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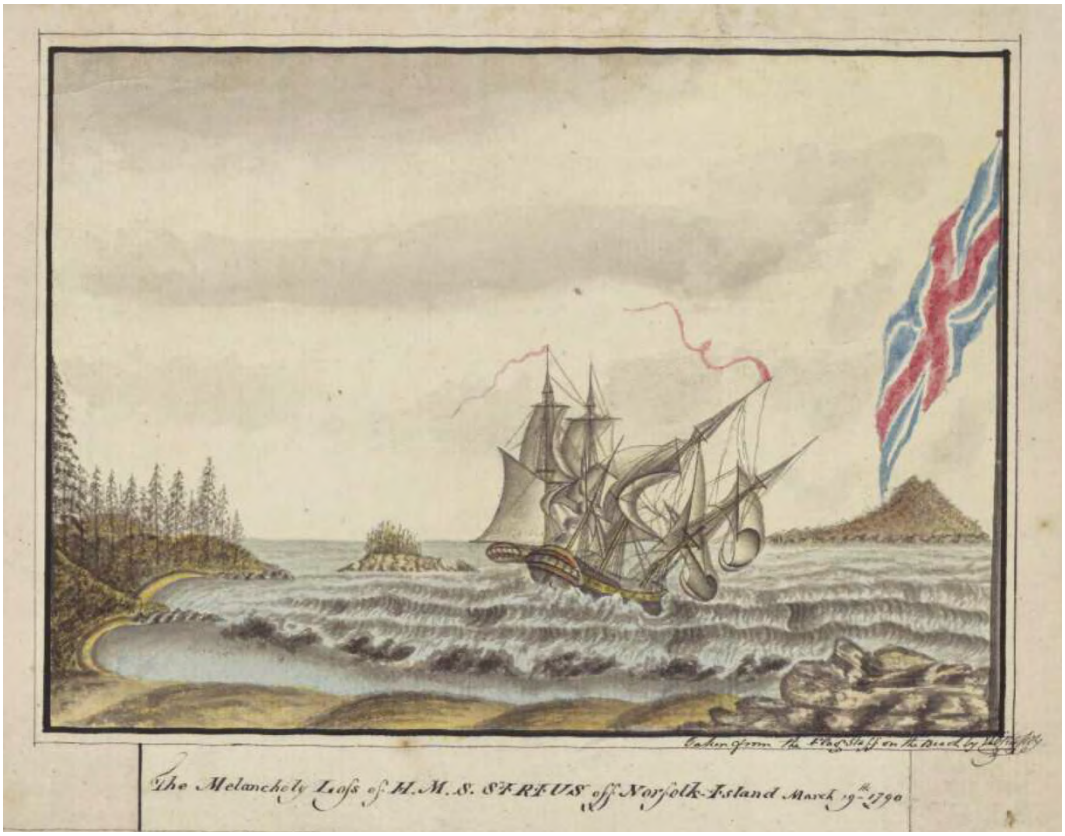
HMS *Sirius*



Site Inspection Report 2020

Norfolk Island

Australian External Territory

March 2021

HMS *Sirius*

Site Inspection Report

Prepared for:

Department of Infrastructure, Transport, Regional Development and Communications.

By:

Jane Mitchell

Senior Maritime Archaeologist

March 2021

Cosmos Archaeology Job Number J20/10

Cover image: **Raper, George, 1790,** *The melancholy loss of H.M.S Sirius off Norfolk Island March 19th 1790.* Available at http://nla.gov.au/nla.obj-136507434.

Revision	Description	Date	Originator	Reviewer	Approver
V0	Draft Site Inspection Report	26/11/2020	JM	CC	CC
V1	Draft Site Inspection Report	26/02/2021	JM	CC	CC
V2	Department comments incorporated.	12/03/2021	JM	CC	CC
V2.1	Further Department comments incorporated. Report finalised.	15/03/2021	JM		

Acknowledgments:

Cosmos Archaeology would like to express appreciation for the help received on the Island in conducting the inspection and in writing the report.

EXECUTIVE SUMMARY

The wreck site of HMS *Sirius* represents a tangible link to the most significant vessel associated with the early migration of Europeans to Australia. It was declared a protected Historic Shipwreck in 1984 under the *Historic Shipwrecks Act* 1976 (now the *Underwater Cultural Heritage Act* 2018) (UCH), and included on the National and Commonwealth Heritage Lists in 2011 under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act)

The Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) is seeking to develop a revised Heritage Management Plan (HMP) for HMS *Sirius* to satisfy all the requirements of the EPBC Act and *Environment Protection and Biodiversity Conservation Regulations* 2000 (EPBC Regulations).

DITRDC engaged Cosmos Archaeology to undertake an inspection of the wreck site of HMS *Sirius* and associated debris field. This inspection included the primary shipwreck site and the other identified archaeological deposits associated with HMS *Sirius* in Slaughter Bay.

The wreck of HMS *Sirius* is over 230 years old and the surviving wreck features are in remarkably good condition despite the site resting in a highly exposed position under the surf zone in an area prone to violent storms and weather.

The inspection found a large number of loose artefacts still rest in the shallow area of Site 1 including shingle ballast, at least one possible copper alloy wall fitting, ammunition, coaks, tacks, broken ceramic and glass. A previously unrecorded anchor was located on the site near the eastern ballast pigs and two loose anchor flukes were recorded.

As a result of the inspection, the 1989 site plan has been updated to incorporate these changes. It has also been digitised and made into a layer within the new site plan, thus keeping the history in one location.

3D Photogrammetry models were built of the two larger anchors (SI 624 and SI 625), the carronade hole, a copper alloy seam in the gully and section of shoreline in Site 4. These models were created using a minimum of images and provide enough detail to be used for comparison purposes over time.

The site inspection included an assessment of the National and Commonwealth Heritage values of HMS *Sirius.* The assessment found that the changes to these values were negligible since they were initially assessed. The assessment did identify some risks to these values, however, predominantly the activity of sea urchins eroding the wreck features.

Recommendations

- Engage a marine biologist to assess the damage caused by sea urchins and develop a plan to mitigate that damage.
- When developing the new HMP:
    - Review the heritage values of the site including an assessment of the Commonwealth Heritage values against the threshold of ‘significant’.
    - Include a section on managing the inshore areas of the HMS *Sirius* boundary as distinct from the main wreck site.
    - Include a ‘Site Inspection Manual’ to outline the method of inspecting the site and provide guidance for the images that are required for comparison purposes. This will allow for objective assessments to be made about such things as changes in concretion cover, changes to artefact condition or damage to the reef platform or site features from heavy weather or sea urchin activities.

- Establish a single repository of information which would include (but not be limited to) items such as:
  - 1965 ABC film of the site (the first footage of the site since it was wrecked).
  - The film made by Ian Kenny raising the 1973 anchor.
  - The film made during the 1980s as part of the Australian Bicentennial Authority project.
  - All documentation from the previous works including reports, artefact drawings/images and conservation reports.

  A method of contributing to this repository should be established so that other contributors can add, and access, information.

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1 INTRODUCTION

1.1 Background

The wreck site of HMS *Sirius* represents a tangible link to the most significant vessel associated with the early migration of Europeans to Australia. It was declared a protected Historic Shipwreck in 1984 under the *Historic Shipwrecks Act* 1976 (now the *Underwater Cultural Heritage Act* 2018) (UCH), and included on the National and Commonwealth Heritage Lists in 2011 under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act)

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DITRDC engaged Cosmos Archaeology to undertake an inspection of the wreck site of HMS *Sirius* and associated debris field. This inspection included the primary shipwreck site and the other identified archaeological deposits associated with HMS *Sirius* in Slaughter Bay.

This proposal is based on the following relevant information that has been supplied:

HMS *Sirius* wreck HMP - maritime archaeology project – revised project scope.pdf (email from KAVHA Secretariat, Friday 13th November 11:04 titled 'HMS *Sirius* wreck HMP - maritime archaeology project').

Site 5, located to the west of Kingston Pier, was out of scope for this inspection.

1.2 Study Area

As outlined in the National Heritage Listing Gazettal, the primary shipwreck site of HMS *Sirius* is located East of Kingston Pier in Slaughter Bay, Norfolk Island, at a point centred on latitude 29 degrees, 3 minutes and 37 seconds South and longitude 167 degrees, 57 minutes and 18 seconds East (Figure 1).[1] The place boundary encompasses the primary shipwreck site and other identified archaeological deposits associated with HMS *Sirius* within Slaughter Bay. These sites are contained within and bounded by an imaginary line:

i. The commencement point being the Southeast corner of Kingston Pier at latitude 29 degrees, 3 minutes and 30.63 seconds South and longitude 167 degrees, 57 minutes and 12.11 seconds East;
ii. thence East along the mean low water mark of the coast of Norfolk Island to a point where the parallel of latitude 29 degrees, 3 minutes and 34.03 seconds South intersects with the meridian of longitude 167 degrees, 57 minutes and 36.38 seconds East;
iii. thence West South West to a point where the parallel of latitude 29 degrees, 3 minutes and 42.36 seconds South intersects with the meridian of longitude 167 degrees, 57 minutes and 20.11 seconds East;

[1] **Commonwealth of Australia, 2011,** *Inclusion of a place on the National Heritage List: HMS* Sirius *wreck site.* Commonwealth of Australia Gazette, No S168, 25 October 2011.

iv. thence West North West to a point where the parallel of latitude 29 degrees, 3 minutes and 39.27 seconds South intersects with the meridian of longitude 167 degrees, 57 minutes and 12.09 seconds East; and

v. thence North along the meridian of longitude 167 degrees, 57 minutes and 12.09 seconds East to the point of commencement.

All geographic coordinates for the location and area are expressed in terms of the Geocentric Datum of Australia 1994 (GDA94).

Figure 1: Boundary of the primary site associated with HMS* Sirius *as listed in the National Heritage Listing Gazettal.

The calcarenite reef extends along an east-west axis of Slaughter Bay and forms a natural barrier protecting an inshore lagoon from the normal action of the sea. At high tide and during storms waves break over the reef and wash onto the foreshore at Kingston. Like the outer reef, the foreshore is formed by a layer of calcarenite stone. The eastern end of Slaughter Bay is defined by Salt House Point, which is a low promontory protecting the crescent beach of Emily Bay. The western end of Slaughter Bay terminates at Kingston Pier. A break in the outer reef forms a natural inlet to the lagoon. In several areas the outer reef is cut by gutters paralleling the shore. Depths within the lagoon are shallow and average around three metres. The lagoon floor is covered by sand over coarse coral rubble. Artefacts

from HMS *Sirius* have been identified at six main locations in the water adjacent to Kingston (Figure 2 and Figure 3):

Site 1. The outer edge of the breakers (primary shipwreck site).

Site 2. The gully between the outer reef and the high inshore reef platform.

Site 3. East of Kingston Pier on the tidal reef platform.

Site 3a. Slightly East of Site 3.

Site 4. The lagoon in Slaughter Bay (secondary shipwreck site).

Site 5. West of Kingston Pier.

Site 6. Stone causeway located between sites 2 and 3.

Sites 1, 2, 3, 3A, 4 and 6 are within the place boundary of HMS *Sirius* and were the focus of this inspection. Site 5 is located outside the place boundary and was out of scope (see Figure 2).

Site 1 has been identified as the primary location of the wreck site of HMS *Sirius*, which is where the vessel first struck the reef on 19th March 1790 and remained there for 9 days. Lightweight objects that were washed inshore from the ship during this period have been located during excavations at sites 2, 3, and 3a. The hull of the ship gradually started to break up and became more buoyant after many heavy objects detached from the hull including two carronades, several anchors and approximately 200 blocks (approximately 60 tonnes) of iron ballast. On 28th March 1790 heavy seas pushed the remains of the vessel closer inshore where much of the contemporary salvage was undertaken between 1790 and 1792. At Site 6, there appears to be a man-made causeway made of calcareous stone between reefs adjacent to the primary shipwreck site.

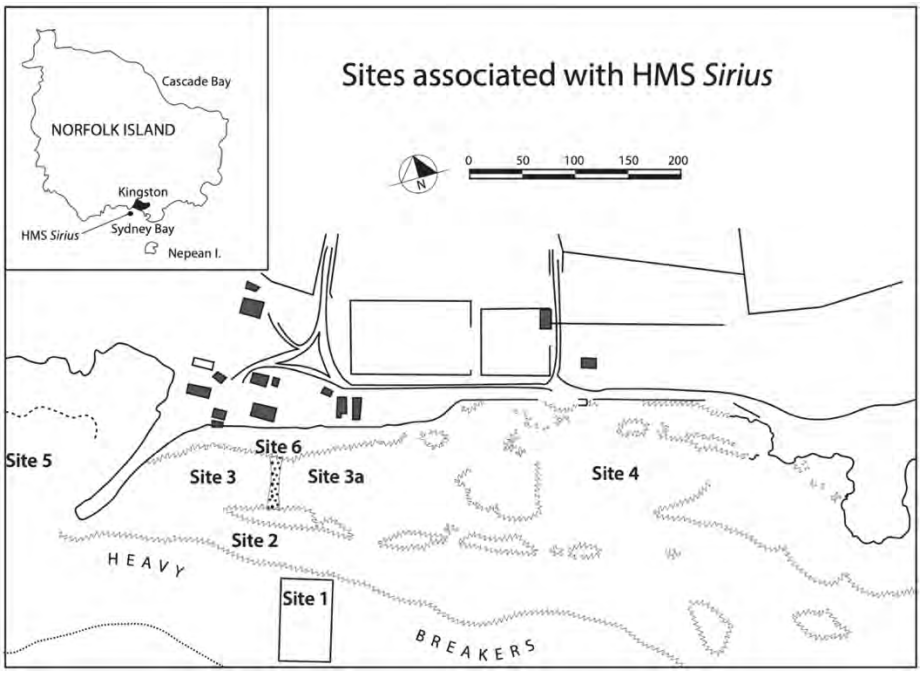

Figure 2: Sites associated with HMS* Sirius*, as depicted in 1985.[2]

[2] **Henderson, G. and M. Stanbury, 1985** *Report to the Australian Bicentennial Authority on the February-March 1985 Bicentennial Project Expedition to the wreck of H.M.S.* Sirius*(1790) at Norfolk Island.* Report prepared for the Australian Bicentennial Authority, p. 7.

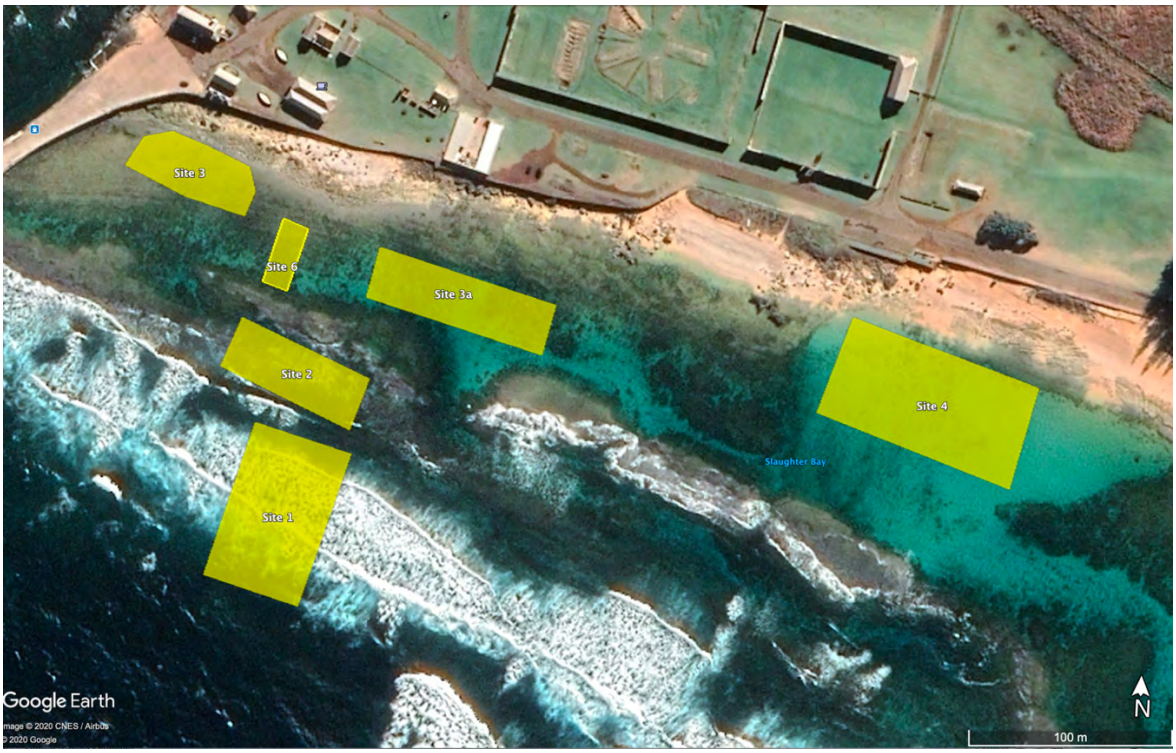

Figure 3: Sites associated with the HMS* Sirius *wreck site adapted from Henderson and Stanbury 1985 plan and overlayed onto recent aerial image. Note Site 1 is the location of the primary wreck site. (Base image Google Earth).

1.3 Objectives

The objective of the site inspection was to:

- complete a non-disturbance survey of the wreck site of HMS *Sirius* including the primary site and associated sites.

The purpose of the inspection was to provide up-to-date information that would assist in the development of an updated management plan for HMS *Sirius*.

The inspection report was to include:

- An overview of the methodology used to inspect the primary and subsidiary sites of HMS *Sirius* (see Section 4).
- Physical features and current condition of the wreck site including observations of the gullies for movement and exposure/damage to small artefacts in the shingle ballast (see Section 5).
- A comparison of any changes against the condition of the wreck of HMS *Sirius* from descriptions of the 1993 management plan and other documents provided by DITRDC (see Section 6).
- Any other aspects or areas that the maritime archaeologists considered noteworthy (see Section 7).

- Images for the making of a 3D model of the wreck site if weather and visibility were condusive (see Section 5.4).
- A brief outline of the National Heritage values, Commonwealth Heritage values and any other heritage values of HMS *Sirius* (see Section 8).
- Current condition of (and changes to) the site's National and Commonwealth Heritage values (see Section 8).
- Damage to the wreck site of HMS *Sirius* or its heritage values, including as a result of natural impacts and recreational and commercial use at and around the site (see Section 7.1.1).

1.4 Abbreviations

ADAS	Australian Diving Accreditation Scheme
ABC	Australian Broadcasting Corporation
AUCHD	Australasian Underwater Cultural Heritage Database
AZMP d2019	draft September 2019 Archaeological Zoning and Management Plan
BOM	Bureau of Meteorology
CHL	Commonwealth Heritage List
DITRDC	Department of Infrastructure, Transport, Regional Development and Communications
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPBC Reg	*Environment Protection and Biodiversity Conservation Regulations 2000*
HSA	Commonwealth *Historic Shipwrecks Act* (1976)
KAVHA	Kingston and Arthur's Vale Historic Area
MSL	Mean Sea Level
NHL	National Heritage List
NSW	New South Wales
OH&S	Occupational Health and Safety
PDS	Professional Diving Services
PoM	Plan of Management
SCUBA	Self-Contained Underwater Breathing Apparatus
SoHI	Statement of Heritage Impact
UCHA	*Underwater Cultural Heritage Act* 2018

3 HISTORICAL BACKGROUND

The history of HMS *Sirius* has been well documented (for example Henderson 1984; Henderson and Stanbury 1988). A brief overview of the wreck is provided below.

HMS *Sirius,* along with the ship HMS *Supply,* were members of the First Fleet that transported the first convicts to Sydney Cove in 1788. Later that year, Philip Gidley King sailed with a group of convicts, soldiers and free settlers to Norfolk Island to establish the first European settlement at what is now known as Kingston. King was officially appointed the first Lieutenant-governor of the Norfolk Island settlement in 1789.

The fledgling Norfolk Island colony's only links to the outside world were HMS *Sirius* and HMS *Supply*. HMS *Supply,* in particular, made regular runs between Norfolk Island and Port Jackson, bringing much needed supplies to the isolated island. William Bradley, a lieutenant serving onboard HMS *Sirius,* was a keen journalist and observer (Figure 4) and recorded that HMS *Supply* made five trips between Port Jackson and Norfolk Island between the island's first settlement and 1790.

In March 1790, HMS *Sirius* and HMS *Supply* were sent to Norfolk with a contingent of supplies, convicts and marines to relieve overcrowding at Sydney Cove. On Friday March 19th, Captain John Hunter steered HMS *Sirius* in for Sydney Bay (Kingston) between the main Island and Nepean Island. The wrecking event has been modelled by previous researchers based on physical remains and historical accounts.

On 19th March 1790, HMS *Sirius* and HMS *Supply* sailed close to shore to unload supplies. A strong western current pushed both vessels towards Point Ross, forcing them to make sail and attempt to leave the bay. HMS *Supply* was successful but HMS *Sirius* was not.

***Figure 4: William Bradley's sketch of HMS* Sirius *HMS* Supply trying to tack away from shore.** [3]

The vessel lost control and momentum as it turned into the wind. A small bower anchor was dropped but the vessel struck the reef stern first before the anchor cable could check it.

[3] **Bradley, W., 1802,** *Part of the reef and Landing Places in Sydney Bay:* Sirius *and* Supply *endeavouring to work their way out of the bay,* Drawings from his journal `A Voyage to New South Wales', available at http://digital.sl.nsw.gov.au/delivery/DeliveryManagerServlet?dps_pid=FL1113940&embedded=true&toolbar=false.

After striking the reef, the vessel turned broadside to the surf. Masts were cut, during which two carronades were lost overboard. Rising tide lifted the vessel and turned it facing seaward where it was stopped by the anchor cable.

The vessel held this position for several days, during which people and supplies were rescued. During the salvage attempts, a hawser and traveller were set up to move stores and provisions to the high reef platform, which was dry at low tide (Figure 5). While there was substantial successful salvage, personal items were deemed less important and were thrown overboard by their owners with the hope that they would float to shore: much of this did not.

On March 28th, high winds snapped the anchor chain and the vessel was turned shoreward and thrown more than its own length nearer to shore. Archival sources indicated that in its final resting position the HMS *Sirius* wreck lay very close to the edge of the high reef platform. It is believed likely that the gully between the outer reef and the high inshore reef platform is the likely place where HMS *Sirius* broke up.

Salvage continued for another fortnight but by June 1790, the vessel was found to be completely holed both fore and aft along both sides.[4]

In January 1791, Hunter salvaged the remaining guns from the wreck, complete with their carriages. Further small items were recovered from the wreck site in December 1791, but in January 1792, the wreck finally disintegrated. King proclaimed that everything possible had been saved.[5]

***Figure 5: William Bradley's sketch of the salvage of HMS* Sirius.**[6]

[4] **Henderson G., and M. Stanbury, 1988,** *The* Sirius *Past and Present,* Collins Publishers Australia, p. 87.
[5] Op. Cit., **Henderson G., and M. Stanbury, 1988**, p. 88.
[6] **Bradley, W., 1802,** *Part of the reef in Sydney Bay, Norfolk Island, on which the Sirius was wrecked,* Drawings from his journal `A Voyage to New South Wales', available at http://digital.sl.nsw.gov.au/delivery/DeliveryManagerServlet?dps_pid=FL1113940&embedded=true&toolbar=false

3.1 *Archaeology of HMS* Sirius

Items have been removed from the wreck site since it sank in 1792. The location of the site has never been lost, showing on survey charts since the vessel was wrecked (Figure 6).

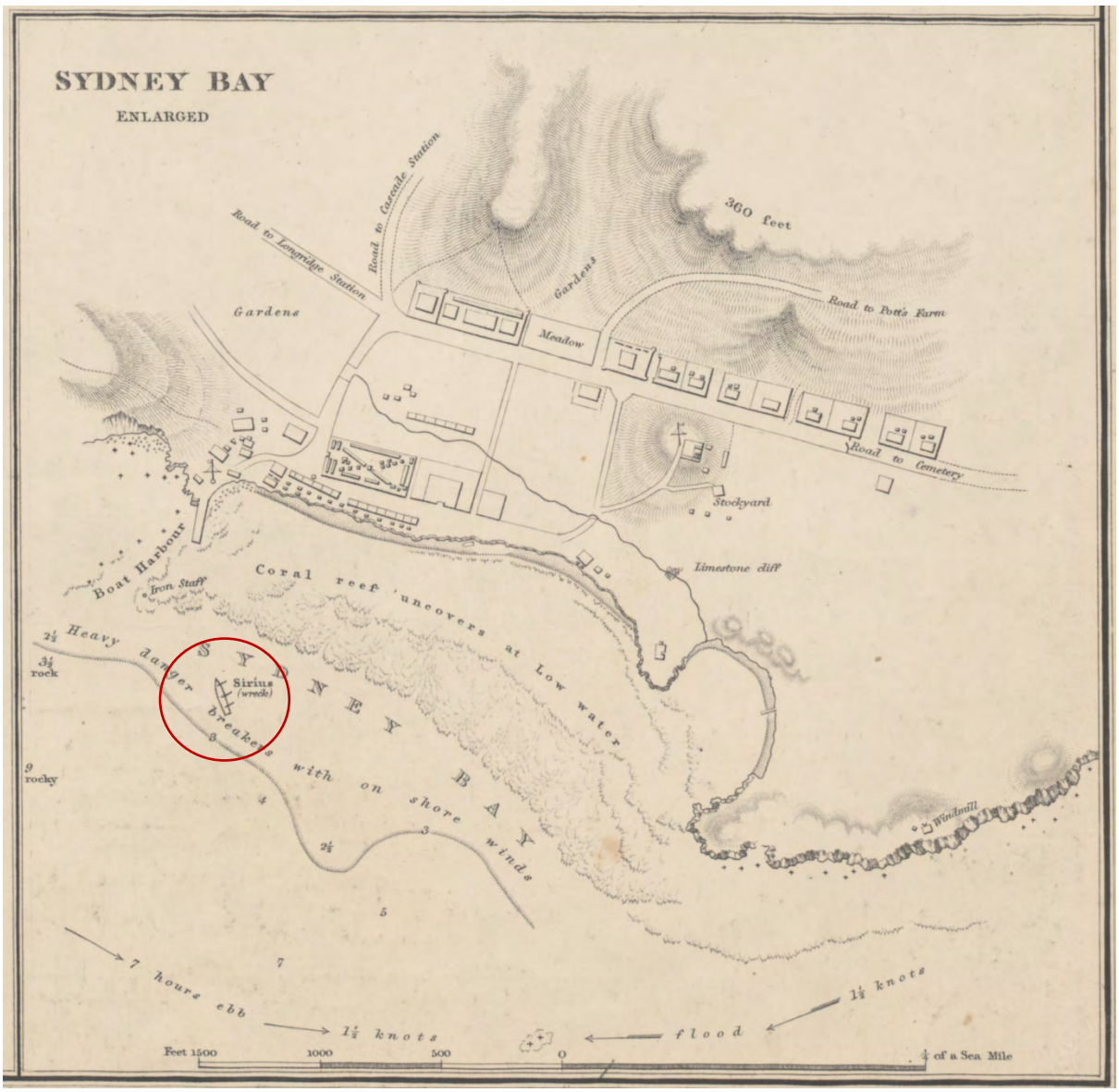

Figure 6: Denham survey of 1856 highlighting the position of the wreck site.[7]

An anchor was visible at extremely low tides and in 1905, this was blasted off the reef by members of the Methodist Church, who received a reward of £20 (Figure 7). The NSW politician, Sir Francis Suttor, wanted to exhibit the anchor besides Sir Arthur Phillip's statue in the Botanic Gardens but when he saw the state of the rusting anchor, which was missing its flukes and ring, he decided the anchor was not impressive enough and it was officially unveiled in Macquarie Place in 1907 (Figure 8).[8]

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[7] **Great Britain. Hydrographic Department & Denham, Henry Mangles, Sir, 1800-1887 & Wilson, James Glen, 1824-1863 & Potter, J. D. (John Dennett), active 1830-1892 & J. & C. Walker 1856,** *Pacific Ocean. Norfolk and Philip Islands*, Published by the Hydrographic Office at the Admiralty : Sold by J.D. Potter agent for the Admiralty charts 31 Poultry and 11 King Street, Tower Hill, [London].

[8] Op. Cit., **Henderson G., and M. Stanbury, 1988,** p. 95.

Figure 7: Anchor recovered in 1905.

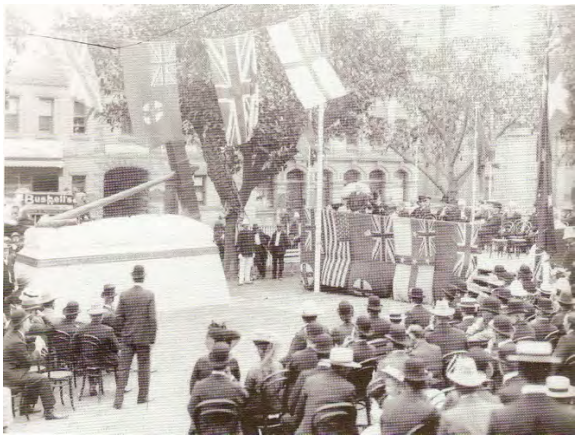

Figure 8: HMS* Sirius *anchor being unveiled in Macquarie Plane on Australia Day 1907.

Further interest in the story of HMS *Sirius* was raised when the Australian Broadcasting Corporation (ABC) cameraman Jack Doyle visited Norfolk Island and filmed the first underwater footage of the wreck site. The footage showed sheathing tacks, fastening bolts and four anchors. This went to air on 31 October 1965 as a segment on the Weekend Magazine.[9]

This increased interest and prompted the Norfolk Islanders to raise the seaward anchor in 1973 (Figure 9 and Figure 10).[10] This anchor, while missing the anchor ring, has both flukes and is the centrepiece of the current HMS *Sirius* museum on Norfolk Island.

[9] **Anon, 2021**,[website] *HMS* Sirius *Anchor Norfolk Island,* available at https://hmssirius.com.au/anchor-norfolk-island/

[10] **Norfolk Island Museum, August 2012**, *Recovering HMS* Sirius *Artefacts,* available at http://norfolkislandmuseum.blogspot.com/2012/08/

Figure 9: HMS* Sirius *anchor being raised in 1973.

***Figure 10: HMS* Sirius *anchor attached to the stern of the* Holmburn.**

Smaller items were raised by locals during the 1960s and 1970s but with the introduction of the Commonwealth *Historic Shipwrecks Act* in 1976, many returned these artefacts to the Norfolk Island Museum.

In the 1980s, as the bicentennial of European settlement in Australia approached, HMS *Sirius,* as the flagship of the First Fleet and currently the only First Fleet vessel with a known location was considered a potential subject for a project to commemorate the bicentenary. The first expedition was designed as a preliminary investigation with the main aim of inspecting the wreck and assessing the significance of any elements that remained on the site and the significance of artefacts that had previously been raised by local divers. It was essentially a feasibility study to see if there was enough of the wreck to warrant a full expedition and subsequent excavation.[11]

During the three dives conducted on the site, one large anchor resting on top of a carronade, two broken anchors and many smaller artefacts were noted. A local diver also provided the position of the anchor removed in 1973. The in-water searches were restricted to the south and to the edge of the surf zone. Figure 11 is a sketch that was drawn using both the archaeologists' and local divers' observations. Photographs were taken of major wreck features such as the broken anchor (Figure 12).[12]

On land the expedition team inspected and measured the anchor raised in 1973. An interesting side note was that this anchor's ring was thought to be on the Island somewhere.[13] This fact does not appear to have been verified in any further reports. Other artefacts recorded included a carronade, gudgeon and pintles, sheathing tacks, copper alloy

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[11] **Stanbury, M., 1994**, *HMS* Sirius *1790 : an illustrated catalogue of artefacts recovered from the wreck site at Norfolk Island*, p. 4.
[12] **Henderson, G., 1984** *Report to the Australian Bicentennial Authority on the December 1983 preliminary expedition to the wreck of H.M.S.* Sirius *(1790) at Norfolk Island*, p. 29.
[13] Op. Cit., **Henderson, G., 1984**, p. 39.

fittings, ceramics and wooden planking. This initial expedition recommended the HMS *Sirius* wreck site be declared a protected wreck under the *Commonwealth Historic Shipwrecks Act* (1976). Further expeditions, sponsored by the Australian Bicentennial Authority, were proposed to map the site in detail and excavate and conserve remaining artefacts.

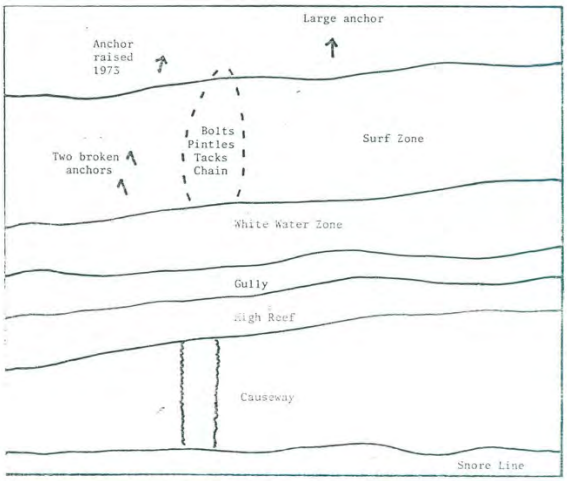

Figure 11: Sketch indicating distribution of artefacts across the reef drawn during the first expedition in 1983, not to scale. Note the large anchor at top right is the anchor raised in 1985.

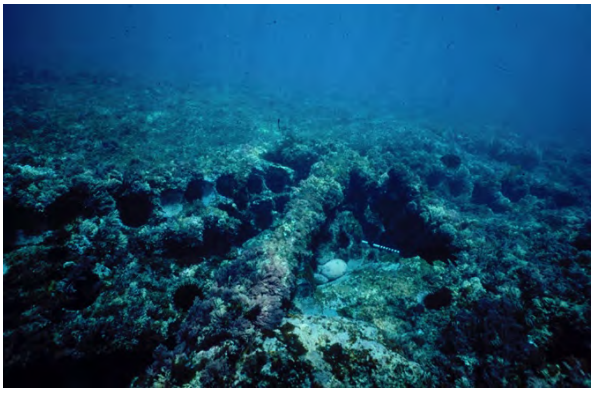

Figure 12: Anchor SI 625 with broken shank and fluke, photographed during the first HMS Sirius expedition. (Image Patrick Baker 1984).

