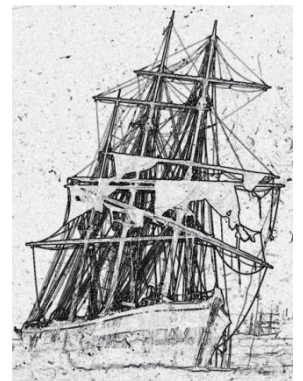


UNDERWATER ARCHAEOLOGICAL IMPACT ASSESSMENT FOR THE
PROPOSED GAS TO POWER POWERSHIP PROJECT AT THE PORT OF
SALDANHA
Western Cape
South Africa



UNDERWATER ARCHAEOLOGICAL IMPACT ASSESSMENT FOR THE PROPOSED GAS TO POWER POWERSHIP PROJECT AT THE PORT OF SALDANHA, WESTERN CAPE**Report #:** 2021/SALD/001**Status:** Draft**Revision #:** 0**Date:** 31 March 2021**Prepared for:** Triplo4 Sustainable Solutions (Pty) Ltd**Representative:** Shanice Singh**Tel:** +27 (32) 946 3213**Address:** Suite 5, The Circle Business Centre, Douglas Crowe Drive, Ballito 4420**E-mail:** shanice@triplo4.com**Prepared by:** Vanessa Maitland**ASAPA Registration #:** 326**Field:** Maritime Archaeology**Address:** 203/71 Elandskraal, Sedgefield Rural, 6573**Tel:** 082 490 4066**E-Mail:** vanessa@cocojams.co.za**Declaration:**

I, Vanessa Maitland, declare that I have no financial or personal interest in the proposed development, nor its developers or any of their subsidiaries, apart from the provision of heritage assessment and management services.



Vanessa Maitland
Maritime Archaeologist
31-03-2021

EXECUTIVE SUMMARY

The project entails the generation of electricity from a floating mobile Powership moored in the Port of Saldanha Bay. It proposes two ships berthing during the project lifespan, a Floating Storage Regasification Unit (FSRU) and one Powership. A Liquefied Natural Gas Carrier (LNGC) carrier is to supply LNG to the FSRU on a short-term basis in a 20-day cycle. The natural gas is pumped from the FSRU to the Powership via the development and operation of a gas pipeline.

This report is an addendum to the Heritage Impact Assessment (HIA) completed by ACRM in October 2020 and was undertaken to address shortfalls noted by the Maritime and Underwater Cultural Heritage (MUCH) Unit of the South African Heritage Resources Agency (SAHRA) (Interim Comment: Case ID 15687 12-03-2021)

As part of the Environmental Impact Assessment (EIA) and HIA, an Underwater Archaeological Impact Assessment (UAIA) needed to be undertaken to identify sensitive cultural heritage sites in the affected environment. The aim of the survey was to attempt to locate, identify, evaluate and document potential underwater and cultural heritage sites within the designated area.

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GLOSSARY OF TERMS AND ACRONYMS

TERMS

Anomaly	A magnetic change within the earth's natural magnetic field
Impact Zone	Area that may be impacted by the pipeline development footprint
nT	Nanotesla – a unit of measure of the strength of the magnetic field

ACRONYMS

ASAPA	Association of Southern African Professional Archaeologists
EIA	Environmental Impact Assessment
HIA	Heritage Impact Assessment
MUCH	Maritime and Underwater Cultural Heritage
NHRA	National Heritage Resources Act (No. 25 of 1999)
RIB	Rigid Inflatable Boat
SAHRA	South African Heritage Resources Agency
UAIA	Underwater Archaeological Impact Assessment

1. INTRODUCTION

The project entails the generation of electricity from a floating mobile Powership moored in the Port of Saldanha Bay. It proposes two ships berthing during the project lifespan, a Floating Storage Regasification Unit (FSRU) and one Powership. A Liquefied Natural Gas Carrier (LNGC) carrier is to supply LNG to the FSRU on a short-term basis in a 20-day cycle. The natural gas is pumped from the FSRU to the Powership via the development and operation of a gas pipeline.

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As part of the Environmental Impact Assessment (EIA) and HIA, an Underwater Archaeological Impact Assessment (UAIA) needed to be undertaken to identify sensitive cultural heritage sites in the affected environment. The aim of the survey was to attempt to locate, identify, evaluate and document potential underwater and cultural heritage sites within the designated area.

This UAIA covers the underwater cultural heritage. The aim of the survey was to attempt to locate, identify, evaluate and document potential underwater cultural heritage sites within the designated area.

This report consists of 4 sections

1. Desktop study, consisting of a database of known and/or suspected wrecks in the area through study of available written and oral resources
2. A magnetometer survey of the designated area to identify magnetic anomalies that may be underwater cultural heritage sites
3. Diver searches on identified magnetic anomalies
4. Conclusions

South Africa's heritage resources comprise a wide range of sites, features, objects and beliefs. According to Section 27(18) of the National Heritage Resources Act (No. 25 of 1999) (NHRA), no person may destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of any heritage or archaeological site without a permit issued by the heritage resources authority responsible for the protection of such site.

Therefore, in accordance with the NHRA, an independent maritime archaeologist was appointed to conduct an UAIA to determine the potential sites, to assess their significance and to mitigate negative impacts.

This report is one section of the Environmental Impact Assessment (EIA) as required by the EIA Regulations in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) and is intended for submission to SAHRA.

2. TERMS OF REFERENCE

The aim of the UAIA is to determine if any sites, features or objects of cultural heritage significance exist within the defined areas.

The scope of work consisted of the following:

- Desktop study, consisting of a database of known and suspected wrecks in the area ascertained through study of available written and oral resources
- Magnetometer (mag) survey of the impact zone
- Diver searches on identified magnetic anomalies

The objectives were to:

- Identify potential Maritime and Underwater Cultural Heritage (MUCH) sites within the impact zone
- Evaluate the potential impact of development in the impact zone
- Recommend measures to mitigate any negative impacts on MUCH sites in the designated area

3. HERITAGE RESOURCES

3.1. THE LEGISLATION

According to Section 32 (1) of the NHRA (No. 25 of 1999), heritage objects consist of:

“An object or collection of objects, or a type of object or list of objects, whether specific or generic, that is part of the national estate and the export of which SAHRA deems it necessary to control, may be declared a heritage object, including— (a) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects, meteorites and rare geological specimens.”

The Act further stipulates that the term “archaeological” includes:

“wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation.”

Section 35 of the Act states:

“(1) Subject to the provisions of section 8, the protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority: Provided that the protection of any wreck in the territorial waters and the maritime cultural zone shall be the responsibility of SAHRA.

(2) Subject to the provisions of subsection (8)(a), all archaeological objects, palaeontological material and meteorites are the property of the State. The responsible heritage authority must, on behalf of the State, at its discretion ensure that such objects are lodged with a museum or other public institution that has a collection policy acceptable to the heritage resources authority and may in so doing establish such terms and conditions as it sees fit for the conservation of such objects.

(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.

(4) No person may, without a permit issued by the responsible heritage resources authority—

- (a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
- (b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;”
- (c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or
- (d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.”

Furthermore Section 38 of the Act states:

“(1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as—

- (a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
- (b) the construction of a bridge or similar structure exceeding 50 m in length;
- (c) any development or other activity which will change the character of a site—

- (i) exceeding 5 000 m² in extent; or
 - (ii) involving three or more existing erven or subdivisions thereof; or
 - (iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or
 - (iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
- (d) the re-zoning of a site exceeding 10 000 m² in extent; or
- (e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.
- (2) The responsible heritage resources authority must, within 14 days of receipt of a notification in terms of subsection (1)—
- (a) if there is reason to believe that heritage resources will be affected by such development, notify the person who intends to undertake the development to submit an impact assessment report. Such report must be compiled at the cost of the person proposing the development, by a person or persons approved by the responsible heritage resources authority with relevant qualifications and experience and professional standing in heritage resources management; or
 - (b) notify the person concerned that this section does not apply.
- (3) The responsible heritage resources authority must specify the information to be provided in a report required in terms of subsection (2)(a): provided that the following must be included:
- (a) The identification and mapping of all heritage resources in the area affected;
 - (b) an assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7;
 - (c) an assessment of the impact of the development on such heritage resources;
 - (d) an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;
 - (e) the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;
 - (f) if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and
 - (g) plans for mitigation of any adverse effects during and after the completion of the proposed development.
- (4) The report must be considered timeously by the responsible heritage resources authority which must, after consultation with the person proposing the development, decide—
- (a) whether or not the development may proceed;
 - (b) any limitations or conditions to be applied to the development;
 - (c) what general protections in terms of this Act apply, and what formal protections may be applied, to such heritage resources;
 - (d) whether compensatory action is required in respect of any heritage resources damaged or destroyed as a result of the development; and
 - (e) whether the appointment of specialists is required as a condition of approval of the proposal.
- (5) A provincial heritage resources authority shall not make any decision under subsection (4) with respect to any development which impacts on a heritage resource protected at national level unless it has consulted SAHRA.
- (6) The applicant may appeal against the decision of the provincial heritage resources authority to the MEC, who—
- (a) must consider the views of both parties; and
 - (b) may at his or her discretion—
 - (i) appoint a committee to undertake an independent review of the impact assessment report and the decision of the responsible heritage authority; and
 - (ii) consult SAHRA; and
 - (c) must uphold, amend or overturn such decision.

