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REPORT ON THE

PROPOSED WRECK REMOVAL TECHNIQUES

MV "RENA", WRECKED ON ASTROLABE REEF

AS CONTAINED IN THE OWNER'S RMA APPLICATION

Date: 18 August 2014 **Our Ref:** 5750/LOCS/NEH/R006

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EXECUTIVE SUMMARY

This report has been commissioned by MNZ to provide expert salvage advice in respect to issues raised in the Resource Management Act (RMA) application report undertaken by Beca Carter Hollings & Ferner Ltd (BECA) on behalf of the owner of the M.V. "RENA". Specifically LOC has been asked to prepare an assessment of the three proposed wreck removal options, namely; (i) a Base Alternative, (ii) Partial Wreck Removal and (iii) Full Wreck Removal contained within the report.

In summary, the BECA report identifies that the existence of copper clove and the Tributyltin (TBT) from the underlying anti-foul paint are potentially harmful to the environment and that the Partial Wreck Removal alternative is the best option to restrict the mass release of these contaminants, which they believe would occur during a full wreck removal option. However, the recent weather event, the passage of tropical storm LUSI, caused significant movement of the wreck and churning up of the debris field which, not only would result in the scraping of the TBT coated hull sections over the rock but also caused a patch of the previously hidden copper clove cargo to be exposed. Consequently, weather events do the same on the remaining parts of the wreck that is such a big concern to BECA as a result of the full wreck removal. Additionally, the BECA report, appears to only consider a single method for Full Wreck removal (FWR) which does not provide for a balanced assessment of the FWR options. Given that the report focuses only on the existing low-tech wreck removal solution a large number of the conclusions reached in the BECA report are correct in their assumptions. However, this does not provided for a balanced view point, if this document is a reflection of a full risk assessment of this option, then it is my opinion that it fails.

Whilst the case histories (alternative methodologies) discussed within this report give examples of successful removal operations of various wrecks around the World, there are many examples of wrecks left in situ following removal of hydrocarbons, marine pollutants and general nuisance pollutants (plastics, miscellaneous waste material, mooring ropes). However, globally a number of jurisdictions use the simple acid test of "if the wreck can technically be removed then it should be" irrespective of whether the wreck may prove to be a risk to the environment or to safe navigation.

In the present environmental climate it is becoming increasingly more difficult to justify leaving wrecks in situ. A number of the wreck removal operations discussed within this

report were enforced on just such a basis. The fact that some of the wrecks posed little or no threat to either the environment or safe navigation made no impact upon the relevant authorities’ decisions to impose total wreck removal notices.

However, to take a balanced approach to any assessment the reasonableness of enforcement of wreck removal notice must be considered. Given that with the recovery of the copper clove cargo and a more detailed assessment of the risk posed by the TBT it may be that the remaining wreck of the RENA poses only a nominal threat to the Astrolabe Reef and the Bay of Plenty in general.

1. INTRODUCTION

1.1 Instructions Received

1.1.1 We are instructed by Sid Wellik, Manager Legal services, Maritime New Zealand (MNZ) to review a report prepared for the owners of M.V. "RENA" entitled "APPLICATION FOR RESOURCE CONSENT (MV RENA) – Background and Consideration of Alternatives – Volume Three" (BECA Report)[1]. The report was prepared for the owner of M.V. "RENA" by Beca Carter Hollings & Ferner Ltd (BECA).

1.1.2 In particular we have been asked to specifically consider and provide expert opinion on the following aspects of the report:

1. A general assessment of the proposed removal techniques:

(a) Are these techniques within the range of techniques that would usually be used, or are appropriate for use, in the present circumstances?

(b) Will SONAR need to be used as part of a removal process and if so, what type and how extensively?

(c) Comment on the stated environmental consequences or likely environmental effects of the use of the proposed techniques (for example, likely effects on the physical damage to the reef, to the sea floor, on sediment, and/or on remaining cargo). Please include the effects of additional moorings that might be required on the reef and the likelihood of other parts of the sea floor being used to set down parts of the wreck (as was recently required with the accommodation block, during the removal process) and the effects that these matters have (if any).

(d) Comment on the owners' assessment of the operational environment, including the assumed operational delays, and how long the proposed techniques would likely take.

[1] Copy of the BECA report attached as Appendix "A".

(e) Assessment of the safety issues that are likely to arise by the use of the proposed techniques, including how dangerous these techniques are.

(f) Is the present exclusion zone sufficient for proposed removal techniques? Do they consider it would need to be bigger or could it be smaller?

(g) If possible, please comment on likely costs.

2. Are there other techniques, or other types of techniques, that could alternatively be used? If so, please comment on the above matters in a similar way.

1.1.3 To allow us to make a fuller assessment we have been provided with the following documents;

i. Report "APPLICATION FOR RESOURCE CONSENT (MV RENA) – Background and Consideration of Alternatives – Volume Three" prepared on behalf of the owner of M.V. "RENA" by Beca Carter Hollings & Ferner Ltd (BECA) dated 27th May 2014; and

ii. Weekly salvage SITREPs prepared by RENA ICC Manager.

and have referred to the following reports which form part of the Application for Resource Consent (M.V. "RENA") namely;

iii. "MARINE MAMMAL ASSESSMENT: proposal to leave the remains of the M.V. "RENA" on the astrolabe reef, prepared by the Cawthron Institute dated 16th May 2014.

iv. RECREATIONAL DIVING ON M.V. "RENA": by D.F. Gorman and S.J. Mitchell, undated.

v. SUPPLEMENTARY REPORT M.V. "RENA". Implications for Recreational Diving after Cyclone LUSI by D.F. Gorman and S.J. Mitchell, dated 25th May 2014.

1.2 Background

1.2.1 The “RENA” ran aground, at a speed of 17 knots, on the Astrolabe Reef at approximately 02:20 hours on 5th October 2011. Preliminary calculations carried out by LOC, and based on the draught of the vessel before and after the grounding, indicated a ground reaction in excess of 9,000 tonnes and therefore it was deemed to be extremely unlikely that the ship could be re-floated without the removal of a significant amount of weight. The vessel also developed a list of approximately 11° to port.

1.2.2 On 11th October a period of bad weather and large seas caused the vessel to move from the original grounded condition with a change of heading of approximately 20º. It is thought that the bow of the vessel remained pinned to the reef during this period with the more buoyant aft section being moved by the heavy swell and rotating about the bow. This resulted in significant damage to the bulbous bow. The list of the vessel also changed from port to approximately 22º to starboard.

1.2.3 During the period of heavy weather a crack developed in way of No. 3 Hold in both the port and starboard side shells. The stern of the vessel rotated an additional 1-2º meaning that the crack on the starboard side opened to approximately 1.7 metres at its widest point. On the port side the crack was overlapping above the waterline and then opened to around 0.15 metres below the waterline.

1.2.4 On 21st October 2011 the vessel was officially declared a constructive total loss and became a wreck, which term is used hereafter.

1.2.5 The wreck was located at a position of 37º 32'.4S, 176º 25’.7E with a heading of 276º True. (The position was provided by Discovery Marine Ltd (DML) who had undertaken single and multi-beam surveys of the reef in the area surrounding the wreck.)

1.2.6 During the initial salvage operation containers were removed from both above deck and partially below deck. However, during the early hours of 8th January 2012 during a period of bad weather, the hull severed in way of the damage in Hold 3. Over the next two days the stern section commenced listing further to starboard until eventually the stern section sank on 10th January 2012, although part of it was visible above the sea surface.

1.2.7 Further bad weather causing movement of the wreck sections occurred in March and April 2012. On the 4th April 2012, the aft section wholly sank beneath the sea surface.

1.2.8 Subsequent to the bad weather it was established that the stern section had sunk on the reef and slid downwards to starboard and aft until coming to rest on the stern at a depth of 74 metres. The section was lying on its starboard side against the reef. The forward end of the aft section was 3.5 metres below the surface. The port bridge wing was some 10 metres below the surface. The fore section remained in place on the Astrolabe Reef. A debris field was created between the fore and aft sections on the Reef from the contents of the cargo holds.

