Maritime Heritage Impact Assessment: ASN Africa METISS Subsea Fibre Optic Cable System

Report prepared for

ERM Southern Africa

On behalf of

Alcatel Submarine Networks (ASN) and Elettra Tlc SpA

March 2019

Version 3.0

ACO Associates cc
Archaeology and Heritage Specialists

Prepared by

John Gribble

ACO Associates CC

8 Jacobs Ladder

St James

7945

Phone 021 7064104

Executive Summary

ACO Associates was appointed to conduct a desk-based assessment of the maritime archaeological potential of the marine portion of the proposed METISS subsea cable system, to determine the likely impacts of the cable on maritime and underwater cultural heritage resources, and to the propose measures to mitigate such impacts.

METISS is owned by a Consortium of companies comprising Canal+ Télécom, CEB FiberNet, EMTEL, Zeop, SRR (SFR) and TELMA. The Consortium was formed for the purposes of developing the system, and has contracted ASN and Elettra for the manufacture and installation of the subsea cable system. The Consortium has contracted Liquid Telecom to act as the Landing Party in South Africa, responsible for all operational aspects in South Africa.

In line with national legislation and policy regarding the marine environment, this maritime archaeological assessment is for the area below the high water.

The proposed subsea cable will be approximately 3200 km long and with a total length of approximately 538 km in South African waters. It will be laid on and in the seabed of South Africa's exclusive economic zone (EEZ), contiguous zone and territorial waters, to a landing site at Amanzimtoti Pipeline Beach in KwaZulu-Natal.

The subsea cable will be laid on the surface of the seabed in water depths greater than 1000 m. Between the low water mark and the 1000 m depth contour the cable will be buried to a target depth of 1 m below the seabed. Burial will be by ploughing using a cable plough, jetting using a remotely operated vehicle or, on the approach to the beach and the low water mark, by diver jet burial using hand-held jets. On the beach the subsea cable will be buried to a target depth of 2 m using a small tracked digger.

Findings: This assessment, which draws its information from readily available documentary sources, South African Heritage Resources Agency's (SAHRA) Maritime and Underwater Cultural Heritage database, a database created by Fedde van den Bosch, the South African Naval Hydrographer's Office list of charted wrecks and obstructions and a database of underwater heritage resources maintained by ACO Associates, reviewed the subsea cable route, buffered by 20 km for maritime and underwater cultural heritage resources.

There are no known submerged prehistoric sites in the Amanzimtoti area or along the proposed subsea cable route and only three known wrecks within the 20 km Marine Study Area around the proposed cable route alignment in the contiguous zone and territorial waters. Two of these wrecks are currently less than 60 years of age and are thus not protected by the National Heritage Resources Act (NHRA) as heritage resources.

An unidentified wreck charted by the South African Naval Hydrographer's Office (SANHO) lies within 40 m of the proposed subsea cable alignment, approximately 45 km from the landfall and the basis of the available data poses the greatest risk to cable lay and construction plant and the subsea cable.

Further offshore, within the EEZ there are two recorded wrecks within the Marine Study Area. Confidence in the positions of both wrecks is extremely low and although the remit of the NHRA does not extend to these two wrecks in respect of this Project their presence is worth noting as a potential risk to cable lay and construction plant and to the subsea cable.

This assessment has found that there is unlikely to be any impact on submerged prehistoric archaeological resources or historical shipwrecks from the Project. No mitigation is required or proposed in respect of potential submerged prehistoric archaeology in the Marine Study Area but the archaeological review of geophysical data is recommended to locate the unidentified SANHO charted wreck and ensure that two wrecks in the EEZ not be affected by, or affect the subsea cable or cable lay plant. The geophysical data review also has the benefit of identifying previously unknown wrecks on the seabed within the subsea cable route corridor.

In the event a previously unknown or unrecorded shipwreck is encountered during the installation of the subsea cable, the Project archaeologist and SAHRA must be notified immediately. If the wreck will be impacted by the subsea cable laying, all work must cease until the archaeologist and SAHRA have assessed the significance of the site and a decision has been taken as to how to deal with it.

Provided the mitigation measures recommended above are implemented, the maritime elements of the proposed METISS fibre optic cable are unlikely to have any impact on known or unknown maritime and underwater cultural heritage resources and are considered archaeologically acceptable.

Content of the Specialist Report Checklist

The content of this report has been prepared in terms of Regulation GNR 326 of 2014, as amended, Appendix 6, as shown in Table 1.

Table 1: Specialist Report Checklist

Contents of this report in terms of Regulation GNR 982 of 2014, Appendix 6	**Cross-reference in this report**
(a) details of— the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix B and C
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix C
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1: Introduction Section 2: Terms of Reference
(cA) an indication of the quality and age of base data used for the specialist report;	Section 5 and 5.1
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	N/A
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	N/A
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 5
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;;	Section 7
(g) an identification of any areas to be avoided, including buffers;	Section 8
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 5
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5.1
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities.	Section 6
(k) any mitigation measures for inclusion in the EMPr;	Section 8
(l) any conditions for inclusion in the environmental authorisation;	Section 8
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	N/A

Contents of this report in terms of Regulation GNR 982 of 2014, Appendix 6	**Cross-reference in this report**
(n) a reasoned opinion— (i) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and (ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 9
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A – HIA to be submitted to SAHRA for comment
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
(q) any other information requested by the competent authority.	N/A

Table of Contents

1 Introduction

ACO Associates cc was appointed by ERM Southern Africa (ERM), on behalf of Alcatel Submarine Networks (ASN),Elettra Tlc SpA (Elettra) and Liquid Telekom to undertake a maritime archaeological assessment for the South African section of the proposed METISS Subsea Fibre Optic Cable System linking South Africa, Madagascar, Réunion and Mauritius.

This assessment forms part of the Environmental Impact Assessment (EIA) process being undertaken for ASN and Elettra by ERM to evaluate the potential environmental impacts of the proposed Project, to manage in-country consultation with authorities, and to manage the process of obtaining Environmental Authorization from the national Department of Environmental Affairs (DEA) for the Project. If the Environmental Aurthorization is approved, it will be given to Liquid Telecom as they are responsible for all operational aspects in South Africa.

2 Terms of Reference

ACO Associates was appointed to conduct a baseline, desk-based assessment of the maritime archaeological potential of the marine portion of the proposed cable route, to determine the likely impacts of the construction and installation of the subsea cable on maritime and underwater cultural heritage resources, and to the propose measures to mitigate such impacts.

In line with national legislation and policy regarding the marine environment, this maritime archaeological assessment is for the area below the high water mark (see Section 4.1 below).

3 Project Description

The METISS Subsea Cable System will consist of a 14 mm to 35 mm diameter subsea cable from South Africa to Mauritius with branches to Madagascar and Reunion. The subsea cable will be approximately 3200 km long and with a total length of approximately 538 km within South African waters. It will cross the Exclusive Economic Zone (EEZ) (approximately 370 km from the seashore) and continue through the territorial waters (approximately 22 km from the seashore), to a landing site at Amanzimtoti Pipeline Beach in KwaZulu-Natal (**Figure 1**).

The subsea cable will be laid on the surface of the seabed in water depths greater than 1000 m. Between the low water mark (LWM) and the 1000 m depth contour the subsea cable will be buried to a target depth of 1 m below the seabed. Burial will be by ploughing using a cable plough, jetting using a remotely operated vehicle (ROV) or, on the approach to the beach and the low water mark, by diver jet burial using hand-held jets. The expected maximum width of the seabed fluidised by jet burial is approximately 210 mm.

On the beach between the LWM and the Beach Manhole the subsea cable will be buried to a target depth of 2 m using a small tracked digger. The burial trench will be approximately 500 mm wide.

Figure 1: Route of the proposed METISS subsea cable from the outer edge of the South African continental shelf to the landfall at Amanzimtoti on the KZN coast.

4 Relevant Legislation

4.1 *National Heritage Resources Act (No 29 of 1999)*

The National Heritage Resources Act (NHRA) came into force in 2000 with the establishment of the SAHRA, replacing the National Monuments Act (No 28 of 1969 as amended) and the National Monuments Council as the national agency responsible for the management of South Africa's cultural heritage resources.

The NHRA reflects the tripartite (national/provincial/local) nature of public administration under the South African Constitution and makes provision for the devolution of cultural heritage management to the appropriate, competent level of government. Because national government is responsible for the management of the seabed below the high water mark, however, the management of maritime and underwater cultural heritage resources under the NHRA does not devolve to provincial or local heritage resources authorities but remains the responsibility of the national agency, SAHRA.

The NHRA gives legal definition to the range and extent of what are considered to be South Africa's heritage resources. According to Section 2(xvi) of the Act a heritage resource is "any place or object of cultural significance". This means that the object or place has aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

In terms of the definitions provided in Section 2 of the NHRA, maritime and underwater cultural heritage can include the following sites and/or material relevant to this assessment:

- material remains of human activity which are in a state of disuse and are in or on land [which includes land under water] and which are older than 100 years, including

artefacts, human and hominid remains and artificial features and structures (Section 2(ii));
- 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, a 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 2(ii)); and
- any movable property of cultural significance which may be protected in terms of any provisions of the NHRA, including any archaeological artefact or palaeontological specimen (Section 2(xxix));

Of the heritage resource types protected by the NHRA, the laying of the proposed subsea cable has the potential to impact the following:

- submerged pre-colonial archaeological sites and materials; and
- maritime and underwater cultural heritage sites and material, which are principally historical shipwrecks.

As per the definitions provided above, these cultural heritage resources are protected by the NHRA and a permit from SAHRA is required to destroy, damage, excavate, alter, deface or otherwise disturb any such site or material.

It is also important to be aware that in terms of Section 35(2) of the NHRA, all archaeological objects and palaeontological material is the property of the State and must, where recovered from a site, be lodged with an appropriate museum or other public institution.

4.2 *Kwazulu-Natal Heritage Act (No 4 of 2008)*

KwaZulu-Natal (KZN) has its own provincial heritage legislation, the Kwazulu-Natal Heritage Act (No 4 of 2008), originally promulgated as Act No. 10 of 1997, prior to the promulgation of the NHRA in 1999.

The KZN legislation provides for the conservation, protection and administration of both the physical and the living or intangible heritage resources of the Province of KwaZulu-Natal. In terms of the Act, the provincial heritage agency, Amafa aKwaZulu-Natali (Amafa), is responsible for the management and protection of battlefield sites, archaeological sites, rock art sites, palaeontological sites, historic fortifications, and meteorite or meteorite impact sites in KZN.

As described above in relation to the NHRA, national government is responsible for the management of the seabed below the high water mark and the management of maritime and underwater cultural heritage resources in KZN therefore takes place under the NHRA and by SAHRA and does not devolve to Amafa. Letter of Exemption for terrestrial Heritage Impact Assessment was submitted to Amafa on 4 March 2019.

4.3 *Maritime Zones Act (No 15 of 1994)*

South Africa's Maritime Zones Act of 1994 is the national legislative embodiment of the international maritime zones set out in the United Nations Convention on the Law of the Sea (UNCLOS).

The Act defines the extent of the territorial waters, contiguous zone, EEZ and continental shelf which together comprises some 4.34 million square kilometres of seabed, and sets out South Africa's rights and responsibilities in respect of these various maritime zones.

Under the terms of the maritime zones established by the Act, the application of the NHRA applies within South Africa's territorial waters (12 nautical miles seaward of the baseline) and extends to the outer limit of the maritime cultural zone (contiguous zone) (24 nautical miles seaward of the baseline). Any offshore activities that have the potential to disturb or damage cultural heritage resources located in or on the seabed within the territorial waters and maritime cultural zone require the involvement of SAHRA, as a commenting body in respect of the NEMA EIA process and as permitting authority where impacts to sites or material cannot be avoided and damage or destruction will occur.