(7) The provisions of this section do not apply to a development described in subsection (1) affecting any heritage resource formally protected by SAHRA unless the authority concerned decides otherwise.

(8) The provisions of this section do not apply to a development as described in subsection (1) if an evaluation of the impact of such development on heritage resources is required in terms of the Environment Conservation Act, 1989 (Act No. 73 of 1989), or the integrated environmental management guidelines issued by the Department of Environment Affairs and Tourism, or the Minerals Act, 1991 (Act No. 50 of 1991), or any other legislation: Provided that the consenting authority must ensure that the evaluation fulfils the requirements of the relevant heritage resources authority in terms of subsection (3), and any comments and recommendations of the relevant heritage resources authority with regard to such development have been taken into account prior to the granting of the consent.

(9) The provincial heritage resources authority, with the approval of the MEC, may, by notice in the *Provincial Gazette*, exempt from the requirements of this section any place specified in the notice.

(10) Any person who has complied with the decision of a provincial heritage resources authority in subsection (4) or of the MEC in terms of subsection (6) or other requirements referred to in subsection (8), must be exempted from compliance with all other protections in terms of this Part, but any existing heritage agreements made in terms of section 42 must continue to apply.”

3.2 CONCLUSION - THE LEGISLATION IN TERMS OF THE PROJECT

There is extensive national legislation covering heritage and archaeological sites. Within the scope of this project, Section 38 of the NHRA (25 of 1999), states that an assessment of potential heritage resources in the development area needs to be done. This is the purpose of the desktop study and the magnetometer survey. These processes identify potential MUCH sites.

4. STUDY APPROACH AND METHODOLOGY

4.1. EXTENT OF THE ASSESSMENT

This survey and impact assessment is concerned with archaeological sites and covers the area as described in Section 5.

4.2. METHODOLOGY

4.2.1. DESKTOP SURVEY

A database was compiled from the available written and oral sources and is available in Section 6.

The shipwreck database highlights the wrecks that are or may be in the area. The nature of the environment, poor historical reporting and the length of time since the wrecks occurred means that underwater cultural heritage sites may literally be anywhere and are thus hard to pinpoint with any accuracy beforehand. It is important to have a database because if MUCH sites are uncovered during the project, it will be easier to identify the wreck and thus assess its cultural and historical significance.

LIMITATIONS

- The database is a research tool that is constantly evolving as information is uncovered and added. In addition, the solitary nature of many wrecks means that information may be scarce and/or inaccurate. Therefore, without definitive information, shipwrecks are allocated to an area, based on limited information and certain assumptions regarding the dynamic nature of the environment.

4.2.2. MAGNETOMETER SURVEY

A Geometrics G-882 cesium-vapor marine magnetometer was towed behind a 5.7 m fibreglass rigid inflatable boat (RIB), with a layback of 15 meters, at an average speed of 3 - 6 knots/hour, utilising 15m run-lines.

The magnetometer data collected by MagLog® software was analysed twice. The first or field analysis is performed as the magnetometer is towed (Figures 1- 3). Possible sites are tabulated and analysed according to the environmental conditions in the field. The post-field analysis was interpreted with geophysical software (Surfer), with knowledge of the environmental conditions. The analyses were compared, and a final analysis completed.

LIMITATIONS

- The magnetometer picks up magnetic anomalies in and below the seabed. All the hits may not be MUCH sites, in addition, searches may not find the cause. Their status may only be revealed during the development process. The process gives the developers an idea of where MUCH sites may be uncovered.



Figure 1: Deployed magnetometer (Maitland, A 2020)

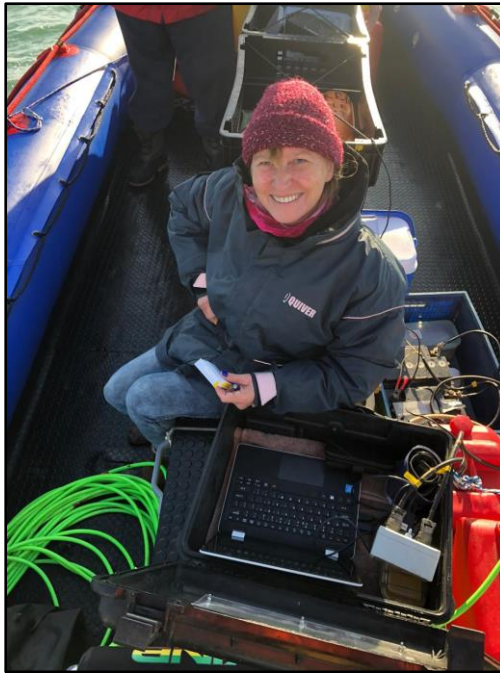


Figure 2: Magnetometer data capture (Maitland, A 2020)

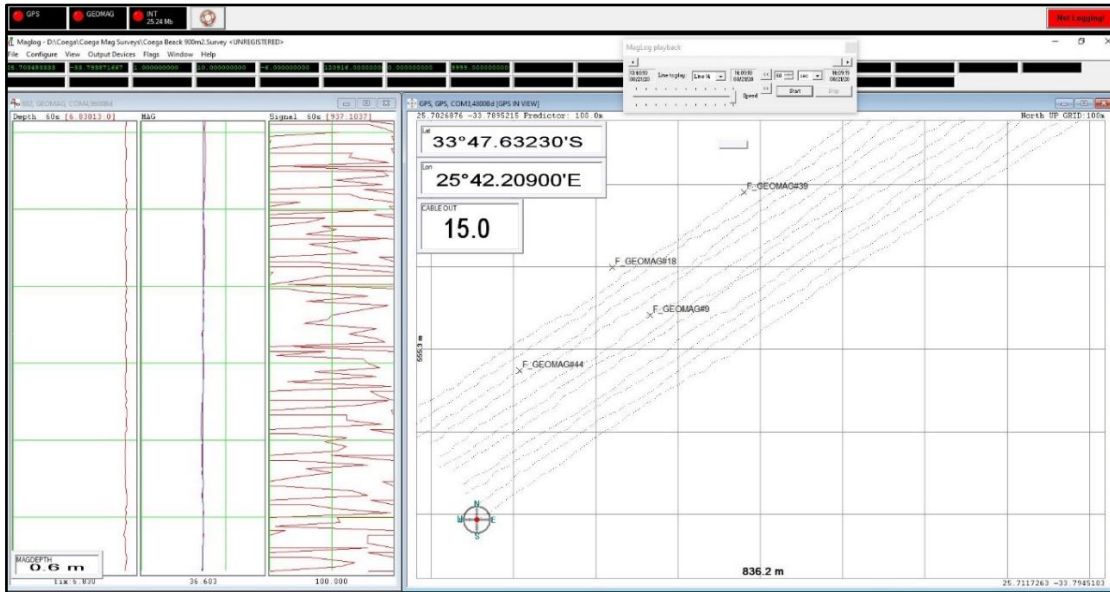


Figure 3: Field Analysis (Maitland 2020)

4.2.3. DIVER SEARCHES

From the analysis of the magnetic data, anomalies are plotted. These need to be investigated by divers. A marker buoy is dropped on the coordinates and a circular search is conducted from this central point (Figure 4 and Figure 5). Results are recorded. A buoy with a handheld GPS attached is held by the diver, this tracks the location of the search (**Error! Reference source not found.**).

LIMITATIONS

Some anomalies may be obvious shipwreck material while others may be covered in conglomerate and/or sand and silt. The limited visibility due to turbidity, that is suspended sediments negatively impacts diver searches.