In October 1984, HMS *Sirius* was officially declared a protected site under the Commonwealth *Historic Shipwrecks Act* (1976).

The second expedition took place in February and March 1985 and included further investigation of Site 1, along with investigations of Sites 2, 3, 4, and 5. Numerous small artefacts were raised, including copper alloy tacks and copper sheathing. A large bower anchor, ballast pigs and a carronade were also raised (Figure 13 and Figure 14).

Site 2 was surveyed, and divers noted copper fasteners, a musket ball and glass fragments. Site 3 was found to contain large ferrous structural elements, probably related to *Ronaki*, a vessel wrecked in 1943, along with glass case bottle fragments contemporary with *Sirius.* At Site 4, a metal detector survey was conducted, identifying a u-shaped piece of metal and an iron ballast pig.

An extensive dive survey was conducted at Site 5. Local divers had previously found HMS *Sirius* material on the site, including a spectacle plate from the rudder. Overall, 53 dives were conducted, identifying numerous iron deck supports, iron staple knees, iron fasteners, copper alloy fasteners, bricks, drum hoops, iron chain and brass sheathing. The majority of material recovered at Site 5 was mostly determined to come from a later wreck, assumed to be from *Mary Hamilton* based on age and size of structural components.[14]

[14] **Henderson, G. and M. Stanbury, 1985** *Report to the Australian Bicentennial Authority on the February-March 1985 Bienentennial Project Expedition to the wreck of H.M.S.* Sirius*(1790) at Norfolk Island.* Report prepared for the Australian Bicentennial Authority.

Figure 13: Raising a ballast pig. (Image Patrick Baker 1985).

Figure 14: Raising the bower anchor. (Image Patrick Baker 1985).

When the expedition returned to the site in 1987, diving conditions were excellent. Sites 1 and 2 were further investigated and excavated. Artefacts recovered included a sextant and pantograph from HMS *Sirius,* a pump housing and glass fragments. Approximately 5000 artefacts were raised from the general area around site 1.[15] The primary ballast mound which was the final wrecking site of HMS *Sirius* was identified and a new stock was fabricated for the anchor raised in 1985. A preliminary site plan was drawn for the main wreck site.[16]

When the team returned in 1988, the project was sponsored by British Airways as the company's contribution to the bicentennial celebrations. Investigations continued at the main wreck site. The project included analysis of wave patterns, currents and wind patterns to assess the trajectory of both the wreck and the artefacts that may have floated away.[17]

As part of this expedition a one-tonne plinth was laid on the site (Figure 15). However, after three days of heavy swell during the project, the plinth had moved over 7 m. The plinth has not been seen for many years.

[15] **Henderson, G. and M. Stanbury, 1987** *The Australian Bicentennial Authority Project on the 1987 Expedition Report on the wreck of H.M.S.* Sirius*(1790) at Norfolk Island,* p. 10.
[16] Op. Cit., **Henderson, G. and M. Stanbury, 1987**, p. 5.
[17] **Henderson, G., 1988**, *Norfolk Island Government Project 1988 Expedition Report on the Wreck of HMS* Sirius *(1790).* Report – Department of Maritime Archaeology, Western Australian Museum, No.37.

Figure 15: Placing the memorial plaque on the wreck site. (Image Patrick Baker 1988).

One of the key outcomes from the 1988 expedition was the development of a detailed site plan (Figure 16). This plan has been the definitive plan of Site 1 since it was published.

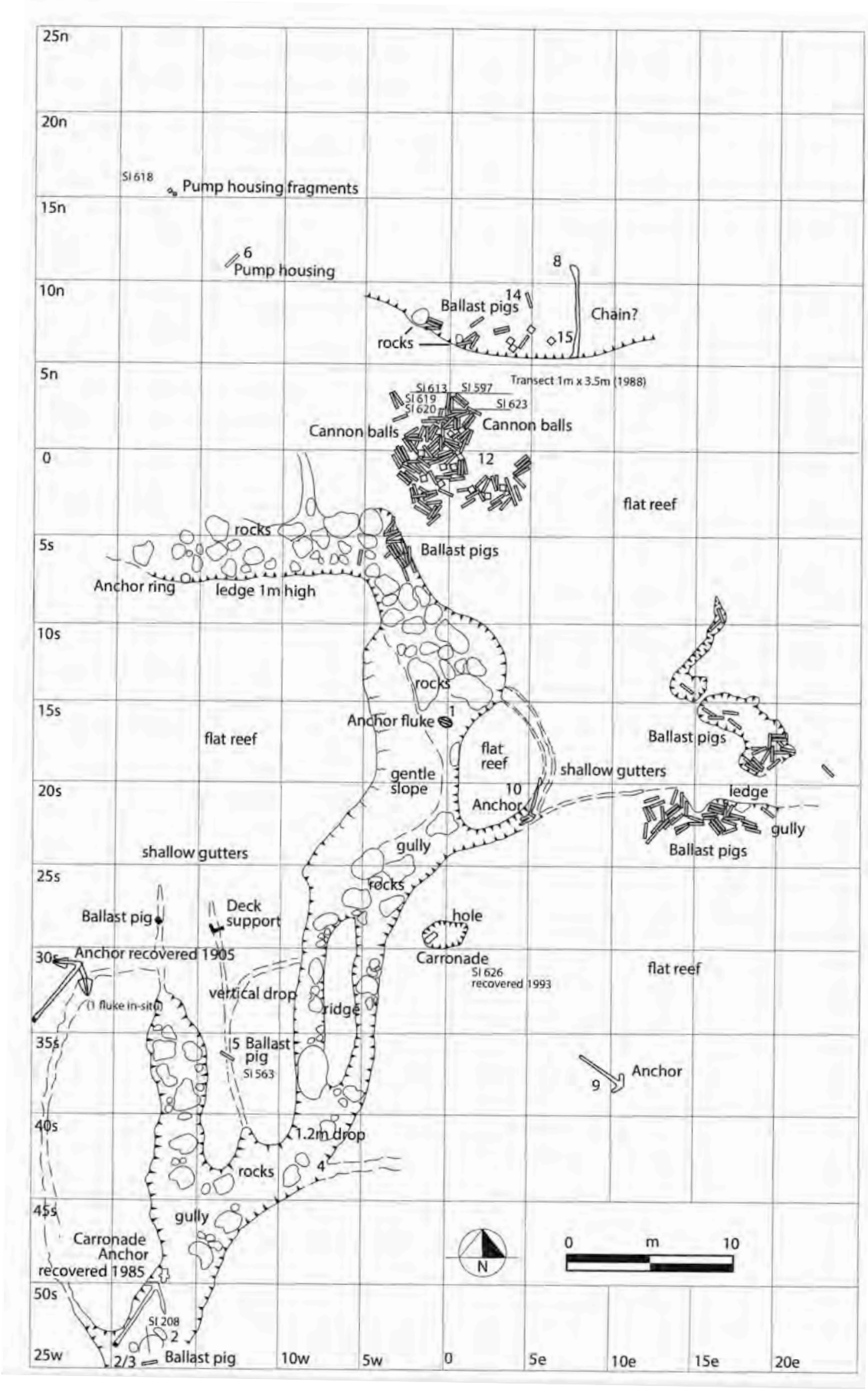

Figure 16: Site plan drawn by B. Jeffery and M. Edmiston 1989.

In 1990, a team visited Norfolk Island, predominately to assess the condition of the artefacts at the Norfolk Island Museum and in storage. As part of the project a brief site inspection was undertaken to assess the condition of the wreck site (Site 1).[18]

The most recent expedition was directed by Nigel Erskine in 2002.[19] This expedition was initiated by the Norfolk Island Museum and funded by a grant under the Commonwealth *Historic Shipwrecks Act* (1976). This project focused largely on the inshore areas of the Slaughter Bay lagoon but also included the seaward side of the outer reef. Approximately 200 artefacts were raised, mostly from Site 3a, which is located north of the main wreck site and to the east of Site 3 and 6. These artefacts were mainly found using a hand-held metal detector. Two anomalies were detected during a magnetometer survey of Sydney Bay, one of these was the anchor SI 624 but the other was located approximately 200 m to the east of Site 1. The expedition did not get an opportunity to investigate the unidentified anomaly.

3.1.1 Other inspections

An annual visitor to Norfolk Island since 2014, Christian Patterson, has been snorkelling the wreck site since 2014 and documenting the wreck since 2017. He has no maritime archaeological training but began taking images out of interest and has been sending these images to the Norfolk Island Museum.[20] A copy of these images were passed onto the inspection team in November and some have been used in this report for comparison purposes.

According to the 2018 Review of the 1993 Plan of Management, another set of images indicating site condition was obtained by members of the Norfolk Island Maritime Archaeological Association (NIMAA) in 2017.[21] At the time of writing this report, these images have not been located.

Staff from Cosmos Archaeology were on Norfolk Island in February 2020 and visited the site for one dive. Conditions were not ideal but images and video were taken during the inspection. Some images have been included in this report for comparison purposes.

[18] **Stanbury, M., 1990**, *HMS* Sirius *Project: Report on the artefact collecftion at Norfolk Island, 13-26 March 1990.* Report – Department of Maritime Archaeology, Western Australian Maritime Museum, No.39.
[19] **Erskine, N., 2002,** *2002 H.M.S.* Sirius *Expedition Report*, Report prepared for Environment Australia and the Norfolk Island Government.
[20] **Patteson, Christian, January 2020**, *pers. comm. 28 January 2020.*
[21] **Henderson, G, 2018,** *Draft Review of the 1993 Plan of Management for HMS* Sirius *Shipwreck*, p. 29.

4 CONDUCT OF SITE INSPECTION

Between 14th and 20th November, Cosmos Archaeology undertook a non-disturbance survey of the main wreck site of HMS *Sirius* (Site 1) and the associated areas. Diving support was supplied by Professional Diving Services. All diving for Site 1 was conducted on Self-Contained Breathing Apparatus (SCUBA) from the dive vessel *Black Dog Cat,* supplied by local diving company Norfolk Island Diving.

The vessel was launched from Kingston Pier using the derrick and dropped divers south of the main wreck site, seaward of the surf break. When conditions were calm, the vessel could drop divers over the seaward anchor, but if the surf was up, the divers would have to swim 100-200 m towards shore. All dives finished back at the dive vessel. Two dives were snorkel dives, where the diver entered the water from the boat but exited via the shore. The dives were timed as much as possible to coincide with high or falling tides.

The inshore areas were shallow enough for surveys to be conducted on foot. Snorkels and half masks were used to examine the seabed and a metal detector was used to find metallic 'hits' along a set transect line in each area. Inshore area inspections were timed to coincide with low tides.

4.1 Personnel

The personnel involved in the site inspections for HMS *Sirius* are outlined in Table 1.

Table 1: Personnel involved in the HMS* Sirius *inspection.

Name	Title	Company
Cosmos Coroneos	Director / Maritime Archaeologist	Cosmos Archaeology
Jane Mitchell	Maritime Archaeologist	Cosmos Archaeology
Connor McBrian	Assistant Archaeologist	Cosmos Archaeology
Milly Bendell	Maritime Archaeologist	Cosmos Archaeology
Malcolm Venturoni	Dive Supervisor / Diver	Professional Diving Services
Jason Blackwell	Dive Supervisor / Diver	Professional Diving Services
Mitch Graham	Vessel and Dive support	Norfolk Diving

4.2 Tides and Weather

Diving conditions over the wreck site of HMS *Sirius* are heavily dependent on weather and sea conditions. Diving on the main wreck site is ideal at high tide and low swell, which is very rare. Overall, the weather allowed three days access to Site 1, with the potential of a fourth. However, the boat was unavailable for the extra day.

***Table 2: Wind and swell conditions for the site inspection of HMS* Sirius.**[22]

Date	Temperature (°C)	Swell (height m)	Wind 09:00 (km/h)	Wind 15:00 (km/h)
14 November 2020	17.9 – 23.8	1.7 - 2	19 NE	20 ENE
15 November 2020	19.6 – 23.9	1.2 - 1.6	19 NE	20 NNE
16 November 2020	18.4 – 23.0	1.1 – 1.4	26 S	28 SW
17 November 2020	16.7 – 22.7	1 – 1.2	22 SSW	19 SSE
18 November 2020	15.3 – 24.0	0.9 – 1.2	15 SW	19 SW
19 November 2020	17.0 – 21.8	1.2 – 1.9	20 SSE	22 SSE
20 November 2020	15.9 – 21.8	1.8 – 1.9	19 SSE	22 SE

Table 3: Tide times and heights for site inspection.[23]

14 November 2020	**Time**	0137	0756	1357	2004
	Height (m Lat)	0.3	1.7	0.4	1.8
15 November 2020	**Time**	0221	0843	1447	2050
	Height (m Lat)	0.19	1.8	0.4	1.8
16 November 2020	**Time**	0303	0929	1537	2136
	Height (m Lat)	0.15	1.9	0.4	1.7
17 November 2020	**Time**	0345	1015	1627	2222
	Height (M Lat)	0.15	1.9	0.49	1.67
18 November 2020	**Time**	0429	1102	1716	1108
	Height (M Lat)	0.19	1.88	0.45	1.58
19 November 2020	**Time**	0513	1151	1808	2356
	Height (M Lat)	0.26	1.81	0.5	1.49
20 November 2020	**Time**	0559	1242	1900	
	Height (M Lat)	0.36	1.73	0.58	

4.3 Methodology

As a non-disturbance survey, the primary focus was to document the primary wreck site (Site 1) and the associated inshore areas (Sites 2 – 6, excluding Site 5) in as much detail as the conditions would allow.

An overview of conditions and time spent on sites is provided in the table below:

[22] **Bureau of Meteorology, Australian Government 2020,** Norfolk Island November 2020 Daily weather observations, available at http://www.bom.gov.au/climate/dwo/202011/html/IDCJDW2100.202011.shtml, accessed 3 December 2020.
[23] **Bureau of Meteorology, Australian Government 2020,** Tide Predictions for Norfolk Island, available at http://www.bom.gov.au/australia/tides/#!/offshore-norfolk-island, accessed 3 December 2020.

Date	Site	Conditions	Notes
14/11/2020	Site 1	Good for diving site 1	2 dives, second dive as tide getting lower more difficult to access shallow areas.
15/11/2020	Site 1	Perfect for diving site 1 in the morning especially in the shallows, swell picked up in the afternoon	Two dives one am and one pm to coincide with mid tides
16/11/2020	Site 2	Excellent diving conditions	Dive boat was unavailable for Site 1. Inspection of site was approximately 3 hours.
17/11/2020	Site 1	Diving conditions good over Site 1	Two dives on Site 1
18/11/2020	Site 3 and 3a	Diving conditions deterioriating	Dive boat was unavailable. Inspection of sites was approximately 3 hours.
19/11/2020	N/A	Diving conditions unsuitable for Site 1	Packing of equipment for return to mainland
20/11/2020	Site 4 and 6	Diving conditions mariginal but these sites were workable at low tide.	Inspection of sites was approximately 2 hours

4.3.1 Survey of main wreck site (Site 1)

Over a number of dives, observations of the current state of the wreck site were recorded and annotated onto the existing site plan. Video and still images were taken which included key features of the wreck site and captured the current condition of its elements.

The purpose of video and photographic recording was to obtain a visual record of key features of the site, which can be repeatedly recorded on subsequent site inspections. This will allow for objective assessments to be made about such things as changes in concretion cover, changes to artefact condition or damage to the reef platform or site features from heavy weather or sea urchin activities.

The primary cameras used were two GoPro Hero 8 cameras set on the highest JPEG setting and recording videos as MP4 files. The back-up camera was a Sony RX100 MK1, also shooting in high JPEG and recording videos as MP4 files.

The order of filming was largely dictated by the conditions on the site once underwater. Swell was ever present but on rougher days the swell breaks overhead, reducing visibility and the ability to stay on station. This is a particular problem when working in the shallower areas of Site 1, i.e. anywhere north of the main ballast mound. However on two of the three diving days, conditions were such that this shallower area could be inspected and recorded in reasonable detail.

As part of documenting the wreck site, Norfolk Island Senior Constable Nathan Weaver offered to fly the police drone, a DJI MAVIC 2 over the site at low tide on the 15th November, 2020. The resulting footage was used to help map the micro gullies that web their way through the reef top onto the site plan and the water was so clear some of the key wreck features can be seen through the water column.

In total 48 GB of video and 208 images were taken over most of Site 1. The full video catalogue can be found at Annex B.

While the main wreck site has been previously mapped by maritime archaeologists, the site plan is over 30 years old. During the inspection, maritime archaeologists dived on the site with copies of the existing plan and checked them against what appears presently (Figure 17). As part of this work, measurements were taken using tape measures when conditions

were calm enough onsite to do so (Figure 18). The site plan was redrawn using Adobe Illustrator to reflect the changes on the site. During the compilation of the site inspection report, the 1989 site plan was also digitised and makes up a layer of the new plan so the information remains available.

Figure 17: Diver marking up 1989 site plan over main ballast mound. (Image taken from video Sirius20_201114_30_JM_Mal recording ballast mound; 00:10).

Figure 18: Diver measuring Anchor 10. (Image taken from video Sirius20_201115_4_JM_Connor measuring Anchor 10; 00:07).

For tasks undertaken during each dive see Annex A.

As part of compiling the site inspection report, comparisons of some key elements have been made from previous videos and images of the site, including some images taken in February 2020 when staff from Cosmos Archaeology were on Norfolk Island and visited the wreck site.

It was hoped that the anomaly detected during the 2002 expedition (29º 03.700S, 167º 57.473E) could be inspected if time allowed (Figure 19). However, the day this was scheduled, conditions meant that diving in and around the surf break was too dangerous.

Figure 19: Location of anomaly detected during the 2002 magnetometer survey of Sydney Bay.

4.3.1.1 Survey bias and accuracy

The following factors had an influence on the bias and accuracy of the survey:

Seabed visibility
For much of the survey area, particularly on top of the reef, there was a thick covering of growth over many of the larger wreck elements. This covering could distort visibility and make discerning individual elements such as single ballast pigs difficult. Therefore the counting of such items may need corroboration with future site inspections.

Swell and breaking waves

While visibility was often upwards of 5 – 10m, the swell and wave action could make achieving tasks onsite difficult.

Concretion

Wreck features may be hidden within concretion and therefore may have been missed.

4.3.1.2 Photogrammetry

When conditions allowed, images were taken for the purposes of creating 3D models of the site. All successful underwater photography for photogrammetry occurred on the second day of diving - 15th November 2020.

Images were taken of Anchor SI 624 and SI 625, the carronade hole and a seam of small copper artefacts that are concreted into the base of the gully wall. Subsequently, 3D models were created of these wreck elements (see Section 5.4). These 3D models will allow for direct comparison, including changes in dimensions such as volume, of the wreck elements and changes to the surrounding seabed over time.

All underwater images were taken with one GoPro Hero 8. The camera was mounted on a floating handle and was handheld (Figure 20 and Figure 21). All images were in JPEG format and averaged 5MB per image. In total over 600 images were taken for the purpose of photogrammetry.

Figure 20: Diver taking image for photogrammetry on Anchor SI 624. (Image taken 15th November 2020).

Figure 21: Diver taking images for photogrammetry on Anchor SI 625. (Image taken 15th November 2020).

Images were processed using Agisoft Metashape Professional v 1.6.0 (64 bit build). The software was running on a Macbook Pro 19" 2019 model using OS Catalina v.10.15.7.

For results of the processing see section 5.4. A list of all 3D digital files created as part of this report can be found at Annex D and will be supplied with the final report.

4.3.2 Surveys of inshore areas (Sites 2 – 4 and 6)

The surveys of the inshore areas associated with HMS *Sirius*, were conducted along similar lines for each one. For all sites, a baseline was laid down and the area searched with a Minelab Excalibur Mk II metal detector. The baseline coordinates were obtained using an iPhone application called 'Solocator', which displays coordinates, bearings and accuracy over an image taken at each end of the line.

One person operated the metal detector and counted the 'hits' along the baseline. A recorder, noted the time taken to cover each side of the baseline. Where strikes were made, snorkellers examined the area to see if the target was visible and if so, would photograph it. There was no attempt at excavating to uncover a 'hit' as such an activity would have required a permit under the *UCHA 2018*. Video of the seabed within the search area was also undertaken.

The search areas and survey methodology for each site is outlined below.

4.3.2.1 Site 2

The survey of Site 2 was undertaken by laying a baseline along the exposed reef platform that forms the southern boundary of the site. The search area was then divided into zones, with the first zone 10 m long and subsequent zones 20 m long working east to west. The first zone, Zone A, commenced on the western edge of the channel that runs out through the outer reef and leads to Site 1. From the baseline, the search area covered 15 m to the south of the line. The coordinates are displayed in Table 4 baseline and zones are displayed in Figure 22.

Table 4: Coordinates for metal detector search of Site 2.

Site 2	Longitude	Latitude	Accuracy
Transect East	29° 3.550'S	167° 57.350'E	± 7 m
Transect West	29° 3.528'S	167° 57.291'E	± 6 m

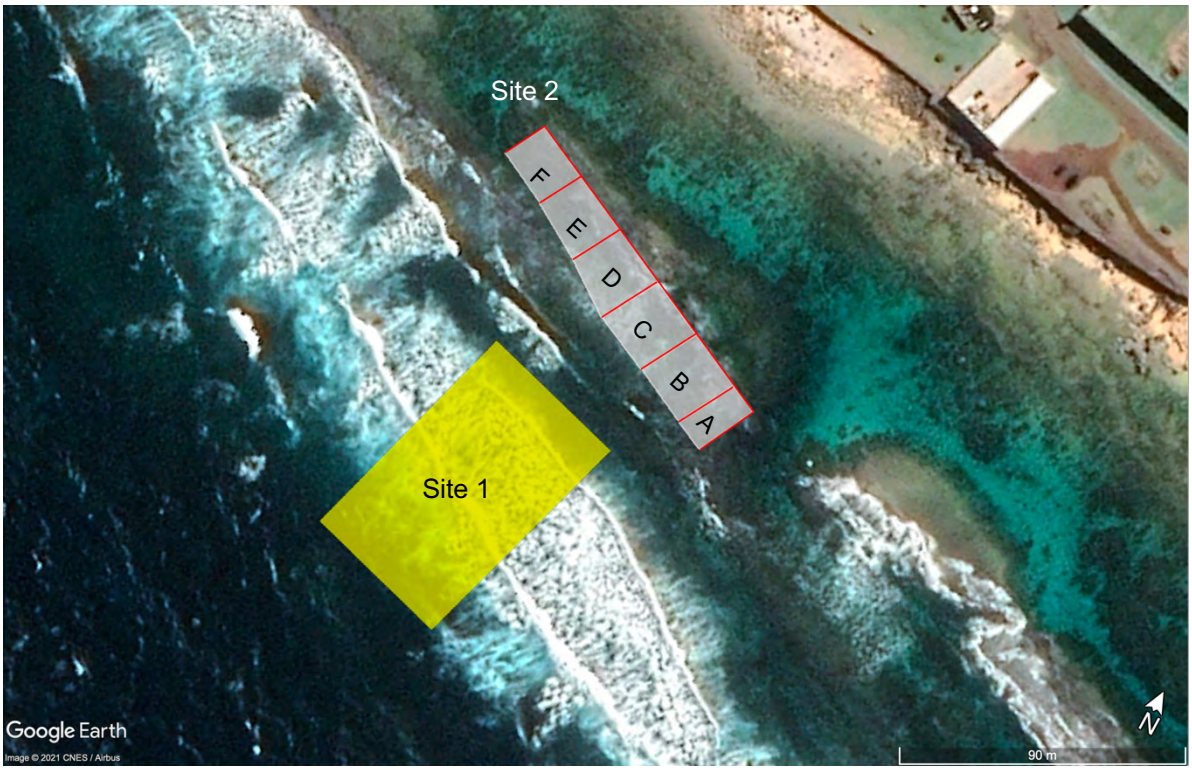

Figure 22: Baseline separated into zones for metal detector survey of Site 2. (Base image Google Earth).

4.3.2.2 Site 3

The survey of Site 3 was undertaken by laying a 30 m baseline at the south west corner of the causeway. Starting at 0 m, the survey area began on the shore side and then returned along the seaward side of the baseline, covering 5 m away from the line on each side. When the 30 m survey was finished, the baseline was extended for a further 30 m and the process repeated. The coordinates for the baseline are displayed in Table 5 and the search area can be seen in Figure 23.

Table 5: Coordinates for metal detector search of Site 3.

Site 3	Longitude	Latitude	Accuracy
Transect East 0 m	29° 3.517'S	167° 57.3'E	± 8 m
Transect West 60 m	29° 3.5'S	167° 57.267'E	± 4 m

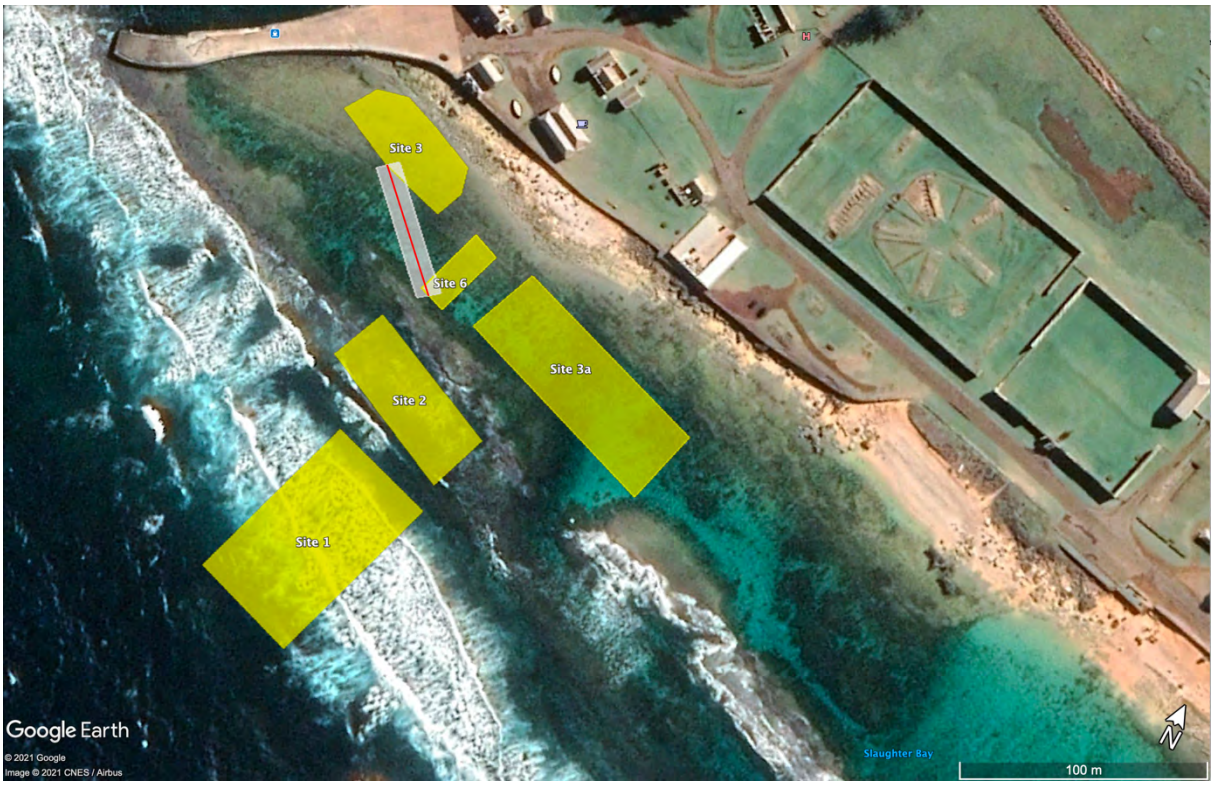

Figure 23: Baseline (in red) and search area (in white) for Site 3. Other areas associated with HMS *Sirius* in yellow. (Base image Google Earth).

4.3.2.3 Site 3a

The survey of Site 3a was undertaken by laying a 60 m baseline at the south east corner of the causeway, running diagonally across the lagoon. Starting at 0 m, the survey area began on the western side of the baseline and then returned along the seaward side, covering 5 m away from the line on each side. The coordinates for the baseline are displayed in Table 6 and the search area can be seen in Figure 24.

Table 6: Coordinates for metal detector search of Site 3a

Site 3a	Longitude	Latitude	Accuracy
Transect West	29° 3.517'S	167° 57.3'E	± 5 m
Transect East	29° 3.521'S	167° 57.348'E	± 5 m

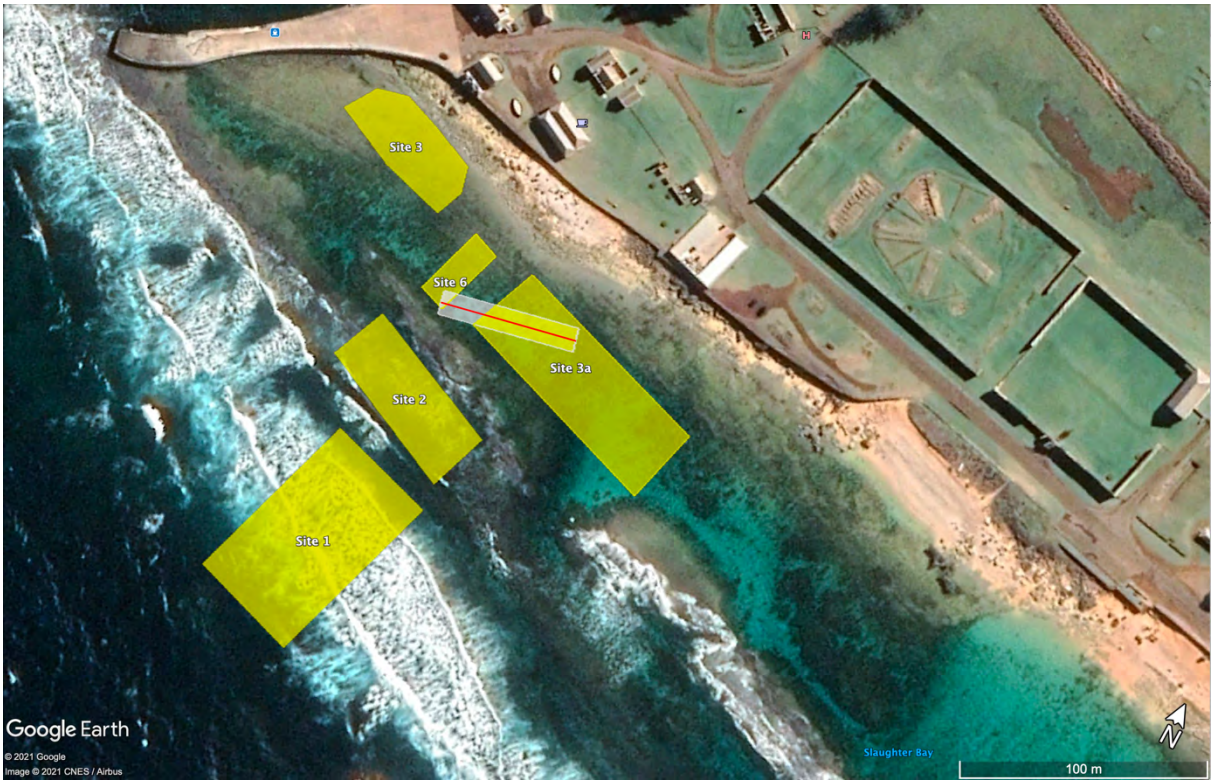

Figure 24: Baseline (in red) and search area (in white) for Site 3a. Other areas associated with HMS *Sirius* in yellow. (Base image Google Earth).

4.3.2.4 Site 4

The survey of Site 4 was undertaken by laying a 40 m baseline parallel to the shore. From the baseline, the search area covered 5 m to the north of the line and 10 m to the south. One this search area was complete, another 20 m baseline was run perpendicular to the first and 5 m either side was searched. The coordinates for the baselines are displayed in Table 7 and the search areas can be seen in Figure 25.

Table 7: Coordinates for metal detector search of Site 4.

Site 4	Latitude	Longitude	Accuracy
Transect West	29° 3.536'S	167° 57.482'E	± 5 m
Transect East	29° 3.544'S	167° 57.506'E	± 5 m
Transect South	29° 3.546'S	167° 57.478'E	± 5 m

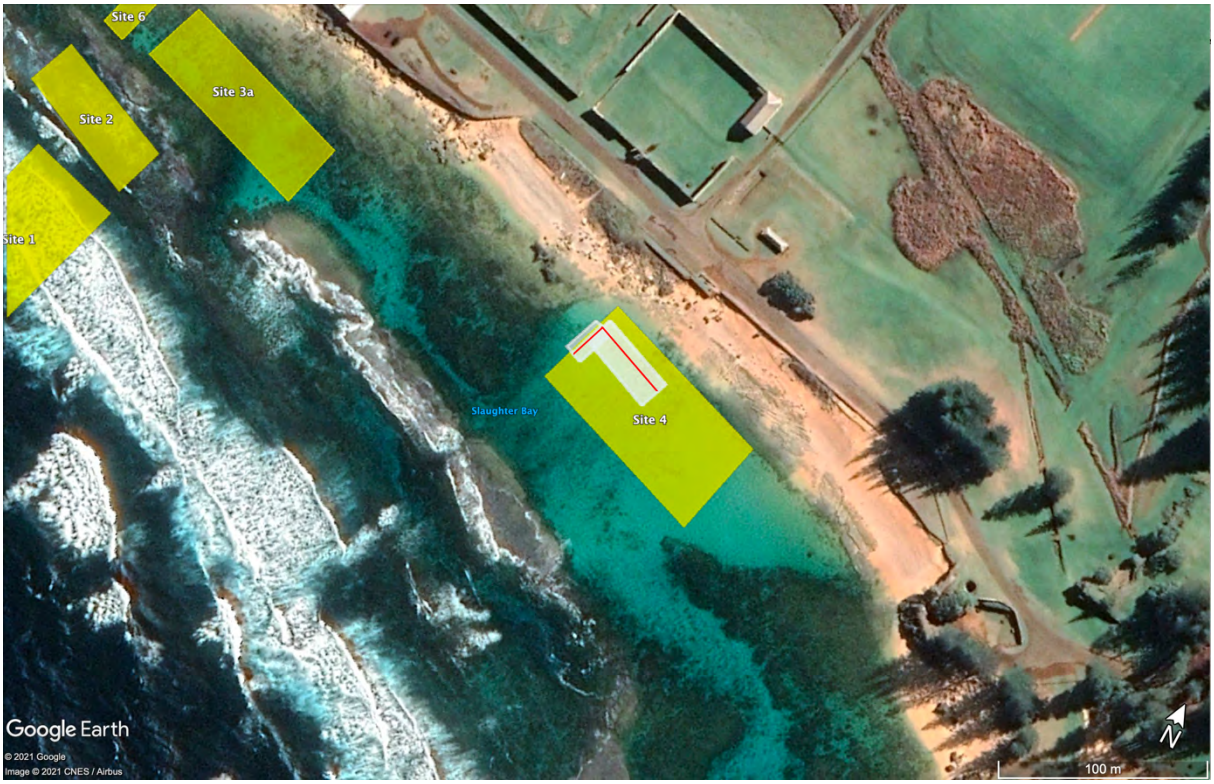

Figure 25: Baselines (in red) and search areas (in white) for Site 4. Other areas associated with HMS *Sirius* in yellow. (Base image Google Earth).

