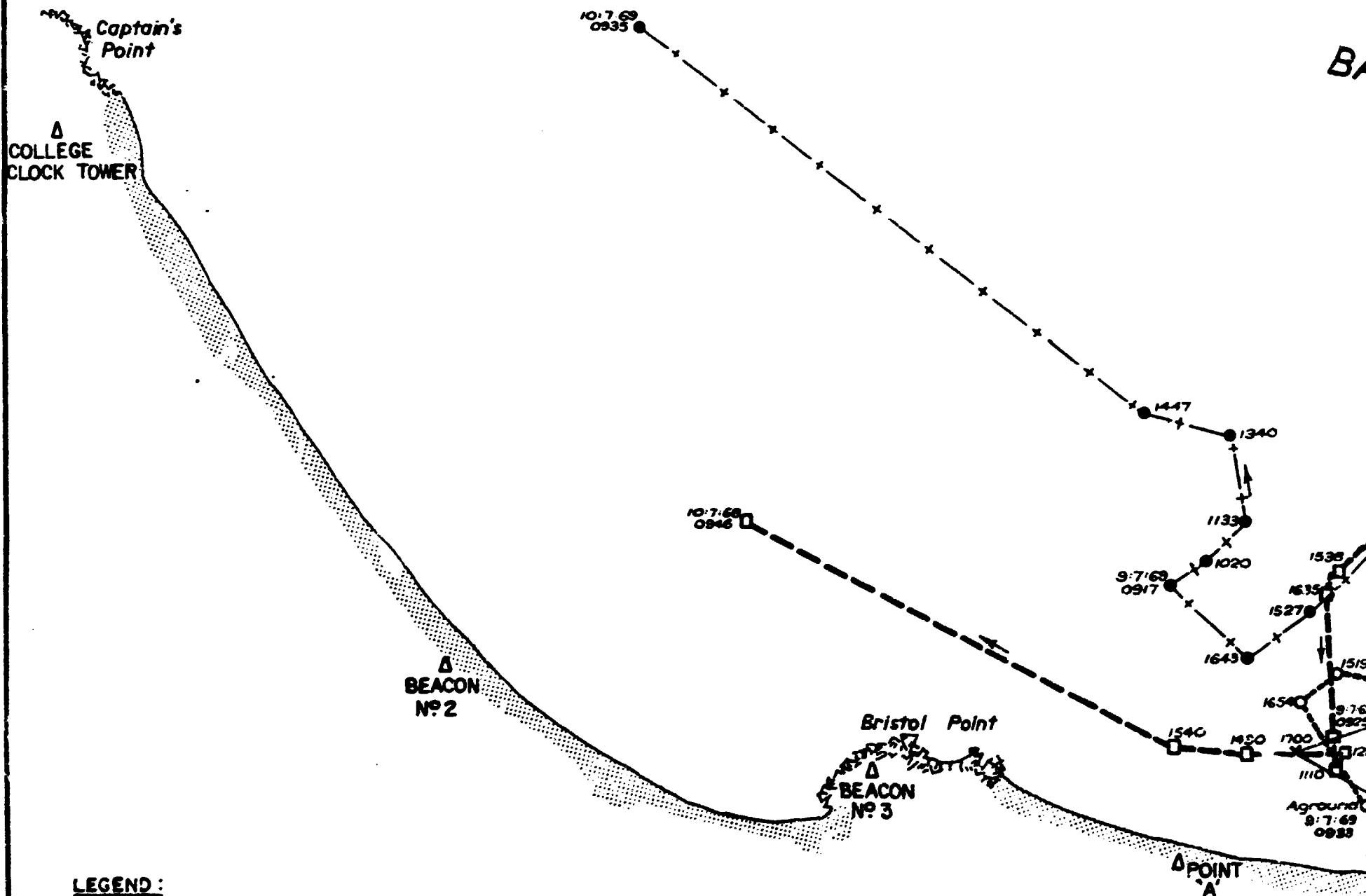
FIG. 7

THE ELECTRICITY COMMISSION OF N.S.W.
POWER DEVELOPMENT DIVISION

DRN	W.W.	JERVIS BAY CURRENT OBSERVATIONS MORNING 8:7:69	APPROVED	DATE
TCD	F.N.G.		<i>[Signature]</i>	29/5/70
CKD	N.L.		C.I. 1682	



JERVIS



LEGEND :

- depth
- 20 feet - FLOAT N° 1
 - ◆----- 6 feet - FLOAT N° 2
 - ×----- 6 feet - FLOAT N° 3
 - +--- 6 feet - FLOAT N° 4
 - 20 feet - FLOAT N° 5
 - △----- 6 feet - FLOAT N° 9

NUMBERS ADJACENT TO FLOAT POSITIONS ARE DATE & TIME IN HOURS.