1.2.9 Removal of containers from the forward section continued under the existing Lloyds' Open Form contract until 8th June 2012 when owners terminated the contract. The contractors Smit & Svitzer departed the site on 13th June 2012.

1.2.10 Owners prepared an invitation to tender for the partial removal of the bow section and on 8th August 2012 Resolve Salvage and Fire (RSF) commenced work on the wreck reduction of the above water forward section. The contract was for the removal of the forward section to -1 metre LAT (Lowest Astronomical Tide).

1.2.11 Surveys undertaken by owners' contractors revealed that the wreck itself was beginning to disintegrate. An ROV survey undertaken in August 2012 showed that the port side of the upper accommodation area (in way of the chief engineer's cabin) had begun to collapse.

1.2.12 RSF were subsequently contracted to remove part of the debris from around the wreck and to recover specific cargo that had dispersed around and remained within the wreck itself. In addition, the owners and their P&I Club also contracted RSF to remove the accommodation block from the wreck, and debris from the debris field.

1.2.13 On the 25th July 2013, it was announced that the bow section had been removed to depths greater than -1m LAT, leaving two main pieces on the Reef. In October 2013, the bow section was found to have broken into several smaller sections.

1.2.14 The removal of the upper section of the accommodation block was completed in March 2014. Prior to the removal of the lower decks of the accommodation block, during the week 14-21 March 2014, a tropical cyclone (LUSI) passed close to New Zealand which resulted in a protracted period of unsettled weather and high seas. The resulting high seas caused the remaining wreck sections to move, the aft section rolling further to starboard and bodily slipping down the reef with parts of the wreck section now beyond safe commercial air diving depth, the remnants of the bow section also moving, as did the contents of the debris field.

1.2.15 As a result, it was decided by the owners to abort the further removal of the accommodation block, the contractors, RSF, instructed to target removal of hazards associated with the debris field.

1.2.16 Whilst the work by RSF was ongoing, the owners submitted an application for resource consent on 27th May 2014.

1.3 Scope of Report

Review the report; "APPLICATION FOR RESOURCE CONSENT (MV RENA) – Background and Consideration of Alternatives – Volume Three" prepared by BECA on behalf of the owners of MV "RENA" to consider and provide expert opinion on the specific questions listed in paragraph 1.1.2 above.

1.4 Disclaimer

This report is based on our understanding of the documents itemised in *para* 1.1.3 and the weekly salvage updates issued by MNZ; such evidence is contemporaneous in its nature. However, our opinions are based on the information available from these documents and not through our own attendances on site. Consequently, if there are any inaccuracies in these reports provided, they may be reflected in this report.

2. GENERAL PARTICULARS

2.1 The Vessel “RENA”

2.1.1 Motor Vessel “RENA” (ex- “ANDAMAN SEA”, ex – “ZIM AMERICA”) was a fully cellular 7-hold, gearless container carrier which was owned at the material time by Daina Shipping Co of Liberia and operated and managed by Ciel Shipmanagement SA of Greece. The vessel’s keel was laid in October 1989 and she was completed in January 1990. The vessel was built at Howaldtswerke-Deutsche Werft AG (HDW) of Kiel. She was registered in Liberia and classed by the American Bureau of Shipping (ABS) with the following Hull Notation, AB*A1.

2.1.2 The vessel had the following principal dimensions:

Length Overall	:	236 metres
Breadth Moulded	:	32.2 metres
Depth Moulded	:	18.8 metres
Summer Loaded Draft	:	12.001 metres
GT	:	37,209
NT	:	16,454
Summer Deadweight	:	47,230 tonnes

2.1.3 The vessel’s propulsion was provided by a Zaklady Przemyslu Metalowego 'H Cegielski' SA - Poznan SULZER 8RTA76 Diesel Engine, developing 29,476 BHP at 98 RPM, driving a fixed pitch propeller. The vessel had a service speed of 21 knots.

2.1.4 The vessel was fitted with seven cargo holds. The vessel had a total capacity of 3,352 twenty foot equivalent units (TEU), split as 1,384 TEU within the holds and 1,968 on deck. In addition, the vessel was originally designed to carry 121 refrigerated units.

2.1.5 Prior to grounding the vessel had onboard 1,368 containers loaded as mixed TEU and FEU (forty-foot equivalent units). Of the containers said to have been onboard, 821 were loaded below deck and 547 were stowed on deck.

2.2 Astrolabe Reef

2.2.1 A brief reference to Astrolabe Reef is made in the New Zealand Pilot (NP51 – 2010 Edition)[2]. The reference is given below:

"***9.95 From a position ENE of "A" Light Beacon (E Cardinal) (37° 36.1'S 176° 10.7'E), at the seaward end of No.1 Reach to Tauranga Harbour, the coastal route leads initially ENE passing clear of Pudney Rock (37° 31'S 176° 19'E), depending on draught. Thence the track either continues ENE to pass N of Volkner Rocks (37° 29'S 177° 08'E) and thence to a position N of Cape Runaway, 41 miles E, or it leads E. The E track passes (with positions from Motiti Island Light (white metal column, 4m in height) (37° 36.4'S 176° 25.1'E)):***

N of Okaparu Reef (3 miles WNW), where the sea breaks in all swell conditions and particularly during NE or N gales, and:

N of Brewis Shoal ($2^{3}/_{4}$ miles NW), which breaks in a moderate to heavy swell from the NE, thence:

Either side of Astrolabe Reef (4 miles N), which breaks in all swell conditions and in fair weather appears like a boat, thence:……."

[2] New Zealand Pilot NP51 Eighteenth Edition 2010, para 9.95.2, page 264

3. CONSIDERATIONS

3.1 Executive Summary of the Assessment

3.1.1 The report was commissioned by the owners of "RENA" in contemplation of S15A and S15B application to leave the remains of "RENA" and her remnant cargo on Astrolabe Reef under the Resource Management Act (RMA)[3]. The report is divided into four parts, consisting of an Executive Summary and Parts A, B and C. The background to the application is contained in Part A, whereas Part B describes the three alternatives considered before determining the preferred alternative that is the subject of the resource consent application. Part C provides an updated comparison of effects following completion of the technical assessments.

3.1.2 The Executive Summary opens by advising that; "***Three broad alternatives were identified, each having potential outcomes ranging from leaving the wreck with little or no further work after the bow reduction, through to removal of such material as would render the wreck as benign as practicable, through to complete removal of the wreck."*** The three alternatives considered are summarised within the executive summary in the following three paragraphs:-

3.1.3 The First Alternative considered undertakes the minimum work necessary to comply with the notices issued by Maritime New Zealand under the Maritime Transport Act 1994 (MTA). It is the owner's position that the notices issued would have been satisfied by rendering the vessel to a condition that it was no longer a hazard to navigation and no longer a hazardous ship in respect to sections 100A and 248 of the MTA. The first alternative is referred to as the Base Alternative (Base) throughout the BECA report.

[3] http://www.legislation.govt.nz/act/public/1991/0069/latest/DLM230265.html

3.1.4 The Second Alternative is referred to as Partial Wreck Removal (PWR) throughout the BECA report. This alternative contemplates additional wreck reduction work and debris removal to that considered within the Base Alternative; with the aim of reducing the potential environmental effects while leaving the bulk of the wreck where it is. The work undertaken by the owner to date is considered in the BECA report to be above and beyond the work required by the notices issued by MNZ pursuant to the MTA citing the bow section reduction to -1 metre LAT, removal of the majority of the accommodation block and recovery of cargo and debris to reduce the snagging hazard to recreational divers and further removal of debris from the debris field. It is stated here that PWR is the preferred option for which consent is sought.