Figure 4: Marker buoy and attached search reel (Maitland 2018)



Figure 5: Diver searches (Hookins 2018)

5. DESCRIPTION OF THE AFFECTED ENVIRONMENT



Figure 6: Proposed Subsea Pipeline Impact Zone (Google Earth 2020)

5.1. BATHYMETRY

The bathymetry of the Impact Zone has a maximum chart depth of 16.9 m Below Sea Level (BSL) sloping inshore to a depth of 1.5 m BSL. There are no indicated reefs or rocky areas, although the Roman Bank is to the east of the survey area (Figure 7).

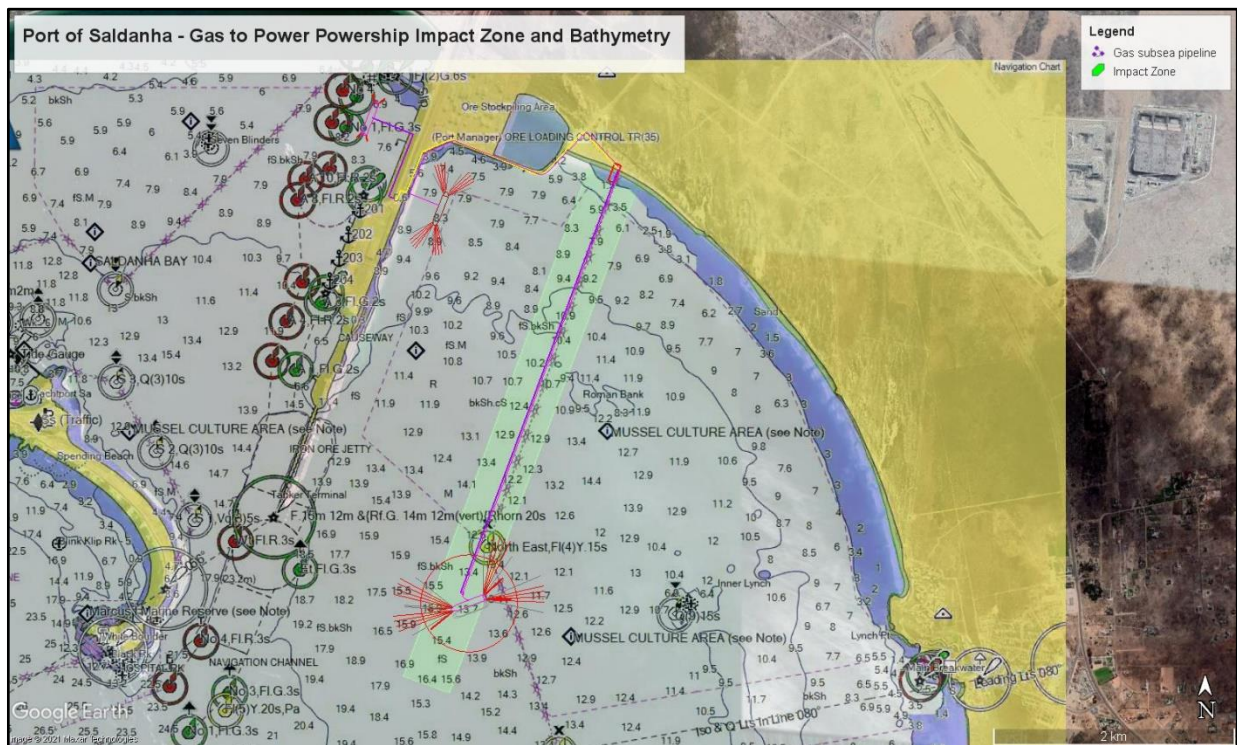


Figure 7: Bathymetry of the Impact Zone (Garmin BlueCharts: 2018)

5.2. WAVES, WIND AND SEDIMENT

According to the Draft Environmental Impact Assessment Report (Triplo4 2021), although the wave heights are small, compared to coastal areas outside the protection of the Bay, the Big Bay area has high turbidity due to strong wind conditions. Currents, caused by predominant south-westerly winds in summer move in a strong anti-clockwise direction, and in winter the north-westerly winds cause the currents to move in a clockwise direction. The seabed has a high mud content mixed with some sand. All of the above information informs on the possible state of underwater cultural resources.

After a wreck event, the cultural materials undergo a period of deterioration/stabilisation until an equilibrium is reached with the receiving environment. However, this deterioration/stabilisation process is ongoing as the environmental factors change (Richards & McKinnon 2009).

Shipwreck material on the seabed immediately starts chemically reacting with the environment. The pH, salinity, temperature, oxygen content and chemical composition of the water all affect the rate of corrosion. Artefacts under the sea usually form conglomerate masses. As ferrous metal objects corrode they become encrusted with layers of calcium carbonate, magnesium hydroxide, rust, sand, shells, pebbles, marine life skeletons and marine life (Hamilton 1976). This conglomerate protects the objects within as the internal environment is anaerobic.

If artefacts are buried beneath sediment, this environment is also anaerobic (the deeper it is buried, the less free oxygen in the sediment) (Cursi 2006). However, currents and wave action cause scour within the site. This scour can expose previously stable artefacts to an oxygen rich environment, this causes the deterioration/stabilisation process to start again. The scouring water is often laden with sediments. The sand can strip conglomerate off wreck material to the bare object and increase deterioration.

The information indicates that while the Impact Zone has periods of high wave energy, The Big Bay area is a "closed" environment. The current circulation reverses seasonally, and the wave action is insufficient to wash objects out to sea. The mud content of the seabed will tend to bury objects. From this we can make certain assumptions:

- Cultural resource material will likely be buried relatively rapidly
- Cultural resource material may be hard to discern as it is buried
- If cultural resources are uncovered during construction, they could be in good condition due to being buried in an anaerobic environment

6. DESKTOP SURVEY

6.1. NAVIGATIONAL OVERVIEW OF THE AREA

The Portuguese explorer, Antonio de Saldanha was attempting to round the southern tip of Africa in 1503 when he landed in Table Bay. It was dutifully named Agoada de Saldanha (the Watering Place of Saldanha). For the next century, Table Bay was referred to by this name. In 1601, the Dutch explorer, Joris van Spilbergen "discovered" the present day Saldanha Bay, assuming it was the same bay where the Portuguese had stopped, he referred to it as Saldanha. He then sailed further south and entered Table Bay, on seeing Table Mountain with its flat top and tablecloth of clouds, he named it Tafel Baay. Thereafter, there was confusion on the charts and in accounts as to which name to use. The Dutch naming eventually winning the battle.

According to historical records, Saldanha Bay was unexplored by Europeans until 1612 when an Englishman, Samuel Castleton entered the bay, went ashore and bartered for cattle with the local Khoen people. It is recorded that there was very little fresh water, and it was this lack of potable water that stopped the bay from developing as an early port. The French used the bay for whaling and sealing operations more in the early 1600s than any other European nation. Although there is very little written about the use of the bay in the French records, other European traders mention

finding a number of items in Saldanha that imply that the French were utilising the bay fairly extensively. The Dutch and French were enemies at this time, and it seems that the French were attempting to keep the knowledge of Saldanha to themselves.

After the Dutch refreshment station was started in Table Bay in 1652, the Dutch began sealing operations in Saldanha. The earliest map here is a Dutch map from 1665 (Figure 8), cartography improves and the French map of 1747 (Figure 9) is more accurate. The 1750 Italian map (Figure 10) interestingly shows a French fort on the peninsula. The last map was drawn by the South African Surveyor-General in 1915 (Figure 11). All these maps have different names for the same locations. These were correlated together and placed on the Google Earth image (Figure 12), this process facilitates the process of attempting to locate shipwrecks in the database.



