

KOOMBANAH BAY WRECKS

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W.A. Museum



an investigation of the wrecks in the bay,
for the State Energy Commission of W.A.

OVERVIEW

The State Energy Commission of Western Australia is proposing construction of a new coal-fired power station at Bunbury, Western Australia. The new station, to be known as Bunbury 'C', will be located overlooking Koombana Bay adjacent to the existing Bunbury Power Station.

As part of its investigations for the Bunbury 'C' project, the Energy Commission has initiated a number of special studies into particular aspects of the environmental impacts of the project. An Environmental Review and Management Programme (E.R.M.P.) will be produced using data from these specialist studies.

This report deals with the shipwrecks of Koombana Bay, some of which were seen to possibly lie in the path of the proposed development.

THE OPPORTUNITY AFFORDED BY THE S.E.C. TO STUDY THE WRECKS OF KOOMBANA BAY IS AN EXAMPLE OF THE BENEFITS OF CLOSE INTERACTION BETWEEN CONSERVATORS AND DEVELOPERS

This working file on the Shipwrecks of Koombana Bay is a report to the Energy Commission and is intended also for the use of interested scholars and members of the public.

MIKE McCARTHY
DECEMBER, 1982

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Acknowledgements

Firstly, I must thank the State Energy Commission for funding this project and helping to bring together in this form, the documentation and history of the Koombana Bay Wrecks. I am also personally indebted to Messrs. Ken Allen and Ken Rayner of the Resources and Planning Division (S.E.C.) and to Mr. John Sullivan and staff of the Bunbury Power Station.

To the staff of the Department of Maritime Archaeology, W.A. Maritime Museum, who ably assisted, I extend my thanks - notably to Graeme Henderson, who generously made available his research for Unfinished Voyages Volumes 1 and 2 on which is based the history and list of wrecks in the Bay (Appendix I), and to Jeremy Green who gave freely of his advice and assistance on the subject of magnetometers. I am also thankful for his help in setting up the search area and in locating the Carbet Castle wreck from early aerial photographs. Thanks are also due to Pat Baker and Brian Richards (photography), Colin Powell (carpentry), Ian Field, Myra Stanbury and Paul Hundley for their assistance on site. Thanks also to the publications branch W.A. Museum for printing the cover which was produced by Chris Buhagiar of the M.A.A.W.A., and special thanks to Sue Cox and Lucy Marchesani, W.A. Museum for their efforts in typing this report.

Volunteer field assistance was rendered by graduate students in Maritime Archaeology, Mark Staniforth, Steve Cushnahan and Nic Clark and their reports appear in Appendix 2. Joan Sewell and Marion Richards also assisted in the field as did Mr. Phil Smith of Bunbury.

Those Bunbury residents who assisted were Mrs. L.E. Wallace, (Bunbury Historical Society); Mr. Leo Sophilis and Trevor Scanlan of Cable Sands Mining Co.; Captain Bob Alsop and staff, (Harbour Master); Mr. G. Baxter, (Bunbury Historical Society) and Mr. S.J. Campbell who, through Miss Clifton, allowed us to record sections of his grandfather's (E.H. Withers) diary on the early events in Koombana Bay.

Advice and assistance was also provided by Dr. John Penrose and Mr. Norm Uren of the Physics Department (W.A.I.T.), Messrs Don Edwards, Bruce Melrose and Jack Austen (aerial photos) and Messrs. Riedel, Byrne and Imrie of the Consulting Engineering firm of Riedel and Byrne.

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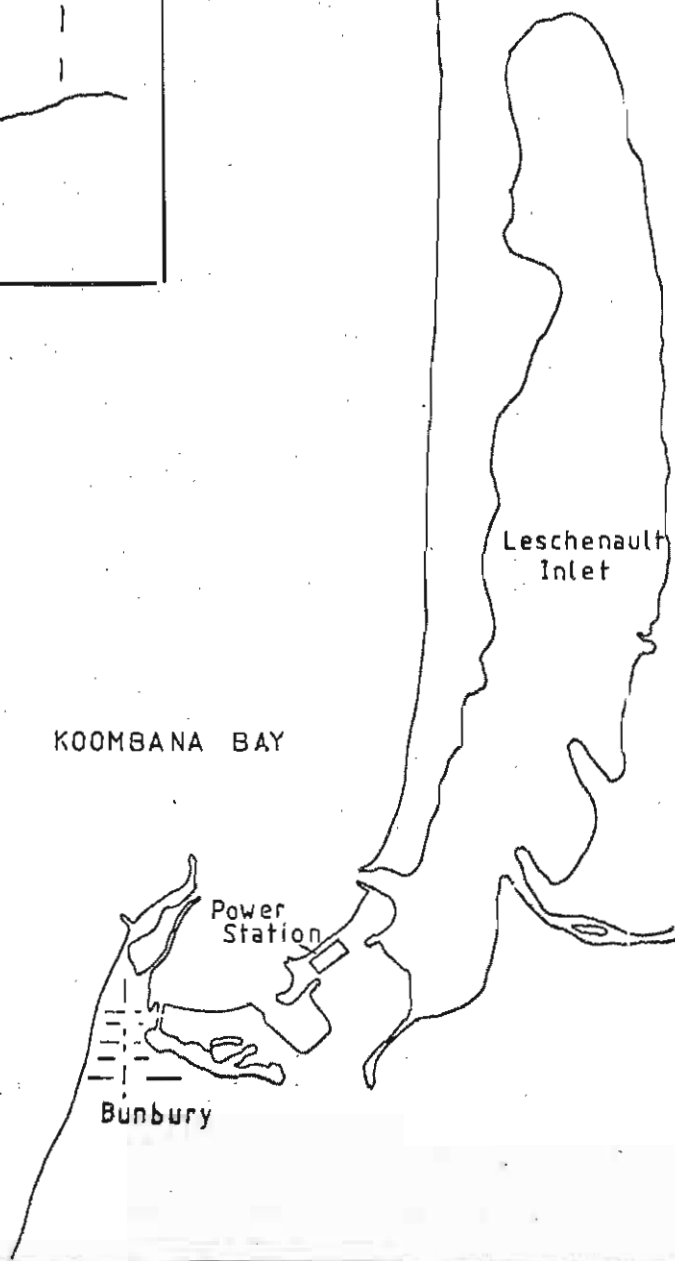
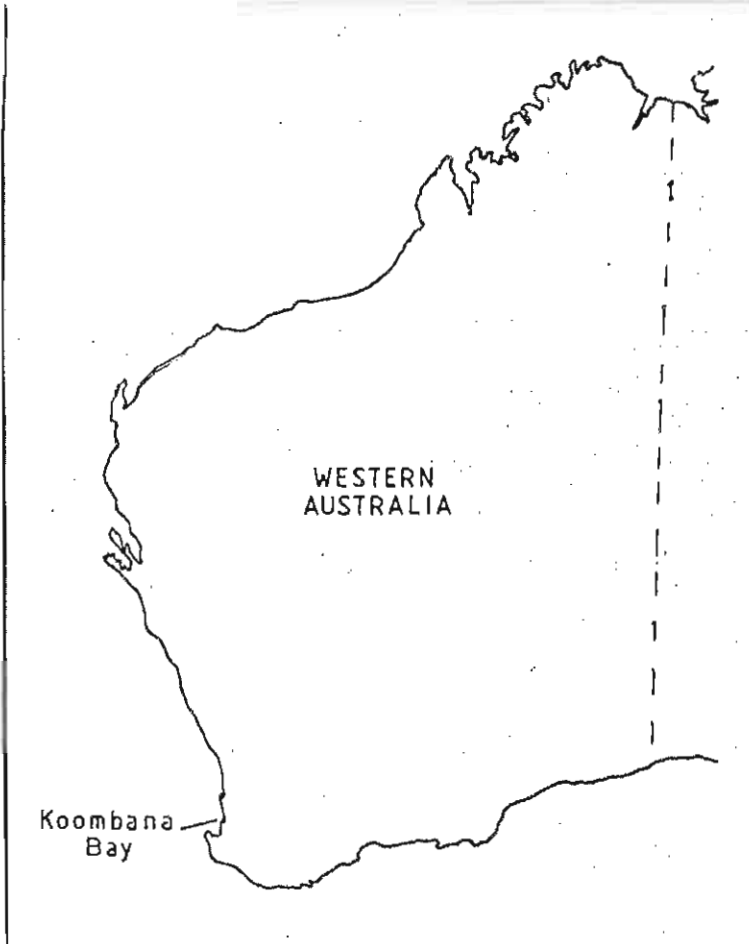


fig.1

FIGURE 2

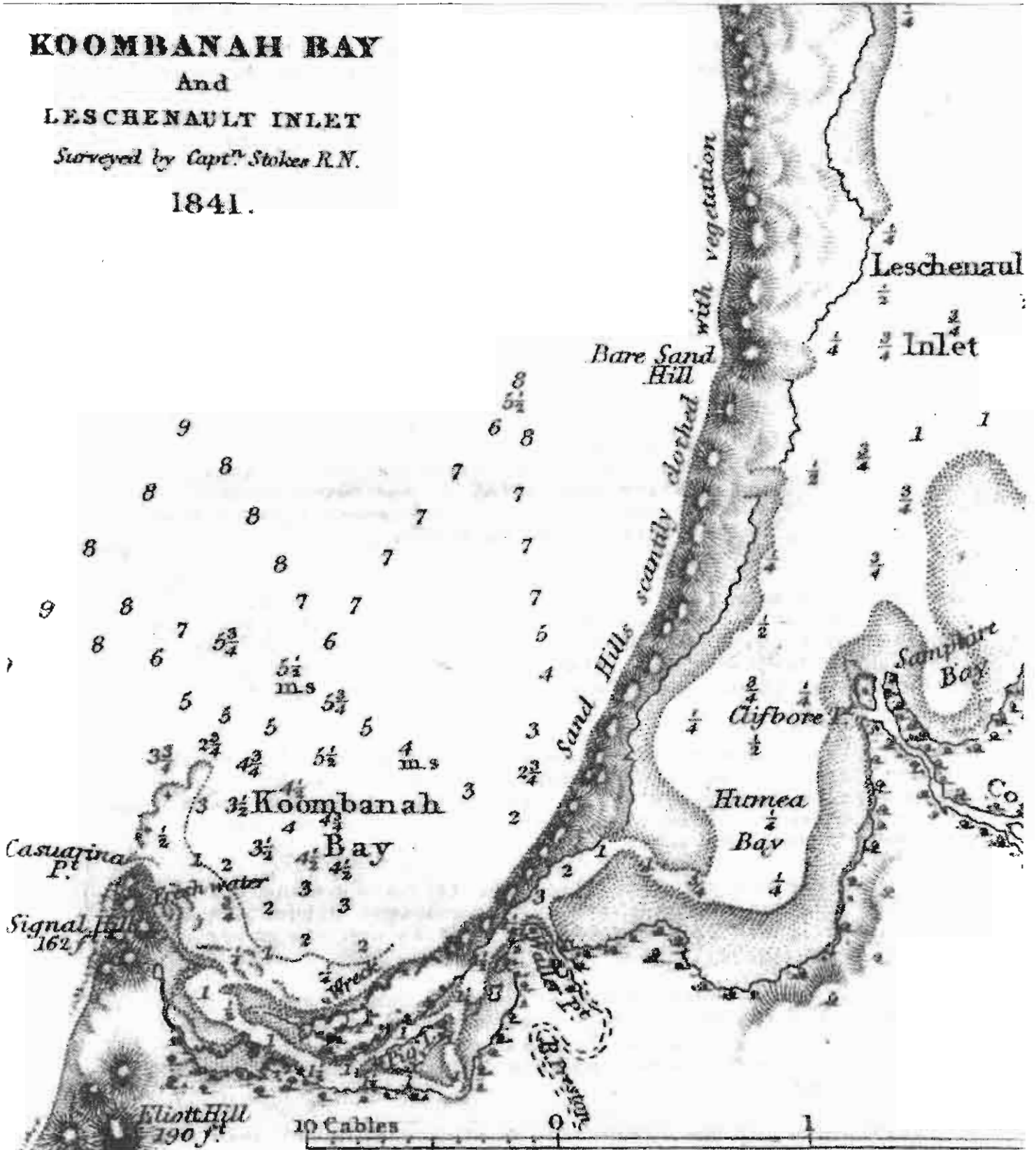
KOOMBANAH BAY

And

LESCHENAULT INLET

Surveyed by Captⁿ Stokes R.N.

1841.



(3) HISTORICAL BACKGROUND

The known maritime history of the Bunbury region (Fig. 1) begins with the discovery and mapping of the Bay by the French explorers in 1803 (1).

The area was duly named Port Leschenault and from then till the beginning of permanent settlement in the region in 1838, the area saw little known European activity.

The American whalers, however, became frequent visitors to the coast and the first recorded wrecks in the Bay occurred in 1840, when the whalers Samuel Wright and North America were driven ashore in the same storm.

These wrecks and those following, showed that despite the protection of a large surf covered reef with a small gap at Casuarina Point, the Bay was a suspect Port in northerly gales (Fig. 2). This failing was noted by Wickham and Stokes of HMS Beagle for they recorded during their visit in 1841, that:

"This does not appear to be a very secure port as when we passed in the Beagle at a wide distance from Point Casuarina two American whale ships were lying on the beach having been driven from their anchorages a short time before during a NW gale" (2).

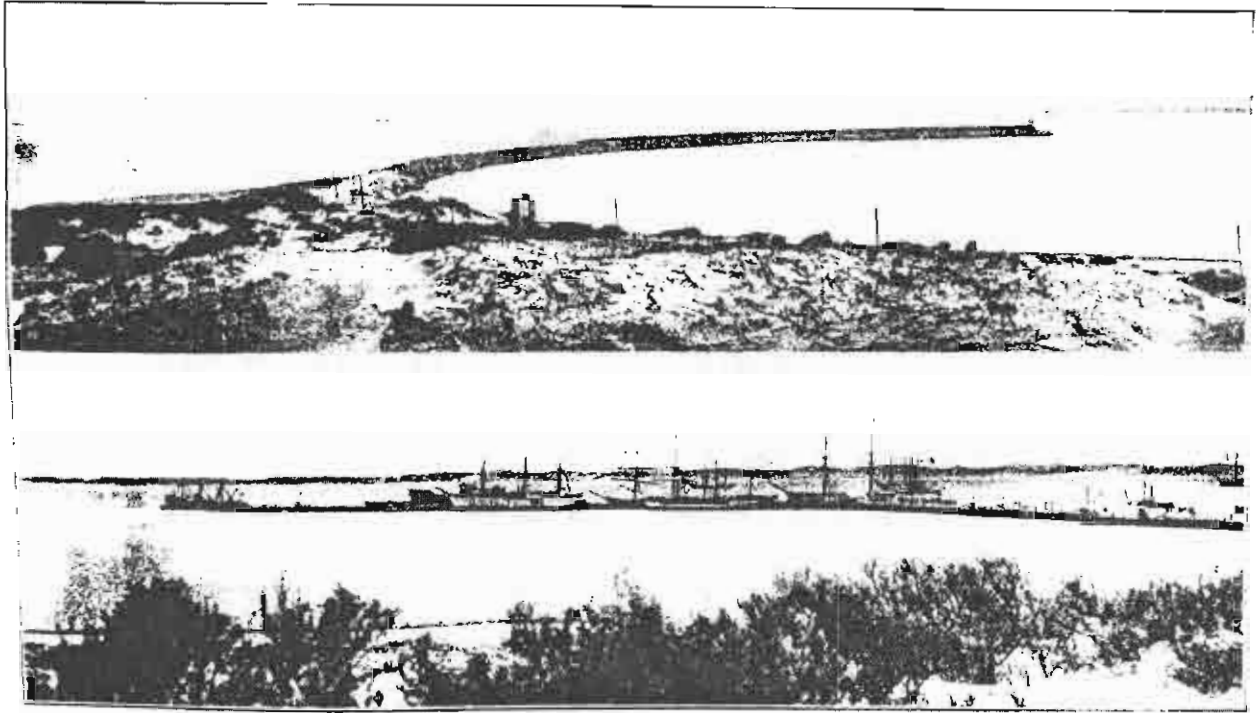
Visits to the port by the American whalers and colonial vessels continued, however, but it was not till 1864 that the benefits of a jetty was offered to visiting ships (3). By that time a further whaler also called North America and 3 other vessels joined the Samuel Wright and North America ashore.

The jetty was further lengthened and upgraded over the years and in 1896 following many complaints and a further 10 shipwrecks, a breakwater was established at Casuarina Point affording greater protection to the harbour and the vessels clustered around the jetty (Figs. 3, 4 & 5).

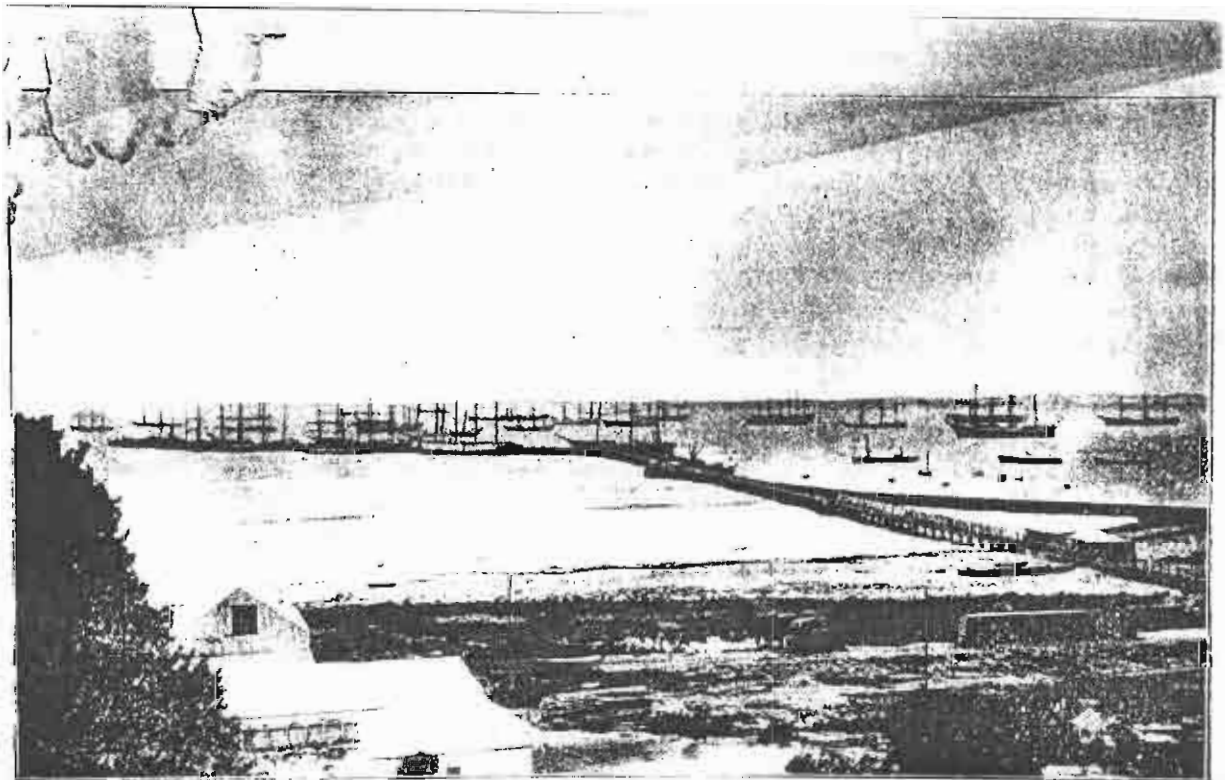
The breakwater was not completed till 1899 and during its construction, Bunbury's largest wreck the iron barque Carbet Castle (1897), was driven ashore on what is now the power station beach.

Despite the improvement to the situation, the losses continued till the early 1900s with the Solglyt of 1901 and Laughing Wave of 1903 being the last major losses in the history of the port. (See Appendix I for a detailed history of each wreck).

The development of the breakwater at Casuarina Point (and its



Bunbury Harbour and Breakwater In Quiet Times.



Bunbury Harbor At a Busy Period.

many additions and extensions) was an obvious boon to seafarers, but soon began to cause the harbour authorities some considerable problems.

The closing of the gap at the Casuarina Point Reef and the extension of the breakwater caused a beach front accretion in the head of the Bay and an erosion of the beach to the north (Figs. 6 & 14). The following extract illustrates the problem more clearly:

"After the completion of the last extension of the breakwater and jetty in 1918, it was discovered that serious siltage was occurring at the head of the breakwater. Further accretion was also observed at the river mouth and, on a survey being made in 1926 and then compared with one made in 1903, a rather surprising change in the coast line was discovered. Severe erosion of the coast hills had taken place with corresponding accretion towards the estuary mouth." (4).

The main result of these dramatic shoreline changes (from the perspective of historic shipwrecks) has been to leave those vessels cast ashore on the beach near the estuary mouth now quite some distance inland and often under some metres of sand.

The shoreline has also been greatly altered by harbour works partly designed to help limit the effects of the problem above. They are explained more fully in a report by the Consulting Engineering firms of Riedel & Byrne Pty Ltd (5). In summary they are, the excavation of the northern "cut" in 1951, the associated plugging of the estuary mouth in 1952, the dredging of the inner harbour 1969-75 and the excavation of the southern "cut" (now Koombana Channel) in 1973.

During this latter activity, a wreck believed to be the remains of the Solglyt (1901), was uncovered and later destroyed (see Appendix I).

The building of the Groyne now situated just south of the power station in 1934-6 was also a part of these harbour schemes and served to help slow the movement of sands from north to south. The resultant build-up of sands north of this groyne engulfed the wreck of the iron Carbet Castle mentioned above, and formed the power station beach as it now appears.

The plugging of the estuary in 1952 also served to connect the town of Bunbury with what previously had always been referred to as the north shore (Fig. 7).