3.1.5 The Third Alternative is referred to as Full Wreck Removal (FWR) within the BECA report and, as the title suggests, contemplates an "industrial-scale" removal of the ship's hull structure and larger (greater than 1m x 1m dimension) items of debris and any directly observable hazard or potentially contaminant material from the Astrolabe Reef and the immediate area. The BECA report advises that this alternative is not specifically focussed on environmental management or the removal of other debris and detritus commenting on an expectation which was expressed to them during the consultation process that the FWR would remove all parts of the wreck including that mixed into the natural sediments of the reef.

3.1.6 The report adds that the owner has adopted the following approach:

"1. To undertake work to leave the remains of the wreck in as benign a state as is practicable in terms of their effects on the environment

2. To comply with the requirements of the notices issued pursuant to the MTA and seek resource consent pursuant to the Resource Management Act 1991 (RMA) to abandon/dump the remains of the wreck and for any future discharge that may occur from those remains."

3.1.7 BECA advises that the consideration of the three alternatives takes a risk-based approach. This approach considers the physical environment, social wellbeing, cultural impacts and potential costs and economic benefits and that the process has been ongoing with the owner responding to assessments and feedback whilst the salvage and recovery works have been underway in a dynamic environment.

3.1.8 The BECA report analyses the risks and considers these in a tabular format; Table 6,included in Part B of the BECA report, at paragraph 11.5. The table identifies the individual risks, the preferred option (of dealing with the risk) and provides a comment on each of these. The risks considered include: release of contaminants/bioaccumulation; release of plastic beads, release of floatable cargo (flotsam); damage to the habitat from removal works; contaminants from machinery operating in coastal waters; noise from removal works; injury or fatality in removal operations; biosecurity risk from foreign vessels; vessel collision through increased activity at site; the prevention of enjoyment of the reef due to exclusion zone; adverse effects on the environment; future risk to recreational divers; exclusion of interested personnel in the formal decision making and ongoing psychological effects of the grounding.

3.1.9 In answering the questions asked of me, these risks are considered in the following paragraphs, however, in summary BECA advise that the PWR alternative was decided upon in January 2013 as that providing the most sustainable response to these identified risks. And, since January 2013, BECA state that the owner has continued to reduce the wreck to as benign a state as practicable, responding to technical assessments and feedback received, in order to prepare for this resource consent application. BECA then state that;

"***In the short-term and medium-term the PWR alternative provides a clear advantage over FWR. This is primarily because FWR is likely to contribute to a greater adverse effect on the physical environment and because the exclusion zone will be in place longer for FWR thereby creating adverse social effects compared to PWR. FWR would also reduce the opportunities for capacity building for Maori and enhancing mana as a result. The main positive outcome FWR would provide is the potential financial benefit to the region from services to support continuing salvage operations, as compared to PWR adding economic value through earlier access to the Reef and opportunity for tourism, boat charter and dive ventures; and through implementation of restoration and mitigation projects. Some iwi also believe that only the FWR alternative will restore the mauri of the Reef.***

In the long-term, the effects on the physical environment are likely to be similar as it recovers naturally, except that FWR is likely to cause more contamination by the release of copper clove and TBT paint flakes en masse and to set back recovery of the ecosystem.

For these reasons, following the finalisation of the technical assessments, PWR remains the preferred alternative, providing an outcome where the actual and potential adverse effects on the environment are expected to be no more than minor. "

Whilst the comparisons between the PWR and FWR are general in nature in this section, it is noted that a specific point is made about the risk caused by the release of the copper clove cargo and TBT paint flakes.

3.1.10 The Purpose of Volume Three is defined in the BECA Report as follows:

"The purpose of Volume Three is to provide a background and context of the process of assessment and analysis that has been undertaken to get to the point where resource consent is being applied for to leave what remains of the Rena, her equipment and cargo, on the seabed at Astrolabe Reef.

Part A, Background, describes the period from the grounding leading up to the decision to apply for resource consent. It contains a summary of the events that followed the Rena grounding and the many responses undertaken since. It also outlines the several streams of technical work and considerations implemented since the grounding and how these have informed each stage of the decision making and salvage operations to the present.

Part B of this volume describes the wreck disposal alternatives considered in the lead-up to the preparation of the resource consent application.

Part C includes a comparison of the effects of the two main alternatives – Partial Wreck Removal and Full Wreck Removal – over short-term, medium-term and long-term timeframes. This comparison of effects is made retrospectively to confirm the preferred alternative of Partial Wreck Removal using the findings of the technical assessments for this resource consent application."

3.2 BECA Report, Part A, Background

3.2.1 On page 1 of the BECA Report[4] (Grounding/Immediate Response) the report advises that; "***In April 2012 the stern section slid further down the side of the Reef.***"

In considering the movement of the two principal wreck sections, since the initial grounding incident, it is worth nothing that there have been a number of occasions when the wreck sections have undergone substantial changes due to adverse weather conditions at site. The latest being in March 2014 when cyclone LUSI[5] passed close to the North of New Zealand. In Table 2; Timeline July 2012 – May 2014, of the BECA report, it states the following; ***"Tropical storm LUSI resulting in shifting of the aft section to a depth of at least -24 m, degradation of Holds 3, 4 and part of Hold 5."***

[4] BECA Report, Part A, Page 1, Second Paragraph

[5] http://www.nasa.gov/content/goddard/LUSI-southern-pacific-ocean/#.U18lWqIXJXU

BECA considers the various risks posed by the wreck in Table 6 of their report, as described in paragraph 3.1.8 above. Significantly, the risk assessment comment made within the matrix advises as follows:

"Two main contaminants of potential concern have been identified: TBT (a biocide found in older antifouling paint on parts of the hull); ~ 21 tonnes of copper clove shipped in in Hold 6.

Mechanical disturbance associated with cutting will release TBT in the form of paint flakes. The Base and PWR alternatives do not contemplate any further cutting of the hull and therefore no additional TBT would be released.

The copper believed to be largely still contained in Hold 6 would most likely be released in a mass quantity to the environment during FWR and copper contamination of the Reef would increase".

The BECA risk assessment does not contemplate any additional dispersion of either TBT[6] or copper clove through movement of the wreck sections caused by weather events. The loosening of TBT flakes from sliding over a rocky surface or break up would certainly cause an equal or greater dispersion of loosened paint flakes as any cutting operation. Similarly, whilst the location of the copper clove had not been positively identified previously within Hold 6, after the passage of tropical storm LUSI, a patch, albeit apparently small, has been revealed showing that movement generated by weather events has exposed this cargo and could do so again potentially generating release ***"in a mass quantity".***

3.2.2 At Part A, Section 3 (Physical Impact of the Grounding on the Reef) the BECA report advises that ***"The RENA grounding caused a number of immediate, significant and in some cases irreversible effects on Astrolabe Reef***. ***These effects included breaking of the rock structure (of the Reef), ploughing a furrow through the Reef, destroying marine growth on the Reef and paint scrapings from the hull discharging TBT into the Reef environment***."

[6] http://en.wikipedia.org/wiki/Tributyltin

Subsequent events have also affected the Reef including the breaking of the ship into two with the aft section sinking and later sliding down the Reef. The BECA report then advises:

"These events have resulted in physical modifications to the Reef – breaking rock, damaging marine growth and paint scrapings dispersed into that environment – as well as the loss to sea of the cargo in Hold 3 at that time. This cargo, including a large quantity of Cryolite, has been spread across the Reef in the area of the debris field, and further afield by dispersion. Further movement of the vessel following tropical storm LUSI in March 2014 resulted in other cargo previously located in Holds 4 and 5 also spilling into the debris field.

Consequently, the environment of the Reef has been modified by the casualty to the extent that it is not possible to return it to its "pre-Rena" state."

3.2.3 It seems unreasonable that the "***Consideration of Risks***" matrix (in Table 6) does not contemplate the risk of paint scrapings due to movement being a problem, and yet it is used as one of the reasons when advising that the Reef has been "***modified***" to such an extent that it is not possible to return it to its "***pre-Rena***" state. It is clear the authors of the report are aware that each time the wreck moves paint scraping and paint flake dispersion will result.