4.3.2.5 Site 6

Site 6 was sketched at low tide using a 2 m scale rod, marked at 200 mm increments (Figure 26). Depths at each side of the causeway were also recorded with the scale rod. A digital representation of the causeway was drawn as a result of the inspection.

Figure 26: Site 6 Causeway (red arrow) visible from drone footage with the KAVHA in background. (Image taken from video Sirius20_201115_02_DJ1 drone_Site1 and 2 with KAVHA view; 02:19).

5 FINDINGS

The inspection of the primary wreck site was carried out over three days; 14th, 15th and 17th November 2020, with two dives per day. Visibility averaged 5 to 10 m when the surf was not breaking and zero when it was. The swell for all six dives was manageable but still provided some difficulty when trying to stay on station.

5.1 Updated site plan

Several updates have been made to the 1989 site plan. Several items still appeared on the plan, despite having been raised. The anchor fluke in area 1 (SI 590) was raised at the end of the 1998 season (Figure 27).[24] The pump housing fittings (SI 482, SI 618) and pump housing (SI 236) in the northern area of the site were raised during the 1987 season (Figure 28).[25]

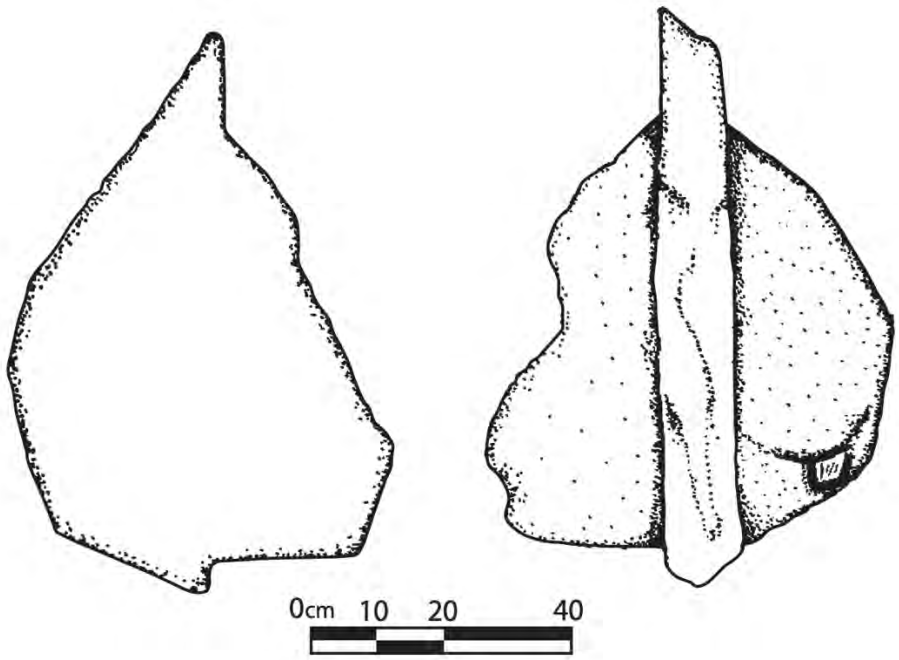

Figure 27: Anchor fluke SI 590 after M. Stanbury 1994.[26]

[24] Op. Cit., **Stanbury, M., 1994**, p. 70.
[25] Op. Cit., **Stanbury, M., 1994,** pp. 40-41.
[26] Op. Cit., **Stanbury, M., 1994**, p. 71.

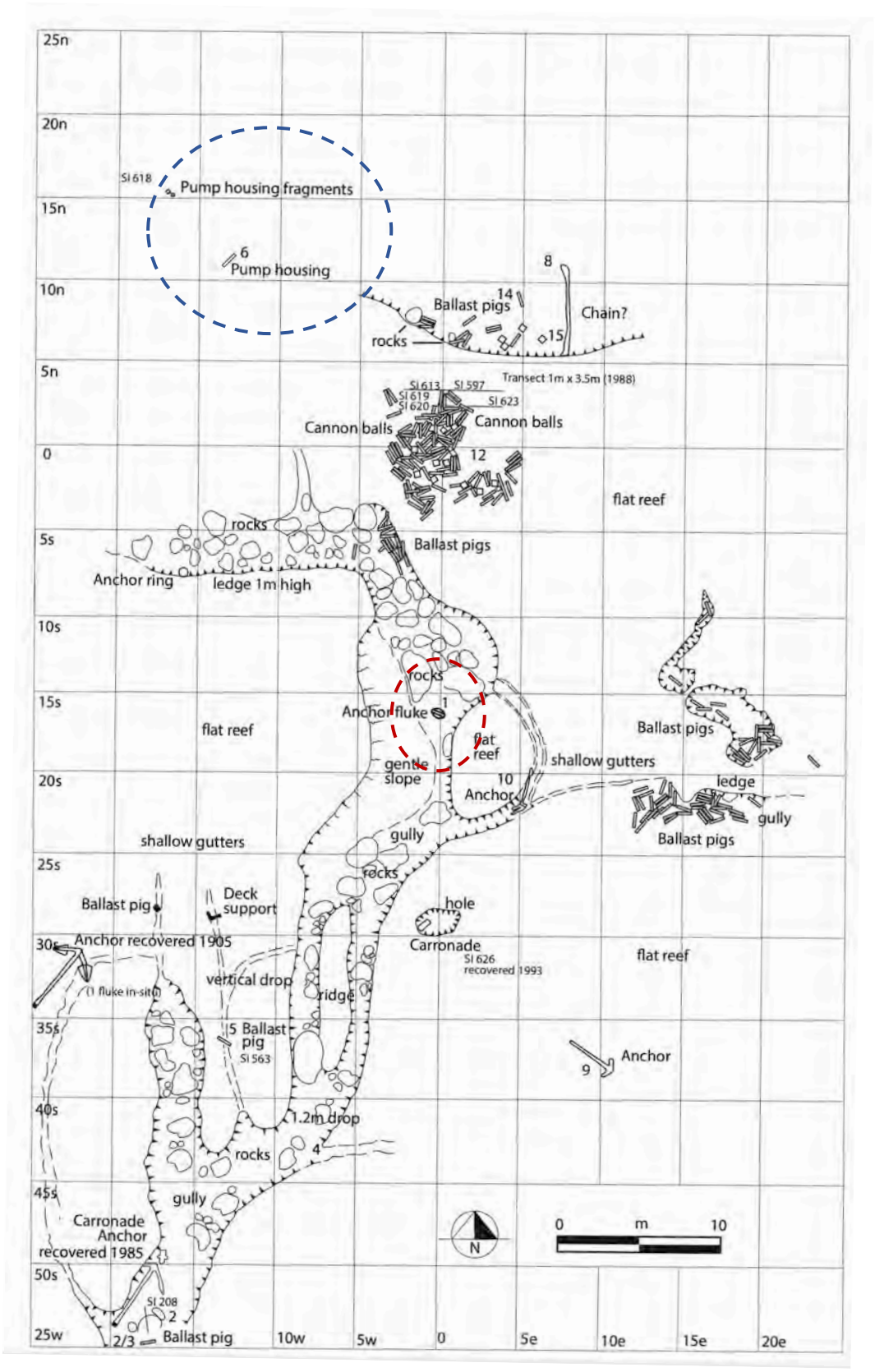

Figure 28: 1989 site plan showing anchor fluke (red) and pump housing fittings (blue) that were raised during the 1980s.

The drone footage helped to identify the main gully as well as new micro gullies in the reef, which could then be placed onto the site plan. The conditions over the site were so calm, wreck features could be seen through the water column which also assisted in spatially mapping the site (Figure 29).

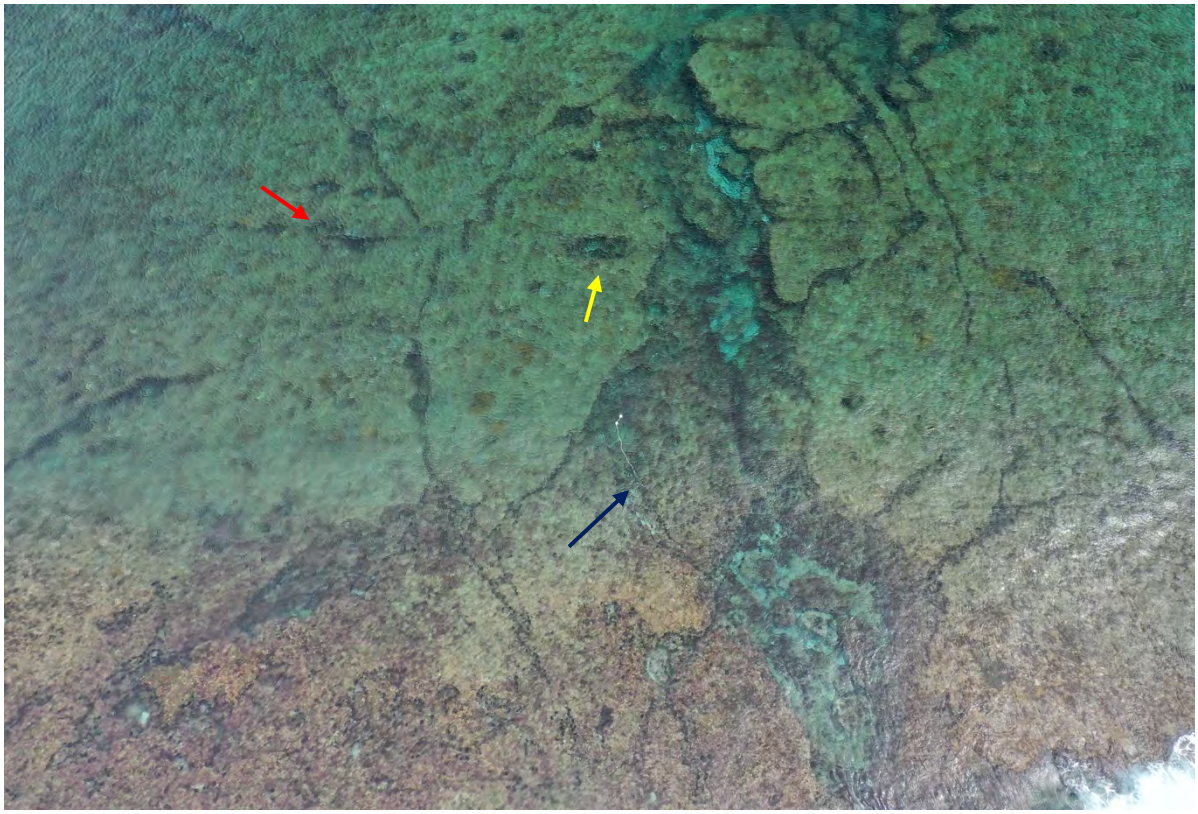

Figure 29: Still image from drone footage, highlighting the main gully through the reef and micro gullies through the reef top. Yellow arrow indicated corranade hole, red arrow indicates Anchor SI 624, dark blue arrow indicates Anchor SI 625. (Image taken 15th November 2020, shore is to the base of the image).

The updated site plan can be seen at Figure 30. Additions to the updated site plan include a loose anchor fluke in the carronade hole, a loose anchor fluke to the west of the site, a section of pump chamber in the north of the site and a new anchor to the east. The approximate location of loose artefacts in the shallow areas of Site 1 has also been noted. All items that have been raised have also been removed for clarity. There was not time during the site inspection to accurately survey the ballast pigs in position so their positions are the same as the 1989 site plan.

There are still some adjustments to be made. The 1905 anchor fluke was concreted into the reef but wasn't found as part of this site inspection. A further search is required to ascertain if this fluke is still in position. The anchor ring located to the south of Site 1 also needs to be located and its position noted on the site plan (the scale of the plan is such that it likely will not fit within the area, however its relative location should be noted).

The site plan was overlaid onto Google Earth using the coordinates of the two main anchors remaining on the site (Figure 31).

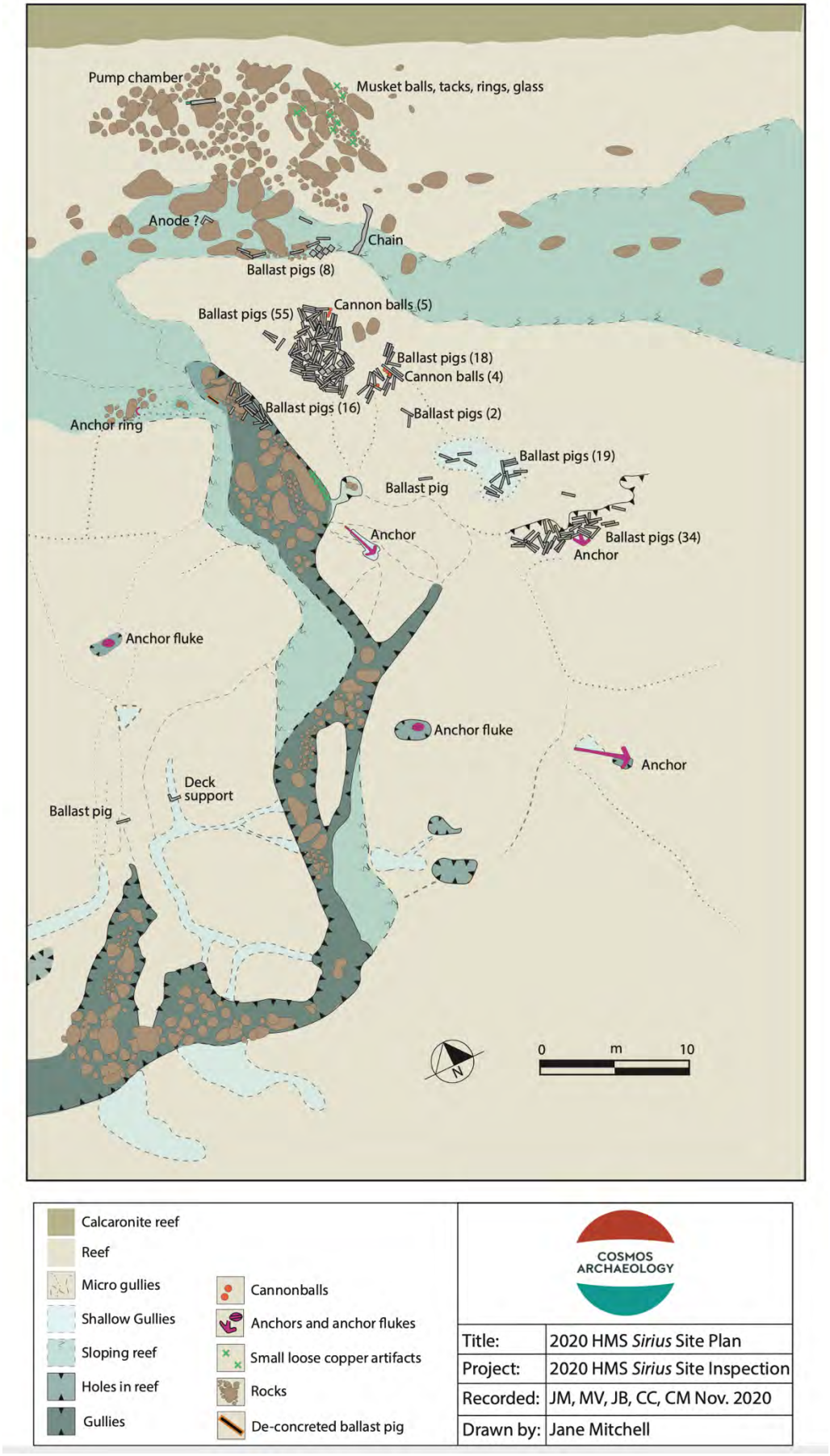

Figure 30: Updated HMS* Sirius *Site Plan

Figure 31: Site plan overlaid onto Google Earth using the two anchor coordinates to align the plan in position. Northern mark is anchor SI 625 and southern mark is anchor SI 624

In general, there was a covering of seaweed over the entire site, and all wreck elements had some growth on them (Figure 32). The base of the main gully running through site 1 was either clear or only had short algae growth, creating a clear view of the bottom (Figure 33). There is very little shingle ballast remaining in the gully. The shallow area of site one had less algae growth and consisted of a rocky rubble seabed with larger calcarenite boulders. Some shingle ballast remains in the shallow areas (Figure 34). The consistent growth across the reef platform meant divers had to look closely to locate some wreck features such as the eastern ballast mound (Figure 35). Figure 36 depicts the direction and location of the images showing coverage across the seabed.

Figure 32: Example of algae growth over site 1 facing south. (Image taken 15th November 2020).

Figure 33: Example of base of gully. (Image taken 15th November 2020).

Figure 34: View over shallow area of site 1 looking west. (Image taken 17th November 2020).

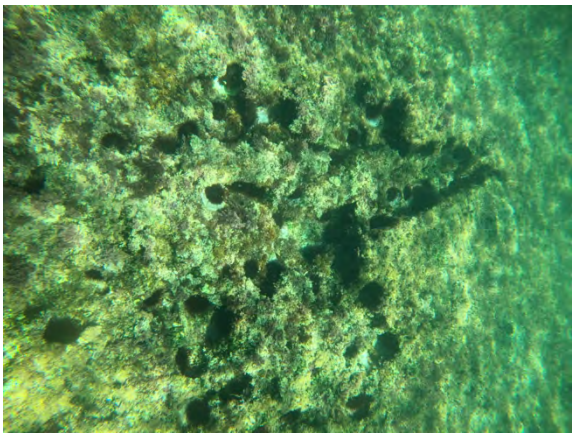

Figure 35: View of eastern ballast pigs. (Image taken 17th November 2020).

Figure 36: Direction and location of images highlighting growth over areas of the sites.

Sea urchins are prevalent over the entire site. They are creating micro gullies that are eating into the reef top. These micro gullies can be seen from drone footage on a clear, calm day (Figure 37). The urchin activity relevant to key features of the wreck will be discussed in the sections below.

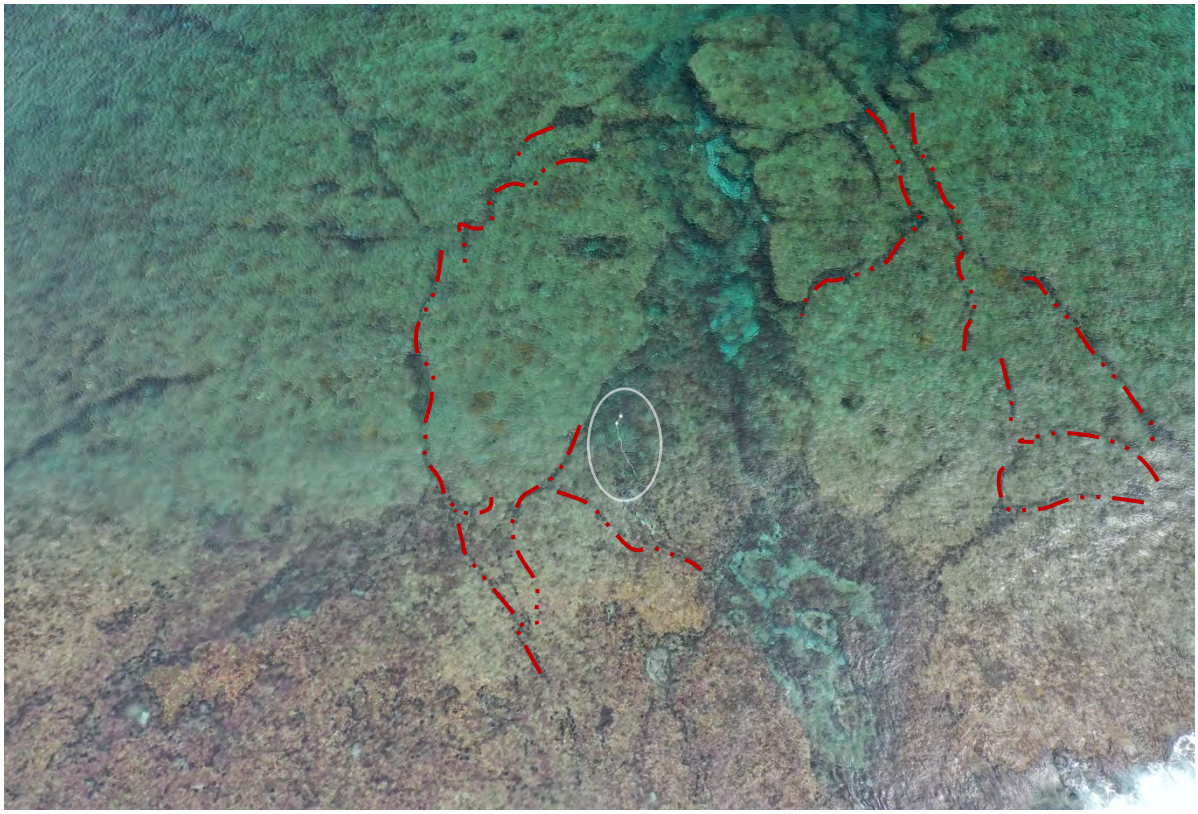

Figure 37: Drone footage showing sea urchin micro gullies, looking south west. Red lines drawn on examples of sea urchin micro gullies. White circle highlights the buoy marking anchor SI 625 (Image taken 15th November 2020, Nathan Weaver).

5.2 Key wreck features Site 1

5.2.1 Main ballast mound

The location of the main ballast mound is shown in Figure 38. The main ballast mound was extensively covered in seaweed growth, making identification of individual ballast pigs difficult (Figure 39 and Figure 40). Various attempts at counting the iron ballast were attempted with an average count of 55 for the main mound and 18 for the ballast scattering to the east of the mound. The northern tip is 3 m away from the ledge that leads into the shallow section of the site. The main section of ballast at its widest point measures 6.4 m north to south and 4.3 m east to west. During low tide, it appeared that the ballast mound was almost exposed and it is likely that it would occasionally be exposed during King tides (Figure 42).

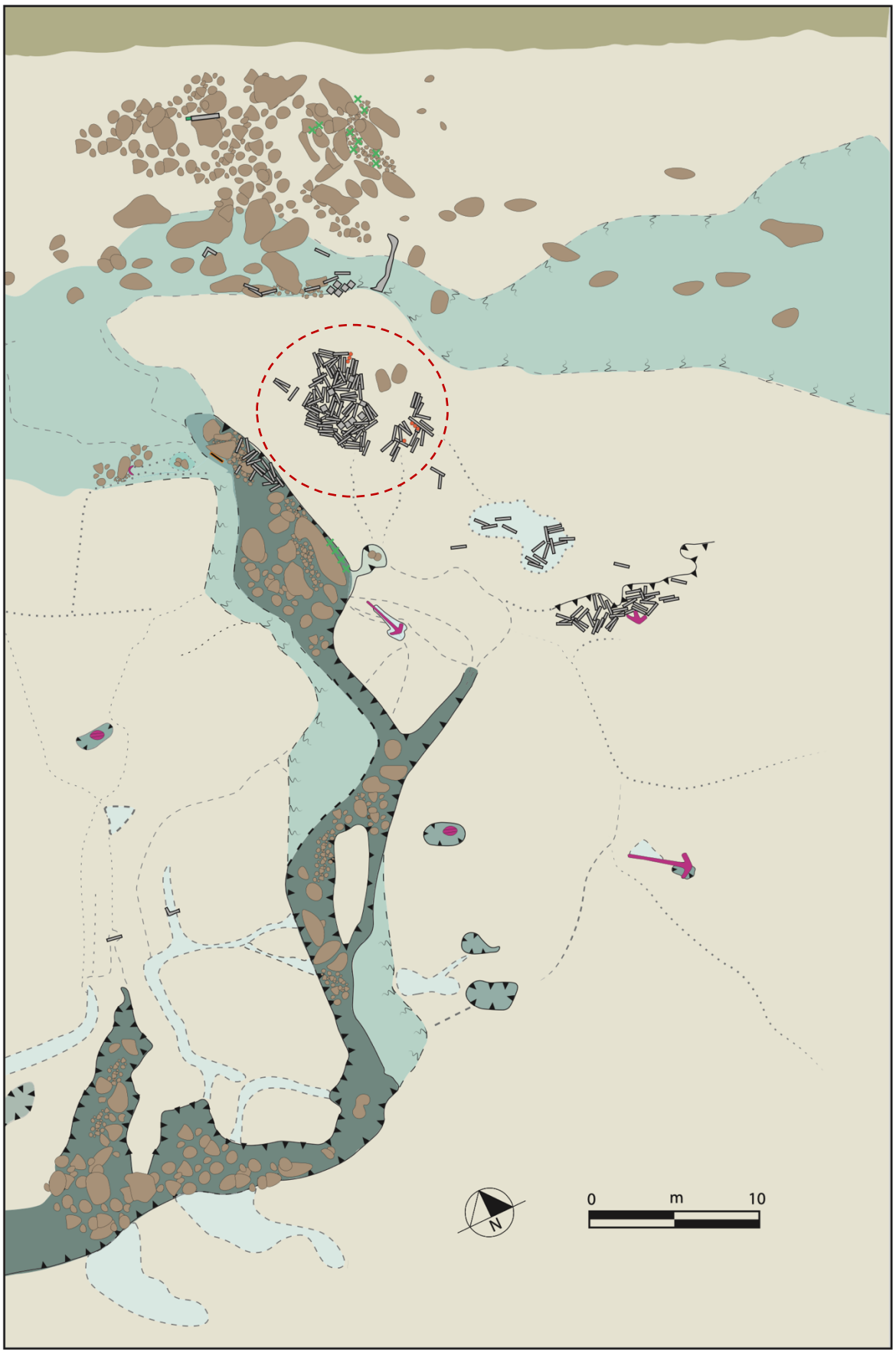

Figure 38: Location of main ballast mound on site plan.

Figure 39: Main ballast mound looking south west. (Image taken 15th November 2020).

Figure 40: Main ballast mound looking down from the western edge. (Image taken 15th November 2020).

Figure 41: Detail of ballast pigs from main ballast mound. (Image taken from video Sirius20_201117_01_CC_ballmound; 00:37).

Figure 42: The main ballast mound is almost exposed at low tide. (Image taken from video Sirius20_201115_16_CC_ballast mound (12);00:09).

Sea urchins are creating micro gullies around the mound and appear to be creating holes in the reef top underneath the outer edge of the ballast (Figure 43).

At the north-east tip of the ballast, concreted into the calcarenite reef, there is a concretion of approximately 5 cannon balls, with the concretion obscuring the dimensions (Figure 44 and Figure 45). A sea urchin was removed next to the cannon balls and underneath was a shined copper alloy fragment, concreted into the seabed (Figure 46 and Figure 47). Figure 48 shows the location of the sea urchin images on the site plan.

Figure 43: Sea urchin activity on the main ballast mound. (Image taken from video Sirius20_201117_01_CC_ballmound; 00:23).

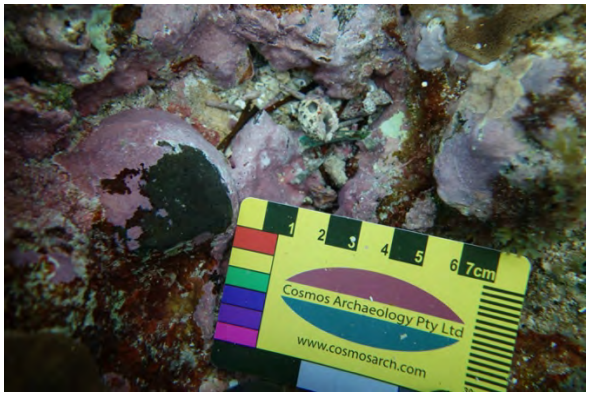

Figure 44: Cannon ball to left of image with small copper artefacts concreted into calcarenite. (Image taken 15th November 2020).

Figure 45: Grouping of cannon balls main ballast mound. (Image taken 15th November 2020).

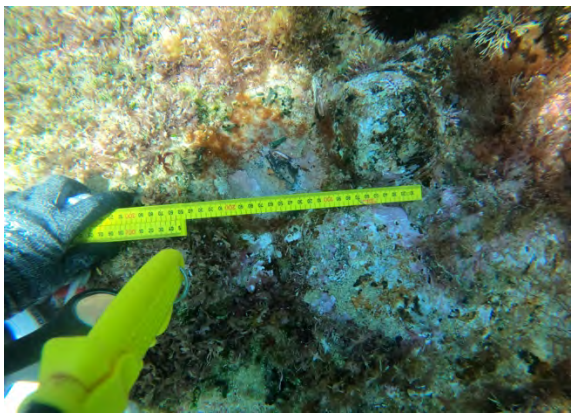

Figure 46: Reef area where a sea urchin was removed next to the cannon balls. (Image taken 17th November 2020).

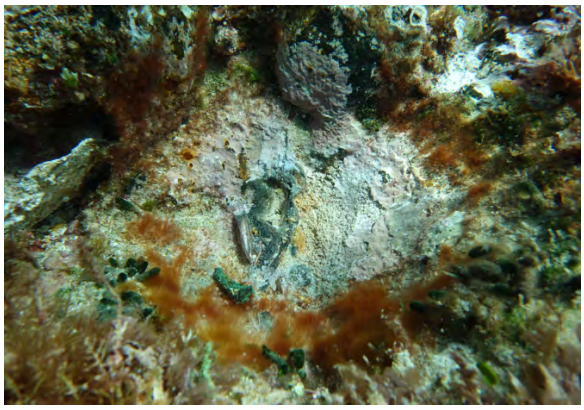

Figure 47: Detail of shined copper alloy fragment after removal of sea urchin. (Image taken 17th November 2020).

Figure 48: Site plan showing location of images of sea urchin activity.

5.2.2 Gully ballast pigs

Figure 49 shows the location of the gully ballast pigs. While the gully was relatively clear of growth, the small mound of approximately 16 ballast pigs along the eastern wall was heavily covered with algae growth (Figure 50 and Figure 51). Sea urchin activity appeared to be concentrated around the ballast, eating into the gully wall.

One ballast pig is rolling loose in the gutter and no longer has any growth or concretion protecting it (Figure 52 and Figure 53). It is unclear where this ballast iron has come from but likely from the gully ballast pigs. The pig is now cylindrical rather than rectangular. Heavy storm action may see this ballast pig move entirely away from the site.

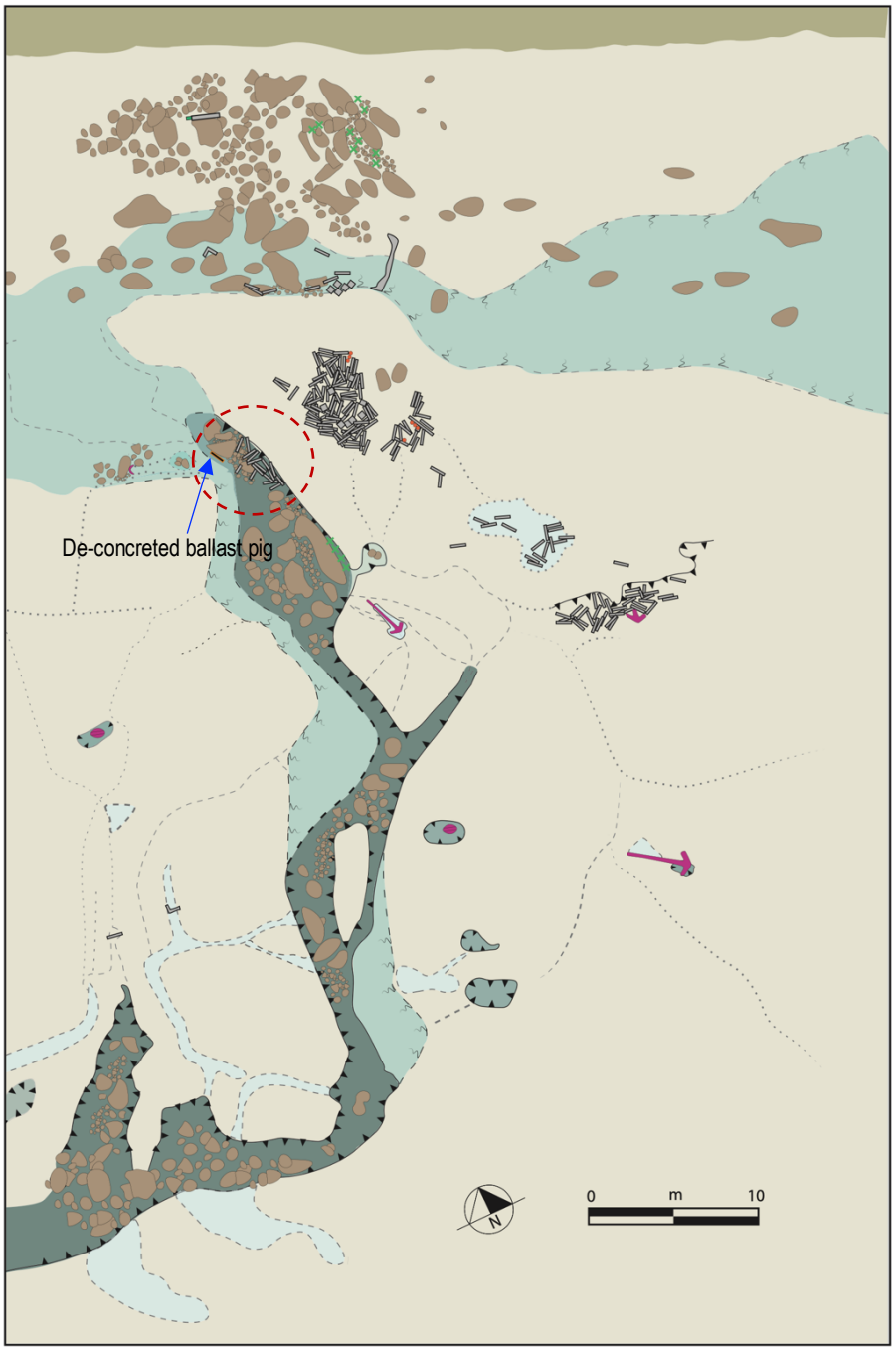

Figure 49: Location of gully ballast pigs (red circle). De-concreted ballast pig indicated with blue arrow.