This area of coastline from Point MacLeod northwards was heavily mined for mineral sand deposits by the Cable Sands

KOOMBANA BAY
SHORELINE CHANGES
1896 TO 1980

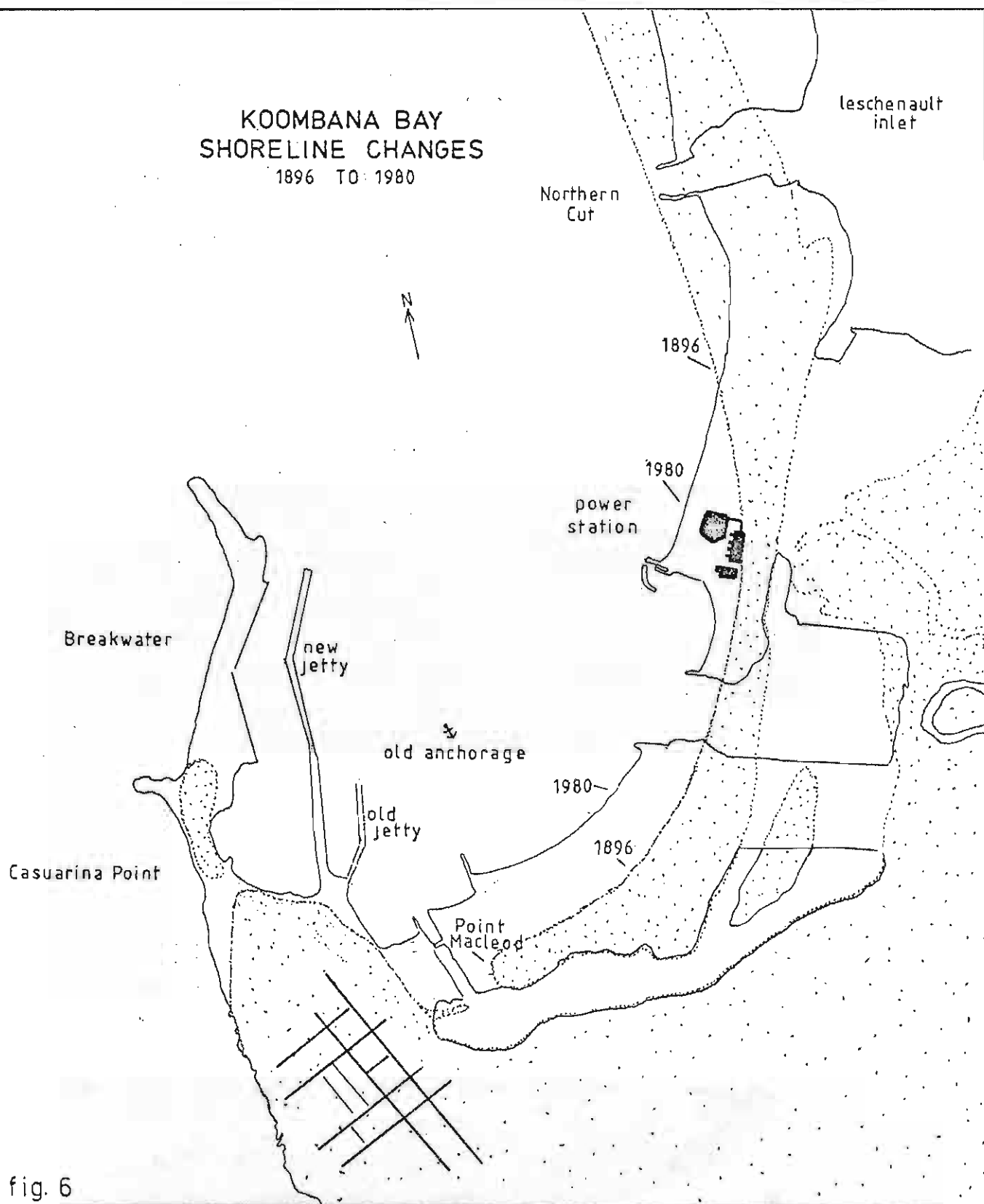


fig. 6

Mining Company whose lease occupied most of the North Shore from Point MacLeod to Turkey Point (Fig. 9).

In the course of the subsequent mining activity in 1962-63, one American whaler (probably the North America) (Fig. 8) and 3 other unidentified sites were found. (Appendix 1, (iii)). Three of these sites were wooden with wood frames and copper and/or copper alloy fastenings and one was a vessel with a wooden hull and iron knees (or deck supports).

Figures 9 (a) & (b) show the areas mined by this company. These can be seen to include most of the North Shore excepting that area now occupied by the golf course, Koombana Bay Caravan Park, the Power Station site, and Cable Sands Mining Company land. Thus, a total of 6 wrecksites were then known to local residents but their positions were not fixed. With the passing of time, their remains were covered and the locations all but forgotten.

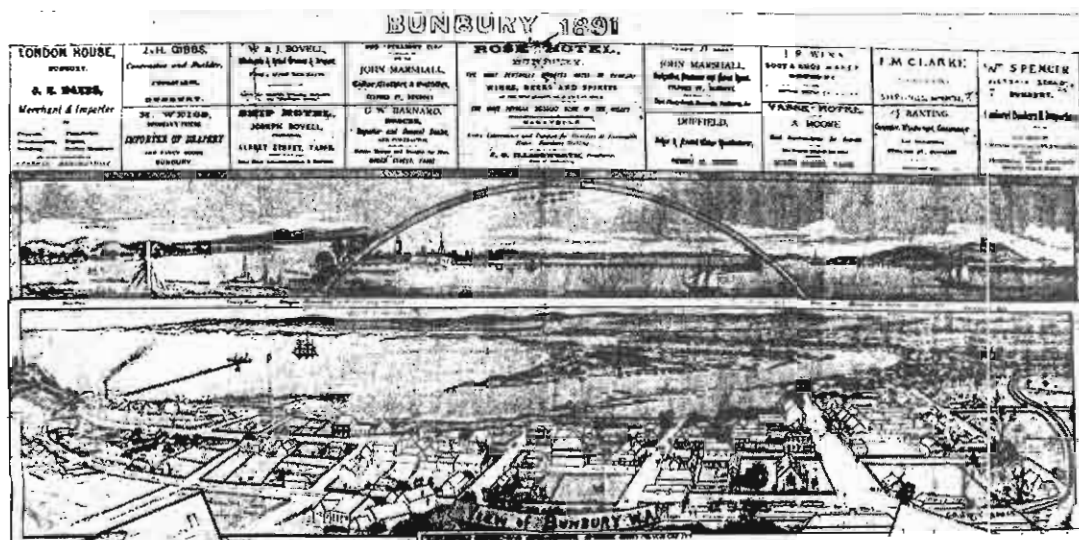
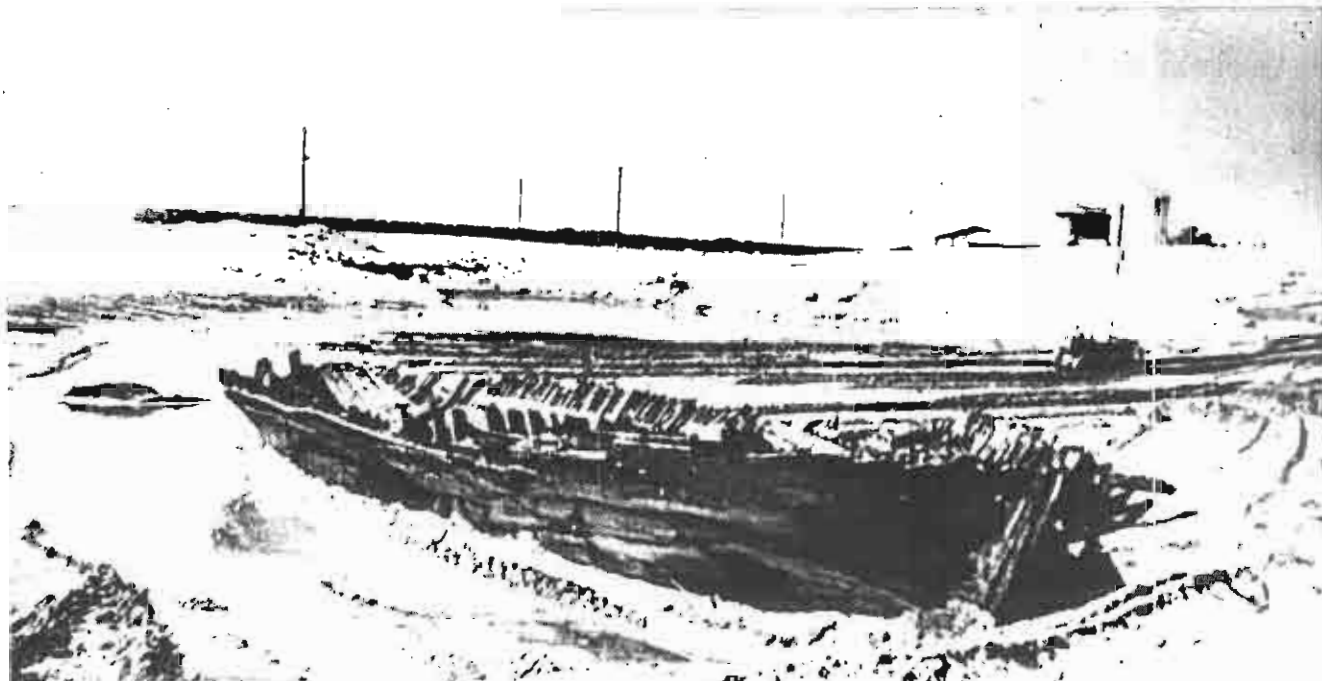


Fig. 7

Fig. 8



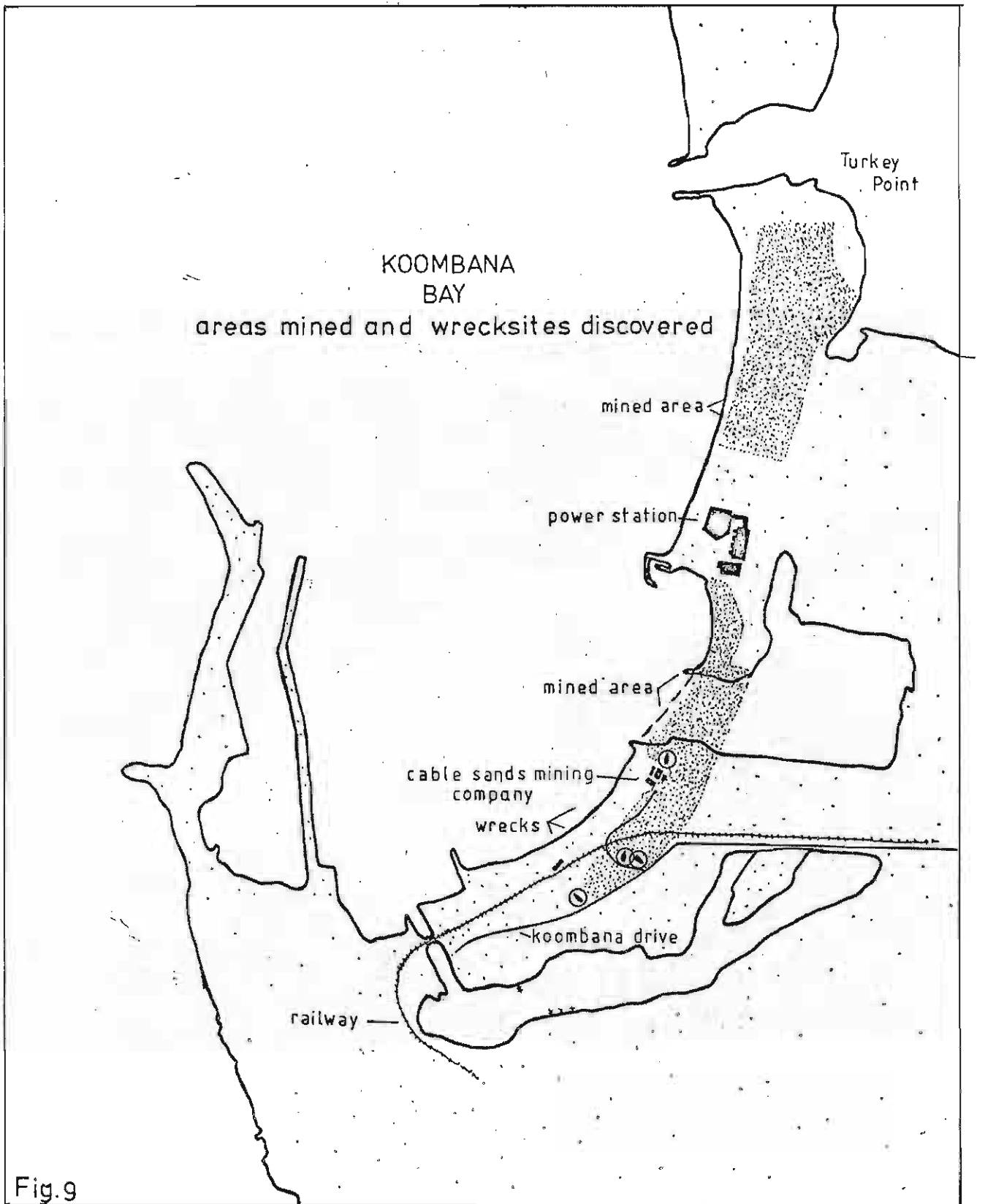
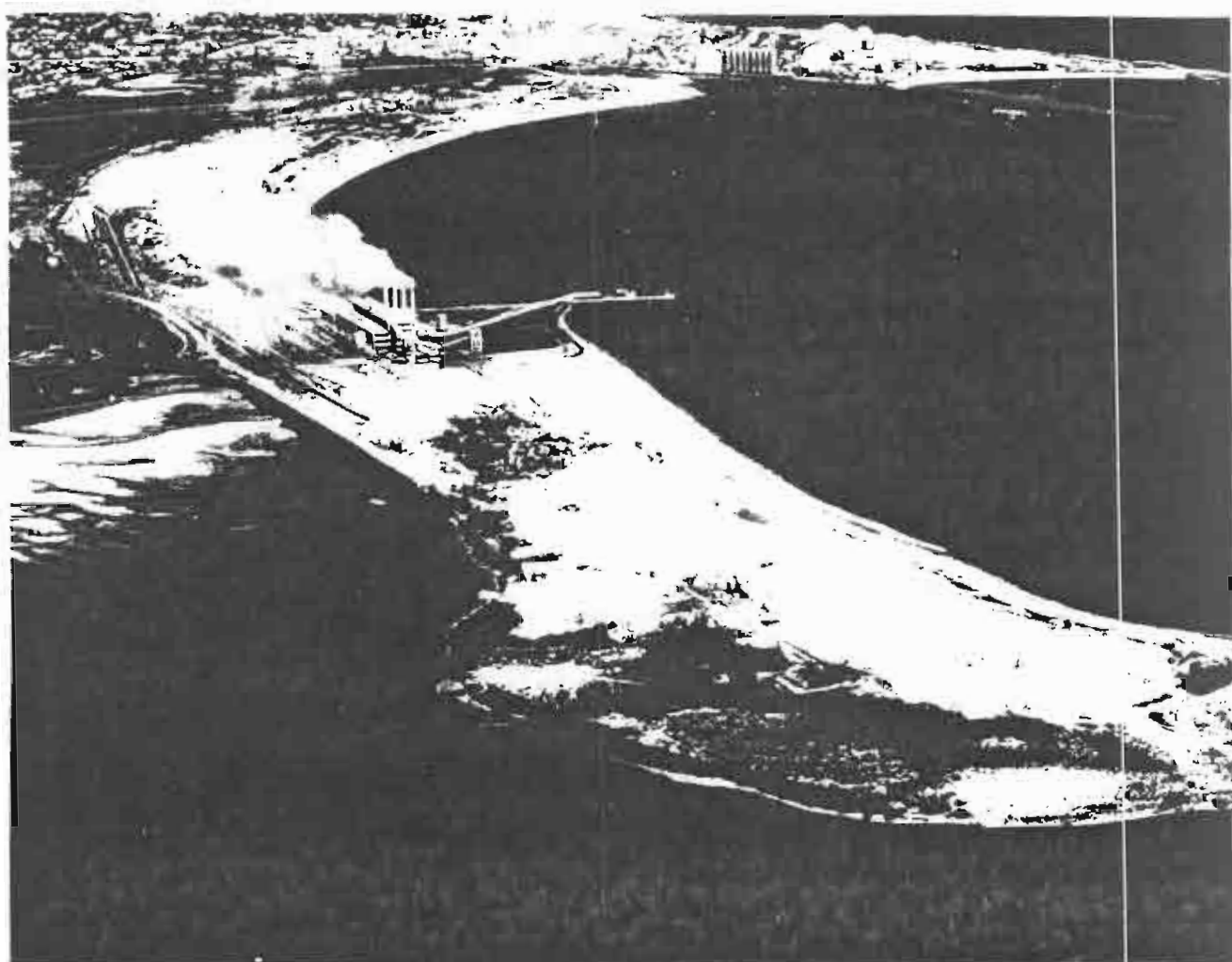


Fig.9

Fig. 9b



THE BUNBURY POWER STATION PROJECT

The Approach to the W.A. Museum:

In November 1980, the W.A. Museum was approached by the firm of T.D. Meagher and Associates (Ecologists) who were doing a preliminary environmental study for the proposed Bunbury 'C' Power Station development.

They sought information as to "the status and location of historic wrecks which might be disturbed by possible earthworks during the construction of the proposed power station". (6)

They were informed, however, that wrecks had been found (7) before the advent of protective legislation (8) and that their position was not recorded before they were covered up. They were also informed that it was quite likely that historic wrecks could lie in the path of the proposed construction work but the documentation available at the time was not sufficient to enable them to be pinpointed.

In April 1981 a sketch of the area of proposed development was sent from the Resources and Planning Section of the Energy Commission asking for further details of wrecksite locations. It was also indicated that site work would probably commence some time in 1982.

The Submission to the Energy Commission:

Having had experience in a similar wrecksite location and identification project in Jervoise Bay near Fremantle (9), this author was allocated the project.

A submission was made and presented to the Energy Commission in July 1981 outlining 4 major project aims.

In the light of the limited information available to the Museum on the location of the Koombana Bay Wrecks, these aims were:

- (a) to locate the Bunbury Wrecks in the path of the extension to Bunbury Power Station Stage C (Koombana Bay);
- (b) to identify each site;
- (c) if necessary, excavate and remove non-historic sites endangered;
- (d) if necessary, excavate, remove and/or preserve and stabilise historic sites endangered.

A magnetometer search of the areas to be developed was proposed with a view to locating the sites.

Pending the subsequent identification of any newly found site as an historic wreck, a number of contingency plans were also proposed. One involved the relocation or removal of the site(s) and associated artefacts. The other was to explore the possibility of altering the proposed power station design to thus avoid destroying the wrecks found.

A list of all known wrecks and casualties in Koombana Bay was included in the submission and was supplied by Graeme Henderson, Curator of Maritime Archaeology and Head of the Colonial Wreck Section. This list is based on research currently being published as "Unfinished Voyages", a chronological history of shipwrecks on the Western Australian coast from 1622 to the Modern Day (10). The list shows a total of 29 casualties in Koombana Bay from 1840-1908 with 20 vessels actually sunk or driven ashore.

On the basis of numbers alone, the possibility of a wreck lying on Energy Commission land seemed high.

The costings and time allocation embodied in the submission were accepted by the Energy Commission in July 1981 and were based on a budget ceiling of \$3000 with an approximate time span of one year till the completion of the report now presented.

A List of Known Wrecks:

The list supplied by Graeme Henderson is as follows:

1. SAMUEL WRIGHT (reported wrecked ashore 1840)
2. NORTH AMERICA (reported wrecked 1840)
3. NORTH AMERICA (reported wrecked 1843)
4. ELIZABETH (wrecked ashore 1843)
5. PERSEVERANCE (reported wrecked 1845)
6. ANTELOPE (reported wrecked 1845)
7. LASS OF GERALDTON (wrecked 1867)
8. MIDAS (wrecked at jetty 1872)
9. ANNIE M. YOUNG (wrecked ashore 1876)
10. MAY (driven ashore 1876)
11. TWILIGHT (blown into the estuary and remained there)
12. IONE (reported wrecked 1897)
13. CITIZEN OF LONDON (wrecked 1880)
14. CINGALEE (wrecked ashore 1887)
15. STAR OF THE SOUTH (stranded 1888)
16. AGRA (wrecked 1895)
17. CARBET CASTLE (wrecked ashore 1897)
18. SOLGLYT (wrecked ashore 1901)
19. AURORA (damaged 1901)
20. GERS (damaged 1901)
21. SILAS (damaged 1901)
22. BONANZA (damaged 1901)
23. ROBERT SCRAFTON (leaking 1902)
24. DAABLONE (damaged 1903)
25. DOLPHIN (ashore 1904)
26. MANOR (casualty 1905)
27. SEQUE (struck bottom 1906)
28. HAMPTON (grounded 1908)
29. LAUGHING WAVE (wrecked at jetty 1903)

An historical description of all twenty-nine casualties in Appendix I. The background and fate of each vessel is also included and an examination of that background material shows that many of the casualties suffered only minor damage. Of those 20 vessels actually wrecked, many were either refloated or were small enough to have been totally removed by contemporary salvagers. Of those twenty only twelve are now likely to remain in some form along the shores and on the beach at Koombana Bay (see Appendix I).

The Remaining Wrecks are:

1. SAMUEL WRIGHT.....1840
2. NORTH AMERICA.....1840
3. NORTHAMERICA.....1843
4. ELIZABETH.....1843
8. MIDAS.....1872
9. ANNIE M. YOUNG.....1876
13. CITIZEN OF LONDON...1880
14. CINGALEE.....1887
15. STAR OF THE SOUTH...1888
17. CARBET CASTLE.....1897
18. SOLGLYT.....1901
29. LAUGHING WAVE.....1903

In the wrecking process, vessels often sank quickly into the sand, near the surf line and with the abating of the storm they were often found buried in sand up to the turn of the bilge, but otherwise apparently unharmed.

If not refloated quickly, the influx of sand and seawater as the hull planking eventually sprung, ensured the entrapment of artefacts and equipment thrown down into the bilge as the ship drove ashore.

Smaller ships and their timbers would be gradually broken up by the seas and were, therefore, easily accessible for salvage but the larger hulls often buried in the beach sands and in many cases they contain artefacts of value to archaeologists, historians and the general public.

The attractions of dressed timber, copper, iron work and other items however, ensured almost complete salvage of those materials accessible to the early settlers (see Wither's Diary in Appendix I). Thus, wrecks were often left with little remaining above the water line, and as the ship sank into the beach sand, only that section buried too deep to warrant the effort of salvage now remains.

Of those 12 vessels listed above as still remaining as wrecks in the bay, the American wrecks (Samuel Wright 1840, North America 1840 and North America 1843) have aroused most public interest and are a most valuable archaeological and historical asset to the State.

The visits of these Yankee Whalers to our coast are well documented and their impact on the development of the south west region in terms of the frequency of their visits and the resulting trade and social effects are well known. Dakin (11) claims that in 1841 there were nearly 300 American and French whalers operating along the southern shores of Australia with the South West coastal region being often visited. Wace and Lovetts research (12) tends to support this view. They also provide a comprehensive and invaluable reference source for further study of the 602 visits by American vessels to the Australian coast up to 1850.

The visits to Koombana Bay itself were no less frequent with J.S. Battye (13) recording the visit of 28 vessels (excluding coasters) to Port Leschenault from January the first to March the thirty first 1841 and of those, twenty four were American whalers.

Of the 8 known American whalers wrecked on the Western Australian coast, three are preserved on land and under sand here at Bunbury. They lie, apparently, within a short distance of each other and are, it appears, in a good state of preservation. The Bunbury Whalers are of significance then to the local region, the State and to any archaeological study of this aspect of worldwide maritime activity.

The remaining sites represent a broad cross section of 19th century shipping and while in themselves not unique, once located, they will provide a valuable and easily accessible resource for future scholars, historians and should provide useful display material for the general public.

Given then that the sites do not hinder vital development or public works then their documentation and preservation in situ would be a valuable legacy to the future.

The Legal Situation:

Apart from the common sense in not allowing unnecessary damage as outlined above, there are, however, legal strictures preventing the destruction of historic wrecksites.

In Western Australia there are two Acts under which such sites are protected:

- (1) the maritime Archaeology Act of 1973 (State Waters)
- (2) the Historic Shipwrecks Act of 1976 (Federal Waters)

The Act applies to State water and lands and the Bunbury wrecks being mainly now above low water mark and in a bay, are within that region.

Under the terms of the State Act all ships wrecked before 1900 are deemed to be protected sites and therefore, cannot be interfered with without the consent of the Trustees of the Western Australian Museum.

The relevant clauses are:

Page 2 "Historic Ship means any ship that before the year 1900 was lost, wrecked or abandoned, or was stranded on or off the coast of Western Australia".

Page 3 A Maritime Archaeological site may be situated below low water mark, on or between the tide marks, or on land, or partly in one place and partly in another".

Page 5 Section 8

(1) A person who -

(a) without the consent of the Trustees, in any way alters, removes, destroys, damages or in any way deals with, or assumes the possession, custody or control of, any maritime archaeological site, ship, relic or thing vested in the Museum on behalf of the crown pursuant to this Act; or

(b) having the consent of the Trustees to do any of the things mentioned in paragraph (a) of this subsection, is in breach of any condition to which the giving of the consent was subject; or

(c) impedes or hinders, or endeavours in any way to impede or hinder, any member of the staff or employee of the Museum or any person acting with the authority of the Trustees who is inspecting, recovering or otherwise dealing with any such site, ship, relic, or thing, commits an offence.