NOTES:

1. CONDITIONS CALM, GLASSY AT TIMES, SWELL TOO SMALL TO BE OBSERVED.
2. FLOATS NOT FOLLOWED DURING THE NIGHT.

WIND:

WIND DATA WAS RECORDED BY A DINE'S ANEMOGRAPH INSTALLED AT 10 METRES HEIGHT ON R.A.N. AIRFIELD - JERVIS BAY.

FIG. 8

SECTION 1

TIDAL INFORMATION

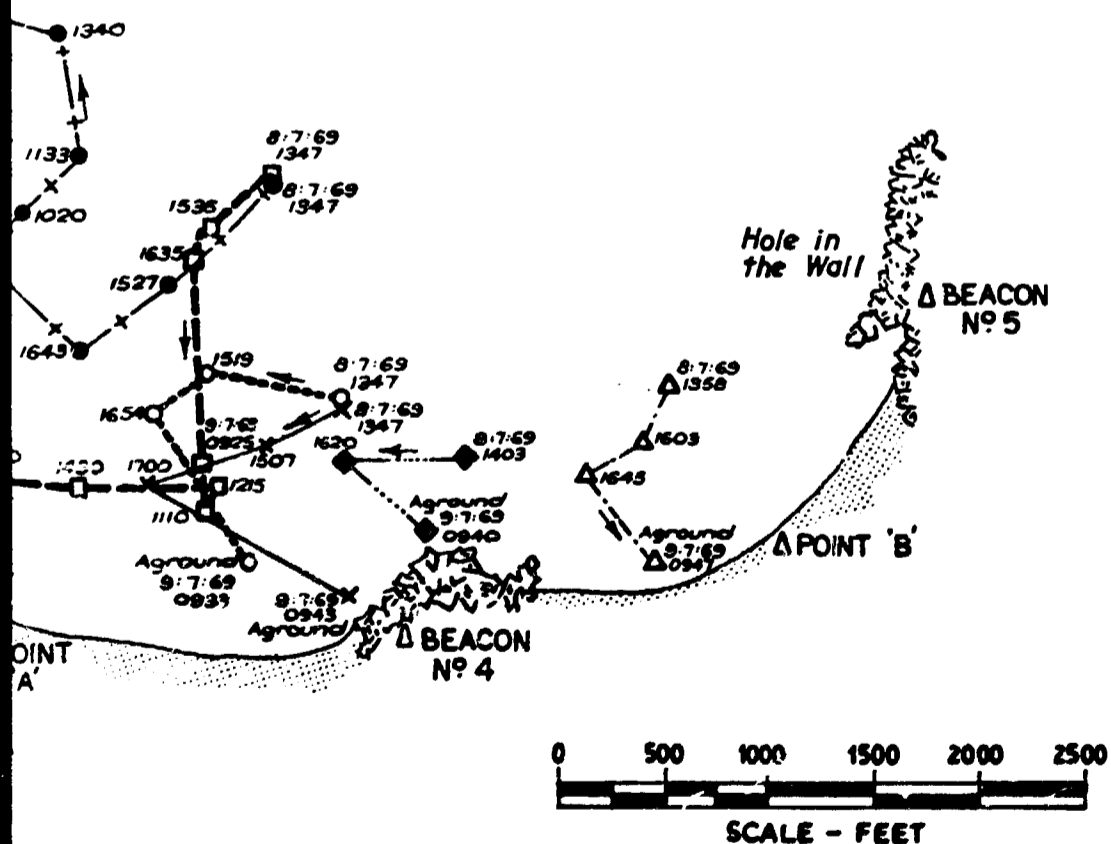
DATE	TIME	TIDE	HEIGHT *
8:7:69	0330 hrs	HIGH	3.8 feet
8:7:69	0930 hrs	LOW	2.1 feet
8:7:69	1600 hrs	HIGH	5.0 feet
8:7:69	2230 hrs	LOW	2.1 feet
9:7:69	0415 hrs	HIGH	3.8 feet
9:7:69	1000 hrs	LOW	2.0 feet
9:7:69	1700 hrs	HIGH	5.0 feet
9:7:69	2315 hrs	LOW	1.8 feet
10:7:69	0515 hrs	HIGH	3.5 feet
10:7:69	1100 hrs	LOW	1.8 feet