Figure 50: Pile of ballast pigs in gully to the west of main ballast mound. (Image taken from video Sirius20_201115_2_MV_Ballast video run PM; 02:23).

Figure 51: Relationship between single ballast pig (bottom right) and northern edge of pile of pigs in the gully (bottom left). Image taken from video Sirius20_201115_2_MV_Ballast video run PM; 02:15).

Figure 52: Single ballast pig. (Image taken from video Sirius20_201117_09_CC_Anch10 to single pig; 01:23).

Figure 53: Single ballast pig in gully with no protective concretion. (Image taken 15th November 2020).

5.2.3 Eastern ballast pile

Figure 54 shows the location of the eastern ballast pile. The eastern ballast mound consists of two main areas. Nineteen ballast pigs are scattered within a shallow gully along the reef platform (Figure 55). A further 34 ballast pigs are scattered at the base of a ledge further to the east of the site (Figure 56). The ballast pigs are generally well covered in algae growth and in some locations blend in so well with the reef platform that they can be difficult to see. There is much sea urchin activity in and around the ballast pigs (Figure 57 and Figure 58).

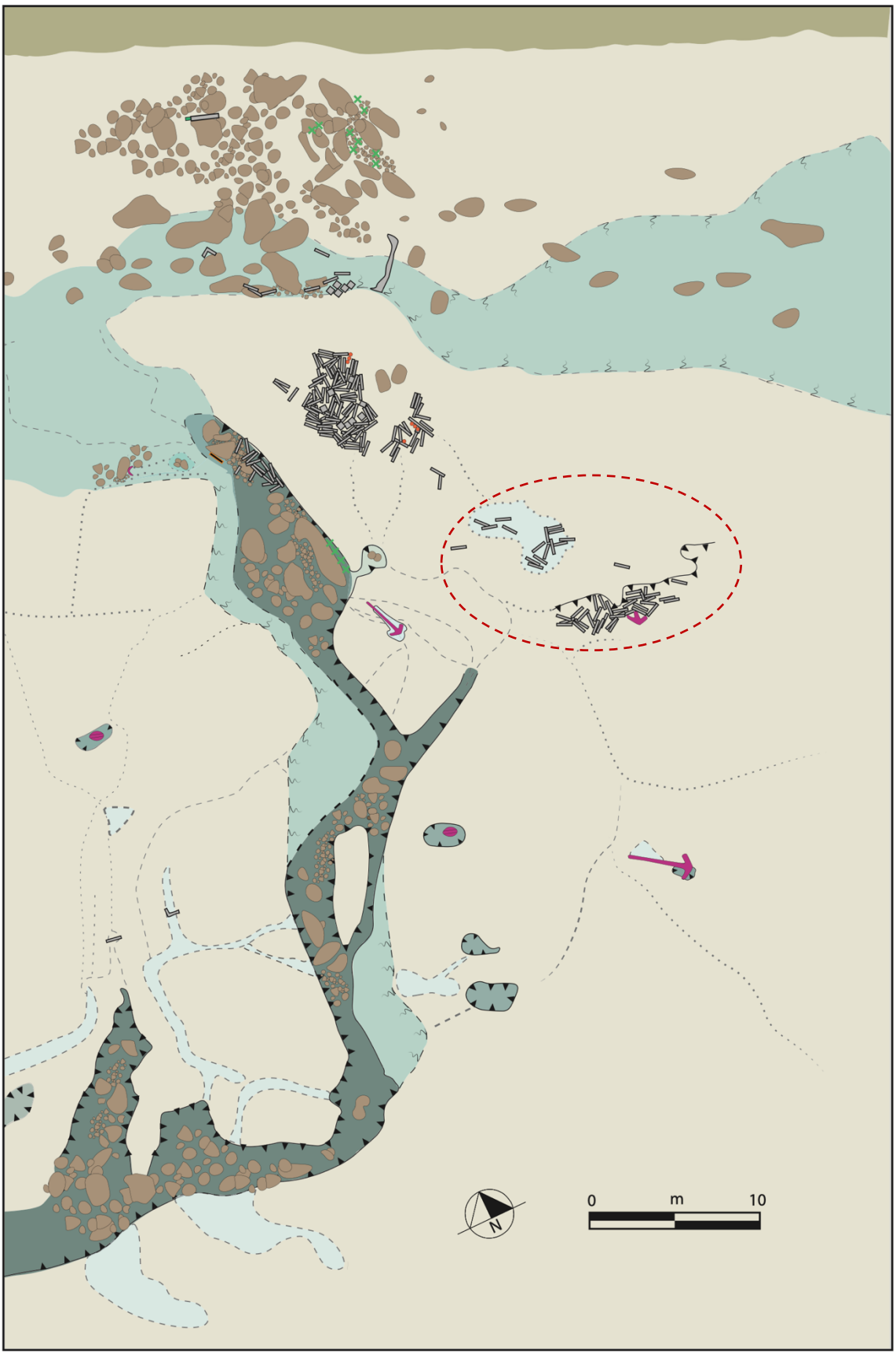

Figure 54: Location of eastern ballast pile.

Figure 55: Ballast pigs spread out along the reef platform in the northern section of the east mound. (Image taken from Sirius20_201115_02_MV_Ballast run PM; 03:47).

Figure 56: Southern end of eastern ballast pile. (Image taken from video Sirius20_201117_08_CC_Anchor 10 to ballast east; 00:46).

Figure 57: Sea urchin activity around eastern ballast pigs. (Image taken from Sirius20_201117_08_CC_Anchor 10 to ballast east; 00:37).

Figure 58: Sea urchin activity scraping into reef platform and in and around ballast pigs. (Image taken from Sirius20_201117_08_CC_Anchor 10 to ballast east; 01:37).

5.2.4 Ballast in shallows

Figure 59 shows the location of the ballast areas in the shallows.There are 6 square ballast pigs running along the edge of the ledge near the chain (Figure 60). One measured approximately 450 mm x 450 mm and was 330 mm high. It was heavily concreted. The other square ballast iron appear to be approximately the same size. There are also 7 rectangular ballast pigs within this shallow area.

These ballast pigs are all directly north of the main ballast mound so were likely dragged to this position or fell out of the wreck as it was pushed closer in to shore after its initial wrecking.

Sea urchin activity in this area is particularly aggressive. Sea urchins are making obvious craters in the ferrous material (Figure 62). One sea urchin was removed to reveal a crater 40 mm deep with a diameter of 150 mm (Figure 63).

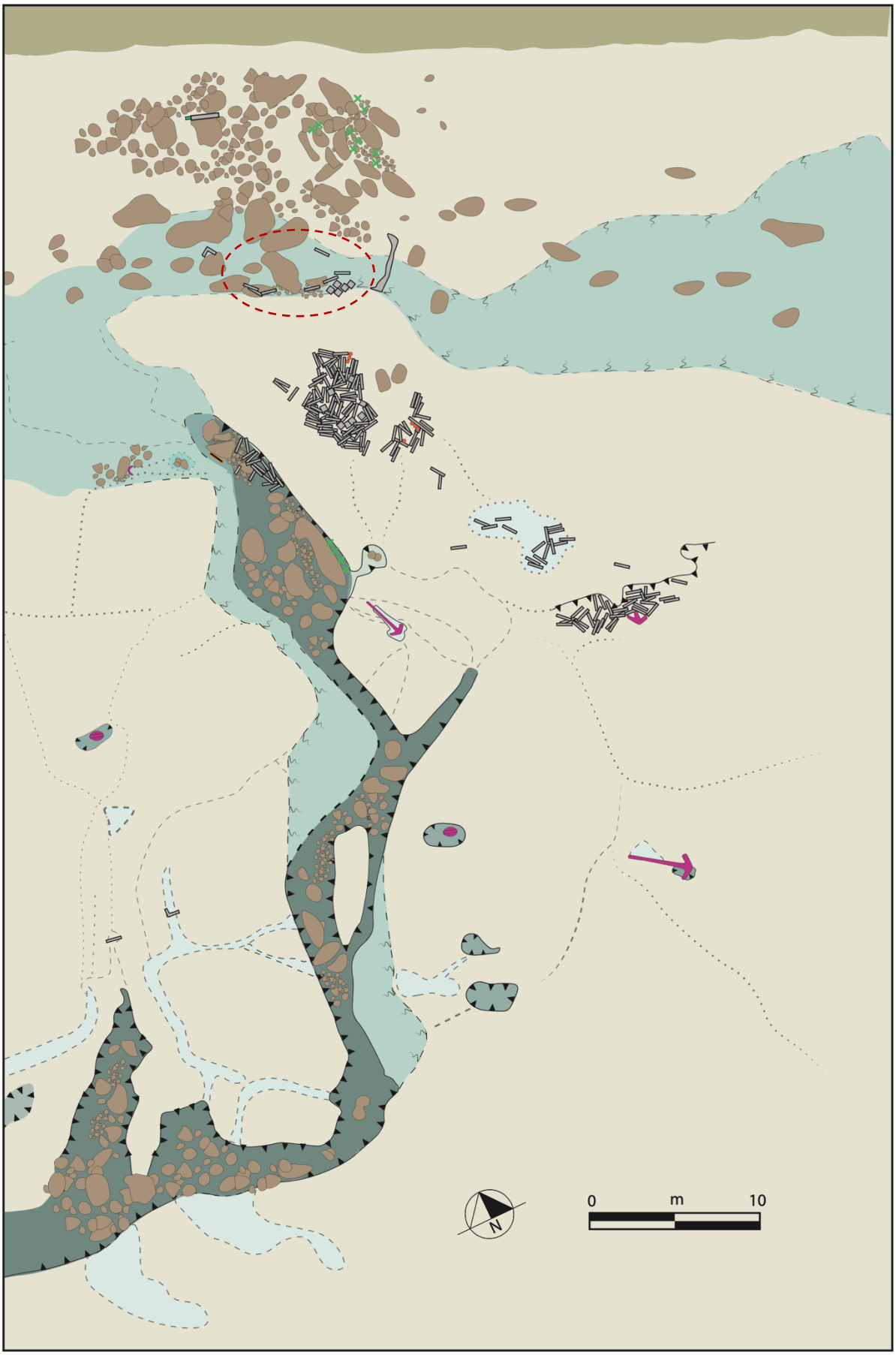

Figure 59: Location of ballast pigs in the shallows.

Figure 60: Square ballast iron in shallows. (Image taken from Sirius20_201117_10_CC_pigs (14); 00:27).

Figure 61: Example of rectangular ballast pig in shallows. (Image taken from Sirius20_201115_17_CC_ballast pigs (14) to chain (8); 00:38).

Figure 62: Example of sea urchins scraping into the ballast iron. (Image taken 15th November 2020).

Figure 63: The sea urchin had scraped 40 mm into the ballast iron. (Image taken 17th November, 2020).

5.2.5 SI 624 Anchor

This broken anchor rests on the top of the reef, south of the main wreck site (Figure 64 and Figure 65). The tip of the left arm is concreted into the reef top, with the arm crossing a hole in the reef (Figure 66). The crown is resting on the reef and the anchor rests at an angle such that the right arm is slightly elevated. Both flukes are missing. The anchor is fully concreted with an indent at the tip of the shank which possibly indicates the position of the notch for the stock or where the shank has eroded away (Figure 67 and Figure 68). The anchor measures 3.35 m long from the crown to the end of the shank. The left arm is 0.8 m from the crown to the tip, while the right arm is 1.15 m.

The sea urchin activity in and around this area appears relatively minor. There appears to be some urchins in the walls of the hole under the right arm and these should be monitored to determine if they are making the hole larger in diameter or deeper (Figure 69).

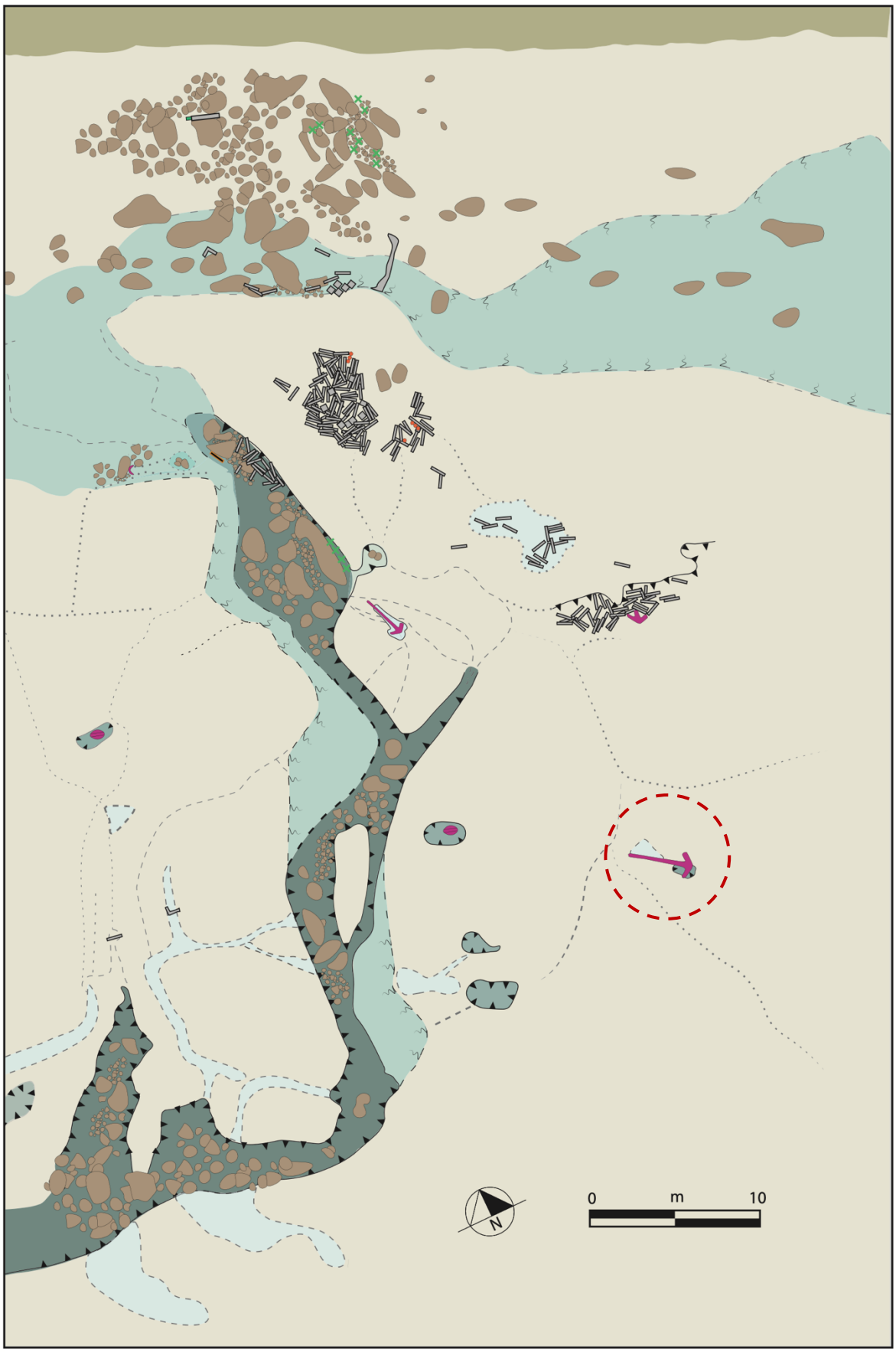

Figure 64: Location of Anchor SI 624 on site plan.

Figure 65: Anchor SI 624 which sits on a flat reef top platform. Scale in 200 mm increments. (Image taken 15th November, 2020).

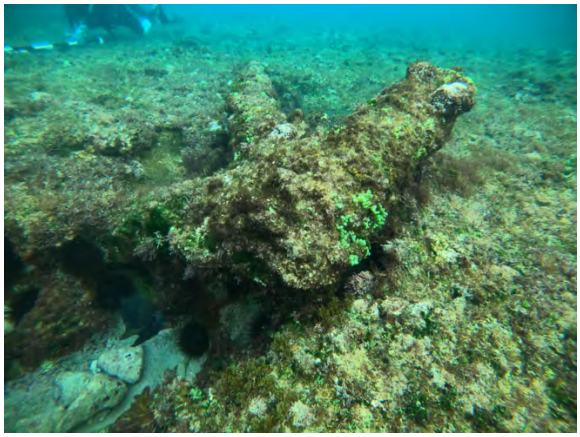

Figure 66: Anchor SI 624. Note right arm unsupported and left arm leaning into hole in reef. (Image taken 15th November 2020).

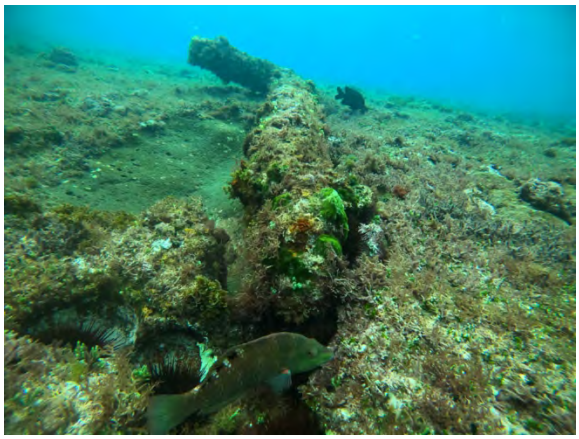

Figure 67: Anchor SI 624, looking along shank towards anchor arms. (Image taken 15th November 2020).

Figure 68: Arms of Anchor SI 624 with hole in reef top right. (Image taken 15th November 2020).

Figure 69: Sea urchins in hole under Anchor SI 624. (Image taken 15th November 2020).

5.2.6 SI 625 Anchor

This anchor rests in a thin gully, south of the main ballast mound (Figure 70 and Figure 71). It is a smaller anchor than SI 624, and lies flat along the seabed. The left arm still has its fluke, and its shape is still evident despite concretion and algae growth. The right arm is broken and the tip lies just under the gully edge (Figure 72). The anchor measures 2.90 m long from the crown to the end of the shank. The left arm is 1.1 m from the crown to the tip of the fluke, while the right arm is 0.5 m.

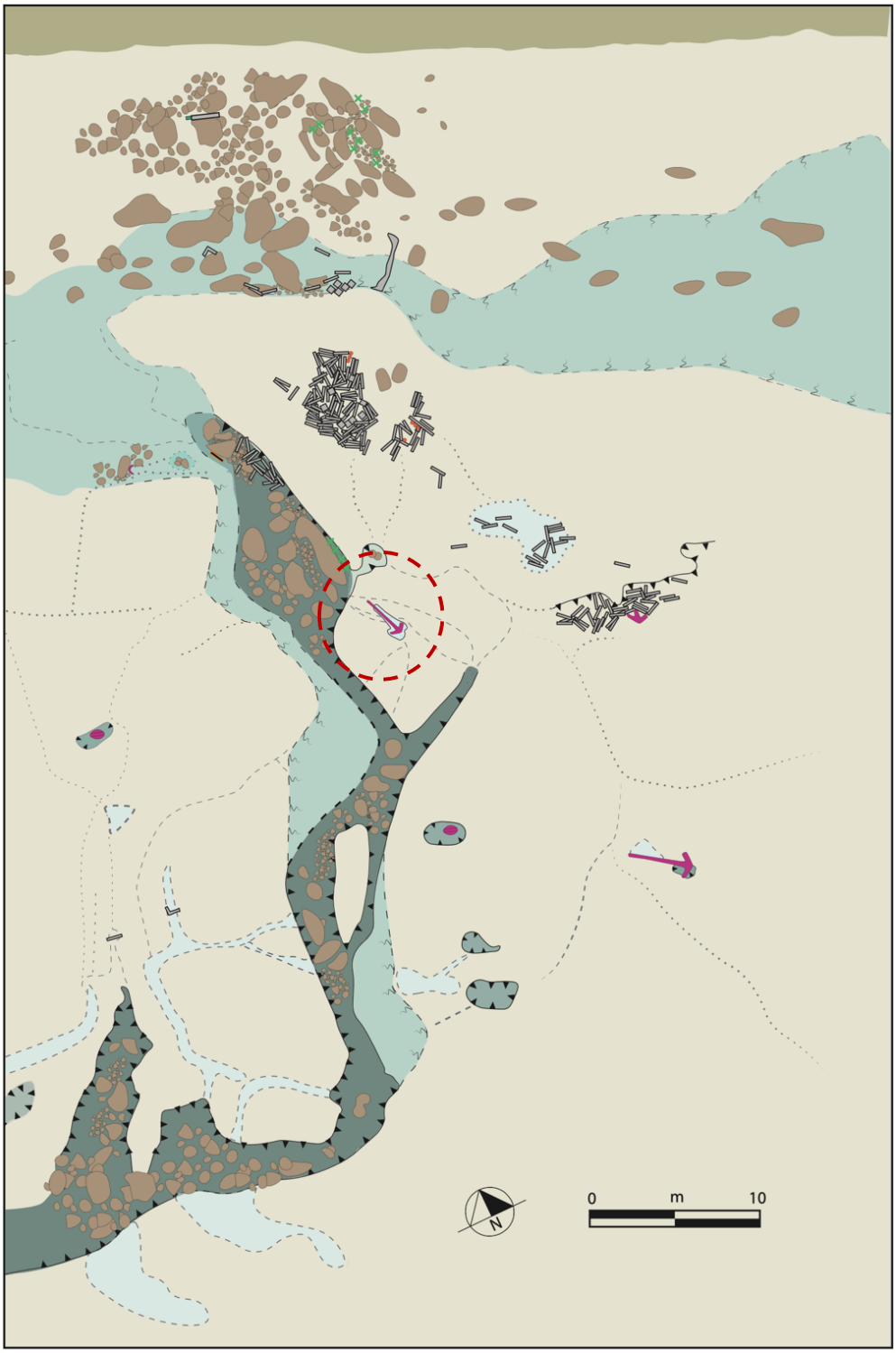

Figure 70: Location of Anchor SI 625.

Figure 71: Anchor SI 625. (Image taken from video Sirius20_201117_08_CC_Anch10 to ballast east; 00:06).

Figure 72: Anchor SI 625 arm and fluke to left of image. (Image taken 15th November 2020).

Figure 73: Shank of Anchor SI 625; note a section of concretion has been removed. (Image taken from video Sirius20_201114_03_JM_anchor 10: 003).

Figure 74: Detail of exposed shank on Anchor SI 625 where concretion has been removed. (Image taken from video Sirius20_201115_5_Anchor 10 concretion, 00:01).

Figure 75: Anchor SI 625 in February 2020. Note concretion covering entire shank. (Image taken 27th February 2020).

A section of the shank was noted to have been deconcreted since February 2020 (Figure 73 and Figure 74). The deconcreted area measures 280 mm in length, 110 mm wide and was approximately 420 mm from the top of the shank. It is unknown what caused the damage,

although the concretion that has broken off appears not to have had seaweed growth on it previously (Figure 75).

Both anchors were recorded on the dive vessel's GPS in degrees, decimal minutes during this inspection (Figure 76).

Anchor	Latitude	Longitude
Anchor SI 624	29° 3.599'S	167° 57.320'E
Anchor SI 625	29° 3.591'S	167° 57.316'E

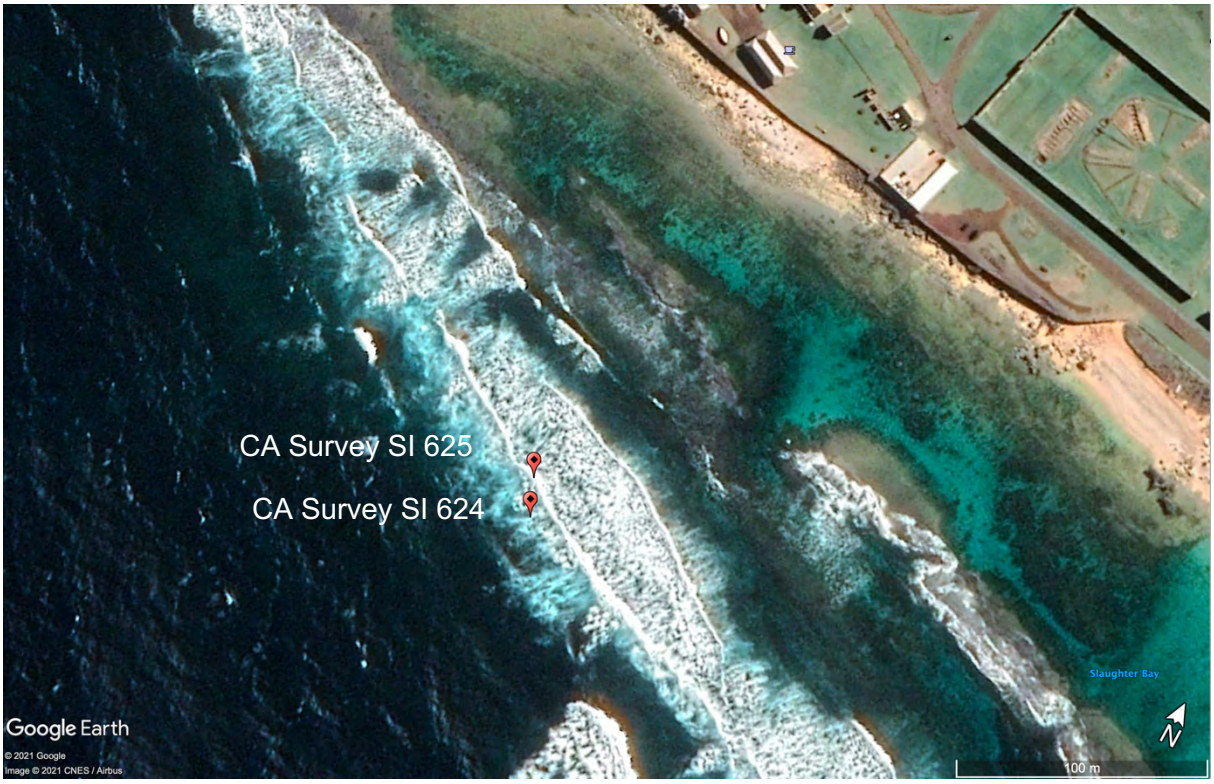

Figure 76: Positions of anchors SI 624 and SI 625 overlaid onto Google Earth.

5.2.7 Anchor 2020

On 17th November, an inspection of the ballast mound at the eastern edge of the site revealed a broken anchor, previously unrecorded (Figure 77). The anchor rests on top of a ballast pig at the southern edge of the ballast pile (Figure 78 to Figure 81).

The anchor measures 740 mm long from the crown to the broken end of the shank. The shank has a circumference of 430 mm. The left arm is 860 mm from the crown to the end of the arm, while the right arm is 300 mm. The longer arm appears to have some of the fluke remaining but it is heavily corroded and covered in concretion. The shape of the arms to the shank indicate a crown angle anchor or old plan long-shanked anchor, the same as the two remaining on site and three already raised from the wreck.

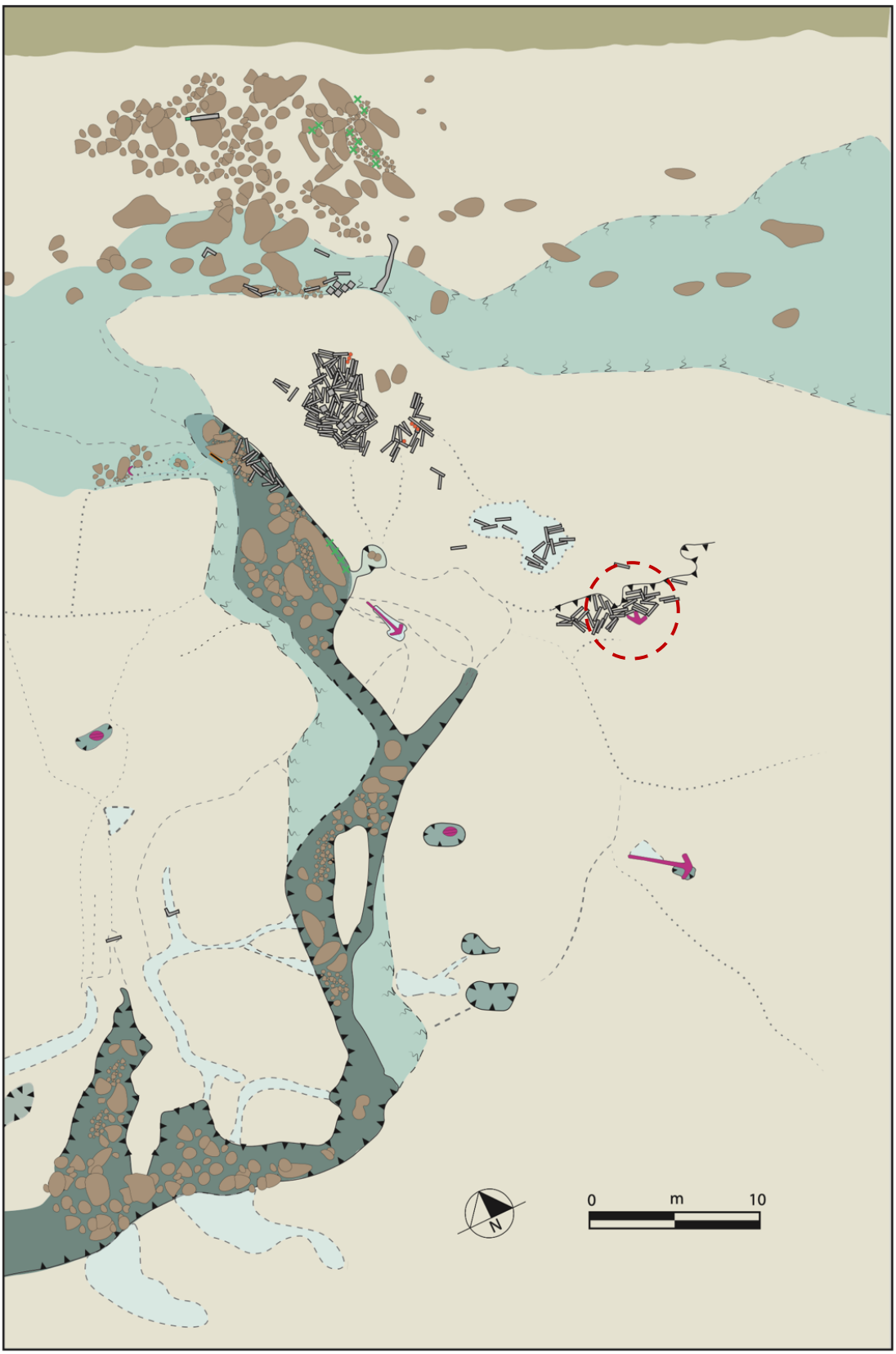

Figure 77: Location of anchor 2020.

Figure 78: Anchor 2020 resting on the eastern ballast mound. (Image taken 17th November 2020).

Figure 79: Anchor 2020 resting on the eastern ballast mound. (Image taken 17th November 2020).

Figure 80: Anchor 2020. (Image taken 17th November 2020).

Figure 81: Crown of anchor 2020. (Image taken 17th November).

5.2.8 Anchor flukes

There are currently two anchor flukes on site. The 1989 site plan lists one anchor fluke concreted into the reef in the south west where the 1905 anchor was raised and another is featured in the gully near Anchor SI 625. The latter (SI 590) was raised at the end of the 1988 season.[27] The two anchor flukes presently on the site are both loose and sit in holes worn into the reef (Figure 82).

The south west fluke appears heavily concreted and covered with a purple sea weed (Figure 83 and Figure 84). The base measures 670 mm, the diagonal sides are 780 mm with the vertical distance from top to base 700 mm. The width was 50 mm. It is uncertain at this stage if this fluke is the one from the 1905 anchor that has broken free of the reef.

[27] **Stanbury, M., 1994**, *HMS* Sirius *1790: An Illustrated Catalogue of artefacts recovered from the wreck site at Norfolk Island*, Australian Institute of Maritime Archaeology Special Publication No. 7, p.70.

Figure 82: Location of western fluke (red) and eastern fluke (blue).

Figure 83: Western anchor fluke, very heavily concreted. (Image taken on 15th November 2020).

Figure 84: Western concreted anchor fluke. (Image taken 15th November 2020).

The second anchor fluke is smaller in size and lies in the carronade hole to the south of Anchor SI 625 and west of anchor SI 624 (Figure 85). The height of the fluke is approximately 630 mm.

The raised part of the arm is visible on the reverse of the palm (Figure 86).

Figure 85: Anchor fluke in carronade hole. (Image taken from video Sirius20_201114_19_JM_ Anchor fluke in Carronade hole; 00:04).

Figure 86: Detail of anchor fluke. (Image taken 15th November 2020).

5.2.9 Anchor ring

The anchor ring is located lying loose in a depression to the west of the site (Figure 87). Approximately just under half appears to remain .The ring has a thickness of 100 mm and the distance between each broken tip is 600 mm (Figure 88 and Figure 89). It is currently unknown which anchor this ring belonged to, although it has been speculated that it is from the 1905 anchor that was blasted from the reef.

