278001

AMOCO AUSTRALIA PETROLEUM COMPANY

REPORT

ON

SEABED INVESTIGATION SURVEY

AT

LOCATION "KOORKAH-1"

BLOCK T-18/P

BASS STRAIT

AUSTRALIA

Dated: 19th August 1985. Report No: K088/85/AM

OR_287

278002

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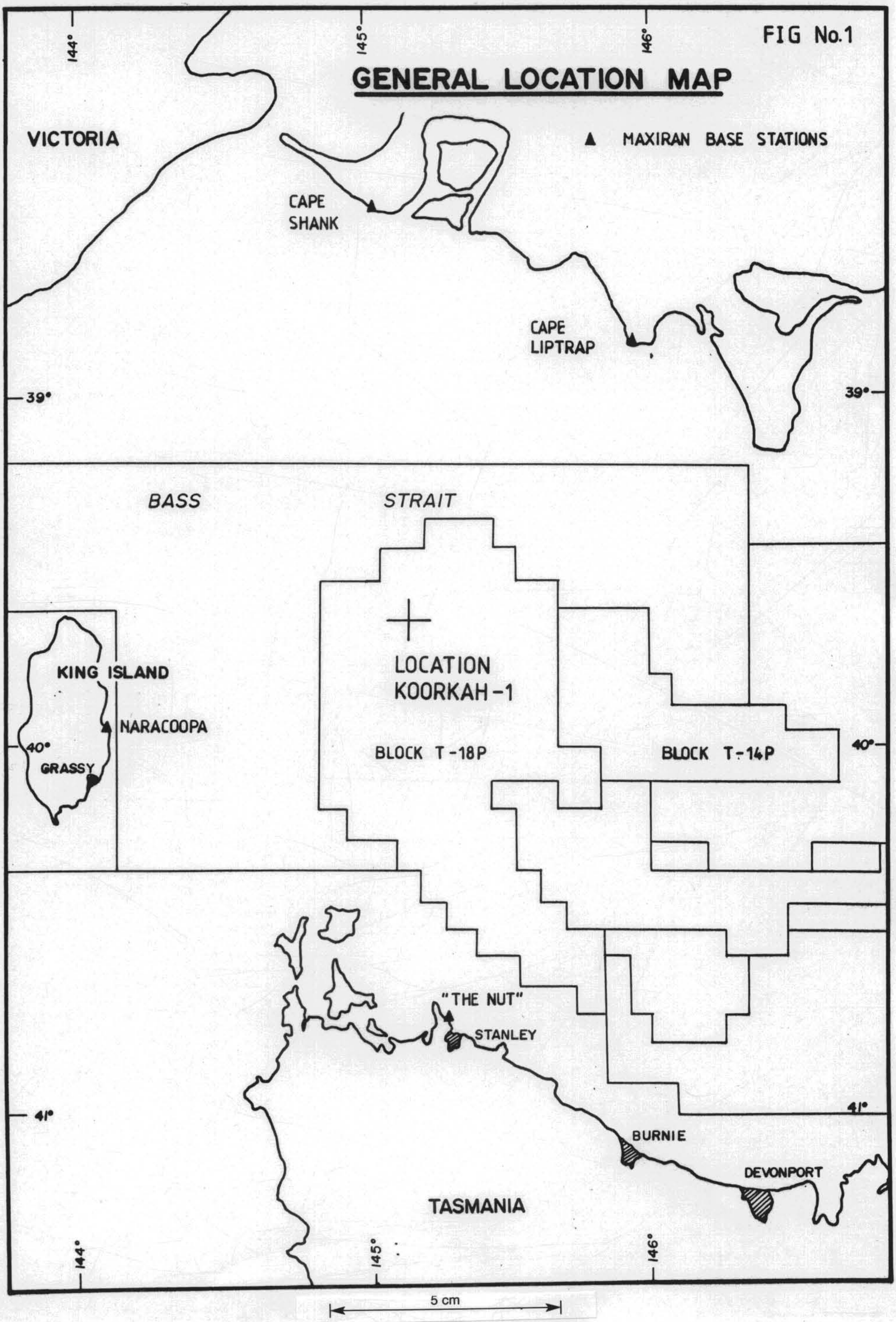


FIG No.1
GENERAL LOCATION MAP
▲ MAXIRAN BASE STATIONS
VICTORIA
CAPE SHANK
CAPE LIPTRAP
144°
145°
146°
39°
40°
41°
BASS
STRAIT
KING ISLAND
NARACOOPA
GRASSY
LOCATION KOORKAH-1
BLOCK T-18P
BLOCK T-14P
"THE NUT"
STANLEY
BURNIE
DEVONPORT
TASMANIA
5 cm

1 INTRODUCTION

GEOMEX SURVEYS (AUSTRALIA) PTY. LTD. was contracted by AMOCO AUSTRALIA PETROLEUM COMPANY to carry out a site investigation survey around the "KOORKAH-1" Location, in permit area T-18-P, in Bass Strait, Australia.

The area surveyed comprised a 4 kilometre square site centered on the proposed well co-ordinates, supplied as follows:

Location: KOORKAH-1
Latitude: 39° 37' 57.11" South
Longitude: 145° 09' 06.83" East

The vessel "M/V Sprightly" was mobilised for this survey in Devonport between 14th and 15th July, 1985 and the survey undertaken between 16th July and 25th July 1985. The geophysical investigation was carried out with fathometer, side-scan sonar, shallow seismic profiling system and grab sampler.

The primary navigation system employed was a pattern of seabed tranponders laid in the survey area. These were initially positioned by Maxiran and later calibrated by satellite fixes.

Upon completion of the survey, the vessel returned to Devonport and was de-rigged on 25th July, 1985.

2 PERSONNEL, EQUIPMENT AND LOGISTICS SUPPORT

2.1 Personnel

The following survey personnel were engaged on this project:

Navigation

Phillip Allen	:	Hydrographic Surveyor/Party Chief
Graham Harries	:	Hydrographic Surveyor
Bruce Robinson	:	Maxiran Engineer
Bill Gray	:	Maxiran Base Station Operator
Tim Moore	:	Maxiran Base Station Operator
Gary Dobson	:	Maxiran Base Station Operator

Geophysical

Jim Anderson	:	Geophysicist
Arthur Peart	:	Analogue Engineer
Bruce Maluish	:	Analogue Operator
Dave Richter	:	Analogue Engineer

Client's Representative

Frank Renton	:	ECL Australia Pty. Ltd.

2 PERSONNEL, EQUIPMENT AND LOGISTICS SUPPORT (Cont'd)

2.2 Equipment

The following survey equipment was employed on this project:

2.2.1 Navigation

- The Maxiran Positioning System comprising:

Four	-	Maxiran monitors plus back-ups S/Ns 74, 78, 166, 168.
One	-	Maxiran interrogator plus one back-up S/N 114, 151
Three	-	Maxiran beacons plus two back-ups S/N 281, 223, 284, 287
Three	-	Maxiran beacons plus two back-ups S/N 281, 227, 232, 282, 279
Five	-	Sets of LPL antennae
Two	-	Sets of omni-antennae
One	-	20 kw linear amplifier plus c/w power supplies, plus one back-up set S/N 1193, 1459
	-	Interface units, power supplies, transformers
	-	Antenna cables, tower sections
	-	Rotor motors
	-	Batteries
	-	Maxiran spares
Five	-	SSB radios

2 PERSONNEL, EQUIPMENT AND LOGISTICS SUPPORT

2.2 Equipment

2.2.1 Navigation (Cont'd)

- The Navigation Computing System comprising:

  Two - HP 9836 computers
  Two - HP 9826 computes
  Two - HP 2671G printers
  Two - Scope 111 interface units
  - Helmsman's monitor
  - Power supplies
  - Software, etc.

- The Magnavox Satellite Receiver comprising:

  One - Mx 1107 Magnavox receiver
  One - Marine antenna
  - Cables
  One - Set of spare boards

- The Oceano Acoustic Positioning System comprising:

  One - Range meter RM 201 S/N 009
  One - Interface module IM 100 S/N 22
  One - Power supply P.S. 100 S/N 27
  One - Telecommand TT 101
  One - Grundig velocimeter
  One - Towcable plus AM 121 unit
  One - Towfish
  One - Tow cable
  One - Transducer unit AM 121
  Ten - Tranponders RT 121
  - Oceano spares kits
  - Cables, etc.

2 PERSONNEL, EQUIPMENT AND LOGISTICS SUPPORT

2.2 Equipment (Cont'd)

2.2.2 Geophysical

- Atlas Deso 10 Survey Echo Sounder System comprising:

  One - Straight line recording unit, plus one back-up
  - Echo sounder transducer, plus one back-up
  - Cables, power supplies
  - Spares.

- The EG&G Side-scan Sonar System comprising:

  One - EG&G 259-4 side-scan sonar recorder plus one back-up
  One - EG&G 272 towfish plus one back-up
  One - Side-scan sonar cable of 500 m.
  One - Side-scan sonar winch
  - Power supply, spares.

- The 1000 Joule Shallow Seismic System comprising:

  One - Multi-electrode sparker plus two back-ups
  One - EG&G 232 power supply
  One - EG&G 231 trigger/capacitor bank
  One - EPC 4600 graphic recorder plus one back-up.
  One - EG&G 265 hydrophone streamer plus one back-up
  One - Krohn-hite filter
  One - T.V.G. amplifier
  One - Swell filter
  - Transformers, power supplies.

2 PERSONNEL, EQUIPMENT AND LOGISTICS SUPPORT (Cont'd)

2.3 Logistic Support

The vessel "M/V Sprightly", operating out of Devonport in Tasmania was used as the survey and accomodation vessel for the work.

Onshore support was provided by the Maxiran shore-based operators in Tasmania and Victoria. Overall project co-ordination was undertaken by the GEOMEX SURVEYS base in Perth.

3 CHRONOLOGICAL RECORD OF EVENTS

Monday 8th July 1985

09.00 Party Chief, Surveyor, Maxiran Engineer and Acoustics Engineer assembled in Devonport.

Assembled and checked out Maxiran equipment.

Tuesday 9th July 1985

10.00 Installed Maxiran equipment at calibration points in preparation for short baseline calibration.

Organised caravans and station equipment.

Wednesday 10th July 1985

06.00 Surveyor commenced search of Cape Schank on Victoria coast for suitable fourth Maxiran base station.

11.00 Assembled acoustic positioning equipment which arrived into Devonport onboard the "M/V Yardie Creek" from rig "Glomar Robert F. Bauer".

12.00 Commenced Maxiran short baseline calibration.

Thursday 11th July 1985

10.00 One Base Station Operator arrived Devonport together with all geophysical equipment.

Continued Maxiran short baseline calibration.

Friday 12th July 1985

10.00 Further two Base Station Operators arrived Devonport.

17.00 Completed Maxiran short baseline calibration.

18.00 Survey vessel "M/V Sprightly" arrived Devonport.

Saturday 13th July 1985

10.00 Second Acoustics engineer and Geophysicist arrived Devonport.

11.00 Commenced mobilisation of equipment onboard survey vessel.

3 CHRONOLOGICAL RECORD OF EVENTS

Saturday 13th July 1985 (Cont'd)

12.00 Commenced Maxiran long baseline calibration.

17.00 Completed Maxiran calibration.

Sunday 14th July 1985

10.00 Maxiran base station equipment and operators despatched to respective stations.

Mobilisation of navigation and geophysical equipment onboard survey vessel.

Monday 15th July 1985

09.00 Fabrication of davit and mounting brackets on survey vessel.

18.00 Completed mobilisation of equipment onboard survey vessel.

22.00 Survey vessel departed Devonport for prospect area.

Tuesday 16th July 1985

09.00 Carrying out Maxiran crossing of The Nut - Liptrap baseline.

12.00 Poor weather conditions.

18.30 Carried out Maxiran crossing of The Nut - Cape Schank baseline.

19.15 Survey vessel proceeded to the shelter of King Island awaiting improvement in the weather.

Wednesday 17th July 1985

Survey vessel anchored in the shelter of King Island, waiting on weather.

3 CHRONOLOGICAL RECORD OF EVENTS (Cont'd)

Thursday 18th July 1985

00.00 Survey vessel departed King Island anchorage.

05.00 Carried out Maxiran crossing of Naracoopa - Cape Schank baseline.

10.00 Carried out Maxiran crossing of Naracoopa - Liptrap baseline.

12.00 Survey vessel proceeded to location although weather conditions were poor.

21.00 Deployed six (6) acoustic transponders around Location "KOORKAH-1".

23.00 Survey vessel standing-by on weather.

Friday 19th July 1985

00.00 Measured velocity profile for acoustic system at location.

00.30 Commenced relative calibration of acoustic transponder array.

07.00 Completed relative calibration.

09.30 Deployed geophysical equipment.

14.00 Commenced running site survey with fathometer, side-scan and shallow seismic system.

Saturday 20th July 1985

00.00 Continued running site survey.

10.20 Postponed further survey runs due to seismic records deteriorating with worsening weather conditions.

11.00 Grab sampler prepared.

14.00 Two (2) grab samples collected in worsening weather conditions.

16.00 All equipment onboard. Survey vessel standing-by due to weather.

17.30 Survey vessel proceeded to the shelter of King Island after receiving adverse weather reports.

3 CHRONOLOGICAL RECORD OF EVENTS (Cont'd)

Sunday 21st July 1985

Survey vessel standing-by in the shelter of King Island.

Monday 22nd July 1985

06.30 Survey vessel departed anchorage for location.

Tuesday 23rd July 1985

04.00 Survey vessel arrived location to re-commence site survey.

20.30 Completed running site survey.

22.00 Continued recording satellite information for absolute calibration of transponder array.

23.00 Further grab samples taken around location.

Wednesday 24th July 1985

00.00 Continued recording satellite information.

02.00 Further grab samples taken around location.

Recording satellite information and Maxiran position information for absolute calibration of transponder array.

Thursday 25th July 1985

01.30 Completed absolute calibration of acoustic transponder array.

02.00 Survey vessel proceeded to Devonport.

12.30 Survey vessel docked in Devonport.

20.00 All equipment de-rigged from survey vessel.

24.00 Survey vessel departed Devonport for its home port of Melbourne.

3 CHRONOLOGICAL RECORD OF EVENTS (Cont'd)

Friday 26th July 1985

09.00 Maxiran base equipment packed and stored at their respective stations.

10.00 Mobile survey equipment packed and stored in Devonport.

16.00 Geophysical equipment despatched from Devonport by road freight.

16.30 All geophysical personnel and one base station operator departed Devonport.

Saturday 27th July 1985

10.00 Remaining base station personnel returned to Devonport.

12.00 All equipment packed ans stored in preparation for future projects.

16.30 Party Chief, Maxiran engineer, one Surveyor and two base station operators departed Devonport.

4 SURVEY METHODS AND PROCEDURES

4.1 Maxiran Positioning System and Calibration

4.1.1 Mode of Operation

MAXIRAN POSITIONING SYSTEM - This is a medium range positioning system operating between the frequencies of 420 and 450 MHz with a bandwidth of ±1.8 MHz. A series of phase-coded pulses emitted from the mobile unit installed onboard the vessel interrogates the beacons at co-ordinated points ashore, each replying to the mobile after synchronizing code generators with an unique coded pulse. The transmission cycle is repeated once every 200 milliseconds. The mobile unit measures the time elapse, allowing for propagation corrections and component delays, to output the range to each beacon to a high standard of accuracy.

This system operating in its range/range mode will provide position accuracies of better than ±10 m., in excess of 200 km. offshore.

The compact units and low power requirements of this system facilitates tranportation and deployment in the field. The shore stations are each manned by one experienced operator who is responsible for the installation and 24 hour operation of his equipment. All units are in contact by SSB radio.

4 SURVEY METHODS AND PROCEDURES

4.1 Maxiran Positioning System and Calibration (Cont'd)

4.1.2 Installation

Four base stations were established, two on the Victorian mainland at Cape Schank and Cape Liptrap, one on Tasmania at Stanley on 'The Nut' and the fourth at Naracoopa on King Island. Ranges from these stations varied from 100 to 125 km. to the location.

Directional LPL antennae were used at both the stations and on the vessel with additional calibrated omni-antennae on the vessel as back-up. Two antenna towers were used on the vessel to enable better orientation of antennae to the stations. There was a spacing of 2.3 m. between the two towers.

4 SURVEY METHODS AND PROCEDURES

4.1 Maxiran Positioning System and Calibration (Cont'd)

4.1.3 Base Station Data

The four Maxiran base stations were installed at the following co-ordinated points:

(a) Cape Liptrap

Latitude:	38° 51' 05.640" S
Longitude:	145° 57' 54.980" E
Easting:	410 212.8 m.
Northing:	5 699 171.4 m.
Antenna Height:	183 m.

Station was established 4.0 m. on a bearing of 140° mag. from the trig station. The tower was 12 m. high.

(b) Cape Schank

Latitude:	38° 29' 39.332" S
Longitude:	144° 53' 07.164" E
Easting:	315 579.85 m.
Northing:	5 737 209.93 m.
Antenna Height:	87 m.

Station was established at PSM 1 adjacent to the Sand Stone Lighthouse, with a 8 m. tower.

(c) The Nut

Latitude:	40° 45' 50.244" S
Longitude:	145° 18' 13.416" E
Easting:	356 829.45 m.
Northing:	5 486 045.74 m.
Antenna Height:	155 m.

Established with a 10 m. tower, offset 1.0 metres bearing 239° from marker ST 674.

4 SURVEY METHODS AND PROCEDURES

4.1 Maxiran Positioning System and Calibration (Cont'd)

4.1.3 Base Station Data (Cont'd)

(d) Naracoopa

Latitude:	39° 55' 29.05" S
Longitude:	144° 07' 39.03" E
Easting :	254 516.76 m.
Northing :	5 576 629.84 m.
Antenna Height:	72 m.

Erected with a 12 m. tower, offset 307.05 metres, bearing 98° 7' 14" from marker 281/150.

All co-ordinates refer to:

Datum	:	Australian Geodetic
Spheroid	:	Australian National
Projection	:	UTM Zone 55
C. Meridian	:	147° East

4 SURVEY METHODS AND PROCEDURES

4.1 Maxiran Positioning System and Calibration (Cont'd)

4.1.4 Short Baseline Calibration

On 12th July 1985, the Maxiran system was calibrated over a short baseline distance of 15,158 m. between Point Sorell station and the trig marker at Mersey Bluff, Devonport. Land pass was negligible and conditions were clear and stable.

Both mobiles were calibrated against all seven (7) beacons, using both LPL's and mobile antennae. The two transit cans were adjusted to read the same distance, after a 4 m. difference became apparent at the beginning, the alteration made by a simple potentiometer movement.