In terms of Section 9 of the Maritime Zones Act, activities undertaken from installations operating within South Africa's EEZ or on the continental shelf may be subject to the requirements of any law in force in the Republic. The definition of "installation" (which includes vessels) provided in the Act, however, appears to limit this to activities related to seabed mining and mineral exploitation.

The extent of the application of the NHRA and Maritime Zones Act in respect of the METISS subsea cable and route is therefore, limited to area between the baseline and the outer edge of the contiguous/maritime cultural zone.

4.4 *National Environmental Management Act (Act No 107 of 1998)*

The National Environmental Management Act (No 107 of 1998) (NEMA) provides a framework for the integration of environmental issues into the planning, design, decision-making and implementation of plans and development proposals that are likely to have a negative effect on the environment.

Regulations governing the environmental authorisation process have been promulgated in terms of NEMA and include the 2014 EIA Regulations (as amended).

The proposed METISS subsea cable triggers a number of activities in the Listing Notices and, in terms of GNR 325 therefore, the Project will be subject to an Environmental Impact Assessment process and Liquid Telekom will be required to obtain a positive Environmental Authorisation from the national Department of Environmental Affairs (DEA) prior to commencement of the proposed activities.

5 Method

This desk-based baseline report provides an assessment of the maritime and underwater cultural heritage potential of the Marine Study Area defined as a corridor 20 km wide, centred on the proposed subsea cable alignment between the outer limit of South Africa's contiguous zone/maritime cultural zone (24 nautical miles from the baseline) and the high water mark at the subsea cable landfall on Amanzimtoti Pipeline Beach (**Figure 2**).

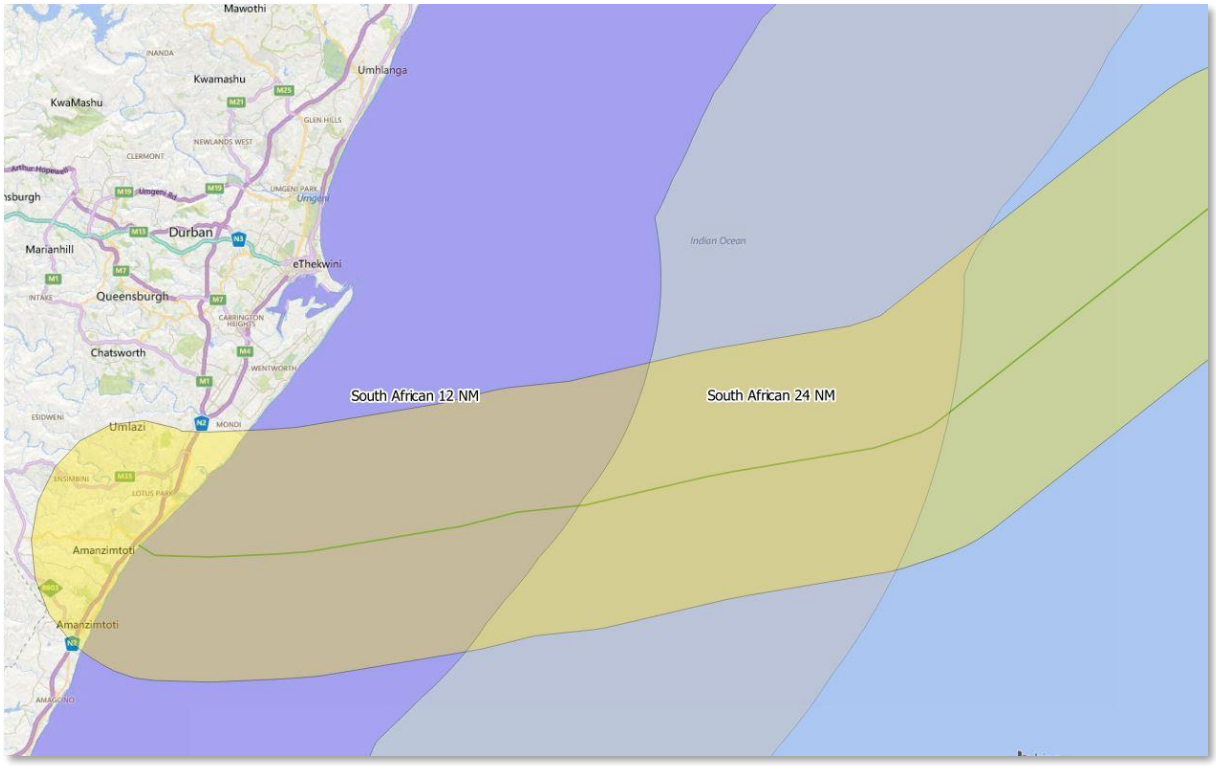

Figure 2: Proposed subsea cable alignment with the 20 km Marine Study Area (yellow) across the South African contiguous zone (grey) and territorial waters (purple).

The report includes a description of what comprises South Africa's maritime and underwater cultural heritage, a brief maritime history of the KZN coast area and a discussion of known heritage resources within the Marine Study Area.

The report draws its information from readily available documentary sources, SAHRA's Maritime and Underwater Cultural Heritage database, a database created by Fedde van den Bosch (2014), the South African Naval Hydrographer's Office (SANHO) list of charted wrecks and obstructions and a database of underwater heritage resources maintained by ACO Associates.

The potential impacts arising from the proposed installation of the METISS subsea cable system on maritime and underwater cultural heritage resources are assessed and, where necessary, recommendations are made to mitigate such impacts.

5.1 *Limitations*

The record of South Africa's maritime and underwater cultural heritage resources is based principally on historical documents and other secondary sources. Where available this is supplemented by primary sources such as geophysical data and other field-based observations and site recordings.

The reliance on secondary data sources means that there are gaps and inaccuracies in this record. Thus, while every effort has been made to ensure the accuracy of the information presented below, the potential exists for currently unknown and/or unrecorded maritime heritage sites to be encountered in the course of the proposed Project.

It is for this reason too that the relatively large (20 km wide) Marine Study Area described above has been used for this report, rather than one that is more narrowly defined around the proposed routing of the subsea cable.

6 Underwater Cultural Heritage

South Africa has a rich and diverse underwater cultural heritage. Strategically located on the historical trade route between Europe and the East, South Africa's rugged and dangerous coastline has witnessed more than its fair share of shipwrecks and maritime dramas in the last 500 years. At least 2500 vessels are recorded as having been wrecked, sunk, abandoned or scuttled in South African waters since the early 1500s.

This list is not complete and does not include the as yet unproven potential for shipwrecks and other sites that relate to pre-European, Indian Ocean maritime exploration, trade and interactions along the South African east coast. It is thus anticipated that further research in local and foreign archives, together with physical surveys to locate the remains of historical shipwrecks will produce a final tally of more than 3000 wrecks in South African waters.

More than 1900 of the wrecks currently recorded in South African waters are older than 60 years and are thus protected by the NHRA as archaeological resources.

The record of South Africa's long association with the sea is much broader than shipwrecks and extends far back into prehistory. This element of our maritime and underwater cultural heritage is represented around the coast by thousands of pre-colonial shell middens which reflect prehistoric human exploitation of marine resources since the Middle Stone Age, more than 150,000 years ago.

Stone-walled inter-tidal fish traps are another, potentially ancient feature of particularly the south-western and southern Cape coast (see Kemp, 2006), although their age is contentious with some authors proposing that they are pre-colonial in origin (Goodwin, 1946; Avery, 1975; Gribble, 2005) and others that they are much more recent (Hine, 2008; Hine *et al*, 2010).

Another, until recently, largely unacknowledged and unexplored aspect of our maritime and underwater cultural heritage are pre-colonial terrestrial archaeological sites and palaeolandscapes which are now inundated by the sea.

This report considers those maritime and underwater cultural heritage resources in the vicinity of the proposed METISS subsea cable route which are located below the high water mark, namely submerged prehistoric resources and historical shipwrecks.

6.1 *Submerged Prehistory*

Since the start of the Quaternary, approximately 2.6 million years ago, the world has been subject to a series of cooling and warming climatic cycles in which sea level was mainly lower than it is today. During the last 900,000 years global sea levels have fluctuated substantially on at least three occasions, the result of increased and decreased polar glaciation. The dropping of sea levels was caused by the locking up in the polar ice caps of huge quantities of seawater as global temperatures cooled. The most extreme recent sea level drop occurred between circa 20,000 and 17,000 years ago when at the height of the last glaciation (Marine Isotope Stage (MIS) 2) the sea was more than 120m lower than it is today (Waelbroeck *et al*, 2002; Rohling *et al*, 2009).

The lower sea levels during glaciations which correspond with MIS 4 (~70,000 years ago), MIS 6 (~190,000 years ago), MIS 8 (~301,000 years ago) and MIS 12 (~478,000 years ago), for example, would have "added a large coastal plain to the South African land mass" (Van Andel, 1989:133) where parts of the continental shelf were exposed as dry land (see Cawthra *et al*, 2016). This would have been most pronounced on the wide Agulhas Bank off the southern Cape coast, but would also have occurred along the narrow continental shelves on South Africa's west and east coasts. It is estimated that this exposed continental shelf may have represented a new area of land as much as 80,000km^2 in extent during the successive glacial maxima (Fisher *et al*, 2010). **Figure 3** below gives an indication of the extent of the continental shelf exposure during the second to last glaciation.

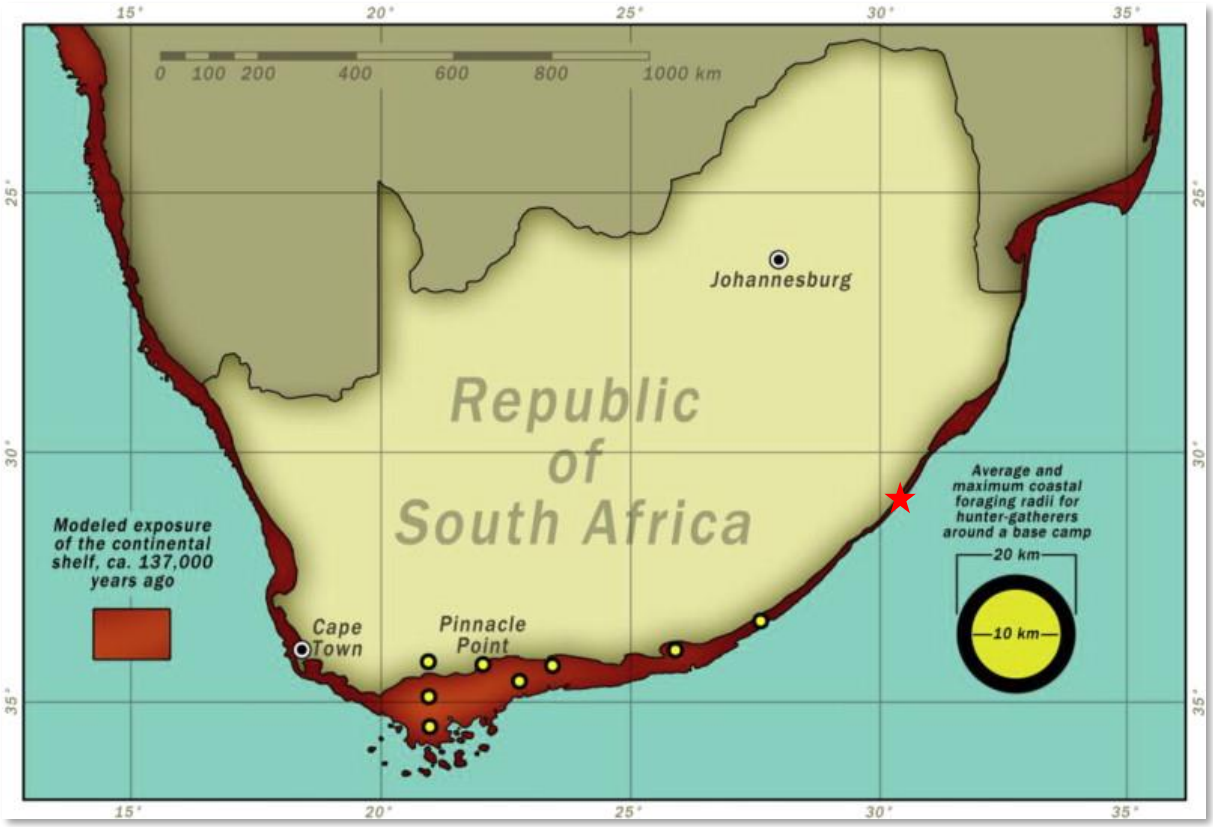

Figure 3: Possible extent of the South African continental shelf during MIS 6. The approximate location of Amamzimtoti is marked by the red star (Source: Franklin et al, 2105)

The exposed continental shelf was quickly populated by terrestrial flora and fauna, and also by our human ancestors who were dependant on these resources (Compton, 2011). As a result, for periods numbering in the tens of thousands of years on at least three occasions during the last 500,000 years our ancestors inhabited areas of what is now seabed around the South African coast. This means that a large part of the archaeological record of the later Middle and early Later Stone Age is located on the continental shelf and is now "inundated and for all practical purposes absent from [that] record" (Van Andel, 1989:133-134).