Penalty: Two thousand dollars or imprisonment for twelve months or both the fine and imprisonment.

Of the 12 known sites, therefore, 10 are automatically protected sites and have been so since the provisions of the 1973 Maritime Archaeology Act came into force.

The question arises then as to whether any of these protected historical wrecks lie in the area of proposed development.

AN ANALYSIS OF THE POSSIBILITY OF WRECKS LYING ON THE POWER
STATION LAND:

The proposed area for development indicated by the Energy Commission is shown below (Fig. 10) and includes not only the Energy Commission land but also a small section of the foreshore opposite and a part of the inner harbour used for a cooling water intake.

An examination of aerial photographs of the area and of the early charts available, show that area (A), the cooling water intake will not be a source of any historic wrecks. It was originally a part of the inlet to Leschenault Estuary and is situated behind a ridge of high sand dunes visible on Stokes chart of 1841 and on a later chart of 1896 (14). Vessels wrecked on the shores of Koombana Bay opposite, could have been driven in severe storms up to these sand dunes but certainly not beyond into the estuary itself.

The area (B) between the sandhills and the foreshore is clearly shown in a photograph (15), supplied by the Cable Sands Mining Company, as having been extensively mined and could not, therefore, be a source of historical wrecks.

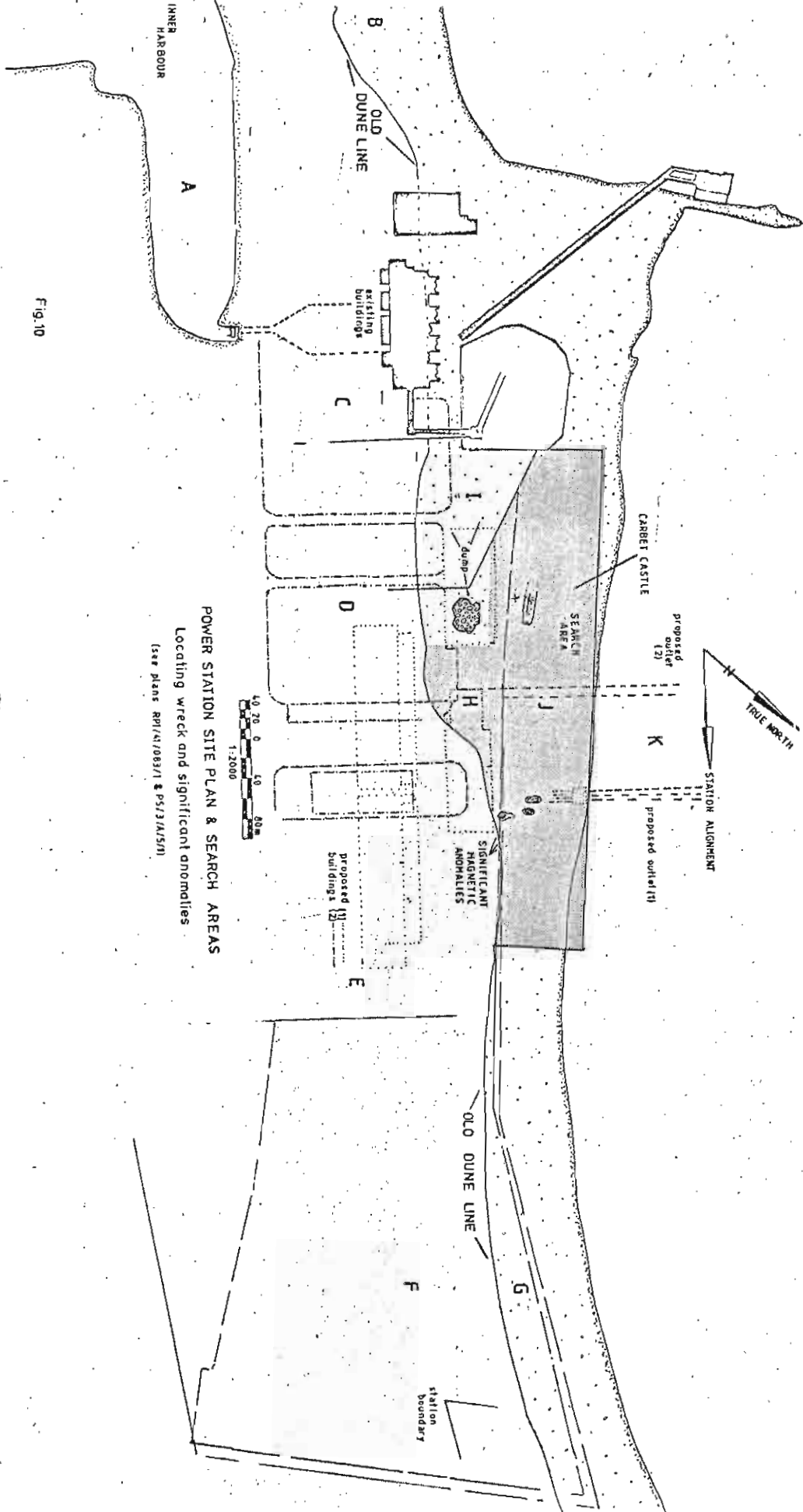
The area excavated for the inner harbour also lies in this mined section south of the Power House and as expected yielded no apparent wrecks. Areas (C), (D) & (E) lie also on and inland of the old dune system and are not possible wreck site locations.

Areas (F) & (G) have been mined by the Cable Sands people (Fig. 9), leaving areas (H), (I), (J), & (K) to be searched for historic wrecks.

Area (I) lies within the present S.E.C. boundary fence and being a relatively small area enclosed with an iron mesh fence within which lie numerous metallic dumps and structures was not searched for reasons soon to become apparent (see discussion on Magnetometers following).

Area (K), the site of the proposed cooling water outlets, was not searched, being within the region of beachfront accretion and therefore, an unlikely position for wrecks lost prior to the beach changes. These changes, according to Riedel & Byrnes' analyses, post-date the development of the power house groyne in 1936 and any wrecks lost before 1900 would, therefore, now lie onshore or inland due to the beachfront accretion. The finding of the 1657 ton Carbet Castle (1897) over 100 metres inland on this section of beach illustrates this point clearly.

An examination of soundings taken offshore in this region in 1896 show an even underwater profile with no offshore bars or reefs. There is then, absolutely no possibility of a vessel smaller than the Carbet Castle (the largest wreck in Koombana Bay) lying anywhere but inshore of that wreck.



POWER STATION SITE PLAN & SEARCH AREAS
 Locating wreck and significant anomalies
 (see plans RP/41/083/1 & PS/3/4/5/1)

Fig. 10

A more efficient method, however, is to set out a permanent (or recoverable) grid system and to plot the readouts back at base for and the purposes of providing a contour map. This map when drawn, shows graphically the position, size and characteristics of the anomalies which can then be relocated and investigated. If considered necessary, a profile (section) through the contours can also show the anomaly "signature" of the object found and this can be compared with known examples. By comparison with known signatures and by the application of suitable formulae. The anomaly width, height and gradient can also be used to give more information as to the magnetic source such as depth and type of source. (see Fig. 12 for an example of a contour map and section through a magnetic anomaly).

By this means then was it hoped to locate any historic vessels containing enough iron work to register above the background magnetic noise in the area is to be searched.

In the search proposed the search targets vary, however, from an iron ship in excess of 1000 tons, to wooden vessels with iron knees, through to all wooden ships with wooden and copper fastenings. After salvage of the ground tackle e.g. anchors, it is apparent that these latter vessels would have virtually no iron work at all and would be the source of relatively small magnetic anomaly. The Cingalee (Appendix I) and the American whalers being wooden framed and copper fastened obviously fit this category.

Limitations of Magnetometers:

Background magnetic noise, however, arising from magnetic geological ferros such as igneous rocks (particularly basalt) and mineral sands deposits render it difficult to detect small subtle anomalies.

Unpredictable daily (diurnal) variations in the earths magnetic field itself can also cause some problems, but these can generally be accounted for.

The north shore of Bunbury unfortunately was and is, an obviously rich source of black sand deposits associated with ilmenite and being magnetic (17) and wide spread, these deposits were later seen to badly effect the sensitivity of the search.

The rock seen throughout the south-western section of the search area also presented similar background problems and reduced sensitivity.

As the search progressed it became readily apparent that wooden wrecks such as the American whalers would be masked by these effects and that the search aims must be limited to finding vessels with measurable iron work present.

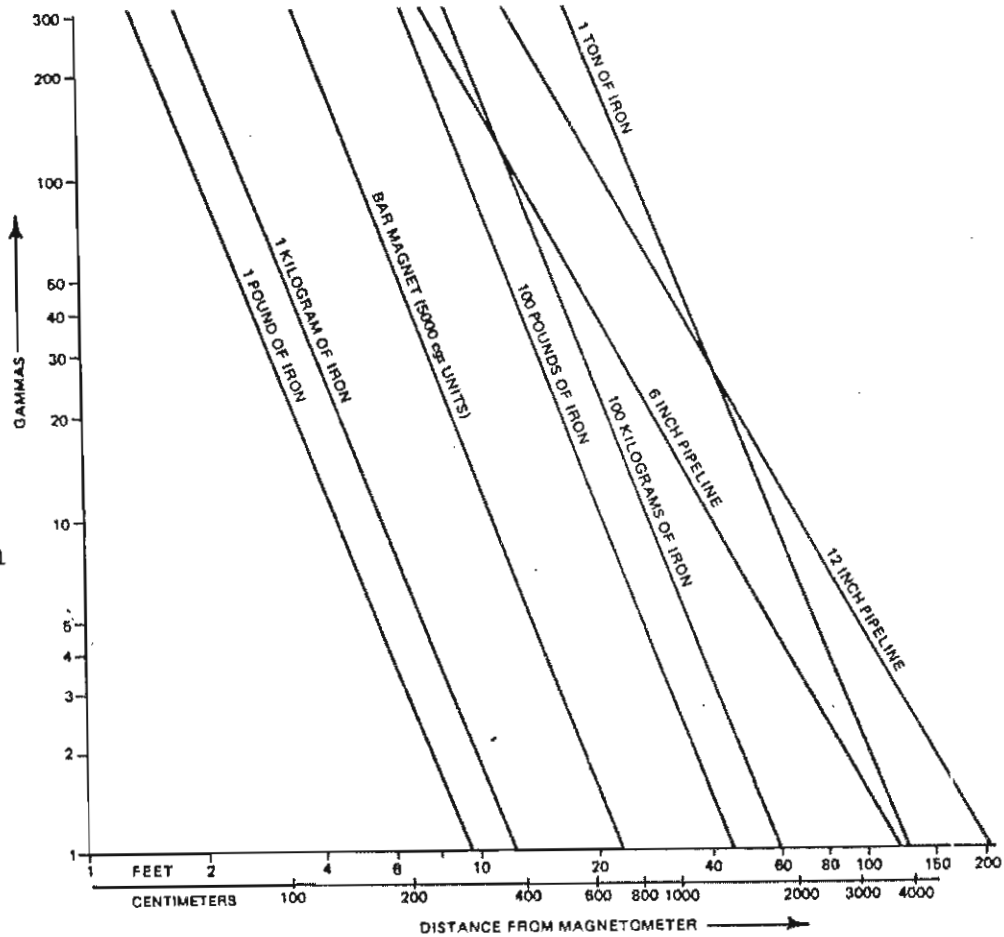


Fig. 11

Table of Anomalies of Common Objects Typical Maximum Anomaly		
Object	Near Distance	Far Distance
Automobile (1 ton)	30 feet 40 gammas	100 feet 1 gamma
Ship (1000 tons)	100 feet 300 to 700 gammas	1000 feet 0.3 to 0.7 gammas
Light Aircraft	20 feet 10 to 30 gammas	50 feet 0.5 to 2 gammas
File (10 Inch)	5 feet 50 to 100 gammas	10 feet 5 to 10 gammas
Screwdriver (5 Inch)	5 feet 5 to 10 gammas	10 feet 0.5 to 1 gamma
Revolver (38 special or 45 automatic) (induced approximately equal to permanent, see text)	5 feet 10 to 20 gammas	10 feet 1 to 2 gammas
Rifle	5 feet 10 to 50 gammas	10 feet 2 to 10 gammas
Ball Bearing (2mm)	3 inches 4 gammas	8 inches (0.5 feet) 0.5 gamma
Handcuff	10 feet 15 gammas	25 feet 1 to 2 gammas
Pipeline (12 Inch diameter)	25 feet 50 to 200 gammas	50 feet 12 to 50 gammas
DC Train	500 feet 5 to 200 gammas	1000 feet 1 to 50 gammas
'Cow' magnet (1/2" W, 3" L)	10 feet 20 gammas	20 feet 2 gammas

Areas (H) and (J) were those sections actually searched and these included the area from the top of the old dune system to the high water mark extending from the power station coal dump wall north to the end of the area of proposed development.

It is near this north eastern end of area (J) also that the process of accretion to the power station beach mentioned previously is replaced with a net erosion of the beach front.

This then would leave any historic vessels cast ashore near what is now the northern S.E.C. boundary and beyond to the northern cut actually further out to sea than before (see Figs. , 6 & 14). These would then be outside the region of development.

CONCLUSIONS:

An analysis therefore, of all the information presented above shows that any of the 12 known wrecksites not as yet unearthed by Mineral Sands Mining and Harbour excavations obviously lie outside these areas of excavation, i.e. in the Koombana Bay Caravan Park and Golf Course site, the Cable Sands Administration Facilities and storage silo area and the Energy Commission holding north of the new inner harbour (Fig. 9).

Most of the region of development proposed by the Energy Commission can also be seen to be unlikely to contain the remains of any wreck excepting those areas designated (H), (I) and (J), i.e. a total of 1500-2000 square metres of hard beach front and sand dunes.

THE REMOTE SENSING SEARCH OF THE AREA FOR DEVELOPMENT

Search Techniques:

There are many remote sensing devices currently available in the field of Maritime Archaeology.

Those available to this department of the Western Australian Museum, included at the time, sea going metal detectors, a side scan sonar system and a sea going proton magnetometer.

For the purposes of this search, only the proton magnetometer and the metal detectors were seen to be of use, with the former chosen as the main searching device.

THE PROTON MAGNETOMETER SIMPLIFIED:

The magnetometer measures the earth's background magnetic field in units called gamma. (Background reading in Bunbury circa 59,000 gamma). Changes in this background are caused by the presence of certain geological features, structures and objects including natural and artificial ferro-magnetic materials, kilns, pottery, buried walls, and other archaeological materials.

In searching for ferro-magnetic materials these changes in the earth's magnetic field vary, mainly according to the mass of the ferro-magnetic material causing the variations in the total magnetic intensity and the distance between the magnetometer and the object. The strength of the variation generally varies inversely as the cube of the distance.

The following charts (Figs. 11a & B) from Briener (16), roughly show the expected size of anomaly for a given mass and distance from a magnetic object.

Thus, for example, 100kg of iron at a distance of 10 metres from the detector head, could be expected to give an anomalous reading of 50 gamma different to that of the background earth's magnetic field and so on. It is generally possible to run a magnetic search on a systematic pattern with run spacings calculated to allow for the size of possible targets. It is possible then to pick up and mark the positions of any such anomalies in the earth's magnetic field and return and excavate the anomalies found.

In order therefore, to assess the effect of the mineral sands deposits on the search and to gauge relative detectability of 3 of the 4 known wrecks excavated by Cable Sands Company in 1962/63, a similar search to that described below was conducted over the known location of these sites. (Two of the wrecks were wooden framed and one had iron knees).

The results were as expected, with the all wooden wrecks being undetectable in a background of mineral sands deposits.

The site with iron knees also lay nearby and showed up in a magnetometer search in classic fashion giving anomaly readings around 800 gamma.

An analysis of the anomalies expected from stockpiled mineral sands and from those deposits lying in very large pockets on the surface was also conducted. The results were plotted and written up by Steve Cushnahan and appear in Appendix 2.

Their signature unfortunately could be mistaken for that shown by an iron object and it was apparent that this was to be another problem in the search.

An analysis of Cushnahan's drawing of the cross section of the anomaly associated with a pile of mineral sands and that of an iron anomaly found during the main search (Fig. 12) shows close similarities.

Fig 13 Iron Knees found near Point MacLeod (Wreck j on Fig 14)



Search of the Area of Development

Two separate search techniques using proton magnetometers were developed to deal with the problems encountered with the terrain. The first, developed by Jeremy Green, Head of the Department of Maritime Archaeology, involved the use of the Department's Elsec small boat proton procession magnetometer with a seagoing head 'fish' trailing on 50 metres of cable. (Sensitivity potential 1 gamma). A continuous digital and graphical (paper tape) display, is available from this machine.

A search area was delineated with tapes and a theodolite and then marked with flags. The operator was seated in a land vehicle and monitored the continuous digital readout transferring the figure shown at 10 second intervals into a portable tape recorder.

The 'fish' was towed on a non-magnetic all wood sled out of range of the vehicle's magnetic field and the vehicle driven at a slow pace down one side of the search area.

Attached to the front of the vehicle and projecting 4 m either side was a large pole on which was suspended a marker trailing one end on the ground. A base reading was taken at the end of each run and on turning for the next, the driver was required to keep the marker in the wheel ruts of the last run and thus a fixed distance (5 m) could be kept between runs.

On return to camp the readings could be then plotted from the tape recorder onto graph paper in preparation for the preparation of a contour plan.

On entering the soft fore-dune, problems were encountered with vehicle traction and snags, and the method described below was developed by the author as an alternative.

The area still to be searched was first pegged out into 100 x 50 m blocks. A search of each block was then completed using a simple derivative of the 'channel leads' system used for entering harbours and previously used as part of a seaborne search of Padre Island, Texas (18).

On this occasion, large stakes were placed at 5 m intervals along one side of the rectangle marked and in front of those were placed similar smaller stakes at the same interval.

The other perimeter was similarly marked thus giving the magnetometer operator ahead a line on which to run and to the side a visual reference for the taking of readings.

The instrument used was a geometrics G816 battery operated mounted model loaned by the Physics Department of the Western Australian Institute of Technology.

The recording head (which must be aligned N/S) can be carried on a back-pack mounted behind the operator's head, or alternatively on a collapsible aluminium pole provided with the instrument.

When the operator is on station and the head aligned, a reading is obtained using a push button switch. This reading and its position is relayed to an assistant acting as recorder. Here, a small portable tape recorder was used, but in ideal circumstances and given more personnel, the reading could be relayed by two way radio to a recorder marking the results directly onto a pre-prepared grid.

Results:

Using the two methods described above, the area shown was searched over a period of 2 visits, extending over 5 working days spent on site.

Changes in the background magnetic field over the period were accounted for, the results plotted and a contour map produced. (Fig. 12). This showed 8 major anomalies (A-H on the plan) 4 of which were seen to be associated with iron objects close to or just under the surface.

Only 4 anomalies (A,B,C and G) therefore, were seen to require further investigation.

Anomaly G was of the order of +5000 to -3500 gamma and was similar in its characteristics to that expected of a large iron or steel object of around 85 metres in length. Aerial photographs (19) of 1960, showed a wrecksite (marked as Samuel Wright or North America on the photograph) in the area and this site was then transposed onto the plan by Jeremy Green.

It's position coincided exactly with the anomaly plotted and it was readily apparent, on length and magnetic characteristics alone, that the site could not possibly have been a whaler or even a vessel with iron frames.

The remains were apparently those of the iron ship Carbet Castle of 1650 tons gross (Fig. 15) which is the only vessel of that size and construction known to have been lost in the Bay.

Discussions with local residents and later, archival research, supported this analysis.

A detailed examination of the characteristics of anomaly complex G the Carbet Castle has been completed and presented by Mark Staniforth and appears in Appendix 2.

Anomalies A, B and C also appeared most promising, being of the order of 300-800 gamma and continuing at depth. When analysed they appeared to stretch from the sand dunes seaward over a distance of 40 metres (an average size for a 3-400 ton vessel). In section (Fig. 12) they showed 3 isolated sources which on half breadth analysis, were located about 5-6 metres below the sensor head (on a two metre pole), i.e. 3-4 metres below the surface i.e. (at or near sea level).

This appeared most promising on paper and when transposed to a plan of the proposed power station, showed the anomalies to lie immediately in the path of the cooling water outlet shown on S.E.C. plan P5/3/A/5/1 of March 1982. An examination of this promising anomaly was, therefore, doubly warranted and a bulldozer kindly loaned by the Bunbury Power Station for the purpose.

When excavated, the anomalies proved to be 3 sections of dredging pipe abandoned or lost in the dredging operations conducted during the construction of the new inner harbour.

Metal Detector Search and Its Limitations:

In view of the proven failure of the magnetometer (in the given conditions) to locate the totally wooden hulls, consideration was also given to the value of using a metal detector search run along the lines as the previous search.

The object here, being to locate the non-ferrous metals, e.g. copper and copper alloys present, as hull fastenings. These instruments, however, are even more dependent upon the distance between a sensor head and object with signal strength decreasing as $1/6$ the power of distance⁽²⁰⁾. They, therefore, would probably not register the small amount of metal expected especially if buried much beyond 2 m from the detector head. This theory was tested in a metal detector search area of the area known to contain the two wooden wrecks uncovered by Cable Sands Company and both sites were either masked by the presence of surface black sand deposits or were undetectable at depth.

On my request, Mr. Phil Smith of Bunbury, undertook another search of the same area using two different models of instruments and while he located one anomaly which persisted at depth, his instruments were similarly unsuccessful in locating both sites.

A report on metal detectors in general and their application to these searches has been compiled by Nic Clark and appears with Mr. Smith's results in Appendix 2.

THE LOCATING OF WRECKS BY OTHER MEANS:

By Mining Activities:

The extent of the areas mined by Cable Sands Company has been outlined above and as indicated, does include most of the shore area north of the power house, extending to the cut at Turkey Point.

The 1981 Museum team viewed and recorded (with the kind permission of the Manager Mr. Trevor Scanlen) the aerial photographs, plans and the artefact collection held by the company.

Mr. Leo Sophilis (the bulldozer operator who uncovered the wrecks found on the company's lease in 1962 and 1963) located the position of those wrecks (Sites K, L, M on Figure 14) and these were then transferred to large scale plans now held at the W.A. Maritime Museum. The details of these excavations have been recorded in Appendix I and it appears that one site at least is an American whaler, probably the North America of 1843 (Wreck K Fig. 14).

This particular vessel was excavated by enthusiastic amateur groups but unfortunately many valuable and historical artefacts were not adequately recorded and were in many cases lost. The other two vessels (L & M) were fortunately left untouched.

If the site (K) is the North America of 1843, then the Samuel Wright of 1840 is known from contemporary accounts (see Appendix I) to lie nearby and is probably one of the other two vessels unearthed by the Cable Sands Company, possibly wreck L, (Fig. 14).

Mr. Sophilis also recalled that while building a road from the processing plant towards the present Point MacLeod marker (see Fig. 13) uncovered a row of "wooden posts" and projecting iron work. Those were levelled and covered by the earthworks and encroaching vegetation. This site was relocated visually and with magnetometers by the 1982 Museum team and the iron work identified as knee riders of a 200-400 ton wooden vessel of the mid to late 18th century (Wreck J).

Thus, the Cable Sands Company in the course of its exercise of the mineral sands lease, uncovered 4 wrecks (J, K, L, M), one and possible 2 of which are the remains of the American whalers.