The mobiles were set-up at Point Sorell on a marker offset 9.4 m. at an azimuth of 254° 25' from ST 51.7, whilst the beacons were installed on a 3 m. tower standing at an offset marker, 10 metres on an azimuth of 74° 25' from SPM 200.

The co-ordinates for the calibration station at Mersey Bluff are given below:

Mersey Bluff SPM 200

Latitude:	41° 09' 37.318" S
Longitude:	146° 21' 15.143" E
Easting :	445 819.27 m.
Northing :	5 443 223.70 m.

4 SURVEY METHODS AND PROCEDURES

4.1 Maxiran Positioning System and Calibration

4.1.4 Short Baseline Calibration (Cont'd)

Mersey Bluff SPM 200 Offset

Latitude: 41° 09' 37.233" S
Longitude: 146° 21' 15.557" E
Easting : 445 828.90 m.
Northing : 5 443 226.39 m.

Port Sorell ST 517

Latitude: 41° 07' 24.6921" S
Longitude: 146° 31' 41.8809" E
Easting : 460 403.278 m.
Northing : 5 447 407.233 m.

Port Sorell ST 517 Offset

Latitude: 41° 07' 24.7709" S
Longitude: 146° 31' 41.4990" E
Easting : 460 394.381 m.
Northing : 5 447 404.752 m.

The spheroid distance between Point Sorell (offset) and Mersey Bluff (offset) were computed as:

15158.85 metres

See Appendix A for results of short baseline calibration.

4 SURVEY METHODS AND PROCEDURES

4.1 Maxiran Positioning System and Calibration (Cont'd)

4.1.5 Long Baseline Calibration

On 13th July 1985, a long baseline calibration was carried out between the stations at Point Sorell and The Nut. The equipment configuration and the weather remaining the same as for the short baseline calibration.

The two towers with the mobile equipment at Point Sorell were left standing and so were at slightly different spheroidal distances from The Nut, as shown below:

Point Sorell - Tower A (STBD) offset 9.4 m. on 254° from ST 517

Latitude: 41° 07' 24.692" S
Longitude: 146° 31' 41.881" E

Spheroidal distance from The Nut equals 110570.4 m.

Point Sorell - Tower B (PORT) offset 9.4 m. on 229° from ST 517

Latitude: 41° 07' 24.776" S
Longitude: 146° 31' 41.491" E

Spheroidal distance from The Nut equals 110573.5 m.

See Appendix A for results of long baseline calibration.

4 SURVEY METHODS AND PROCEDURES

4.1 Maxiran Positioning System and Calibration (Cont'd)

4.1.6 Baseline Crossings

Enroute to site on 16th July 1985, and on 18th July 1985, the baselines, The Nut - Cape Liptrap, Naracoopa - Cape Schank, Naracoopa - Cape Liptrap, and The Nut - Cape Schank were crossed.

On the latter baseline no results of any reliability were recorded due to extremely poor signals.

The Nut - Cape Liptrap (Beacon 2 - Beacon 4)

Between 09.34	229301.0	Heading	300°
and 11.10 hrs	229302.0		110°
	229303.0		300°
	229303.0		110°
Mean Obs. Dist.	229302.2		
Calculated dist.	229298.2		
O - C	4.2 m.		

Naracoopa - Cape Schank (Beacon 3A - Beacon 5)

04.50 hrs	171770.2	Heading	110°
05.08 hrs	171769.6		290°
05.22 hrs	171770.0		110°
Mean Obs. Dist.	171769.9		
Calculated Dist.	171768.7 m.		
O - C	1.1 m.		

4 SURVEY METHODS AND PROCEDURES

4.1 Maxiran Positioning System and Calibration

4.1.6 Baseline Crossing (Cont'd)

Naracoopa - Cape Liptrap (Beacon 3A - Beacon 4)

09.52 hrs	198145.3	Heading 140°
10.08 hrs	198144.6	320°
10.33 hrs	198145.5	160°
Mean Obs. Dist.	198145.1	
Calculated Dist.	198141.3	
O-C	3.8 m.	

4 SURVEY METHODS AND PROCEDURES (Cont'd)

4.2 Satellite-Acoustic Positioning System

4.2.1 Mode of Operation

The system comprises a marine satellite receiver and acoustic positioning which are integrated to provide high accuracy navigation and tracking for a vessel, or a number of vessels, any distance from the shore.

The MARINE SATELLITE RECEIVER is a MAGNAVOX MX 1107 complete with antenna and cable, which operates by monitoring the change in frequency, or doppler effect, of the 400 MHz and 150 MHz frequencies transmitted by each of the five transit satellites circling the earth in polar orbits.

Orbital data and time are received from each satellite with an up-dated message every two minutes. Interpolation of the satellite's position monitored with the change of received frequencies will provide a line of position on which the receiver lies. The recording of data from a number of satellites will therefore provide the position of the receiver. The greater the number of good satellite passes recorded, the greater the accuracy of the results.

The receiver will take account of the course and speed of a moving vessel while recording satellite passes, and interfaced to the acoustic system will provide a means of co-ordinating seabed transponders on the earth's surfaces to an accuracy of better than 10 metres.

4 SURVEY METHODS AND PROCEDURES

4.2 Satellite-Acoustic Positioning System

4.2.1 Mode of Operation (Cont'd)

The ACOUSTIC POSITIONING SYSTEM used was an OCEANO system comprising four (4) onboard units; a range meter, a telecommand, an interface unit and dedicated power supply. These interrogate a number of transponders, laid on the seabed, via a transducer mounted-over-the-side of a vessel in a streamlined towfish. The travel time to each transponder is recorded, processed onboard and passed to a HP 9826/36 computer with graphic and numeric display monitors for surface, and if required, sub-surface positioning, navigation, tracking and data logging.

The accuracy and operation of the acoustic positioning system is largely dependent on the calibration of the seabed transponder network on which all ranges and subsequent position fixing is based.

The calibration of the system is usually carried out at the time of deployment and involves the survey vessel steaming through the array, collecting data from both the acoustic system and the satellite navigation receiver or Maxiran, to derive the transponder co-ordinates from a series of least squares fit computations.

4 SURVEY METHODS AND PROCEDURES

4.2 Satellite-Acoustic Positioning System

4.2.1 Mode of Operation (Cont'd)

The relative accuracy of this system is 1.5 - 3.0 metres; in operating this system these high accuracies are attained by making allowance for a number of variable factors including the seawater temperature profile, salinity, tidal heights, etc.

This system has interrogation frequencies of 8 KHz to 16 KHz on 0.5 KHz stepping, with a reception bandwidth of 300 Hz and a pulse-width which can be adjusted from 6-15 milliseconds. The 16 receivers have similar frequency settings and bandwidth to the interrogation pulse.

Working ranges for the acoustic system are 3 km. to 8 km. dependent on the water depth and temperature. Up to 16 seabed transponders may be interrogated simultaneously.

All position data is displayed graphically and constantly updated on the computing system's VDU monitors or plotters.

4 SURVEY METHODS AND PROCEDURES

4.2 Satellite-Acoustic Positioning System (Cont'd)

4.2.2 Installation and Calibration

At 18.00 hours on 18th July 1985, the acoustic fish was deployed, and between 20.25 hours and 23.11 hours six (6) transponders were deployed on the seabed. A velocity profile was recorded at the centre of the location at midnight, and stored in the computer. The profile was very linear varying from 1500.3 m/s at the surface to 1501.4 m/s at the seabed. A mean value of 1500.9 m/s was employed.

Between 00.10 hours and 02.40 hours, a relative calibration sampling of ranges was carried out to determine the geometry of the array. However, once completed, there was found to be a lot of noise spread throughout the ranges that made it difficult to determine a result. This noise was found on the southern sections of the site, and mainly influenced the one transponder in this area (XP 579 on channel 3). To solve the problem a second relative calibration was carried out between 03.30 hours and 05.30 hours, keeping the vessel away from the southern corner of the site and by rejecting the ranges from transponder S/N 579 on Channel 3. This result proved to be more satisfactory, producing a maximum RMS of 0.84 m. on transponder S/N 675, channel 1. This result can be seen in Appendix A.

4 SURVEY METHODS AND PROCEDURES

4.2 Satellite-Acoustic Positioning System

4.2.2 Installation and Calibration (Cont'd)

Near completion of the survey it was decided to attempt placing a replacement transponder at the location of transponder S/N 579 on a much higher frequency. On 23rd July 1985, at 05.15 hours transponder S/N 564 (channel 10) was deployed at the southern corner of the site. During a gap between satellite passes on 24th July 1985, between 22.36 hours and 23.24 hours, a relative calibration was carried out to tie transponder S/N 564 (channel 10) into the array. Again however, due to noise received locally in the southern part of the area, the result proved to be unacceptable and it was decided to leave the transponder uncalibrated. Neither of these transponders will be used for the rig move.

To obtain absolute co-ordinates for the transponder array, two methods were employed. The first involved collecting satellite passes to correctly orientate and obtain the absolute co-ordinates of the transponders, and the second method involved a comparison of acoustics and Maxiran. The results from both methods were obtained from a least squares algorithm to find the rotational and translational parameters for the transponder array. With the final co-ordinates:

4 SURVEY METHODS AND PROCEDURES

4.2 Satellite-Acoustic Positioning System

4.2.2 Installation and Calibration (Cont'd)

TRANSPONDER			POSITION	
No.	S/N	Chan. Code	Easting	Northing
1	24	6	338225.6	5611750.5
3	643	14	342346.8	5610216.7
4	553	7	340513.0	5612583.7
5	675	1	341853.0	5614665.2
6	652	5	344703.2	5610983.4

These locations have been plotted on Map No. 1.

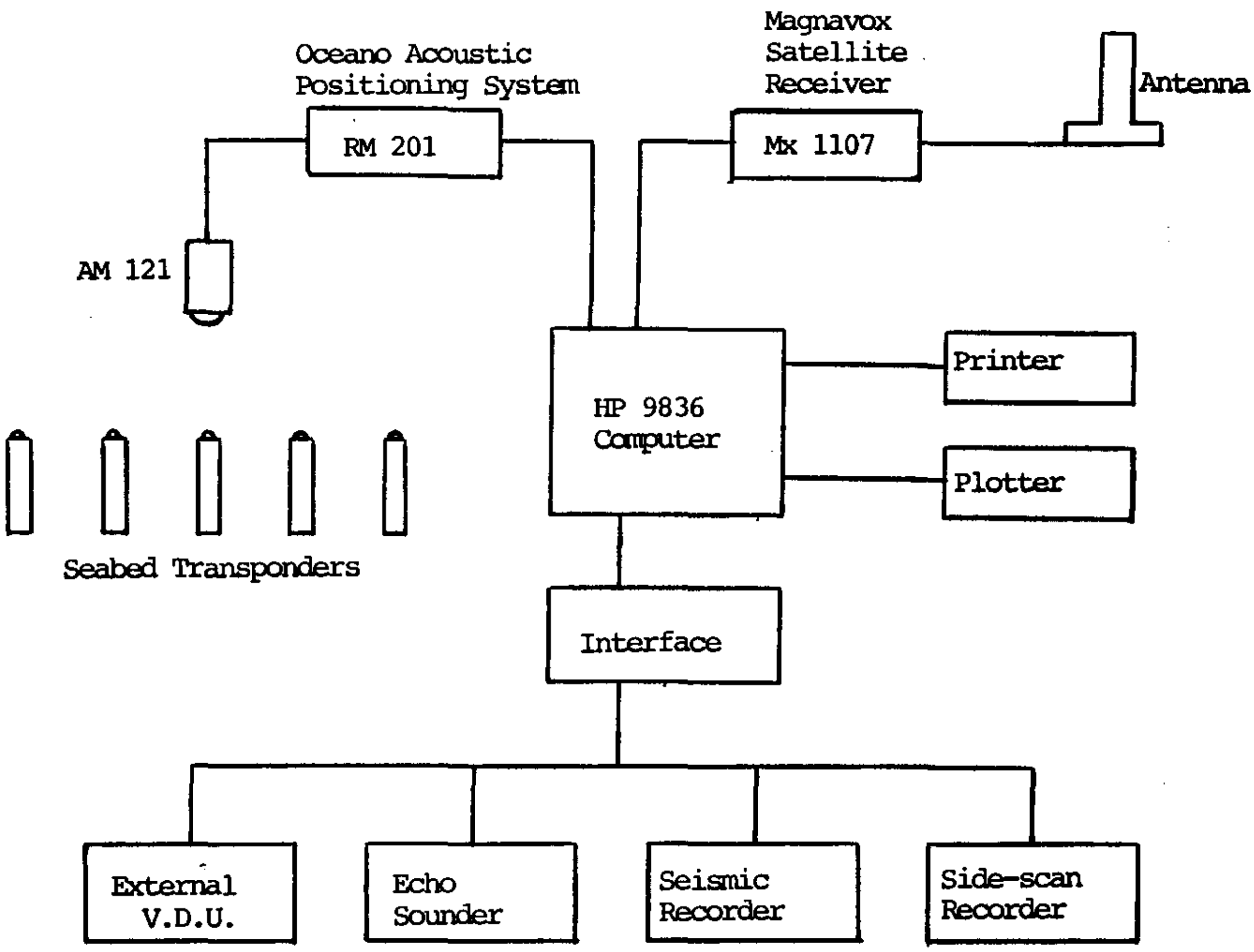
NOTE : Transponder 2 (S/N 579) and transponder 7 (S/N 564) were not calibrated into the array due to excessive noise in this area. Their positions are approximately (within 50 m.):

XP 579	340933 m. E	5608070 m. N
XP 564	340933 m. E	5608088 m. N

4 SURVEY METHODS AND PROCEDURES (Cont'd)

4.3 Navigation Computer System

The survey was carried out using the satellite-integrated underwater acoustic navigation system coupled to a HP 9836 computer. From the computer, a hard copy of survey data was available on a HP 2671G printer and positional information displayed via a Scope 111 interface box to an external V.D.U. on the bridge. From the Scope interface box, fix commands were sent to the analogue equipment on a set time interval controlled by the HP 9836 computer.



4 SURVEY METHODS AND PROCEDURES

4.3 Navigation Computer System (Cont'd)

The computer accepts the raw ranges from the Oceano RM 201 received by the acoustic fish and applies the velocity profile to compute the vessel's position. The computer monitors continuously the quality of those ranges and performance from each seabed transponder. From this data the computer can display the results on a choice of projections and monitor the vessel's layback position in relation to a number of targets or survey line.

The absolute calibration with satellites can be run concurrently with the analogue survey as the computer also continuously checks the Magnavox satellite receiver for satellite information which is recorded on disc for later processing.

The time interval between each fix was chosen to give a spacing of about 100 m. The fix datum used was the satellite navigation aerial and offsets used to compute the positions of the various items of geophysical equipment, as shown in Figure 2, "Configuration of Equipment". The "Survey Line Layout" is given in Figure 3.

CONFIGURATION OF EQUIPMENT ON BOARD MV SPRIGHTLY

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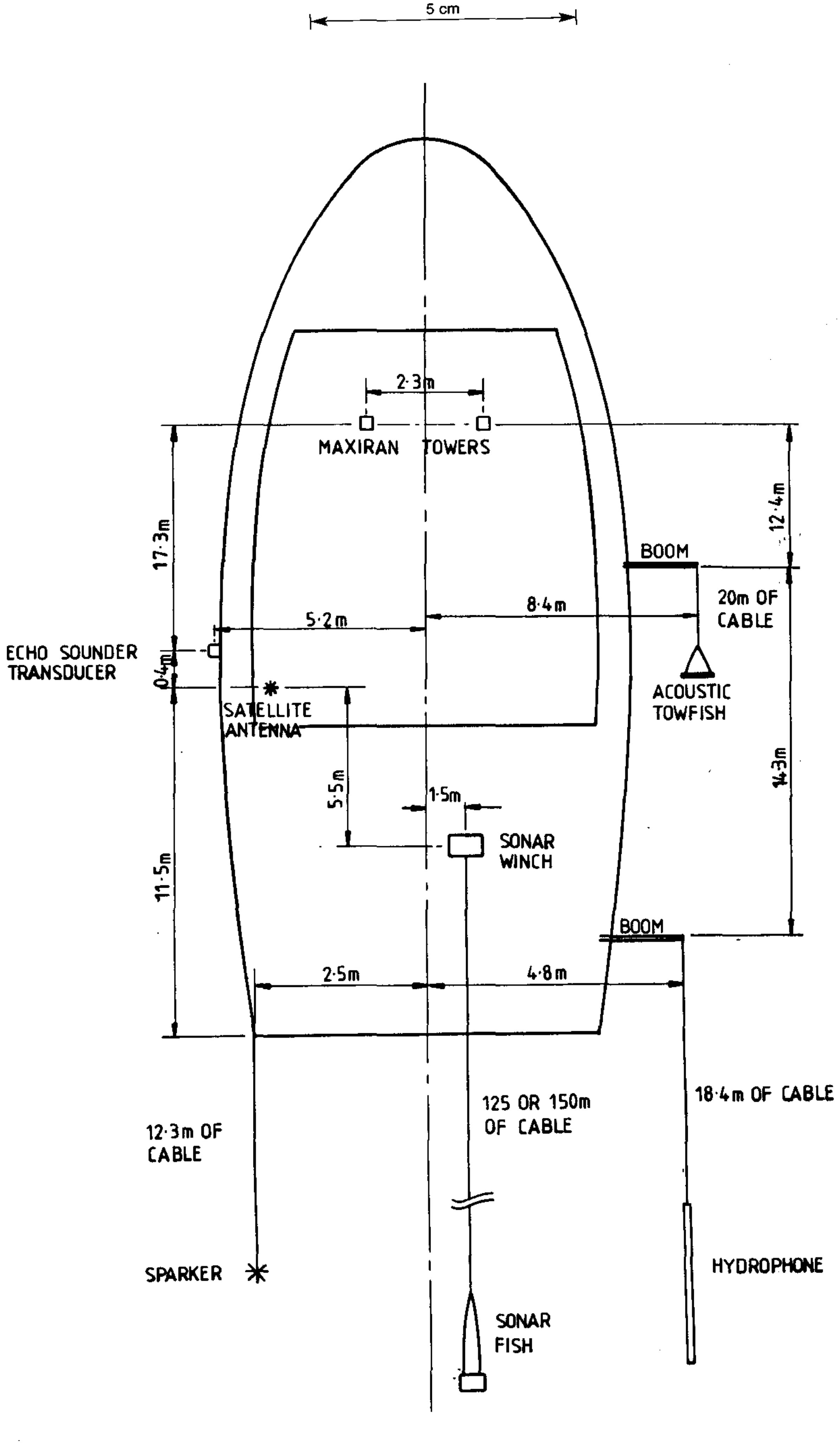
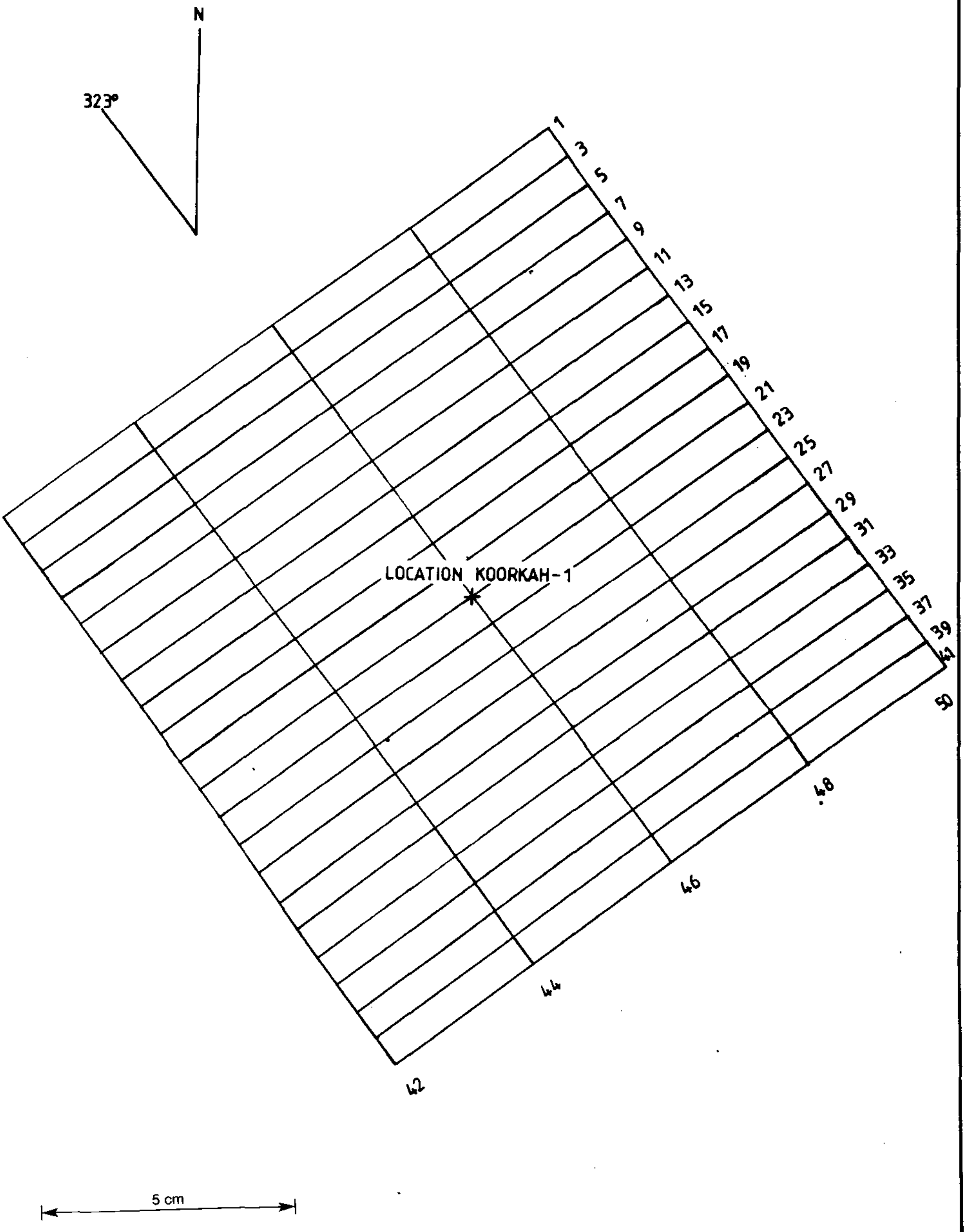