WIND RECORDS

DATE	TIME	MEAN SPEED	DIRECTION*
8:7:69	0830 hrs	7 M.P.H.	265°
8:7:69	0900 hrs	7 M.P.H.	265°
8:7:69	0930 hrs	5 M.P.H.	260°
8:7:69	1000 hrs	7 M.P.H.	270°
8:7:69	1030 hrs	7 M.P.H.	270°
8:7:69	1100 hrs	CHANGE OF DIRECTION	270°-320°
8:7:69	1130 hrs	2 M.P.H.	330°
8:7:69	1200 hrs	0	320°
8:7:69	1230 hrs	1 M.P.H.	300°
8:7:69	1300 hrs	0	330°
8:7:69	1345 hrs	CHANGE OF DIRECTION	
8:7:69	1400 hrs	3 M.P.H.	100°
8:7:69	1500 hrs	6 M.P.H.	90°
8:7:69	1600 hrs	2 M.P.H.	60°
8:7:69	1700 hrs	0	60°
8:7:69	1730 hrs	CHANGE OF DIRECTION	
8:7:69	1800 hrs	0	300°
8:7:69	1900 hrs	5 M.P.H.	300°
8:7:69	2000 hrs	3 M.P.H.	290°
8:7:69	2100 hrs	3 M.P.H.	290°
8:7:69	2200 hrs	3 M.P.H.	290°
8:7:69	2300 hrs	3 M.P.H.	290°
9:7:69	0000 hrs	2 M.P.H.	280°
9:7:69	0100 hrs	0	280°
9:7:69	0200 hrs	0	270°
9:7:69	0300 hrs	1 M.P.H.	260°
9:7:69	0400 hrs	3 M.P.H.	260°
9:7:69		NO CHANGE	
9:7:69	0900 hrs	3 M.P.H.	250°
9:7:69	1000 hrs	8 M.P.H.	210°
9:7:69	1100 hrs	8 M.P.H.	200°
9:7:69	1200 hrs	7 M.P.H.	200°
9:7:69	1245 hrs	CHANGE OF DIRECTION	
9:7:69	1300 hrs	3 M.P.H.	130°
9:7:69	1400 hrs	2 M.P.H.	120°
9:7:69	1500 hrs	2 M.P.H.	140°
9:7:69	1600 hrs	0	120°
INSUFFICIENT WIND TO REGISTER SPEED OR CHANGE OF DIRECTION			
10:7:69	0930 hrs	0	120°
10:7:69		CHANGE OF DIRECTION	
10:7:69	1000 hrs	0	280°
10:7:69	1100 hrs	8 M.P.H.	350°

* DIRECTION GIVEN RELATIVE TO TRUE NORTH.
 * HEIGHT AS INDICATED BY STAFF GAUGE & BRISTOL RECORDER IN INSTALLED ON CAPTAIN'S WHARF, CAPTAIN'S POINT