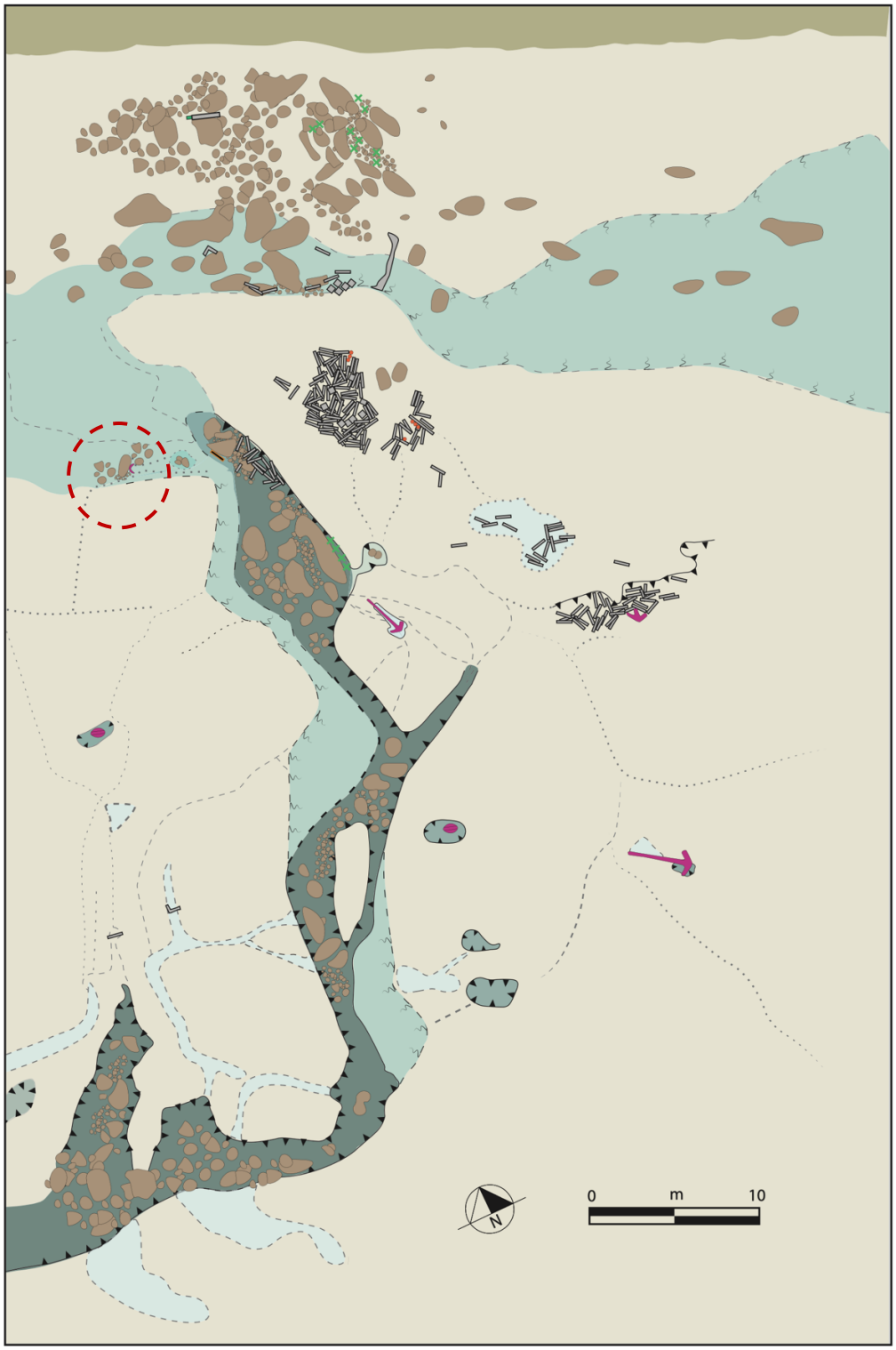

Figure 87: Location of anchor ring.

Figure 88: Anchor ring in a depression amongst the seaweed growth (red arrow). (image taken from video Sirius20_201115_15_CC_solo pig to anchor ring; 00:59).

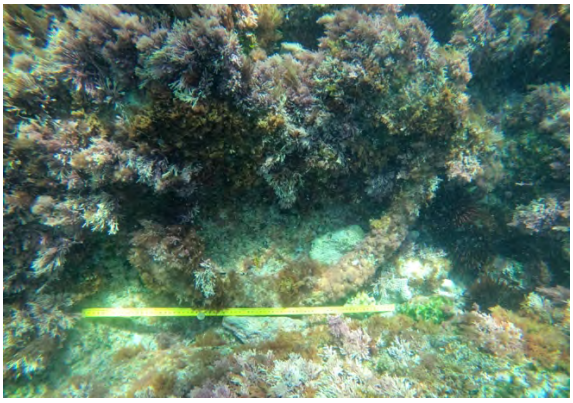

Figure 89: Anchor ring. (Image taken 17th November 2020).

5.2.10 SI 830 Pump chamber

This pump chamber was first described in the 2002 Expedition Report, although it was not located as part of that inspection. It was located post expedition, during a particularly calm day in the shallow section of Site 1 (Figure 90).[28] The chamber with the concretion is approximately 1.4 m long, while the de-concreted copper alloy section measures 350 mm. There appears to be a small bevel at the end, measuring 15 mm. The outside diameter of the copper alloy chamber is 175 mm (
Figure 91 to Figure 94).

[28] **Erskine, N., 2002**, 2002 *HMS* Sirius *Expedition Report*, prepared for the Norfolk Island Government, p. 20.

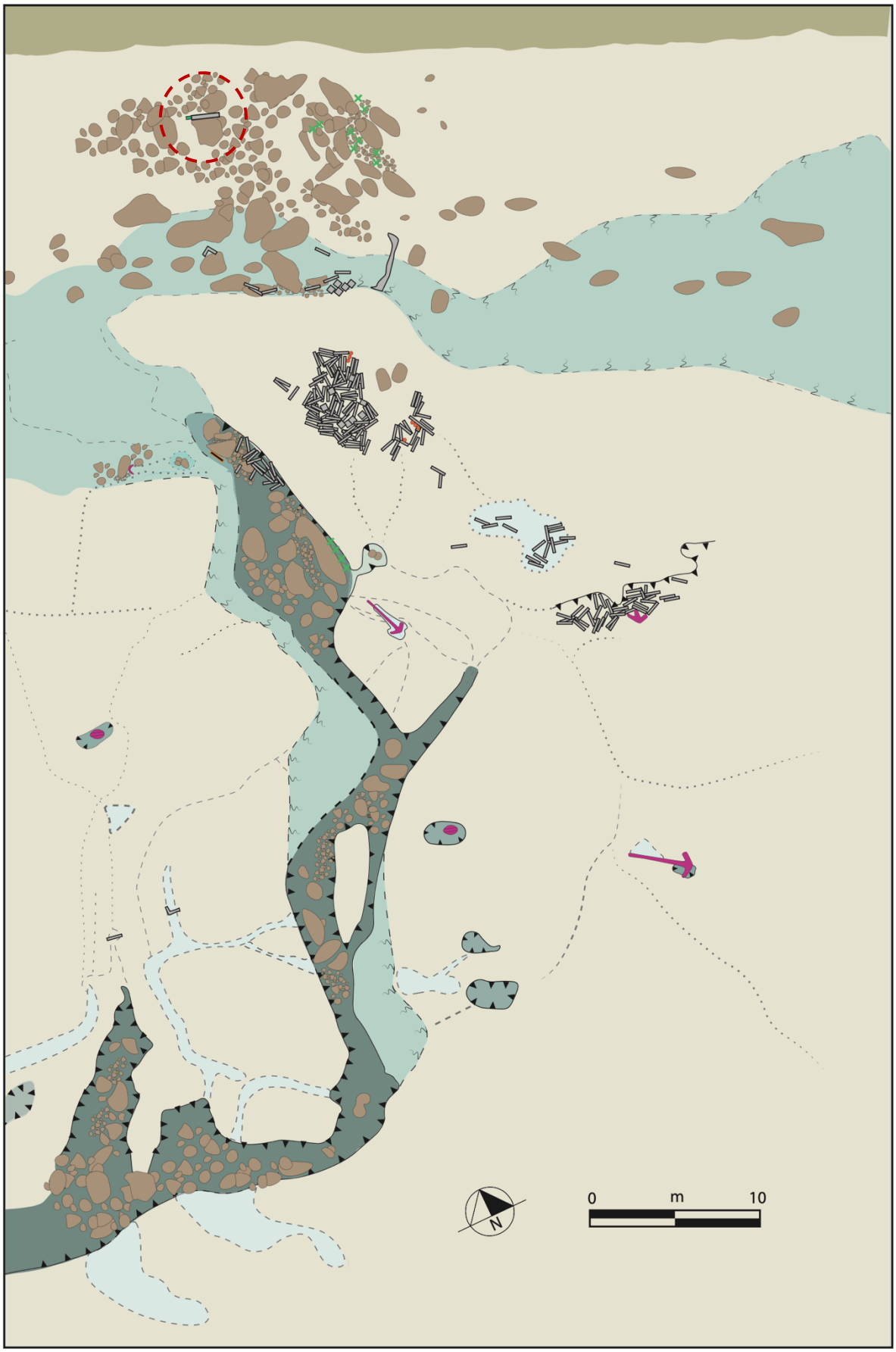

Figure 90: Location of pump chamber.

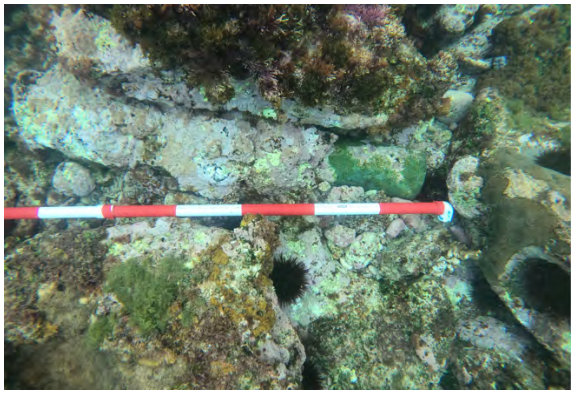

Figure 91: Pump housing, scale in 200 mm increments. (Image taken 15th November 2020).

Figure 92: De-concreted section of bronze pump chamber (Image taken 15th November 2020).

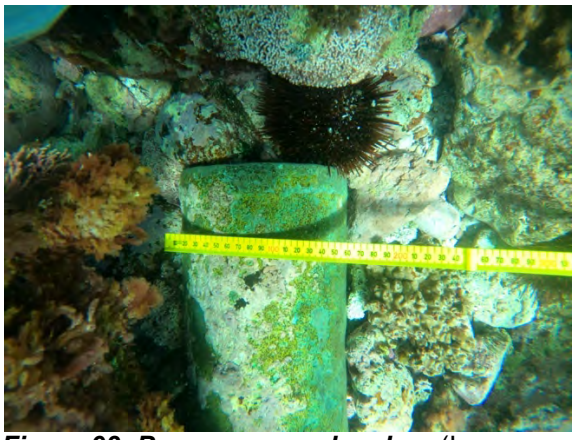

Figure 93: Bronze pump chamber. (Image taken 17th November 2020).

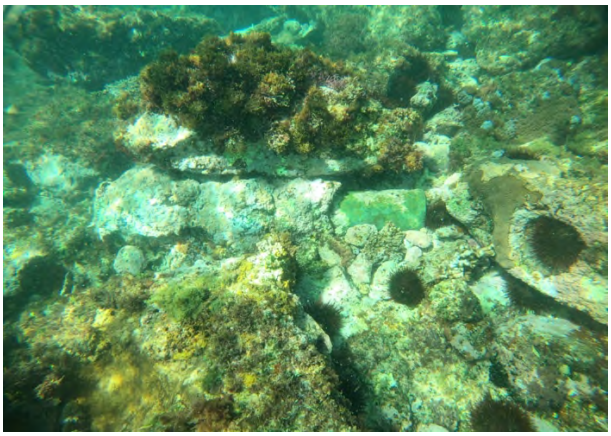

Figure 94: Bronze pump chamber tucked under calcarenite boulder. (Image taken 17th November 2020).

5.2.11 Small copper alloy artefacts

A 2.2 m long copper artefact seam is concreted into the base of the main gully wall, 4.4 m north of Anchor SI 625 (Figure 95). This seam of artefacts includes copper tacks, copper sheathing and weathered ceramics (Figure 96 and Figure 97).

A section of metal sheathing has been concreted into the gully wall just south of the artefact seam (Figure 98 and Figure 99).

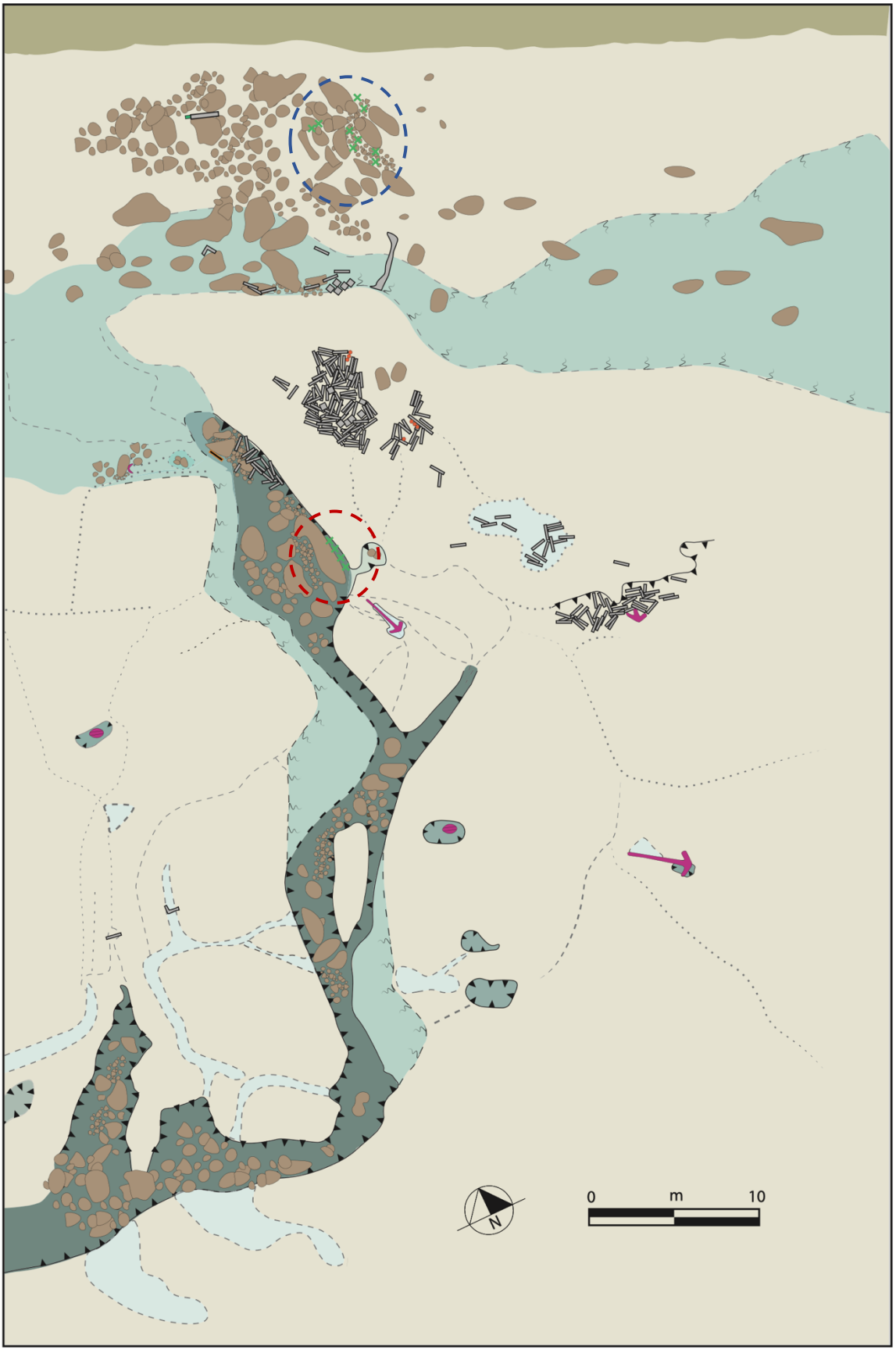

Figure 95: Location of loose copper allow artefacts; in the gully (red) and in the shallows (blue).

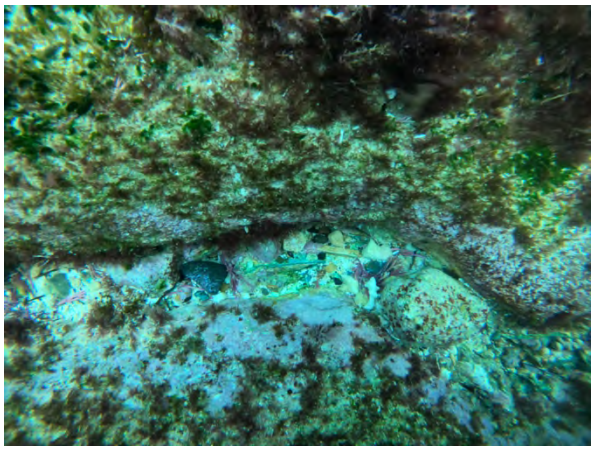

Figure 96: Small copper artefacts concreted into gully crevice, including weathered ceramics. (Image taken 15th November 2020).

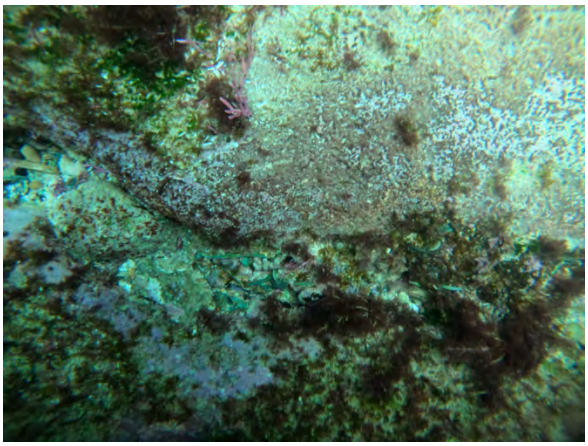

Figure 97: Small copper artefacts including tacks concreted into gully crevice. (Image taken 15th November).

Figure 98: Copper sheathing in the gully wall near anchor SI 625. (Image taken 15th November),

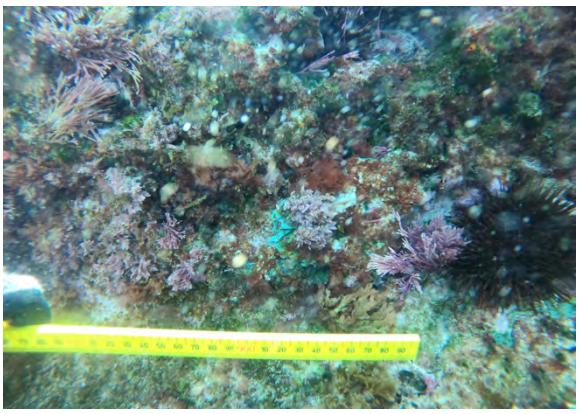

Figure 99: Another example of copper sheathing in gully wall near anchor SI 625. (Image taken 17th November).

There was a surprising amount of loose material in the shallow area of Site 1. Musket balls, lead shot, coaks, clench rings, copper alloy tacks are all still on the site. Some of the artefacts have been concreted into the seabed or gullies (Figure 100) however, there was a relatively large number of loose artefacts in fissures and under rocks and boulders (Figure 101 to Figure 103).

One copper alloy artefact appeared to be a wall fitting (Figure 104 and Figure 105). The artefact is very similar to one raised during the 1980s and presently exhibited in the HMS *Sirius* Museum.

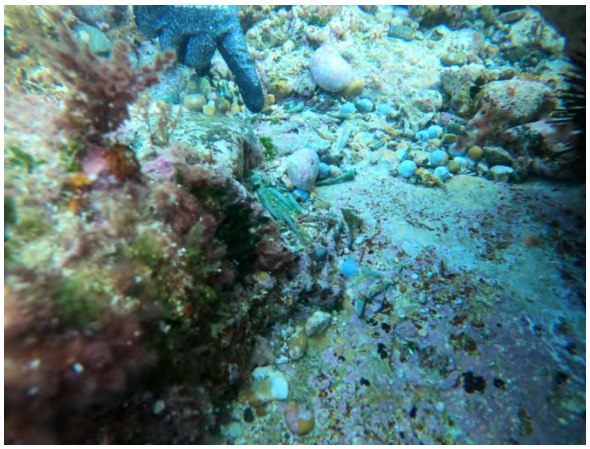

Figure 100: Copper tacks and ammunition in shallow area Site 1. (Image taken 15th November).

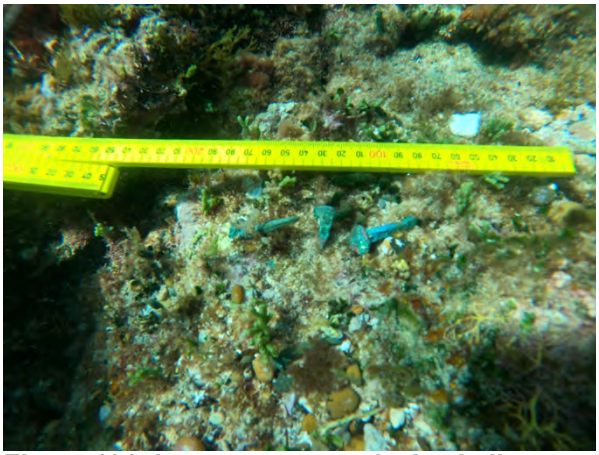

Figure 101: Loose copper tacks in shallow area of site 1. (Image taken 17th November 2020).

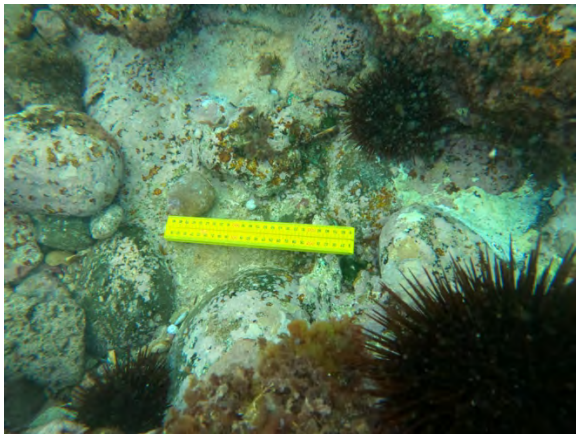

Figure 102: Loose ammunition and copper concreted into crevices in shallow area of Site 1. (Image taken 17th November 2020).

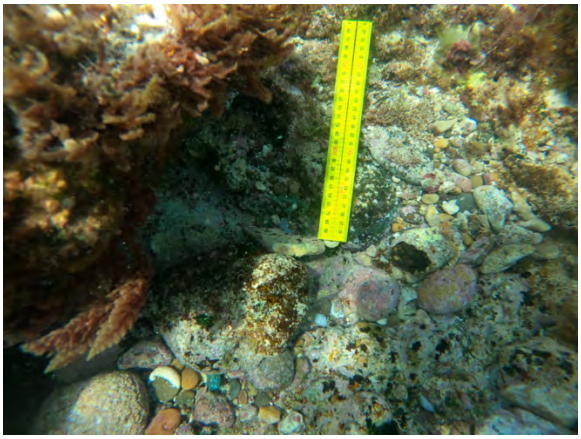

Figure 103: Loose ammunition and copper concreted into crevices in shallow area of Site 1. (Image taken 17th November 2020).

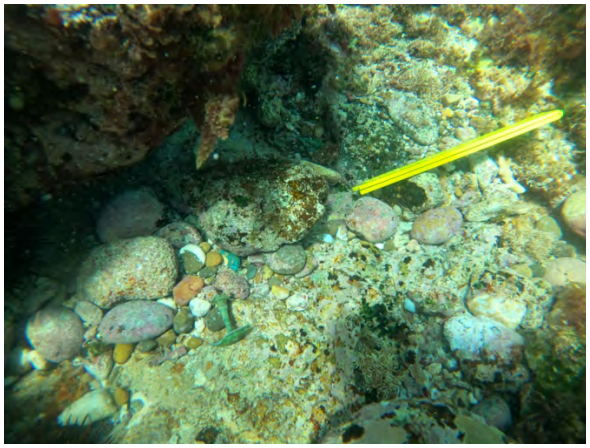

Figure 104: Possible copper alloy wall fitting in shallow area site 1. (Image taken 17th November 2020).

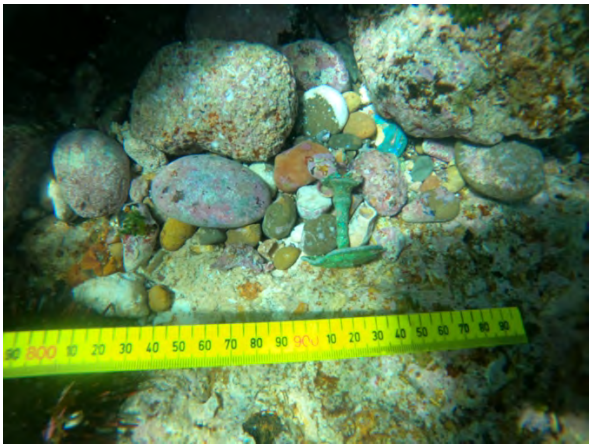

Figure 105: Detail of possible copper alloy wall fitting shallows site 1. (Image taken 17th November 2020).

5.2.12 Possible anode

This artefact is located in the shallows of Site 1, to the east of the SI 830 pump chamber (Figure 106 to Figure 108). The artefact consists of what appears to be a concreted bar, approximately 300 mm long and 40 mm wide with a ferrous bracket 80 mm long attached at the western end. There is an insulated copper wire cable attached to the bar which runs in a westerly direction underneath rocky boulders for approximately a metre (Figure 109 and Figure 110) .

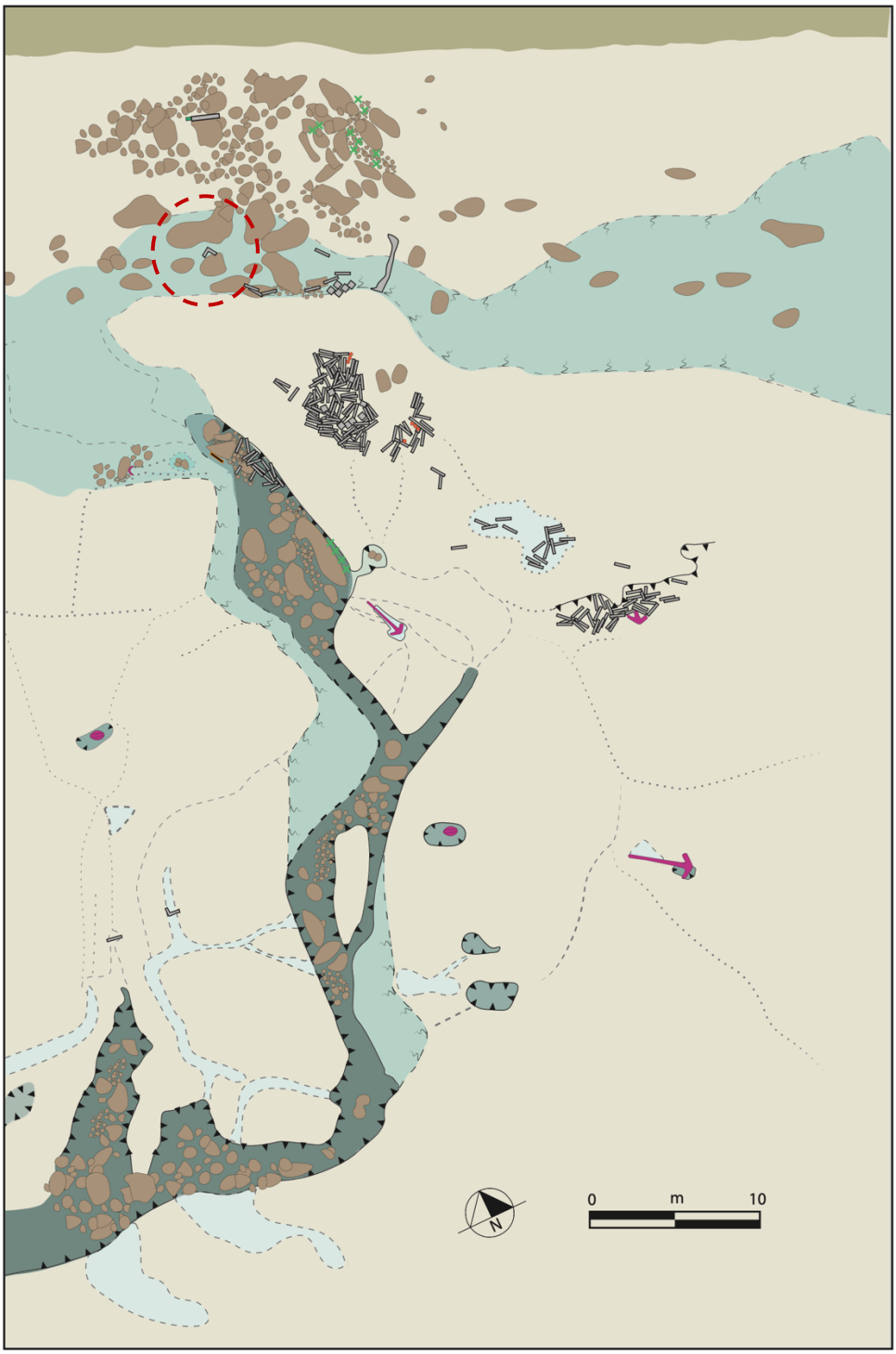

Figure 106: Location of possible anode.

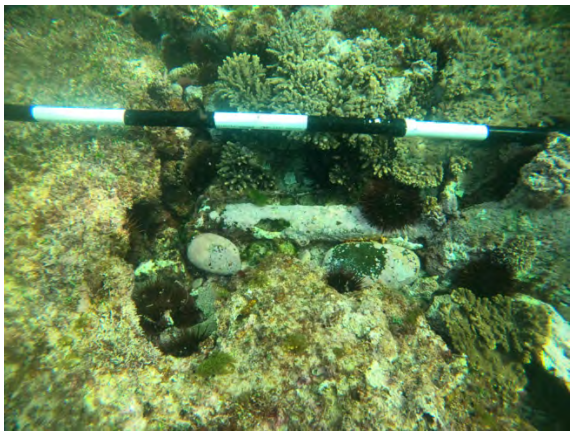

Figure 107: Possible remains of anode in shallows of site 1. Scale in 200 mm increments. (Image taken 15th November 2020).

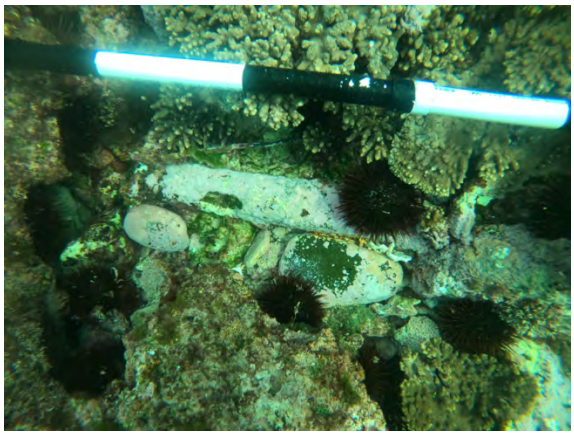

Figure 108: Close-up of possible anode in shallow area of Site 1. Scale in 200 mm increments. (Image taken 15th November 2020).

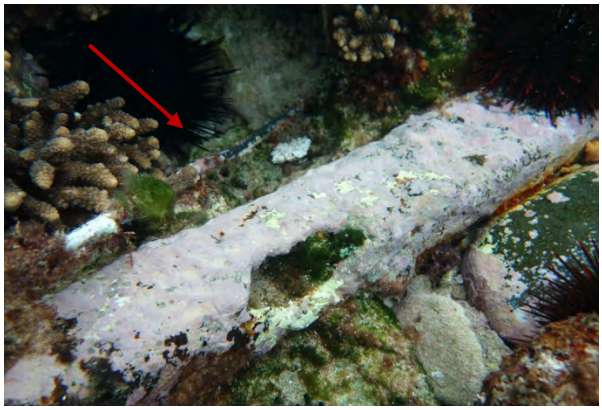

Figure 109: Close-up of possible anode in shallow area of Site 1. Red arrow indicates cable. (Image taken 15th November 2020).

Figure 110: End of cable running in a westerly direction attached to possible anode. (Image taken from video Sirius20_201115_03_CC_Anode; 00:06).

5.2.13 Single ballast pig

This single ballast is an isolated find in the south west of Site 1 (Figure 111). It is resting over a steep gutter and appears to be affected by sea urchin activity, with one animal in particular making a deep crater in the southern face of the ballast iron (Figure 112 and Figure 113).