Figure 8: 1665 Dutch map of Saldanha Bay (Vingboons)

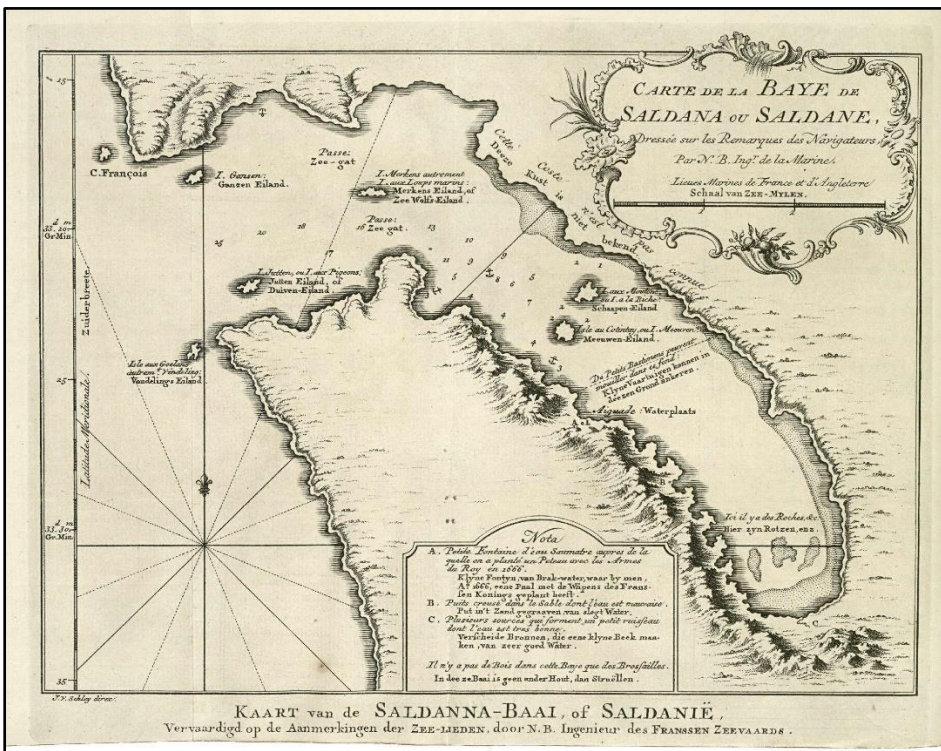


Figure 9: 1747 French map of Saldanha Bay (Bellin)



Figure 10: 1750 Italian map of Saldanha (L'Isle)

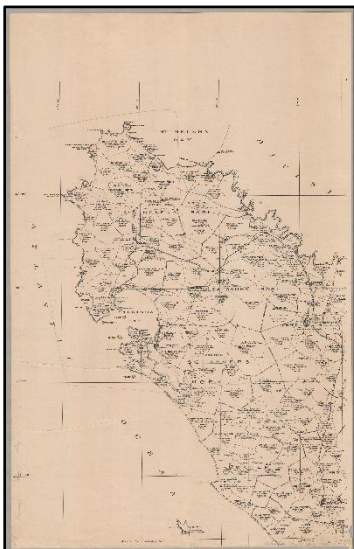


Figure 11: 1915 South African map of Saldanha (Surveyor-General)



Figure 12: Saldanha historical place names

6.2. SHIPWRECK DATABASE

The shipwreck database highlights the quantities of wrecks that may be in the area. The nature of the environment, poor historical reporting and the length of time since the wrecks occurred means that underwater cultural heritage sites may literally be anywhere and are thus hard to pinpoint with any accuracy beforehand. It is important to have a database because if MUCH sites are uncovered during the project, it will be easier to identify the wreck and thus assess its cultural and historical significance. Where possible, wrecks have been independently verified.

Some of the wrecks, particularly from the early 19th century, are easier to allocate to a specific area within the bay as there was an official maritime presence in the area by then. Before the first settlers, the accounts of wrecks were often passed along by word of mouth and the information becomes less reliable. Additionally, it seems that the bay was used for decades with little archival presence, particularly by the French, therefore it is entirely possible there are unknown wrecks.

Points to bear in mind when reading the below database.

Abandoned – This term means, generally, that the vessel was further out to sea. Older ships were sometimes badly maintained. A lifetime of rough seas had a heavy toll on the old vessels. Through storms and possibly bad maintenance, ships could become death traps. If the vessel was leaking badly and running repairs and continuous pumping had little to no effect, the captain would make a decision to abandon ship. However, sometimes these vessels would not sink but float along in the currents and could end up thousands of miles from where they were abandoned. There are numerous accounts of such derelicts being spotted. Figure 13 is an example of such a sighting. This vessel was spotted off the Cape south coast, she was on fire and had been abandoned. The whaler that spotted her could not read her name.

ST. HELENA, 26th July.
 A black clipper barque, apparently abandoned, was seen off the Cape of Good Hope 4th July, by the *Beejopore*. M'Clay, arrived here.
 A ship on fire was seen 6th July, in lat. 35 S. lon. 24 E., by the *Benjamin Morgan* (whaler), arrived here, which vessel lowered a boat and went alongside but could ascertain her name, her stern being burnt away; saw the Danish bark *Mathilde*, setting some

Figure 13: London Lloyd's List 13-09-1856

Condemned – In the modern era condemned ships are broken up and at least partially recycled. Historically, condemned vessels were often left on the beach or where they were moored until they were covered by sand or sank.

Sold – Although numerous shipwrecks were auctioned off and recorded in the newspapers as sold, this did not necessarily mean that they were completely salvaged. Figure 14 is an example of a wreck that was sold. However, wrecks were often sold and never removed. There are also numerous historical references to old wreckage being navigational hazards as well as hampering rescue efforts (Maitland 2009)

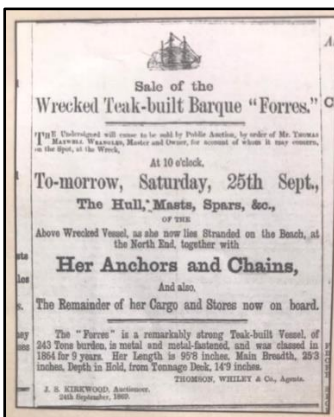


Figure 14: An example of a wreck sale notice (Turner 1988)

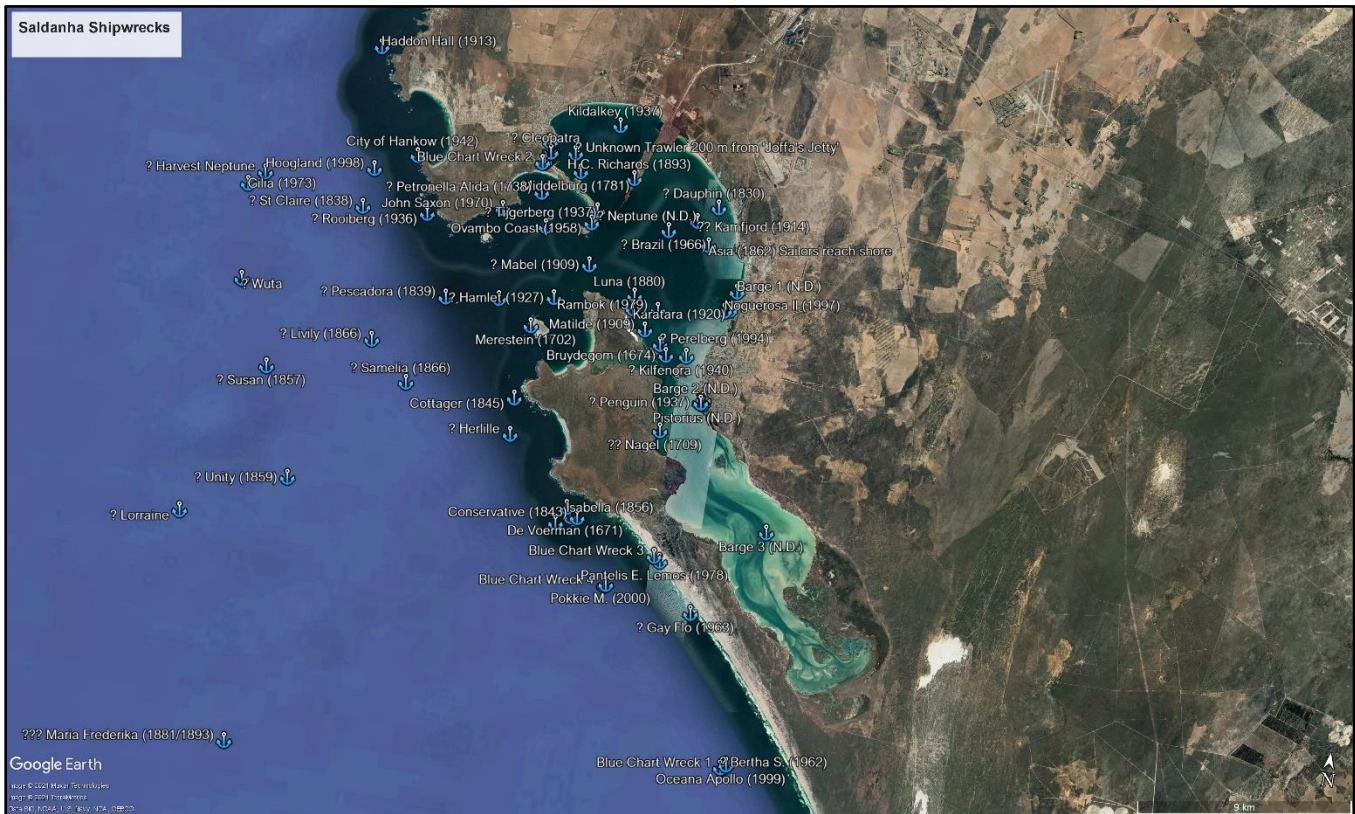
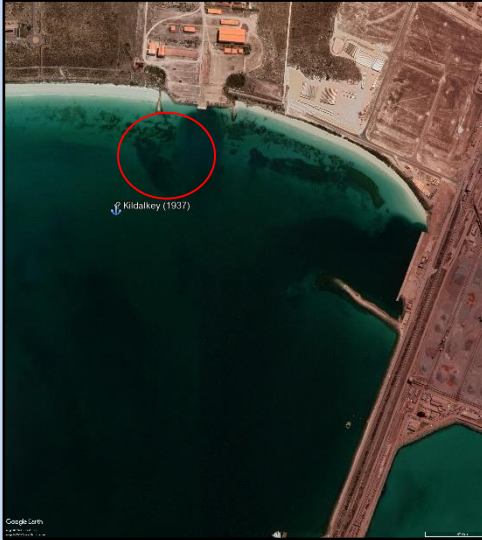