Until relatively recently there was little or no access to the submerged prehistoric landscapes and sites on the continental shelf, although evidence from various parts of the world of drowned, formerly terrestrial landscapes hinted at the tantalising prospect of prehistoric archaeological sites on and within the current seabed. Perhaps the best-known example of such evidence is archaeological material and late Pleistocene faunal remains recovered by fishing trawlers in the North Sea between the United Kingdom and the Netherlands throughout the 20th century (Peeters *et al*, 2009; Peeters, 2011) and the recent archaeological interpretation of 3D seismic data, collected in the same area by the oil and gas industry, which has revealed well-preserved prehistoric landscape features under and on the seabed of the southern North Sea (Fitch *et al*, 2005).

Closer to home, there is archaeological evidence for a prehistoric human presence in what is now Table Bay. In 1995 and 1996 during the excavation of two Dutch East India Company shipwrecks, the *Oosterland* and *Waddinxveen*, divers recovered three Early Stone Age handaxes from the seabed under the wrecks (**Plate 1**).

The stone tools, which are between 300,000 and 1.4 million years old, were found at a depth of 7-8m below mean sea level and were within Pleistocene sediments associated with an ancient submerged and infilled river channel. Their unrolled and unworn condition indicated that they had not been carried to their current position by the ancient river and suggests that they were found more or less where they were dropped by Early Stone Age hominins at least 300,000 years ago, at a time when the sea level was at least 10m lower than it is today (Werz and Flemming, 2001; Werz *et al*, 2014).

Plate 1: Early Stone Age Acheulian hand axes found in Table Bay (Source: http://www.aimure.org/index.php/aimure-projects)

Ancient river courses, whose channels are today buried under modern seabed sediment, would have been an important focus for hominin activity in the past and, as demonstrated in Table Bay, there is the potential for the occurrence of submerged pre-colonial archaeological material in association with palaeo-river channels.

Where alluvial sediment within these channels has survived post-glacial marine transgressions there is also the potential to recover palaeoenvironmental data which can contribute contextual information to our understanding of the ancient human occupation of South Africa

6.1.1 Submerged Prehistory of the Amanzimtoti area

Although there are currently no known submerged prehistoric sites in the Amanzimtoti area or along the proposed subsea cable route, a number of studies of the wider KZN continental shelf describe Pleistocene and Holocene palaeolandscape features and sediments which have archaeological potential.

Martin and Flemming (1988) describe three Quaternary sequences overlying older strata: consolidated and fossilised aeolian foredune complexes, buried fluvial channels with infill sediments, and unconsolidated Holocene sediments.

Rugged and linear aeolianite shoals like the Protea Banks and Aliwal Shoal form prominent features on the KZN shelf and Cawthra *et al* (2012) also recently identified aeolianite deposits off of The Bluff in Durban. These aeolianite deposits form a succession of shore-parallel reef systems extending to depths in excess of 100 m below mean sea level. They are linked to global Quaternary sea level fluctuations and are thought to represent Late Pleistocene palaeocoastlines. They formed as coastal dunes associated with barrier beaches and are interpreted as submerged coastal dune cordons (Martin and Flemming, 1988; Bosman *et al*, 2005; Cawthra *et al*, 2012). Martin and Flemming (1988) suggest that they were formed during the last glacial, between 120 000 and 30 000 years ago. An Infrared Stimulated Luminescence age of 60 ka obtained by Cawthra *et al* (2012) supports this dune building during the Marine Isotope Stage 4, last glacial period. Coastal dunes are a known focus of pre-colonial human activity, and sites are often found in dune slacks which provide shelter from the prevailing wind. It is possible, therefore, that there will be archaeological sites and material associated with the aeolianite deposits off the KZN coast, although such material has not yet been identified.

A number of studies (see for example, Green and Garlick, 2011; Dladla, 2013) have also described incised valleys on the continental shelf which were cut during sea-level low-stands when river courses extended onto the shelf. This downcutting would have occurred during glacial periods and the resultant channels are filled by fluvial sediment and are overlain by Holocene sediments deposited when sea-level regained levels near to those of present day (Martin and Flemming, 1988). Such palaeo-rivers would have been attractive resources to our human ancestors on the now submerged continental shelf and just as on land, archaeological sites and material can be expected to be associated with these river valleys. Where fluvial deposits within the palaeochannels have survived subsequent marine transgression these have the potential to preserve palaeoenvironmental information useful in the reconstructing the environment and thus contributing to the study of our early ancestors in South Africa.

Across much of the continental shelf modern seabed sediments, laid down during the Holocene as the sea level rose to the level it is today, are draped over and infill the incised palaeochannels. Although this unconsolidated surface sediment is likely to have some archaeological potential, it is likely to be low.

6.2 ***Shipwrecks***

In 1498 the Portuguese explorer Vasco da Gama finally pioneered the elusive sea route around Africa from Europe to the East. Since then, the southern tip of the African continent has played a vital role in global economic and maritime affairs, and until the opening of the Suez Canal in 1869, represented the most viable route between Europe and the markets of the East (Axelson, 1973; Turner, 1988; Gribble, 2002; Gribble and Sharfman, 2013).

The South African coast is rugged and the long fetch and deep offshore waters mean that the force and size of seas around the South African coast are considerable, a situation exacerbated by prevailing seasonal winds.

The geographical position of the South African coast on the historical route to the East and the physical conditions mariners could expect to encounter in these waters have, in the last five centuries, been responsible for the large number of maritime casualties which today form the bulk of South Africa's maritime and underwater cultural heritage (Gribble, 2002).

For obvious historical reasons, the earliest known South African wrecks are Portuguese, dating to the sixteenth century when that country held sway over the route to the East. Due to the later, more prolonged ascendancy of first the Dutch and then the British in European trade with the East and control at the Cape, the majority of wrecks along the South African coast are Dutch and British. However, at least 36 other nationalities are represented amongst the other wrecks that litter the South African coast

Da Gama's maritime incursion into the Indian Ocean laid the foundation for more than 500 years of subsequent European maritime activity in the waters off the South African coast. The Portuguese and other European nations who followed their lead around the Cape and into the Indian Ocean, however, joined a maritime trade network that was thousands of years old and in which east and south east Africa was an important partner.

This trade spanned the Indian Ocean and linked the Far East, South East Asia, India, the Indian Ocean islands and Africa. Archaeological evidence from Africa points to an ancient trade in African products – gold, skins, ivory and slaves – in exchange for beads, cloth, porcelain, iron and copper. The physical evidence for this trade includes Persian and Chinese ceramics excavated sites on African Iron Age like Khami, Mapungubwe and Great Zimbabwe (see Garlake, 1968; Huffman, 1972; Chirikure, 2014), glass trade beads found in huge numbers on archaeological sites across eastern and southern Africa (Wood, 2012).

There is shipwreck evidence on the East African coast for this pre-European Indian Ocean trade (see for example Pollard *et al*, 2016) and clear archaeological and documentary evidence that this trade network extended at least as far south as Maputo in Mozambique. This suggests that there is the potential for shipwrecks and other sites that relate to pre-European, Indian Ocean maritime exploration, trade and interactions to exist along the South African east coast and offshore waters.

The more than 2500 historical shipwrecks that make up the bulk of South Africa's underwater cultural heritage are a thus huge, cosmopolitan, repository of information about mainly global maritime trade during the last five centuries and potentially much further back into the past. These sites contain a wealth of cultural material associated with that trade and clues to the political, economic, social and cultural changes that accompanied this trade and which contributed to the creation of the modern world.

6.3 *Maritime History of the KZN Coast*

The earliest European detailed description of the KZN coast is by the Portuguese navigator and cartographer Manuel de Mesquita Perestrelo who charted the South African coast between November 1575 and January 1576 (**Figure 4**). One of the major coastal landmarks noted by Perestrelo was Durban Bluff, which he named Ponta Pescaria (Knox-Johnston, 1989; http://cvc.instituto-camoes.pt/navegaport/a31.html).

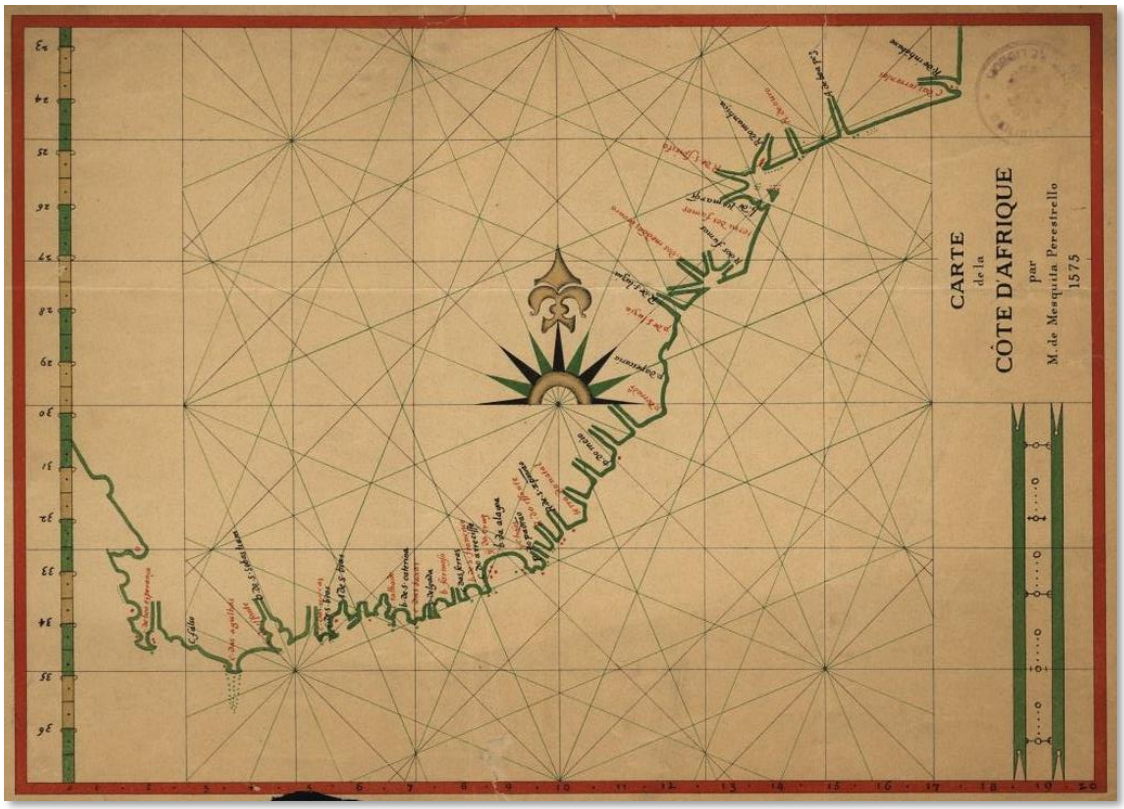

Figure 4: Manuel de Mesquita Perestrelo's map of the South African coast (Source: Wikipedia)

Sheltered behind the Bluff is Natal Bay, now Durban Harbour, a shallow and swampy lagoon surrounded by mangrove forests when the first visited by European shipwreck survivors in the 16th and 17th centuries.