BAY



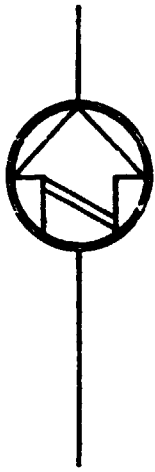
THE ELECTRICITY COMMISSION OF N.S.W. POWER DEVELOPMENT DIVISION

FIG. 8

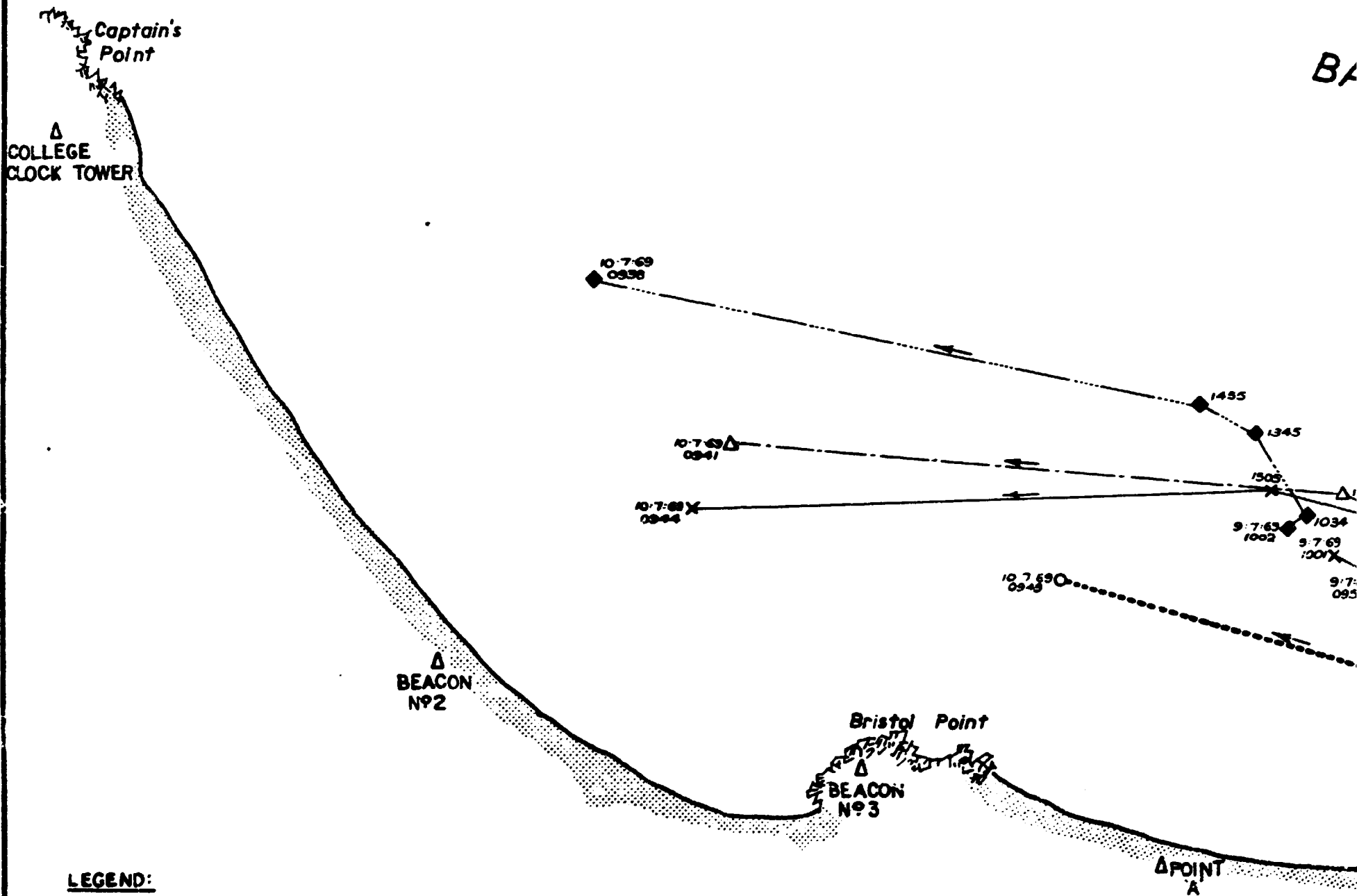
DRN	W.W.	JERVIS BAY CURRENT OBSERVATIONS 8:7:69 TO 10:7:69	APPROVED	DATE
TCD	F.N.G.		<i>[Signature]</i>	29/5/70
CKD	N.L.		C.I. 1683	

SECTION 2

TIMES, RECORDED.
 THE NIGHT.
 METRES HEIGHT



JERVIS



LEGEND:

depth

- 20 feet - FLOAT N° 1
- ◆----- 6 feet - FLOAT N° 2
- ×----- 6 feet - FLOAT N° 3
- △----- 6 feet - FLOAT N° 9

NUMBERS ADJACENT TO FLOAT POSITIONS ARE DATE & TIME IN HOURS.

FIG. 9

SECTION 1

NOTES:

1. CONDITIONS CALM, GLASSY AT TIMES, SWELL TOO SMALL TO BE OBSERVED.
2. FLOATS NOT FOLLOWED DURING THE NIGHT.

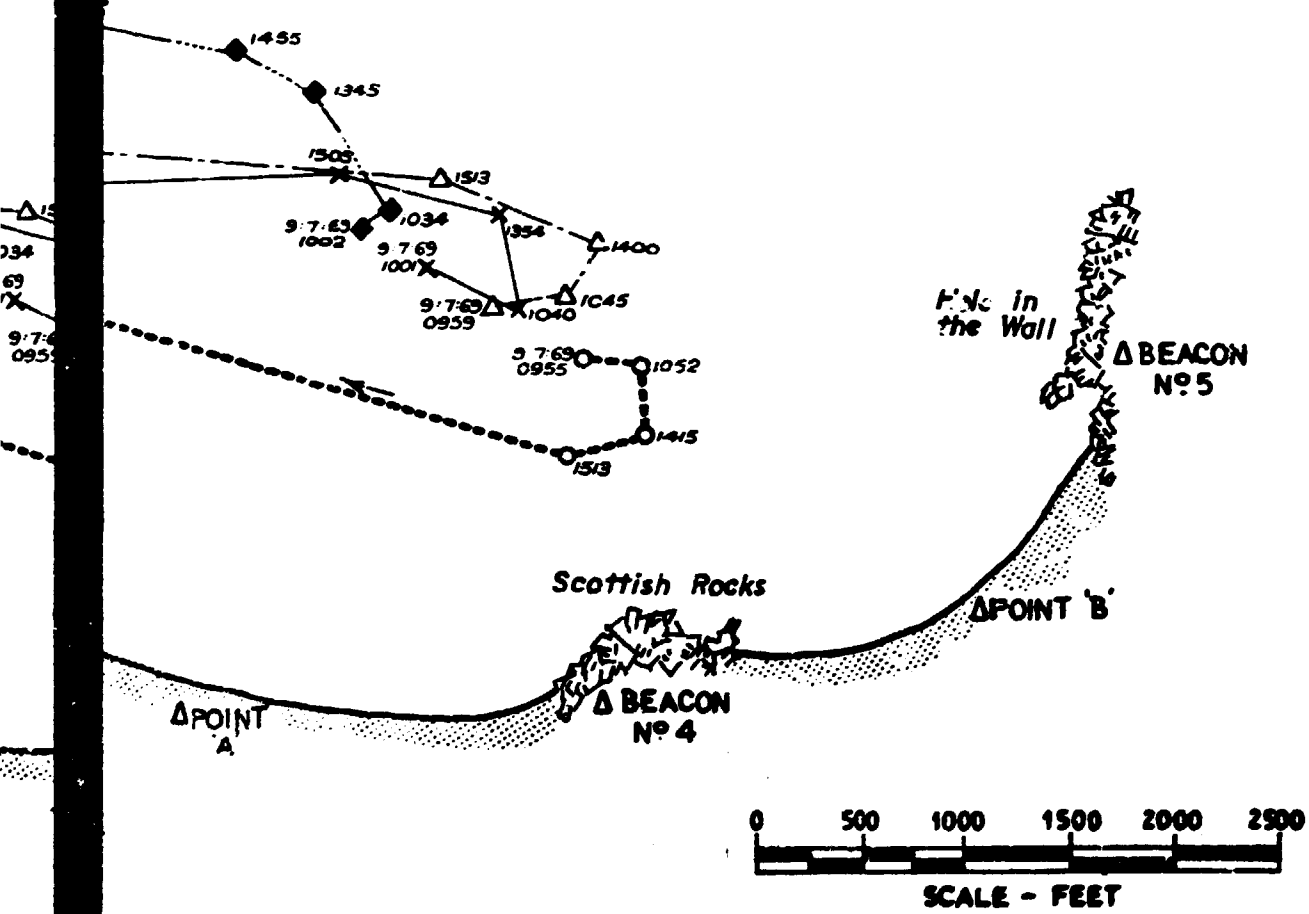
WIND:

WIND DATA WAS RECORDED BY A DINE'S ANEMOGRAPH INSTALLED AT 10 METRES HEIGHT ON R.A.N. AIRFIELD - JERVIS BAY.

TIDAL INFORMATION			
DATE	TIME	TIDE	HEIGHT *
9:7:69	0415 hrs.	HIGH	3.8 feet
9:7:69	1000 hrs.	LOW	2.0 feet
9:7:69	1700 hrs.	HIGH	5.0 feet
9:7:69	2315 hrs.	LOW	1.8 feet
10:7:69	0515 hrs.	HIGH	3.5 feet
10:7:69	1100 hrs.	LOW	1.8 feet

WIND RECORDS			
DATE	TIME	MEAN SPEED	DIRECTION *
9:7:69	0900 hrs.	3 M.P.H.	250°
9:7:69	1000 hrs.	8 M.P.H.	210°
9:7:69	1100 hrs.	8 M.P.H.	200°
9:7:69	1200 hrs.	7 M.P.H.	200°
9:7:69	1245 hrs.	CHANGE OF DIRECTION	
9:7:69	1300 hrs.	3 M.P.H.	130°
9:7:69	1400 hrs.	2 M.P.H.	120°
9:7:69	1500 hrs.	2 M.P.H.	140°
9:7:69	1600 hrs.	0	120°
INSUFFICIENT WIND TO REGISTER SPEED OR CHANGE OF DIRECTION			
10:7:69	0930 hrs.	0	120°
10:7:69	CHANGE OF DIRECTION		
10:7:69	1000 hrs.	0	280°
10:7:69	1100 hrs.	8 M.P.H.	330°

BAY



* DIRECTION GIVEN RELATIVE TO TRUE NORTH.
 * HEIGHT AS INDICATED BY STAFF GAUGE & BRISTOL RECORDER INSTALLED ON CAPTAIN'S WHARF, CAPTAIN'S POINT.