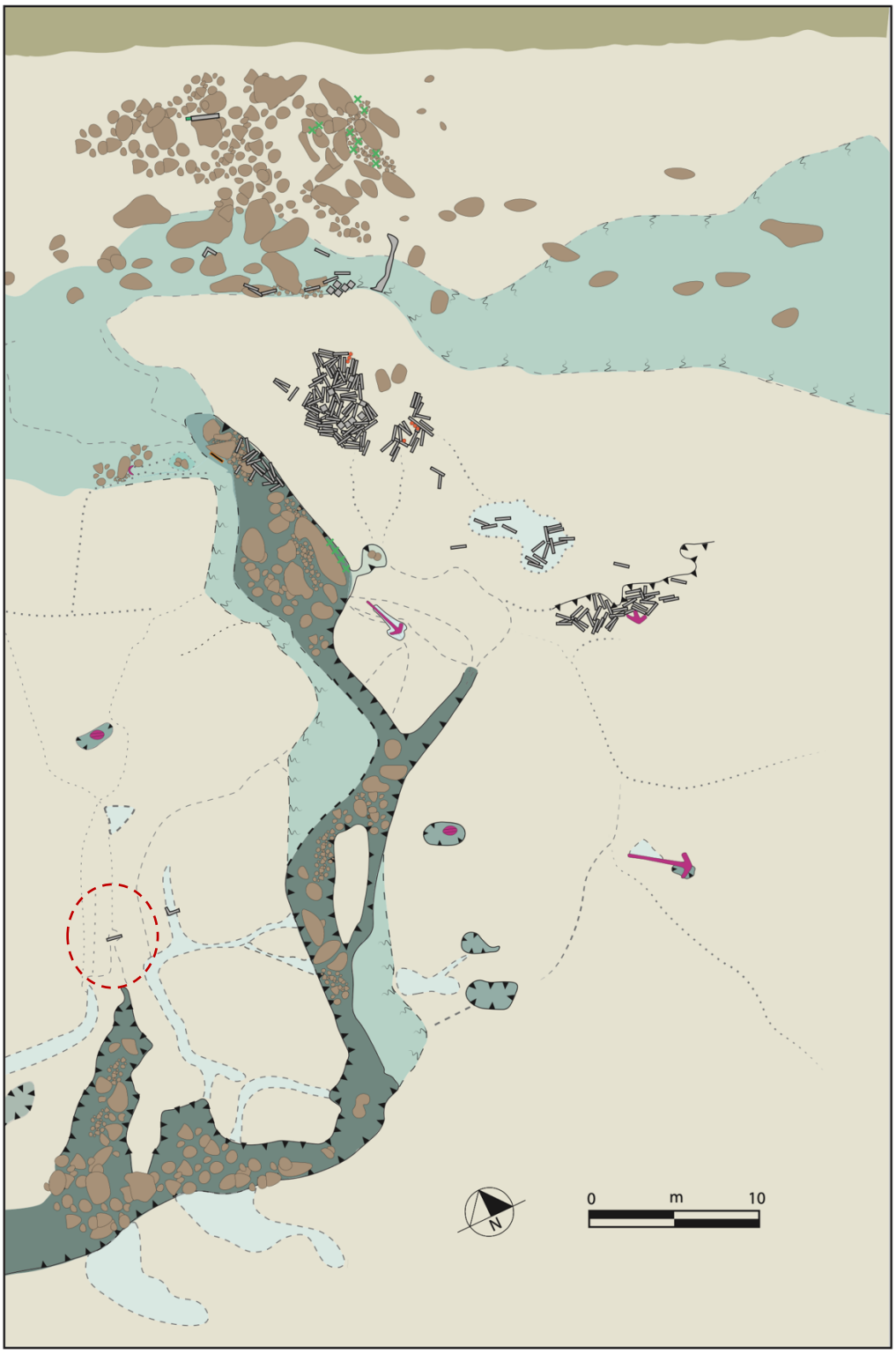

Figure 111: Location of single ballast iron in south west.

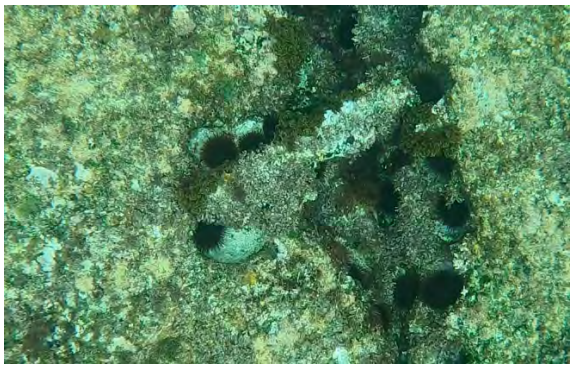

Figure 112: Single ballast pig in the south of site 1. (Image taken from Sirius20_201115_10_CC_pig to anchor 10; 00:03).

Figure 113: Single ballast pig in the south of Site 1. (Image taken 14th November 2020).

5.3 Inshore areas (Sites 2 – 6)

5.3.1 Site 2

The survey of Site 2 was completed on the 16th November 2020, beginning at approximately 3 pm, timed to coincide with low tide. The metal detector was operated by Malcolm Venturoni who counted the 'hits' in each zone. Jane Mitchell took observation notes of the time taken to record each zone.

The southern limit of the survey was a low linear mound of rubble up to 15 m away from the baseline. For Zone A and B, the search extended over the rubble line for up to 5 m. For the majority of the survey, the water was waist deep, however in Zones E and F, the water was neck deep, and some areas in these zones may not have been searched effectively.

The seabed was rubbly and uneven, the search with the metal detector being directed towards small gullies and depressions within each zone (Figure 114 and Figure 115). The impression was there was a strike in every scanned gully while the open areas were quite sterile.

Table 4 outlines the results of the survey with 105 'hits' recorded over 69 minutes. Very few hits revealed artefacts of note visible above the seabed. However, what appeared to be a musket ball was concreted into the reef in Zone A (Figure 116) and a small piece of worn green glass was found in Zone C (Figure 117).

Figure 114: Example of seabed in Site 2 Zone E. (Image taken from video Sirius201116_ 01_MB_Example of site 2 seabed; 00:06).

Figure 115: Example of seabed in Site 2 Zone D. (Image taken from video Sirius201116_ 01_MB_Example of site 2 seabed; 01:23).

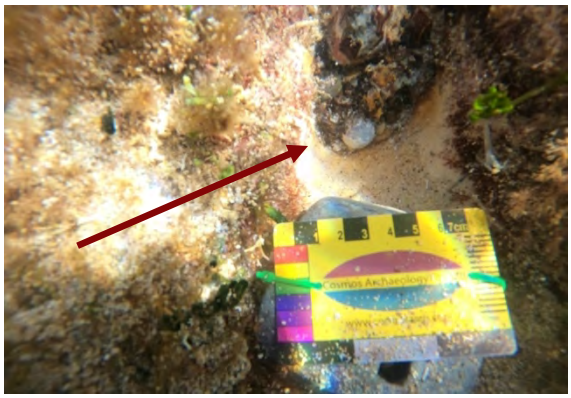

Figure 116: Possible musket ball concretion found in Zone A (red arrow). (Image taken 16th November, 2020).

Figure 117: Piece of glass concreted in seabed located in Zone C. (Image taken 16th November 2020).

A digital representation of the search area of Site 2 can be found at Figure 118.

Table 8: Results from Site 2 metal detector survey.

Zone	Baseline (m)	Start time	End time	Total time (min)	Total hits	Seabed description
A	0 – 10	1520	1525	5	5	Sand gullies and pits amongst rock rubble
B	10 – 30	1527	1543	16	22	Mostly flat area with not as many gutters
C	30 – 50	1546	1600	14	37	Reef and coral growth in gutters
D	50 – 70	1601	1613	12	26	Reef and coral growth in gutters
E	70 – 90	1615	1622	5	5	Reef and coral growth in gutters relatively deep
F	90 – 110	1636	1653	17	10	Reef and coral growth in gutters relatively deep
			Total	69	105	

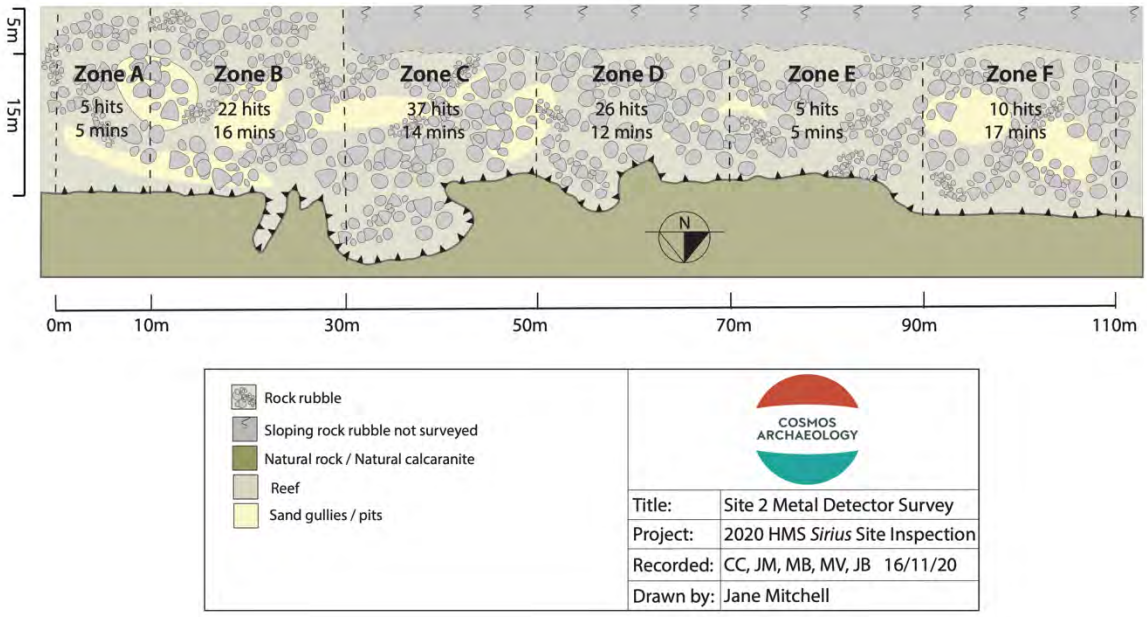

Figure 118: Digital representation of site 2 search area.

The area of Site 2 is a gully between two higher reef platforms, an ideal location for trapping artefacts. The greater artefact densities came from zones B, C and D. This correlates with the position of these zones being almost directly north of the main wreck site of the HMS *Sirius* (Figure 119), where lighter metallic objects may have washed into the area. However, the *Ronaki* was also wrecked further inshore on the hard calcarenite reef and objects from that wreck may also be present.

Figure 119: Site 2 search area in relation to Site 1.

5.3.2 Site 3

The survey of Site 3 was completed on the 18th November 2020, beginning at approximately 3:30 pm, timed to coincide with low tide. The metal detector was operated by Malcolm Venturoni who counted the 'hits' in each zone. Jane Mitchell took observation notes of the time taken to record each zone.

For the first 15 m, the seabed consisted of rocky rubble and coral outcrops. From 15 – 50 m the terrain was predominantly sandy gullies with rocky reef outcrops. The final 10 m consisted of hard calcarenite reef with rock pools.

Table 9 outlines the results of the survey, however, no hits revealed anything of note. Some strong hits, when examined on snorkel, appeared to be rocky or coral outcrops which may have artefacts concealed under the growth or within the rock (Figure 120). One modern golf ball and a modern tin can were the only visible cultural material located during the search (Figure 121).

Figure 120: Location of one 'hit' did not reveal an obvious artefact. (Image taken 18th November 2020).

Figure 121: Modern golf ball, with no growth indicating it had not been in the water long. (Image taken 18th November 2020).

Table 9: Results from Site 3 metal detector survey.

Baseline (m)	Start time	End time	Total time (min)	Total hits	Seabed description
0 – 30	1616	1625	9	7	Rocky rubble with coral growth 0-15 m then sandy gullies with reef outcrops.
30 – 0	1526	1636	10	3	Rocky rubble with coral growth 0-15 m then sandy gullies with reef outcrops.
30 – 60	1642	1651	9	5	Sandy gullies with reef outcrops 30 – 50 m then hard calcarenite reef with rock pools
60 – 30	1653	1702	9	6	Hard calcarenite reef with rock pools for 10 m then sandy gullies with reef outcrops to the end.
		Total	37	21	

The majority of 'hits' were located within reef outcrops and the rock rubble. Three 'hits' were located in the rock pools near the 60 m mark. If these are cultural they are likely to be from the vessel *Ronaki*.

A digital representation of the spread of 'hits' in this area can be seen in Figure 122.

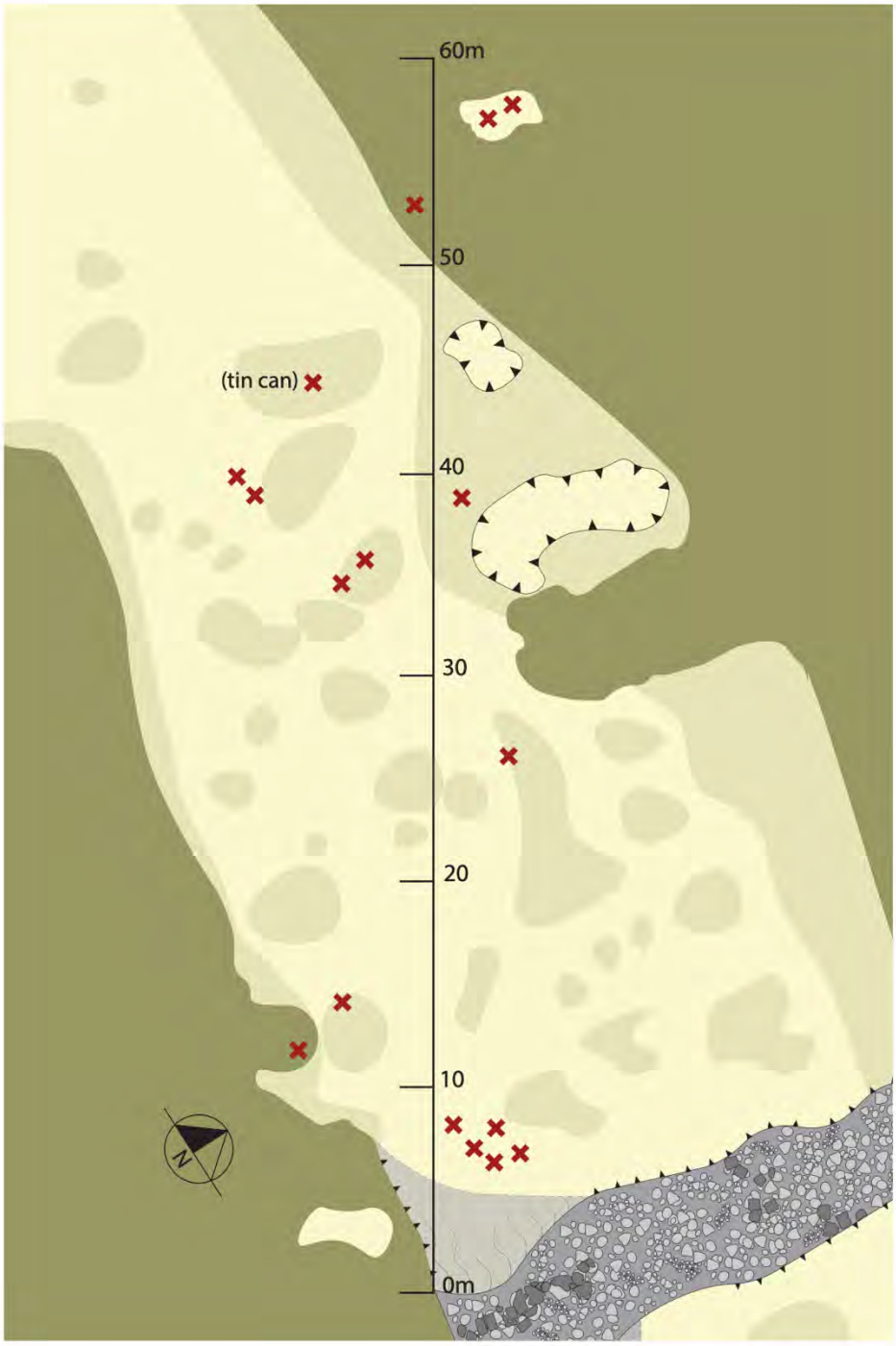

Figure 122: Digital representation of metal detector survey of Site 3.
Location of 'hits' is indicitive only.

5.3.3 Site 3a

The survey of Site 3a was completed on the 18th November 2020, beginning at approximately 17:00 pm, as the tide was turning. The metal detector was operated by Milly Bendell who counted the 'hits' in each zone. Jane Mitchell took observation notes of the time taken to record each zone.

The seabed consisted of rocky rubble with coral outcrops for the first 12 m. From that point the terrain was a flat sandy sea floor with some rocky outcrops and coral growth (Figure 123).

Table 10 outlines the results of the metal detector survey with a total time of 30 minutes for a total of 59 'hits'. However, there were no visible cultural artefacts apart from what appeared to be possible chain link (Figure 124).

Figure 123: Transect Area 3a, noting coral rocky rubble in foreground, leading to sandy patches. (Image taken 18th November 2020).

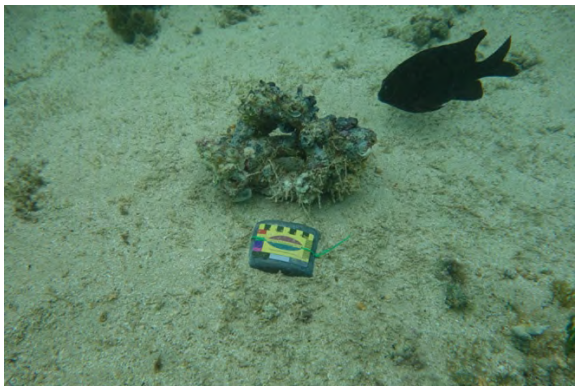

Figure 124: Potential ferrous piece of chain. (Image taken 18th November 2020).

Table 10: Results from Site 3a metal detector survey.

Baseline (m)	Start time	End time	Total time (min)	Total hits	Seabed description
0 – 60	1712	1729	17	29	Rocky rubble with coral 0 – 12 m then sand with rocky/coral outcrops
60 – 0	1730	1643	13	30	Sand with rocky/coral outcrops then rocky rubble for the final 12 m
		Total	30	59	

5.3.4 Site 4

The survey of Site 3a was completed on the 20th November 2020, beginning at approximately 6 am, as the tide was turning to high. The metal detector was operated by Malcolm Venturoni who counted the 'hits' in each zone. Jane Mitchell took observation notes of the time taken to record each zone.

The seabed in this area is a largely flat course sandy matrix with rocky outcrops varying in size from fist size to up to 1 m across and 0.5 m high (Figure 125 and Figure 126).

Table 11 outlines the result of the survey with 92 'hits' found over 48 minutes. In the first transect (running parallel with the shore west to east) there was a greater number of hits in the first 20 m with the amount reducing as the sand appeared to get shallower and the grey tuff was visible in places. No cultural material was noted, although one hit appeared to be unidentified concretion embedded in the sand (Figure 127). The second transect (running perpendicular to the shore south to north) had far less hits and cultural material finds included 2 ring pulls from cans, the top of a beer can and the bottom of another beer can.

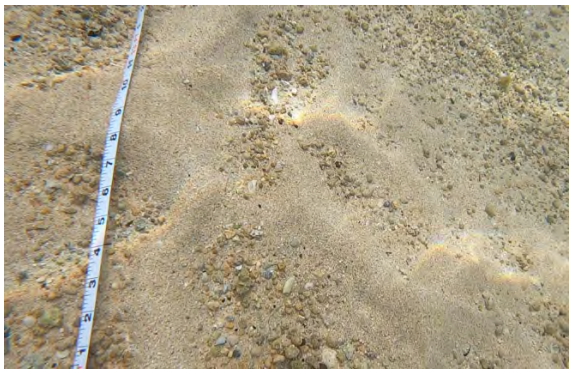

Figure 125: Example of seabed at eastern end of transect. (Image taken from Sirius20_201120_02_CM_Site 4 Centre transect seafloor west to east; 00:14).

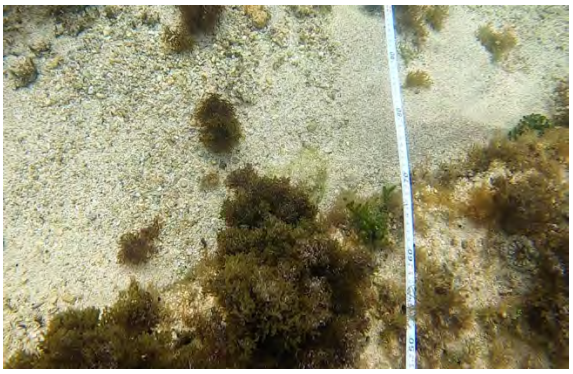

Figure 126: Example of rocky outcrop in area 4. (Image taken from Sirius20_201120_02_CM_Site 4 Centre transect seafloor west to east; 01:39).

Figure 127: Unidentified concretion in Area 4. (Image taken from Sirius20_201120_01_CM_Concretion site 4, 00:01).

Table 11: Results from Site 4 metal detector survey.

Transect	Baseline (m)	Start time	End time	Total time (min)	Total hits	Seabed description
1 (North)	0 – 60	0649	0705	16	36	Relatively flat sandy seabed with rocky outcrops.
1 (South)	60 – 0	0706	0725	19	36	Relatively flat sandy seabed with rocky outcrops.
2 (West)	0 – 20	0727	0733	6	9	Relatively flat sandy seabed with rocky outcrops.
2 (East)	20 - 0	0734	0741	7	11	Relatively flat sandy seabed with rocky outcrops.
			Total	48	92	

In the inshore area of Site 4, some cultural material was noted concreted into the cracks and gullies of the calcarenite rock (Figure 128, Table 12). This area would be underwater during high tides. There were two unidentified concretions, a small piece of copper alloy and some heavily worn glass (Figure 129 to Figure 131).

Figure 128: Location of cultural material noted in shallows of Site 4. It is likely there will be more cultural material in the calcarenite rock. (Base image Google Earth.)

Table 12: Coordinates of noted cultural material in shallows.

Site 4	Longitude	Latitude	Accuracy
Shallows	29° 3.531'S	167° 57.503'E	± 6 m

Figure 129: Concretion embedded into a gully in the shallows of area 4. (Image taken 20th November 2020).

Figure 130: Concretion embedded into a gully in the shallows of area 4. (Image taken 20th November 2020).

Figure 131: A small piece of copper alloy material. (Image taken 20th November 2020).

Over the four inshore sites approximately 3,300 m^2 was searched and a total of 277 'hits' were recorded using the metal detector. This equals approximately 31 ferrous artefacts likely per m^2 over the entire area (Table 13). However, it is impossible to estimate how many of these potential hits equal significant cultural material. It is likely some of the material will be from HMS *Sirius* but the extensive use of Slaughter Bay and the KAVHA since 1788 and the strong weather conditions means it is likely the cultural sensitivity of the material will be scrambled and mixed with modern discard.

Table 13: Approximation of potential ferrous artefacts located in four inshore search areas.

Site	Approx. search area (m^2)	Number of 'hits'	Artefacts per m^2
2	1350	105	7
3	600	21	3
3a	600	59	9
4	750	92	12
	3300	277	31

5.3.5 Site 6

Site 6 was recorded on the 20th November 2020 at the tide turning from low between 06:30 and 08:00 by Cosmos Coroneos. The causeway consists of rock rubble and roughly cut calcarenite pavers ,some up to 0.75 m across (Figure 132 to Figure 135). The causeway is 27 m in length running in a north south direction. The eastern and western edges have subsided, making the width variable along the length of the causeway but it appears that it was once wider at the southern end. The causeway meets natural calcarenite reef at both the southern and northern ends.

For a digital representation of the causeway see Figure 136.

Figure 132: Causeway running between shallow reef (Site 6) with Phillip Island in the background. Image courtesy of Betty Matthews September 2020.

Figure 133: Causeway detail looking south. (Image courtesy of Betty Matthews, September 2020).

Figure 134: The edges of the causeway visible before low tide with Phillip Island in the background. (Image taken from video Sirius20_201120_01_CC_Causeway underwater Phillip Island; 00:02)

Figure 135: Example of roughly cut pavers, looking west. Scale in 200 mm increments. (Image taken from video Sirius20_201120_05_CC_Site 6; 00:14).

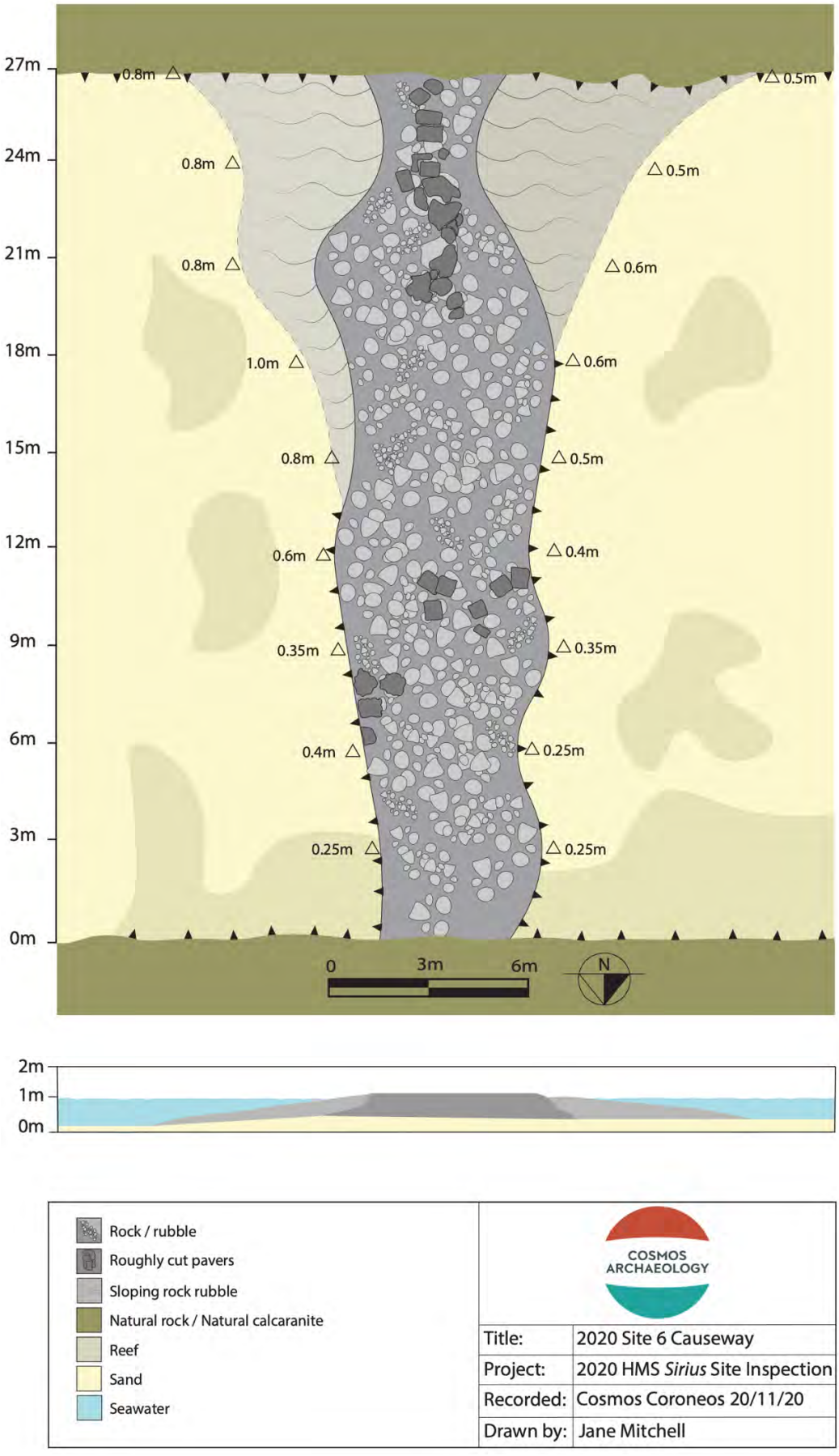

Figure 136: Digital representation of the Causeway (Site 6).

5.4 Photogrammetry

One of the objectives of the site inspection was to take images for the purposes of building a 3D model of the site. The images taken were processed through Agisoft Metashape Pro to ascertain the effectiveness of the images. The results are outlined in this section. While the models do not translate well in the 2D format, the resulting 3D models shows enough detail for use in comparison purposes over time. 3D PDF versions have been provided at Annex D. A full listing of the digital files can be found at Annex E and will be provided with the final report.

5.4.1 SI 624 Anchor

Anchor SI 624 is an old plan style anchor with a broken shank and two broken arms. It is resting on top of a flat section of calcarenite reef with a hole underneath its right arm and a smooth hollow to the left of the shank. Table 14 outlines the stages of the Agisoft Metashape Pro process for this model, while the model is displayed in Figure 137. This anchor works well as a 3D model as it lies flat on the reef and has contrasting gullies and a hole around it. A useful addition to the model would be the addition of a scale. One along the length of the anchor to measure changes in the length, and another scale near the hole at the anchor's crown, to measure changes in the sea urchin activity. However, bearing in mind that conditions on site are not always conducive to good diving conditions, being able to obtain a model using images taken in a 15 minute period is still useful for comparison of condition over time.

Table 14: Details of Agisoft Metashape Pro process for SI 624.

Agisoft Metashape Pro Process	Output
Starting images	121
Align Photos	120/121 aligned, medium quality.
Tie Points	77, 536 points, medium quality.
Depth Maps	119, medium quality, mild filtering.
Dense Cloud	8,98,534; medium quality.
3D Model	292,888 faces, medium quality.

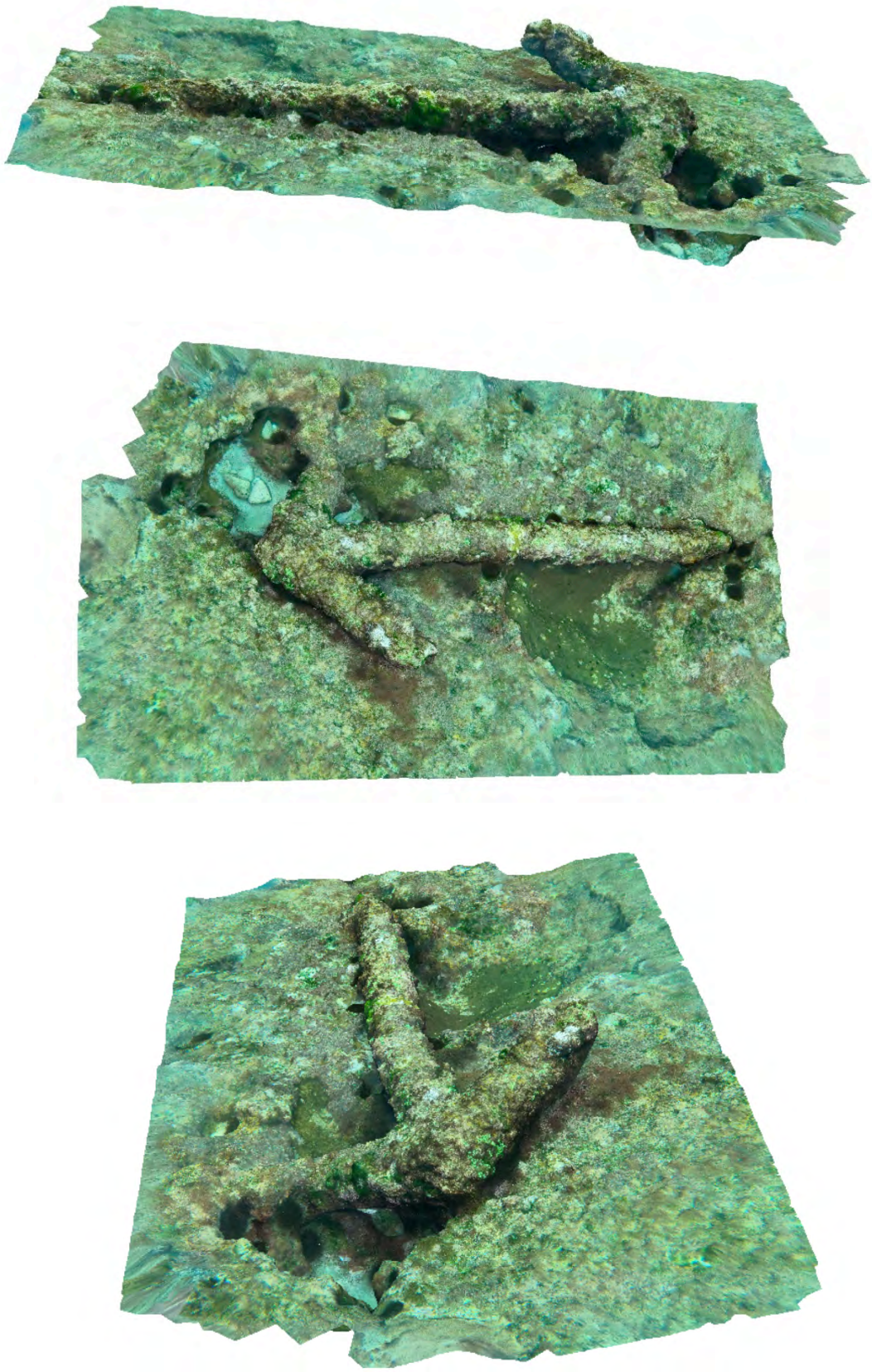

Figure 137: Three views of 3D model of Anchor SI 624. (Image processed in Agisoft Metshape Pro.)

5.4.2 SI 625 Anchor

Anchor SI 625 is an old plan anchor which is lying over a crack in the reef platform. It is smaller than SI 624 and rests in an area of higher and longer algae growth.

Table 15 outlines the stages of the Agisoft Metashape Pro process for this model, while the model is displayed in Figure 138. This was the least successful model of the five created as part of this project. It was also the model made from most images. Anchor SI 625 has more algae growth than SI 624, which makes obtaining clear overlapping images difficult as the swell moves the algae into a different position between shots. This accounts for the large amount of blur. This anchor is also shallower than SI 624 and closer to the breaking surf zone so images clear of bubbles can be difficult to take. The model does however, show the area of the shank that has been de-concreted which can be used for comparison purposes in the future. Further work selecting and manipulating the images may assist in improving the output levels.

Table 15: Details of Agisoft Metashape Pro process for SI 625.