FIG. 3

SURVEY LINE LAYOUT FOR LOCATION: KOORKAH-1

SCALE 1 : 30 000



4 SURVEY METHODS AND PROCEDURES (Cont'd)

4.4 Geodetic Parameters

The complete survey was carried out using U.T.M. co-ordinates based on the Australian Map Grid. All transponder and base station co-ordinates are given according to the parameters defined below:

Spheroid	:	Australian Map Grid
Projection	:	UTM Zone 55
False Easting	:	500 000
False Northing	:	10 000 000
Scale Factor	:	0.9996
Central Meridian	:	147° East

For the satellite absolute calibration, the satellite positioning was received in WGS 72 and transformed to Australian Map Grid, using the following parameters:

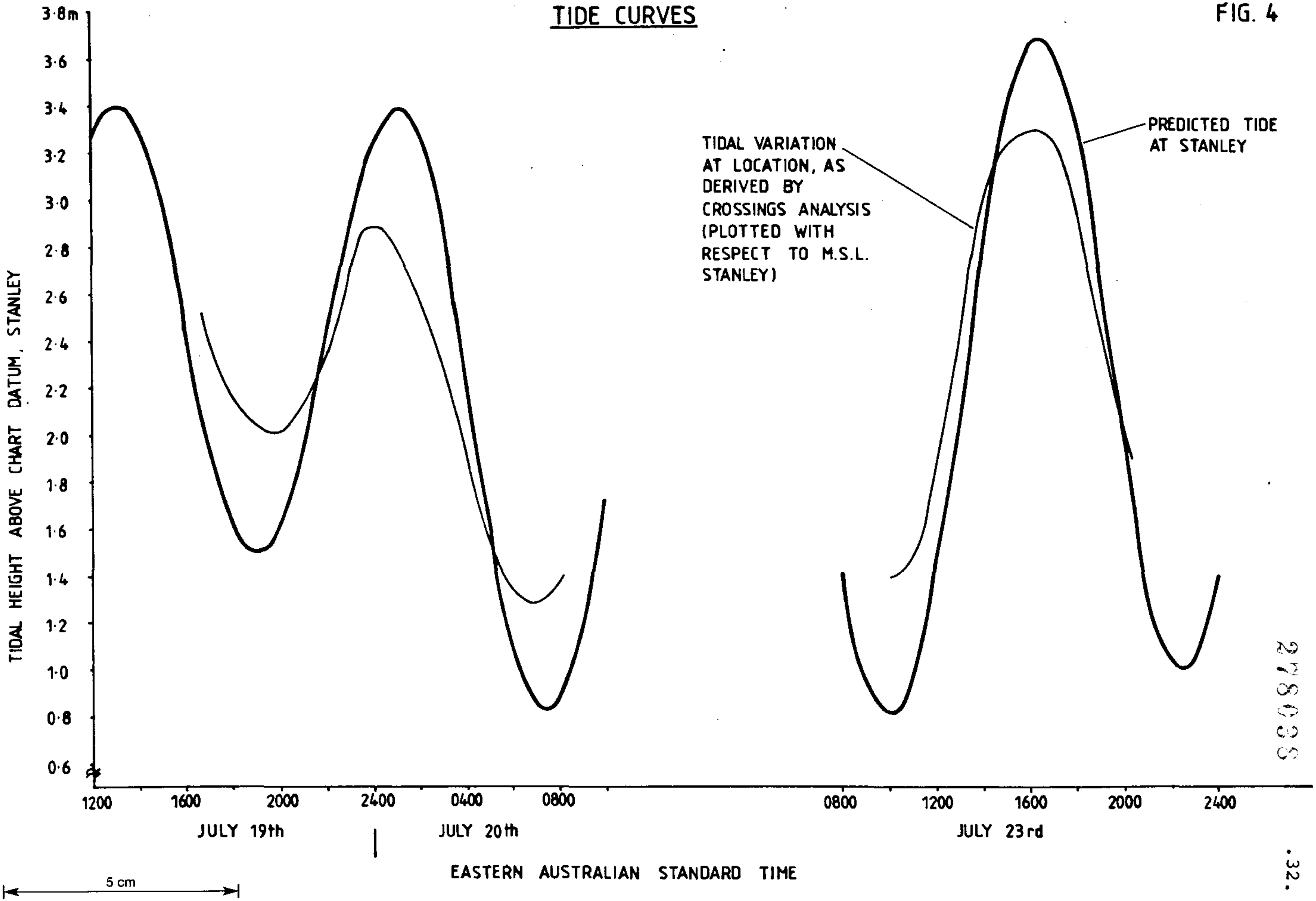
Datum	:	Broadcast Ephemeris
Spheroid	:	WGS 72

Shift Parameters

X	:	125.6 m.
Y	:	27.9 m.
Z	:	-139.9 m.

TIDE CURVES

FIG. 4



4 SURVEY METHODS AND PROCEDURES (Cont'd)

4.5 Echo Sounding

Continuous bathymetric profiles were obtained using an ATLAS DESO 10 echo sounder with its transducer mounted on the starboard side of the survey vessel (see Figure 2).

The sounder was calibrated by the disk check method, to compensate for transducer draft (1.9 m.) and the prevailing speed of acoustic transmission in the water column (1500 m/sec). This velocity figure agreed with the mean velocity derived by the velocimeter, prior to the calibration of the acoustic transponder array.

The data was reduced first by drawing a mean line through the wave motion (up to 2 m.) superimposed on the bottom trace, then by reading off the seabed levels at the intersections of the survey lines. Mis-matches of up to 2.1 m. were found at these crossing points, presumably due to tidal variations.

To derive the appropriate tidal corrections, a technique developed by GEOMEX, known as "Crossing Analysis"[1] was employed. This method involves the addition or subtraction of small values from the raw soundings on each line. After the application of the technique, the mis-ties were a maximum of 0.2 m. The effective datum implied by the analysis, is the mean tidal level during the survey. In the long term this will approach mean sea level.

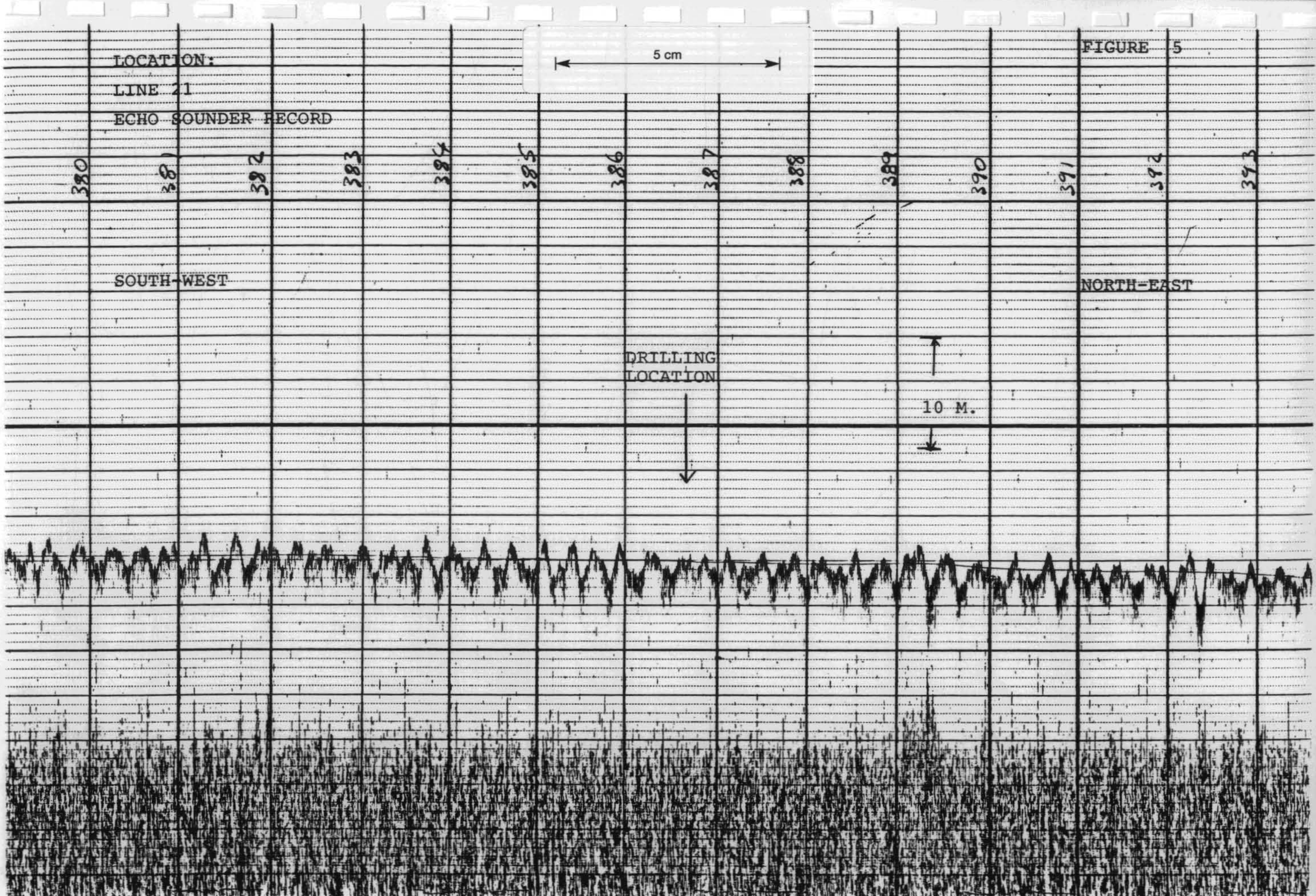
(1) Crossing Analysis, an Easy Method to Calculate the Tidal Curve from Bathymetric Data
J.L. Oustlant, The Hydrographic Journal - April 84

4 SURVEY METHODS AND PROCEDURES (Cont'd)

4.5 Echo Sounding

The predicted tide curve for Stanley has been shown on Figure 4. Also plotted is the tidal variation at the location as derived by the crossing analysis. This curve is obtained from the small (positive and negative) corrections to each survey line plotted about a zero of 2.3 m. above chart datum at Stanley (this is the mean sea level at Stanley). It will be seen that there is no obvious difference in phase between the Stanley and KOORKAH-1 location tides, but that the range at the latter is apparently only about 0.6 of the Stanley amplitude.

The bathymetric record for the line running SW-NE through the location has been reproduced as Figure 5. The sounding plan is presented as Map 2, and the results are discussed in Section 5.2.



5 cm
FIGURE 5
LOCATION:
LINE 21
ECHO SOUNDER RECORD
380
381
382
383
384
385
386
387
388
389
390
391
392
393
SOUTH-WEST
NORTH-EAST
DRILLING LOCATION
10 M.

278041

4 SURVEY METHODS AND PROCEDURES (Cont')

4.6 Side-scan Sonar and Bottom Sampling

4.6.1 Side-scan Sonar

An EG&G side-scan sonar was used to map changes in seabed lithology and search for any anomalous objects on the seafloor. The fish was towed off the stern of the vessel, on either 125 or 150 m. of cable, which placed the fish 20-30 m. above the seabed. The recorder was set to a sweep speed giving 125 m. slant range per channel.

The side-scan sonar utilizes an acoustic beam which is very narrow in the horizontal plane yet sufficiently broad in the vertical plane to impinge on targets ranging from directly under the fish out to 500 m. abeam. The two channels are fired simultaneously and then each receives echoes from the seafloor sediments to port or starboard. These acoustic signals are converted to voltages and fed-up the tow cable to the wet paper recorder which uses dual helix electrodes sweeping out from the centre of the recording drum. The signal voltages cause a current to flow from the helix, through the recording paper to another electrode, and marks are created on the paper in proportion to the strength of the seabed echoes. The helix on the right receives signals from the starboard side of the towfish, while the helix on the left prints those from the port side. The results from successive firings of the fish are printed close together on the recording paper, thereby building up a graphic representation of the seafloor nature as the vessel proceeds.

4 SURVEY METHODS AND PROCEDURES

4.6 Side-scan Sonar and Bottom Sampling

4.6.1 Side-scan Sonar (Cont'd)

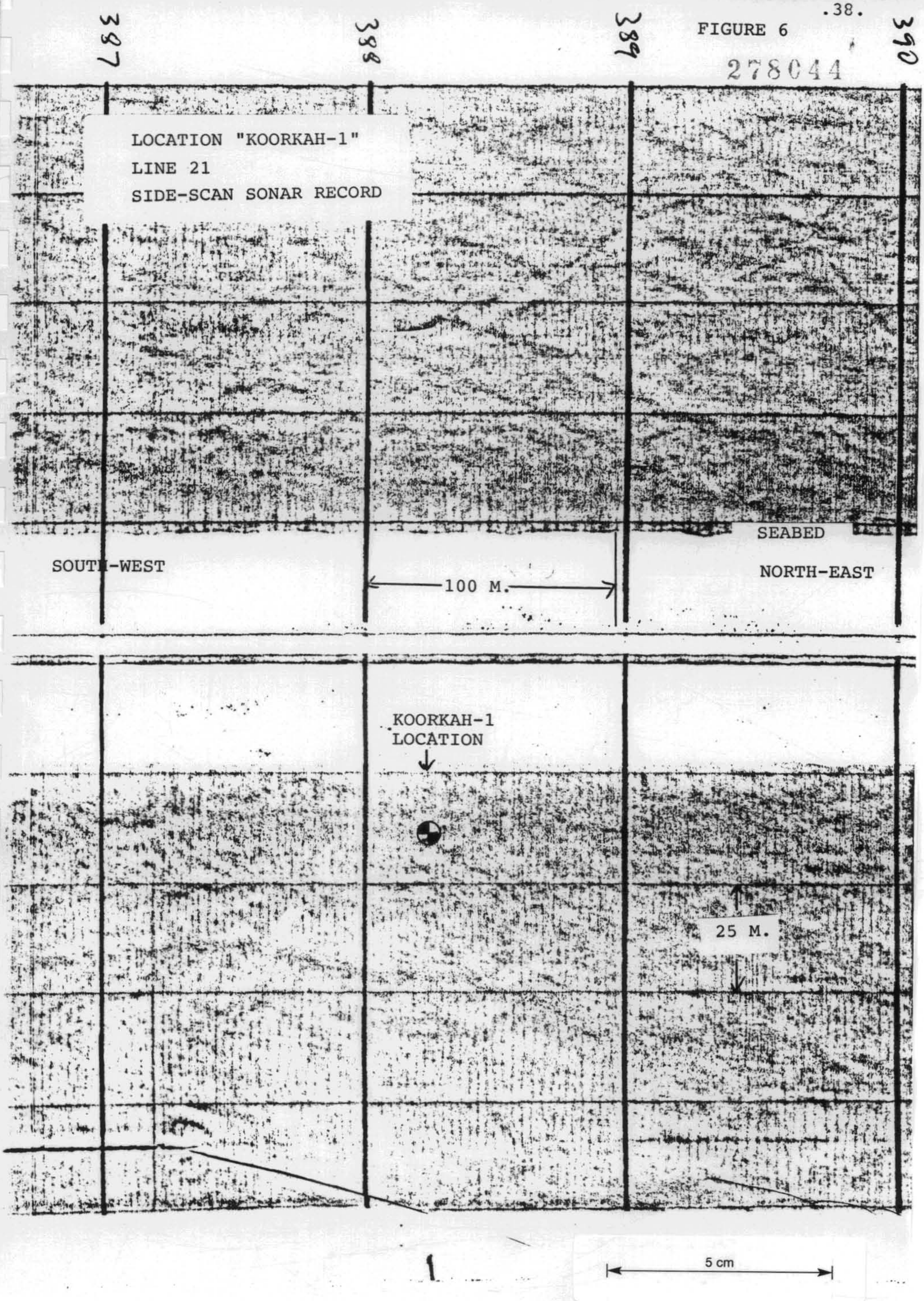
The strength of the echoes (and thus the darkness of the record) will depend on the grainsize of the seabed material (coarse sediments reflect a higher proportion of the incident energy), and the attitude to the sonar beam of any object protruding above the surrounding level. Thus, targets such as wrecks or rock outcrops will typically appear as very dark markings on the paper, with an acoustic shadow (light area) behind them.