3.2.4 Section 5 of Part A of the BECA report ponders the "***Technical*** Considerations and Work Undertaken"[7]. At sub-paragraph 5.1 (Background) the report states:

"***It became apparent in the course of the recovery operation that Full Wreck Removal (FWR) would be very dangerous, technically challenging, take a very long time and be likely to cause further significant adverse effects.***"

[7] BECA Report, Part A, Section 54, Page 6

This section also advises that all work undertaken by the owner of RENA since the initial grounding has been to ensure that each action undertaken mitigates, or creates no adverse effect on the environment and human safety. In considering the alternatives a set of activities are identified that take into account the effects of those alternatives on the environment. The following activities have been undertaken since the grounding to achieve the owner’s goal:

- Removal of oil onboard.
- Removal/recovery of containers.
- Removal (or dispersal) of potentially contaminant cargo.
- Collection of beach oil.
- Collection of shoreline debris.
- Reduction of bow to minimum LAT -1m.
- Recovery of debris from debris field.
- Recovery of material from cargo holds.
- Removal of upper section of accommodation block.

Despite the owner’s good intentions, it is evident from this report that despite specifically identifying both the TBT and Copper Clove (cargo) as being potentially harmful to the Reef, the solution is effectively to do nothing about them (PWR as the preferred option), apart from monitor the actual effects on the environment over time (copper clove), but leave the TBT under the assumption the TBT in paint will be sealed beneath subsequent paint layers and a leach layer, so that the effects on the water column will be negligible. However, this does not take into account release and/or exposure of paint scrapings or copper clove cargo during any further movement or degradation of the wreck sections and debris field in a weather event.

3.2.5 Sub-Paragraph 5.2 of Section details the removal of the oil from Rena. The figures presented in the BECA report suggest that only about 1 tonne of Heavy Fuel Oil remains, and no diesel oil (DO). However, these figures are newly presented without any supporting evidence, so require more detailed clarification. In particular, the status of the potential pocket of HFO in No.5 starboard FO tank and the 5 tonnes of diesel oil left in No.6 port DO tank on January 2012. It is not clear from this BECA report, after the passage of tropical storm LUSI, the status of these two tanks, i.e. can pockets of oil remain?

3.2.6 Sub Paragraph 5.3, Section A of the BECA report details the "***Removal of Containers***" providing a table (Table 4.) which lists the overall status of the containers on board, as extracted from the MNZ Report of 26th July 2013. In summary of the 1,368 containers on board at the time of the incident, 1,039 have been landed ashore either whole or in part, the remaining 329 containers are unrecovered. Of the unrecovered containers, 34 are said to be dispersed remote to the wreck, 18 are said to be remaining in the fore section (though none are intact and are effectively scrap) and 277 remain within the stern section or dispersed within the debris field. Diver observations at site indicate that there are no containers remaining in a form that would be recognized as a complete container.

The BECA report states that the; ***"Containers remote from the wreck were located and majority identified with locator beacons (pingers) that were monitored to observe any change in location over time. No change in location of containers with pingers was recorded."***

The reports detailing the present position of the remote containers are not included in this application, but I note that the latest MNZ sitrep, dated 13th June 2014, makes the following statement;

"TMC provided MNZ with an update of the seabed containers Pinger survey conducted 7 June 2014. There was a 140m change to "target" T005 situation at 62 meter, which is thought to be acceptable given the recent storm weather. The other 6 targets have not moved."

The BECA report also states that

"All but three of the remote containers are at depths greater than -50m. All containers have been reported to MNZ and are the subject of a Notice to Mariners advising of their location."

It is assumed that the Notice to Mariners is directed towards the fishing vessels to which these containers on the seabed may be a hazard to their operations. However, we note that the BECA report says that the majority of the 34 containers were fitted with pingers, yet the remark in the MNZ sitrep implies that only 7 targets have working pingers, one of which was found to have moved after the passage of cyclone LUSI. Clearly, the statement ***"no change in location of containers with pingers was recorded"*** needs to be clarified with additional detail provided in this application on their monitoring.

3.2.7 Sub Paragraph 5.4, Section A of the BECA report provides for the contaminants said to be onboard at the time of the grounding. A table is included at page 8 of the report (Table 5.) detailing the potentially harmful cargoes, which includes plastic beads and copper clove cargoes. The table describes the cargoes, and provides the vessel slot number, the weight, status, potential effects, and also a description of each cargo.

The BECA report effectively states that with the exception of the copper clove cargo all of the remaining potentially harmful cargoes have been recovered, dispersed or rendered harmless with time. I am unable to comment further on the potential harmful properties of these cargoes or whether those that are said to have been dispersed have dispersed.

However, I note from the latest MNZ Sitrep, dated 13th June 2014, attempts were being made by the contractors to recover exposed copper clove in the debris field and locate and recover pockets of beads trapped between layers of debris. In the BECA report, in respect of the plastic beads, it states: ***"The second Hold 4 container is thought to be covered by a large (600 tonne) port side piece. Work has been done to cut up and remove that piece so as to allow the container to be located and its contents retrieved (if still present)."*** As of 13th June 2014, substantial pockets of beads are still being recovered. The amount recovered during this week ending 13th June 2014

was 1.5 tonnes; so the plastic beads are still present. With regard to the copper clove, the BECA report confirms that an isolated patch of this cargo has been identified in the sediments near where Hold 6 was located prior to tropical storm LUSI. However, the report says that ***"As this patch is small and limited to a single sampling location, the copper is believed still to be largely contained beneath major structural debris in Hold 6."*** Although the copper clove cargo can be exposed during a weather event.

3.2.8 Details of the "***Reduction of Bow***" are detailed in Sub Paragraph 5.5, Section A of the BECA report. The report advises that a contract was placed with Resolve Salvage and Fire (RSF) in July 2012 with the aim of reducing the bow section to a minimum of -1 metre LAT. This was undertaken for two main reasons: -

- ***"To reduce the potential for hazards as the wreck proceeded to break up in the dynamic reef environment***
- ***To remove the sight of the wreck on the Reef above the water."***

This operation was completed by June 2013. It is then stated in the BECA report that:-

"***In October 2013, storm action resulted in the bow breaking into several sections and being dispersed across the Reef. The bulbous bow broke into two sections and fell away to a depth of LAT -12m to -18m."***

However, nowhere in the report is there a detailed sounding of the Reef showing the location of the bow sections confirming that they are actually at a depth deeper than -1m LAT, and how they have subsequently moved during tropical storm LUSI or other previous weather events. In the "**MV RENA: IMPLICATIONS OR RECREATIONAL DIVING AFTER CYCLONE LUSI – SUPPLEMENTARY REPORT",** submitted as part of the resource consent application, the authors, Gorman & Mitchell, discovered when diving on the wreck after tropical storm LUSI that, at the bow section, the ***"very shallow section of wreck with the long corridor which we commented on in our first report has actually shifted shallow (to about -6m) making it a greater surge hazard…".*** In their first report, this corridor is described as

being 30m long and having an entry at 2m and 8m depth. If the corridor location at 8m depth has moved 2m shallower, then it begs the question as to what depth is the 2m depth entry or other shallower parts of this section. Consequently, the above not only shows that the bow sections moved significantly after tropical storm LUSI and other earlier storms, but one large section in particular has apparently moved upwards on the Reef to a shallower depth.

Also, in the MNZ report of 2nd May 2014, it states:- “***Reef Dive: Cushla Loomb (Beca) plus one other (female without proper gear) conducted a snorkel survey on top of the reef; it was reported that Ms Loomb was standing on a piece of wreck with her head out of the water; arguably this piece of wreckage in no longer at LAT -1.”*** As such, the historic depth readings taken of the Reef in way of the bow section and to date are essential for any proper assessment of this resource consent application and any further removal operations.