Agisoft Metashape Pro Process	Output
Starting images	283
Align Photos	279/283, medium quality
Tie Points	228,901 points, medium quality
Depth Maps	279, medium quality, mild filtering
Dense Cloud	14, 327,865; medium quality
3D Model	414,727 faces, medium quality

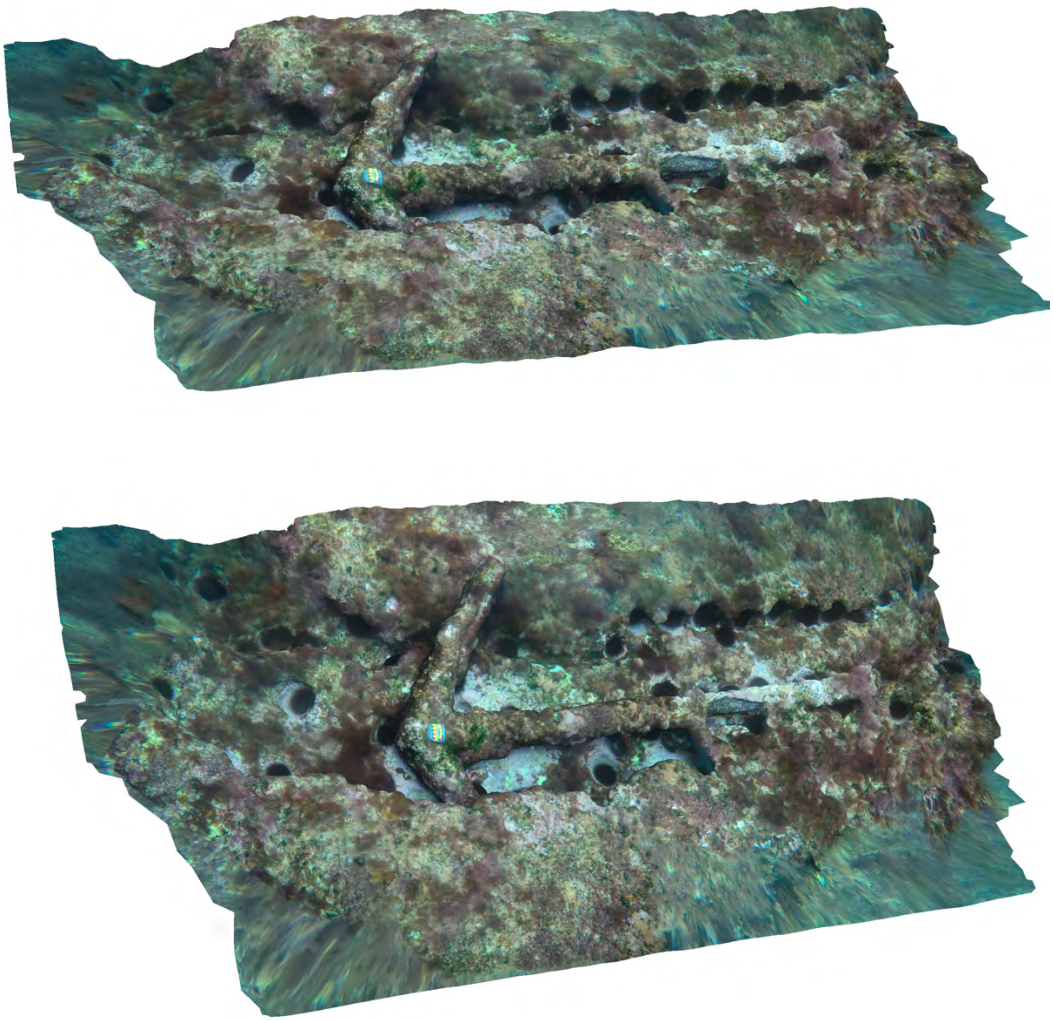

Figure 138: Three views of Anchor SI 625 3D model.

5.4.3 'Carronade hole' with anchor fluke

The anchor fluke located in the 'carronade hole' was an unexpected find. It is lying loose within the hole and has a minimum of algae growth as do the internal walls of the hole itself.

Table 16 outlines the stages of the Agisoft Metashape Pro process for this model, while the model is displayed in Figure 139. This 3D model worked well, showing the anchor fluke and the surrounding environment clearly. It could be used as a baseline for future site inspections. The holes created by the sea urchins can be monitored through the creation of future quick 3D models such as this one.

Table 16: Details of Agisoft Metashape Pro process for carronade hole.

Agisoft Metashape Pro Process	Output
Starting images	86
Align Photos	86/86 aligned, high quality
Tie Points	69,351 points, high quality
Depth Maps	86, high quality, mild filtering.
Dense Cloud	40,456,563; high quality.
3D Model	2,544,387 faces, high quality.

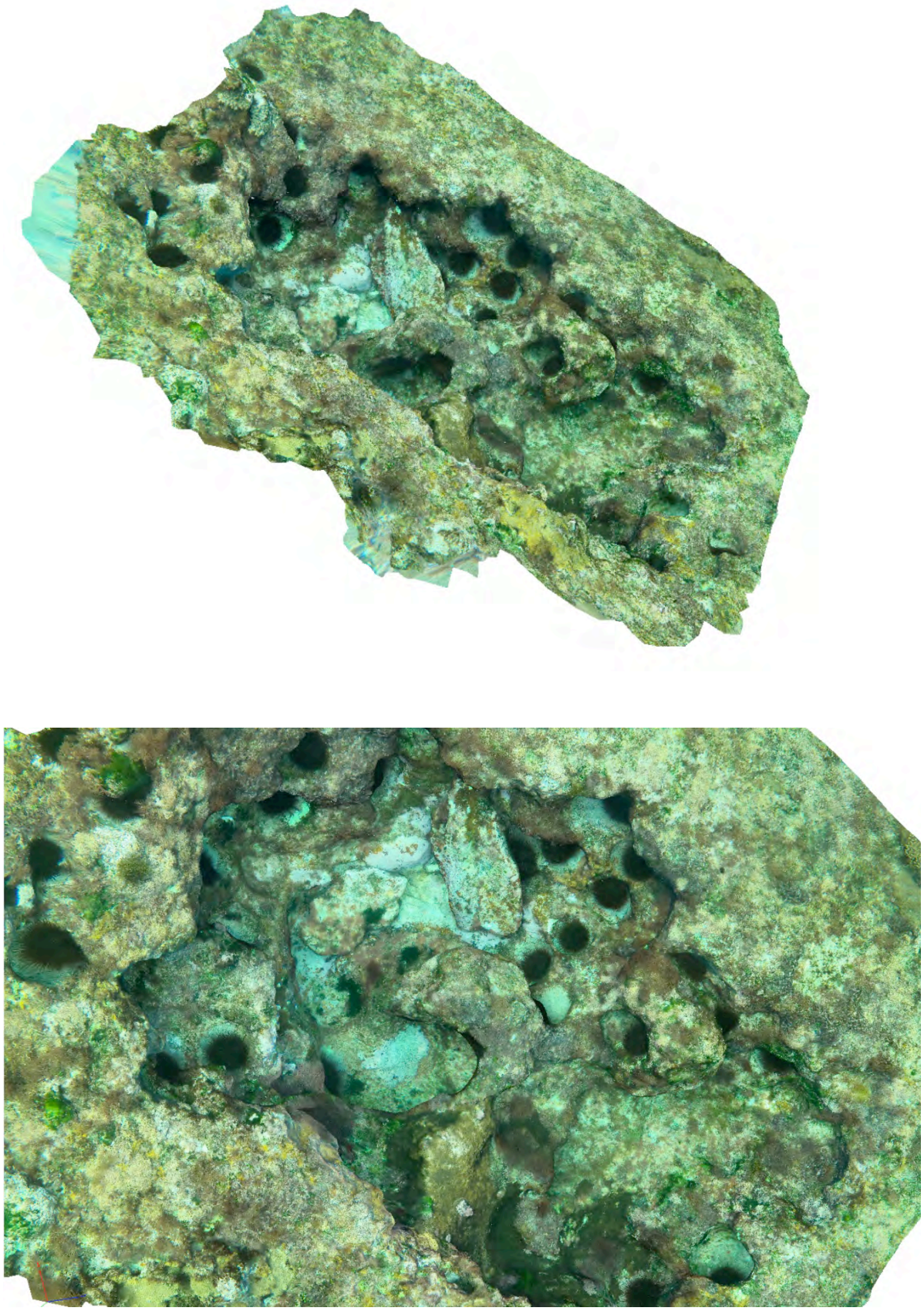

Figure 139: Two views of the 3D model of the loose anchor fluke in carronade hole. (Image processed using Agisoft Metashape Pro).

5.4.4 Small copper artefacts concreted in gully

The 2.2 m long section of artefacts concreted into the main gully lies in a fissure underneath the eastern wall. The wall itself is covered in algae growth, which prohibits photogrammetry images, however the artefacts are relatively clear of growth. Because the artefacts have been concreted in a fissure, shadows are an issue with taking images; as are the fish that tend to feed on the algae along the gully walls. Table 17 outlines the stages of the Agisoft Metashape Pro process for this model, while the model is displayed in Figure 140.

The model is not crisp and somewhat blurry but it does give an indication as to the types of artefacts concreted into the seam. Further manipulation of the images with the Agisoft program may produce better results.

Table 17: Details of Agisoft Metashape Pro process for artefact seam in gully.

Agisoft Metashape Pro Process	Output
Starting images	36
Align Photos	34/36 aligned, high quality.
Tie Points	28,639 points, high accuracy.
Depth Maps	33, high quality, mild filtering.
Dense Cloud	30,561,340 points; high quality.
3D Model	1,147,085 faces, high quality.

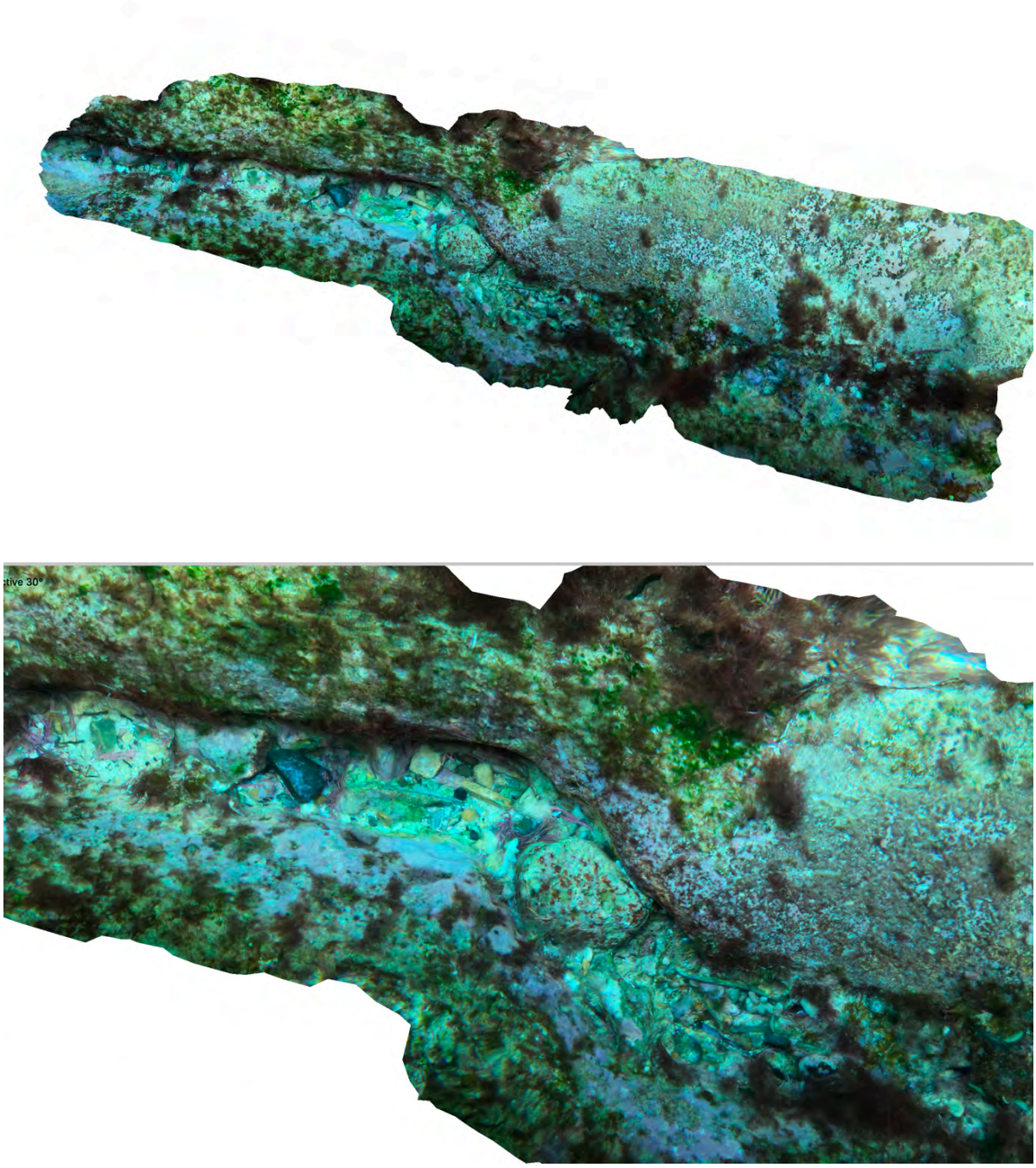

Figure 140: Small artefacts concreted into the main gully. Top image is a section of the seam and the bottom image highlights some detail. (Image process using Agisoft Metashape Pro).

5.4.5 Site 4

During the survey of Site 4, it was noted the calcarenite rock that stretched along the shallows was patterned with gullies and fissures that would be conducive to the making of a 3D model. There was also cultural material concreted into the gullies that could be captured. The images were taken with an iPhone 11 in JPEG format. Table 18 outlines the stages of the Agisoft Metashape Pro process for this model, while the model is displayed in Figure 141.

The images were processed on the medium setting throughout the process and the resulting model is clear with crisp edges. The model was taken in the early morning before the sun was high in the sky thereby reducing the influence of shadows and creating an even light. This model also serves to highlight the difficulties of shooting images through water as opposed to on land.

Table 18: Details of Agisoft Metashape Pro process for the shallows in Site 4.

Agisoft Metashape Pro Process	Output
Starting images	40 (iPhone JPEGS)
Align Photos	40/40 aligned, medium quality.
Tie Points	48,961 points, medium quality.
Depth Maps	40, medium quality, mild filtering.
Dense Cloud	8,019,437, medium quality.
3D Model	222,060 faces, medium quality.

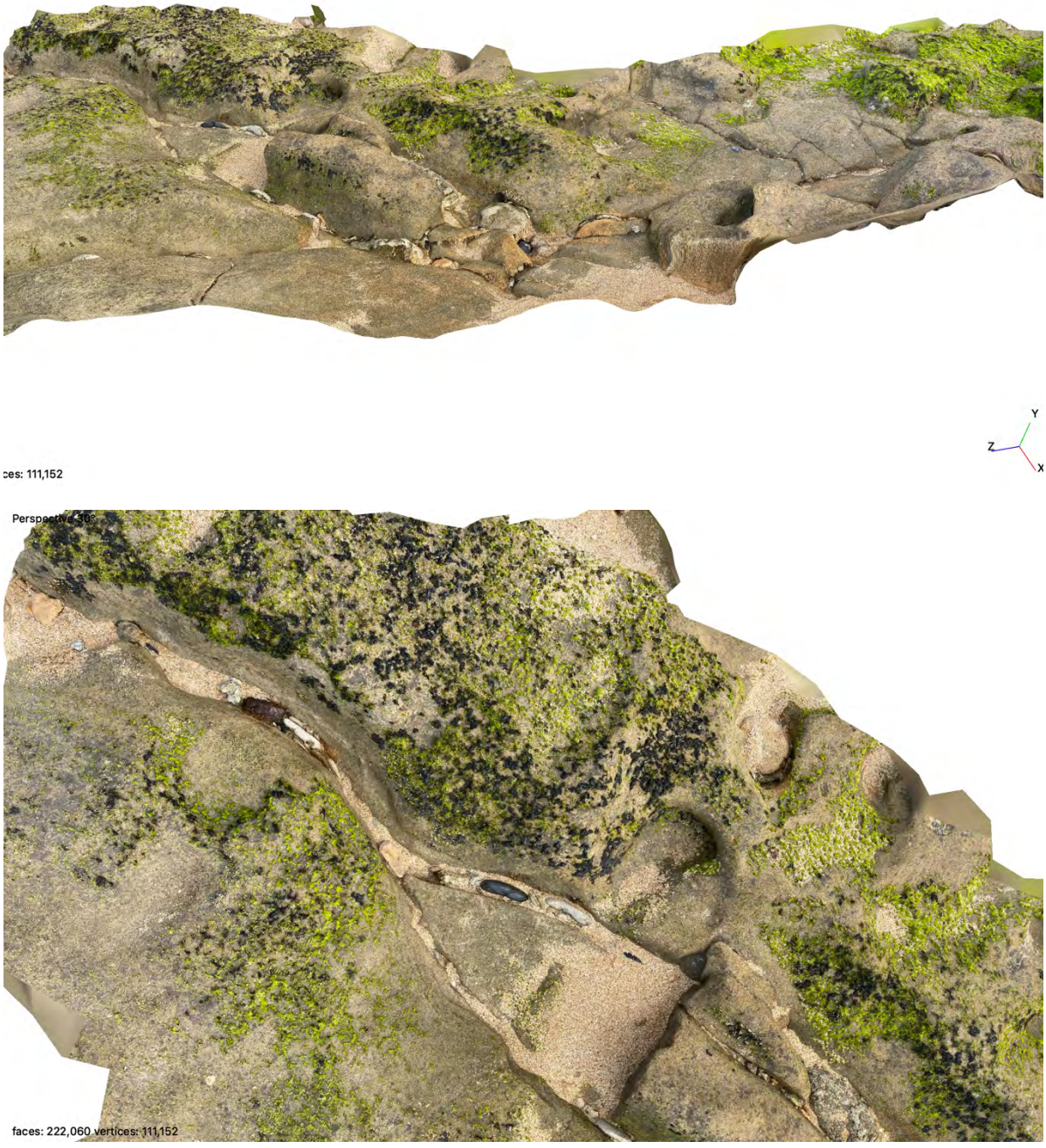

Figure 141: Two views of the 3D model of the shallows at Site 4. (Model created using Agisoft Metashape Pro).

Limitations

Further images were taken of the reef top between, and including, anchors SI 624 and SI 625. However, these images have not been able to be processed successfully. This maybe because the reef top is very similar across its surface and the program couldn't recognise enough points of difference (Figure 142 and Figure 143). This can be rectified using photogrammetry targets, however a method of securely attaching the targets to the seabed will need to be determined, taking into consideration the conditions and timely access to the site. There is also an issue with the sun dappling through the water column causing ripple shadows which distort the images.

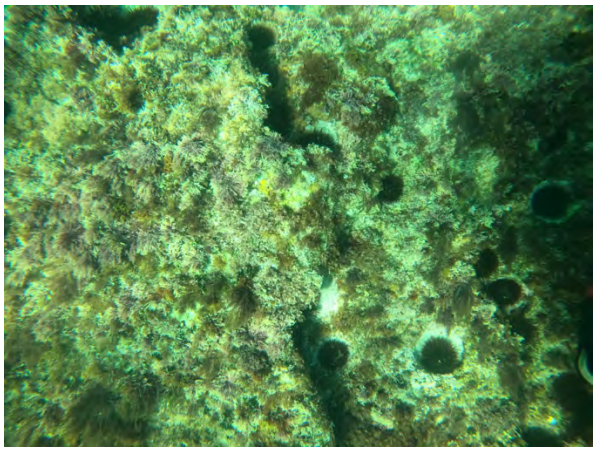

Figure 142: Example of reef top between Anchors SI 624 and SI 625. (Image taken 17th November 2020).

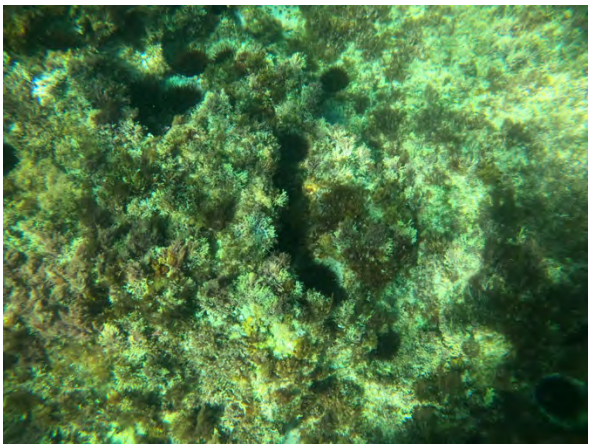

Figure 143: Example of reef top between Anchors SI 624 and SI 625. (Image taken 17th November 2020).

6 SITE 1 CHANGES OVER TIME

An important aspect to managing a site such as the HMS *Sirius* is to monitor changes to the wreck site over time. Understanding the rate of change (if any) and the causes will allow informed decisions for any remedial action to be taken to safeguard the cultural heritage values of the site.

This is done by detailed and repeated observations and measurements of key features and other established datums across the site. Measurements are obtained by means of scales and tapes as well as from comparing images taken from the same position and angles. Advances in photogrammetry technology allow for volumes to be measured, such as the expansion or contraction of a hole or the reduction in size of an object. Such observations and measurements can account for the effects of biological and mechanical (such as wave action and human interference) forces but not for chemical reactions (corrosion). The effects of the latter can not often be observed as the reactions are concealed by the corrosion products (concretions) covering an object. Corrosion potential measurements on the ferrous artefacts could not be organised in the time between project commission and the commencement of the field inspection.

The following sections display the known changes over time, however, at the time of writing this report, only some of the underwater images from the early expeditions was available. Comparisons have been done using a limited number of Patrick Baker's images obtained from the Norfolk Island Museum and the Western Australian Maritime Museum, Christian Patteson's images taken in 2017 and 2019 and images taken during the site inspection in November 2020.

6.1 Anchor SI 624

The position and alignment of SI 624 does not appear to have altered since 1985 when it was first photographed. It is difficult to ascertain exact changes when images have not been taken from the same angle and alignment but an approximate assessment can be made. Figure 144 to Figure 146 display the site of Anchor SI 624 from 1985 to 2020. The angle of the raised arm does not not appear to have altered significantly.

Figure 144: Anchor SI 624. (Image Pat Baker 1985).

Figure 145: Anchor SI 624 October 2019. Image courtesy Christian Patteson, 28th October 2019).

Figure 146: Anchor SI 624. (Image taken 15th November 2020).

However, the hole under the right arm of anchor SI 624 appears to have become become significantly deeper and wider in the three years since 2017 (Figure 147 to Figure 150). No images from the 1980s expeditions of this section of the anchor have been located at the time of writing this report, so it is unknown if these changes are occurring slowly over time or are accelerating over the past few years. Recurring photogrammetric modelling on subsequent inspections will provide some absolute measurements on the rate of expansion of the hole.

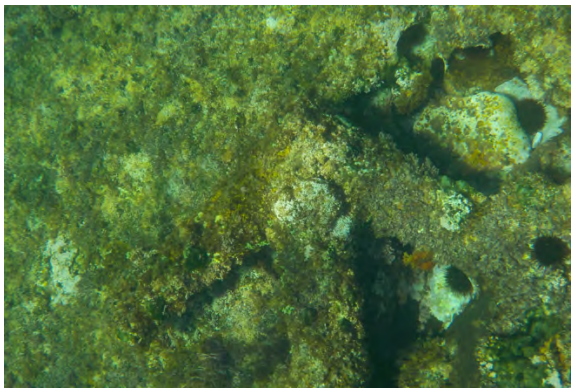

Figure 147: Anchor SI 624 hole under right fluke October 2017. (Image courtesy Christian Patteson, 27th October 2017).

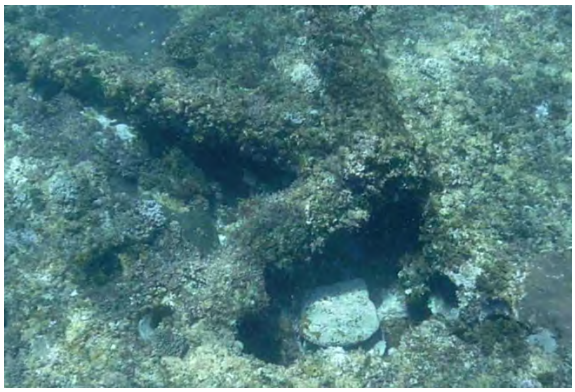

Figure 148: Anchor SI 624 hole under right fluke November 2019. (Image courtesy Christian Patteson, 5th November 2019).

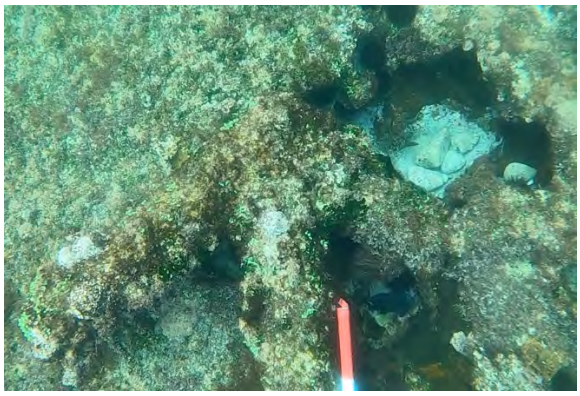

Figure 149: Anchor SI 624 hole under right fluke November 2020. (Image taken 14th November 2020).

Figure 150: Anchor SI 624 hole under right fluke November 2020. (Image taken 15th November 2020).

6.2 Anchor SI 625

A comparison has been made of SI 625 from its appearance in 1985 to November 2020. The anchor itself appears to have changed very little although perhaps has slightly less concretion as the shank appears thinner recently (Figure 151 to Figure 153). This could be measured during future site inspections to ascertain if this is a trend.

Figure 151: Anchor SI 625 in 1985. (Image taken by Pat Baker 1985).

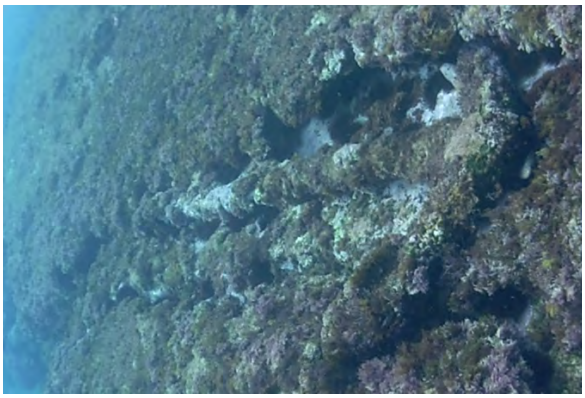

Figure 152: Anchor SI 625 October 2019. (Image courtesy of Christian Patteson 28th October 2019).

Figure 153: Anchor SI 625 in 2020. (Image taken from video Sirius20_201114_15_JM_Anchor 10 heading north to gully; 01:21).

The significant change is not to the anchor itself however, but rather the change in the reef platform underneath and around it. Figure 154 shows the anchor in 1985, where the broken arm rests on top of a ledge and the anchor angles down towards the fluke on the opposite arm. Sea urchin activity is quite prevalent along this ridge line. Figure 155 shows the same anchor, around which the reef platform has changed. The broken arm now rests underneath a much smaller ledge, and the angle of the anchor has changed to almost flat, if not slightly angled the opposite way. There is still sea urchin activity underneath the ledge, although it appears less than in 1985. It appears that sea urchin activity is causing the seabed to collapse underneath the anchor.

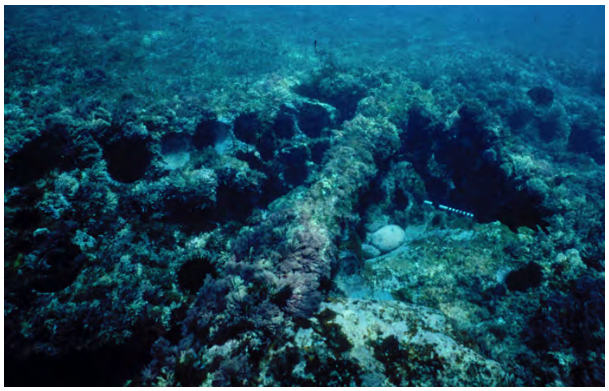

Figure 154: Anchor SI 625 in 1985. (Image taken by Pat Baker 1984).

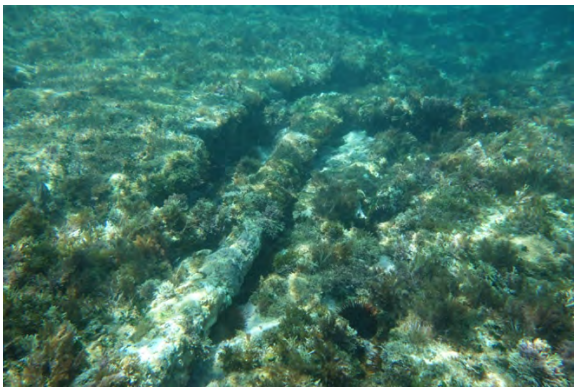

Figure 155: Anchor SI 625 in 2020. (Image taken 17th November 2020).

6.3 De-concreted ballast pig in gully

The earliest known images for the de-concreted ballast pig in the gully are from 2017. In 2017, there was still some concretion present over most of the surface, although the ballast iron is beginning to lose its rectangular shape (Figure 156). In 2019, the ballast iron has largely lost the entire protective concretion (Figure 157). In November 2020, there is no concretion left and both ends of the pig iron are obviously eroding away (Figure 158). The seafloor appears to be wearing away from the mechanical action of the ballast pig and forming a depression.

Figure 156: De-concreted pig in gully in October 2017. (Image courtesy of Christian Patteson 21st October 2017).

Figure 157: De-concreted pig in gully in November 2019. (Image courtesy of Christian Patteson 5th November 2019).

Figure 158: De-concreted pig in gully in November 2020. (Image taken 14th November 2020).

6.4 Anchor Ring

The anchor ring does not appear to have altered in appearance or placement since 2017 (Figure 159 and Figure 160). If anything, the ring appears to have become wedged underneath a shallow ledge in the calcarenite reef (Figure 161).

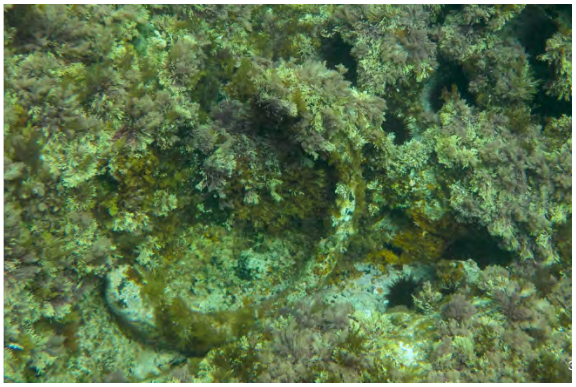

Figure 159: Anchor ring in October 2017. (Image courtesy of Christian Patteson 30th October 2017).

Figure 160: Anchor ring in November 2019. (Image courtesy of Christian Patteson 5th November 2019).

Figure 161: Anchor ring in November 2020. (Image taken 17th November 2020).

6.5 SI 830 Pump Chamber

The pump chamber, located in 2002, does not appear to have substantially changed in appearance. There was substantial loss of concretion on the exposed copper alloy section between 2002 and 2017 (Figure 162 and Figure 163). The biggest change between 2019 and 2020 was the loss of some seaweed growth on the eastern end of the pump chamber. This loss reveals a dent in the protective concretion at this end which may prove to be a vulnerable section of the chamber (Figure 164 and Figure 165).

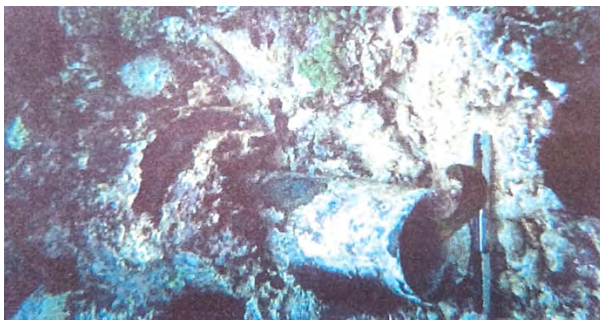

Figure 162: Pump Chamber in 2002.[29]

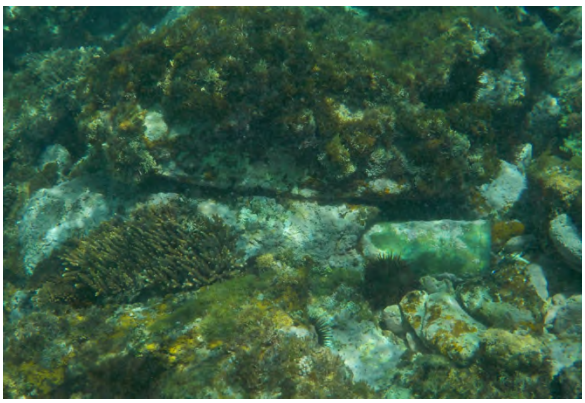

Figure 163: Pump chamber in October 2017. (Image courtesy of Christian Patteson 29th October 2017).

Figure 164: Pump chamber in November 2019. Red arrow indicates algae growth. (Image courtesy of Christian Patteson 5th November 2019).

Figure 165: Pump chamber in November 2020. Red arrow indicates where algae growth was in 2019. (Image taken 17th November 2020).

[29] Op. Cit., **Erskine 2002,** p.20.

7 DISCUSSION

7.1 Condition of HMS Sirius *Site 1*

Despite the site resting in a highly exposed position under the surf zone in an area prone to violent storms and weather, the surviving elements of the wreck are in remarkably good condition. The large number of loose artefacts in the shallow area of Site 1 include shingle ballast, at least one possible copper alloy wall fitting, ammunition, coaks, tacks, broken ceramic and glass. While two wreck features, anchor SI 625 and gully ballast pig, have experienced varying degrees of deconcretion, the majority of wreck features appear to have a layer of concretion over their entire surface. Corrosion potential measurements were not taken as part of this inspection, however through visual comparisons, objects do not appear to have reduced greatly in size. The majority of artefacts are still concreted into the seabed where they have been mapped over the past thirty years.

There were some artefacts not previously recorded such as the anchor amongst the eastern ballast pigs and two anchor flukes that are loose on the site. The location of the new anchor potentially indicates there may be other significant artefacts still to find on the site.

7.1.1 Threats

Chemical and mechanical attack processed through corrosion and wave action is an on-going threat to the site and conditions have not changed since the 1980s to suggest an acceleration of these identified processes.