The records are reduced by first identifying zones of contrasting relectivity (i.e. sediment type), and anomalous features such as scours, pipelines, craters, outcrop, etc., then plotting these results on either side of the fish track, after adjustment of the slant ranges to true horizontal ranges.

A photocopy of the sonar record running SW-NE through the location is presented as Figure 6. The results are discussed in Section 5.3.

FIGURE 6

278044



4 SURVEY METHODS AND PROCEDURES (Cont'd)

4.7 Seismic Reflection Profiling

The technique of seismic profiling employs a source of acoustic energy with sufficient power and low enough frequency content to penetrate the seafloor and obtain echoes from the underlying strata. The sound source, typically a boomer or sparker, sends a pulse of energy to the seabed, where part is transmitted and part reflected. The transmitted signal, as it penetrates the sub-seafloor sediments, is in turn part-reflected and part transmitted at succeeding interfaces separating materials with different acoustic impedances. The reflected components travel as a long wave-train up through the water column and are received by a hydrophone towed at the sea-surface next to the sound source. The hydrophone passes the signal inboard to various filters and amplifiers, before presentation on a graphic recorder. A continuous time section is built-up on the recorder by firing the acoustic source several times per second and printing the returned echoes side-by-side on the paper record.

For the KOORKAH-1 site survey, a multi-electrode sparker was employed as the sound source. Short, high voltage electrical pulses are passed from the capacitor bank, down the electrical cable to the sparker, which discharges into the water, causing vapourisation in the vicinity of the spark tips. A short-duration, multi-frequency shock wave is thereby produced, which travels downwards towards the seabed.

4 SURVEY METHODS AND PROCEDURES

4.7 Seismic Reflection Profiling (Cont'd)

The sparker was towed 12.3 m. astern from the port stern of the survey boat and the hydrophone was suspended from a boom on the starboard side, to ensure it was well out of the vessel's wake. Before commencement of the survey, several trial runs were made to test the effect on record quality of various filter and amplifier settings. The filter bandpass was eventually optimised at 400 - 2000 Hz. Before presentation to the recorder, the seismic signals were passed through a two stage T.V.G. (Time-Variable-Gain amplifier). This enables the gain to be kept very low until the seabed echo is received, thereby minimising the obscuring effect of the direct sparker-hydrophone arrival on the part of the record representing the water column. The seabed return is then employed to trigger a second amplifier ramp which is used to compensate for spreading loss and absorption on the sub-seabed material.

The sparker was fired every 750 ms at a power of 300 joules, to complete the grid of 21 by 5 lines.

A copy of the seismic record for the line running SW-NE through the location has been given as Figure 7. The seismic results are presented as Maps 3 and 4, and discussed in Section 5.4.

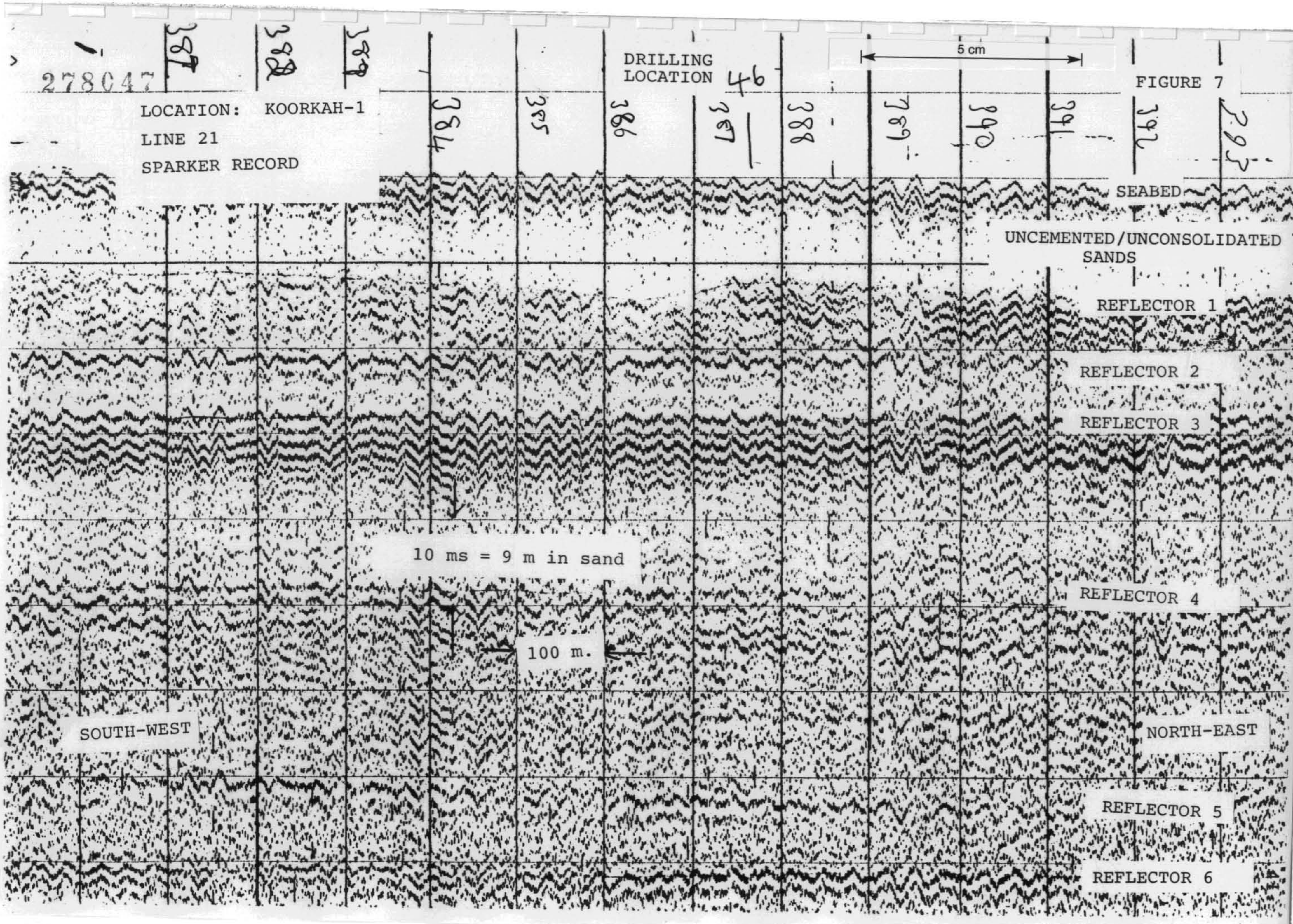

278047
LOCATION: KOORKAH-1
LINE 21
SPARKER RECORD
DRILLING LOCATION
5 cm
SEABED
UNCEMENTED/UNCONSOLIDATED SANDS
REFLECTOR 1
REFLECTOR 2
REFLECTOR 3
10 ms = 9 m in sand
REFLECTOR 4
100 m.
SOUTH-WEST
NORTH-EAST
REFLECTOR 5
REFLECTOR 6

FIGURE 7

5 RESULTS

5.1 Navigation

Due to the poor Maxiran signals, the site survey was carried out using the satellite integrated underwater acoustics system.

The transponders were deployed using weak 2-range fixing with Maxiran and the relative calibration carried out after the velocity profile was measured in the centre of the location (see Section 4.2.2). Due to the fact that the movemenet of transponder positions in the relative calibration averaged 14 m. consistently, except for the first transponder, it proved that the Maxiran was accurate through the deployment and therefore the transponder co-ordinates could be accepted as approximate absolute co-ordinates to carry out the site survey.

Throughout the survey, satellite passes were taken to be used to calculate the absolute co-ordinates at the completion of the survey. A small timing error was found in the computer which affects the deskewing of results between the acoustics and satellites for the first eighteeeen passes recorded in the first 24 hours of shooting which had to be rejected. Also during the survey, Maxiran signals were constantly monitored in an attempt to find signals good enough to carry out an absolute calibration. At the completion of the survey on 24th July 1985, a weak 3-way fix using Maxiran was possible so a calibration was carried out in 22 locations within the site, recording simultaneous fixes on Maxiran and acoustics.

The 22 sets of 10 fixes recorded on both the Maxiran and acoustic systems were entered into the computer to carry out a least squares adjustment to find a mean rotation and translation for the transponder array. The results are as follows:

5 RESULTS

5.1 Navigation (Cont'd)

(for print-outs see Appendix B):

Translation East	:	-9.7 m.
Translation North	:	13.3 m.
Rotation	:	0.55°

From 41 satellites recorded on disc, 24 of which were acceptable passes, the final satellite absolute results are:

Translation East	:	28.3 m.
Translation North	:	31.5 m.
Rotation	:	-0.41 °

The difference between the two sets of absolute results from Maxiran to satellite are:

Translation East	:	38.0 m.
Translation North	:	18.2 m.
Rotation	:	0.96°

However, because of the weak Maxiran signals and fluctuating standard deviations recorded during this calibration and its inconsistency throughout the whole survey (especially during the baseline crossings - see Section 4.1.2), the Maxiran result could not assumed better than within 20 m. Combined with the absolute accuracy of transit satellites with acoustics of within 30-40 m. brings the overall result well within the results expected.

Due to the unreliability of the Maxiran at this time of year, and the inability to precisely determine its accuracy during the survey the

5 RESULTS

5.1 Navigation (Cont'd)

absolute results from the transit satellites were used for the final result. All survey lines shot were adjusted by this result:

Translation East	:	28.3 m.
Tranlation North	:	31.5 m.
Rotation	:	-0.41°

5 RESULTS (Cont'd)

5.2 Echo Sounding

The bathymetric plan (Map 2) shows the seafloor to slope very gently downwards towards the north-east, at an average gradient of 1 in 1500. The variation in levels across the 4 km. by 4 km. area is 65.6 to 68.7 m. below the mean tidal level during the survey. At the proposed drilling location the seafloor is at -67.2 m. below datum.

5 RESULTS (Cont'd)

5.3 Side-scan Sonar and Bottom Sampling

5.3.1 Side-scan Sonar

The sonar revealed a featureless seafloor, with an acoustic reflectivity consistent with fine to medium grade sandy sediment. No sand waves or other sedimentary features indicative of strong bottom current action were observed on the records. Similarly, no bottom obstructions or hazards were revealed.

5 RESULTS

5.3 Side-scan Sonar and Bottom Sampling (Cont'd)

5.3.2 Bottom Sampling

Seven (7) grab samples were obtained, with a Van Veem bucket, from locations shown on Map 2. Weather conditions during the two phases of the sampling were quite varied, and great difficulty was experienced in achieving any recovery when a heavy sea was running. This is presumably primarily due to the sampler not falling vertically onto the seabed, but may also reflect the hard-packed nature of the bottom sediment.

The material recovered was as follows:

Sample No 1 Pale-brown, fine to medium grade SAND, with shell fragments to 15 mm.

Sample No 2 Pale-brown, fine to medium grade SAND (N.B. Very small recovery).

Sample No 3 Pale-brown, fine to medium grade SAND, with live sponges to 50 mm. diameter, and shells to 60 mm diameter.

Sample No 4 Pale-brown, fine to medium grade SAND, with shells to 55 mm diameter.

Sample No 5 Pale-brown, fine to medium grade SAND, with shells and shell fragments to 15 mm.

Sample No 6 Pale-brown, medium to coarse SAND with shell fragments (N.B. very small recovery - fine fraction probably washed out of sampler).

5 RESULTS

5.3 Side-scan Sonar and Bottom Sampling

5.3.2 Bottom Sampling (Cont'd)

Sample No 7 Pale-brown, fine to medium SAND, with shells to 55 mm. diameter.

5 RESULTS (Cont'd)

5.4 Seismic

The 300 J sparker recorded a series of flat-lying reflectors down to about 90 ms two-way travel time beneath the seabed. Below this level, the arrival of the first seabed multiple echo made identification of deeper horizons difficult. At an assumed average propagation velocity of 1800 m/sec, this effective penetration time is equivalent to 81 m.

This efficient propagation of the seismic signals into the seabed and to considerable depths indicates an absence of cemented material at the seafloor. No shallow geological information is available within the surveyed area, hence a precise lithology cannot be assigned to each reflecting layer. The seismic boundaries represent interfaces across which there is a change in acoustic impedance (the product of the compressional shock-wave velocity and the density of the transmitting medium). Thus, sudden changes in cementation or consolidation, or grain-size changes (e.g. silt to sand or sand to gravel) may generate reflections. The acoustic boundaries recorded in the KOORKAH-1 area are all laterally-persistent, and of roughly similar amplitude. Therefore major changes in cementation or grain-size are considered unlikely and it is believed the sequence represents an interbedded series of silts and sands, with different degrees of consolidation.

No seismic reflectors were present in the top few metres beneath the seabed, i.e. the material is acoustically transparent. The first laterally-persistent boundary (designated "Reflector 1") occurs at depths ranging from 5.7 to 16.1 m. across the site. This variation has been presented on Map No. 3 as an isopach plan of the sediment between

5 RESULTS

5.4 Seismic (Cont'd)

the seabed and Reflector 1. The lithology is believed to comprise fine to medium grade unconsolidated sand. Reflector 1 (presumably an old erosion surface) is a pronounced boundary over most of the site, however in the western corner, where it is shallowest, it is generally quite weak - the isopachs in this area have been dashed. At the proposed drilling location the depth to Reflector 1 is 11.5 m.

Map No. 4 comprises three representative seismic cross-sections across the site. The six main reflectors portrayed can be seen to be almost horizontal, with the most topography being exhibited by Reflector 1. Reflector 3 is particularly strong and may be comprised of several closely-spaced boundaries. Reflectors 4 and 6 are both fairly strong, however Reflectors 2 and 5 are relatively weak - Reflector 2 is only clearly seen in the north-western half of the survey area.

6 CONCLUSIONS

During the period July 16th and 25th 1985, echo sounding, side-scan sonar and shallow penetration analogue seismic surveys were carried out over a 4 km. by 4 km. area centred on the proposed "KOORKAH-1" drilling location.

The bathymetric work showed the seafloor to be nearly horizontal, with an average gradient of about 1 in 2000 towards the north-east. Depth variation was 65.6 to 68.7 m. below mean tidal level, and at the location the seabed lies at -67.2 m.

The sonar records were of low to moderate reflectivity, indicating a seafloor of fine to medium grade sand. No sedimentary features or obstructions could be identified. Grab samples of the sediment recovered pale-brown fine to medium sand, generally with some whole and broken shells.

The sparker survey recorded a series of nearly horizontal reflectors to depths of over 70 m. beneath the seabed. The first major horizon lies at depths ranging from 6 to 16 m., suggesting that the uncemented, largely unconsolidated sand prevails to at least this depth.

J.M. ANDERSON
Geophysicist

APPENDIX A

MAXIRAN CALIBRATION RESULTS

MAXIRAN BASE STATION CONFIGURATIONS

Beacon	S/N	Control Box S/N	Cable S/N
1	218	281	112
2	287	279	18
3A	62	311	62
3B	59	58	59
4	58	284	58
5	85	81	85
6	60	52	60

APPENDIX A : MAXIRAN CALIBRATION RESULTS

MONITOR S/N 74; OMNI

Beacon:S/N	Tower	Short Baseline		Long Baseline		Δ
		Raw Range	Zero Set	Raw Range	Zero Set	
1:218	STBD	19933	4775	115346	4776	+1
	PORT	19932	4774	115353	4780	+6
2:287	STBD	19933	4775	115345	4775	0
	PORT	19933	4775	115348	4775	0
3A:62	STBD	19931	4773	115342	4772	-1
	PORT	19933	4775	115345	4772	-3
3B:59	STBD	19927	4769	115334	4764	-5
	PORT	19927	4769	115338	4765	-4
4:58	STBD	19927	4769	115338	4768	-1
	PORT	19927	4769	115342	4768	-1
5:85	STBD	19926	4768	115339	4769	+1
	PORT	19925	4767	115343	4769	+2
6:60	STBD	19928	4770	115335	4765	-5
	PORT	19928	4770	115339	4765	-5

APPENDIX A : MAXIRAN CALIBRATION RESULTS

MONITOR S/N 74 L.P.L.'s

Beacon:S/N	Tower	Short Baseline		Long Baseline		Δ
		Raw Range	Zero Set	Raw Range	Zero Set	
1:218	STBD	19931	4773	115348	4778	+5
	PORT	19932	4774	115352	4779	+5
2:278	STBD	19929	4771	115341	4771	0
	PORT	19929	4771	115345	4772	+1
3A:65	STBD	19933	4775	115346	4776	+1
	PORT	19933	4775	115350	4776	+1
3B:59	STBD	19925	4767	115335	4765	-2
	PORT	19925	4767	115339	4765	-2
4:58	STBD	19925	4767	115337	4767	0
	PORT	19925	4767	115341	4767	0
5:85	STBD	19925	4767	115339/40	4769	+2
	PORT	19925	4767	115341/42	4768	+1
6:60	STBD	19925	4767	115338	4768	+1
	PORT	19926	4768	115341	4768	0

APPENDIX A - MAXIRAN CALIBRATION RESULTS

MONITOR S/N 78 - OMNI

Beacon:S/N	Tower	Short Baseline		Long Baseline		Δ
		Raw Range	Zero Set	Raw Range	Zero Set	
1:218	STBD	19933	4775	115344	4774	-1
	PORT	19932	4774	115350	4776	+2
2:287	STBD	19932	4774	115344	4774	0
	PORT	19932	4774	115347	4774	0
3A:65	STBD	19929	4771	115342	4772	+1
	PORT	19929	4771	115347	4774	+3
3B:59	STBD	19926	4768	115334	4764	-4
	PORT	19925	4767	115339	4766	-1
4:58	STBD	19926	4768	115338	4768	0
	PORT	19926	4768	115342	4768	0
5:85	STBD	19925	4767	115338	4768	+1
	PORT	19924	4766	115341	4768	+2
6:60	STBD	19927	4769	115335	4765	-4
	PORT	19927	4769	115338	4765	-4