FIG. 9

THE ELECTRICITY COMMISSION OF N.S.W.
 POWER DEVELOPMENT DIVISION

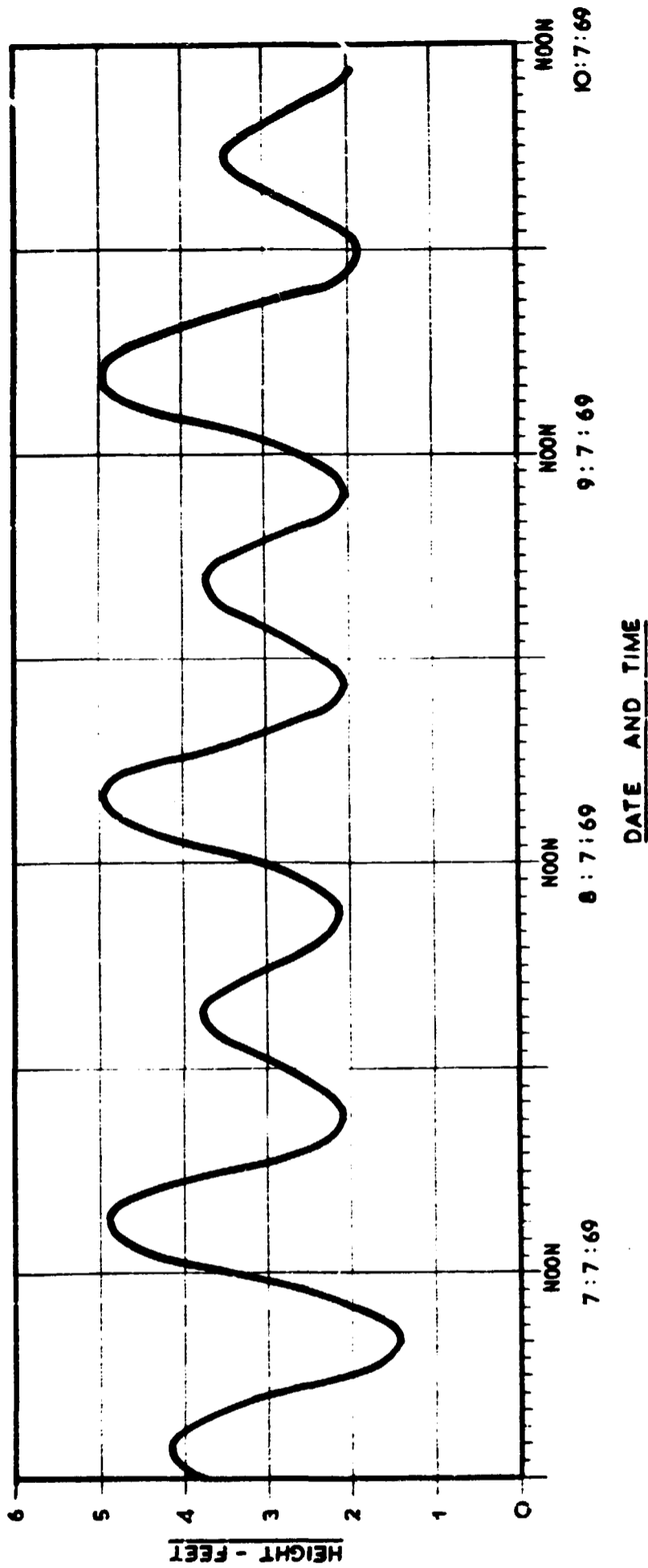
JERVIS BAY
 CURRENT OBSERVATIONS
 9:7:69 TO 10:7:69

APPROVED DATE
[Signature] 29/5/70
 C.I. 1684

DRN	W.W.
TCD	F.N.G.
CKD	N.L.

SECTION 2

AT TIMES, OBSERVED.
 DURING THE NIGHT.
 BY A DINE'S
 AT 10 METRES HEIGHT
 BAY.