The greatest observed threat to the site is the action of sea urchins. These animals are scraping away the reef platform and creating hollows in the ballast iron. Sea urchins can be long lived and their mouths have five large teeth, which they use to scrape algae and other food off rocks. These teeth are also used to excavate hiding places in rock or coral.[30] It also appears that these teeth are strong enough to scratch into ferrous material. This damage was previously noted in 1988.[31] Placing anodes on the ballast iron will not prevent the urchins from continuing to scrape at the ferrous metal or the surrounding reef platform.

A key feature of the wreck's National and Commonwealth Heritage values is its archaeological remains and these values are being impacted by mechanical, chemical and biological forces. Of these the biological influence of sea urchins, appear to present the greatest threat (see Section 8). The site appears to be reaching a state of near equilibrium with regards to mechanical and chemical attack. This statement is made with the qualification that no corrosion potential measurements were taken for this survey. While biological action is a relatively slow process, further work towards mitigating this threat is required for the long term survival of the remaining wreck features.

The site inspection also highlighted particular wreck features that require monitoring into the future as they are either loose or damaged. Loose items include the two anchor flukes, the anchor ring and the small artefacts in the shallow area (Figure 166).

[30] **Encyclopedia Britannica, 2021,** *Sea Urchins*, available at https://www.britannica.com/animal/sea-urchin
[31] Op. Cit., **Henderson, 1988**, Conservation and Management issues.

Figure 166: Areas of the site requiring particular monitoring. Red squares indicate areas of de-concretion, yellow circles indicate loose artefacts.

7.2 *HMS* Sirius *Anchors*

All six anchors from the wreck site of HMS *Sirius* are old plan long-shanked anchors. Three large anchors have previously been raised, two with their arms intact. One other, the anchor at Macquarie Place, did not have its flukes attached and the arms are likely to have broken where the palms would have been welded onto the arms. The shape of these anchors with their straight arms and large palms made them susceptible to breakage. These types of anchors were frequently raised and found to be missing one or both arms.[32]

The expeditions during the 1980s theorised that the two remaining anchors may have been carried as ballast and the finding of a third broken anchor along with the eastern ballast mound may give this theory further weight.[33] However, it could also equally be argued that a vessel travelling to a known difficult landing place would not just carry three bower anchors only while using broken anchors as extra ballast. These types of anchors where known to break easily and the violence of the vessel hitting the reef and being subject to violent sea action could prove quite destructive. The anchor measurements for all six anchors can be found in Table 19. It is possible this new anchor could be a small stream or kedge anchor that broke during or after the wrecking. However until new anchors, or anchor parts, are found the question of how many anchors HMS *Sirius* was carrying and for what purpose will remain unanswered.

Table 19: Table of HMS* Sirius *anchor measurements adapted from Stanbury 1994.[34]

Artefact ID	Description	Length of shank (m/ft)	Length of fluke (throat-bill)	Span of flukes	Thickness of palms	Weight
MPS	1905 - MP	4.60 / 15'1"		c. 1.5 / 5'		Est. 1.72 tonne / 34 cwt
NI 20	1973 - NIM	4.62 / 15'1"	1.75 / 5'		6.5 cm / 2 $^{9}/_{16}$"	Est. 1.72 tonne / 34 cwt
SI 57	1985 - ANNM	4.55 / 14'11"		2.62 / 8'11"		Est.1.4 ± 0.2 t / 28 cwt
Anchor SI 624	*In-situ*	3.35 / 10'11"				Est. 12-17 cwt
Anchor SI 625	*In-situ*	2.85 / 9'4"	c. 0.82 / 2'8"	c. 1.8 / 5'11"		Est. 10 ½ cwt
Anchor 2020	*In-situ*	0.75 / 2'5 $^{1}/_{2}$"*	c. 0.86 / 2'9"			

* Shank is broken

[32] Op. Cit., **Stanbury, M., 1994,** p. 72.
[33] Op. Cit., **Henderson and Stanbury, 1988**, p.133.
[34] Op. Cit., **Stanbury, M., 1994,** p. 71.

7.3 Inshore areas

Sites 2 – 4 have always been classified as associated with HMS *Sirius.* Certainly, the 2002 expedition uncovered over 200 artefacts from the wreck, the majority of them from Site 3a, although some were from Site 2 and a small number from the shallows of Site 1.[35]

While it is apparent that there has been, and in all likelihood will continue to be, artefacts from HMS *Sirius* in these sites, it is felt the requirement to regularly inspect them is not as important as it is for the main site (Site 1). Cultural processes have scrambled the artefacts remaining in these areas. Not just from shipwrecks but also the close proximity of the KAVHA and its use since 1788.

These inshore areas are useful from a search perspective but not so much from a management one. During the development of the HMP it is suggested that the areas within the curtilage be divided into 'zones' or 'sectors' based on environmental and topographic characteristics and incorporate public usage of the site.

7.3.1 Site 6

The causeway first appears on official maps in 1900 (Figure 167 and Figure 168). Survey maps are sometimes an uncertain source of information as the items that often appear on these charts will be specific to the needs of the survey, rather than representing everything in the area.

Figure 167: 1900 map of Norfolk Island showing causeway.[36]

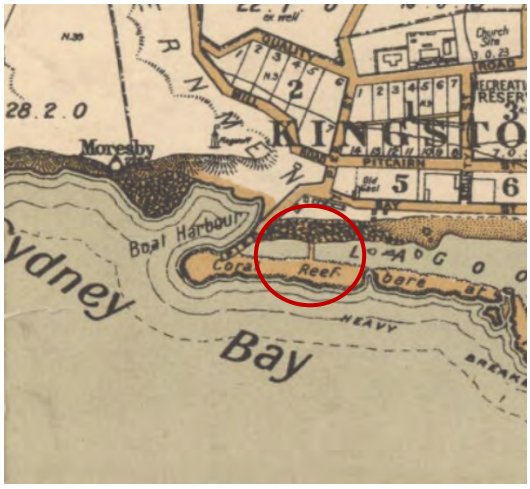

Figure 168: Detail from 1900 survey map highlighting causeway.

Several theories have been presented in the past as to the causeway's origin. It may have been built by convicts to help with the salvage attempts of the wreck although there is no mention of building a causeway in the accounts of the wreck and subsequent salvage attempts. In January 1791, John Hunter wrote in his journal:

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[35] Op. Cit., **Erskine, N., 2002,** pp.36-37.

[36] **Murphy, M. V & New South Wales. Department of Lands 1900**, *Map of Norfolk Island showing grants and subdivisions 1900* Lithographed and printed at the Department of Lands, Sydney, N.S.W viewed 9 March 2021 http://nla.gov.au/nla.obj-231835675

> *we began with the Guns, & in a few days got every Gun & Carriage on shore, by means of a traveler upon a Nine Inch Hawser, there were only of our Ordnance two Carronades lost, which were carried away by the fall of the Masts.*[37]

It could also have been built for quarrying stone for the buildings of the KAVHA, for salvaging the *Ronaki* wreck or for quarrying stone for Kingston Pier. Further research is required to answer if the causeway is contemporary with the wreck of *HMS* Sirius, as it may equally be significant as a part of the KAVHA.

[37] **Hunter, J, 1791** *Collection 5: John Hunter Journal kept on board the Sirius during a voyage to New South Wales May 1787 – March 1791,* available at http://digital.sl.nsw.gov.au/delivery/DeliveryManagerServlet?embedded=true&toolbar=false&dps_pid=IE1608703, p. 157.

8 HERITAGE VALUES OF HMS *SIRIUS*

In 1997, the Council of Australian Governments agreed that heritage listing and protection should be the responsibility of the level of government best placed to deliver agreed outcomes. It was agreed that the Commonwealth's involvement in environmental matters should focus on matters of National environmental significance, including World Heritage properties and places of National significance.

This led to the creation of two new heritage lists in 2003. Under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act), the National Heritage List (NHL) includes places of outstanding heritage value to the nation and the Commonwealth Heritage List (CHL) includes significant heritage places owned or controlled by the Commonwealth.

Under the heritage system, the Commonwealth Heritage List and the National Heritage List have similar criteria. The key difference is the level or 'threshold' of significance required to meet the criteria. To reach the threshold for the National Heritage List, a place must have 'outstanding' heritage value to the nation. To be entered in the Commonwealth Heritage List, a place must have 'significant' heritage value.

8.1 National Heritage List

The National Heritage List includes natural, historic and indigenous places that are of outstanding national heritage value to the Australian nation.

The National Heritage values are cited below:

(a) *the place has outstanding heritage value to the nation because of the place's importance in the course, or pattern, of Australia's natural or cultural history.*

(b) *the place has outstanding heritage value to the nation because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history.*

(c) *the place has outstanding heritage value to the nation because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history.*

(d) *the place has outstanding heritage value to the nation because of the place's importance in demonstrating the principal characteristics of:*

i) a class of Australia's natural or cultural places;

ii) a class of Australia's natural or cultural environments.

(e) *the place has outstanding heritage value to the nation because of the place's importance in exhibiting a particular aesthetic characteristics valued by a community or cultural group.*

(g) *the place has outstanding heritage value to the nation because of the place's strong or special association with a particular community or cultural group for social, cultural or spiritual reasons.*

(h) *the place has outstanding heritage value to the nation because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history.*

(i) *the place has outstanding heritage value to the nation because of the place's importance as part of Indigenous tradition.*

HMS *Sirius* was placed on the National Heritage List on 25 October 2011 (Place ID 106167). The national values of HMS *Sirius* site predominantly relate to its significance as a tangible link to the most significant vessel associated with early migration of Europeans to Australia. Other values are also recognised in the listing. HMS *Sirius* satisfies National Heritage Criteria (a), (b), (c), (g) and (h). The official National Heritage values of HMS *Sirius* are presented below:

Criterion (a) *the place has outstanding heritage value to the nation because of the place's importance in the course, or pattern, of Australia's natural or cultural history.*

The shipwreck site of HMS *Sirius* has outstanding heritage value to the nation because of its importance in defining events in Australia's cultural history and for its part in development of the processes of Australian migration and defence.

The archaeological remains of HMS *Sirius* represent a tangible link to one of the most significant vessels associated with early migration of European people to Australia. HMS *Sirius* was guardian of the first fleet during its epic voyage to Australia between 1787 and 1788, which brought the convicts, soldiers and sailors who became Australia's first permanent European settlers. HMS *Sirius* was also the mainstay of early colonial defence in New South Wales and the primary supply and communication link with Great Britain during the first two years of the settlement.

The loss of HMS *Sirius* at Norfolk Island on 19 March 1790 was a disaster to the fledgling colony during a period of crisis, when the settlement at Port Jackson was in danger of collapse and abandonment. It can be argued that the adaptability, ingenuity and grim determination to survive, demonstrated by the colonists at Port Jackson and Norfolk Island following this disaster, became an enduring trait of the Australian people.

Criterion (b) *the place has outstanding heritage value to the nation because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history.*

The shipwreck site of HMS *Sirius* has outstanding heritage value to the nation because it possesses rare and uncommon aspects of Australia's cultural history relating to early European settlement.

The archaeological remains of HMS *Sirius* are the only known remains of a vessel of the first fleet that sailed to Australia.

As the first fleet flagship, the story and in-situ remains of HMS *Sirius* are pivotal to the understanding of aspects of life during the early years of Britain's New South Wales colony. The artefacts already recovered during salvage and archaeological excavations of the site, represent the largest single assemblage of material culture from the first fleet voyage to Australia and the early European occupation of Port Jackson and Norfolk Island during the first two years of the settlement.

In an international context, HMS *Sirius* also represents one of the few located examples of an 18th century British warship that exhibits the use of experimental construction techniques in the period following the American revolutionary war and along with HMS *Pandora* is one of only two such naval shipwrecks from this period located in Australian waters.

Criterion (c) *the place has outstanding heritage value to the nation because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history.*

The shipwreck site of HMS *Sirius* has outstanding heritage value to the nation because of its potential to yield information that would contribute to a greater understanding of Australia's history of early European settlement.

The existing artefact collections and the remaining *in-situ* fabric of HMS *Sirius* contain important physical evidence of key historical events in Australia's history, including the voyage to Australia and the movement of colonists to Norfolk Island.

Contemporary historical documentation relating to HMS *Sirius* is limited and there remain many unanswered historical and technical questions surrounding the ship and its cargo, especially at the time of its loss on Norfolk Island. The archaeological investigations of the shipwreck site of HMS *Sirius* have demonstrated its significant archaeological potential for research into the cultural heritage of the early European settlement of Australia.

The remaining fabric of HMS *Sirius* and associated artefact assemblages represents a "time capsule" of cultural life from the period leading up to its shipwreck in 1790, which are relatively free from the effects of cultural disturbance after contemporary salvage ended in 1792.

Criterion (g) *the place has outstanding heritage value to the nation because of the place's strong or special association with a particular community or cultural group for social, cultural or spiritual reasons.*

The shipwreck site of HMS Sirius has outstanding heritage value to the nation because of its strong and special association with the Norfolk Island Community, the descendants of the first fleet settlers and the Australian community as a whole.

The arrival of HMS *Sirius* and the first fleet at Sydney Cove on 26 January 1788 is one of the most important moments in our country's history, which is celebrated each year as the "Australia Day" national public holiday. The importance of the role HMS *Sirius* played in the founding of Australia is often reiterated on Australia Day including the unveiling of the HMS *Sirius* memorial in Macquarie Place, Sydney, which contains an anchor and cannon from the ship, which was conducted with great fanfare on Australia day in 1907.

The important role played by HMS *Sirius* in the European phase of Australian settlement is widely recognised within the Australian community and is especially significant to the descendants of the first European settlers or "first fleeters" as they are often described. This importance was highlighted with the selection of HMS *Sirius* as a significant archaeological project to celebrate the Australian bicentennial in 1988.

HMS *Sirius* is also important to the people of Norfolk Island and is a celebrated part of their island's history, with the artefact collection from HMS *Sirius* housed in the Norfolk Island Museum. The history and archaeological remains of the HMS *Sirius* are highly valued by the people of Norfolk Island as the vessel represents a significant phase in the peopling of the Island and its development as a place of secondary punishment of convicts transported to Australia.

Criterion (h) *the place has outstanding heritage value to the nation because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history.*

The shipwreck site of HMS *Sirius* has outstanding heritage value because of its special association with the lives of prominent Australians who served as officers on HMS *Sirius*.

The careers of the first three governors' of the colony of New South Wales, Arthur Phillip (1788-1792), John Hunter (1795-1800) and Philip Gidley King (1800-1806) are closely associated with the history of HMS *Sirius*.

All three sailed as senior officers on board HMS *Sirius* during the voyage of the first fleet to New South Wales; Phillip as Fleet Captain, Hunter as his second in command and King as Second Lieutenant. Hunter was also Captain of HMS *Sirius* during its last ill-fated voyage in 1790, when it was wrecked at Norfolk Island.

8.2 Commonwealth Heritage List

The CHL is a list of Indigenous, historic and natural heritage places owned or controlled by the Australian Government. These include places connected to defence, maritime safety, communications, customs and other government activities that also reflect Australia's development as a nation. The Commonwealth Heritage values are cited below:

(a) *the place has significant heritage value to the nation because of the place's importance in the course, or pattern, of Australia's natural or cultural history.*

(b) *the place has significant heritage value to the nation because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history.*

(c) *the place has significant heritage value to the nation because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history.*

(d) *the place has significant heritage value to the nation because of the place's importance in demonstrating the principal characteristics of:*

i) a class of Australia's natural or cultural places;

ii) a class of Australia's natural or cultural environments.

(e) *the place has significant heritage value to the nation because of the place's importance in exhibiting a particular aesthetic characteristics valued by a community or cultural group.*

(g) *the place has significant heritage value to the nation because of the place's strong or special association with a particular community or cultural group for social, cultural or spiritual reasons.*

(h) *the place has significant heritage value to the nation because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history.*

(i) *the place has outstanding heritage value to the nation because of the place's importance as part of Indigenous tradition.*

HMS *Sirius* was placed on the CHL on 25 October 2011 (Place ID 105179).

8.2.1 Changes to the Heritage Values

The National Heritage values are still relevant, in the main, to the current condition of HMS *Sirius* and the collection. However, during the development of the Heritage Management Plan there is an opportunity to revisit these values. One case in point is the significant relationship between the KAVHA and HMS *Sirius* that should be included in the updated heritage values. The threat to the site of sea urchin activity also needs to be addressed before the National Heritage values are significantly eroded.

HMS *Sirius* was placed on the CHL using the same wording and heritage values as defined for the National Heritage List. However, this should be revisited during the development of the new HMP as the Commonwealth heritage thresholds are lower and therefore some or all of the heritage values may be different and increased.

Table 20 outlines the Heritage values, changes, risks and opportunities.

Table 20: Summary of HMS* Sirius *wreck site heritage values.

National Heritage values	Changes	Risks	Opportunities
Criterion (a) *the place has outstanding heritage value to the nation because of the place's importance in the course, or pattern, of Australia's natural or cultural history.*	No change	None	There is an opportunity to link HMS *Sirius* more closely with the World Heritage site of KAVHA.
Criterion (b) *the place has outstanding heritage value to the nation because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history.*	Negligable	The slow but cumulative impacts of sea urchin damage will eventually exceed the threshold for negligible changes to the criterion. This will also occur for mechanical damage and corrosion but likely at a lesser rate.	With new technologies, there is potential to showcase underwater remains to a non-diving public through websites, 3D models etc. increasing exposure to the significance of the wreck site.
Criterion (c) *the place has outstanding heritage value to the nation because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history.*	Negligable	The slow but cumulative impacts of sea urchin damage will eventually exceed the threshold for negligible changes to the criterion. This will also occur for mechanical damage and corrosion but likely at a lesser rate.	
Criterion (g) *the place has outstanding heritage value to the nation because of the place's strong or special association with a particular community or cultural group for social, cultural or spiritual reasons.*	No change	None	
Criterion (h) *the place has outstanding heritage value to the nation because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history.*	No change	None	
Commonwealth Heritage values	Changes	Risks	Opportunities
Criterion (a) *the place has significant heritage value to the nation because of the place's importance in the course, or pattern, of Australia's natural or cultural history.*	No change		There is an opportunity to assess the Commonwealth Heritage values for the site using the lower threshold of 'Significance'. This could

			enhance the commonwealth values and the heritage values overall of the site.
Criterion (b) *the place has significant heritage value to the nation because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history.*	Negligable	The slow but cumulative impacts of sea urchin damage will eventually exceed the threshold for negligible changes to the criterion. This will also occur for mechanical damage and corrosion but likely at a lesser rate.	
Criterion (c) *the place has signficant heritage value to the nation because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history.*	Negligable	The slow but cumulative impacts of sea urchin damage will eventually exceed the threshold for negligible changes to the criterion. This will also occur for mechanical damage and corrosion but likely at a lesser rate.	
Criterion (g) *the place has significant heritage value to the nation because of the place's strong or special association with a particular community or cultural group for social, cultural or spiritual reasons.*	No change		
Criterion (h) *the place has significant heritage value to the nation because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history.*	No change		

8.3 Management Plans

A management plan for both a National and Commonwealth Heritage place must meet the requirements of the EPBC Act. Management plans must adhere to the principles and requirements for World, National and Commonwealth Heritage levels as outlined at Schedule 5, 5A, 5B, 7A and 7B of the EPBC (Regulations) In particular:

- Regulation 10.01C states that a plan for a National Heritage place, made under section 324S of the EPBC Act, must address the matters set out in Schedule 5A of the EPBC Regulations
- Regulation 10.03B states that a plan for a Commonwealth Heritage place, made under section 341S of the EPBC Act must address the matters set out in Schedule 7A of the EPBC Regulations
- Regulation 10.01E states that for subsection 324Y(1) of the EBPC Act, the National Heritage management principles are set out in Schedule 5B of the EPBC Regulations
- Regulation 10.03D states that for subsection 341Y(1) of the EBPC Act, the Commonwealth Heritage management principles are set out in Schedule 7B of the EPBC Regulations

A management plan which was prepared prior to the introduction of the National or Commonwealth Heritage Lists (in 2004) is unlikely to provide adequate consideration of, or protection for, the official Commonwealth Heritage values, as it would pre-date the introduction of the Heritage Lists and not meet the statutory requirements.

It may, however, be possible to amend an existing plan to provide for the management of the Heritage values of the place. The existing plan will need to undergo a review process to assess whether the plan meets the *EPBC Act* requirements. Areas which will require updating will also need to be identified.

Should the review of the management plan conclude that the plan is sufficient to protect the Commonwealth Heritage values and meets the statutory requirements it can be retained. However, the plan will need to go through the requirements for the making of a new plan. If the existing plan is deemed insufficient to protect its heritage values it will be necessary for a new management plan to be developed or amendments made to the existing plan.[38]

The January 2019 Commonwealth report on the National Heritage and Commonwealth Heritage lists outlines the number of management plans and how effectively they are working. At the time of publication, there were 113 places on the National Heritage List. Of these, only 11 are placed entirely within a Commonwealth area, with HMS *Sirius* being one of those. Of these 11 National Heritage Places, only four have legislated Heritage Management Plans, while 6, including HMS *Sirius*, are in the process of preparing one.[39]

8.4 *HMS* Sirius *Plan of Management*

A draft Plan of Management was first outlined in the 1988 Expedition Report.[40]

This plan was adopted in 1990 by the Commonwealth and Norfolk Island Government as the 1990 Plan of Management. The scope of the 1990 Management Plan included the site, artefact collections and records collection. It provided a statement of significance, an outline

[38] **Commonwealth of Australia, 2019** Working together, managing Commonwealth Heritage Places. A guide for Commonwealth Agencies, p.21.
[39] **Department of the Environment and Energy, January 2019** *The National Heritage List and the Commonwealth Heritage List: 1 July 2013 – 30 June 2018.* Commonwealth of Australia, pp. 10-11.
[40] **Henderson, G., 1988** *The Norfolk Island Government Project on the 1988 Expedition Report on the wreck of H.M.S.* Sirius*(1790) at Norfolk Island.* Recommendations.

of conservation and management issues, a conservation-and-management policy and an implementation policy. With minor modification this became the 1993 Plan.

The site for the purposes of the first Plan of Management was predominantly Site 1, although it was acknowledged that artefacts had been found to the west and east of the Pier and in the lagoon. The artefact collection included all artefacts recovered between 1983 and 1990, all artefacts recovered prior to the project, the carronade recovered in 1993 and the material loaned to the Australian National Maritime Museum. The records collection included 2600 colour transparencies and 65 black and white films, mainly taken by Patrick Baker of the Western Australian Maritime Museum.

The 1993 Plan was agreed to by the Minister for the Arts and Administrative Services, representing the Commonwealth Government, and the Minister for Immigration and Lands, representing the Norfolk Island Government, on 8 September 1993. A 'Review of HMS *Sirius* Management Plan' was prepared by Myra Stanbury and Ian MacLeod of the Western Australiam Museum in 1996, but was not adopted by the Commonwealth. Further proposals for changes and updating of the 1993 Plan were made in 1997, 1999 and 2002, but were either not completed or not adopted by the Commonwealth.[41]

8.4.1 Review of the 1993 Plan of Management for the HMS *Sirius* Shipwreck

Section 324W of the EPBC Act requires that at least once in every 5 years the minister must ensure a review of Heritage Management Plans is carried out: assessing whether the current plan is consistent with National Heritage management principles; assessing whether the plan is effective; and making recommendations for the values of the place.

In 2018, Graeme Henderson undertook a review of the 1993 PoM. The review found that the majority of the measures outlined in the 1993 implementation plan had been put into effect by both the Commonwealth and Norfolk Island governments and that some of the heritage values had been considerably enhanced over the preceding 25 years. The review recommended that a maritime archaeologist and conservator visit the site for an assessment and anodes be attached to the main wreck features to reduce corrosion.

8.5 Norfolk Island Heritage Register

The *Heritage Act* 2002 (NI), in association with the *Planning Act* 2002, provides for the promotion of the conservation of the heritage of Norfolk Island. The Heritage Act 2002 (NI) establishes: the Norfolk Island Heritage Register; criteria for listing items in the Heritage Register; a panel of heritage advisers; procedures for a heritage conservation fund, and requirements for heritage impact statements and conservation management plans. For development applications that are in relation to, or likely to affect a heritage item, the Heritage Act requires the applicant to prepare a heritage impact statement, and requires that the responsible Minister has regard to the heritage impact statement. The responsible Minister (or his or her delegate) may also require an applicant to prepare a conservation management plan in relation to a heritage item. The Heritage Register identifies properties and sites on Norfolk Island that are considered, following an extensive consultation process, to be of heritage significance. HMS *Sirius* does not feature on the Register except for the vessel's association with the KAVHA.

[41] Op. Cit., **Henderson, 2018,** pp. 7-8.

8.6 HMS Sirius summary of significance

The summary statement of significance below is cited from the Australian Heritage Council's assessment of the place for inclusion onto the National Heritage List:[42]

The archaeological remains of HMS *Sirius* represent a tangible link to the most significant vessel associated with early migration of European people to Australia. HMS *Sirius* was guardian of the first fleet during its epic voyage to Australia between 1787 and 1788, which brought the convicts, soldiers and sailors who became Australia's first permanent European settlers. HMS *Sirius* was also the mainstay of early colonial defence in New South Wales and the primary supply and communication link with Great Britain during the first two years of the settlement.

The careers of the first three governors' of the colony of New South Wales, Arthur Phillip (1788-1792), John Hunter (1795-1800) and Philip Gidley King (1800-1806) are closely associated with the history of HMS *Sirius* as all three sailed as senior officers on board HMS Sirius during the voyage of the first fleet to New South Wales. Hunter was also Captain of HMS *Sirius* during its last ill-fated voyage in 1790, when it was totally wrecked at Norfolk Island.

The loss of HMS *Sirius* at Norfolk Island on 19 March 1790 was a disaster to the fledgling colony during a period of crisis, when the settlement at Port Jackson was in danger of collapse and abandonment. It can be argued that the adaptability, ingenuity and grim determination to survive, demonstrated by the colonists at Port Jackson and Norfolk Island following this disaster, became an enduring trait of the Australian people.

The archaeological investigations of the shipwreck site of HMS *Sirius* have demonstrated its significant archaeological potential for research into the cultural heritage of the early European settlement of Australia. The remaining fabric of HMS *Sirius* and associated artefact assemblages represents a "time capsule" of cultural life from the period leading up to its shipwreck in 1790.

The important role played by HMS *Sirius* in the European phase of Australian settlement is widely recognised within the Australian community and is especially significant to the descendants of the first European settlers or "first fleeters" as they are often described. This importance was highlighted with the selection of HMS *Sirius* as a significant archaeological project to celebrate the Australian bicentennial in 1988.

The history and archaeological remains of the HMS *Sirius* are also highly valued by the people of Norfolk Island as the vessel represents a significant phase in the peopling of the Island and its development as a place of secondary punishment of convicts transported to Australia.

[42] **Department of Sustainability, Environment, Water, Population and Communities, 2010,** *Australian Heritage Database, Places for Decision, Class: Historic.* Australian Heritage Council, pp.2-3.

9 CONCLUSION AND RECOMMENDATIONS

The wreck of HMS *Sirius* is over 230 years old and the wreck features remain largely in good condition compared to when they were first investigated in the 1980s. Despite the site resting in a highly exposed position under the surf zone in an area prone to violent storms and weather, the surviving elements of the wreck are in relatively good condition. There is one de-concreted ballast pig in the gully and a section of concretion on the shank of anchor SI 625 has been knocked out, likely from mechanical (wave) damage.

A large number of loose artefacts still rest in the shallow area of Site 1 including shingle ballast, at least one possible copper alloy wall fitting, ammunition, coaks, tacks, broken ceramic and glass. A previously unrecorded anchor was located on the site near the eastern ballast pigs and two loose anchor flukes were recorded.

The 1989 site plan has been updated to incorporate these changes. As part of the inspection, the 1989 site plan was digitised and made into a layer within the new site plan, thus keeping the history of the site plan in one location.

3D Photogrammetry models were built of the two larger anchors (SI 624 and SI 625), the carronade hole, a copper alloy seam in the gully and section of shoreline in Site 4. These models were created using a minimum of images and provide enough detail to be used for comparison purposes over time. The digital files will be provided with the final report.

9.1 Future Work

9.1.1 Completing the site plan

- Ascertain if the 1905 anchor fluke is still in the position of the 1989 site plan, if so add this to the updated plan.
- Measure and draw the large loose western anchor fluke onsite in more detail.
- Ascertain if the 1973 anchor ring is still in position (not drawn on 1989 site plan). and make a note of location on the updated site plan.
- Redraw the shape and position of the gully ballast pigs.
- Search for and identify the 2002 anomaly.

9.1.2 Protecting the site

For the past 30 years, the management plan for the wreck has pressed for the requirement to place anodes on the ferrous wreck features to reduce corrosion. However, the activity of the sea urchins observed during this inspection indicate that these animals are posing a great threat to the site, albeit a slow one. Craters up to 40 mm deep and 150 mm wide were observed in some of the ballast iron and the reef platform is being scraped away and changing the topography of the site. While anodes will reduce corrosion, they are no protection for the hard teeth of the sea urchins. A plan to manage the damage the sea urchins are inflicting needs to become a high priority.

9.2 Recommendations

9.2.1 Assessing the sea-urchin risk

A follow-up study by a marine biologist to specifically assess the sea urchin activity and subsequent risk to the wreck site should be considered.

9.2.2 Heritage Management Plan

During the development of the new HMP, the heritage values should be revisited. While the National Heritage values are still appropriate, there is an opportunity to examine the relationship between the KAVHA and HMS *Sirius* as they may each enhance the National Heritage values of the other. In addition, the Commonwealth Heritage values have never been assessed against the lower threshold of 'significant' rather than 'outstanding'.

The HMP should include a section on managing the inshore areas associated with HMS *Sirius*. Bundling these areas in with the main wreck site is useful for search purposes but not for management of the site.

The updated HMP should include a 'Site Inspection Manual', that outlines the method of inspecting the site and provide guidance for the images that are required for comparison purposes. This will allow for objective assessments to be made about such things as changes in concretion cover, changes to artefact condition or damage to the reef platform or site features from heavy weather or sea urchin activities.

9.2.3 Collating past, present and future work

One of the problems encountered in attempting to compare the site over time, was the difficulty in accessing previous data. A repository of information should be established and should include (but not be limited to) items such as:

- The 1965 ABC film of the site (the first footage of the site since it was wrecked).
- The film made by Ian Kenny raising the 1973 anchor.
- The film made during the 1980s as part of the Australian Bicentennial Authority project.
- All documentation from the previous works including reports, artefact drawings/images and conservation reports.

A method of contributing to this repository should be established so that other contributors can also add information. A case in point is Christian Patterson who has been visiting the site over the past few years and has taken images of the site that have proven useful in the compilation of this report.

REFERENCES

Commonwealth of Australia, 2019 *Working together, managing Commonwealth Heritage Places. A guide for Commonwealth Agencies.*

Department of the Environment and Energy, January 2019 *The National Heritage List and the Commonwealth Heritage List: 1 July 2013 – 30 June 2018.* Commonwealth of Australia.

Erskine, N., 2002, *2002 H.M.S.* Sirius *Expedition Report*, Report prepared for Environment Australia and the Norfolk Island Government.

Great Britain. Hydrographic Department & Denham, Henry Mangles & Wilson, James Glen & Potter, J. D & J. & C. Walker, 1856, *Pacific Ocean* Published by the Hydrographic Office at the Admiralty ; Sold by J.D. Potter agent for the Admiralty charts 31 Poultry and 11 King Street, Tower Hill, [London] viewed 17 January 2021 available at http://nla.gov.au/nla.obj-231292577

Henderson, G., 1984 *Report to the Australian Bicentennial Authority on the December 1983 preliminary expedition to the wreck of H.M.S.* Sirius *(1790) at Norfolk Island.* Report prepared for the Australian Bicentennial Authority.

Henderson, G., 1988 *The Norfolk Island Government Project on the 1988 Expedition Report on the wreck of H.M.S.* Sirius*(1790) at Norfolk Island.* Report prepared for the Norfolk Island Government.

Henderson, G., 2018, *Draft Review of 1993 Plan of Management for the HMS* Sirius *wreck site.* Report prepared for the Department of the Environment and Energy and the Norfolk Island Regional Council.

Henderson, G. and M. Stanbury, 1985 *Report to the Australian Bicentennial Authority on the February-March 1985 Bienentennial Project Expedition to the wreck of H.M.S.* Sirius*(1790) at Norfolk Island.* Report prepared for the Australian Bicentennial Authority.

Henderson, G. and M. Stanbury, 1987 *The Australian Bicentennial Authority Project on the 1987 Expedition Report on the wreck of H.M.S.* Sirius*(1790) at Norfolk Island.* Report prepared for the Australian Bicentennial Authority.

Henderson, G and M. Stanbury, 1988, *The Sirius; Past and Present*, Collins Publishers Australia.

Hunter, J, 1791 *Collection 5: John Hunter Journal kept on board the Sirius during a voyage to New South Wales May 1787 – March 1791,* available at http://digital.sl.nsw.gov.au/delivery/DeliveryManagerServlet?embedded=true&toolbar=false&dps_pid=IE1608703.

Murphy, M.V. and Gullick, W. A., 1904, *Map of Norfolk Island* [Cartographic material] *shewing grants and subdivisinos 1904*, Government Surveyor, available at https://nla.gov.au/nla.obj-232787421/view

Stanbury, M., 1990, *H.M.S.* Sirius *Report on the Artefact Collection at Norfolk Island, 13-26 March 1990.* Report 039 prepared for the Department of Maritime Archaeology, Western Australian Maritime Museum.

Stanbury, M., 1994, *HMS Sirius 1790 : an illustrated catalogue of artefacts recovered from the wreck site at Norfolk Island*. Special Publication for the Australasian Institute for Maritime Archaeology Adelaide, South. Australia.

Stanbury, M., 2002, *H.M.S.* Sirius *2002 Expedition Report*, Report preparted for the Norfolk Island Government and Environment Australia.

Stanbury, M. and A. Evans, 2002, *H.M.S.* Sirius *2002 Expedition Report – Audit Supplement*, Report preparted for the Norfolk Island Government and Environment Australia.