APPENDIX A : MAXIRAN CALIBRATION RESULTS

MONITOR S/N 78 L.P.L.'s

Beacon:S/N	Tower	Short Baseline		Long Baseline		Δ
		Raw Range	Zero Set	Raw Range	Zero Set	
1:218	STBD	19931	4773	115349	4779	+6
	PORT	19931	4773	115353	4780	+7
2:287	STBD	19928	4769	115342	4772	+3
	PORT	19928	4769	115346	4772	+3
3A:65	STBD	19928	4770	115344	4774	+4
	PORT	19928	4770	115347	4774	+4
3B:59	STBD	19924	4766	115334	4764	-2
	PORT	19924	4766	115337	4764	-2
4:58	STBD	19924	4766	115337	4767	+1
	PORT	19924	4766	115341	4768	+2
5:85	STBD	19923	4765	115336	4767	+2
	PORT	19923	4765	115340	4767	+2
6:60	STBD	19925	4767	115336	4766	-1
	PORT	19925	4767	115340	4766	-1

APPENDIX B

ACOUSTIC CALIBRATION RESULTS

1) RELATIVE CALIBRATION AT XP ARRAY

	Xp. 1	Xp. 2	Xp. 3	Xp. 4	Xp. 5	Xp. 6St	RMS
St. 1	2.6E-1	******	[illegible].4E-1	2.7E-1	7.9E-1	1.4E-2	5.4E-1
St. 2	1.4E+0	******	[illegible]E+0	1.7E-1	2.3E+0	******	1.7E+0
St. 3	3.0E-1	******	[illegible]	8.3E-1	7.8E-1	6.2E-1	6.0E-1
St. 4	1.5E+0	******	2.[illegible]E-1	1.2E+0	1.5E+0	8.7E-1	1.2E+0
St. 5	4.3E-1	******	3.7E-1	7.0E-1	9.1E-1	8.7E-1	6.9E-1
St. 6	2.4E+0	******	2.4E+0	2.3E+0	1.6E+0	3.5E-2	2.0E+0
St. 7	******	******	2.9E-1	1.1E-1	******	2.8E-1	2.4E-1
St. 8	******	******	******	******	******	******	******
St. 9	******	******	[illegible]E-1	1.2E-1	2.3E-1	1.8E-1	1.7E-1
St.10	******	******	1.2E-[illegible]	2.4E-1	[illegible]E-1	3.4E-1	2.4E-1
St.11	******	******	1.1E-1	1.4E-?	[illegible].8E-1	6.0E-1	4.6E-1
St.12	5.9E-1	******	4.1E-1	1.1E+0	5.0E-1	2.1E-1	6.6E-1
St.13	1.3E+0	******	1.0E+0	3.3E-1	******	6.8E-1	9.0E-1
St.14	2.6E-1	******	6.0E-1	9.3E-1	******	6.1E-1	6.5E-1
St.15	******	******	1.0E+0	1.0E+0	4.3E-1	1.3E+0	1.0E+0
St.16	******	******	******	******	******	******	******
St.17	5.1E-1	******	9.0E-1	2.1E-1	9.5E-1	1.9E-1	6.4E-1
St.18	1.3E-1	******	4.0E-1	4.2E-1	5.6E-1	8.2E-2	3.7E-1
St.19	5.4E-1	******	4.4E-1	1.6E-1	3.9E-1	9.1E-2	3.6E-1
St.20	6.2E-2	******	2.4E-1	[illegible].0E-1	3.0E-1	1.8E-3	1.8E-1
St.21	4.0E-2	******	2.0E-1	[illegible].6E-3	2.0E-1	4.8E-2	1.3E-1
St.22	9.7E-3	******	4.1E-1	[illegible]E-1	5.6E-1	2.0E-2	3.3E-1
St.23	7.0E-2	******	3.1E-1	[illegible].3E-1	4.9E-1	1.7E-1	2.9E-1
St.24	9.2E-2	******	3.6E-1	7.7E-2	3.8E-1	5.8E-2	2.4E-1
St.25	2.3E-2	******	9.0E-1	2.1E-1	5.2E-1	5.4E-1	5.3E-1
St.26	4.6E-1	******	7.4E-1	7.5E-1	1.4E-1	7.7E-1	6.2E-1
St.27	8.1E-1	******	2.9E-1	7.9E-1	2.5E-1	7.0E-1	6.2E-1
St.28	4.4E-1	******	3.3E-1	[illegible].1E+0	7.7E-1	3.2E-1	6.5E-1
St.29	2.5E-1	******	2.8E-1	8.3E-1	7.9E-1	3.4E-1	5.6E-1
St.30	5.6E-1	******	3.7E-1	1.4E-1	3.5E-1	2.7E-1	4.0E-1
St.31	1.0E+0	******	9.2E-1	9.4E-3	9.3E-1	1.3E-1	7.4E-[illegible]
Xp RMS	8.0E-1	0.0E+0	7.9E-1	7.1E-1	8.4E-1	4.9E-1	

------ : distance not known ****** : distance rejected

worst distance: st 6 to Xponder 1 worst station : 6

relative position of the transponders

Xp01 :	0.00	0.00	40.20
Xp02 :	4392.80	-0.00	39.20
Xp03 :	4326.10	-788.88	40.20
Xp04 :	2106.31	1220.61	41.10
Xp05 :	3061.34	3504.53	42.90
Xp06 :	6511.91	378.43	42.[illegible]

Square residum 7.37E+01 Valid dist 136 Variance : [illegible].36E-01

Absolute Positions of [illegible]nsponders

	On File		Calculated		Difference
Xp 1 :06:	338229.00	5611724.00	338199.27	561[illegible]744.00	35.83
Xp 3 :14:	342295.00	5610179.00	342309.48	[illegible]	14.59
Xp 4 :07:	340492.00	5612576.00	34049[illegible].57	[illegible]	15.22
Xp 5 :01:	341847.00	5614646.00	341847.41	5614632.70	13.30
Xp 6 :05:	344657.00	5610924.[illegible]	34467[illegible].26	5610930.[illegible]	15.76

2) ABSOLUTE CALIBRATION USING MAXIRAN

Results of the absolute calibration

Rejected stations : ,8

Fix	radio position		corrected acous. posit.		distance
1	339659.40	5612759.00	339657.35	5612778.88	19.99
2	340608.50	5613467.80	340514.44	5613473.76	8.41
3	340829.80	5615232.50	340840.51	5615237.38	11.77
4	342426.70	5615466.70	342420.35	5615484.59	18.98
5	343706.60	5611597.70	343706.00	5611604.21	6.54
6	345451.90	5613349.60	345452.82	5613354.29	4.73
7	343972.00	5612848.00	343976.26	5612854.09	7.43
8	*******.**	********.**	*******.**	********.**	******.**
9	338648.20	5609430.60	338636.92	5609444.99	18.28
10	339036.10	5613017.20	339031.41	5613028.58	12.31
11	340138.00	5611683.00	340120.78	5611692.00	19.43
12	340431.60	5612097.30	340448.35	5612064.63	36.67
13	340965.00	5612187.10	340979.11	5612162.22	28.61
14	341395.40	5611649.60	341390.73	5611660.16	11.54
15	341214.60	5611034.10	341208.21	5611041.97	10.14
16	340767.70	5610690.70	340784.16	5610662.21	32.90
17	339470.30	5609513.90	339471.73	5609494.21	19.74
18	339428.00	5608624.30	339441.63	5608605.75	23.02
19	340182.30	5608771.00	340164.75	5608782.15	20.79
20	340688.90	5609375.90	340676.75	5609385.78	15.66
21	341071.90	5609932.80	341081.18	5609910.04	24.58
22	342505.60	5610940.10	342495.06	5610946.96	12.58

channel	position on file		new position	
6	338199.30	5611744.00	338191.18	5611784.86
3	*******.**	********.**	*******.**	********.**
14	342309.50	5610180.80	342286.24	5610182.43
7	340492.60	5612560.80	340492.18	5612579.69
1	341847.40	5614632.70	341866.73	5614638.54
5	344671.30	5610930.70	344655.10	5610909.71

Mean Error	:	19.27
Acoustic rotation point	:	341085.85 5611590.02
Translation (east = +)	:	-9.73
Translation (north = +)	:	13.26
Rotation	:	.55
Heading of transponder 1 to transponder 2	:	143.90

3) ABSOLUTE CALIBRATION USING SATELLITES

Results of the absolute calibration

Rejected stations : ,1,3,4,6,7,9,10,12,14,18,19,20,22,23,25,27,28,29,30,31,32,34,36,37,40

fix	satellite position		corrected acous. posit.		distance
1	*******.**	********.**	*******.**	********.**	******.**
2	339978.33	5611931.41	340030.00	5611947.98	54.26
3	*******.**	********.**	*******.**	********.**	******.**
4	*******.**	********.**	*******.**	********.**	******.**
5	342664.05	5610428.44	342667.47	5610351.56	76.94
6	*******.**	********.**	*******.**	********.**	******.**
7	*******.**	********.**	*******.**	********.**	******.**
8	343104.24	5610251.57	343178.00	5610240.16	74.64
9	*******.**	********.**	*******.**	********.**	******.**
10	*******.**	********.**	*******.**	********.**	******.**
11	341243.45	5610087.16	341185.43	5610074.79	59.32
12	*******.**	********.**	*******.**	********.**	******.**
13	343215.78	5610473.04	343244.63	5610553.76	85.72
14	*******.**	********.**	*******.**	********.**	******.**
15	341795.86	5614315.86	341761.18	5614281.92	48.53
16	342883.55	5611860.13	342898.43	5611874.35	20.58
17	342937.89	5613533.86	343002.33	5613548.62	66.11
18	*******.**	********.**	*******.**	********.**	******.**
19	*******.**	********.**	*******.**	********.**	******.**
20	*******.**	********.**	*******.**	********.**	******.**
21	340960.47	5611570.51	340893.86	5611603.42	74.30
22	*******.**	********.**	*******.**	********.**	******.**
23	*******.**	********.**	*******.**	********.**	******.**
24	342694.83	5611718.09	342693.78	5611694.92	23.19
25	*******.**	********.**	*******.**	********.**	******.**
26	342695.23	5608992.33	342652.31	5609022.36	52.39
27	*******.**	********.**	*******.**	********.**	******.**
28	*******.**	********.**	*******.**	********.**	******.**
29	*******.**	********.**	*******.**	********.**	******.**
30	*******.**	********.**	*******.**	********.**	******.**
31	*******.**	********.**	*******.**	********.**	******.**
32	*******.**	********.**	*******.**	********.**	******.**
33	*******.**	********.**	*******.**	********.**	******.**
34	*******.**	********.**	*******.**	********.**	******.**
35	339295.18	5614033.04	339244.91	5614032.50	50.27
36	*******.**	********.**	*******.**	********.**	******.**
37	*******.**	********.**	*******.**	********.**	******.**
38	339445.12	5611701.11	339459.37	5611728.05	30.48
39	340911.27	5610294.75	340947.06	5610273.74	41.49
40	*******.**	********.**	*******.**	********.**	******.**
41	342067.02	5611066.69	342033.53	5611029.82	49.81

hannel	position on file		new position	
6	338199.30	5611744.00	338225.57	5611750.51
3	*******.**	********.**	*******.**	********.**
14	342309.50	5610180.80	342346.83	5610216.70
7	340492.60	5612560.80	340512.98	5612583.66
1	341847.40	5614632.70	341852.95	5614665.19
5	344671.30	5610930.70	344703.21	5610983.45
10	340933.00	5608088.00	340985.31	5608114.12

ean Residual : 57.10
coustic rotation point : 341697.89 5611452.36
ranslation (east = +) : 28.26
ranslation (north = +) : 31.50
otation : -.41
eading of transponder 1 to transponder 2 : 142.94

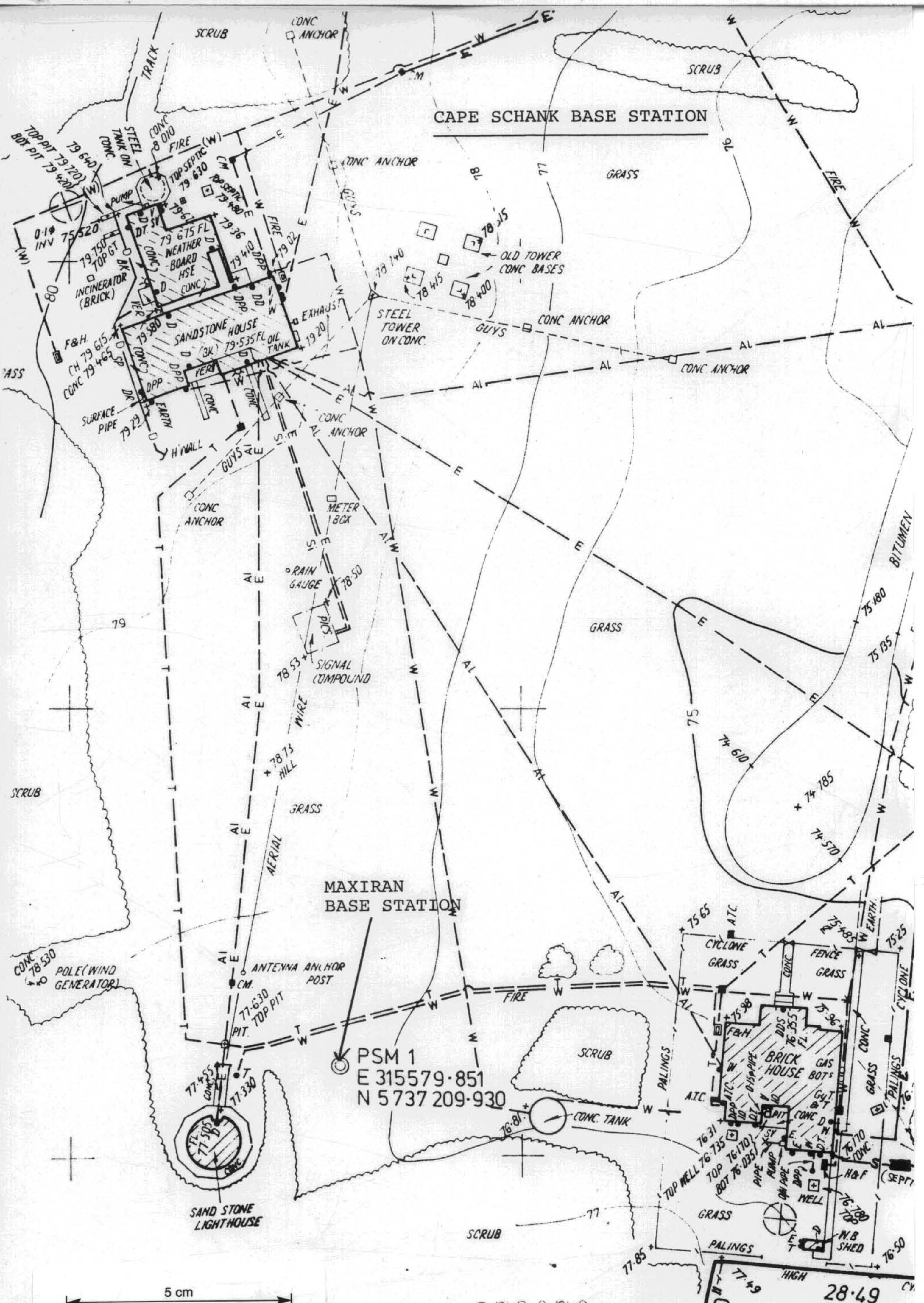
APPENDIX C

MAXIRAN BASE STATION DESCRIPTIONS

STATION:	CAPE SCHANK
LOCATED:	Station Schank is located about 14 km. south of Rosebud, Victoria. Access is via the Rosebud - Flinders road, then by a right-hand turnoff onto the Cape Schank road, which leads onto the Cape Schank Reserve.
MARKER:	The Maxiran tower was erected over marker PSM-1 which lies adjacent to the sand stone lighthouse.
GENERAL:	Permission to occupy the station should be obtained from Mr. Norman Loughton, Senior Navigation Aids Engineer, Federal Department of Transport, Telex AA 35259 VITRAN. Accomodation for the base station operator may be obtained in one of the lighthouse keeper's vacant quarters.
ELEVATION:	79 metres.
CO-ORDINATES:	The co-ordinates of PSM-1 are as follows:

Latitude:	38° 29' 39.332" S
Longitude:	144° 53' 07.164" E
Easting:	315 579.85 m.
Northing:	5 737 209.93 m.

The maxiran tower was erected over the station.


CAPE SCHANK BASE STATION
MAXIRAN
BASE STATION
PSM 1
E 315579·851
N 5737 209·930
SANDSTONE HOUSE
79·535 FL
WEATHER BOARD HSE
79·675 FL
BRICK HOUSE
SAND STONE LIGHTHOUSE
STEEL TOWER ON CONC.
OLD TOWER CONC BASES
CONC ANCHOR
SIGNAL COMPOUND
RAIN GAUGE
METER BOX
ANTENNA ANCHOR POST.
POLE (WIND GENERATOR)
INCINERATOR (BRICK)
CONC. TANK
W.B SHED
WELL
GRASS
SCRUB
BITUMEN
TRACK
AERIAL
WIRE
GUYS
PALINGS
CYCLONE FENCE
78·73 HILL
74·185
5 cm
28·49
274° 00' 20"

278070

STATION: THE NUT (ST 674)

LOCATED: This station is located on a hill overlooking the town of Stanley, on the north coast of Tasmania, Australia. The hill is named "The Nut" and its summit is flat to slightly rolling. This hill, as well as the historical town of Stanley, are very popular tourist attractions. The vegetation on this hill consists of grass and low native bushes. There is a tourist walk track around the perimeter of the top which is some 4 km. around. There are many mutton bird burrows along this track. The surrounding district, Circular Head, derives its name from the distinctive shaped "Nut" which juts into Bass Strait. The station marker is on the northern side of The Nut.

ACCESS: Access to the town of Stanley can be made from Burnie or Devonport. It must be noted that minor towns may not appear on road signs. When leaving Devonport, read "Smithton" for "Stanley". At times, only route numbers appear in lieu of town names. It is approximately 120 km. from Devonport to Stanley.