NOTE: THIS GRAPH HAS BEEN REPRODUCED FROM THE BRISTOL RECORDER INSTALLED ON THE CAPTAIN'S WHARF, CAPTAIN'S POINT.

FIG. 10

THE ELECTRICITY COMMISSION OF N.S.W.
POWER DEVELOPMENT DIVISION

DRN	W.W.	JERVIS BAY TIDES 7:7:69 TO 10:7:69	APPROVED	DATE
TCD	F.N.G.		<i>[Signature]</i>	29/5/70
CKD	N.L.		C.I. 1685	

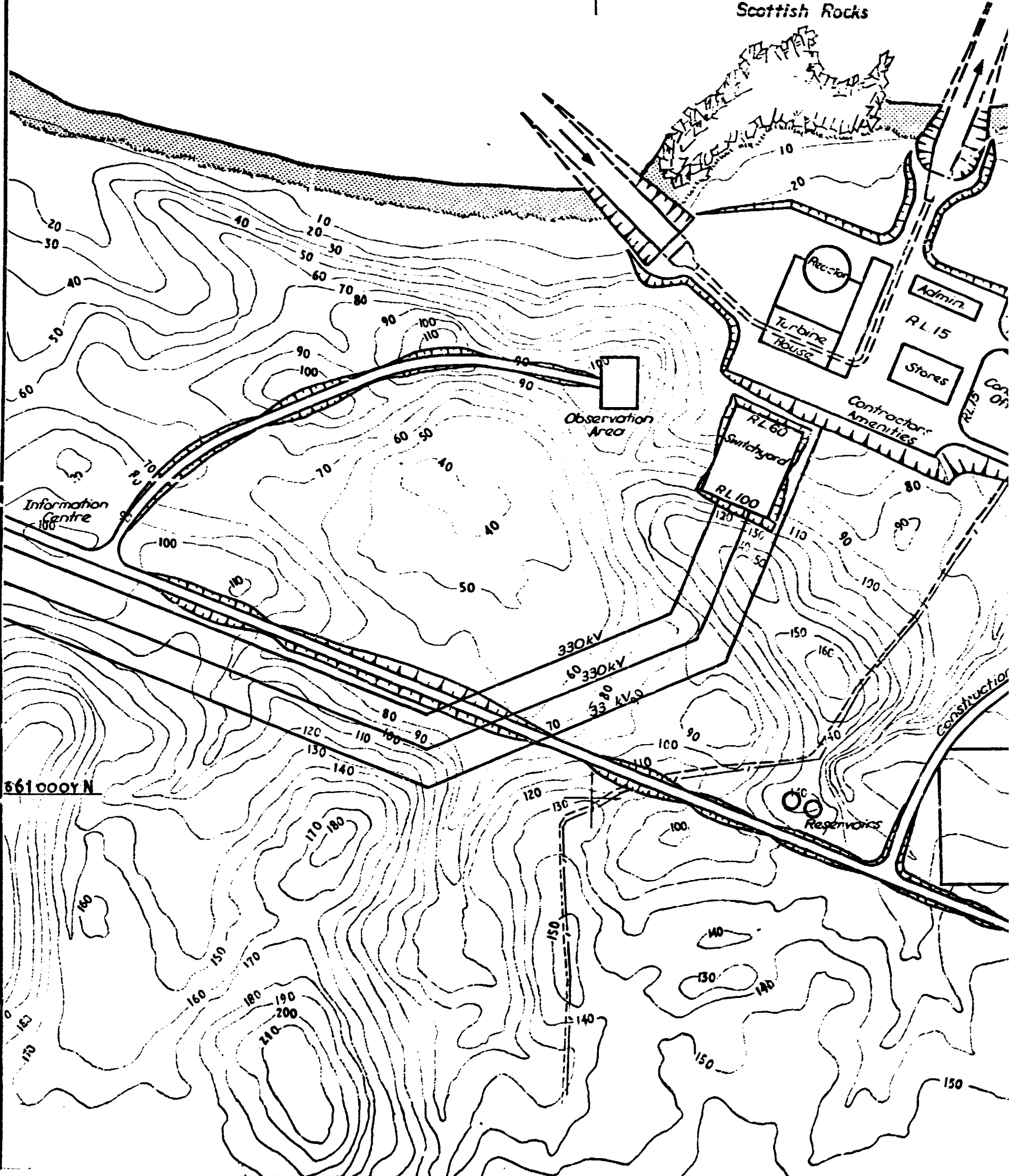
JERVIS

662 000 Y N