Until the 1820s the KZN coastline was avoided whenever possible by European sailors because of its lack of shelter. The coast is characterised by long stretches of sandy beach punctuated by river mouths, very few of which are accessible from the sea or navigable.

After a Royal Navy survey of the coast by Captain Owen in 1822, however, a small group of settlers led by James King and Francis Farewell arrived at Port Natal, one of the few natural harbour on the coast, and established an agricultural community in 1824 (Knox-Johnston, 1989). During the 19th century Port Natal (renamed Durban after of the Governor of the Cape in 1835) was the principal harbour on the KZN coast, although small harbours were established at Scottburgh and Umkomaas in 1850 and 1861 respectively to export sugar (https://en.wikipedia.org/wiki/Scottburgh; https://en.wikipedia.org/wiki/Umkomaas), at Port Shepstone on the Mzimkulu River 120 km south of Durban in 1867 after the discovery of marble in the area (https://en.wikipedia.org/wiki/Port_Shepstone), and at Richards Bay in the Mhlatuze River lagoon during the Anglo-Zulu War of 1879 (https://en.wikipedia.org/wiki/Richards_Bay)

As a result, the records consulted for this study show a concentration of historical shipwrecks at KZN's historical ports, with relatively few wrecks in the areas in between.

There are, for example, at least 170 recorded wrecks in the immediate vicinity of Durban. In addition, the remains of nearly a dozen whalers and other vessels that were scuttled during the 20th century are charted by the SANHO to the east and south-east of Durban (see **Figure 5** below). These positions for these charted wrecks are relatively accurate, but those available for most of the historical shipwrecks are less so.

6.3.1 Amanzimtoti

Amanzimtoti, named according to local legend by the Zulu king Shaka for the sweetness of the water in the river, has no specific maritime history or heritage. The town developed around the Adams Mission, established inland of the modern town in 1836 by an American missionary, Dr Netwon Adams. A mission school, Adams College, was established in 1853 and still exists.

In 1897 the area was still largely rural (**Plate 2**) when a railway station was built at Amanzimtoti on the new line down the coast from Durban, and this improved access from Durban resulted in the growth of the town into the modern beach resort it is today (https://en.wikipedia.org/wiki/Amanzimtoti) (**Plate 3**).

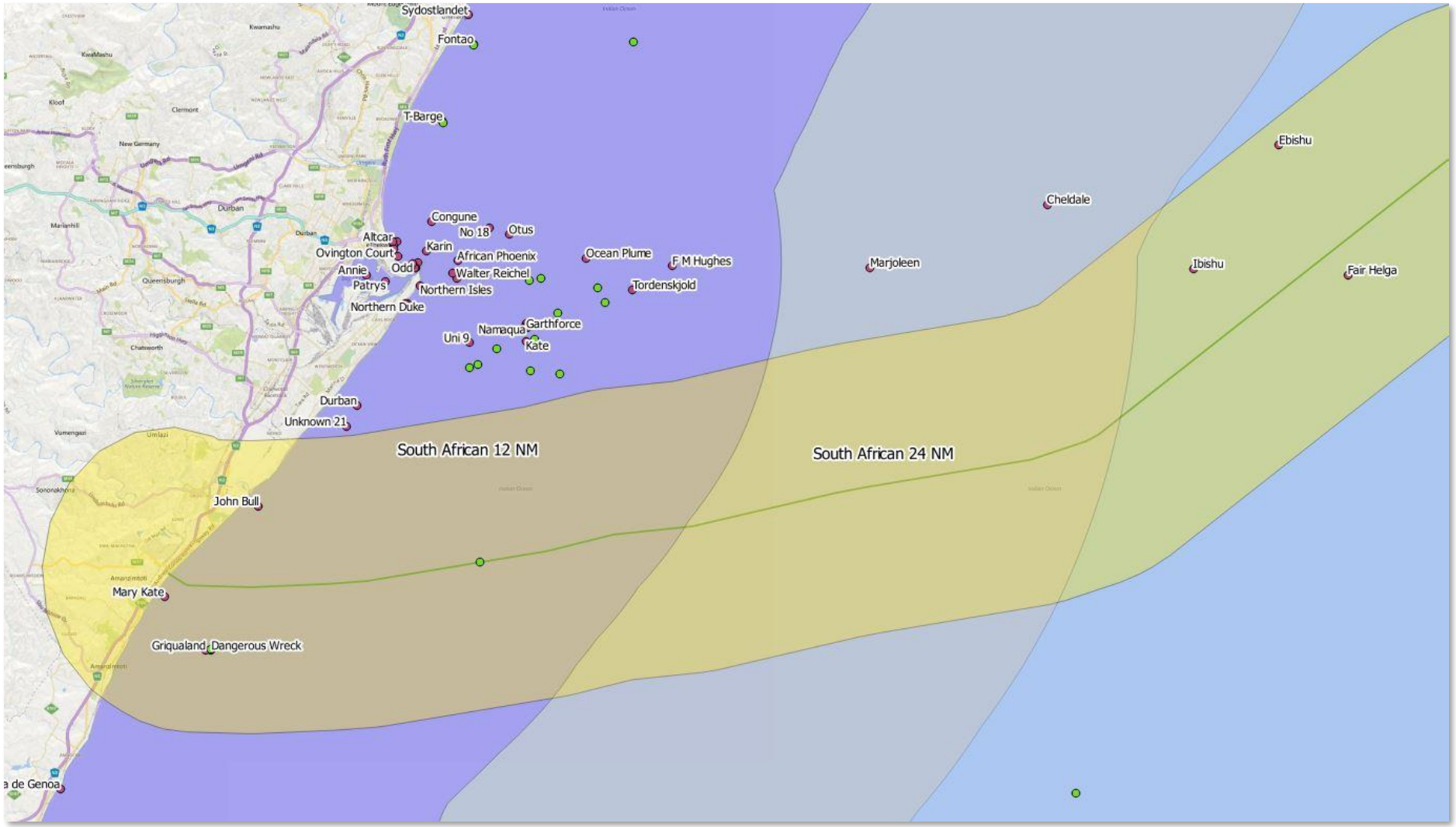

Figure 5: Known and recorded wrecks in the subsea cable route Marine Study Area within 24 nautical miles of the baseline. The 20 km study area shown as the yellow polygon. The green points on the image are unnamed SANHO charted wrecks. The green point on the subsea cable route is the SANHO "Position Approximate" wreck described in the report text. Please note that the number of wrecks shown around Durban is not a true reflection of the total number known.

Plate 2: Photograph of Amanzimtoti c. 1895-1900 (Source: http://www.oberlinlibstaff.com/omeka_anthro/items/show/86)

Plate 3: Bathing at the Chain Rocks, Amanzimtoti late 19th/early 20th century (Source: https://southcoastsun.co.za)

6.4 *Shipwrecks in the Marine Study Area*

According to the available records, there are only three known wrecks within the 20 km Marine Study Area around the proposed subsea cable route alignment in the contiguous zone and territorial waters. These are the *John Bull*, *Griqualand* and *Mary Kate* and they are described below (see also **Appendix A**).

6.4.1 John Bull (1948)

The *John Bull* was a 15 ton Durban-based fishing boat which sank off Isipingo on 2 December 1948 after being hit by a freak 10 m wave. Four people died. No further information about this vessel is available.

6.4.2 Griqualand (1970)

The *Griqualand* was a motor coaster chartered by the Green 'R' Line which served ports around the South African coast (**Plate 4**). She was lost in strange circumstances in November 1970 when, shortly after leaving Durban with a cargo of spirits and petrochemicals, there was an explosion in her holds which set her highly inflammable cargo alight. After futile attempts by salvage tugs to douse the blaze and tow her offshore she was sunk by gunfire from HMS *Dido* (**Plate 5**). There were no casualties (Ingpen, 1979).

The wreck still contains part of its cargo of liquid chlorine and is considered dangerous.

Plate 4: The coaster *Griqualand* (Source: https://www.balticshipping.com/vessel/imo/5329293)

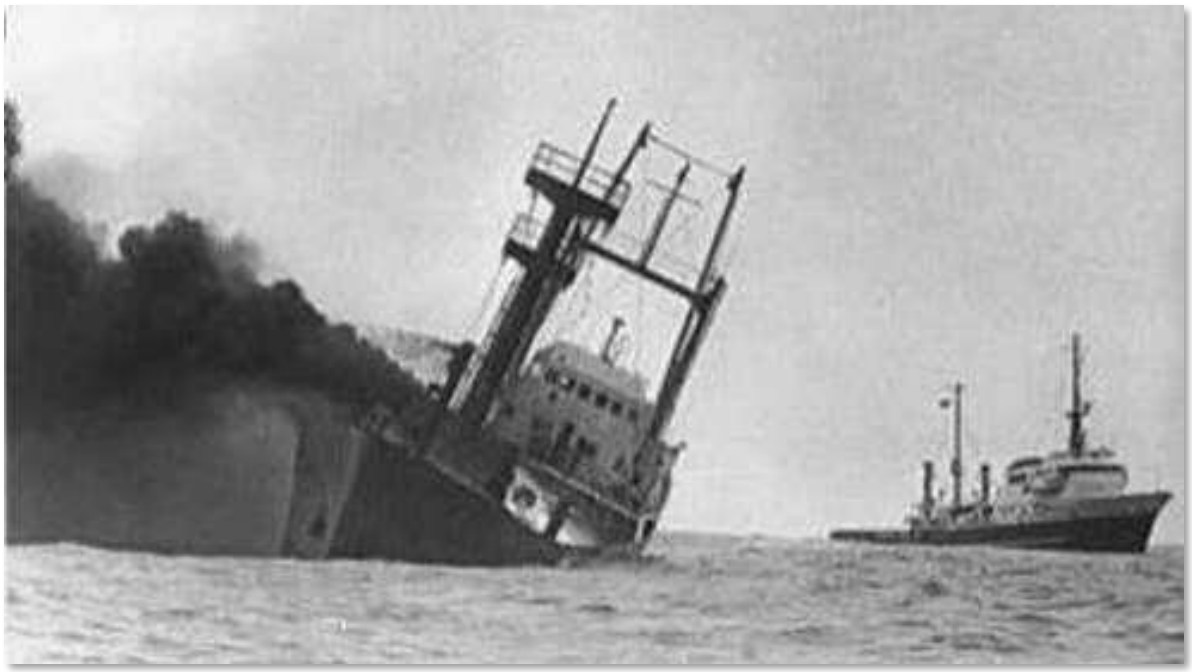

Plate 5: The *Griqualand* ablaze in November 1970 with the tug *Statesman* standing by (Source: https://www.wrecksite.eu/)

6.4.3 Mary Kate (1976)

The *Mary Kate* was another fishing vessel which foundered off Amanzimtoti on 27 December 1976. No further information about this vessel is available.