Figure 15: Saldanha Bay Shipwrecks (Google Earth 2018; Turner 1988; Levine 1989; Morris 2005; Urquhart 2007; van den Bosch 2009; SAHRIS 2016; Reocities 2017; Maitland 2020)

Table 1: Port of Saldanha Shipwreck Database

#	Name	Events	Date	Type	History	Area may be found	Probability
1	<i>Atlantic Pride II</i>	Abandoned, scuttled	Post-1972	Fishing Trawler	This 175-ton South African fishing trawler was abandoned at her mooring and deteriorated. She was sunk just outside the harbour (van den Bosch 2009)	33 01.24S 17 56.90E (approx.)	None
2	<i>Barge</i>	Stranded, abandoned	1972	Barge	This diamond mining barge was stranded, and the remains were still visible in 1992 (van den Bosch 2009)	33 04.17S 18 02.33E	None
3	<i>Barge 1</i>	Stranded, abandoned	N.D.	Barge	Stranded, the remains were still visible in 1992 (van den Bosch 2009)	33 03.74S 18 02.45E	None
4	<i>Barge 2</i>	Stranded, abandoned	N.D.	Barge	Stranded, the remains were still visible in 1992 (van den Bosch 2009)	33 06.31S 18 02.00E	None
5	<i>Barge 3</i>	Stranded, abandoned	N.D.	Barge	Stranded, the remains were still visible in 1992 (van den Bosch 2009)	33 09.00S 18 04.22E	None
6	<i>Brazil</i>	Burning, scuttled	1966-03-29	Fishing vessel	This fishing vessel was built in 1960 and had oil engines. While welders were working on the engine of this fishing boat, waste in the bilge caught on fire. The fire raged for fourteen hours. The boat was then towed to the middle of Saldanha Bay, 2.5 kilometres from the shore and sunk.	Middle of Saldanha Bay	Medium
7	<i>Bruydegom</i>	Stranded, refloated, abandoned	1674-04-09	Sloop	This small ship registered in the Cape, was used by the Saldanha traders to harvest seals, seabird eggs and shells. On a trip to the watering place, it ran aground during a squall. Although carpenters were sent from Table Bay to repair the vessel, it was deemed too dangerous as relations with the local Khoen people were precarious and the vessel was abandoned (Burman and Levin 1974).	Near Kraal Bay	None

#	Name	Events	Date	Type	History	Area may be found	Probability
					According to Leibbrandt (1902) the ship either Meeuw or Skaap Islands and she was lightened and refloated but as she was leaking badly, she was beached in order to be repaired. Unable to repair her, she was abandoned. They had on-board a cargo of shells and limestone. According to van den Bosch (2009) she drifted into the lagoon and sank near Kraal Bay.		
8	<i>City of Hankow</i>	Aground, wrecked	1942-12-18	Steel cargo ship	This 7 360-ton British cargo ship ran aground just north of the Saldanha Bay entrance. She broke her back and could not be refloated.	33 01.80S 17 53.40E	None
9	<i>Cleopatra</i>	Burning, sank	1968-05-1	Fishing vessel	This 75-ton fishing vessel caught fire and burned at her slip in Saldanha Bay.	33 01.04S 17 56.87E (Approx.)	None
10	<i>Dauphin</i>	Aground, wrecked	1830-03-05	Whaler	This 273-ton American whaler under Capt. Hussey. While anchored at Saldanha Bay, her anchor cable parted, she drifted ashore and became a wreck. The cargo was saved. No lives were lost. Although van den Bosch (2009) states this vessel is in Hoetjes Bay, I could find no corroborating evidence and as the prevailing winds are from the south-west at this time of year, one would assume she was blown across the bay.	Saldanha Bay	Low - Medium
11	<i>Forget-Me-Not</i>	Abandoned, Converted to jetty	N.D.	Ketch	Apparently, this vessel lies near the Whaling Station jetty and next to the H.C. Richards (van den Bosch 2009)	33 04.45S 17 59.78E Donkergat Whaling Station	None
12	<i>H.C. Richards (ex-Emily Faithful, ex-Iron Queen)</i>	Abandoned, converted to jetty	1893-11-02	Barque	Built in 1863, this 806-ton Norwegian barque was built originally as a clipper but later converted. Carrying a cargo of deals, when she struck a rock off Aliwal Shoal. After filling with water she was run aground near the Illovo River and patched up. She was towed to Durban. Later she was towed to Cape Town where she was condemned. She was eventually scuttled at the Salamander Whaling Station to form a jetty.	33 04.93S 18 00.17E Salamander Whaling Station	None
13	<i>Hamlet</i>	Wrecked	1927-04-07	Steam coaster	An Irvin & Johnson steam coaster of 328 tons. Under Capt. Dumares she serviced the Kerguelen sealing fleet. She had a cargo of provisions and coal from Table Bay when she was wrecked near South Head, Saldanha.	South Head	None
14	<i>Herlille</i>	Wrecked	1978-01-17	Fishing vessel	This 82-ton purse seiner was according to Levine (1987) wrecked at Saldanha Bay. Van den Bosch (2009) states that this vessel was wrecked at Kommetjie and the newspapers (The Argus in van den Bosch 2009) confirm this.	Not at Saldanha	None
15	<i>Hoogland</i>	Sank	1998-03-04	Fishing vessel	The South African fishing vessel sank just outside Saldanha Bay (van den Bosch 2009; Levine 1987).	33 02.24S 17 52.30E	None
16	<i>John Saxon</i>	Wrecked	1970-02-13	Wood ship	This vessel dragged her anchor and sank near North Head (van den Bosch 2009; Levine 1987)	33 02.69S 17 55.88E (Approx.)	None
17	<i>Kamfjord</i>	Hulk – Fate unknown	1914-07-31	Wood barque	This Norwegian barque was used as a hulk in Saldanha Bay (van den Bosch 2009). There is no record of her fate after she was no longer able to be used as a hulk. Sometimes hulks were dismantled, sometimes they were left to sink at their moorings.	Unknown	Low - Medium

#	Name	Events	Date	Type	History	Area may be found	Probability
18	<i>Karatara</i>	Fire, converted to jetty	1921-05-16	Steam coaster	This vessel was built for the sealing trade. While in Table Bay, she caught on fire. Although the fire was put out, the vessel was scuttled at the Donkergat Whaling Station, as part of the jetty (van den Bosch 2009).	Donkergat Whaling Station	None
19	<i>Kildalkey</i>		1936-11-18		<p>This steamship was built during WWI and was built with her stern and bow identical. This was in order to confuse enemy submarines. After the war she was converted into a tanker and used in the sealing trade. Later she transported whale oil. She had a cargo of whale oil when, during a heavy fog, she hit the rocks known as the Seven Blinders. The wreck may have been removed in 1974 (van den Bosch 2009; Levine 1987).</p> <p>Although if one looks at the Google Earth image, in the reported vicinity of the wreck, a wreck may be visible (Figure 16).</p>  <p>Figure 16: Possible wreck of the <i>Kildalkey</i></p>	West of Iron Ore Jetty	None
20	<i>Kilfenora</i>	Aground, wrecked	1940-04-28	Tanker	This 610-ton vessel managed by Irvin & Johnson ran aground on the easterly point of the north side of Scarpen Island. The wreck may have been removed in 1974 (van den Bosch 2009; Levine 1987).	Scarpen Island/ Removed/ Partially removed	None
21	<i>Livily</i>	Aground, possibly refloated	1866-08		Although this vessel is reported as a wreck in Saldanha Bay (van den Bosch 2009; Levine 1987), it is only reported as grounded. Therefore, it may have been refloated	Unknown	Low
22	<i>Luna</i>	Wrecked	1880-07-29	Wood Schooner	This 41-ton schooner was carrying a cargo of skins between Hondeklip Bay and Cape Town when she began to leak. The crew abandoned her half a kilometre from shore in Saldanha Bay. Apparently near Salamander Point. She sank but no lives were lost (van den Bosch 2009; Levine 1987).	Near Salamander Point	Low
23	<i>Mabel</i>	Aground, capsized, sank	1909-05-23	Wood Cutter	A sailing cutter of 8 tons and a crew of four, sailed from Langebaan for Cape Town with a cargo of wheat. She was sailing between Marcus Island and the mainland when she struck a rock. Thereafter she capsized and sank. Only one crew member survived by swimming ashore.	Between North and South Points	Low
24	<i>Matilde</i>	Converted to jetty	1909	Whaler	One of the whalers operating out of Donkergat, it became part of the jetty when it was no longer seaworthy (Burman and Levin 1974).	Donkergat Whaling Station	None