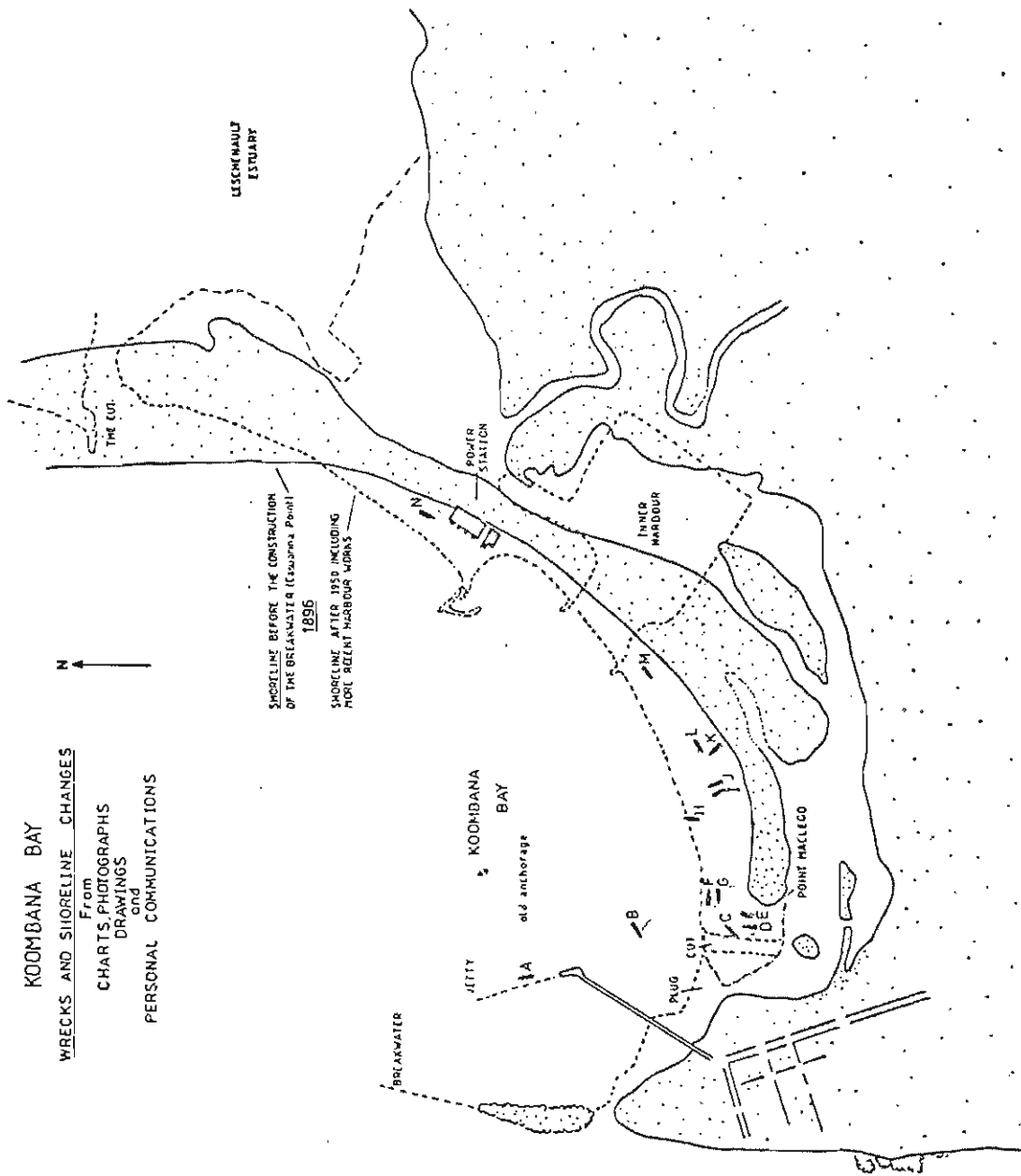
Harbour Works:

KOOMBANA BAY

WRECKS AND SHORELINE CHANGES

From
CHARTS, PHOTOGRAPHS
DRAWINGS
and

PERSONAL COMMUNICATIONS



- 1 Samuel Wright 1840 L⁷
- 2 North America 1840
- 3 North America 1843 K
- 4 Elizabeth 1843 B
- 5 Midas 1872 B
- 6 Annio M. Young 1876 E^{PA}
- 7 Citizen of London 1880 E^{PA}
- 8 Cingalee 1887
- 9 Star of the South 1888 O^{PA}
- 10 Agra 1895 H
- 11 Carbet Castle 1897 N
- 12 Solgylt 1901 C
- 13 Laughing Wave 1903 A^{PA}

As indicated previously, PWD engineers preparing the southern cut near Point MacLeod (now Koombana Channel) in 1973 unearthed another wreck (Fig. 14a). The Museum was notified and with the aid of shovel hands, a bulldozer and a front-end loader, (generously supplied by PWD,) the wreck was cleared for examination by the Museum team, including Graeme Henderson. The site (Wreck C) lay below the water table and a run off channel and pumps were required to expose the remains.

The site was tentatively identified as that of the Norwegian barque Solglyt, wrecked 1901 (see Appendix I). Negotiations to save the site failed, and it was bulldozed (Fig. 14b) into a small pile and reburied by the contractors (21). The site now lies under a parking area on the north east side of Koombana Channel and appears as wreck C on Figure 14.

Early Charts:

Stokes' chart of 1841 (Fig. 2) shows either the North America or Samuel Wright of 1840 (Wreck K or Lm Fig. 14) and the harbour works charts of 1876 and 1896 show the positions of Midas 1874 (Wreck B) and Agra 1895 (Wreck H) respectively. The latter vessel was subsequently refloated.

Archival Search:

The background information on each wreck was supplied by Graeme Henderson as part of his research for Unfinished Voyages, Vols. 1, 2 and 3. The major additions are those found in Putnam's "Salem Vessels and their Voyages" (22) pertaining to contemporary visits to the site of Samuel Wright in 1841 and the contemporary diary of Mr. E.H. Withers who arrived at Bunbury in 1864 (23).

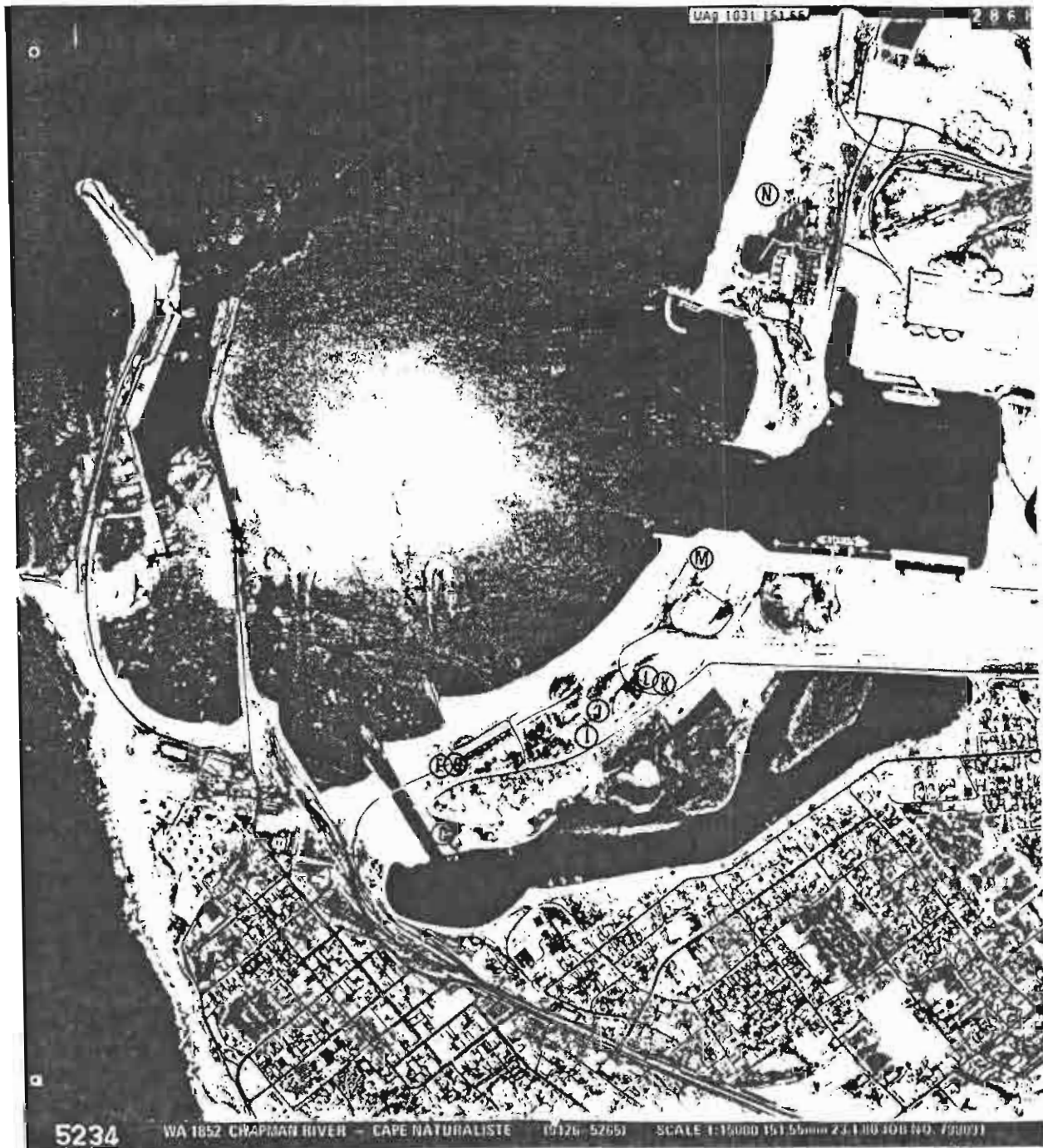
Withers casts more light on the fate and in some cases the position of the wrecks Annie M. Young, Carbet Castle (Wreck N), Star of the South (Wreck D), Cingalee, Citizen of London (Wreck E) and two American whalers North America and Robert Hall? The latter appears to be an error on Withers part, as no vessel of that name appears lost on this coast or is recorded in the area.

These reminiscences however, appear with Henderson's notes in Appendix I and the wreck positions as recalled by Withers are embodied in Figure 14.

Living Memory:

Great assistance in locating the wrecks was also given by Mr. Leo Sophilis (Appendix I), Mrs. Lois E. Wallace (Appendix 3), Mr. George Baxter and Mr. Don Edwards.

Fig. 14 b An Aerial Photograph showing the wrecks found on the shores of Koombana Bay



Mr. G. Baxter was greatly involved in the Bunbury Historical Society's efforts in preserving the whaler wrecks and enabled us to document and record the old charts, photographs and artefacts held at the local Museum.

Mrs. Wallace has lived continuously on the North Shore since 1920 and was able to point out the location of two sites (Wrecks B & I) on the foreshore (now the golf course), one other a small vessel, is not shown and lies in the estuary near her home. She also remembers the Carbet Castle (Wreck N) and gave additional information on other sites seen in her 60 years living on the North Shore. Her reminiscences appear in Appendix 2.

Mr. Don Edwards of the Maritime Archaeology Association of W.A. recalled a site (Wreck F) on Point MacLeod in 1947. He then transposed that wreck from an early aerial photograph to more modern examples and when transposed further to (Fig. 14) is seen to correspond closely with that seen by Mrs. Wallace (Wreck G) in the vicinity, i.e. just offshore of the Yacht Club buildings. Wrecks F & G could, therefore, be reports of the same site.

Another site (Wreck I) reported by Mrs. Wallace, i.e. that located near the number two tee, Koombana Bay Golf Course, corresponds closely with that seen (Wreck J) by Leo Sophilis while mining for Mineral Sands, i.e. the iron framed wreck near the Point MacLeod sign. There is a possibility, however, that there are two wrecks in the vicinity, as Mr. Sophilis and Mrs. Wallace's descriptions vary as to the framing seen, i.e. wood or iron.

Wrecks F & G and Wrecks I & J could, therefore, be duplicated reports and refer to only two actual sites. Withers' account of the Cingalee and Annie M. Young lying in "nearly the samespot" must be considered however, and it is possible there may be two sites close together in similar fashion to those found by the Cable Sands Mining Company in 1962/63.

From the excavations of the Cable Sands Mining Company, and the PWD, a study of old charts, archives, the diary of Mr. E.H. Withers, the memory of Mrs. L.E. Wallace and Mr. D. Edwards, a plan showing the locations of wrecks seen in the Bay can be made (Fig. 14).

A site breakdown is as follows:

- Wreck A Laughing Wave: Wrecked alongside the jetty in 1903. Some remains possible. Exact position on the jetty unknown.
- Wreck B Midas 1872: Position shown on contemporary charts - wreck removed but some remains are expected. (see Appendix I)
- Wreck C Solglyt 1901: A tentative identification of a known wreck uncovered in 1973 and remains were bulldozed and reburied. Position known. This vessel was apparently dismantled and removed to its present location. Some remains may, therefore, lie at its original location.
- Wreck D Star of the South 1888: Reported by Withers (Appendix I) as ashore at the mouth of the Estuary. Some remains possible. Position approximate.
- Wreck E Citizen of London 1880: Reported by Withers as ashore at the mouth of the Estuary. Some remains possible. Position approximate.
- Wreck F Unknown: Reported by Mr. Don Edwards, seen in 1947. Some remains expected. Could be the same site as G.
- Wreck G Unknown: Reported by Mrs. L.E. Wallace. Seen in the 60s. Some remains expected. Could be the same site as F. Relocatable (Appendix 3).
- Wreck H Agra 1895: Position shown on contemporary charts. Refloated.
- Wreck I Unknown: Wreck seen by Mrs. L.E. Wallace. Lying now under the Number 2 Tee Koombana Park Golf Course. Could be the same as J. Relocatable. Some remains expected.

- Wreck J. Unknown: Iron knees from a wreck, mid to late 19th century wreck, seen by Mr. Sophilis in the 60s. Could be the same as I but the accounts differ. Relocatable. Some remains expected.
- Wreck K North America 1843?: The site uncovered by Mr. Sophilis (Cable Sands Mining Co. and excavated by local groups. Position known. Substantial remains.
- Wreck L Unknown: Possibly Samuel Wright 1840: Uncovered by Cable Sands Company. Position known. Substantial unexcavated remains.
- Wreck M Unknown: Wooden wreck uncovered by Cable Sands Company. Position known. Some remains expected.
- Wreck N Carbet Castle 1897: Well known landmark. Position fixed by aerial photography. Site locatable. Substantial remains of large iron vessel.

CONCLUSIONS:

The 12 substantial wrecks expected to still lie in or around Koombana Bay are:

1. SAMUEL WRIGHT.....1840
2. NORTH AMERICA.....1840
3. NORTH AMERICA.....1843
4. ELIZABETH.....1843
8. MIDAS.....1872
9. ANNIE M. YOUNG.....1876
13. CITIZEN OF LONDON...1880
14. CINGALEE.....1887
15. STAR OF THE SOUTH...1888
17. CARBET CASTLE.....1897
18. SOLGLYT.....1901
29. LAUGHING WAVE.....1903

For those twelve expected sites, we have fourteen sites shown in Fig. 14. as either relocatable from existing charts, plans and visible remains (i.e., B, C, F-G, I-J, K, L, M) or as reported but not as yet located wrecks in specific locations i.e. A, D & E.

Wreck H (Agra) was refloated, leaving thirteen sites. Wrecks I-J and F-G could be re-reports of the same wreck. Leaving 11 locatable and definite wrecksites.

On this analysis then, we have a maximum possible of 13 reported sites and a minimum of 11 (if I-J and F-G are re-reports) for the twelve known wrecks in the Bay.

Bearing in mind, however, E.H. Withers contemporary account showing that two wrecks Cingalee and Annie M. Young lie "in nearly the same spot" (Appendix I), there is a strong possibility that either sites I-J or F-G are separate wrecks and we then have 12 possible sites for the twelve wrecks. Solglyt (see Appendix I) could also lie in two sections, thus explaining the 13 reports of sighting for 12 wrecks. This rather neat result however, cannot be considered absolutely conclusive enough to clear the Power House site of the possibility of further wrecks being found.

A glance at Fig. 14, however, shows the obvious tendency of vessels either at anchor in the Old Anchorage shown on contemporary charts (Figs. 6 & 14) or clustered around the jetty (Fig. 5) to be blown ashore south of the new inner harbour.

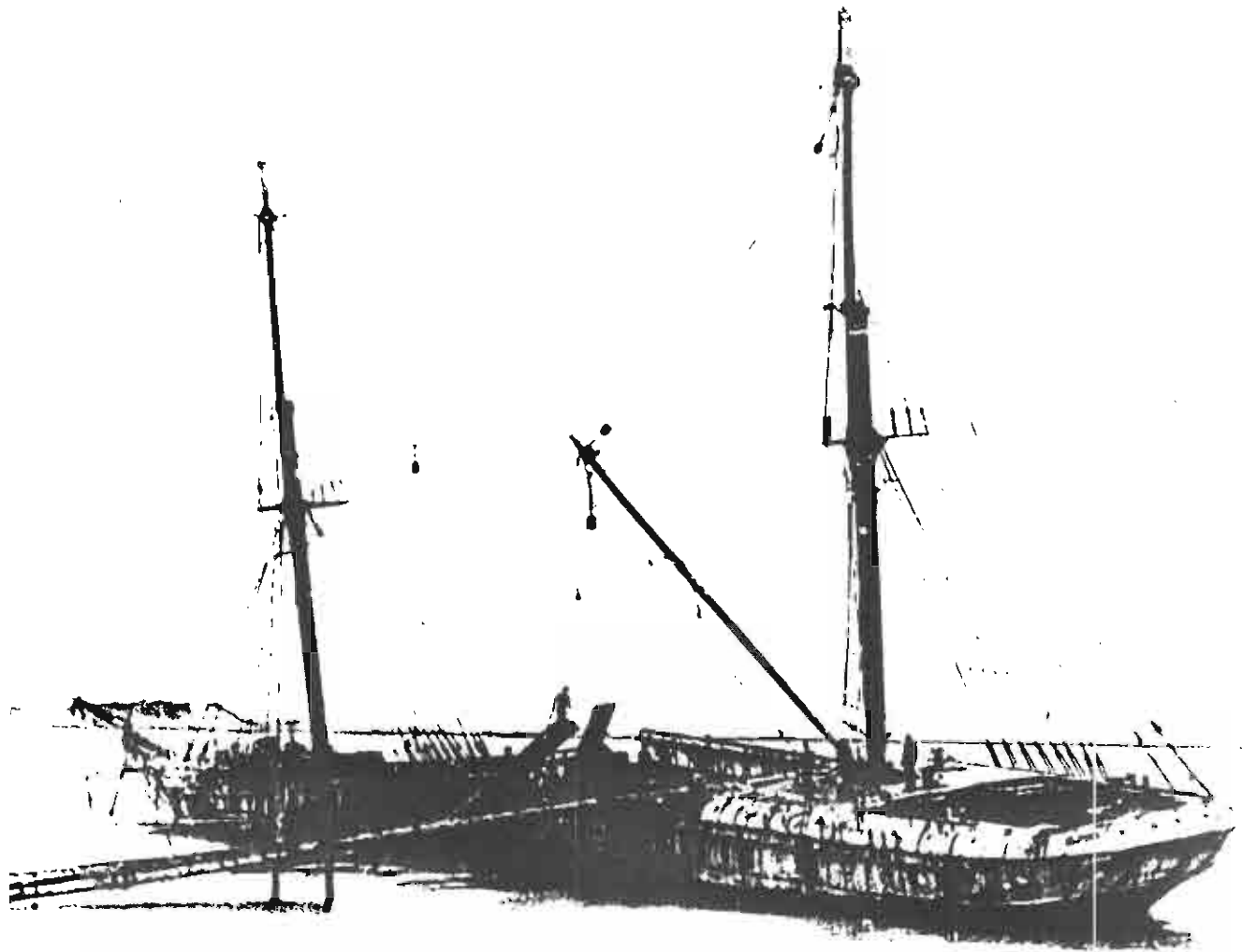
The largest wreck of all, the iron Carbet Castle of 1897, appears the exception to the trend and this was the only site located in the search area.

GIVEN THEN, THE PHYSICAL AND HISTORIC EVIDENCE PRESENTED ABOVE AND IN THE THREE APPENDICES FOLLOWING, IT APPEARS UNLIKELY THAT FURTHER WRECKS OF HISTORIC SIGNIFICANCE LIE IN THE AREA SOON TO BE DEVELOPED BY THE STATE ENERGY COMMISSION.

Mike McCarthy

November 1982

Fig. 15



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APPENDICES

APPENDIX I

HISTORY AND BACKGROUND OF KOOMBANA BAY WRECKS

(A compilation of sources)

- Graeme Henderson: Unfinished Voyages
Vol.1 U.W.A. 1980
Vol.2 In press
- E.H. Withers: Happenings Through the Years
A contemporary diary p.18-51
- Leo Sophilis: Verbal accounts of the Cable Sands
Company Mining Activities
- G.H. Putnam: Salem Vessels and Their Voyages
Massachusetts 1930 Vol.2 on the Samuel
Wright wreck, p.58

A List of Wrecks and Casualties in Koombana Bay:

Supplied by Graeme Henderson.

1. SAMUEL WRIGHT (reported wrecked ashore 1849)
2. NORTH AMERICA (reported wrecked 1840)
3. NORTH AMERICA (reported wrecked 1843)
4. ELIZABETH (wrecked ashore 1843)
5. PERSEVERANCE (reported wrecked 1845)
6. ANTELOPE (reported wrecked 1845)
7. LASSOF GERALDTON (wrecked 1867)
8. MIDAS (wrecked at jetty 1872)
9. ANNIE M. YOUNG (wrecked ashore 1876)
10. MAY (driven ashore 1876)
11. TWILIGHT (blown into the estuary and remained there)
12. IONE (reported wrecked 1879)

13. CITIZEN OF LONDON (wrecked 1880)
14. CINGALEE (wrecked ashore 1887)
15. STAR OF THE SOUTH (stranded 1888)
16. AGRA (wrecked 1895)
17. CARBET CASTLE (wrecked ashore 1897)
18. SOLGLYPT (wrecked ashore 1901)
19. AURORA (damaged 1901)
20. GERS (damaged 1901)
21. SILAS (damaged 1901)
22. BONANZA (damaged 1901)
23. ROBERT SCRAFTON (leaking 1902)
24. DAABLONE (damaged 1903)
25. DOLPHIN (ashore 1904)
26. MANOR (casualty 1905)
27. SEQUE (struck bottom 1906)
28. HAMPTON (grounded 1908)
29. LAUGHING WAVE (wrecked at jetty 1903)

SAMUEL WRIGHT

(Henderson p.171-3. Vol.1)

"Three American whalers were wrecked on the South West coast of Western Australia on 8 July 1840: the Samuel Wright, the North America and the Government Endicott. The Samuel Wright had been lying at Koombana Bay with the Hudson and the North America when a gale came on at about 8 p.m. on 7 July.

The Samuel Wright's chain cable parted, leaving the vessel with only two anchors. Her largest anchor was stowed away in the hold, and the ship was driven ashore before it could be made ready. She was left high and dry on the beach.

The wrecks were sold by public auction at Leschenault 12 days later. The Samuel Wright which lay in a remote part of the bay was bought by her own captain, Francis Coffin, for 305 pounds. The whale boats, gear, etc., were included in the purchase. Other sales included thirty tons of sperm oil at 50 pounds per ton, thirty-six tons of black oil at 9 pounds per ton, and 5 tons of whale bone at 90 pounds. Most of the crews of the stranded vessels were almost immediately re-employed in bay whaling, conducted from the ships whale boats.