Although the accurate positions of these wrecks is not known, based on the descriptions of these casualties in the historical record it is safe to assume that they are sufficiently distant from the cable route to be discounted as potential risks to the Project.

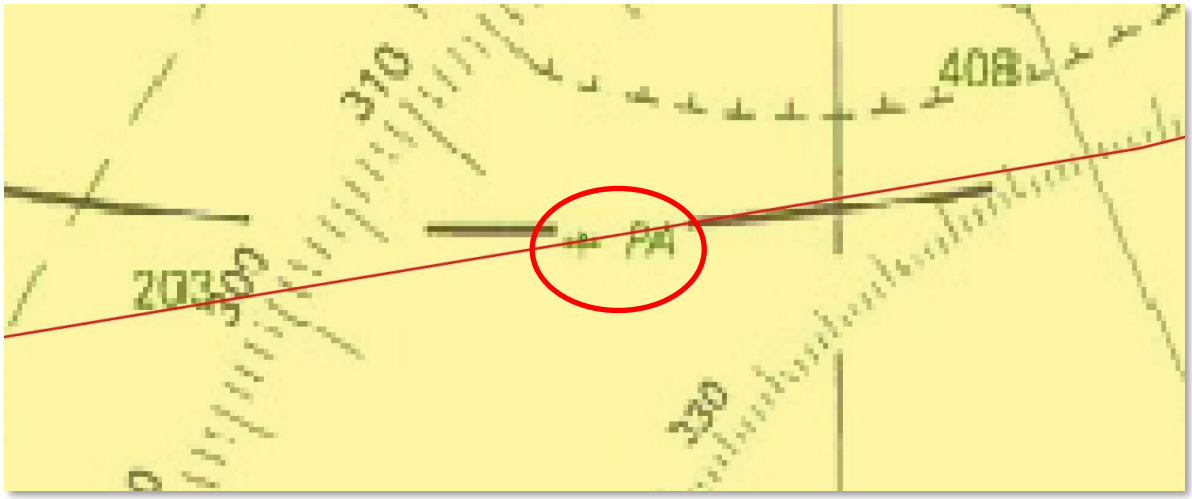

Figure 6: The SANHO wreck charted as "Position Approximate" (PA) (circled) which lies within 40 m of the subsea cable route alignment (Source: SAN Chart 0135)

Two unidentified wrecks charted by the SANHO are also within the Marine Study Area. The first is probably the *Griqualand* and its given position is likely to be relatively accurate. The

identity of the second wreck, however, is not known and the chart gives its position as approximate. This latter wreck lies within 40 m of the proposed subsea cable alignment, approximately 45 km from the landfall (**Figure 6** above).

A last point to make is that only one of the known wrecks in the Marine Study Area (*John Bull*) is currently less than 60 years of age and thus protected by the NHRA as a heritage resource.

6.5 *Shipwrecks within the EEZ*

Further offshore, within the EEZ there are two recorded wrecks within the Marine Study Area: the whaler *Fair Helga*, which sank in 1927 and a crayfish boat, the *Ibishu*, lost in 1967. Confidence in the positions of both wrecks is extremely low.

Although the remit of the NHRA does not extend to these two wrecks in respect of this Project (see Section 4.3 above) their presence is worth noting as a potential risk to Project plant and to the subsea cable.

7 Impact Assessment

To minimise subjectivity and accurately assess the Project impacts, the impact assessment methodology supplied by ERM and shown in Apprndix D has been followed.

It is important to note that with respect to determnining the magnitude of impacts heritage receptors do not fit comfortably into the either of the two categories provided, namely biophysical impacts and socio-economic impacts. The best fit is biophysical impacts and this has been used for this impact assessment.

7.1 *Submerged Prehistory*

The available information about the palaeolandscapes of the KZN continental shelf suggests that while no submerged pre-colonial archaeological sites or material are known from the Amanzimtoti area, the potential exists for such material to be present associated with the palaeochannel of the Amanzimtoti River or with any aeolianite reefs offshore.

7.1.1 Impact Description

The risk to submerged prehistoric archaeological resources from the installation of the proposed subsea cable is from **direct impacts** that can arise from the physical penetration and disturbance of the seabed during cable burial, or where the plough or ROV encounters heritage resources, on the seabed surface

7.1.2 Impact Assessment

Where direct impacts from the installation of the proposed subsea cable occur these will be **permanent** as heritage resources are non-renewable and cannot recover from disturbance or damage. The **extent** of impacts are likely to be on-site and their **scale** will be limited to the footprint of the area disturbed by the Project – in this case the maximum extent will probably be the plough zone.

7.1.3 Mitigation

The small footprint and limited penetration of the seabed intervention associated with the burial of the subsea cable mean that it is likely to affect only unconsolidated surface Holocene

sediments. This suggests that the potential for interaction with or direct impact on submerged prehistoric archaeological material is **unlikely**.

No mitigation is therefore proposed in respect of potential submerged prehistoric archaeology in the Marine Study Area and the potential residual impact on submerged prehistoric archaeology is **Moderate**.

Table 2: Significance of Impacts on Submerged Prehistoric Archaeological Resources

Characteristic	**Impact**	**Residual Impact**
Extent	Local (On-site)	Local (On-site)
Duration	Permanent	Permanent
Scale	The footprint of the area disturbed by project activities. Probably the maximum extent of the plough zone for this receptor	The footprint of the area disturbed by project activities. Probably the maximum extent of the plough zone for this receptor
Reversibility	Irreversible	
Loss of resource	High – Any archaeological material disturbed or destroyed is essentially lost and cannot be replaced or renewed	
Magnitude	Small – the limited penetration of the seabed intervention means that activities are likely to affect only unconsolidated surface Holocene sediments. Furthermore, the extent of impacts is likely to be on-site and their scale will be limited to the footprint of the area disturbed by the Project.	Small - the limited penetration of the seabed intervention means that activities are likely to affect only unconsolidated surface Holocene sediments. Furthermore, the extent of impacts is likely to be on-site and their scale will be limited to the footprint of the area disturbed by the Project.
Sensitivity/Vulnerability/Importance of the Resource/Receptor	High – heritage resources are finite and non-renewable and are protected under the terms of the National Heritage Resources Act (1999)	High - heritage resources are finite and non-renewable and are protected under the terms of the National Heritage Resources Act (1999)
Significance of Impact	**Moderate**	**Moderate**

7.2 *Shipwrecks*

Although there is a large concentration of historical shipwrecks around Durban, only a handful are recorded in the vicinity of the proposed subsea cable alignment within the 24 nautical mile limit of the contiguous zone covered by this report.

The *John Bull* off Isipingo is roughly 8 km north of the subsea cable alignment, and the positions given for the *Griqualand* are more than 4.5 km south of the proposed subsea cable route. Neither of these wrecks is likely to affected by the installation of the subsea cable.

7.2.1 Impact Description

The risk to historical shipwrecks from the installation of the proposed subsea cable is from **direct impacts** that can arise from contact during pre-lay grapnel runs, from the physical penetration and disturbance of the seabed during cable burial, or where the plough or ROV encounters a wreck on the seabed surface.

7.2.2 Impact Assessment

The two wrecks at most risk of impacts from the Project are the *Mary Kate*, recorded as lost off Amanzimtoti and the SANHO charted wreck marked as “Position Approximate” which is less than 40 m from the current route alignment.

Any direct impacts from the installation of the proposed subsea cable occur on historical shipwrecks will be **permanent** as heritage resources are non-renewable and cannot recover from disturbance or damage. The **extent** of impacts are likely to be on-site and their **scale** will be limited to the footprint of the area disturbed by the project.

Because of the risk wrecks pose to seabed machinery and to the subsea cable, the route alignment will always be adjusted to avoid wrecks, which makes the potential for any interaction with or impact on historical wrecks by the installation of the proposed METISS subsea cable unlikely, except during pre-lay grapnel runs where the risk of impact is greater.

7.2.3 Mitigation

The archaeological review of geophysical data, particularly sidescan sonar and multibeam bathymetry, is recommended before the grapnel run or subsea cable laying to locate the SANHO "Position Approximate" wreck and ensure that the wrecks of the *Fair Helga*, and *Ibishu* will not be affected by, or affect the subsea cable or cable-laying machinery. The geophysical data review has the additional benefit of identifying any previously unknown wrecks on the seabed within the subsea cable route corridor.

In the event a previously unknown or unrecorded shipwreck is encountered during the grapnel run or installation of the subsea cable, the Project archaeologist and SAHRA must be notified immediately. If the wreck will be impacted by the subsea cable laying, all work must cease until the archaeologist and SAHRA have assessed the significance of the site and a decision has been taken as to how to deal with it.

Table 3: Significance of Impacts on Historical Shipwrecks

Characteristic	**Impact**	**Residual Impact**
Extent	On-site	On-site
Duration	Permanent	Permanent
Scale	The footprint of the area disturbed by project activities. Probably the maximum extent of the plough zone for this receptor	Unknown wrecks maybe damaged if present
Reversibility	Irreversible	
Loss of resource	High – Any archaeological material disturbed or destroyed is essentially lost and cannot be replaced or renewed	
Magnitude	Small	Negligible
Sensitivity/Vulnerability/Importance of the Resource/Receptor	High – heritage resources are finite and non-renewable and are protected under the terms of the National Heritage Resources Act (1999)	Low – Sites will be avoided through the implementaiotn of mitigation measures
Significance of Impact	**Moderate**	**Negligible**

8 Mitigation

No mitigation is required or proposed in respect of potential submerged prehistoric archaeology in the Marine Study Area.

In respect of shipwrecks, the archaeological review of geophysical data, particularly sidescan sonar and multibeam bathymetry, is recommended to locate the SANHO "Position Approximate" wreck and ensure that the wrecks of the *Fair Helga*, and *Ibishu* will not be

affected by, or affect the subsea cable or cable-lay plant. The geophysical data review also has the benefit of identifying previously unknown wrecks on the seabed within the subsea cable route corridor. There should be early communication between the geophysical and archaeological contractors on the Project with regard to this archaeological data review.

In the event a previously unknown or unrecorded shipwreck is encountered during the installation of the subsea cable, the Project archaeologist and SAHRA must be notified immediately. If the wreck will be impacted by the cable laying, all work must cease until the archaeologist and SAHRA have assessed the significance of the site and a decision has been taken as to how to deal with it.

9 Conclusion

Provided the mitigation measures recommended above are implemented, the maritime elements of the proposed METISS subsea cable system are unlikely to have any impact on known or unknown maritime and underwater cultural heritage resources and are considered archaeologically acceptable.

Any impact from the Project on previously unknown shipwreck or other maritime archaeological material encountered during the cable laying can be dealt with through the implementation of the mitigation measures proposed in this report.

10 References

Avery, G. 1975. Discussion on the Age and Use of Tidal Fish-Traps. *South African Archaeological Bulletin*, 30: 105-113.

Axelson, E. 1973., *The Portuguese in South-East Africa, 1488-1600*. Wits University Press. Johannesburg.

Bosman, C., Uken, R., and Smith, A.M. 2005. The bathymetry of the Aliwal Shoal, Scottburgh, South Africa. *South African Journal of Science* 101: 1-3.

Cawthra, H.C., Uken, R. and Ovechkina, M.N. 2012. New Insights into the Geological Evolution of the Durban Bluff and Adjacent Blood Reef, South Africa. *South African Journal of Geology*, 115.3: 291-308.

Cawthra, H.C., Compton, J.S., Fisher, E.C., Machutchon, M.R. and Marean, C.W. 2016. Submerged shorelines and landscape features offshore of Mossel Bay, South Africa. In Harff, J., Bailey, G. and Luth, F. (eds). *Geology and Archaeology: Submerged Landscapes of the Continental Shelf*. Geological Society, London, Special Publications, 411, 219– 233.