#	Name	Events	Date	Type	History	Area may be found	Probability
25	<i>Merestein</i>	Wrecked, sank, salvaged	1702-04-03	East Indiaman	This Dutch pinnace of 826 tons was built in 1693 at the Amsterdam Yard for the V.O.C. Under the command of Capt. Subbing, she was wrecked on the south-west corner of Jutten Island at the entrance to Saldanha Bay. She was on her outward-bound voyage from Texel with a large cargo of coins. One hundred and one people died in the wreck. Most of the coins, cannon and lead bars were salvaged in 1971. The wreck lies in the harbour area of Saldanha Bay at a depth of between 3 and 6 metres.	Jutten Island	None
26	<i>Middelburg</i>	Burnt, sank, salvaged, buried	1781-07-21	VOC Ship	This Dutch East-Indiaman of 1150 tons was built in 1775 for the Zeeland Yard. She was on her homeward bound voyage with a cargo of porcelain, tea, silk, aniseed and tin under Capt. Van Gennep. Her crew set her on fire in order to avoid her capture by the British. She eventually sank near Hoedjies Point. The wreck has been worked on by various salvors over the years, but now lies buried under the Saldanha Breakwater (van den Bosch 2009; Turner 1986; Levine 1987)	Saldanha Bay Breakwater	None
27	<i>Nagel</i>	Burning, scuttled	1709-05-27	VOC Galiot	This boat was in Saldanha netting fish when the crew got very drunk. A candle fell over and the vessel caught on fire. The crew tried to sink the vessel to put out the fire, but the water was too shallow, and fire destroyed the vessel (Burman and Levin 1974)	Oude Post	None
28	<i>Neptune</i>	Converted to jetty	N.D.	Whaler	One of the whalers operating out of Donkergat, it became part of the jetty when it was no longer seaworthy (Burman and Levin 1974).	Donkergat Whaling Station	None
29	<i>Noguerosa II</i>	Aground, abandoned	1997	Fishing vessel	An Old fishing vessel that was bought to convert into a restaurant. It was eventually abandoned.	33 04 20.9 S 18 02 19.7 E	None
30	<i>Olive</i>	Sank	1900	Small sailing coaster	Sank near the entrance to Saldanha in heavy seas (van den Bosch 2009).	Entrance Channel	Low
31	<i>Ovombo Coast</i>	Aground, wrecked	1958-07-23	Steel coaster	This South African coaster of 217 tons was built in 1939 and owned by Thesens. Commanded by Capt. Baird she was wrecked on Marcus Island, during a fog. She was carrying a cargo of fish oil for Cape Town (van den Bosch 2009; Levine 1987).	Marcus Island	None
32	<i>Penguin</i>	Converted to jetty	1937	Watership	This vessel was used as a watership in Saldanha. When she was no longer seaworthy, the hull was incorporated into the Langebaan Yacht Club Jetty (van den Bosch 2009)	Jetty at Langebaan Yacht Club	None
33	<i>Perelberg</i>	Aground, wrecked, abandoned	1954-05-18	Whaler	This whaler went aground on Meeuw Island and was abandoned (van den Bosch 2009; Levine 1987).	Meeuw Island	None
34	<i>Pescadore</i>	Aground, wrecked	1839-01-04	Schooner	This Portuguese vessel owned by the Lisbon Fishing Company was wrecked on a reef near the entrance to Saldanha Bay. No lives were lost (van den Bosch 2009; Levine 1987).	Entrance Channel	Low
35	<i>Petronella Alida</i>	Abandoned	1738	VOC Ship	This 550-ton Dutch East-Indiaman was abandoned and "scrapped" at Saldanha Bay as unseaworthy (De VOC Site). This ship was probably not broken up as there was no manpower in Saldanha at this time. The ship may have been scuttled or left to drift ashore. The local Khoen could have salvaged the wreck for iron.	Unknown	Medium
36	<i>Pistorius</i>	Abandoned	N.D.	Watership	This vessel was used as a watership in Saldanha. When she was no longer seaworthy, the hull was	Langebaan Yacht Club	None

#	Name	Events	Date	Type	History	Area may be found	Probability
					abandoned near the Langebaan Yacht Club (van den Bosch 2009). The hull is still visible in Google Earth (2021).		
37	<i>Präsident</i>	Converted into jetty	Between the two world wars	Steamer	This 3385-ton German steamer masqueraded at a hospital ship during WWI. She served as a supply ship for the German raider, <i>Konigsberg</i> . However, in 1914, the <i>Präsident</i> was spotted by a British patrol vessel and sunk near the Lindi River in East Africa. Later she was raised by Irvin & Johnson and she served as a coal depot for the Donkergat Whaling Station. After the whaling station was shut down, the vessel was stripped and served as a hulk at Hoedjies Point. Years after this, she was finally filled with stone and sunk to form a jetty. When WWII broke out, the jetty was used by small military vessels and the jetty became known as President Jetty .	Hoetjes Bay President Jetty	None
38	<i>Rambok</i>	Sank, refloated, scuttled	1979	Lifting and Mooring vessel	This vessel sank at her moorings, was relocated and disposed of later (van den Bosch 2009; Levine 1987).	33 04.42S 18 00.42E (Approx.)	None
39	<i>Rooiberg</i>	Aground, wrecked	1936-08-11	Whaler	This Irvin & Johnson, 200-ton whaler struck the rocks near North Head and was a total wreck. Her crew of twelve were rescued (van den Bosch 2009; Levine 1987).	North Head	None
40	<i>Roode Vos boat</i>	Wrecked	1654-12-17	Ship's boat	While on a sealing trip in Saldanha, two Dutch seamen mutinied. They stole the ship's boat and sailed off to the mainland. The boat was stoved in by the rocks and sank, and one of the mutineers drowned. The other mutineer was killed by the Khoen (Burman and Levin 1974)	Unknown	Low - Medium
41	<i>Tijgerberg</i>	Aground, wrecked	1937-08-01	Whaler	This 314-ton, Irvin & Johnson whaler ran aground near Eland's Point, Saldanha Bay. Two of the crew died (van den Bosch 2009; Levine 1987).	Near Eland's Point	None
42	<i>Samelia</i>	Aground, wrecked	1866-08	Cutter	This vessel is reported as wrecked at Saldanha Bay (van den Bosch 2009; Levine 1987).	Unknown	Medium
43	<i>St Clair</i>	Wrecked	1838-03-14	Ship	This British ship was wrecked in the vicinity of Saldanha Bay, during a south-east gale, several people lost their lives.	Unknown	Medium
44	<i>Unidentified Ferry</i>	Abandoned	N.D.	Ferry	This small ferry is recorded as being a little north of the Langebaan Yacht Club by van den Bosch (2009)	North of Langebaan Yacht Club	None
45	<i>Unidentified Trawler</i>	Burning, sank	1967-06-24	Trawler	A trawler, anchored 200m from Joffa's Jetty caught on fire. Two local men boarded the vessel where they found a man fast asleep in the bows. After waking him and returning to shore, the vessel sank.	33° 1.208'S 17° 57.588'E (Approx.)	None
46	<i>Vale</i>	Converted to jetty	N.D.	Whaler	Donkergat's first whaling ship. When it was no longer seaworthy, it was incorporated into the breakwater at the factory (Burman and Levin 1974).	Donkergat Whaling Station	None

SHIPWRECK SUMMARY

	Probability of Presence in Impact Zone	Shipwreck Count
	None	34
	Low	5
	Low to Medium	3
	Medium	4
	Medium - High	0
	TOTAL	46

There are 46 wrecks, in various databases, in the Saldanha Bay area. However, deeper investigation of the wrecks showed that one was actually wrecked at Kommetjie, and one was in all probability refloated after grounding. Thirty four were given a zero probability, as their locations were able to be narrowed down to specific sites. Six wrecks had a low probability based on the recorded history and six had a higher probability based on scant information on the wreck event. It is these twelve wrecks that may be uncovered during construction.