The Shipping Register at Fremantle shows that the 372 ton Samuel Wright was registered at Salem, Massachusetts. Her owners were J.B. Osgood. She was a ship rigged vessel with two decks, a square stern, no galleries and a billet head. The Register gives her draft as 13.7 feet and her dimensions as 110 feet by 28 feet by 13.7 feet".

(Putnam, 1930, p.58-59)

"Along this coast, on the passage from Swan River, was seen at night, looming at a great distance, the light of the natives' fires. March 3 (1842) at 3 a.m., made the land; at 11, anchored at Leschenault, Geographe Bay, in the roads off a small settlement called Bunbury. This bay is 35 miles wide, comprising or bounding on most of Sussex County, West Australia. The Captain at once went on shore in his gig, landing the Fellow of the Royal Geographical Society and his son and another passenger, also a few goods.

A Salem man, resident here a few years past, soon came off on board; he had been a boatsteerer of the Samuel Wright, probably Salem's best sperm whaler, about 400 tons, nearly new, wrecked in a remote part of the Bay, having gone ashore on the beach "with everything all standing".

We had climbed her, when a small boy, as well as most of the other square-rigged vessels at the Derby Wharf, and it would remind us of home to see her once more. Besides the wife and young son of the Captain, a Nantucket man, were passengers with us round the world. He had written to them to come out here to reside at the "land of the Pomegranate", as he called it. But he had been gone hence some time. So, with part of the crew taking the jolly-boat, we landed some miles away from Bunbury on the hard, smooth and seemingly endless beach. Walking some miles on, the sailors occasionally perceived a singular discolourization of the clear, placid water, and finally discovered a huge ground-shark, 20 feet abreast. Wading in cautiously, with some pieces of driftwood, they made out to give him a few punches, whereat he started seaward, leaving behind him a muddy wake for a hundred yards.

Some miles further we came to the wreck of the noble ship; there she lay sound as ever, except with her back broken - "hogged". The sand had washed away from her bow and stern, leaving under a bar amidships, causing her to settle aft in deeper water. "A shame!" cried all the sailors, as they gazed upon her. Had means and material been nearer, it would well have repaid the underwriters earlier to have repaired and got her off again. On going up the staging some forty feet leading to her deck, over on his back to enable him to swallow any falling victim, his white belly conspicuous, was our unwelcome but forgotten companion of the beach! His eyes were rolling and his jaws (capable of taking in at once half a horse) lined with two rows of two-inch sharp teeth, were gaping and yawning, apparently with voracious hunger. Some of the settlers now regaled us with stories of how these monsters had been known to leap into open boats in the bay and snatch out their victims".

NORTH AMERICA

(Henderson, p.174 Vol.1)

An American whaler called the North America was wrecked at Koombana Bay along with the Samuel Wright on 8 July 1840. The North America was blown ashore and left almost high and dry.

The wreck was sold by public auction on 20 July to J.R. Phillips for 400 pounds. The Perth Gazette complained that a larger price might have been obtained had the auction not been held so soon after the gale had taken place.

The North America had anchored in the bay on 16 May, and had intended to remain there, bay whaling, for the winter, the first whale being taken on 21 May. The master of the North America was Mr. Kempton, and a list of arrivals states that the vessel was a 260 ton ship with a crew of twenty-five men, from Wilmington, Delaware. The North America was owned by William Wheeler, and she left on her last voyage in August 1839.

NORTH AMERICA

(Henderson, p. 202-4, Vol.1)

A second American whaler named North America was wrecked in Koombana Bay in 1843. The Inquirer described events during and after the gale in the evening of 15 April as follows:

"At about 10 o'clock the North America, which had only one anchor out, began to drive; she had at that time top-gallant masts and royal masts up. She let go her only other (large) anchor and kedge, which it is said went down foul. She soon struck on the edge of the bar, and there grounded. When daylight broke on Tuesday morning, she still had her masts up. Her crew, it is said, lost all self possession when she began to drive, and were in a state of mutiny; the master could scarce prevent them from taking to the boats. During Wednesday morning they hove up the first anchor, and it proved to be twisted, and broke in the shank. By heaving on the other anchor (which proved to be broken) and the kedge, the ship was hove off into 3 fathoms; but nothing done with her all that day, and her anchors being in the state described, she by degrees drove back to the bar, and over it to the beach, where she now lies, but apparently with little or no damage. She has 500 barrels of oil on board. It is lamentable that from such neglect, and the bad equipment of this ship, discredit may be thrown on Port Leschenault, which it does not deserve".

According to the Rev. Wollaston's contemporary diary, the North America went ashore within a few yards of the 1840 wreck of the same name, whose remains lay scattered on the beach in April 1843 when the second ship was wrecked.

Despite the many contemporary accounts there are problems in matching them to get a clear picture of the location of the American whalers.

Stokes' account of 1841 notes that as he passed at a wide distance he saw two American ships on the beach yet he records only one wreck on his chart. This infers that they were either close together or that he believed only one wreck would stay intact long enough to remain visible from the sea.

Putnam's account of the visit of the Grotius in 1842 refers only to the Samuel Wright, despite a long walk along the beach and that she was as "sound as ever."

Wollaston's account of the loss of the North America of 1843 places it initially near the 1840 ship of the same name whose remains still lay scattered on the beach and then after refloating and coming ashore again now close to "the wreck of the Samuel Wright."

The inference here is that the Grotius crew while probably seeing the remains of both the North America 1840 and Samuel Wright 1840 in their walk along the beach did not warrant the former remains worthy of a mention. Stokes' chart showing only one wreck and Wollaston's account of the "scattered" remains of the 1840 North America tend to support that theory.

The wreck marked on Stokes' chart of 1841 corresponds closely to the location of the two well preserved wrecks unearthed by the Cable Sands Company in 62/63 (see Appendix 4). If we accept the identification of rudder timbers from the site as "local" (see Sophilis' account following) then according to Henderson's account one of the wrecks found is most likely the North America of 1843 and as Wollaston records, the Samuel Wright of 1840 lies close by, i.e. where Stokes has marked a wreck on his chart of 1841.

This apparently neat fit locating the North America of 1843 and the Samuel Wright of 1840 is spoiled, however, by Putnam's account that the Grotius' crew walked many miles along the beach to where the Samuel Wright lay in a "remote part of the bay".

Being a local resident, the Rev. Wollaston, purchased the ship's bell at 1 pound 15 shillings for use in his church. Captain Daniel Scott purchased the wreck itself, and by the 14 June had succeeded in hauling her off the beach without much damage.

Scott was anxious to put the vessel into use, and approached the Government for advice as to re-registering her as a Colonial ship.

Unfortunately, the North America again broke her moorings and became a total wreck, according to Wollaston, now on her side close to the wreck of the Samuel Wright with her bottom stove in. Scott was said to have spent at least \$500 on purchasing, refloating, making a new rudder for her, and other repairs, but now it was expected that no one would buy her as the expense of taking her to pieces at such a place would be so great. Nevertheless, on 23 November, Wollaston observed in his diary that the North America had been broken up, and that the pieces were being loaded on to the schooner Elizabeth. Even this venture was unsuccessful. A heavy gale at the end of November drove the Elizabeth ashore where she became a complete wreck.

This vessel was owned in Warren, Rhode Island, and on the voyage during which she was wrecked sailed on 12 June 1842 under Captain Grinnell. The dimensions of this 285 ton vessel were 95.5 feet by 26 feet by 13 feet. She was built at New York in 1804 with two decks, three masts and a billet head. A list of arrivals at Vasse indicates that the same vessel had visited the coast in February 1840 under the command of Captain Mosher.

(Withers, p.25)

"A few years before we (E.H. Withers) came in 1864 to Bunbury there were 2 ships wrecked just East of the mouth of the river, one was called the North America and the other Robert Hall, two American whalers. We often got composite bolts out of them as they were both vessels we used to cut and burn the timber to get the bolt, some were 3ft long, about 1 inch round, others shorter and Mr. D. Hay used to give us four pence a pound for them"

ELIZABETH

(Henderson, p.207-208, Vol.1)

The schooner Elizabeth was built at Calcutta in 1831 and launched in January 1832. During the 1830s it was bought by L. and W. Samson of Fremantle, and used for trade with the Eastern Australian Colonies and Asian ports.

On 17 November 1843, the vessel was driven ashore and wrecked in Koombana Bay. Messrs. Clifton and Stirling wrote to the owners:

"We regret to inform you that the schooner Elizabeth is lying a total wreck on the north beach at Bunbury, having parted her cable and come on shore during a heavy gale yesterday morning. It had been blowing strong from the North West for the last week, and on Wednesday last, the Elizabeth parted her larboard cable. On Thursday evening, it came on to blow a heavy gale, which increased during the night, when about 7 o'clock yesterday morning her starboard chain parted, and although the other held on, she soon drove ashore. At 2 o'clock she struck heavily and immediately took a list to leeward, exposing her deck to the whole force of the surf. By the afternoon, the deck being washed away, her mainmast went over the side, and she now lies on her beam ends a complete wreck, the whole of the bottom on her larboard side being washed away, the surf breaking right through her. All the hands got ashore by a rope in safety, but her register, log book, chronometer - everything is lost; and we fear too, that a great portion of Mr. Leake's oil, all of which had been shipped, will be lost too. Some 18 or 20 casks (about 10 tons) have been washed on shore, and will be saved, but the remainder of 32 casks which had been shipped we expect have been stowed in the hold. A large quantity of Captain Scott's shooks (barrel staves) etc. etc., from the North America, had also been shipped. Captain James has noted his protest before Mr. Eliot, but the extending of it must be done at Perth. We shall call a survey on her as soon as the weather sufficiently moderates to enable the masters of the vessels now in port to come on shore. She will of course be condemned, but nothing further will be done except procuring all that can be saved from the wreck, until we have received instructions from you".

PERSEVERANCE

(Henderson, p.214, Vol.1)

During the same gale which on the 28 February 1845 drove the Merope and Halifax Packet ashore at Fremantle, a small vessel, the Perseverance, belong to Captain Daniel Scott, parted from her anchor at Port Leschenault and was driven ashore where she became a complete wreck. Although no details of the vessel were given, it is likely to have been the cutter which the Rev. Wollaston mentioned arriving from Fremantle in September 1843.

ANTELOPE (Henderson, p.215, Vol.1)

The gale of 28 February 1845 which wrecked the Perseverance also sank another vessel belonging to Captain Scott. The Antelope went down at her anchor, drowning one man, Franz. The vessel must have been refloated because during another gale in August 1847 at Fremantle the Inquirer reported that:

"Captain Scott's boat, the Antelope, also came ashore the same day as the Lord Stanley, and the whalers' cutting in flat the following one. The former got off uninjured; the latter remains on the beach".

Then again in August 1856 the cargo boat Antelope, loaded with goods from the Empress, was reported to have broken up on rocks on the Fremantle Bar.

MIDAS

(Henderson, unpublished notes Vol. II of Unfinished Voyages

Lloyds

1872-73 (several listed)

O.N.59806

F. and Y.M. 71 part iron bolts

Ship

Master: Murchison

390 tons

Dimension: 144.3 x 28.1 x 14.9

Built: P.E. Island

By: Duncan (1870)

Owners: Duncan and Co.

Port: P.E. Island.

C.S.R. 813 John Johnson (Master of Twilight) etc. to
Capt. Cumming (Master of Midas)

11 March 1872.

...."found the rudder and rudder trunk gone, the stern post and wood ends started, her decks and topsides severely strained, and to all appearances she is bilged on the port side.

C.S.R. 813 Tender 16 March 1873

"to remove and clear away the whole of the wreck of the Midas at present lying in the Port of Bunbury and to raise and deposit above high water mark on the beach between the Bar and the jetty all the raised and sawn timber now in the wreck....

C.S.R. 813 Lefroy to Col. Sec. 16 October 1873.

"list of things recovered from the wreck of the Midas

30 fathoms of 1 5/8 inch chain

40 iron knees

Iron work of windlass

about 1 ton of chain plates, bolts, thatch bars and other iron about 1/4 ton of copper, consisting of rudder plates, sheathing and bolts.

C.S.R. 813/113

"Account of Sale of piles, sawn timber, iron knees. Muntz's metal etc. et. recovered from the Midas...."

C.S.R. 813/109

M. Fraser 17 May 1873

Removal of Midas wreck - Bunbury.

"Mr. Manning's report says that nothing remains now but certain parts which stand from 12 to 18 inches above the sandy bottom, though the bottom of the wreck is presumably 6 feet below. About 1/3 of the starboard side remains and about 2/3 of the port side. Mr. Manning also informs me that unless an experienced diver is employed it will be very difficult to do more than has been done..."

(Withers, p.23)

"In 1872 March 10th, the Barque Midas came ashore at the mouth of the Estuary at Bunbury, she was the first vessel that I ever worked at the load timber. Her cargo was piles mostly 70ft long and the balance was decking and joists for the wharf at Christchurch, New Zealand. We finished her on the Saturday 9 March. She became a total wreck and a few months after, a vessel the James Hannal came in and took away the timber. It was a long job to get the timber up and reload it but it was done and got safely to its destination. Later, when a schooner (Alto) belonging to Lt. W. Bateman who bought the wreck was getting the anchors and chains up, they were in a big bunch (she the Midas) had laid so long in loading that she had let the second anchor down on the other one and the 2 anchors and 96 and 45 fathoms were in a tangle and it took a long time to clear them and stow them in the Alto.

The decking of the Midas was put on while she was being loaded, it was Kauri Pine and Mr. Gibbs and Sons and Jas Wenn built a flat bottomed boat out of it about 30 tons displacement. I was working for Gibbs most of the time we cut the knees out of the wreck, and also get knees from all round the district and mostly at Australind. Afterwards (E.H. Withers) used to take or help take cargo to and from ships in the Bay.

In 1872, a vessel called the Midas, a barque of about 300 or 400 tons burden came in for 70' piles for a wharf in New Zealand. I think it was for (Wellington Harbour) they used to take the piles out to the boats with 4 horses and a 9ft. and then we, that is D.A. Hay Boss Will White Thomas Proprietor and E.H. Withers would chain them to a crosspiece on a flat bottomed boat of about 20 tons and float them to the ship and the wire taken through a porthole in the ships bow, we also took a lot of sleepers 10 x 5 9ft. long which three of us would carry out from the beach to the lighter and then take off to the ship we finished loading the ship on the 9th of....., a Saturday and on the Sunday a storm came up and the ship ashore at the mouth of the estuary and became a total wreck. A few months afterwards, another vessel, the James Hannel, came in and the timber was manshipped and went to its destination safely of course, it was very hard work and wet all the time as we had to push out the piles and timber. We took the deck off as it was new Kauri pine and had only just been put on while the Midas was loading. Mr. Gibbs built a 30 ton flat bottomed boat out of it for a Mr. W.F. Stephens who was Manager for a New Zealand firm of Connor and McKay".

ANIE M. YOUNG

(Henderson, unpublished notes Vol.II)

Lloyds

1876-77
Brig
VRHM
ON 48084
303 registered tons
345 net tons
334 gross tons
Dimensions: 109.0 x 26.5 x 17.4
Forecastle 3 tons
Built: N. Scotland
By: Young (1864)
Owners: W. McCormick
Port: Dublin
Anchors and chain proved
Blown ashore in northerly winds 1876.

(Withers, p.31)

"Some time in the 80s a vessel called the Annie M.

Young went on the north beach, she was partly loaded with timber, a man named Sam Ward had a bullock team, he took on the job of getting the piles and other sawn timber out of her,, she was too far gone to refloat so they took what they could and then left the rest. A lot of people got firewood from her and wire rigging. She was a wooden ship, as nearly all were at that time.

Another ship, the Cingaluse or something like that, also went ashore in nearly the same spot and was broken up.

LASS OF GERALDTON

(Henderson, unpublished notes)

Foundered some distance out to sea from Bunbury.

MAY (Cutter)

(Henderson, unpublished notes, Vol.11)

On shore at Bunbury.

Ref. Herald 4/11/1876. Hoped that she will sustain no serious damage.

TWILIGHT

(Henderson, unpublished notes, Vol. II)

The Twilight was blown into the estuary together with the Wild Wave in 1872. Both vessels were carried safely over the bar. G.E. Clark in his 'Early History of Bunbury' states that the Twilight remained inside the bar, but does not say how long. A small coastal vessel called the Twilight (a cutter) was wrecked off the South Coast in the late seventies and it seems likely that this was the vessel earlier trapped in the estuary.

IONE

(Henderson, unpublished notes, Vol. II)

Schooner, wrecked at Bunbury, October 2, 1879. Inquiry disclosed that (1) schooner was riding with two anchors down off the Middle head on the west side of the jetty during a heavy gale blowing from the north-north-west, (2) that flukes and stock of the smaller anchor broke and after a time breaking the other, she drifted down the jetty; through which she ultimately forced a passage, having knocked away her stern and rudder and broken her main boom and gaff. No blame attachable to master or crew.

One reference states that the schooner Ione was wrecked at Bunbury on 2nd October, 1897. However, the 'Herald' indicates that the Ione arrived at Fremantle from Bunbury on 15th October and does not mention any casualty.

CITIZEN OF LONDON

(Henderson, unpublished notes)

Schooner stranded at Bunbury, August 20, 1880.

W.A. 5/8/1882 p.3a. (Under repair)
Abandoned and subsequently broken up.
(P 387.2)BAT

53 tons
ON 75303
Reg: Fremantle
Built: Vasse 1878
ld, 2m counter stern
Carvel built, wood frame
57 x 18 x 8
Reg. closed 23/5/1884
HMC

(Withers, p.24)

"The lighter Star of the South loaded with guano from Sharks Bay went ashore in the mouth of the estuary and is still there, also a boat called the Citizen of London, belonging to a Mr. Payne of Capel went to keep the Star company and is still doing so but there is not a sign of either of them left now".

CINGALEE

(Henderson, unpublished notes)

Lloyds

1887-88
Barque. Wrecked
Wood
ON 63993
Master: Pringle
337 registered tons
350 net
325 gross
LCQH
Y.M. 11,1883
Dimensions: 131.6 x 26.1 x 14.7
Built: Dundee
By: Dundee Ship Co. (1872)
Owners: Pearse, Owston and Co.
Port: Fremantle
Anchors and chains proved
Wood frame
1 deck, 3 masts, carvel build

(Withers)

"Another ship, the Cingaluse or something like that also went ashore in nearly the same spot (as the Annie M. Young) and was broken up and used for all sorts of things. A lot of her gear was sent to Fremantle also the masts and , the remainder was blown up and used for all sorts of things, mostly fire wood".

STAR OF THE SOUTH (Cutter)

(Henderson, unpublished notes)

Stranded at Bunbury. Reported to be breaking up.
Ref. "W.A." 27/6/1888 p. 3d.

"The lighter Star of the South was loaded with guano from Sharks Bay, went ashore in the mouth of the Estuary and is still there, also a boat called the Citizen of London belonging to a Mr. Payne of Capel went to keep the Star company and is still doing so but there is not a sign of either of them left now".

AGRA

(Henderson, unpublished notes)

The wreck of the barque Agra appears close to Point MacLeod on a chart of Bunbury Harbour Improvements, compiled in 1896. The Agra was wrecked at Bunbury on 27 July 1895. It was condemned and sold, but repaired and re-registered as the Rose in January 1897.

The wreck of this vessel is shown on Chart 66 - Bunbury Harbour Improvements compiled in 1896.

CARBET CASTLE

(Henderson, unpublished notes, Vol.II)

Wrecked at Bunbury. Left Newport Wales on January 14, 1897, laden with railway materials for W.A. Government and arrived off Bunbury on April 2. On April 13, was discharging cargo at wharf when gale blew up. Master let go port anchor to avoid trouble with Corolla anchored nearby. Wind drove ship onto north beach, broadside on, about 1 1/2 miles from Bunbury. The ship broke in half and became a total wreck.

Lloyds

1895-96
PDCT
Master: C.H. Paige. 93.
1 Bulk head. Cement
Iron ship
2 decks
1657 gross tons
1469 under deck
1531 net
Built 1875

Authors note:

Furniture from the vessel is now in many private homes at Bunbury though some artefacts, notably a bench seat and light, are at the local museum. The bell hangs at the Bunbury church of England Grammer School.

SOLGLYT

(Henderson, unpublished notes)

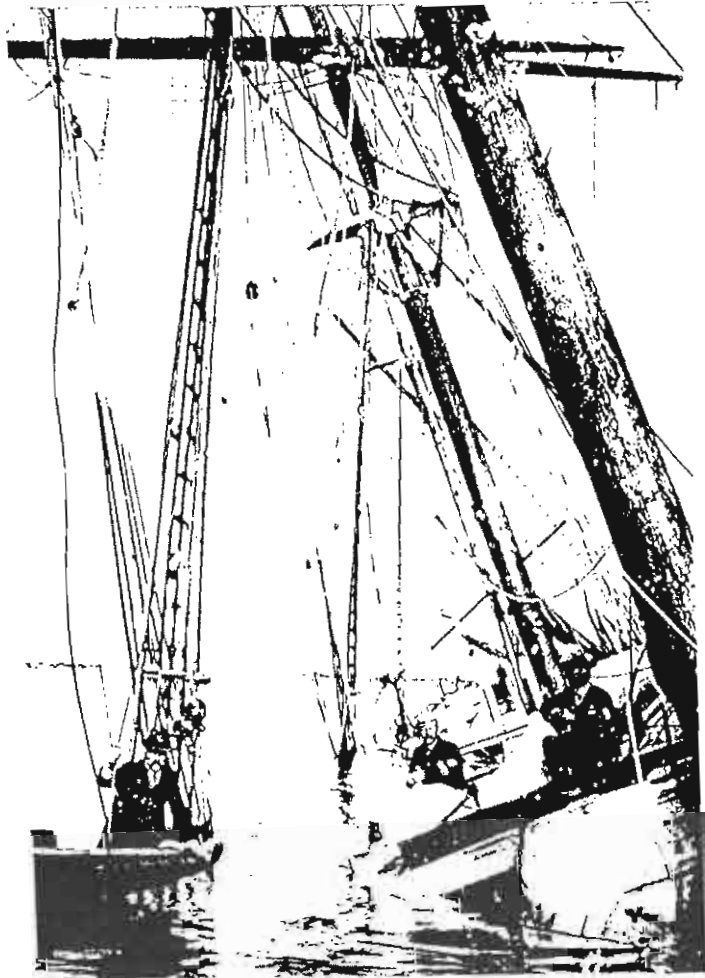
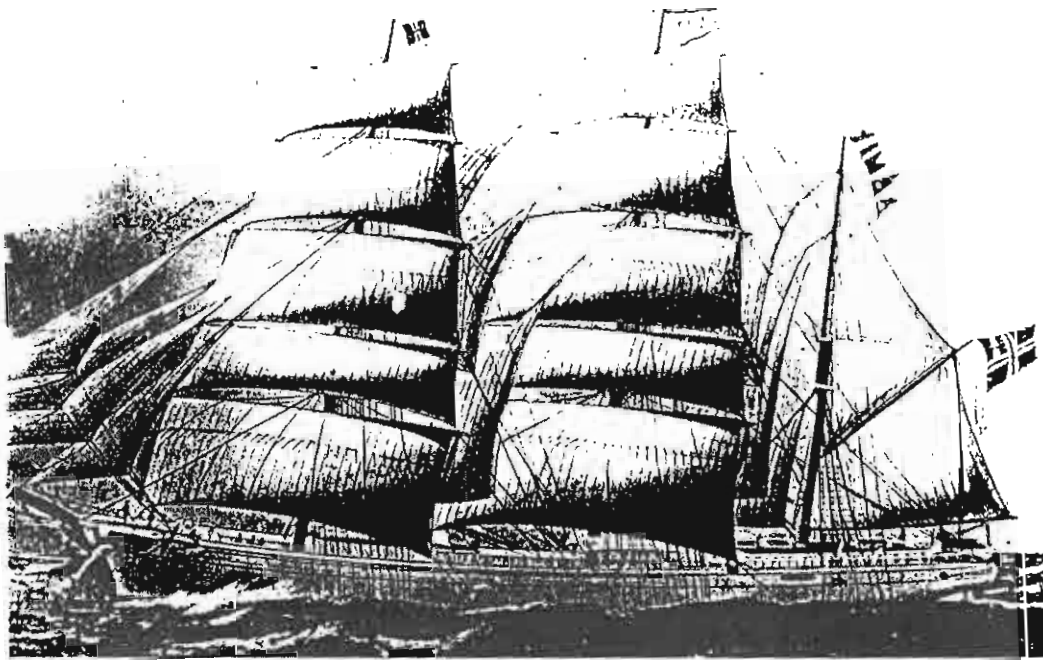
Norwegian barque. Wrecked on beach at Bunbury. Captain was trying to haul his vessel towards heavy mooring buoy to which he had run a line in preparing to go to sea. When the vessel was caught by a sudden strong wind and was blown ashore despite both anchors being let go. Inquiry finding was that the stranding was due to Captain Rasmussen, Master, who had disregarded the orders of the Harbour Master to move his vessel to a safe position.