Chirikure, S. 2014. Land and Sea Links: 1500 Years of connectivity between southern Africa and the Indian Ocean rim regions, AD 700 to 1700. *African Archaeological Review*, 31:4, 705-724.

Compton, J.S. 2011. Pleistocene sea-level fluctuations and human evolution on the southern coastal plain of South Africa. *Quaternary Science Reviews* 30: 506-527.

Dladla, N.N. 2013. *Seismic-Stratigraphic Models for Late Pleistocene/Holocene Incised Valley Systems on the Durban Continental Shelf*, Unpublished MSC Thesis, University of KwaZulu-Natal.

Fisher, E.C., Bar-Matthews, M., Jeradino, A. and Marean, C.W., 2010, Middle and Late Pleistocene paleoscape modeling along the southern coast of South Africa, in *Quaternary Science Reviews*, Vol 29, pp 1382-1398.

Fitch, S., Thomson, K. and Gaffney, V. 2005. Late Pleistocene and Holocene depositional systems and the palaeogeography of the Dogger Bank, North Sea. *Quaternary Research,* 64, 185-196.

Garlake, P.S. 1968. The Value of Imported Ceramics in the Dating and Interpretation of the Rhodesian Iron Age. *The Journal of African History* 9:1, 13-33.

Goodwin, A.J.H. 1946. Prehistoric fishing methods in South Africa. *Antiquity* 20: 1-8.

Green, A.N. and Garlick, G.L. 2011. A sequence stratigraphic framework for a narrow, current-swept continental shelf: the Durban Bight, central KwaZulu-Natal, South Africa. *Journal of African Earth Sciences*, 60, 303-314.

Gribble, J. 2002. The Past, Present and Future of Maritime Archaeology in South Africa. *International Handbook of Underwater Archaeology* (eds Ruppe and Barstad). New York. Plenum Press.

Gribble, J. 2005. The ocean baskets: pre-colonial fish traps on the Cape south coast. *The Digging Stick* 22: 1-4.

Gribble, J. and Sharfman, J. 2013. Maritime Legal Management in South Africa. *Online Encyclopaedia of Global Archaeology*, pp 6802-6810.

Hine, P.H. 2008. *Stone-Walled Tidal Fish Traps: An Archaeological and Archival Investigation*. Unpublished Masters Thesis. University of Cape Town.

Hine, P.H., Sealy, J., Halkett, D. and Hart. T. 2010. *Antiquity of stone-walled tidal fish traps on the Cape Coast, South Africa*. South African Archaeological Bulletin 65:191, 35-44.

Huffman, T.N. 1972. The Rise and Fall of Zimbabwe. *The Journal of African History* 13:3, 353-366.

Ingpen, B.D., 1979, *South African Merchant Ships: An illustrated recent history of coasters, colliers, containerships, tugs and other vessels*, A.A. Balkema, Cape Town.

Kemp, L.V. 2006. Ancient stonewall fish traps on the south coast of South Africa: documentation, current use, ecological effects and management implications. Unpublished Masters Thesis. University of Cape Town.

Knox-Johnston, R. 1989. *The Cape of Good Hope: A Maritime History*. Hodder and Stoughton. London.

Martin A.K. and Flemming B.W. 1988. *Physiography, structure, andgeological evolution of the Natal continental shelf. In Coastal Ocean Studies off Natal, South Africa*. Lecture Notes on Coastal and Estuarine Studies, vol. 26, ed. E.H.Schumann, pp. 11–46. Springer-Verlag, New York.

Peeters, H., Murphy, P., Flemming, N. (eds), 2009, *North Sea Prehistory Research and Management Framework*, Amersfoort.

Peeters, H., 2011, How Wet Can It Get? – Approaches to submerged prehistoric sites and landscapes on the Dutch continental shelf, in Benjamin, J., Bonsall, C., Pickard, C., and Fischer, A. (eds), *Submerged Prehistory*, Oxbow Book, Oxford and Oakville.

Pollard, E., Bates, R., Ichumbaki, E.B. and Bita, C. 2016. Shipwreck Evidence from Kilwa, Tanzania. *The International Journal of Nautical Archaeology* 45:2, 352–369.

Rohling, E.J., Grant, K., Bolshaw, M., Roberts, A. P., Siddall, M., Hemleben, Ch., and Kucera, M. 2009. Antarctic temperature and global sea level closely coupled over the past five glacial cycles. *Nature Geoscience*, 2 July 2009.

Turner, M. 1988. *Shipwrecks and Salvage in South Africa: 1505 to the Present*. C Struik. Cape Town.

Van Andel, T.H., 1989, Late Pleistocene Sea Levels and the Human Exploitation of the Shore and Shelf of the Southern South Africa, *Journal of Field Archaeology*, Vol 16, No 2, pp 133-155.

Van den Bosch, F., 2014, *A Database of South African and Namibian Shipwrecks*, CD Rom.

Waelbroeck, C., Labeyrie, L., Michela, B.E., Duplessy , J.C., McManus, J.F., Lambeck, K., Balbon, E., and Labracherie, M. 2002. Sea-level and deep water temperature changes derived from benthic foraminifera isotopic records. *Quaternary Science Reviews*, 21: 295–305.

Werz, B.E.J.S and Flemming, N.C. 2001. Discovery in Table Bay of the oldest handaxes yet found underwater demonstrates preservation of hominid artefacts on the continental shelf. *South African Journal of Science* 97: 183-185.

Werz, B.E.J.S., Cawthra, H.C. and Compton, J.S. 2014. Recent Developments in African Offshore Prehistoric Archaeological Research, with an Emphasis on South Africa. In Evans, A.M., Flatman, J.C. and Flemming, N.C. (Eds) *Prehistoric Archaeology on the Continental Shelf: A Global Review*. Springer Science and Business Media. New York. 233-253.

Wood, M. 2012. Interconnections. Glass beads and trade in southern and eastern Africa and the Indian Ocean – 7th to 16th centuries AD. *Studies in Global Archaeology*, 17, 62 pp.

10.1 *Online Resources*

South African Heritage Resources Information System (Accessed online on 21 November 2018) http://www.sahra.org.za/sahris

What kind of projects does the AIMURE undertake? (Accessed online on 21 November 2018) http://www.aimure.org/index.php/aimure-projects

Navegacoes Portuguesas (Accessed online on 21 November 2018) http://cvc.instituto-camoes.pt/navegaport/a31.html

Port Shepstone (Accessed online on 21 November 2018) https://en.wikipedia.org/wiki/Port_Shepstone

Scottburgh (Accessed online on 21 November 2018) https://en.wikipedia.org/wiki/Scottburgh

Umkomaas (Accessed online on 21 November 2018) https://en.wikipedia.org/wiki/Umkomaas

Richards Bay (Accessed online on 21 November 2018) https://en.wikipedia.org/wiki/Richards_Bay

Appendix A: Gazetteer of Known Shipwrecks within 20 km Buffer Zone

Ship Name	Area	Place	EventType	Ship Type	Nationality	Date	Notes
Griqualand	Durban	Amanzimtoti	Sunk	Coaster	South African	1970-11-14	Vessel caught fire shortly after leaving Durban. She was sunk by gunfire from a British frigate, the HMS Dido, 15km south of Durban, and 8km offshore. Her crew of 12 were all saved.
John Bull	Isipingo	Isipingo	Foundered	Fishing Vessel	South African	1948-12-02	Vessel struck by 30ft wave and sank. 4 lives lost.
Mary Kate	Amanzimtoti	Amanzimtoti	Foundered	Fishing Vessel	South African	1976-12-27	Foundered in heavy seas off Amanzimtoti.

Appendix B: Specialist's CV

Name:	John Gribble
Profession:	Archaeologist
Date of Birth:	15 November 1965
Parent Firm:	ACO Associates cc
Position in Firm:	Senior Archaeologist
Years with Firm:	1
Years of experience:	28
Nationality:	South African
HDI Status:	n/a

Education:

1979-1983	Wynberg Boys' High School (1979-1983)
1986	BA (Archaeology), University of Cape Town
1987	BA (Hons) (Archaeology), University of Cape Town
1990	Master of Arts, (Archaeology) University of Cape Town

Employment:

- ACO Associates, Senior Archaeologist and Consultant, September 2017 – present
- South African Heritage Resources Agency, Manager: Maritime and Underwater Cultural Heritage Unit, 2014 – 2017 / Acting Manager: Archaeology, Palaeontology and Meteorites Unit, 2016-2017
- Sea Change Heritage Consultants Limited, Director, 2012 – present
- TUV SUD PMSS (Romsey, United Kingdom), Principal Consultant: Maritime Archaeology, 2011-2012
- EMU Limited (Southampton, United Kingdom), Principal Consultant: Maritime Archaeology, 2009-2011
- Wessex Archaeology (Salisbury, United Kingdom), Project Manager: Coastal and Marine , 2005-2009
- National Monuments Council / South African Heritage Resources Agency, Maritime Archaeologist, 1996-2005
- National Monuments Council, Professional Officer: Boland and West Coast, Western Cape Office, 1994-1996

Professional Qualifications and Accreditation:

- Member: Association of Southern African Professional Archaeologists (No. 043)
- Principal Investigator: Maritime and Colonial Archaeology, ASAPA CRM Section
- Field Director: Stone Age Archaeology, ASAPA CRM Section
- Member: Chartered Institute for Archaeologists (CIfA), United Kingdom
- Class III Diver (Surface Supply), Department of Labour (South Africa) / UK (HSE III)

Experience:

I have nearly 30 years of combined archaeological and heritage management experience. After completing my postgraduate studies, which were focussed on the vernacular architecture of the West Coast, and a period of freelance archaeological work in South Africa and aboard, I joined the National Monuments Council (NMC) (now the South African Heritage Resources Agency (SAHRA)) in 1994. As the Heritage Officer: the Boland I was involved in day to day historical building control and heritage resources management across the region. In 1996 I become the NMC's first full-time maritime archaeologist in which role was responsible for the management and protection of underwater cultural heritage in South Africa under the National Monuments Act, and subsequently under the National Heritage Resources Act.

In 2005 I moved to the UK to join Wessex Archaeology, one of the UK's biggest archaeological consultancies, as a project manager in its Coastal and Marine Section. In 2009 I joined Fugro EMU Limited, a marine geosurvey company based in Southampton to set up their maritime archaeological section. I then spent a year at TUV SUD PMSS, an international renewable energy consultancy based in Romsey, where I again provided maritime archaeological consultancy services to principally the offshore renewable and marine aggregate industries.

In August 2012 I set up Sea Change Heritage Consultants Limited, a maritime archaeological consultancy. Sea Change provides archaeological services to a range of UK maritime sectors, including marine aggregates and offshore renewable energy. It also actively pursues opportunities to raise public awareness and understanding of underwater cultural heritage through educational and research projects and programmes, including some projects being developed in South Africa.

Projects include specialist archaeological consultancy for more than 15 offshore renewable energy projects and more than a dozen offshore aggregate extraction licence areas.

In addition to managing numerous UK development-driven archaeological projects, I have also been involved in important strategic work which developed guidance and best practice for the offshore industry with respect to the marine historic environment. This has included the principal authorship of two historic environment guidance documents for COWRIE and the UK renewable energy sector, and the development of the archaeological elements of the first Regional Environmental Assessments for the UK marine aggregates industry. In 2013-14 I was lead author and project co-ordinator on the Impact Review for the United Kingdom of the 2001 UNESCO Convention on the Protection of the Underwater Cultural Heritage. In 2016 I

was co-author of a Historic England / Crown Estate / British Marine Aggregate Producers Association funded review of marine historic environment best practice guidance for the UK offshore aggregate industry (.