Drive north on the Bass Highway to the intersection with the Stanely Highway (B21). This intersection is 64 km. past Wynyard. Turn onto Stanley Highway and drive 7 km. to the town of Stanley. The Nut will be easily seen to the northeast of Stanley, right beside the town. The road to the hill is signposted "Nut". A vehicle can be taken as far as the car park on the slopes of The Nut. A zi-zag 1 m. wide cement track with centre hand rail leads from the car park to the summit. Take the left hand track at the fork on the top of the hill. The station marker is from 400-500 m. along this track. It is a walk of about 20-30 minutes (unburdened) from the base of the hill to the station.

STATION: THE NUT (ST 674) (Cont'd)

MARKER: The station marker consists of a brass mushroom S.P.M., which is not numbered. The marker is embedded in concrete which is at ground level. A 1.26 m. high stone cairn is built 2.5 m. W.N.W. of the marker.

A 3.86 m. high quadropod has been erected close to the marker. The quadropod has a 60 cm. diameter black disc attached to its top.

The Maxiran tower was erected 1.0 m. at a bearing of 239° Magnetic from the marker. Co-ordinates are listed in this description for the brass mushroom marker, and the Maxiran tower offset.

GENERAL: Food, fuel, oil and water is unavailable in Stanley. Fuel and oil can be obtained from W.T. House, Inc. BP Service Station. Mr. House can also assist in obtaining labour. Labour may also be obtained at the Union Hotel. Emergency water can be obtained from a tank near the old telecom hut, which is located alongside the lookout, approximately 700 m. from the station site.

Although limited camping equipment is available in Stanley, this should be purchased in larger centres, such as Burnie or Devonport.

Hotel accomodation are available at the Union Hotel in Stanley. The nearest airport to this station is in Smithton, approx. 20 miles away.

The station site is completely exposed to weather. This should be taken into consideration when erecting the station. Ample bedding, tent pegs, and spare rope should be taken. During the winter months (June through to September), the site is very cold and damp. A heater is

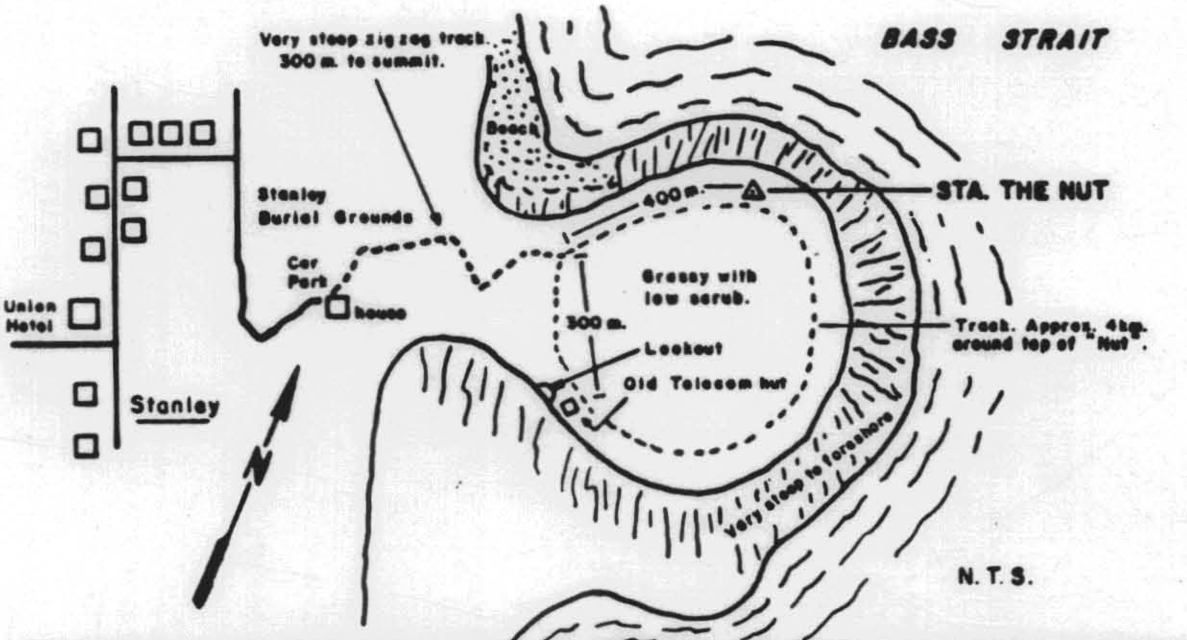
STA. THE NUT (ST 674) — AUSTRALIA

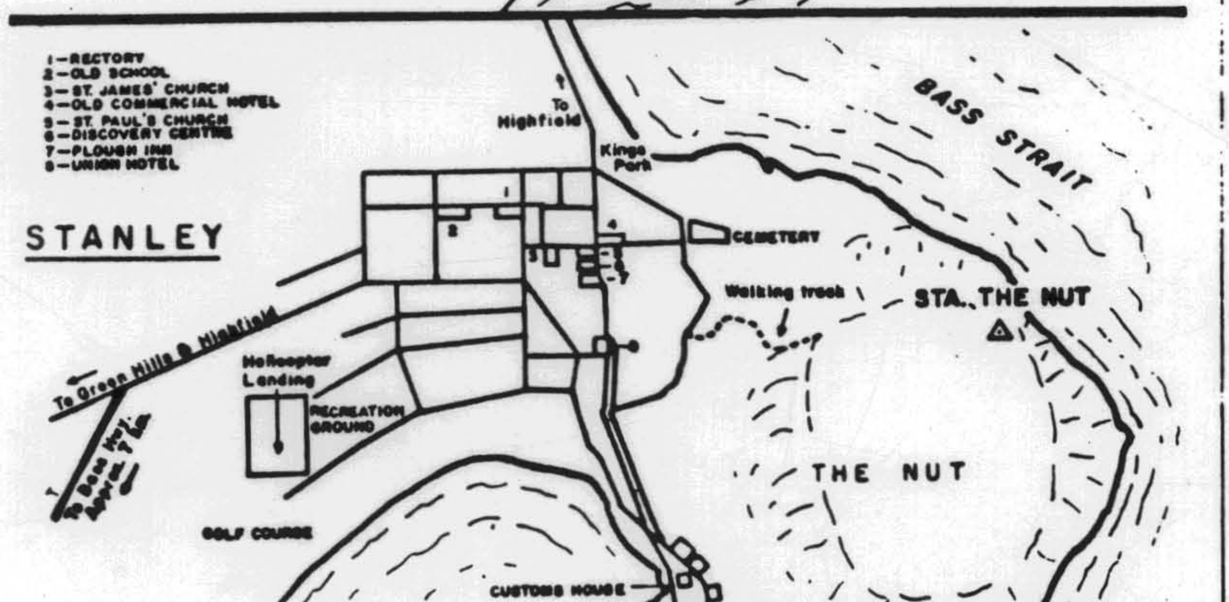
LAT.	40°45'50".23	S	(MARKER COORDS.)	N	5,486,046 meters
LONG.	145°18'13".45	E		E	356,830 meters

ELEV. 143 meters

UTM PROJ. — AUST. NAT. SPHEROID

ZONE 55, C.M. 147° E — A.G.D.



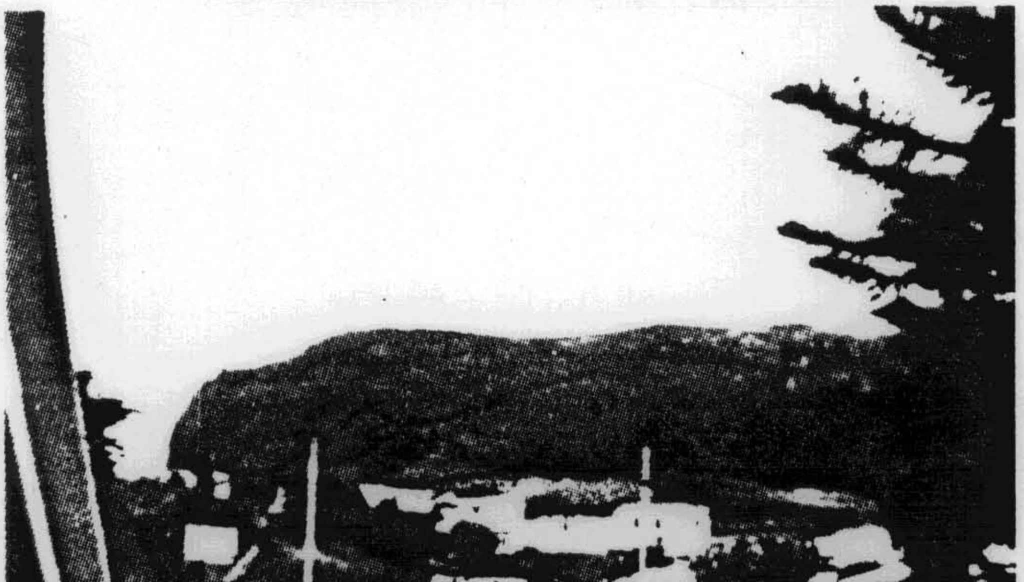


OFFSHORE NAVIGATION (AUSTRALIA) PTY. LTD.

5 cm

STATION THE NUT

FROM TURNOFF AT STANLEY BURIAL GROUND



FROM THE OUTSKIRTS OF STANLEY. NOTE ZIG-ZAG TRACK UP MOUNTAIN. THIS IS THE ONLY ACCESS ROUTE BY FOOT.

STATION: NARACOOPA

LOCATED: Station Naracoopa is located in a paddock in the village of Naracoopa, King Island, Tasmania, Australia. The station site overlooks the Mobil oil tanks and jetty. The paddock is of grass on top soil with an underfelt of clay. The two markers at this site are located on the north end of the paddock, on the edge of a hill.

ACCESS: Fraser Bluff is in the village of Naracoopa, approximately 20 km. from the main town of Curry on King Island. Just as you enter the village, there is an intersection with a sign-post to the right towards "Millbrook". Turn onto Millbrook Road and drive o.8 km. to a turn-off and gate to the left. Go through this gate and drive to the right around a small dam. Continue on through the scrub to the paddock. Drive through the paddock to the ridge and station site.

Heavy rain fall can be expected during June through September. In the event of a recent rainfall, a four-wheel drive vehicle or tractor will be needed to reach this site as the paddock can become very marshy. Tractors can be obtained from Mr. D. Spittle, whose telephone number is 004-611206. If the ground is marshy and no tractor or 4-wheel drive vehicle is available, it is a distance of approx. 250 yards from the staging area to the site.

MARKER: Two markers exist and consist of two brass plaques embedded in cement 3 inches below ground level. Both positions are marked by star pickets. One plaque is inscribed "ONI ARGO 1984" and the second is inscribed "GSI SYLEDIS 1984".

STATION: NARACOOPA (Cont'd)

GENERAL: Local labour is not available unless prior arrangements are made in the village. Ian Whitehouse, who transported the station to the site in 1984, can make arrangements for Labour from curry.

All supplies for the site should be purchased in Curry. Websters Store has everything necessary in regard to hardware. Cars and caravans can also be obtained in Curry. A 4-wheel drive vehicle or tractor must be leased from private sources.

There is a cafe in Naracoopa that is owned by Mr. and Mrs. Hoopwood. Limited food supplies can be obtained from there.

During dry season, there is limited water on the island, and water must be purchased in Curry.

There is no elctricity in the area. However, power will be available within 2 years.

Heavy winds can be expected at this site from all directions. Winds from the southwest and east are the stronger, and can reach from 40 to 80 knots. A tent at this site would most likely not survive, especially during the winter months.

In the event a tent or caravan cannot be placed at this site, the operator may be able to stay in an empty house 150 to 200 yards from the site. The house and out buildings nearby are owned by Mrs. Gail Henderson, who also owns the property on which the site is located. She lives in Curry.

STATION: NARACOOPA

GENERAL: (Cont'd)

Everyone on the island is helpful. However, prior arrangements must be made for any assistance that is required.

Permission to occupy the station site must be obtained from Mrs. Gail Henderson.

A 60 ft Maxiran tower was erected over the ARGO marker. A minimum tower height of 40 ft is required to clear surrounding obstructions. Clear Vista is from 120° to 340°. Star pickets were used to secure the towers. The anchors must be doubled and driven into the ground. Also, they must be taken out at the end of an operation as their remaining in the paddock will constitute a hazard for cattle and other livestock.

SKETCH: See next page.

Co-ordinates of this station were provided by ONA.

UTM PROJECTION, AUSTRALIAN NATIONAL SPHEROID
ZONE 55, C.M. 147° EAST - A.G.D.

MARKER CO-ORDINATES (281/150)

Lat.	39° 55' 27.64" S	N = 5 576 663 m.
Long.	144° 07' 26.23" E	E = 254 211 m.

The Maxiran tower was erected over the Argo marker, on an offset of 307.051 m., at an adjusted azimuth of 98.1204805551° from the (281/150) marker.

MAXIRAN TOWER CO-ORDINATES

Lat.	39° 55' 29.05" S	N = 5 576 630 m.
Long.	144° 07' 39.03" E	E = 254 517 m.
Elev.	53 metres.	

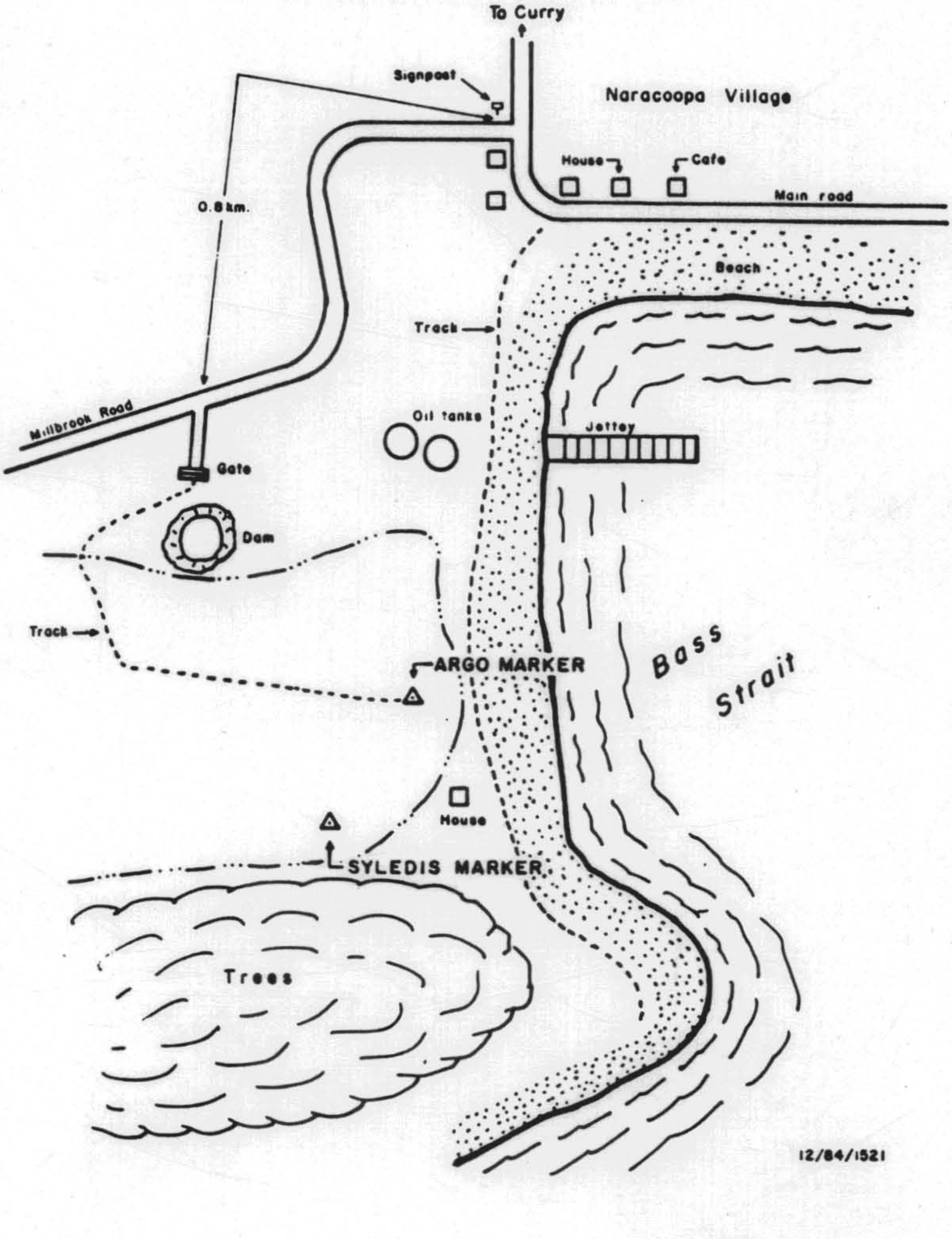
STA. NARACOOPA —————— AUSTRALIA

MARKER (281/150) COORDINATES

LAT.	39° 55' 27".64 S	N	5,576,663 meters
LONG.	144° 07' 26".23 E	E	254,211 meters
ELEV.	Not reported		

UTM PROJ. ———— AUST. NAT. SPHEROID

ZONE 55, C. M. 147° E ———— A. G. D.



12/84/1521

5 cm

STATION: LIPTRAP

LOCATED: Station Liptrap is located approximately 15 miles from the township of Tarwin Lower, Victoria, Australia, and 5 miles north of the Cape Liptrap Lighthouse. The station site is 170 metres above sea level, and surrounded on three sides by the sea. The land around the base station is undulating sand hills, covered by low mallee scrub with areas of secondary growth consisting of ferns and prickly bush. Also, some livestock grazing areas are within a mile radius of the site.

The station is located within a triangle of dirt roads, the northern side being the apex leading to the township of Tarwin Lower. The two southern apexes lead to beaches, one at Cape Liptrap, and the other at Walker Ville. The immediate area at the trig marker is covered by scrub 1 to 2 feet high, growing on white and yellow sand. The trig marker is approximately 200 feet east of the dirt raod. The area, for approximately 200 feet around the marker, is reasonably flat.

This station is accessible by any type of vehicle.

MARKER: The original marker, placed in 1863, was about 3/4 mile south-southwest from the present marker, but could not be recovered. A second marker, about 1 mile north-northeast of the present marker, was placed in 1920. The beacon on this marker disappeared during the 1950's.

The present marker consists on a 3-foot square slab of concrete, that is flush with ground level. A brass plaque, inscribed "AUST. TRIANGLULATION STN., SURVEY CORPS.", is imbeded in the concrete.

<u>STATION:</u> <u>LIPTRAP</u> (Cont'd)

<u>MARKER:</u> (Cont'd)

A 15-foot steel quadripod, with 2-foot vanes on top, has been constructed over the marker. The quadripod and vanes are painted black.

There are no prominent features in the immediate vicinity of the marker that could be used as reference, with the exception of the roads, (see sketch).