374 000 Y E



Scottish Rocks



661 000 Y N

FIG. 11

SECTION 1

BAY

Scottish Rocks

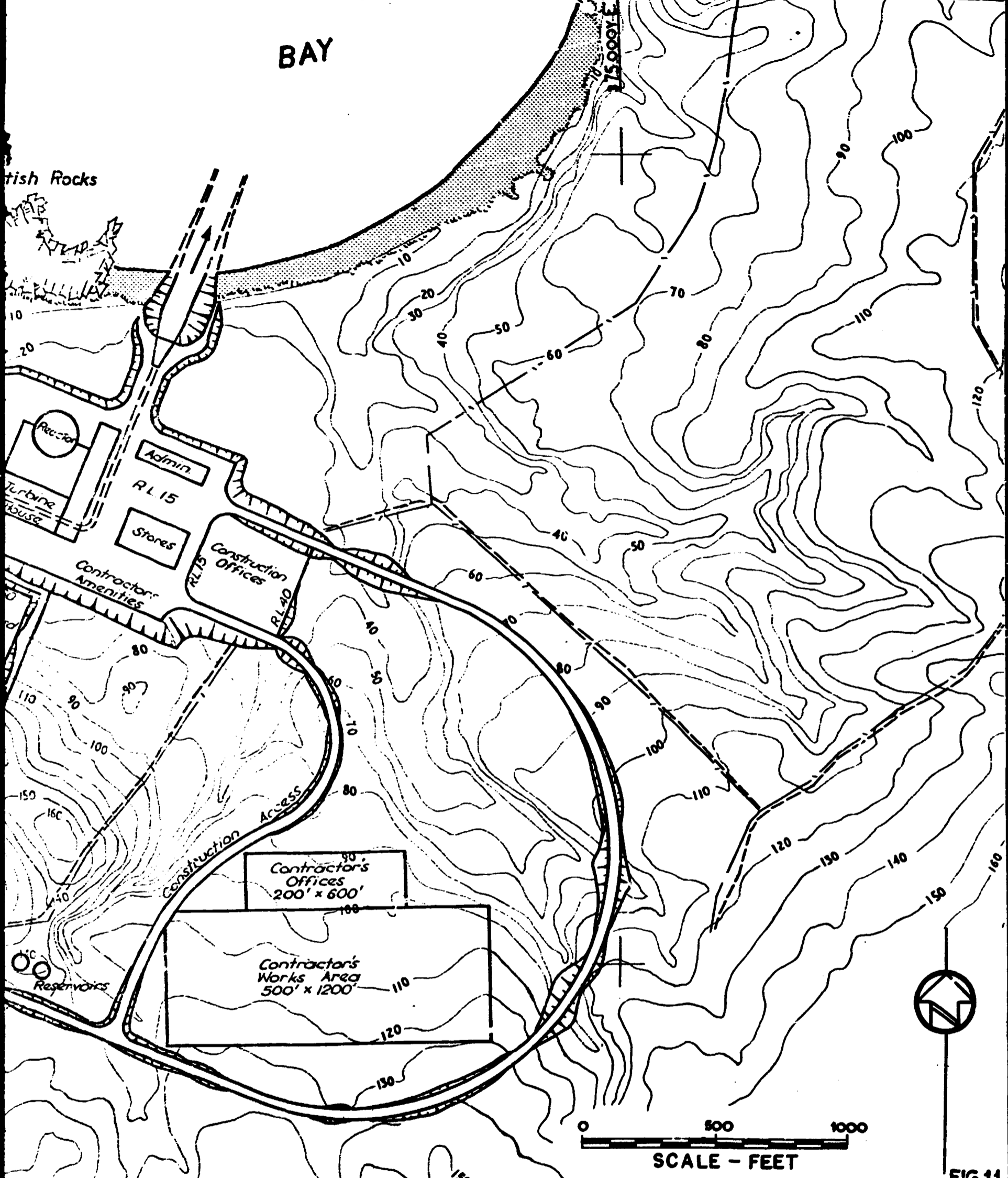


FIG. 11

THE ELECTRICITY COMMISSION OF N.S.W.
POWER & TRANSMISSION DEVELOPMENT DIVISION

SCOTTISH ROCKS POWER STATION

LAYOUT FOR 1 x 500 MW

DRN	C.K.M.K.
TCD	F.N.G.
CKD	N.L.

APPROVED DATE

W. Hunter 9/6/70

C.I. 2672

SECTION 2