I returned to South African in mid-2014 where I was re-appointed to my earlier post at SAHRA: Manager of the Maritime and Underwater Cultural Heritage Unit. In July 2016 I was also appointed Acting Manager of SAHRA's Archaeology, Palaeontology and Meteorites Unit.

I left SAHRA in September 2017 to join ACO Associates as Senior Archaeologist and Consultant.

I have been a member of the ICOMOS International Committee for Underwater Cultural Heritage since 2000 and have served as a member of its Bureau since 2009. I am currently the secretary of the Committee.

I have been a member of the Association of Southern African Professional Archaeologists for more than twenty years and am accredited by ASAPA's CRM section. I have been a member of the UK's Chartered Institute for Archaeologist's (CIfA) since 2005, and served on the committee of its Maritime Affairs Group between 2008 and 2010. Since 2010 I have been a member of the UK's Joint Nautical Archaeology Policy Committee.

I am currently a member of the Advisory Board of the George Washington University / Iziko Museums of South Africa / South African Heritage Resources Agency / Smithsonian Institution 'Southern African Slave Wrecks Project' and serve on the Heritage Western Cape Archaeology, Palaeontology and Meteorites Committee.

Books and Publications:

Gribble, J. and Scott, G., 2017, *We Die Like Brothers: The sinking of the SS Mendi*, Historic England, Swindon

Lloyd Jones, D., Langman, R., Reach, I., Gribble, J., and Griffiths, N., 2016, Using Multibeam and Sidescan Sonar to Monitor Aggregate Dredging, in C.W. Finkl and C. Makowski (eds) *Seafloor Mapping along Continental Shelves: Research and Techniques for Visualizing Benthic Environments, Coastal Research Library 13*, Springer International Publishing, Switzerland, pp 245-259.

Athiros, G. and Gribble, J., 2015, *Wrecked at the Cape Part 2*, The Cape Odyssey 105, Historical Media, Cape Town.

Gribble, J. and Sharfman, J., 2015, The wreck of SS Mendi (1917) as an example of the potential trans-national significance of World War I underwater cultural heritage, *Proceedings of the UNESCO Scientific Conference on the Underwater Cultural Heritage from World War I*, Bruges, 26-28 June 2014.

Gribble, J., 2015, Underwater Cultural Heritage and International Law. Cambridge by Sarah Dromgoole, in *South African Archaeological Bulletin*, 70, 202, pp 226-227.

Athiros, G. and Gribble, J., 2014, *Wrecked at the Cape Part 1*, The Cape Odyssey 104, Historical Media, Cape Town.

Gribble, J., 2014, Learning the Hard Way: Two South African Examples of Issues Related to Port Construction and Archaeology, in Dredging and Port Construction: Interactions with Features of Archaeological or Heritage Interest*, PIANC Guidance Document 124*, pp 97-107.

UK UNESCO 2001 Convention Review Group, 2014, *The UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001: An Impact Review for the United Kingdom*, ISBN 978-0-904608-03-8.

Sadr, K., Gribble, J. and Euston-Brown, G, 2013, Archaeological survey on the Vredenburg Peninsula, in Jerardino et al. (eds), *The Archaeology of the West Coast of South Africa*, BAR International Series 2526, pp 50-67

Gribble, J. and Sharfman, J, 2013, Maritime Legal Management in South Africa, *Online Encyclopaedia of Global Archaeology*, pp 6802-6810.

Gribble, J., 2011, The UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001, *Journal of Maritime Archaeology* 6:1 77-86.

Gribble, J., 2011, The SS Mendi, the Foreign Labour Corps and the trans-national significance of shipwrecks, in J. Henderson (ed.): *Beyond Boundaries, Proceedings of IKUWA 3, The 3rd International Congress on Underwater Archaeology*, Römisch-Germanische Kommission (RGK), Frankfurt.

Gribble, J., 2011, Competence and Qualifications, in Guèrin, U., Egger, B. and Maarleveld, T. (eds) *UNESCO Manual for Activities directed at Underwater Cultural Heritage*, UNESCO - Secretariat of the 2001 Convention, Paris.

Gribble, J. and Leather, S. for EMU Ltd., 2010, *Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector*. Commissioned by COWRIE Ltd (project reference GEOARCH-09).

Sadr, K and Gribble, J., 2010, The stone artefacts from the Vredenburg Peninsula archaeological survey, west coast of South Africa, *Southern African Humanities* 22: 19–88.

Gribble, J., 2009, HMS Birkenhead and the British warship wrecks in South African waters in *Proceedings of the Shared Heritage Seminar*, University of Wolverhampton, 8 July 2008

Gribble, J., Parham, D. and Scott-Ireton, D., 2009, Historic Wrecks: Risks or Resources? In *Conservation and Management of Archaeological Sites*, Vol. 11 No. 1, March, 2009, 16–28.

Gribble, J. and Athiros, G., 2008, *Tales of Shipwrecks at the Cape of Storms*, Historical Media, Cape Town.

Gribble, J., 2008, The shocking story of the ss Mendi, in *British Archaeology*, March/April 2008.

Gribble, J., 2007, The Protection of the Underwater Cultural Heritage: National Perspectives in light of the UNESCO Convention 2001 by Sarah Dromgoole, in *The International Journal of Nautical Archaeology*, 36, 1, pp 195-6.

Gribble, J., 2006, The Sad Case of the ss Maori, in Grenier, R., D. Nutley and I. Cochran (eds) *Underwater Cultural Heritage at Risk: Managing Natural and Human Impacts*, pp 41-43, ICOMOS, Paris

Gribble, J., 2006, Pre-Colonial Fish Traps on the South Western Cape Coast, South Africa, in Grenier, R., D. Nutley and I. Cochran (eds) *Underwater Cultural Heritage at Risk: Managing Natural and Human Impacts*, pp 29-31, ICOMOS, Paris.

Forrest, C.S.J., and Gribble, J., 2006, The illicit movement of underwater cultural heritage: The case of the Dodington coins, in *Art and Cultural Heritage: Law, Policy and Practice*, (ed B.T. Hoffman), New York, Cambridge University Press.

Forrest, C.S.J., and Gribble, J., 2006, Perspectives from the Southern Hemisphere: Australia and South Africa, in *The UNESCO Convention for the Protection of the Underwater Heritage: Proceedings of the Burlington House Seminar*, October 2005, JNAPC / NAS.

Gribble, J., 2003, "Building with Mud" – Developing historical building skills in the Karoo, in ICOMOS South Africa, in *The Proceedings of Symposium on Understanding and using urban heritage in the Karoo*, Victoria West, South Africa, 3-5 March 2002.

Forrest, C.S.J., and Gribble, J., 2002, The illicit movement of underwater cultural heritage: The case of the Dodington coins, *International Journal of Cultural Property*, Vol II (2002) No 2, pp 267-293.

Gribble, J. 2002, The Past, Present and Future of Maritime Archaeology in South Africa, *International Handbook of Underwater Archaeology* (eds Ruppe and Barstad), New York, Plenum Press.

Thackeray, F. and Gribble, J., 2001, Historical Note on an Attempt to Salvage Iron from a Shipwreck, *Looking Back*, Vol 40, November 2001, pp 5-7.

Gribble, J., 1998, Keeping Our Heads Above Water – the development of shipwreck management strategies in South Africa, *AIMA Bulletin*, Vol 22, pp 119-124.

Gribble, J. 1996, Conservation Practice for Historical Shipwrecks, Monuments and Sites of South Africa, Colombo, Sri Lanka, ICOMOS 11th General Assembly.

Gribble, J. 1996, National Databases on Monuments and Sites, Monuments and Sites of South Africa, Colombo, Sri Lanka, ICOMOS 11th General Assembly.

Sadr, K, Gribble, J, & Euston-Brown, G L, 1992 The Vredenburg Peninsula survey, 1991/1992 season, *Guide to Archaeological Sites in the South-western Cape, Papers compiled for the South African Association of Archaeologists Conference*, July 1992, by A.B. Smith & B. Mutti, pp 41-42.

Smith, AB, Sadr, K, Gribble, J, & Yates, R., 1992 Witklip and Posberg Reserve, *Guide to Archaeological Sites in the South-western Cape*, Papers compiled for the South African Association of Archaeologists Conference, July 1992, by A.B. Smith & B. Mutti, pp 31-40.

Smith, AB, Sadr, K, Gribble, J & Yates, R., 1991, Excavations in the south-western Cape, South Africa, and the archaeological identity of prehistoric hunter-gatherers within the last 2000 years, *The South African Archaeological Bulletin* 46: 71-91.

Appendix C: Details Of Specialist and Declaration of Interest

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

ASN Africa METISS Subsea Fibre Optic Cable System

Specialist:	Maritime Heritage		
Contact person:	John Gribble		
Postal address:	Unit D17, Prime Park, Mocke Road, Diep River		
Postal code:	7800	Cell:	0786162961
Telephone:	021 706 4104	Fax:	
E-mail:	john.gribble@aco-associates.com		
Professional affiliation(s) (if any)	Member: ASAPA		

Project Consultant:			
Contact person:			
Postal address:			
Postal code:		Cell:	
Telephone:		Fax:	
E-mail:			

4.2 The specialist appointed in terms of the Regulations_

I, John Gribble, declare that -- General declaration:

I act as the independent specialist in this application;
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
I will comply with the Act, Regulations and all other applicable legislation;
I have no, and will not engage in, conflicting interests in the undertaking of the activity;
I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
all the particulars furnished by me in this form are true and correct; and
I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

ACO Associates

Name of company (if applicable):

28 February 2019

Date:

Appendix D: Impact Assessment Methodology

10.2 *Assumptions and Limitations*

Impact Assessment is a process that aims to identify and anticipate possible impacts based on past and present baseline information. As the EIA deals with the future there is, inevitably, some uncertainty about what will actually happen in reality. Impact predictions have been made based on field surveys and with the best data, methods and scientific knowledge available at this time. However, some uncertainties could not be entirely resolved. Where significant uncertainty remains in the impact assessment, this is acknowledged and the level of uncertainty is provided.

In line with best practice, this EIA has adopted a precautionary approach to the identification and assessment of impacts. Where it has not been possible to make direct predictions of the likely level of impact, limits on the maximum likely impact have been reported and the design and implementation of the project (including the use of appropriate mitigation measures) will ensure that these are not exceeded. Where the magnitude of impacts cannot be predicted with certainty, the team of specialists has used professional experience to judge whether a significant impact is likely to occur or not. Throughout the assessment, this conservative approach has been adopted to the allocation of significance.

10.3 *Impact Identification and Characterisation*

An 'impact' is any change to a resource or receptor caused by the presence of a Project component or by a Project-related activity. Impacts can be negative or positive. Impacts are described in terms of their characteristics, including the impact's type and the impact's spatial and temporal features (namely extent, duration, scale and frequency). Terms used in this EIA process are described Table 0-1.

Table 0-1 Impact Characteristics

Characteristic	Definition	Terms
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect).	**Direct** - Impacts that result from a direct interaction between a planned Project activity and the receiving environment/receptors (ie, between occupation of a site and the pre-existing habitats or between an effluent discharge and receiving water quality). **Indirect** - Impacts that result from other activities that are encouraged to happen as a consequence of the Project (ie, in-migration for employment placing a demand on resources). **Induced** - Impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project. **Cumulative** - Impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the Project.
Duration	The time period over which a resource / receptor is affected.	**Temporary** - (period of less than 3 years - negligible/ pre-construction/ other). **Short term** - (period of less than 5 years ie, production ramp up period).