<u>GENERAL:</u>

Local labour, food, fuel, oil and drinking water can be obtained from the towns of Fish Creek (15 miles) or Tarwin Lowers (14 miles). If the operator has no transportation, the local Lands Department will be only too willing to get water and/or supplies for the operator.

Permission to occupy the site should be obtained from the Victorian Crown Lands and Surveys. Permission can be obtained from Mr. Ken McMahon, P.O. Box 349, Traralgon, 3844, Victoria. Telephone: (051) 745 244. No rental fee is charged. However, conditions of occupancy are on a "LEFT AS FOUND" basis.

Rain and wind, mainly from the west and east, will be the main discomfort experienced on this station. It would be advisable to double-tie the tents down. The station should never be left unmanned, due to the heavy tourist traffic in the area.

A minimum tower height of 40 feet is required to clear surrounding obstructions, Clear vista is from 120° to 290°. Six-foot steel star stakes are used to secure the tower.

<u>ELEVATION:</u> 170 metres.

<u>SKETCH:</u> See next page

STATION: LIPTRAP (Cont'd)

Co-ordinates of the station markers were obtained from a Department of Crown Lands and Survey, Victoria summary sheet.

UTM PROJECTION, AUSTRALIAN NATIONAL SPHEROID
ZONE 55, C.M. 147° EAST - A.G.D.

Latitude:	38° 51' 05.51"	South
Longitude:	145° 57' 54.92"	East
Northing:	5 699 175 metres	
Easting:	410 211 metres	

The Maxiran tower was erected 4.0 metres on a bearing of 140° magnetic from the station marker.

MAXIRAN TOWER OFFSET CO-ORDINATES:

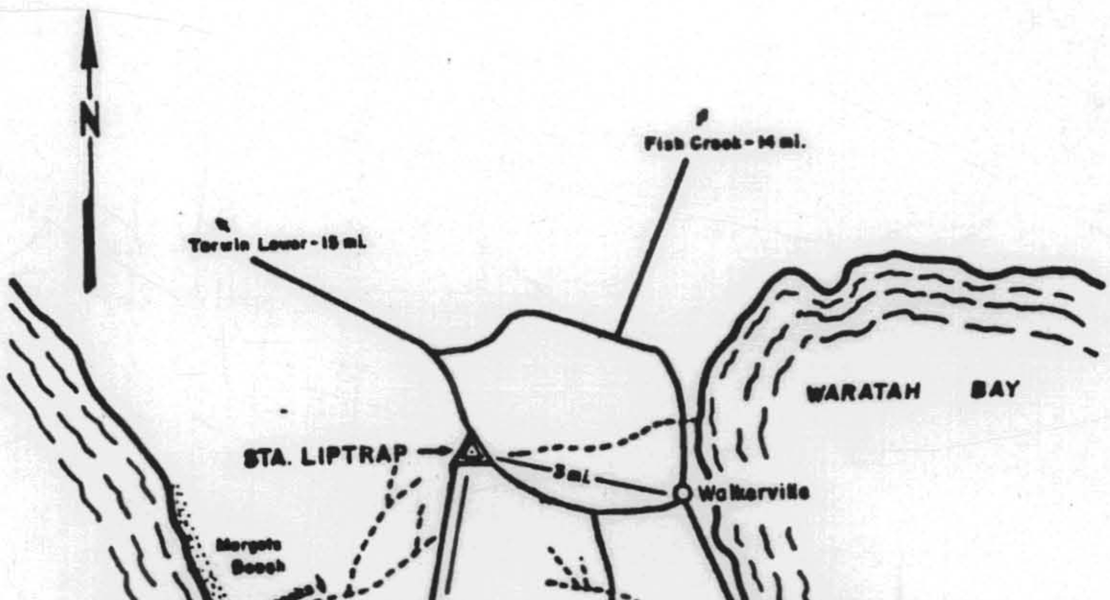
Latitude:	38° 51' 05.64"	South
Longitude:	145° 57' 54.98"	East
Northing:	5 699 171 metres	
Easting:	410 213 metres	

STA. LIPTRAP——————AUSTRALIA

LAT. 38°51'05."51 S
LONG. 145°57'54."92 E
ELEV. 170 meters

N 5,699,175 meters
E 410,211 meters

UTM PROJECTION, AUST. NATIONAL SPHEROID
ZONE 55 C.M. 147° E
AUSTRALIAN GEODETIC DATUM

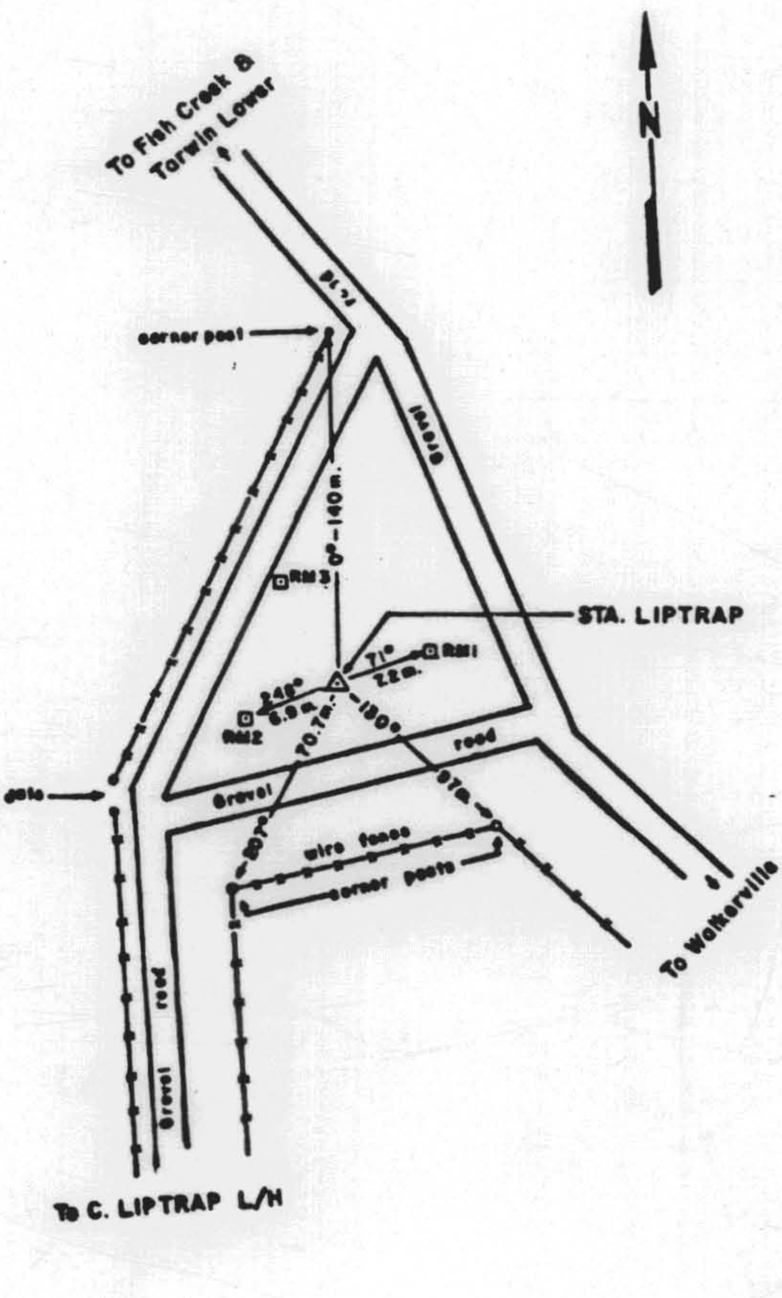


2/81/1201

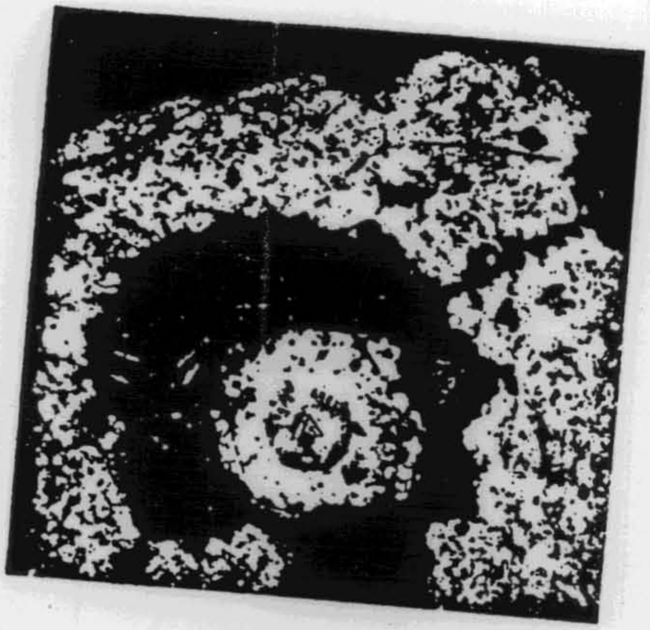
5 cm

STA. LIPTRAP ——————— AUSTRALIA

STATION DETAILS



2/81/1201



STATION LIPTRAP
MARKER

278085

APPENDIX D

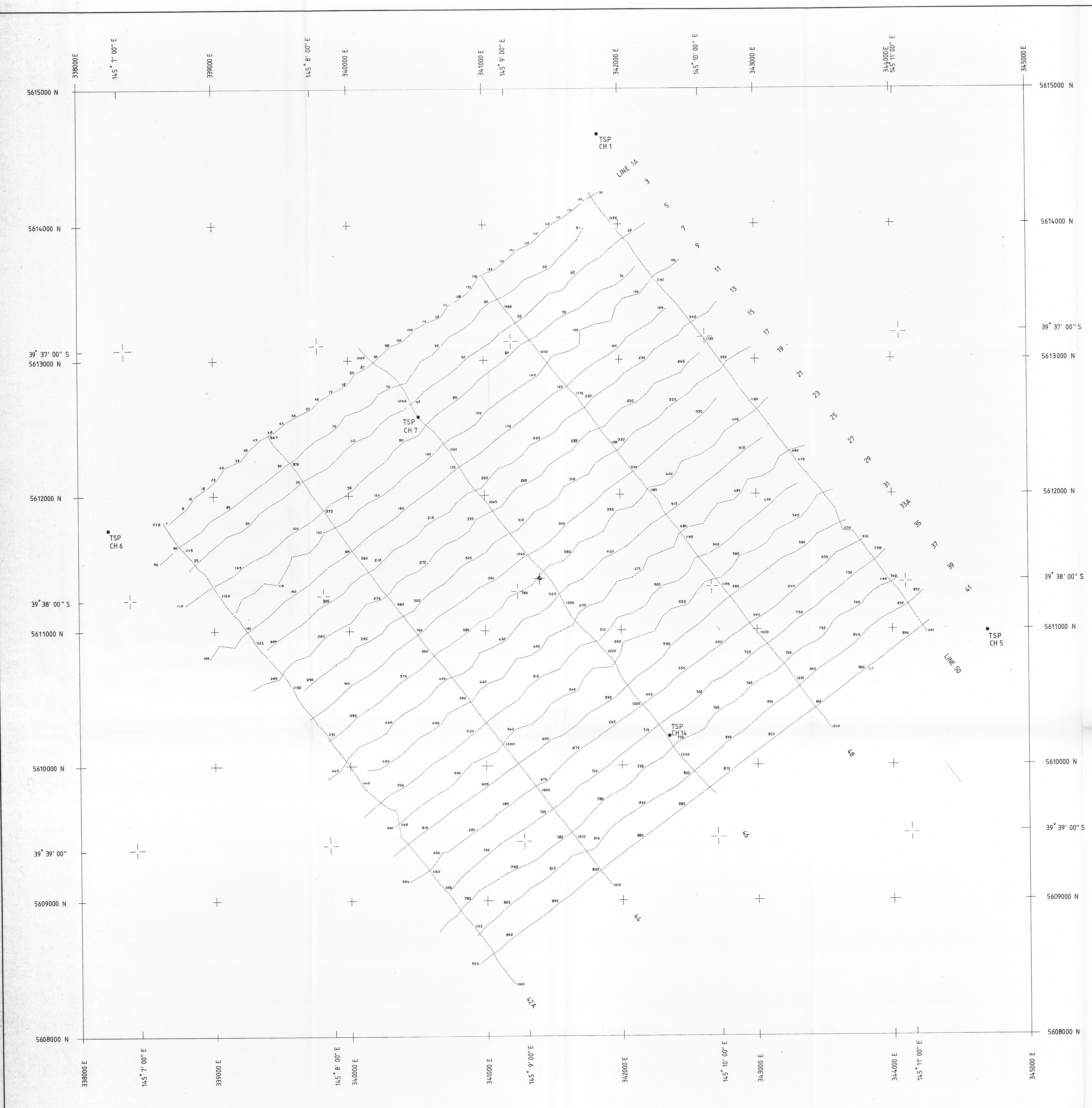
ACOUSTIC TRANSPONDER PARAMETERS

APPENDIX D : ACOUSTIC TRANSPONDER PARAMETERS

Transponders deployed on Location KOORKAH-1:

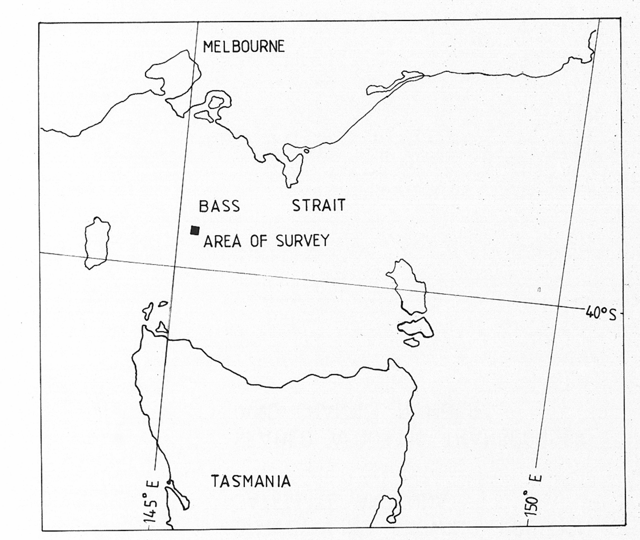
Transponder	S/N	Channel Freq.	Bit 0	Bit 1	Enable	Disable	Release
1	24	6	08	04	11	12	15
2	579	3	13	10	63	64	66
3	643	14	08	03	13	14	16
4	553	7	12	10	53	54	56
5	675	1	08	03	43	44	46
6	652	5	03	01	47	48	49
7	564	10	13	10	11	12	15

N.B. Transponders Nos. 2 and 7 were uncalibrated - see Section 4.2.2.



T.N.

LOCATION PLAN



LEGEND :

PROPOSED KOORKAH LOCATION
GEOGRAPHICAL 39° 37' 57".11 S
145° 09' 06".83 E
U.T.M. 5611379·8 m N
341398·4 m E

SURVEY LINE, SHOWING POSITION OF SATELLITE ANTENNA

TSP — SEABED ACOUSTIC TRANSPONDER (AND CHANNEL NUMBER)

SURVEY DATA

DATUM	AUSTRALIAN GEODETIC
SPHEROID	AUSTRALIAN NATIONAL
PROJECTION	UNIVERSAL TRANSVERSE MERCATOR ZONE 55
CENTRAL MERIDIAN	147° EAST
FALSE NORTHING	10 000 000 m AT EQUATOR
FALSE EASTING	500 000 m AT C.M.

5 cm

SCALE 1 : 10 000

0 200 400 600 800 1000 metres

AMOCO AUSTRALIA PETROLEUM COMPANY

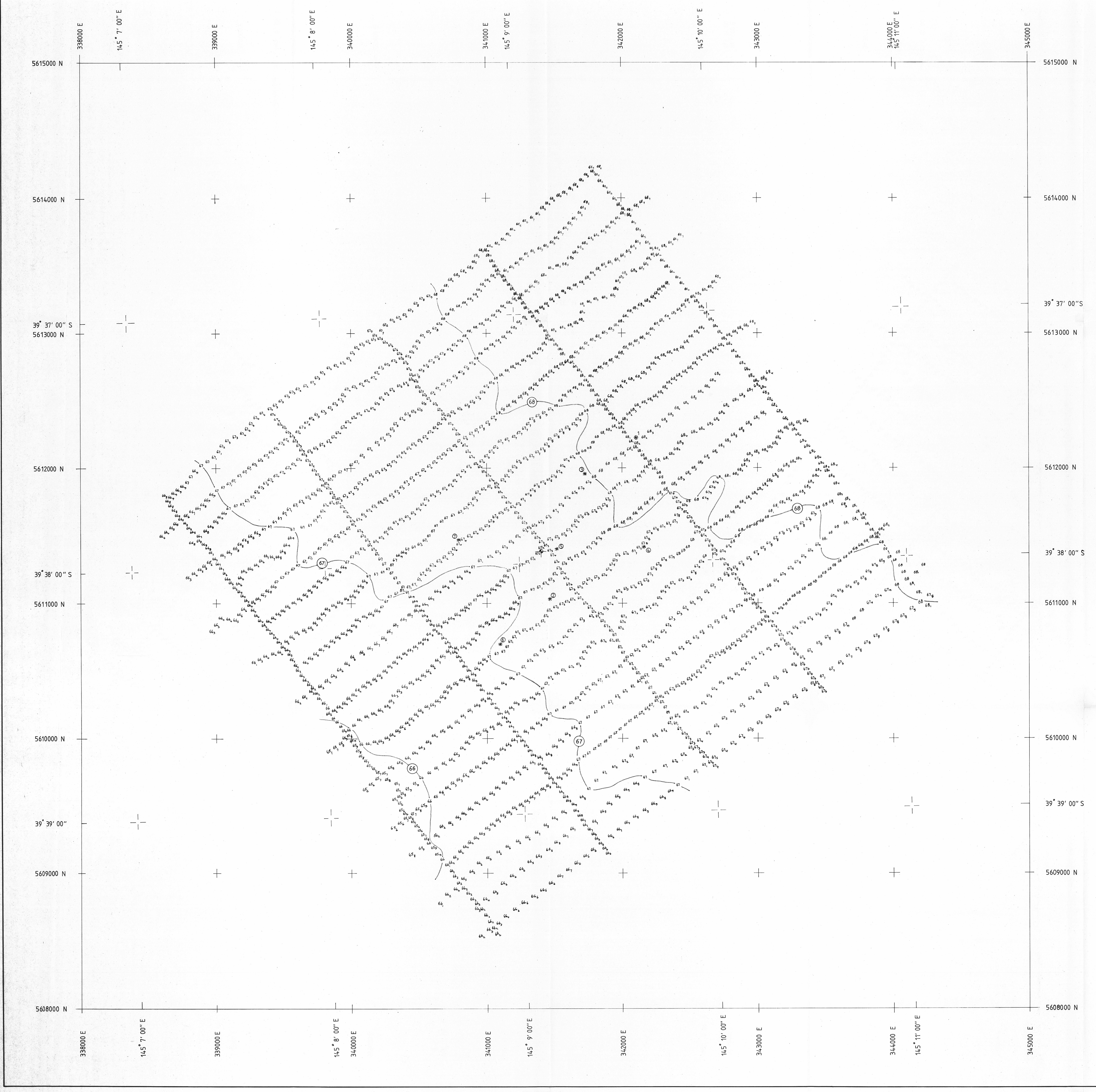
SITE SURVEY ON
LOCATION KOORKAH - 1

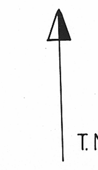
POSITIONING MAP OF SATELLITE ANTENNA

OR-0287 278087 MAP Nº 1

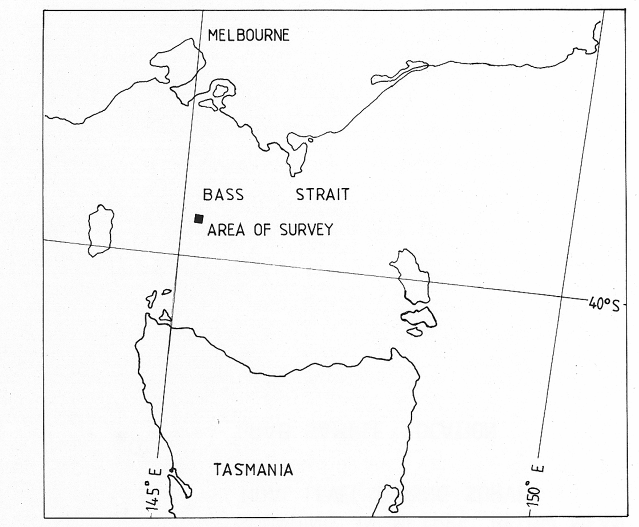
GEOMEX SURVEYS

JOB NUMBER
KO 88/85/AM





LOCATION PLAN



LEGEND :

⊕	PROPOSED KOORKAH LOCATION GEOGRAPHICAL 39° 37' 57".11 S 145° 09' 06".83 E U.T.M. 5611379·8 m N 341398·4 m E
66_8	SOUNDING IN METRES BELOW MEAN TIDAL LEVEL DURING SURVEY
✳③	GRAB SAMPLE LOCATION

SURVEY DATA

5 cm

DATUM	AUSTRALIAN GEODETIC
SPHEROID	AUSTRALIAN NATIONAL
PROJECTION	UNIVERSAL TRANSVERSE MERCATOR ZONE 55
CENTRAL MERIDIAN	147° EAST
FALSE NORTHING	10 000 000 m AT EQUATOR
FALSE EASTING	500 000 m AT C.M.