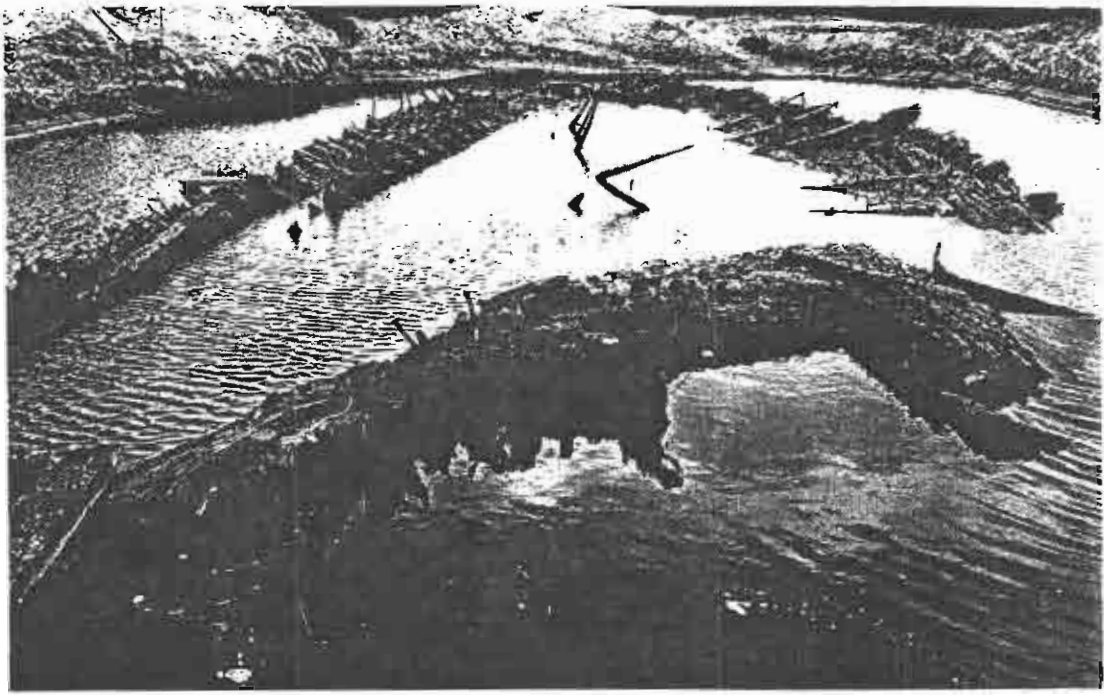
Lloyds

1898-9
Wood barque
Signals: JBFD
Master: A. Rasmussen
Special Survey 1890
Y.M. 6. 1897
1 deck. Two tiers of beams
875 total tons
760 under deck
843 net
Built: 1888
By: M. Suensen
At: Grimstead
Owners: O.R. Foreid
Dimensions: 176.5 x 34.6 x 20.0
Raised quarter deck 82 tons
House on deck 33 tons
Port of Register: Grimstead Norwegian
Clase NV

Six months after the Solglyt was wrecked the purchasers of the wreck were ordered to remove the wreck or it would be blown up. It seems likely that the site found had been removed from elsewhere, as there is no sign of the other side of the vessel, or of the superstructure, or even the keel. Possibly a lighter towed one side of the Solglyt inside the estuary to be beached (as a local resident, Mr. Smithall, was told by his father).

- (1) The wreck uncovered in 1973 by the P.W.D. is believed to be the remains of this vessel.
- (2) A painting of the Solglyt shows scrollwork similar to that taken from the site, but insufficient detail is given in the painting to make any firm conclusion.
- (3) The P.W.D. notified the museum and a team, led by





Graeme Henderson, visited the site and with the aid of staff and machinery, kindly supplied by the P.W.D., excavated the site and pumped it dry.

The site measured 80' x 25' and appeared to be only one side of a vessel with iron frames and two decks. The woodwork appeared to be a species of pine pinus sylvestrus or pinus resinosa and the hull was iron and yellow metal fastened with yellow metal sheathing after the on-site recording was completed (see photo file W.A. Museum). The pumps were stopped and the site left.

Unsuccessful negotiations to save the site were conducted and it was bulldozed into a small pile, shifted and reburied.

Photographs

MA223; 1342; 232; 214; 215; 220; 213; 228;
221.

AUTHOR'S NOTE:

If the Solglyt was dismantled and moved as Henderson's notes indicate, then further remains could lie at her original place of wrecking and could be one of the reported sites.

AURORA
GERS
SILAS
ROBERT SCRAFTON
DAABLONE
DOLPHIN
MANOR
SEQUE
HAMPTON

(Henderson, unpublished notes).

The Aurora (Norwegian barque, 681 tons) was damaged in a collision alongside the jetty at Bunbury in May 1901. However, the vessel left port on 28th June. The Gers (barque 755 tons), which collided with the Aurora, left port on 29 June. The Silas (Norwegian barque 690 tons) collided with the Bonanza, in July 1901, but damage was confined to the upper works. The Robert Scrafton (barque 737 tons) although leaking in May 1902 suffered no damage. The Daablone (720 tons) received only minor damage in January 1903.

In 1904 the W.A. Lighterage S. and T. Co. vessel Dolphin (63 tons) was driven ashore at Bunbury.

The Manor was a slight casualty in July 1905. The Seque (Norwegian barque) and the Hampton (2779 tons) were not reported to have sustained serious damage.

LAUGHING WAVE

(Henderson, unpublished notes)

29 August 1903

Vessel total wreck, caused through bumping against fender at
Bunbury Jetty during heavy weather. Ship valued at 600
pounds. Built Fremantle, 1868.

Lloyds

Universal 1889-90
ON 61085
Master: Miles in 1885
Wood brig
British
Net tonnage 161
Deminsions: 105.7 x 21.8 x 11.0
Built: Fremantle 1868
Owner: J. Bateman
Port: Fremantle
Crew: 6.

THE UNCOVERING OF THE "BUNBURY WHALER WRECKS"

By: The Cable Sands Company 1962/63

The following are the recollections of Mr. Leo Sophilis of the Cable Sands Mining Company who in the course of exercising their mining rights unearthed 3 sites locally and commonly referred to as the Bunbury Whalers.

Site 1. The Drying Shed Wreck

Uncovered in December 1962 by Mr. Sophilis' bulldozer. Only a few timbers were located at first as the wreck apparently lay below the water table.

The Company then used its dredging equipment and continued mining around the area of the wreck.

It was not fully uncovered as it appeared to pass underneath existing company buildings.

The wreck now lies under the drying shed, a part of the Cable Sands Company's treatment plant.

The remains consist of a "stern" section and timbers that were "naturally grown" and of the largest scantlings of all those wrecks excavated by the Company. Glass fragments were also seen.

No conclusions can be drawn at this stage as to the wreck's identity.

Site 2. The North America (1843)?

This wreck was found a few days later and lay on a N/S axis about 800m south of those remains described above.

The remains were excavated (Fig. 8) with the aid of interested parties from local Service Clubs and the Bunbury Historical Society.

A windlass and rudder were found nearby along with willow pattern sherds, bottle fragments, a Holloways ointment jar, bricks and a cask lid inscribed Prime Pork Baltimore 18-1.

A W.A. Museum team led by Dr. Ian Crawford (then

A photograph showing the Cable Sands Mining Company buildings and wrecks .



Curator of Archaeology and Anthropology) measured the site at 95.5 feet long and after taking photographs and other details, departed with a timber sample identified as American timber (Juniperus Virginiana or Pencil Cedar).

Unfortunately, the windlass (see below), rudder (and its brass depth markings) and the cask lid disappeared. Mr. Sophilis, however, identified the rudder's timber as of local origin.

Some artefacts from this vessel are now kept by the W.A. Museum, the Bunbury Historical Society and the Cable Sands Company.

Unfortunately, none of these groups was able to salvage those objects mentioned above from the many souvenir hunters who frequented the site.

An analysis of Henderson's historical account of North America of 1843 shows that the loss of these artefacts, especially the rudder, to be a crucial blow to identifying the wreck.

Site 3. Approximately one year later in early October 1963, the Cable Sands Co. uncovered another site lying only about 30 metres from that excavated.

This wreck lay E/W and was, according to Mr. Sophilis, of lighter timbers and brass sheathed in contrast to the copper of its partner.

In view of the problems and losses incurred in the previous excavations, the Bunbury Historical Society wisely decided to allow no excavation, (there being no adequate protective legislation then) and it was recovered with sand by the Cable Sands Company before her full length was visible.

A glance at Graeme Henderson's historical resume of the whalers Samuel Wright 1840, North America 1840, North America 1843, shows that either Samuel Wright and North America (1) could be likely that wreck appearing on Stokes Chart of 1841 in Koombana Bay (Fig. 2).

Allowing for errors and distortions when transposed to modern aerials using Pig Island and other prominent features, the location roughly fits that of the area of the sites uncovered by Cable Sands in 1963, i.e. wrecks 1,3 and E of Fig. 14.

Henderson shows that North America 1843 went ashore within a "few yards of the 1840 wreck of the same name" and that she was salvaged by Captain Scott who, after refloating her, fitted a new rudder.

She found her way ashore again, however, this time, according to a contemporary account (see Henderson), a total wreck and lying on her side close to the wreck of the Samuel Wright with her bottom stove in.

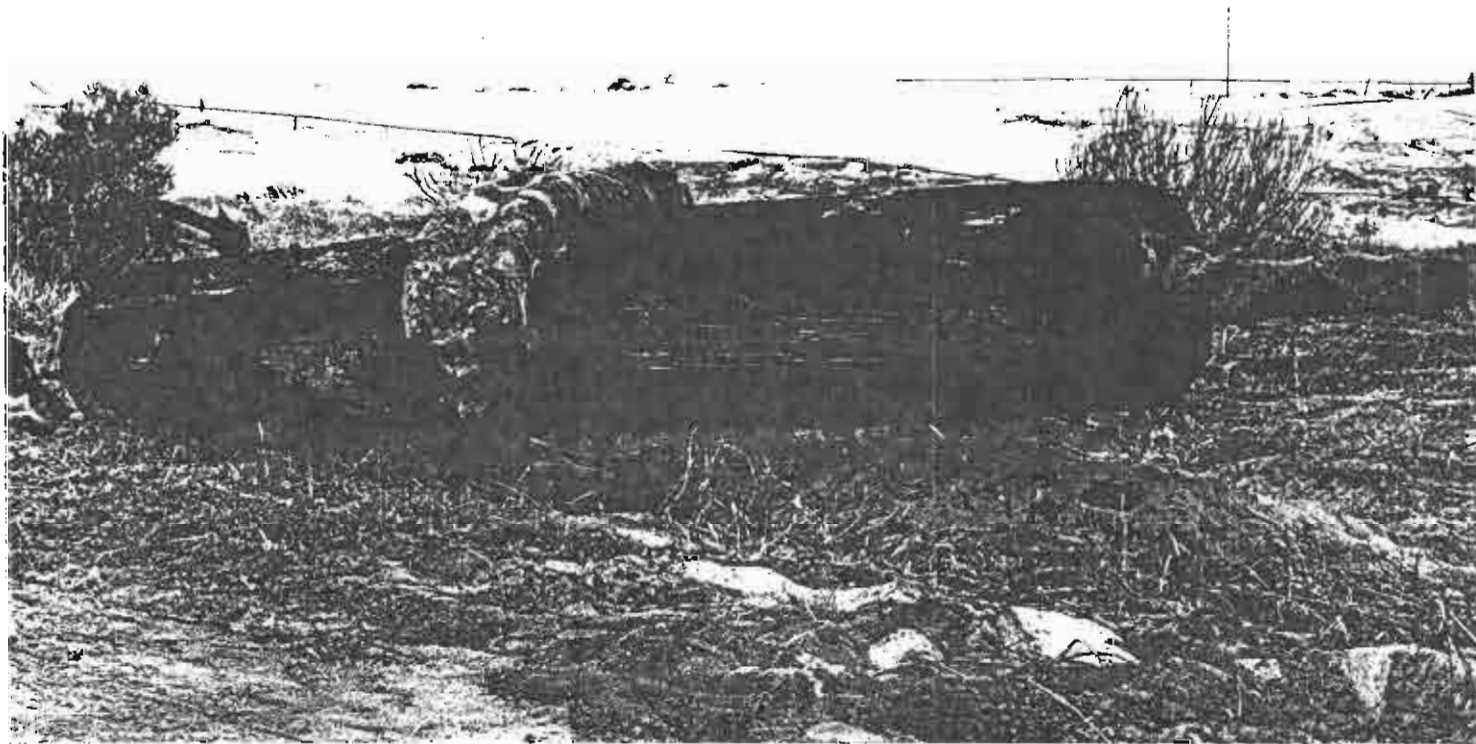
Conclusions:

The North America (1843) was 285 ton, 95.5 feet long (surprisingly exactly the length of the site measured by Dr. Crawford's team in 1963). While wrecksite length can be a misleading clue, this and the rudder of 'local timber' found on the 1963 site are most interesting and support the link.

Further examination of the sites is obviously required but the evidence based on Stokes Chart, the excavation and Sophilis' recollection is, that the 1963 wreck is most likely North America (2) with Samuel Wright nearby.

These identifications are tentative to date and the location of North America (1840) is even more uncertain.

The Windlass uncovered with the Rudder of "local timber" (photo W.10)



The actions of the Cable Sands Mining Company and Bunbury Historical Society in helping preserve these three wrecks and in keeping some of the artefacts intact and on display for all to see, is most appreciated.

Relics held by Cable Sands Co. and on public display:

1 axe head
2 bricks
1 pulley sheave MA1342 + sides
1 pipe bowl
1 copper spike

Relics held by Bunbury Historical Society and on display:

Trypot
Brick fragments
Rope
Cargo hook MA 1345
Sledge hammer head
Copper sheathing
Bottle
Spike

Relics held by W.A. Museum:

Bottle fragments WE717, 720
Coppernail and iron WR721
Nail conglomerate
Ceramic fragments WR718, 719, 722
Sheathing
Timbers

APPENDIX II

SITES KNOWN TO MRS. L.E. WALLACE

North Shore Resident

Sites of Known Wrecks, Koombana Bay, Bunbury August 1981

1. "Carbet Castle" 1897 wrecked on North Shore. Later engulfed by sand draft and incorporated in groyne.

2. Two sites uncovered during development of new Inner Harbour, believed to be "North America" and "Samuel Wright". This is near Sands and mineral silos.
3. Site below my residence Koombana Park, North Shore, I believe to be Ecclestone's "Fanny" (Ruby?). (Small schooner) Butt of main mast visible today.
4. Site at junction of road to Koombana Park and that to the Mineral Sands Silos (first one) outline of ribs were visible until cut off by machine.
5. Paddy's Blunder site old barge (in estuary).
6. Passenger launch "Nautilus" (prior name "Yorke" - Springman, J.) used at Turkey Point and Burbury Boat Shed. Vessel beached below my residence and remained there some years.
7. Remains of vessel uncovered in dredging new Channel from Estuary to Koombana Bay in 1973.
8. "MV Valdemar" brought to Bunbury by my brother J. Pat Lyons one of the Swan "Vale" boats. Used as passenger and stores, berthing lines at Burbury Harbour (old harbour). Buried at La Porte pipeline.
9. Wreck with iron ribs opposite the yacht club on the golf club side of railway. Disturbed and covered by railway development.

Mrs. Wallace showing a wrecksite.

Lois E. Wallace
August, 1981.



APPENDIX III

- (i) Magnetometers for Wrecksite Location
Steve Cushnahan
Mark Staniforth

A Report on the Bunbury Whaler
Magnetometer Study and the Carbet Castle
Anomaly.

- (ii) Metal Detectors
A report on the metal detector search of
the area of the Bunbury whalers and on
metal detectors in general.

Nic Clark
Phil Smith

MAGNETOMETERS FOR WRECKSITE LOCATION
A Case Study at Bunbury, Western Australia.

Steve Cushnahan and Mark Staniforth

Introduction

The application of the proton precession magnetometer in locating wrecksites, both in the ocean, and on the beach front, has been clearly demonstrated by a number of workers (Hall, 1966; Barto Arnold, 1981; Green, et.al., 1967; and Green, 1970). In recent years, the use of the seaborne towed fish magnetometer has become widespread in wrecksite location and survey; while the use of airborne magnetometers in the location of the HMS Pandora off the Queensland coast, has been noted (Henderson, 1980).

As part of the wreck inspection programme carried out by the Department of Maritime Archaeology of the Western Australian Maritime Museum, investigations have been undertaken in a number of areas where there are concentrations of wrecksites, and ships graveyards, (McCarthy, 1981). The study of more than a dozen nineteenth century ships which ran ashore in Koombana Bay, near Bunbury in Western Australia, is a part of this continuing programme.

An examination of old charts and aerial photographs of Koombana Bay, shows clearly that the shoreline has retreated 100-200 m in the last hundred years or so. This has left the wrecked vessels buried on dry land under sand dunes and ridges covered by colonizing coastal plant species.

In April 1982, a series of magnetometer surveys were carried out in two specific areas:

- (1) the area where proposed extension of the Bunbury powerhouse are to be located; and,
- (2) where the remains of two American whaling ships are known to be located.

Search Techniques

Both surveys utilized the same search techniques only the area dimensions and the search intervals differed. Because of the constraints of time and personnel, a relatively rapid method for carrying out these surveys needed to be developed. The system decided upon was a derivative of the leading marks system used by shipping; and has previously been used in ocean-going magnetometer surveys (Barto Arnold & Weddel, 1978).

The method required only 2 measuring tapes (of 100 m length), 3 people, some wooden stakes, and a minimum of time. Firstly, the area to be examined was pegged out, using standard procedures. Then a series of 1.5 m long stakes were placed along the perimeter of the search area at the required interval. The stakes were placed using an alidade or optical square (a small optical instrument which enables the operator to see objects at right angles). A second line of stakes was placed in front of the first, again at the required interval. At 90° to this line, further stakes were then placed along another perimeter.

The recorder merely needed to walk in a line until the shorter stakes superimposed onto the larger ones in the background. By using the lines of stakes on both perimeters, the recorder could place himself exactly in position; as these lines were 90° to each other. If there were not enough stakes to cover both the perimeters, those which fell short could be leap-frogged to provide the positioning needed.

The magnetometer used was a Geometrics G816, on loan from the Western Australian Institute of Technology. This model is suitable for rapid and accurate small-scale surveys, since it can be carried and operated by a single person. The instrument measures the total magnetic field intensity of the earth, and has an accuracy of ± 1 gamma within a 20,000 - 9,000 gamma range.

The recording head, which must be positioned N-S, may be carried in a backpack provided, or on a collapsible aluminium pole also provided. The instrument is operated simply by pushing a button and waiting for a short period (5-7 seconds). The resultant readings are displayed as a five figure digital readout. Due to magnetic interference from metallic articles, the operator had to ensure that he was not wearing such items as watches, zips, metal buttons etc.

Once the reading was obtained, it was relayed by the operator to a second person, who acted as recorder. The results were recorded on audio cassette tape using a portable recorder (Sanyo M1001 with built-in microphone), along with relevant comments regarding surface conditions and visible artefacts.

While possible for one person to operate both the magnetometer and recorder, it was discovered that this resulted in mental fatigue, which itself resulted in erroneous results being recorded. While the results were being recorded, a third person was able to move the stakes on one perimeter, if this was required. Thus, the entire operation could proceed with a minimum of three people.

For the purposes of interpreting the results gathered, and to reduce the magnetometer readings to allow for diurnal variation and changes in the magnetic field intensity, a series of base readings were taken before, and after, each section of runs of readings. These allowed the natural change in the magnetic field to be estimated.

BUNBURY WHALERS MAGNETOMETER SURVEY Steve Cushnahan

Aims

There were three aims in this survey. Two of these were distinctly interwoven and specific; and the third has wider implications. These were:

- (1) the main aim was to carry out a close plot magnetometer survey of the area, and thus to establish whether the vessels known to be in the area would produce magnetic anomalies. The vessels in question would have little or no ferro-magnetic material on them, as they would have been copper or treenail fastened. Thus the question posed was: would vessels such as these, being predominantly wooden, be located through a wrecksite survey utilizing magnetometers?
- (2) was closely linked with this. The search area and beyond, contains mineral sands deposits. The aim was to establish what magnetic signature this material would produce; and if these anomalies could be distinguished from those made by the vessels.