3.2.9 "***Removal of Debris from Debris Field***" is discussed at Sub Paragraph 5.6, Section A of the BECA report. The debris field is described as being in two main areas as shown in *Figure 1* below. The major debris field is stated as between the bow section and the aft section and originally comprised of the bulk of the contents of Hold 3 with structural debris from the wreck. Beyond this is what is termed a minor debris field containing cargo and remnant ship material. The debris field (and the wreck) is said to occupy approximately one hectare (10,000 sq.m) of the Reef and extends down to about -40 metres.

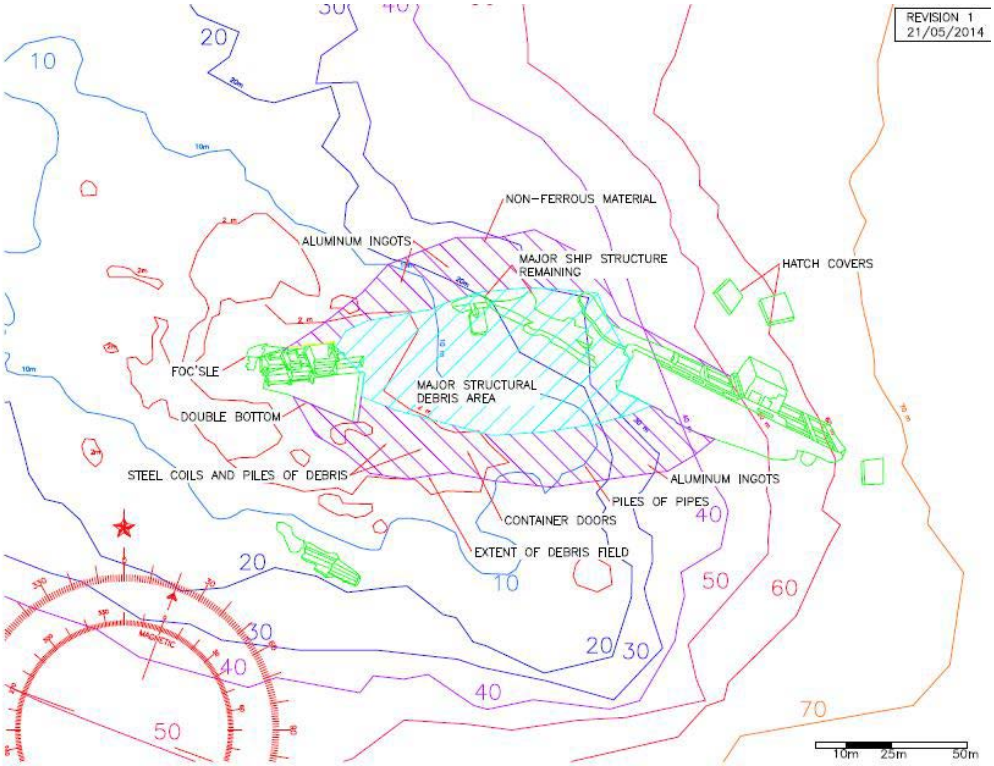


Figure 1. RSF Debris Field Survey April 2014.

It is noted in Table 2 (in Part A, Section 3.1) of the BECA report that in April 2014 that a survey of the entire wreck and debris field was conducted, by ADUS[8], using advanced multi-beam echo-sounder technology, subsequent to the latest wreck shift resulting from cyclone LUSI. The full results of the ADUS survey detailing the debris field are not included in the resource consent application. However, it is noted that in **the "MV RENA: IMPLICATIONS OR RECREATIONAL DIVING AFTER CYCLONE LUSI –**

[8] http://www.adus-uk.com/surveys 67

SUPPLEMENTARY REPORT", submitted as part of the resource consent application, by the authors, Gorman & Mitchell, they state that, after the passage of tropical storm LUSI, "***In the shallower reaches of the wreck, the wire hazard in the debris field has become worse, with partial uncoiling of many of the previous coils. We remain of the opinion that these need to be removed"***. In addition, when discussing the Plastic Bead status under Table 5, Potentially Harmful Cargo, the BECA report states: - ***"Following an extension to the Resolve contract to locate and remove them, the two containers shipped in Hold 4 were located within and below the wreckage in the remains of that Hold. Prior to recovery of the first container a severe storm struck (April 2013) and some of its contents escaped, much of which was collected in the shoreline recovery operation."*** Both these examples illustrate the movement experienced in the debris field after a major storm. Consequently, in order to be able to fully assess the extent and possible movement of the debris field and its potential removal methods, it is essential that the full ADUS survey results and any other underwater surveys and/or video footage of the debris field are provided with this application.

This section also advises that RSF's contract was extended to include removal of debris from the debris field and from Hold 4. This contract extension focussed on the removal of beads, cargo, such as wire coils and protrusions which may be hazardous to divers, and aluminium ingots. The report advises that a total of 835 tonnes of debris has been removed from the debris field (by 27th May 2014) and it is said that it will be cleared, as far as practicable, of major snags and hazards to divers. However, as can be seen from the quote above extracted from the Supplementary report from Gorman & Mitchell, after a major storm the debris field became worse than that they had seen before the passage of the storm. Consequently, given past experience, this churning up of the debris field during a storm event effectively re-sets the hazards associated with the debris field and potentially its extent. It is noted from the latest MNZ report, dated 13th June 2014, that a total of 884 tonnes of debris material has been recovered and landed. However, from the photographs included in Gorman & Mitchell's report on **"Recreational diving on MV RENA"** taken in October 2013, show that the

debris field is extensive and will contain far more debris than the 884 tonnes currently (13th June 2014) recovered. Consequently, not only is the full extent of the debris field un-confirmed by detailed surveys in this BECA report, but neither is the historical nature of the debris movement, although it is clear that after every major storm there are changes with the debris field.

3.2.10 "***Removal of Material from Cargo Holds***" is discussed at Sub Paragraph 5.7, Section A of the BECA report. This section refers to Table 4 earlier in the report where it shows that there are 295 containers unaccounted for within the wreck site (discounting the 34 containers remote from the wreck site) of which 18 empty containers in the bow section were left, becoming scrap amongst this area of the wreck site. The report explains how containers from No.3 and 4 holds were released into the debris field when the ship broke in two and the aft section sank in January 2012 and that the remaining cargo within the hull was concentrated in Holds 4 and 5. However, with the break-up of the aft section the contents of Hold 4 and part of Hold 5 are said to have been mixed with the structural debris from the ship and now form part of the major debris field between the bow and what remains of the aft section. Because of the now increased depths of the aft section, the report states that access to the cargo holds and removal of material from this part of the hull is very difficult and poses a high degree of risk to divers working within the wreckage. Resolve have been commissioned to locate, investigate and where practicable remove cargoes considered potentially harmful from the wreckage of the aft section; such as the two containers of plastic beads in Hold 4, three containers of ferrosilicon in Hold 5 and one container of copper clove in Hold 6. Whilst it says that the latter container of copper clove has not been able to be located, the report does go on to state that; ***Recently (March 2014) an isolated patch of copper clove was identified in the sediments near to the location of Hold 6. It is expected that the remainder of the copper is largely intact within the remains of Hold 6, contained beneath major structural debris. It is anticipated that further small releases of copper clove may occur as the wreck continues to break up (but below LAT -45m)."***

The three containers of ferrosilicon have not been located but BECA refer to the Cawthron Institute report, and consider that any remaining ferrosilicon is

not a hazard. We are unable to comment on the hazards posed by this chemical.