SCALE 1 : 10 000

0 200 400 600 800 1000 metres

AMOCO AUSTRALIA PETROLEUM COMPANY

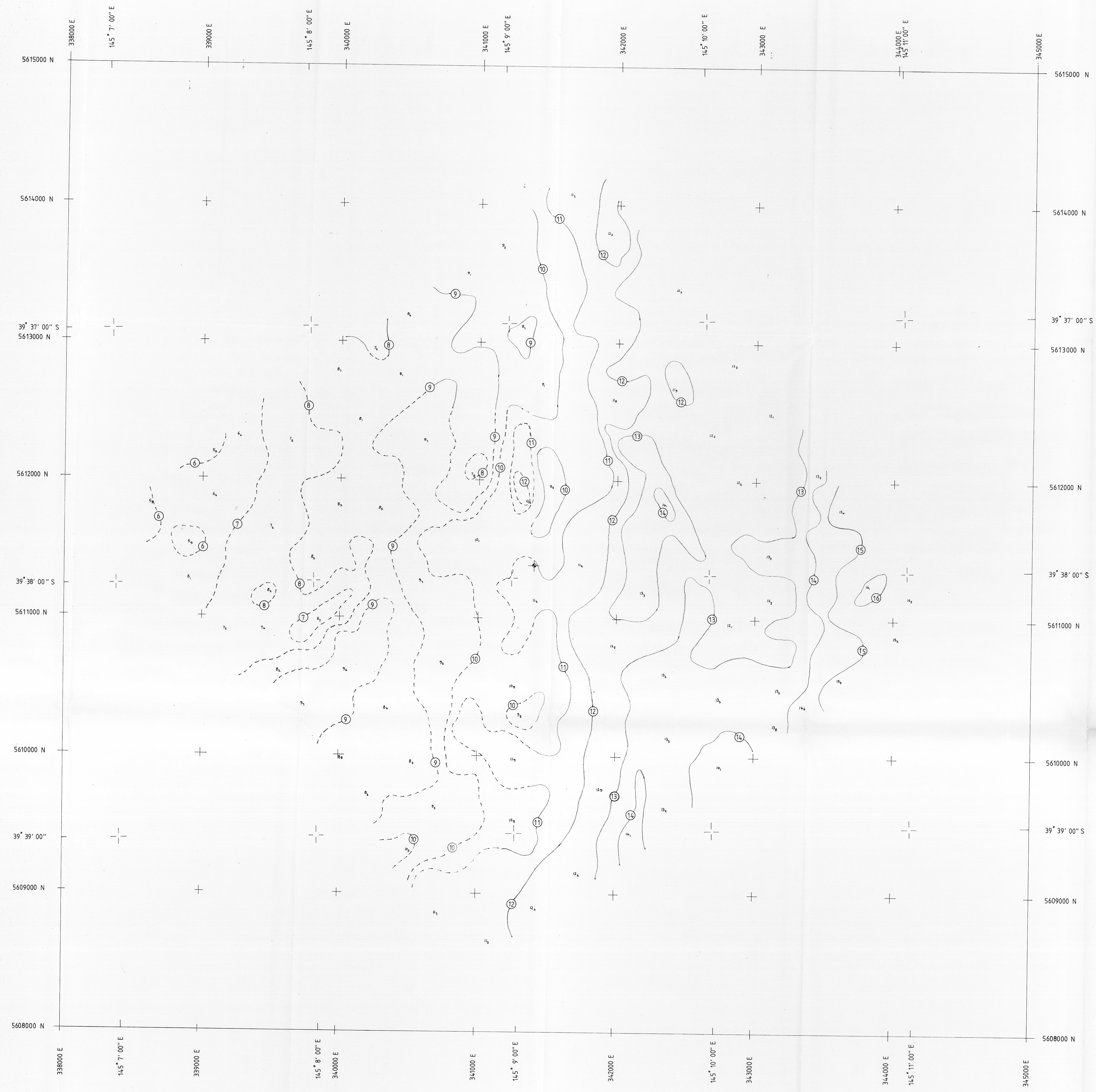
SITE SURVEY ON
LOCATION KOORKAH - 1

BATHYMETRIC PLAN

OR-0287 278088 MAP Nº 2

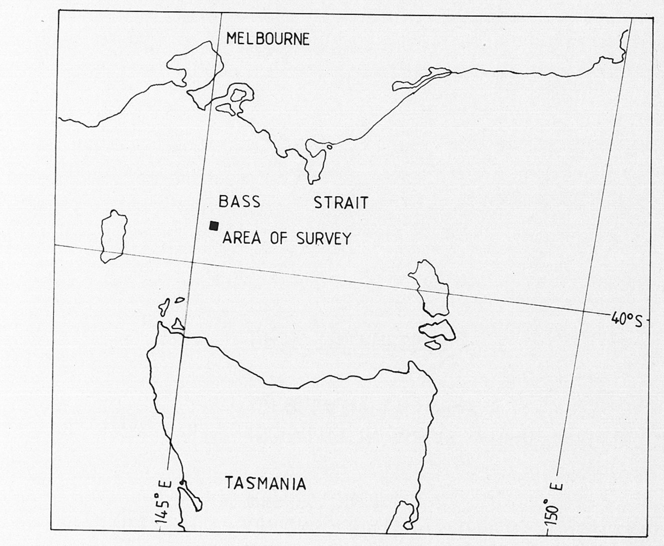
GEOMEX SURVEYS

JOB NUMBER
KO 88/85/AM



T.N.

LOCATION PLAN



LEGEND :

- PROPOSED KOORKAH LOCATION
  - GEOGRAPHICAL 39° 37' 57".11 S, 145° 09' 06".83 E
  - U.T.M. 5611379.8 m N, 341398.4 m E
- ISOPACHS (IN METRES) OF INTERPRETED UNCONSOLIDATED SEDIMENT OVERLYING REFLECTOR 1
- ISOPACHS IN AREAS WHERE REFLECTOR 1 IS RELATIVELY WEAK
- SPOT THICKNESSES

SURVEY DATA

DATUM	AUSTRALIAN GEODETIC
SPHEROID	AUSTRALIAN NATIONAL
PROJECTION	UNIVERSAL TRANSVERSE MERCATOR ZONE 55
CENTRAL MERIDIAN	147° EAST
FALSE NORTHING	10 000 000 m AT EQUATOR
FALSE EASTING	500 000 m AT C.M.

SCALE 1 : 10 000

0 200 400 600 800 1000 metres

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SITE SURVEY ON
LOCATION KOORKAH - 1

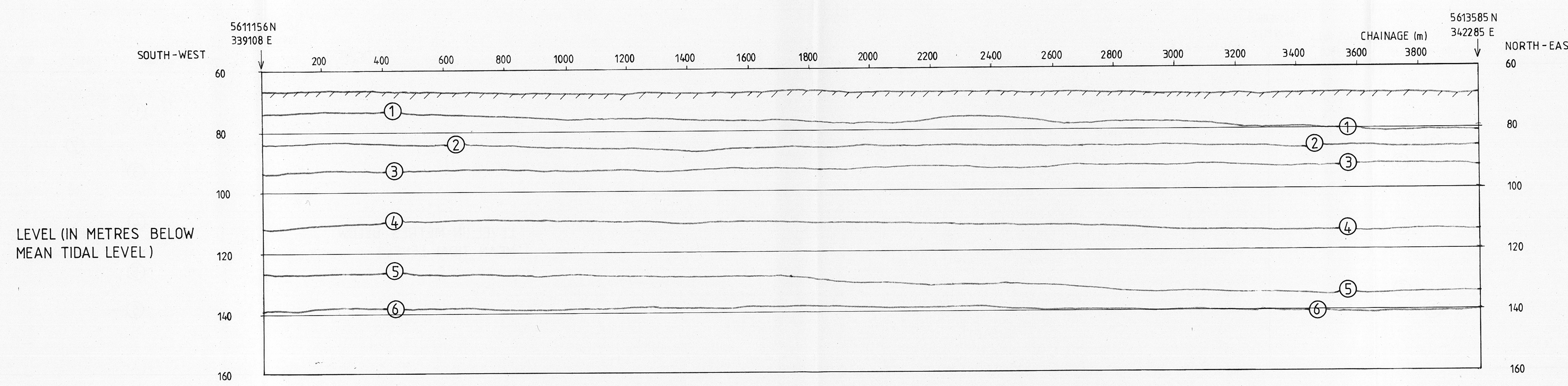
ISOPACHS OF SEDIMENT ABOVE REFLECTOR 1

OR-0287 278089 MAP N° 3

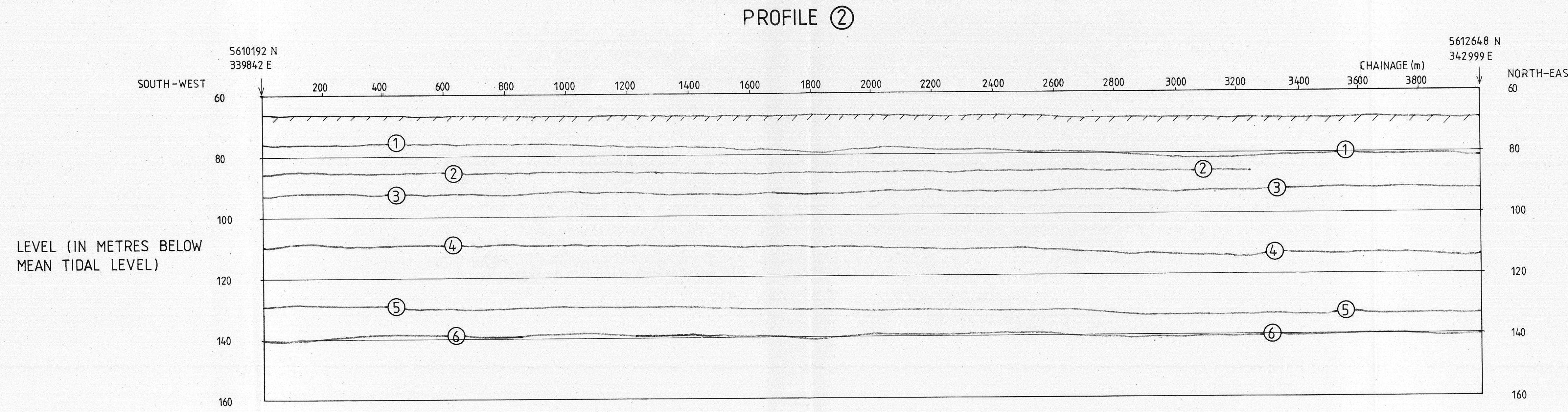
GEOMEX SURVEYS

JOB NUMBER
KO 88/85/AM

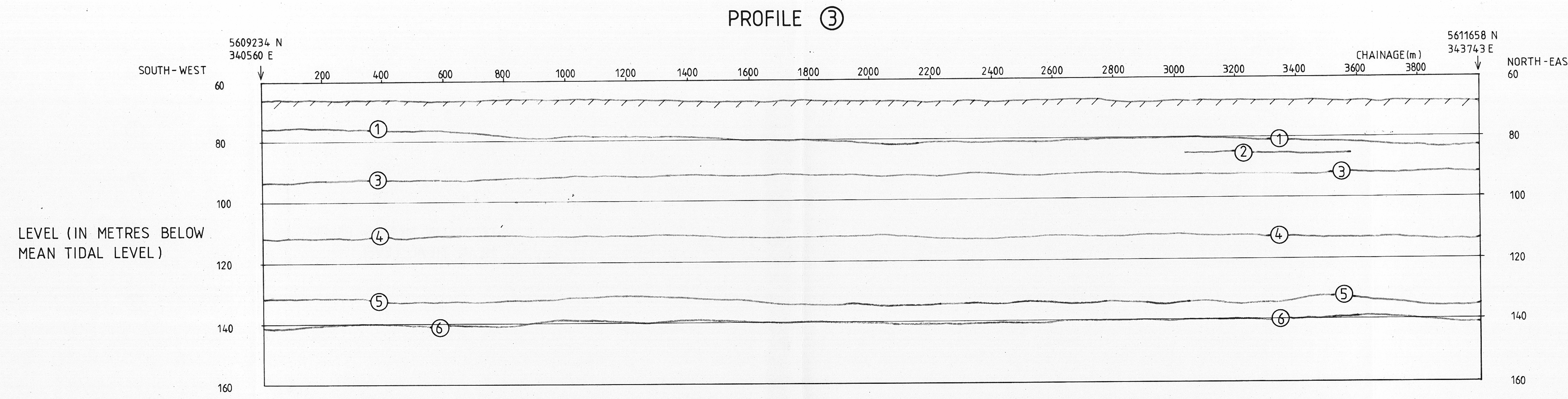
PROFILE ①



PROFILE ②

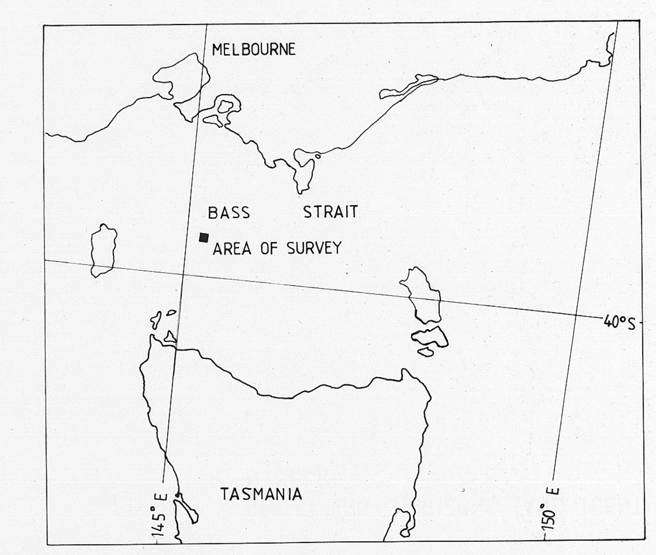


PROFILE ③



T.N.

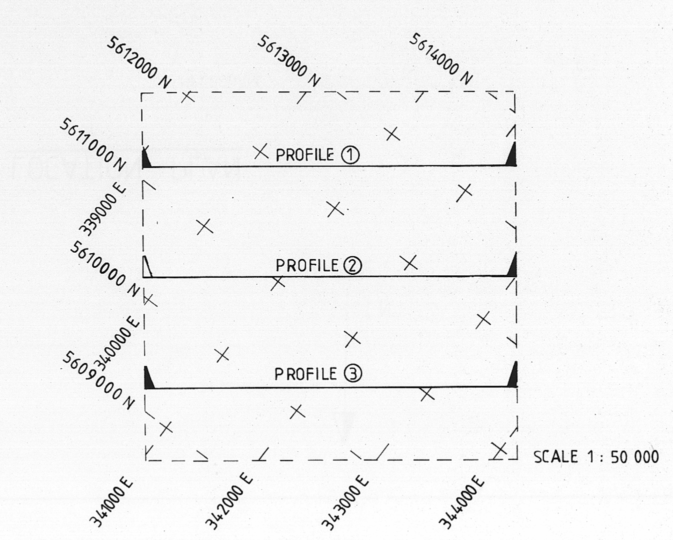
LOCATION PLAN



LEGEND :

SEABED

REFLECTING HORIZONS (AND IDENTIFYING NUMBER)



LOCATION OF PROFILES

SURVEY DATA

5 cm

DATUM	AUSTRALIAN GEODETIC
SPHEROID	AUSTRALIAN NATIONAL
PROJECTION	UNIVERSAL TRANSVERSE MERCATOR ZONE 55
CENTRAL MERIDIAN	147° EAST
FALSE NORTHING	10 000 000 m AT EQUATOR
FALSE EASTING	500 000 m AT C.M.

HORIZONTAL SCALE 1 : 10 000
VERTICAL SCALE 1 : 1000

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SITE SURVEY ON
LOCATION KOORKAH - 1

SEISMIC SECTIONS

OR-0287 278030 MAP Nº 4

GEOMEX SURVEYS

JOB NUMBER
KO 88/85/AM