BUNBURY WHALERS MAGNETOMETER SURVEY

COASTLINE CHANGES 1876 - 1960

LEGEND: Coastline: 1876 — Wrecksites +

Scale: 0 500 metres 1960 - - - - -

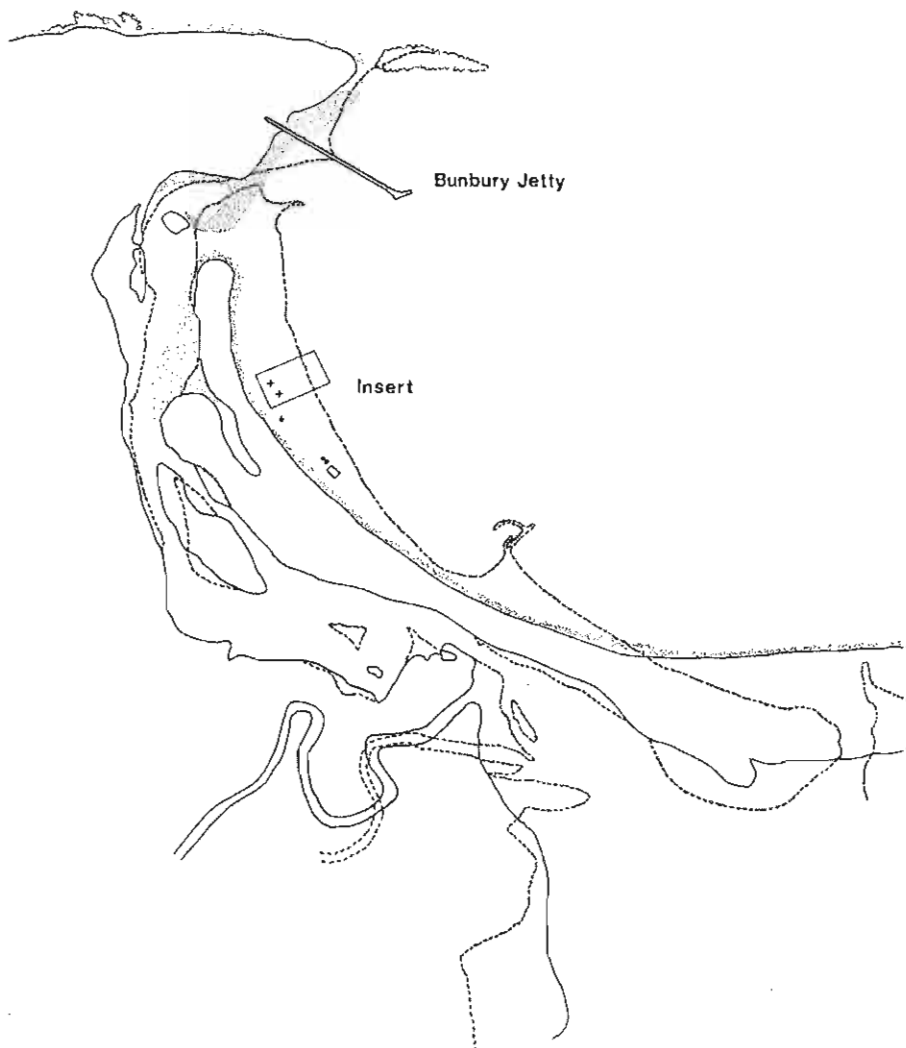


Figure 1. Bunbury Coastline Changes

SCALE:- 1:1000

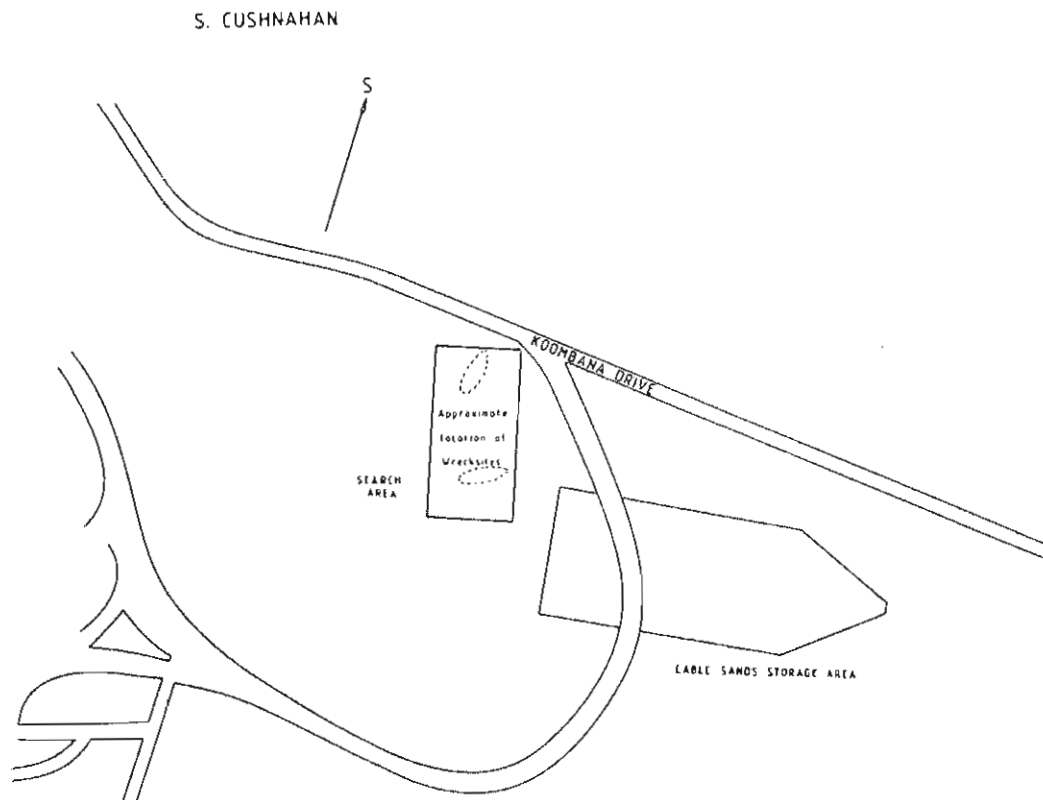
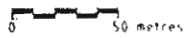


Figure 2. Cable Sands Search Area and Approximate Location of Wreck Site

Wrecksite locations and other features

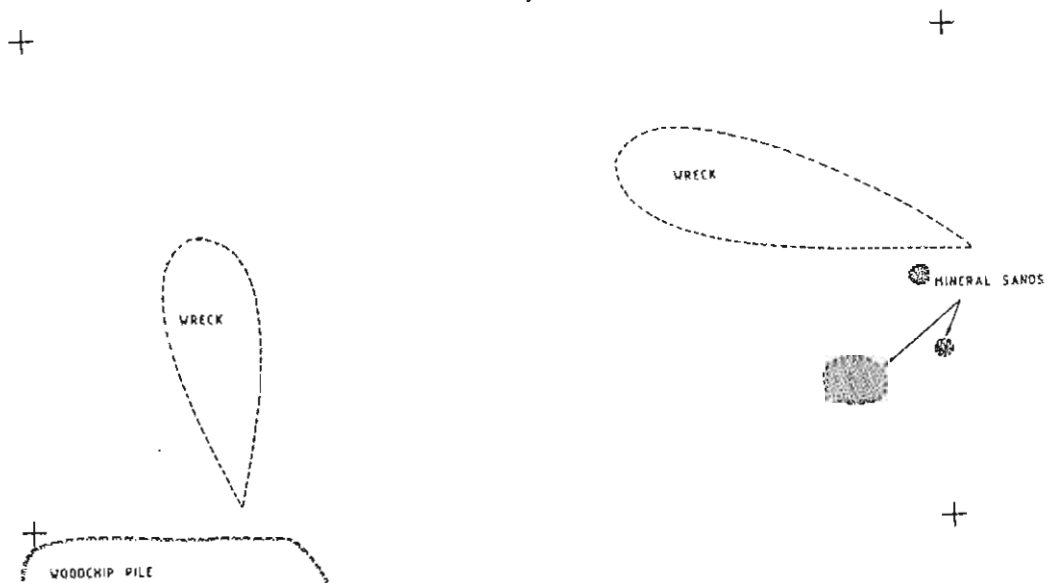


Figure 3. Wreck Site Locations and Other Features

common to both surveys, was the development of a simple, rapid method for conducting small close plot surveys when confronted by a minimum of time and personnel.

- (4) through the results of both surveys, it was hoped that an examination of the limitations of the magnetometer could be made.

Historical Background and Location

In July 1840, during an unexpectedly fierce storm, three American whaling ships were driven ashore in Koombana Bay, near Bunbury, in Western Australia. The vessels: Samuel Wright, of Salem, Massachusetts (372 tons); the North America, of Rhode Island (294 tons); and the Governor Endicott, also of Salem, Massachusetts (298 tons), were wrecked. In order to recoup some of the money lost through the ships being wrecked, the fittings and equipment were sold at public auction. Meanwhile, the hulls remained basically intact.

After 180 years of continual development in the area, the shoreline gradually changed on this section of the coast. As mentioned in the Introduction, the seafront retreated up to 200 m in some areas, leaving the vessels on dry land - by this time, buried. During further development in the 1960s, several of the vessels were re-discovered. The Western Australian Museum was notified, and there was prompt action which saw the wrecks being recorded photographically. The vessels were deemed to be of historical importance, and were re-covered with sand.

The sites are presently located approximately 200 m from Koombana Bay, near the site of the Cable Sands mineral sands storage and treatment plant (see Fig. 1 and 2). The work described in this paper was supervised by Mike McCarthy, of the W.A. Museum, with the assistance of this author and Mark Staniforth.

This survey covered an area in which it is known that two of the vessels lie. Their locations are marked approximately by stakes at the bow and stern of each vessel. The close plot search was carried out over an area of 40 m x 80 m. Also, within the search area, were several mounds of accumulated rubbish, and mineral sands (see Fig. 3). A large mound of mineral sands also lies in a nearby storage area (see Fig. 2), all of which affect the survey.

Results

The readings which were made on to audio cassette were transcribed onto paper by the author. These readings were then reduced to a value, which was a differential either above or below the base reading for the survey. Several base readings were taken during this survey, giving an average of 59,790 gamma, and this was the reading which was used in the interpretation. All other readings were reduced relative to this figure.

BUNBURY WHALERS MAGNETOMETER SURVEY

Conducted by M. McCarthy, S. Cushnahan, & M. Staniforth

Contours in 50 gamma intervals

Scale:  Metres

S. CUSHNAHAN

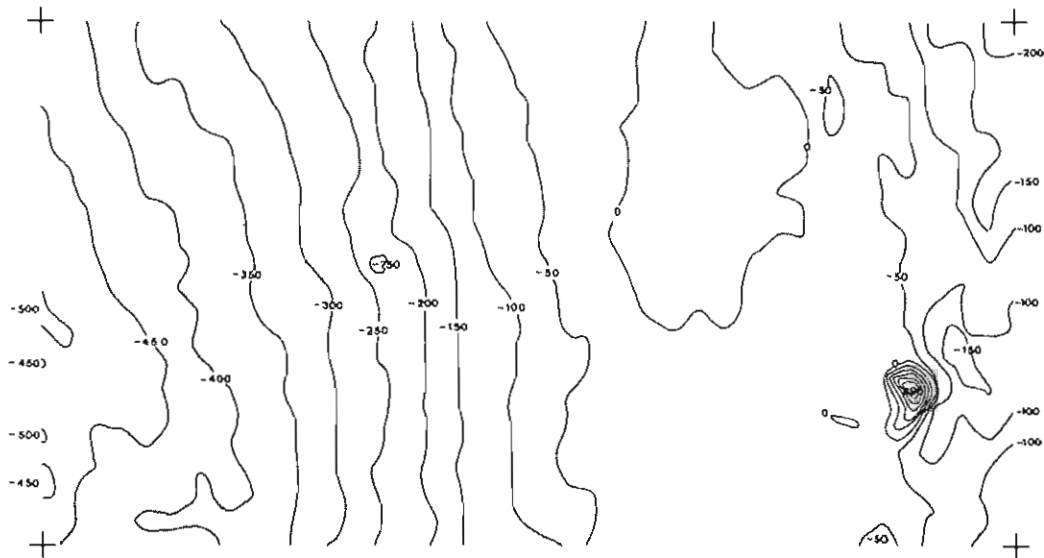


Figure 4. Magnetometer Survey Contour Plan.

The results were plotted onto graph paper, and contours were drawn on the plot. The contours were spaced at intervals of 50 gammas; and the results can be seen in Fig. 4. The reason for selecting 50 gamma intervals is concerned with the natural magnetic field fluctuations in the area. The field increases as one heads inland from the sea. This increase is gradual, but noticeable.

The drawing shows several anomalies in the search area, which will be discussed later. From the plotted readings, profiles were drawn up (see Fig. 6). These profiles were taken along the 66 m - 72 m runs, and from a run on a large mineral sand pile nearby. Also, a profile was drawn up of a run done in the direction of the 80 m perimeter.

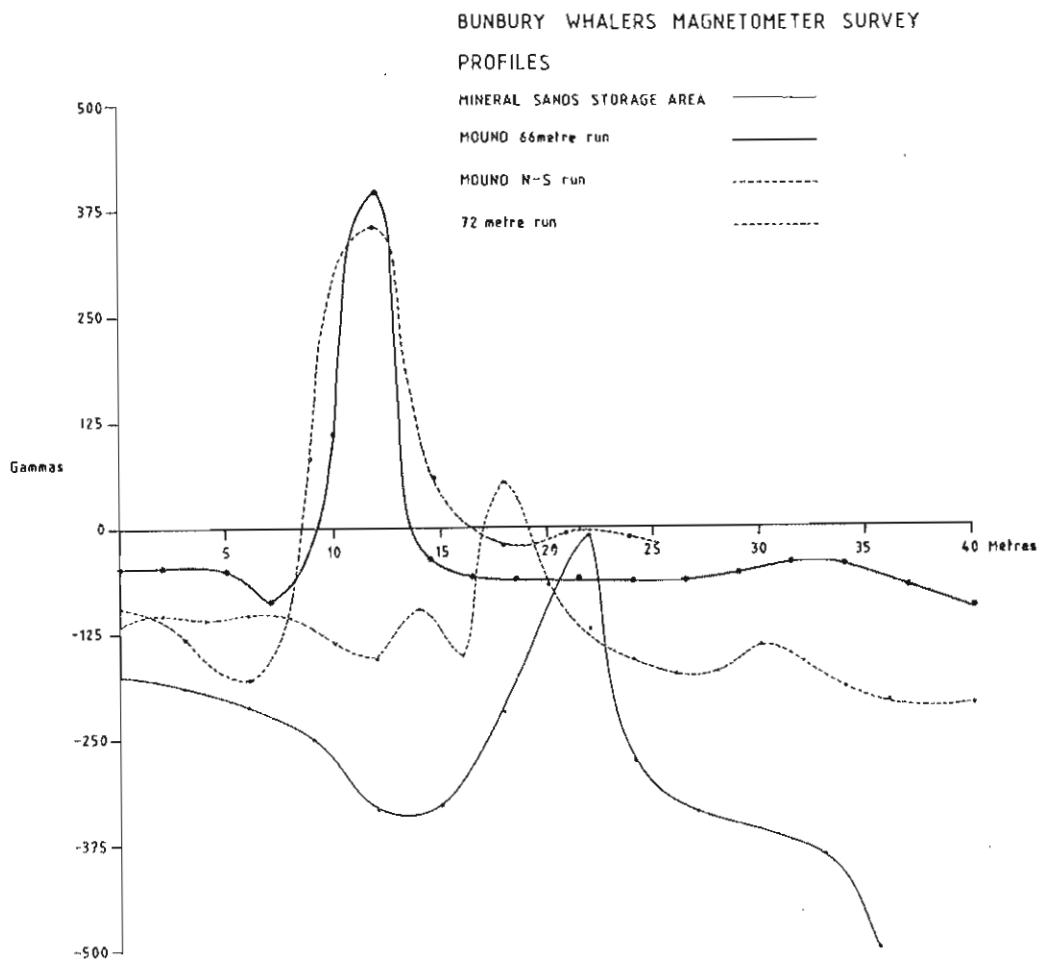


Figure 5. Magnetometer Profiles.

The anomalies shown in the 50 gamma contour plot were then re-plotted at 25 gamma intervals to see if any other features could be discovered (see Fig. 5).

Interpretation of the Results

Firstly, in order to test if the wrecks were, in fact, producing magnetic anomalies, it is simply a matter of examining Fig. 3, 5 and 6. From this exercise, it can be seen that the approximate location of the wrecks (as shown by the stakes on the site) do not correspond with the magnetic anomalies. However, at this point the objection may be raised that these locations are only approximate, and that the vessels may be producing anomalies, or at least be partially responsible for the anomalies found.

BUNBURY WHALERS MAGNETOMETER SURVEY

DETAIL MAGNETIC ANOMALIES

Contours in 25 gamma intervals

Scale:  Meters

S. CUSHNAHAN

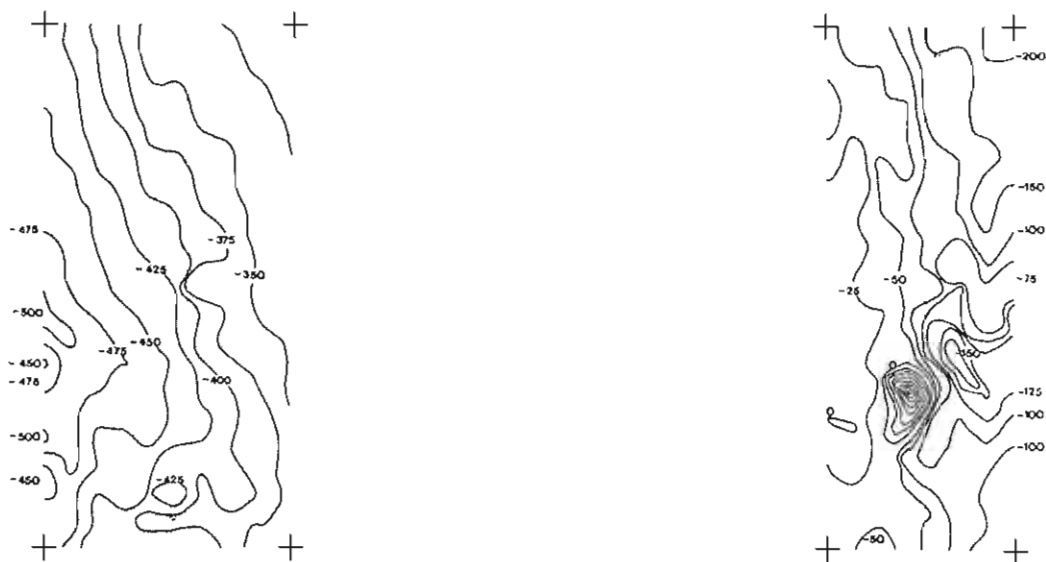


Figure 6. Magnetometer Survey 25 gamma intervals.

There are several factors which mitigate against this argument. Firstly, upon examining the plots again, it is apparent that the small mineral sands mounds do correspond to the anomalies; and, for reasons discussed later, it may be seen that these are the major factor in producing an anomaly of this type. Secondly, the vessels are not iron-fastened, and contain little, if any, ferro-magnetic material. The size of the anomalies is not consistent with this.

An associated interpretation of the size of the anomalies is concerned with the depth of the object which is causing the disturbance. Breiner (1973:18) states that a "significant characteristic of a magnetic anomaly is its variation with the depth between the magnetometer and the source, the deeper the source, the broader the anomaly". As can be seen from the profiles as drawn up, the anomalies are, in fact, short and high, an indication that the object is close to the surface. In fact, the object in at least two of the cases are mineral sands mounds - above the surface! All of the profiles indicate these mounds and thus, the characteristic signature of the mineral sand deposits is evident.

Thus, if one looks at the evidence from the location of the vessels, and from the interpretation of the anomaly profiles and contours, one may conclude that the anomalies which are present are due to deposits of mineral sands, and that there is no magnetic evidence of any other objects in the area.

Therefore, a definitive statement maybe made about magnetometer searches which are employed to locate vessels, either on land, or at sea, i.e. if the vessel has a wooden hull, constructed with the use of treenails or copper fittings, the anomaly produced would be small, and perhaps be masked by other features of the search area. It is possible for ships which had iron fittings or hulls to be located accurately, as has been shown by Staniforth (see below). It is even possible to discern the shape and depth of some vessels. However, as can be seen here, it is extremely difficult to locate a wooden-hulled vessel with these methods.

Achievement of Aims and Implications for Further Surveys:

All three stated aims of this survey were achieved. It has been demonstrated that it is very difficult to locate a wooden-hulled vessel using a magnetometer system; and if these vessels contain no ferro-magnetic material, virtually impossible.

Also, the signatures of the mineral sands have been examined, and it has been found that:

- (a) any anomaly produced by a vessel with only a small amount of ferro-magnetic material will be masked by that of the mineral sands (or any comparable material); and

- (b) it may be difficult to distinguish solid iron objects from the mineral sands (if those objects are small).

The variation on the leading marks method of positioning has also proved successful in this survey. This method not only worked efficiently, but also shortened the amount of time required to carry out the survey.

These all have implications for any further surveys in the area; and also for surveys in any other similar areas. If the aim is to locate a wooden-hulled, copper-fastened ship, a magnetometer will probably not be useful. Also, an examination of the geology of the area may prove that a magnetometer survey is impractical because of the presence of mineral sands or other magnetic disturbances. Although these implications are negative, they may be positive in producing a result in a survey.

BUNBURY POWERHOUSE MAGNETOMETER SURVEY

Mark Staniforth

This survey was carried out over the area of proposed extensions to the Bunbury powerhouse. It was supervised by Mike McCarthy (W.A. Museum), assisted by this author and Steve Cushnahan. The area covered was approximately 500 m x 55 m along the frontal dune system parallel to, and some 30 m from the sea. Previous work by a Museum team using a towed fish magnetometer mounted on a sled (which was pulled along the sand behind a Land Cruiser) had covered some of the area on the lower beach front.

According to archival sources, the most recent vessel to have run ashore on the beach at Bunbury was also the largest, the 2,000 ton Carbet Castle. The work done previously in locating some of the wrecksites in the area indicated that the position of the Carbet Castle could safely be assumed to be the closest wrecksite to the present seafront. As all of the vessels lost in the area are known to have run ashore, and being smaller and shallower than the Carbet Castle, these vessels are likely to be further inland, in the dune.

The survey techniques used in this survey are those described in the Introduction. Using these techniques, a complete 100 m x 55 m section could be laid out and surveyed in about 2 hours, taking 252 readings. In order to fully cover the area associated with the remains of the Carbet Castle, it was necessary to extend the readings down towards the beach from section B (see Fig. 7) by pacing 5 m intervals.

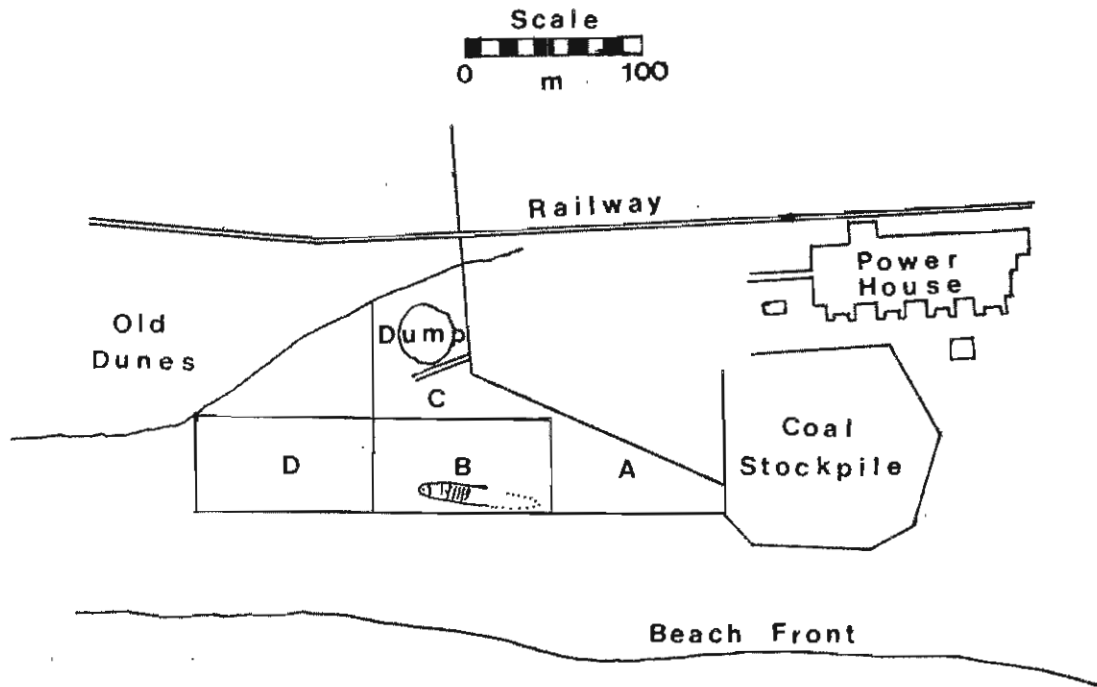


Figure 7. Bunbury Power House Magnetometer Survey

Results

This study will examine only the sector in which the Carbet Castle was found (sector B) and will not deal with the other sectors where anomalies were found. In order to fully cover the complex magnetic anomalies associated with the remains of the Carbet Castle, it was necessary to use some readings obtained in sector A (the 90 m and 95 m runs) and to continue some of the runs in sector B down towards the present seafront.