Of the two containers of plastic beads in Hold 4, one has been located and its contents said to be either dispersed or recovered, and; "***The second container will be sought to be located after further works to remove major structural debris and its contents will be removed if still there."***

The latest MNZ sitrep of 13th June 2014 shows that the plastic beads are still there. The following is quoted from this sitrep: ***"Recovery of plastic beads from Cargo Hold 4 remained the priority. Debris was removed using the hydraulic grab fitted to RMG 280 crane, exposing a pocket of beads trapped between layers of debris, ship's hull plate and container wreckage. 1.5 tons of beads in 25 kgs bags and some loose beads were recovered on surface. To prevent an uncontrolled released during a forecast storm, RSF Divers surveyed the cargo holds to ensure some form of security remained covering the cargo in the interim period however; the public have reported beads on the high tide mark indicating that some have escaped and subsequently come ashore."***

3.2.11 Sub Paragraph 5.8, Section A of the BECA report details the "***Implementation of the Exclusion Zone***". After the initial grounding MNZ imposed a 3 nautical mile exclusion zone around the wreck, in April 2012 this was reduced to 2 nautical miles. The purpose of the exclusion zone was to allow salvors to operate safely without creating a hazard to the public and without interference. The exclusion zone is monitored by the salvors and the Tauranga Harbour Master enforces the zone by issuing infringement notices to vessels that breach it. Consequently, since the vessel grounded in October 2011 to date, the public has had no access to the Reef, nor are aware of the detail of the wreck status and debris field. The report states that the exclusion zone can be removed when operations cease at the site, which will allow the public access to the wreck site including the debris field.

3.2.12 Sub Paragraph 5.9, Section A of the BECA report details the ***"Removal of the Accommodation Block"***. This section describes how the accommodation block contains a number of lightweight items included in both its structure (e.g. partitioning) and loose items. The report says that, following expressions of concern over the degradation of the structure due to the weather, potentially releasing flotsam and creating a hazard for recreational divers, it was intended to remove the accommodation block in two stages. The first stage, the upper level to Deck D was removed and landed just before the passage of tropical storm LUSI. During the weather conditions created by this storm, the aft section slid further down the Reef and rotated more to starboard increasing the depth of the remaining shallowest part of the accommodation block from -11m to -24m. It is now stated in the BECA report that; ***"It is not intended to remove the lower decks of the accommodation block as it has been shown from the operations to remove the upper section that there is little risk of an uncontrolled release of flotsam and the remaining levels are below recommended limits for recreational divers of moderate experience."***

3.2.13 The sixth section of the BECA Report deals with the "***Legislative Framework***"[9]. Sub paragraph 6.1 defines the requirements of the Maritime Transport Act 1994 (MTA).

The MTA confers powers on the Director of MNZ where, following a casualty a ship, or its cargo, is a hazard to navigation or is a hazardous ship. The MTA also contains provisions which give effect to various International Treaties and Conventions to which New Zealand has signed up to under the International Maritime Organisation (IMO)[10]. Since the grounding of RENA, MNZ has taken on a regulatory role in accordance with the MTA.

[9] BECA Report, Part A, Section 6, Page 15

[10] http://www.imo.org/Pages/home.aspx

Subsequent to the grounding incident, the Director of MNZ issued the following notices, as defined in the BECA report:

- "***A notice under s100A of the MTA to secure and remove the wreck, including its equipment, cargo, marine pollutants, or any articles belonging to or separated from the vessel. The statutory basis for these notices is that the wreck constitutes a hazard to navigation, and the notices can only remain effective so long as that situation pertains.***

- ***A notice under s248 of the MTA to require the complete removal of the remains of the vessel. The statutory basis for these notices is that the wreck constitutes a hazardous ship within the definition in s247 of the MTA. That definition applies to a ship that, as a result of a shipping casualty or acts relating to such a casualty, is discharging, or is likely to discharge, a harmful substance into the sea or the seabed.***"

3.2.14 Sub Paragraph 6.2, Section A of the BECA report advises on "***MNZ Notices and Salvage Works***" and provides for the owners interpretation of the MTA Notices as follows:

"Salvage and recovery works since the grounding have been carried out in accordance with the MNZ notices. Compliance with these notices to the stage where the wreck is no longer a hazard to navigation and is no longer a hazardous ship (such as to entitle the Director to maintain the Notices) is considered to be the minimum that the owner can be obliged to do under New Zealand law. The Base Alternative considered in this Volume is premised on doing the minimum that could be required to satisfy the notices, in terms of the MTA.

The interventions at the wreck site by the salvors, as instructed by the owner, have been undertaken in accordance with the MNZ notices. The intent has been to remove the hazard to navigation and to ensure that the wreck and its cargo are no longer 'hazardous' in terms of the MTA, taking into account concerns raised in consultation and to remove the risk of flotsam."

3.2.15 Section A is finalised with a sub paragraph defining the requirements and the owner's interpretation of the "***Resource Management Act 1991 (RMA)***". This is defined as follows:

"The notices issued by MNZ specifically refer to compliance with the Notices by other lawful means. This contemplates the owner seeking consent pursuant to sections 15A and 15B of the RMA which provide for consent to the dumping (or abandonment) of a ship and its cargo and the discharge of harmful substances from a ship into the coastal marine area.

The consideration of alternatives that follows assumes that the Base Alternative and the PWR alternative constitute an alternative means of satisfying the notices issued by MNZ."

3.3 BECA Report, Part B, Consideration of Alternatives

3.3.1 Sub paragraph 1 of Part B of the BECA report provides an overview of Section B. Section B outlines the alternative considerations for dealing with the wreck. The alternatives considered range from the leaving what remains of the wreck and cargo after undertaking the minimum required to comply with the notices issued by the Director of MNZ under the MTA through to fully removing the wreck.

The three alternatives considered were refined over time after the owner undertook consultation and technical advice and assessments, the three alternatives considered are defined in the ensuing paragraphs.

3.3.2 **Base Alternative**. This alternative considers the minimum required work to be undertaken to comply, with the owner's interpretation of, the MNZ notices issued under the MTA. Defined as the wreck no longer constituting a "***hazardous ship***" in terms of ss 247 and 248 or a "***hazard to navigation***" in terms of s100A.

The MNZ notices do provide for an alternative to full wreck removal as being: "***…by some other lawful means***" (s248) and "***…under other lawful means of dealing with the wreck have been achieved***" (s100A). The owner's interpretation of these alternatives is to obtain resource consent to abandon the wreck pursuant to s15A (RMA).

This option is summarised as follows:

"***This option was to cease work at a point where the minimum necessary had been done and then to apply for resource consent to abandon the remains of the vessel and its cargo in its then state."***

3.3.3 **Partial Wreck Removal**. The second alternative considers undertaking additional salvage and recovery work beyond the minimum to comply with the MTA notices (as discussed in the Base alternative above). The BECA report advises that this would render the wreck as benign as is practicable, albeit this is considered beyond the owner's strict legal obligations.

3.3.4 **Full Wreck Removal**. As the name suggests, this alternative contemplates the removal of the wreck and cargo in its entirety. The BECA report advises as follows:

"***There is no certainty as to what this would involve exactly, how it might be carried out and how long it would take. Assessing this alternative requires a number of assumptions.***"

3.3.5 The BECA report advises that when assessing the alternatives it is necessary to separate out those effects that have already occurred, or are likely to occur, as a result of the grounding and break-up of the ship, from the effects of the alternatives being considered. The report further advises; "***Even the alternative of FWR will not return the Reef or the environment to a "pre-Rena" state and has the potential to cause additional significant adverse effects.***"

Whilst it is accepted that FWR will not repair the physical damage sustained to the rock structure of the Reef or replace the displaced sands adjacent to the Reef (where the wreck has slid down), I believe it is a moot point to argue

that the FWR "***has the potential to cause additional significant adverse effects.***" Whilst not having a scientific background, it is difficult to conceive that leaving a wreck which is coated in TBT in situ is more beneficial than removal of the source. Similarly, the copper clove, which is identified in the BECA report has having a potential adverse effect on the marine environment as it can enter the food chain with adverse effects to some organisms, surely cannot benefit the environment by remaining in situ. The effects of cyclone LUSI and the previous storm systems experienced are evidence enough that the wreck and cargo are mobile. Additional dispersion, not removal, can only increase the adverse effect these products are already having on this affected environment.

3.3.6 The BECA report further advises that the key assumptions made in assessing the relative change in effects are:

"1. The most negative effects occurred at the time of the grounding and in its immediate aftermath. Actions taken since the grounding have mitigated the effects of that event, resulting in an improved (less negative) state of the environment."