Of these twelve wrecks, the *Petronella Alida* of 1738, would be of high significance, due to its age and the insights it could offer on VOC ship building.

7. MAGNETOMETER SURVEY

The closer the magnetometer is to the seabed, the better the data. In shallow areas, the mag is generally towed from the nose, this tows the mag about 0.5 m below the surface. As the depth increases, one should switch to a top tow, which drops the mag to about 3 m below the surface. After -12 m, one should add a lead wing to the mag, this allows the mag to be towed at 7-8 m below the surface. However, due to time constraints on this project, as well as the narrow Impact Zone perpendicular to the coast, it was decided to use a top tow and vary the speed of the survey in order to allow the magnetometer to drop closer to the seabed. If the mag is required to go deeper, the speed needs to be reduced.

As mentioned in Section 5.1, the bathymetry of the Impact Zone is -1.5 near the shore to -17 at the end of the Impact Zone. Big Bay has a tidal range of approximately 2 m and we went as close to the shore as safety dictated (Figure 17).

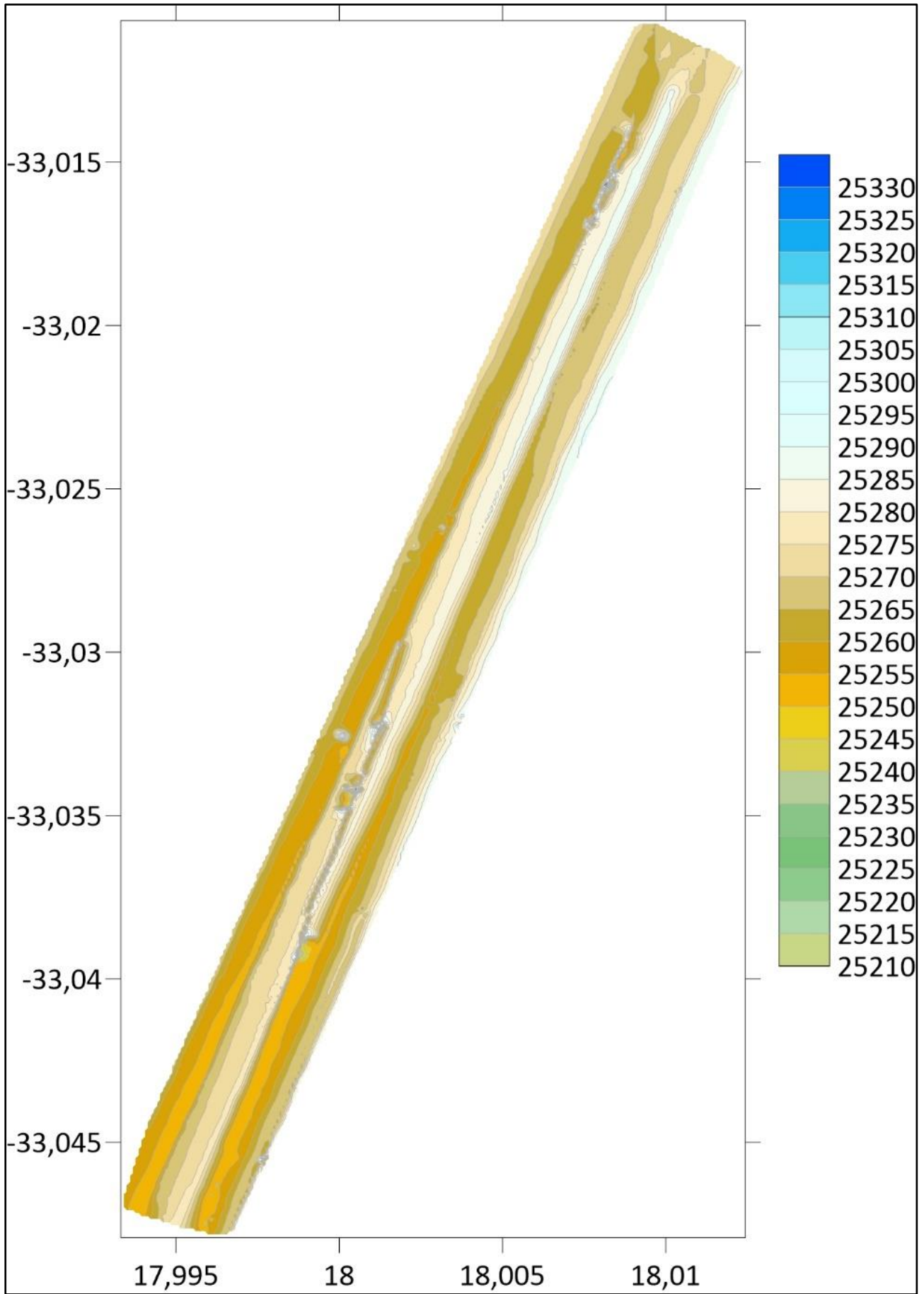


Figure 18: Surfer Survey Plot using contour intervals of 5 nT



Figure 19: Magnetic Map overlain on Google Earth with the Proposed Pipeline

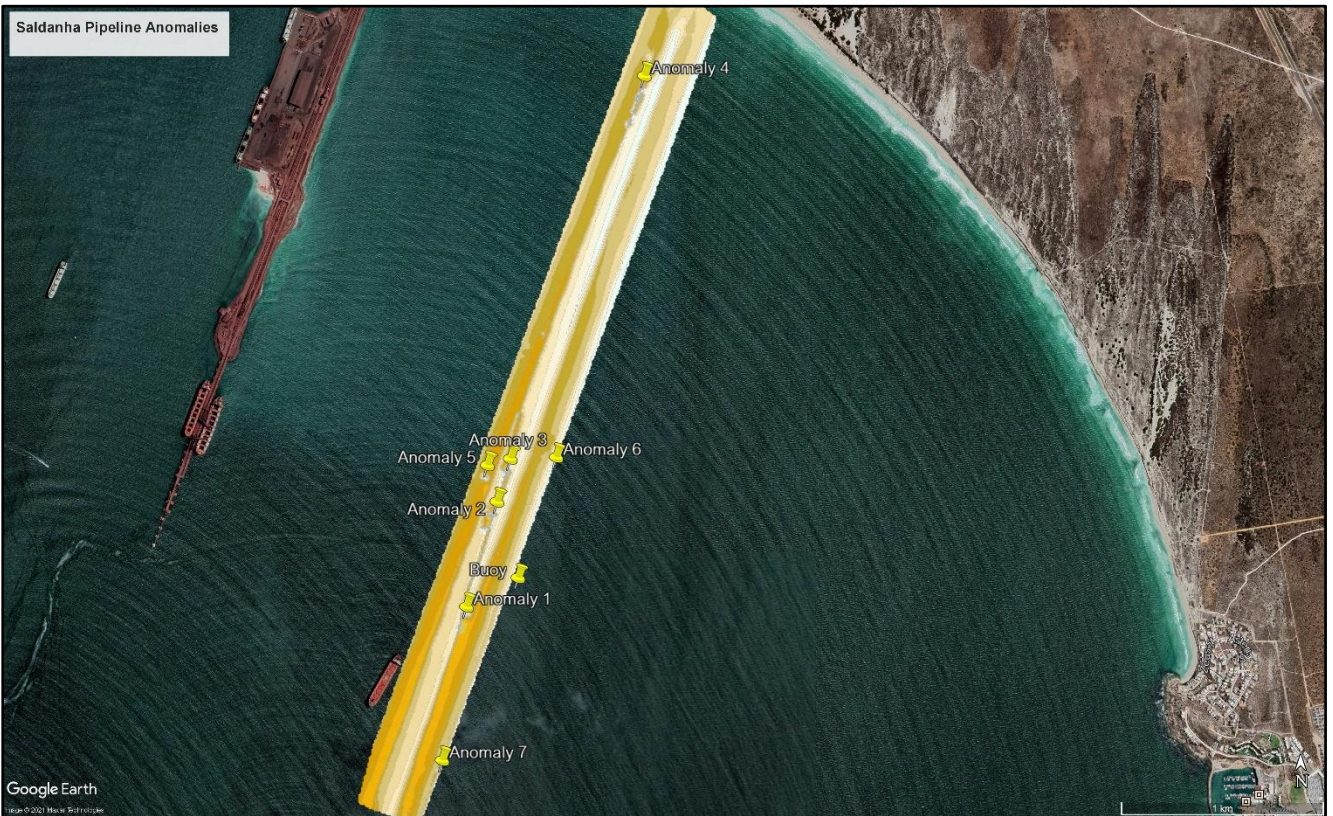


Figure 20: Magnetic map of Impact Zone with anomalies plotted

7.2. MAGNETOMETER SURVEY CONCLUSIONS

All shipwrecks, even wooden shipwrecks have a large magnetic signature. The field survey revealed several anomalies (Figure 20). Anomalies 1 – 4 are in a fairly straight line and there is a line of smaller anomalies connecting Anomalies 1 - 3. However, Anomalies 1 – 3 were much bigger than the connecting magnetic signature. Anomalies 5 – 7 were off the old pipeline. Diver searches were necessary to verify that the anomalies were not MUCH.