The readings were transcribed from the tape recording onto a large rough plan of the sector. A computer programme was then used which reduced each reading by subtracting the base figure (base = 59,173 gammas); this was printed out onto a computer sheet. As the anomalies obtained were extremely large (in thousands of gammas) it was decided that they should be rounded off to the nearest 100 gammas. These figures were then plotted onto a large magnetic anomaly chart.

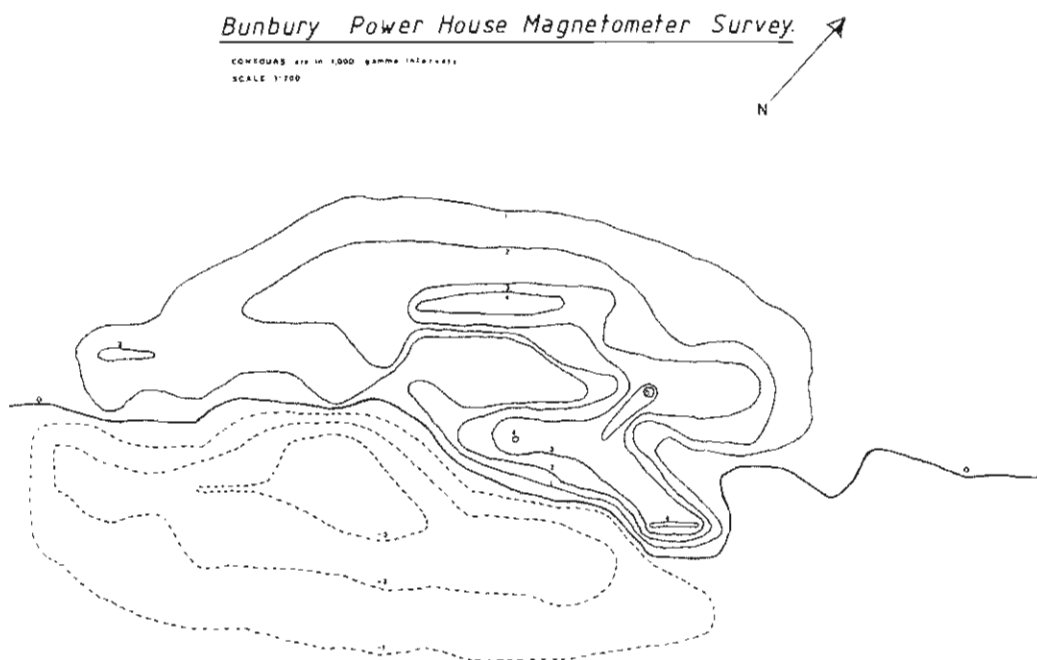


Figure 8. Bunbury Power House Magnetometer Survey, contours 1000 gamma.

From the chart a contour map of the magnetic anomaly was drawn (in 1,000 gamma intervals) (see Fig. 8). A number of profiles using the 0 m, 20 m, 45 m, 60 m, 90 m, and 100 m runs were drawn up (using magnetic anomaly against distance) across sector B (see Fig. 9). Both Figs. 8 & 9 were photographically reduced to the same scale to allow the profiles to be related to the contour map.

Discussion

The visible features which appear in the enlargement of the aerial photograph correspond well with the features which can be seen on photographs of the Carbet Castle after she ran ashore in 1897. The old photographs clearly show that the vessel had broken in front of the main mast, (see Fig. 9). This represents approximately 35 m from the stern to the break in the hull, and the aerial photograph also shows approximately the same amount of the vessel remaining above the sand. Therefore, it can be concluded as late as the 1960s, the stern half of the Carbet Castle retained structural integrity; and while there is no way of telling how high the sides of the vessel extend above the keel, it can be assumed that the sides and stern have retained their original shape.

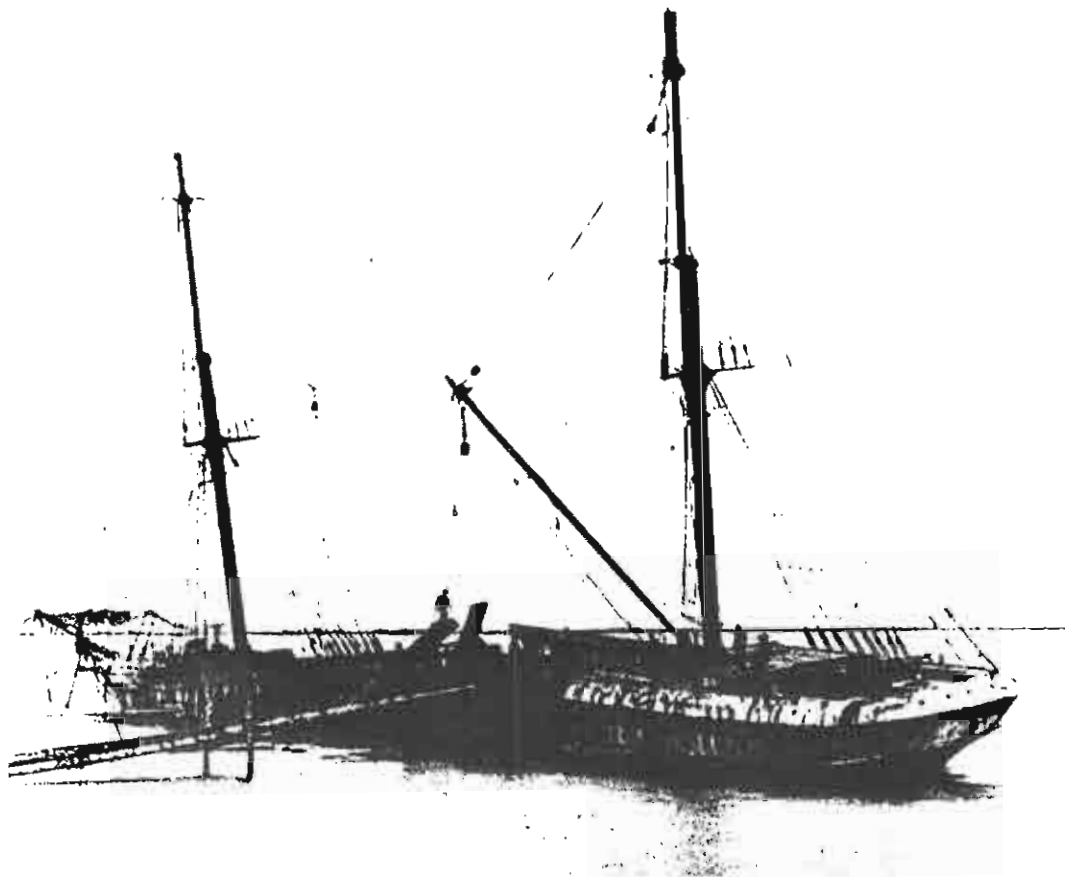


Figure 9. Carbet Castle after she ran ashore in 1897.

If the contour map is examined with the aerial photograph enlargement, it can be seen that: the overall configuration of the contour map shows a remarkably similar general shape and size as the known shape and size of the vessel's remains. The largest magnetic anomalies are over 4,000 gammas above the local base reading, and the majority of these readings appear in a U shape approximately 40 m long, and 20 m wide. This, of course, does not mean that the greatest magnetic anomaly is directly above either the largest remaining section of the vessel, or the closest part of the remains to the surface. However, if as the aerial photograph suggests, the sides of the ship have remained substantially intact, then there will be a larger mass of metal closer to the surface near the sides of the vessel than directly over the centre line of the ship. This would then result in a double peak in the profiles taken over this section of the remains. That is, the magnetic anomaly will rise sharply to a peak corresponding to - but offset from - the side of the vessel, will then drop, and finally will rise to a second peak corresponding to the other side of the vessel. Profiles 2 and B show this double peak, (Fig. 10) and therefore tend to support the theory that these peaks correspond to the sides of the vessel.

Unfortunately, the peaks of the magnetic anomaly do not lie directly over the sides of the vessel. Instead, the sides should be beneath a point some distance down the slope of the curve; at least for profiles 2 and B, because this is where there is maximum rate of change in the slope of the curve (Breiner, 1973). The complexity of this magnetic anomaly, and the extremely large peaks, are a result of being in the near field of a very large mass of iron material. Consequently, it is difficult to accurately determine the depth which the material is located at, and its' exact position.

The best estimate which can be made is that there is at least 5 m of sand over the sides of the vessel; based on the half width of the anomaly where the signal is $M/2.83$ (Green, 1981). Because there is a large section of the vessel buried in the sand, and because any excavation of the site would initially be done with large earth-moving machinery, it is probably unnecessary to locate the remains any more accurately than within the given 5 m. After removal of the surface overburden, the exact position of the vessel could be determined by a probe survey.

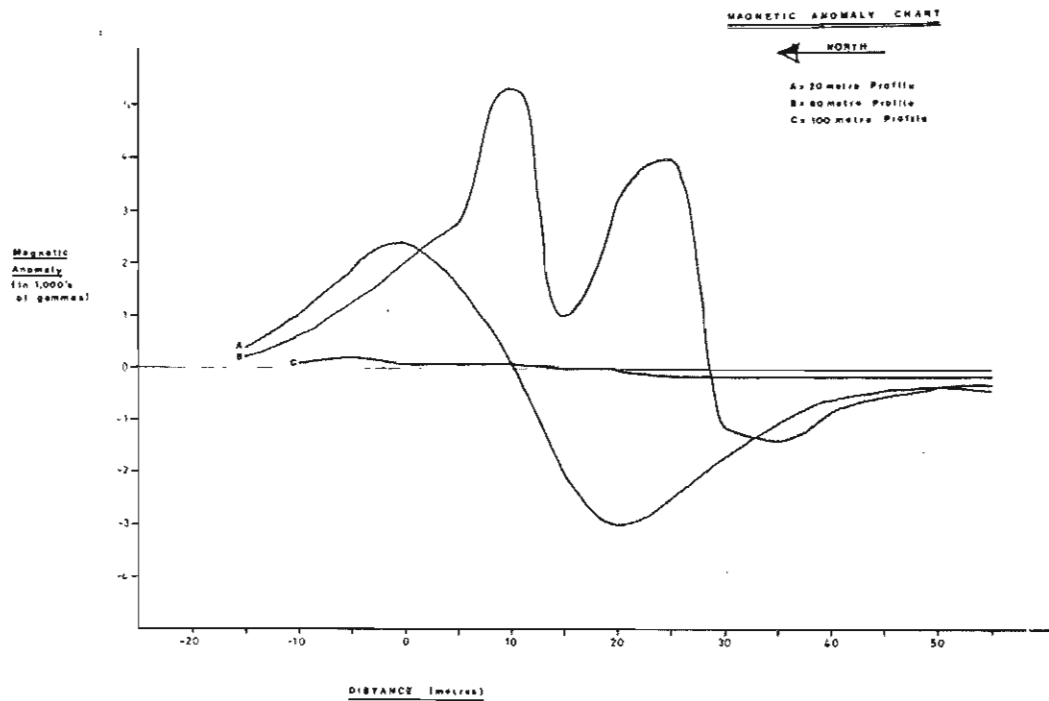
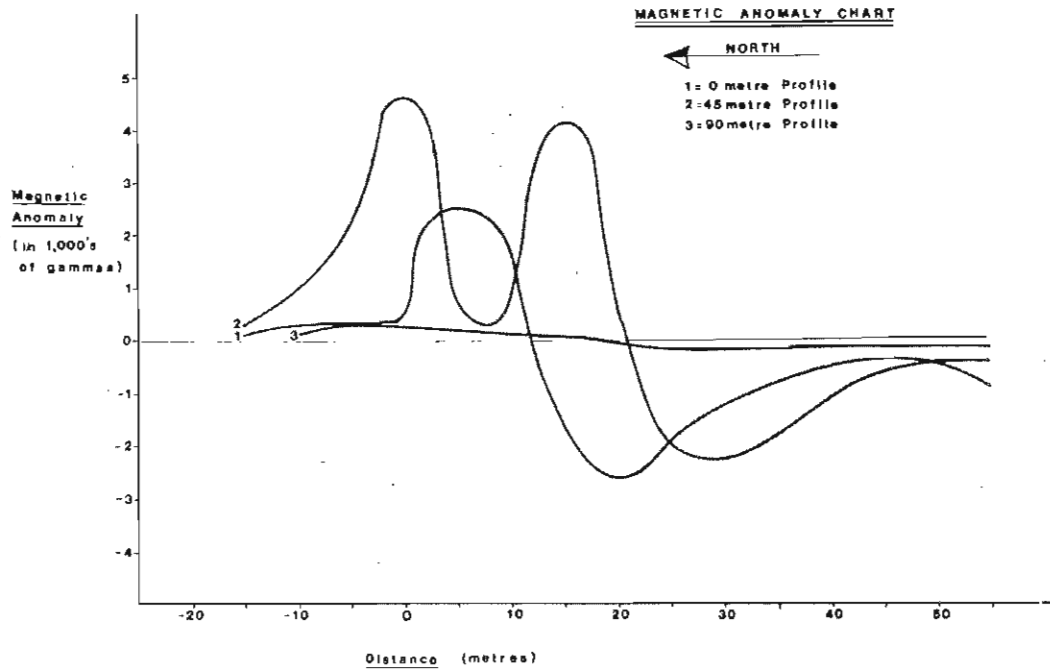


Figure 10. Magnetic Anomaly Chart.

Although the stern section of the Carbet Castle is undoubtedly the most intact, and consequently the most interesting part of the site, here is some evidence that at least part of the broken bow section remains (this represents about 25 m of the vessel forward of the main mast). On the contour map (Fig. 8), there are a group of 2,000 gamma peaks on the left of the map, at the beginning of sector B. These are represented by profiles 1 and A (Fig. 10), and are characterized by a broad single peak. This section of the remains of the vessel is more deeply buried than the stern section (7-10 m of sand). While the increased depth of burial will mask some of the magnetic anomaly signature from this section, there is undoubtedly a smaller mass of material in this area.

There were a number of magnetic anomalies recorded in section A which may have been caused by strongly magnetic basaltic rock (evidence was seen on the surface of this), but recent material from the powerhouse, or by the broken bow section of the vessel. Because the bow section of the ship is less intact, and more deeply buried, than the stern section, any future excavation would begin with the stern section.

Conclusions

The use of a portable proton magnetometer, carried in a back pack, proved an extremely accurate and versatile method of locating and plotting the magnetic anomalies associated with a large, steel ship buried under the sand. The complexity of the near field magnetic anomaly signature of a large, steel vessel was demonstrated in the size and shape of the anomalies detected. A good degree of accuracy (± 5 m) in locating and plotting the size, shape, and orientation of the vessels' remains, was shown despite the problem of being within the near field. The importance of correlating information from diverse sources was noted. Material available in the form of old photographs, aerial photographs and charts proved invaluable in this study.

Acknowledgements

We would particularly like to thank Mike McCarthy, of the Western Australian Maritime Museum, for inviting us to be a part of the overall project of which these reports detail only a small part. Without his invaluable assistance, encouragement and support, these reports would not have been possible. Our thanks also

go to Joan Sewell, who assisted during field work; and to Brian Richards, for the photography. Finally we would like to thank Dr. John Penrose and Jeremy Green for their comments and interpretations of the magnetic anomaly signatures.

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The Metal Detector Search (Author's Note)

The area of the two known and pre-located whaler wrecks was searched with 3 different metal detectors along similar lines as the magnetometer search described above.

The results were not encouraging as in only one of the 3 searches conducted with metal detectors did an anomaly persist at depth, i.e. continue below the surface after preliminary excavation of indicated targets.

The instruments used were:

1. An amphibious metal detector (location technology)
2. A "C" scope metal detector
3. A white metal detector (with good discriminatory powers)

Mr. Phil Smith of Bunbury conducted a search in the area of the whalers and found an anomaly which unlike all others persisted at depth. This anomaly was located with the "White" detector just off line of one of two flags marking the most northerly of the wrecks shown in Fig. 2 above.

The other two instruments failed to locate the sites which appeared to be buried between 2-3 metres below the surface as the instruments failed to locate both known sites, they like the magnetometer, were considered not satisfactory for the finding of any copper fastened hulls on the power house site.

The decision was influenced also by the apparent greater distance between the expected targets and the detector head on the rough power house terrain in contrast to the flat whaler site already unsuccessfully searched.

The following analysis of Nic Clark illustrates the problem:

Metal Detectors, Nic Clark

The other widely used instrument in electromagnetic remote sensing is the pulse induction metal detector. The present widespread use of such instruments for treasure hunting and gold-seeking belie the serious archaeological uses of the instrument in land surveys (see Foster, 1970) and in underwater surveys (see Green, et.al. 1967; Green and Martin, 1970).

In land applications, the instrument can be used either for location of metallic objects, or to detect pits, ditches, and portholes - by virtue of the enhanced magnetic viscosity of the soil filling (Colani and Aitken, 1966).

As there are no known magnetic viscosity in marine sediments, only the metal detection function is used underwater surveys (Foster, 1970).

Principals:

The pulse induction metal detector works in the following manner (after Colani, 1966):

A pulse generator feeds strong short duration current pulses into a transmitter loop which produces strong magnetic field pulses into the surrounding medium. If a metal object is within the pulses magnetic field, eddy currents are induced, picked up by the receiver part of the loop, amplified, and fed to the meter. The strength of the reading depends on the decay time of the induced eddy currents: a function of size, shape and conductivity of the object.

The purpose built underwater metal detector used in the Point Cloates survey represents the state of the art technology. The sensitivity of this instrument is continuously adjustable to allow for tuning out of the background signal and/or to allow accurate pinpointing of artefact locations. The adjustability enables the instrument to be used effectively on land and in fresh and salt water: a valuable feature given that seawater is several orders of magnitude more conductive than freshwater, which is in turn, several orders of magnitude more conductive than soil.

Early workers with waterproofed land metal detectors found that the seawater induced eddy currents (resulting from the higher conductivity) drowned out all of the metal produced signals. Success was achieved in 'de-tuning' the instrument by carefully positioning a piece of lead in the centre of the detector head (Green, et.al., 1967).

Detection Range:

The detection range of the pulse induction metal detector varies according to the conductivity of the medium. The mass, dimensions and conductivity of a target effects the signal strength but has little effect on the detection range. From the above diagram, it can be seen that the detection range of a brass plate 10cm x 10cm x 0.1cm is between 0.5m and 1.5m in seawater (Foster, 1970).

Operation:

(a) The Instrument: The Location Technology underwater

metal detector is very simple to use, mainly due to the minimal number of controls. The only control that the diver operates is the dual purpose on/off sensitivity in increased until the background produces full scale deflection on the meter. The sensitivity is then reduced until the meter gives a zero reading. The instrument is then ready for use, though the sensitivity may be increased or decreased by the operator to facilitate pinpointing of an object.

- (d) Search Technique: As the strength of the eddy current signal decreased as the $1/6$ power of distance (signal strength $\times 1/d^6$), and thus, has a maximum detection range for any metal object of about 2.5 metres, the instrument is really suitable for close-plot surveys such as site delineation (e.g. Green and Martin, 1970a).

Due to the limited detection range of the instrument, search lines should be no more than 2 metres apart; the diver needs to sweep the detector loop back and forth over a one meter wide path to ensure that the instrument to target distance is never more than one metre.

As with the close plot swim magnetometer surveys, a rectangular grid offers systematic coverage and ease of plotting data. 'Strikes' may be recorded on a presence/absence basis, or contoured over the entire survey area.

MAGNETOMETERS AND METAL DETECTORS COMPARED

The magnetometer and metal detector both make use of electromagnetic properties of matter to aid detection of targets. Although their use in close plot on site survey is widespread, it is worth considering their similarities and differences in terms of operation, resolution, and applicability.

As detailed in the proceeding section, the magnetometer (in marine survey) is capable of detecting ferromagnetic material such as iron, and to a lesser extent thermo-remnant material. The underwater metal detector, on the other hand, is only reliably capable of detecting "reasonably sized objects of good electrical conductivity" (Foster, 1970).

However, as iron is the major metal found on a shipwreck site (North, 1976), the overlap of detection strikes is likely to be considerable.

The advantages and disadvantages of each instrument will be considered in the next section.

MAGNETOMETER ADVANTAGES

The greatest advantage of this instrument over the metal detector (for iron detection) is its detection range, which increases with the mass and dimensions of the target: the strength of the apparent anomaly decreases as the 1/3 power of distance. This allows for surveys to be carried out over large areas for objects moderately distant from the detector head. The ability of the proton pulse magnetometer to detect thermo-remnant magnetised material is also a potential advantage for in-site survey (see Green, et.al., 1967).

Disadvantages:

(a)

Noise: this is the most serious problem with the instrument. It cannot be 'de-tuned' to minimise the noise effects as can be done with the metal detector. The effects of noise are most significant in diminishing the detectability of low order apparent anomalies produced by small or distant objects;

(b)

Bugs: the magnetometer can be effected by a wide range of internal (electronic) or external problems which cause frustrating spurious readings. To a certain extent, recognising and dealing with these is a matter of experience. The metal detector by contrast, has a simple 'yes/no' detection system. 'Bugs' are far less common, and generally attributable to metal objects the diver is wearing (i.e. diving watch).

(c)

Logistics: in a close plot survey of any kind, it is necessary to construct an X-Y grid system for the accurate plotting of finds. Logistical problems for close plot magnetometer survey stem mainly from the fact that only the detector head is submersible. Thus, at least two operators are required. One to move the detector head along the grid, and one, in a boat on the surface to monitor and record the readout. This system also requires some form of diver to surface communication to indicate when the head is in position (see Green, et.al., 1967). Such communication is best done electronically, though low cost systems (such as signal floats) are quite effective.

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The sensor head and the recording instrument are connected via a co-axial cable which is negatively buoyant. If the bottom topography is rocky, outcropping or coralline, the cable has an annoying tendency to snag - impeding the underwater

operators movement over the grid.

(d)

Diver effects: the diver's equipment may have direct noise effects on the magnetometer readings. It is, therefore, necessary to remove any ferromagnetic material from his personal equipment. This involves use of an alloy SCUBA tank, though many stainless steels (300 and 330 series) can be regarded as non-magnetic. Tests should be made to determine diver effects prior to the survey.

Apparent Target Locations:

The shape of a magnetic anomaly depends on the vector addition of the field due to the object and the normal ambient field (Aitken, 1958). At magnetic latitudes 0 degrees (near the Equator) and 90 degrees (near the poles), the maximum anomaly will generally be located directly over the object. At other latitudes, the maximum anomaly will be displaced relative to the object; to the north of the object in the southern hemisphere, and to the south of the object in the northern hemisphere (Tite, 1966).

METAL DETECTORS - Advantages:

The pulse induction metal detector has some advantages over the magnetometer in site delineation surveys. The unit is purpose built for underwater use. The small size and weight do not restrict the diver's movement through the water appreciably. The entire unit is submersible, therefore no surface to diver communication is necessary; the entire survey and recording can be carried out by a single operator.

Noise is not a significant problem, as the instrument's sensitivity can be adjusted to suit the medium, or to compensate for the effects of very large objects.

Target Location: The target can be expected to be directly beneath the maximum signal. The signal is a function of the electromagnetic conductivity of the artefact and the surrounding medium; it is not affected by magnetic latitude.

Disadvantages:

Detection Distance: the signal strength from a metal detector target diminishes as a 1/6 power (i.e. of distance). Thus, only shallowly buried objects are likely to be detected.

Non-metals are generally unlikely to be detected (i.e. thermo-remnant materials), though in some cases ballast material may have enhanced magnetic viscosity, and be detectable.

Conclusions:

The preceding discussions on the use of the pulse induction metal detector and proton precession magnetometer in close plot surveys demonstrates that they have a wide area of functional overlap, though each has inherent advantages and disadvantages. The two devices should be regarded as complimentary for close plot search and site delineation programme.

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