2. Natural recovery has occurred since the grounding and has been assessed as being most positive at times when there is no salvage activity disturbing the site.

3. The Base Alternative and PWR result in an increased habitat surface area that will provide for an expanded environment once negative effects have been mitigated as far as practicable.

4. FWR will potentially cause significant adverse environmental and cultural effects during removal and have potentially significant (fatal) health and safety impacts on salvors. The long-term effect is likely to be that the environment recovers naturally to a state of equilibrium."

Figure 1 at paragraph 3.2.9 of this report shows the relative small size of the footprint of the actual wreck as compared to the large footprint of the debris fields (both major and minor) therefore the argument raised in point 1 above

appears incorrect. By far the largest impact on the Reef appears to be the effects of the debris field, and the movement of the wreck, something that appears to worsen each time there is weather system impact.

Similarly, the argument raised in point 4 above appears counter-productive, the BECA report accepts that the long term effects of FWR allows the environment to recover naturally to a state of equilibrium.

3.4 Base Alternative

3.4.1 Sub paragraph 8.1 of the BECA report reiterates the owner's interpretation of the MTA Notices that compliance with the notices to the stage where the wreck is no longer a hazard to navigation and is no longer a hazardous ship is the most that the owner can be obliged to do under New Zealand law.

A hazardous ship is defined within s247 MTA as a ship which is discharging, or is likely to discharge, a harmful substance into the sea or seabed. BECA and their advisory team have identified that TBT and the Copper Clove within or adjacent to the mobile wreck and debris field are a potential risk and harmful to the marine environment.

3.4.2 In summary, the BECA report provides an explanation as why the works undertaken would achieve the outcomes described in the MNZ notices;

- ***"With regard to the s 248 Notice, the effects of all "pollutants and dangerous goods" have been assessed. There remain two potential pollutants that have not been removed or dispersed from the wreck. These are copper clove in Hold 6 and tributyltin (TBT) in the underlying antifouling paint. It is considered that the remaining TBT on the hull and the copper clove in Hold 6 would be unlikely to cause serious harmful consequences to the marine environment or marine interests with the Base Alternative.***

- ***With regard to the s 100A Notice, the aft-section of the wreck is located at a minimum depth of approximately LAT -24m. The bow section of the wreck has been cut down to a minimum depth of LAT -1m. Astrolabe Reef already represents a hazard to***

navigation clearly marked on charts of the area. The wreck itself is to be marked on the charts. The bow section represents no greater hazard to navigation than the Reef itself and is not itself a hazard to navigation."

Given the recent changes to the wreck site during the passage of tropical storm LUSI, where both the aft section and bow sections were reported to have moved considerably, and a patch of copper clove exposed in the debris field, these two statements need to be confirmed. That is, is the release of any TBT and copper clove during the movement of the hull in a storm event likely to create an environmental hazard, and are the bow sections on the reef maintaining a depth of -1m LAT, without likelihood of that depth being decreased.

3.4.3 Sub paragraph 8.2.2 "***Natural Environment***", under a Water Quality, considers in some detail the findings of a study undertaken by the Cawthron Institute and commissioned by the owner of "RENA".

The BECA report advises; "***The container of copper clove has not been able to be located but it is assumed to remain in the wreck***. ***The Cawthron report (see Volume Two) concludes that while it remains contained in Hold 6 the copper is unlikely to have a significant adverse effect and any adverse effects would be localised and related to small-scale releases as the Hold breaks up over time. However, if there were to be a mass release there is the potential for significant effects on water quality and ecology."***" It should be noted that after the passage of tropical storm LUSI causing movement in the wreck, deposits of the copper clove were sighted in the debris field near No.6 cargo hold. Further the report advises; ***"The cargo is not able to be removed and it is assumed that it has largely not dispersed."*** This statement is made without explanation as to why it is not possible to remove this cargo. In fact, in the MNZ sitrep of 13th June 2014, it describes that: "***extraction of copper sediment from a depth a 30m was achieved early in the week. The use of the Peri Pump suction device and an adapted CMA recycling bin fabricated with baffles was crudely arrangement, but effective***." Given the movements described with the hull after the passage of tropical storm LUSI, the potential risk of this

copper being exposed remains with the Base and PWR alternatives. In a footnote to this section in the BECA report it states; ***"Monitoring and contingencies would be implemented under the PWR alternative, as a condition of resource consent pursuant to s15B of the RMA. By comparison, FWR has the potential to break-up the copper clove container and its cargo resulting in a mass release of copper into the environment with the potential for significant adverse effects."*** The results of the recent weather event, the passage of tropical storm LUSI, has also shown that by doing nothing with the wreck there remains the risk that further movement and degradation of the hull, bow pieces and debris field could result in both the release of TBT and the copper clove cargo.

3.4.4 I note at sub paragraph 8.2.2, section b. Ecology, final paragraph that the BECA report states:

"***The naturalness of the Reef was affected temporarily by the grounding. However, in the longer term the wreck will be recovered by the Reef ecology and the character that was present before the Rena grounding will be re-established.***"

I find it disconcerting that such a high-level report does not conclude such a statement without any comparative time scale. How long will the reef ecology take to recover fully by leaving the wreck, debris and pollutants in situ against how long it will take to recover after FWR. It should be noted that following the latest weather event, the passage of tropical storm LUSI, that the hull pieces and debris field have moved (see paragraph 3.2.9 above) but the report does not detail how such future movements will impact on the recovery of the Reef.

3.5 <u>Partial Wreck Removal</u>

3.5.1 Sub paragraph 9.1 "***Description***"[11] of the BECA report again advises that the Base alternative involves the partial removal of the wreck to a degree that satisfies the requirements of the MTA. Furthermore, compliance by other

[11] BECA report, Section B, Chapter 9, sub-paragraph 9.1

lawful means would be achieved by way of an application for consent under the RMA to the Bay of Plenty Regional Council.

3.5.2 The PWR alternative contemplates additional works above and beyond those considered in the Base alternative. Consideration is also given to the environmental effects of the physical change to the Reef that will result from the leaving the wreck on the Reef.

All matters described in the Base alternative are assumed to apply to the PWR alternative, with the addition of the proposed following actions:

- ***“Removal of the accommodation block, originally down to A Deck but after tropical storm LUSI in March 2014 this was amended to D Deck***
- ***Reduction, as much as practicable, of debris in the wreck, particularly cargo and structural debris that might be hazardous to recreational divers down to a depth of LAT -30m***
- ***Reduction of debris in the debris field***
- ***Implementation of a scientific sampling protocol to monitor not only the effects of leaving the wreck but will also provide information as to the recovery of the environment from the effects of the grounding and its aftermath***
- ***Implementation of a comprehensive suite of conditions of consent over the duration of the resource consent including:***
    - ***A Monitoring Plan to monitor cultural values, environmental effects, the condition of the wreck and to provide for review of monitoring frequency and scope and for contingencies***
    - ***A Wreck Access Plan to educate and inform visitors to the Reef, including recreational divers***

- ***A Shoreline Debris Management Plan to recover debris from the Rena washing up on the shoreline***
- ***Restoration and Mitigation to address any potential adverse effects of leaving the wreck.***

This PWR option is anticipated to leave the wreck in a state where any adverse effects on the environment are no more than minor."

The second two points explain, commendably, that reduction of the debris field will be undertaken both to reduce the debris field and remove the hazards to recreational divers. To date, from the MNZ sitrep of 13th June 2014, the total amount of debris recovered is 884 tonnes but it is not clear from this application how much debris remains. But what is clear from the Supplementary Report from Gorman & Mitchell is that after the passage of storm LUSI, the movement in the debris field caused a worsening of the diver hazards. Consequently, the issue not raised in the actions above is how much debris will be removed and when it is considered sufficient given the re-setting of the debris field after a weather event.

3.5.3 Sub paragraphs 9.1.1 through to 9.1.4 consider the partial removal of the accommodation block, the reduction of the debris field, the scientific sampling protocol and the proposed conditions in respect of the PWR alternative, but again does not address the extent to which the debris field will be reduced.