Table 2: Anomaly Co-ordinates

Anomaly Number	Co-ordinates	
1	33° 2.328'S	17° 59.936'E
2	33° 2.048'S	18° 0.033'E
3	33° 1.934'S	18° 0.075'E
4	33° 0.916'S	18° 0.500'E
5	33° 1.951'S	18° 0.002'E
6	33° 1.930'S	18° 0.221'E
7	33° 2.736'S	17° 59.859'E

8. DIVER SEARCHES

Seven dives were planned (**Error! Reference source not found.**). On arrival at the site on Monday 29 March 2021, the LNG vessel was being moored by the tugs.

We decided to dive on Anomaly 6 first as it was further away from the vessels. The visibility was hampered by the turbidity with a visibility of 0.5 m (Figure 21). A circular search was conducted, and some ferrous objects were found (Figure 22).

Thereafter, we decided to dive on Anomaly 1, this was the higher magnetic signature possibly on the old pipeline. A circular search was conducted. If this is the old pipeline, it is buried in silt. We found a large rock-like object that may be responsible for the anomaly. There were no reefs or other rocks visible. The object was not obviously from a shipwreck and it was covered in sea life.



Figure 21: Silt seabed and low visibility



Figure 22: Ferrous objects from Anomaly 6

8.1. DIVER SEARCHES CONCLUSION

Only two dives were undertaken. The high turbidity and zero visibility severely hampered the searches. No visible underwater cultural heritage resources were found. As the old pipeline was not visible, it is believed that the thick silt in this area buries objects and therefore further searches would likely achieve similar results.

8.2. FIELD SURVEY CONCLUSION

A number of magnetic anomalies were identified during the magnetometer survey. The majority of these are probably along the old pipeline. These anomalies have been recorded above and care should be taken during the construction phase. If shipwreck material is uncovered, a maritime archaeologist should be contacted to assess the finds.

While there is a low probability that shipwrecks will be found underwater, there exists a chance that shipwreck material and/or pre-colonial sites (shell middens and stone tools) may be found in the dunes and on the beach during construction. If such materials are found, the steps in Section 10 must be followed.

9. SITE SIGNIFICANCE AND ASSESSMENT

HERITAGE ASSESSMENT CRITERIA AND GRADING

According to the NHRA, No. 25 of 1999, Section 2(vi), the *significance* of heritage sites and artefacts is determined by its aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technical value in relation to the uniqueness, condition of preservation and research potential.

The NHRA stipulates the assessment criteria and grading of archaeological sites. The following categories are distinguished in Section 7 of the Act:

- **Grade I:** Heritage resources with qualities so exceptional that they are of special national significance;
- **Grade II:** Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and
- **Grade III:** Other heritage resources worthy of conservation, on a local authority level.

The occurrence of sites with a Grade I significance will demand that the development activities be drastically altered in order to retain these sites in their original state. For Grade II and Grade III sites, the application of mitigation measures would allow the development activities to continue.

A matrix exists whereby the above criteria, as set out in Sections 3(3) and 7 of the NHRA, No. 25 of 1999, can be applied for identified sites. This allows some form of control over the application of similar values for similar sites. This matrix will be applied if any sites are uncovered (Appendix I).

10. RECOMMENDED MANAGEMENT MEASURES

Heritage sites are fixed features in the environment, occurring within specific spatial confines. Any impact upon them is permanent and non-reversible. Those resources that cannot be avoided and that are directly impacted by the proposed development can be excavated / recorded and a management plan can be developed for future action. Those sites that are not impacted on can be written into the management plan, whence they can be avoided or cared for in the future.

10.1. OBJECTIVES

- Protection of heritage sites within the marine servitude project boundary, this includes coastal zone against vandalism, destruction, and theft.
- The preservation and appropriate management of new discoveries in accordance with the NHRA, should these be discovered during development activities.

The following shall apply:

- An archaeologist must be appointed for the duration of the construction phase of the project.
- The appointed archaeologist must have the requisite experience and knowledge to recognise maritime cultural heritage that may be found in the beach/dune area.
- The appointed archaeologist must do a short induction to familiarise the contractors and workers, including divers, to the potential heritage material artefacts that may be exposed during work. This includes Stone Age, Early Farming Communities, Colonial Period and Shipwreck artefacts and burials.
- Should any heritage artefacts be exposed during marine excavations, work in the immediate area where the artefacts were discovered, shall cease immediately and the on-site archaeologist shall be notified as soon as possible.
- All discoveries shall be reported immediately to the on-site archaeologist so that an investigation and evaluation of the finds can be made. The archaeologist will advise the necessary actions to be taken, including notifying SAHRA and if the artefacts are below the high water mark, SAHRA's MUCH Unit must be contacted.
- Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site; and
- Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the NHRA (Act No. 25 of 1999), Section 51. (1).

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APPENDIX I

CONVENTIONS USED TO ASSESS THE IMPACT OF PROJECTS ON HERITAGE RESOURCES

Significance

According to the NHRA, Section 2(vi) the **significance** of heritage sites and artefacts is determined by its aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technical value in relation to the uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these.

Matrix used for assessing the significance of each identified site/feature

1. Historic value

- Is it important in the community, or pattern of history
- Does it have strong or special association with the life or work of a person, group or organisation of importance in history
- Does it have significance relating to the history of slavery

2. Aesthetic value

- It is important in exhibiting particular aesthetic characteristics valued by a community or cultural group

3. Scientific value

- Does it have potential to yield information that will contribute to an understanding of natural or cultural heritage
- Is it important in demonstrating a high degree of creative or technical achievement at a particular period

4. Social value

- Does it have strong or special association with a particular community or cultural group for social, cultural or spiritual reasons

5. Rarity

- Does it possess uncommon, rare or endangered aspects of natural or cultural heritage

6. Representivity

- Is it important in demonstrating the principal characteristics of a particular class of natural or cultural places or objects
- Importance in demonstrating the principal characteristics of a range of landscapes or environments, the attributes of which identify it as being characteristic of its class
- Importance in demonstrating the principal characteristics of human activities (including way of life, philosophy, custom, process, land-use, function, design or technique) in the environment of the nation, province, region or locality.

7. Sphere of Significance	High	Medium	Low
International			
National			
Provincial			
Regional			
Local			
Specific community			

8. Significance rating of feature

1. Low
2. Medium
3. High

Significance of impact:

- low: where the impact will not have an influence on or require to be significantly accommodated in the project design
- medium: where the impact could have an influence which will require modification of the project design or alternative mitigation
- high: where it would have a "no-go" implication on the project regardless of any mitigation

Certainty of prediction:

- Definite: More than 90% sure of a particular fact. Substantial supportive data to verify assessment
- Probable: More than 70% sure of a particular fact, or of the likelihood of that impact occurring
- Possible: Only more than 40% sure of a particular fact, or of the likelihood of an impact occurring
- Unsure: Less than 40% sure of a particular fact, or the likelihood of an impact occurring

Recommended management action:

For each impact, the recommended practically attainable mitigation actions which would result in a measurable reduction of the impact, must be identified. This is expressed according to the following:

- 1 = no further investigation/action necessary
- 2 = controlled sampling and/or mapping of the site necessary
- 3 = preserve site if possible, otherwise extensive salvage excavation and/or mapping necessary
- 4 = preserve site at all costs
- 5 = retain graves

Legal requirements:

Identify and list the specific legislation and permit requirements which potentially could be infringed upon by the proposed project, if mitigation is necessary.