		Long term -impacts that will continue for the life of the Project, but ceases when the Project stops operating. **Permanent** - (a period that exceeds the life of plant – ie, irreversible.).
Extent	The reach of the impact (ie, physical distance an impact will extend to)	**On-site** - impacts that are limited to the Project site. **Local** - impacts that are limited to the Project site and adjacent properties. **Regional** - impacts that are experienced at a regional scale. **National** - impacts that are experienced at a national scale. **Trans-boundary/International** - impacts that are experienced outside of South Africa.
Scale	Quantitative measure of the impact ie, the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.).	Quantitative measures as applicable for the feature or resources affects. No fixed designations as it is intended to be a numerical value.
Frequency	Measure of the constancy or periodicity of the impact.	No fixed designations; intended to be a numerical value or a qualitative description.

10.4 *Determining Magnitude*

Once impacts are characterised they are assigned a 'magnitude'. Magnitude is a function of some combination (depending on the resource/ receptor in question) of the following impact characteristics:

- Extent;
- Duration;
- Scale; and
- Frequency.

Magnitude (from small to large) is a continuum. Evaluation along the continuum requires professional judgement and experience. Each impact is evaluated on a case-by-case basis and the rationale for each determination is described. Magnitude designations for negative effects are: Negligible, Small, Medium and Large.

The magnitude designations themselves are universally consistent, but the definition for the designations varies by issue. In the case of a positive impact, no magnitude designation has been assigned as it is considered sufficient for the purpose of the impact assessment to indicate that the Project is expected to result in a Positive impact.

Some impacts will result in changes to the environment that may be immeasurable, undetectable or within the range of normal natural variation. Such changes are regarded as having no impact, and characterised as having a Negligible Magnitude.

Determining Magnitude for Biophysical Impacts

For biophysical impacts, the semi-quantitative definitions for the spatial and temporal dimension of the magnitude of impacts used in this assessment are provided below.

Large Magnitude Impact affects an entire area, system (physical), aspect, population or species (biological) and at sufficient magnitude to cause a significant measureable numerical increase in measured concentrations or levels (to be compared with legislated or international limits and standards specific to the receptors) (physical) or a decline in abundance and/ or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations (physical and biological). A High Magnitude impact may also adversely affect the integrity of a site, habitat or ecosystem.

Medium Magnitude Impact affects a portion of an area, system, aspect (physical), population or species (biological) and at sufficient magnitude to cause a measurable numerical increase in measured concentrations or levels (to be compared with legislated or international limits and standards specific to the receptors) (physical) and may bring about a change in abundance and/or distribution over one or more plant/animal generations, but does not threaten the integrity of that population or any population dependent on it (physical and biological). A moderate magnitude impact may also affect the ecological functioning of a site, habitat or ecosystem but without adversely affecting its overall integrity. The area affected may be local or regional.

Small Magnitude Impact affects a specific area, system, aspect (physical), group of localised individuals within a population (biological) and at sufficient magnitude to result in a small increase in measured concentrations or levels (to be compared with legislated or international limits and standards specific to the receptors) (physical) over a short time period (one plant/animal generation or less, but does not affect other trophic levels or the population itself), and localised area.

Determining Magnitude for Socio-Economic Impacts

For socio-economic impacts, the magnitude considers the perspective of those affected by taking into account the likely perceived importance of the impact, the ability of people to manage and adapt to change and the extent to which a human receptor gains or loses access to, or control over socio-economic resources resulting in a positive or negative effect on their well-being. The quantitative elements are included into the assessment through the designation and consideration of scale and extent of the impact.

10.4.1 Determining Receptor Sensitivity

In addition to characterising the magnitude of impact, the other principal step necessary to assign significance for a given impact is to define the sensitivity of the receptor. There are a range of factors to be taken into account when defining the sensitivity of the receptor, which may be physical, biological, cultural or human. Where the receptor is physical (for example, a water body) its current quality, sensitivity to change, and importance (on a local, national and international scale) are considered.

Where the receptor is biological or cultural (ie, the marine environment or a coral reef), its importance (local, regional, national or international) and sensitivity to the specific type of impact are considered. Where the receptor is human, the vulnerability of the individual, community or wider societal group is considered. As in the case of magnitude, the sensitivity designations themselves are universally consistent, but the definitions for these designations

will vary on a resource/receptor basis. The universal sensitivity of receptor is Low, Medium and High.

For ecological impacts, sensitivity is assigned as Low, Medium or High based on the conservation importance of habitats and species. For the sensitivity of individual species, Table 0-2 presents the criteria for deciding on the value or sensitivity of individual species.

For socio-economic impacts, the degree of sensitivity of a receptor is defined as the level of resilience (or capacity to cope) with sudden social and economic changes. Table 0-2 and Table 0-3 present the criteria for deciding on the value or sensitivity of biological and socioeconomic receptors.

Table 0-2 Biological and Species Value / Sensitivity Criteria

Value / Sensitivity	**Low**	**Medium**	**High**
Criteria	Not protected or listed as common / abundant; or not critical to other ecosystem functions ie, key prey species to other species).	Not protected or listed but may be a species common globally but rare in South Africa with little resilience to ecosystem changes, important to ecosystem functions, or one under threat or population decline.	Specifically protected under South African legislation and/or international conventions e.g. CITIES Listed as rare, threatened or endangered e.g. IUCN

Note: The criteria are applied with a degree of caution. Seasonal variations and species lifecycle stage will be taken into account when considering species sensitivity. For example, a population might be deemed as more sensitive during the breeding/spawning and nursery periods. This table uses listing of species ie, IUCN) or protection as an indication of the level of threat that this species experiences within the broader ecosystem (global, regional, local). This is used to provide a judgement of the importance of affecting this species in the context of Project-level changes.

Table 0-3 Socio-Economic Sensitivity Criteria

Sensitivity	**Low**	**Medium**	**High**
Criteria	Those affected are able to adapt with relative ease and maintain pre-impact status.	Able to adapt with some difficulty and maintain pre-impact status but only with a degree of support.	Those affected will not be able to adapt to changes and continue to maintain-pre impact status.

10.4.2 Assessing Significance

Once magnitude of impact and sensitivity of a receptor have been characterised, the significance can be determined for each impact. The impact significance rating will be determined, using the matrix provided in Figure 0-1.

Figure 0-1 Impact Significance

		Sensitivity/Vulnerability/Importance of Resource/Receptor		
		Low	**Medium**	**High**
Magnitude of Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

The matrix applies universally to all resources/ receptors, and all impacts to these resources/ receptors, as the resource/ receptor-specific considerations are factored into the assignment of magnitude and sensitivity/ vulnerability/ importance designations that enter into the matrix. Box 0.1 provides a context for what the various impact significance ratings signify.

Box 0.1 Context of Impact Significances

An impact of **Negligible** significance is one where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.
An impact of **Minor** significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards.
An impact of **Moderate** significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.
An impact of **Major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of IA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (ie, ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

10.5 *Mitigation Potential and Residual Impacts*

A key objective of an EIA process is to identify and define socially, environmentally and technically acceptable and cost effective measures to manage and mitigate potential impacts.

Mitigation measures are developed to avoid, reduce, remedy or compensate for potential negative impacts, and to enhance potential environmental and social benefits.

The approach taken to defining mitigation measures is based on a typical hierarchy of decisions and measures, as described in Box 0.2.

The priority is to first apply mitigation measures to the source of the impact (ie, to avoid or reduce the magnitude of the impact from the associated Project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (ie, to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

Once mitigation measures are declared, the next step in the impact assessment process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation measures. The approach taken to defining mitigation measures is based on a typical hierarchy of decisions and measures, as described in Box 0.2.

Box 0.2 Mitigation Hierarchy

Avoid at Source; Reduce at Source: avoiding or reducing at source through the design of the Project ie, avoiding by siting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity).

Abate on Site: add something to the design to abate the impact ie, pollution control equipment).

Abate at Receptor: if an impact cannot be abated on-site then control measures can be implemented off-site ie, traffic measures).

Repair or Remedy*:* some impacts involve unavoidable damage to a resource ie, material storage areas) and these impacts require repair, restoration and reinstatement measures.

Compensate in Kind; Compensate Through Other Means where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate ie, financial compensation for degrading agricultural land and impacting crop yields).

10.5.1 Residual Impact Assessment

Once mitigation measures are declared, the next step in the impact assessment process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation measures.

10.5.2 Cumulative Impacts

A cumulative impact is one that arises from a result of an impact from the Project interacting with an impact from another activity to create an additional impact.

How the impacts and effects are assessed is strongly influenced by the status of the other activities (ie, already in existence, approved or proposed) and how much data is available to characterise the magnitude of their impacts.

The approach to assessing cumulative impacts is to screen potential interactions with other projects on the basis of:

- Projects that are already in existence and are operating;
- Projects that are approved but not as yet built or operating; and
- Projects that are a realistic proposition but are not yet built.

10.6 *Assessing Significance of Risks for accidental events*

The methodology used to assess the significance of the risks associated with accidental events differs from the impact assessment methodology set out in Section 5 of this Report. Risk significance for accidental events is based on a combination of the likelihood (or frequency) of incident occurrence and the consequences of the incident should it occur. The assessment of likelihood and consequence of the event also includes the existing control and mitigation measures for this project.

The assessment of likelihood takes a qualitative approach based on professional judgement, experience from similar projects and interaction with the technical team.

The assessment of consequence is based on specialists' input and their professional experience gained from similar projects.

Definitions used in the assessment for likelihood and consequence are set out in Box 0.3.

Box 0.3 Risk Significance Criteria for Accidental Events

Likelihood

Likelihood describes the probability of an event or incident actually occurring or taking place. It is considered in terms of the following variables:

- **Low**: the event or incident is reported in the telecommunication industry, but rarely occurs;
- **Medium**: the event or incident does occur but is not common; and/or
- **High**: the event or incident is likely to occur several times during the project's lifetime.

Consequence

The potential consequence of an impact occurring is a combination of those factors that determine the magnitude of the unplanned impact (in terms of the extent, duration and intensity of the impact). Consequence in accidental events is similar to significance (magnitude x sensitivity) of planned events and is classified as either a:

- **Minor consequence**: impacts of Low intensity to receptors/resources across a local extent, that can readily recover in the short term with little or no recovery/remediation measures required;
- **Moderate consequence**: impacts of Low to Medium intensity across a local to regional extent, to receptors/resources that can recover in the short term to medium term with the intervention of recovery/remediation measures; or
- **Major consequence**: exceeds acceptable limits and standards, is of Medium to High intensity affecting receptors/resources across a regional to international extent that will

recover in the long term only with the implementation of significant/remediation measures.

Once a rating is determined for likelihood and consequence, the risk matrix in Table 0.4 is used to determine the risk significance for accidental events. The prediction takes into account the mitigation and/or risk control measures that are already an integral part of the project design, and the management plans to be implemented by the project.

Table 0.4 Accidental Events Risk Significance

Risk Significance Rating				
Likelihood		**Low**	**Medium**	**High**
Consequence	**Minor**	Minor	Minor	Moderate
	Moderate	Minor	Moderate	Major
	Major	Moderate	Major	Major

It is not possible to completely eliminate the risk of accidental events occurring. However, the mitigation strategy to minimise the risk of the occurrence of accidental events is outlined in Box 0.4.

Box 0.4 Mitigation Strategy for Accidental Events

Control: aims to prevent or reduce the risk of an incident happening or reduce the magnitude of the potential consequence to As Low as Reasonably Possible (ALARP) through:

- Reducing the likelihood of the event ie, preventative maintenance measures, emergency response procedures and training);
- Reducing the consequence ; and
- A combination of both of these.

Recovery/ remediation: includes contingency plans and response

- Emergency Response Plans and

Tactical Response Plans.