3.5.4 The considerations given to the PWR alternative are contained within sub paragraph, 9.2 "***Consideration of the PWR Alternative***"[12] of the BECA report and consist of a number of sub-headings which are discussed below when relevant to this report.

3.5.5 The stated objective of the PWR alternative is given as:

"The objective is to reduce to as benign a state as practicable the effects on the environment of leaving the remains of the wreck. In addition conditions are proposed as outlined in section 9.1.4 above."

Paragraph 9.1.4 states;

[12] BECA report, Section B, Chapter 9, sub-paragraph 9.2, page 27

"The PWR alternative provides for 2 resource consents to be sought. The conditions of the resource consents as they are offered by the owner/applicant are an important feature of the alternative. Proposed conditions include:

- ***A Monitoring Plan to monitor cultural values, environmental effects, the condition of the wreck and to provide for review of monitoring frequency and for contingencies***
- ***A Wreck Access Plan to educate and inform visitors to the Reef, including recreational divers***
- ***A Shoreline Debris Management Plan to recover debris from the Rena washing up on the shoreline***
- ***Restoration and Mitigation to address any potential adverse effects of leaving the wreck."***

3.5.6 Sub paragraph 9.2.2 **"*Natural Environment*"** of the report considers the water quality, the ecology and the impact on marine mammals. Of note is the section regarding marine mammals, where it is stated that the option with the lowest overall risks to marine mammals is to leave the wreck in place. This seems somewhat at odds in reference to the known dangers of TBT[13] as referenced: "…***TBT leaches from the ships hulls and has incredibly toxic effects on organisms at all points of the food chain, including mammals…***"

3.5.7 This section also discusses the impact of noise on marine mammals, advising that while still existing within the PWR alternative these are at a much lesser scale than that required for the FWR alternative. In addition, the following comment is made:

"***If further small-scale sonar surveys are deemed necessary for this option, precautions can be taken to ensure that minimal sound disturbance occurs including; the use of the lowest practicable sonar***

[13] http://en.wikipedia.org/wiki/Tributyltin

sound levels, ramping up of sound sources and/or sound containment options."

It is unclear from the above on what basis SONAR is being used or why this particular technology would be considered. The effects of SONAR on marine mammals[14] have been widely studied and can be seen to be detrimental to some marine mammals. However, the studies show that this is generally limited to the long-range low-frequency military SONAR (often referred to as "Boomers") used for long-range submarine detection. I am concerned that the reference to SONAR in the BECA report is confusing SONAR with Multi-beam Echo-sounders (of the type used during the ALDUS surveys). It should be noted that studies made of the high-frequency, low-duration transmissions of Multi-Beam Echo-Sounders (MBES) show that: ***"… while echosounders may transmit at high sound pressure levels, the very short duration of their pulses and their high spatial selectivity make them unlikely to cause damage to marine mammal auditory systems, according to current knowledge.***"[15]

3.5.8 The remainder of this section regarding the PWR alternative is focussed on the social impact of the exclusion zone, navigation impact and operational health and safety.

3.5.9 The "***Summary***" of the PWR alternative is provided at sub-paragraph 3.6 and states as follows:

"***The PWR alternative proceeds further along the continuum of actions that may be taken to leave a non-hazardous environment. It includes all practicable interventions and provides for conditions to be included with a resource consent, including benefits to the community and the environment that the alternative of FWR will not.***

The only alternative beyond enabling the remains of the wreck to be in as benign a state as practicable is, therefore, the alternative of fully removing the wreck. This alternative is discussed in the following section. "

[14] http://en.wikipedia.org/wiki/Marine_mammals_and_sonar
[15] http://www.iho.int/mtg_docs/IHReview/2011/IHR_Nov032011.pdf

I am at a loss how the PWR alternative can possibly provide benefits "***to the community and the environment that the alternative of FWR will not.***" It is difficult to understand the reasoning behind a statement that advises that leaving a wreck and debris that contain TBT and copper clove pollutants is better for the community and the environment than their full removal given the recent movements and degradation in the hull structure after the passage of tropical storm LUSI which also exposed copper clove. Future storms may also cause similar movements and a churning of the debris field.

3.6 Full Wreck Removal

3.6.1 The description of full removal is provided within the BECA report at Section B, Chapter 10 "***Full Wreck Removal (FWR) Alternative***"[16]. Sub paragraph 10.1 provides a description of this alternative:

"FWR would involve removing the entire ship structure and cargo/debris within the holds and surrounding environs. While it may be possible to remove the bulk of the ship structure it is not possible to remove every last vestige of debris which may be either impossible to locate, jammed in rock crevices, buried in the seabed or overgrown. Removal of the wreck structure would also be likely to result in a mass release of contaminants, such as copper clove and TBT. Such a release has the potential to have a significant contamination effect on the surrounding reef environment. In international wreck removal it is usual to undertake removal of material to a minimum dimension of 1 metre by 1 metre, or by type."

As stated in the above excerpt, it is normal on wreck removal tenders to quote a minimum specified size that should be removed as a definition of contractual completion. This minimum specified size is often mutually agreed between the vessel owner and the local regulatory authority. $1m^2$ has been used for a number of years in international tenders as it is the minimum size of ferrous scrap material that can be reasonably detected using either multi-beam echo-sounders and/or magnetometers. However, it should be realised that it is possible to detect and remove smaller debris size than the figure

[16] BECA report, Section B, Chapter 10, page 29

quoted. Rest assured, if the aluminium ingots carried onboard RENA had happened to be gold then it is safe to say that the minimum specified size requirement for removal would be less than the size of an ingot.

3.6.2 The methodology considered for FWR has been assessed by TMC Marine Consultants (TMC) and they have provided the information for sub paragraph 10.1.1, Methodology, of the BECA report.

TMC have identified a number of significant challenges in this operation primarily because of the location and depth of the wreck and the likely down-time as a result of the weather and sea conditions. The specific difficulties and hazards identified by TMC are provided in the BECA report, namely:

- ***"Activities are weather dependent – 57% of the time available has been down-time since July 2013 due to weather and sea conditions at the Reef***
- ***Piecemeal cutting will create additional debris and will release contaminants such as paint flakes (containing TBT) and copper***
- ***All stages of the recovery would require intensive diving operations and some of these operations would be at saturation diving depths (below -50m)***
- ***Using the mechanical grab may damage the seabed and may itself be subject to damage when used inside the wreck***
- ***Structure and cargo recovery will be extremely slow***
- ***Risk of premature collapse of the structure while divers are cutting***
- ***Cutting the hull itself will result in further damage to the Reef."***

TMC advise that the specific methodology that might be used in FWR is highly variable and would only be determined through a competitive tender process. As this process has not been undertaken at this stage (for this work) they are unable to conclusively state what methodology would be used.

However, I would comment that some of the specific hazards identified by TMC above would indicate that these relate to the present methodology and the existing spread on site. Therefore to allow a more reasonable and fairer interpretation of the hazards these should be re-assessed based on the various methodologies and technologies available and not simply on air diving, piecemeal removal.

Furthermore TMC have identified the fact that piecemeal removal "***will create additional debris and will release additional contaminants such as paint flakes (containing TBT) and copper***" yet despite this, this was the chosen method to deal with the partial wreck and debris removal to date.

3.6.3 Similarly on page 31, TMC state:

"Throughout the main period of the operation to cut down the hull there would need to be up to three barges at the site, being a cutting barge, a lifting barge and a transport barge. These would require a high degree of coordination including the provision of large anchor spreads for at least the lifting and the cutting barges. The anchor spreads could comprise 12 – 16 individual anchors extending up to 1km from the site. There would also be a number of smaller craft patrolling the area and providing logistical support."

This statement assumes that the removal operation will be undertaken by chain cutting using a moored spread. Alternatives exist to a moored spread, such as Jack-up rigs and Dynamically Positioned (DP) craft.

3.6.4 TMC have made a number of assumptions in the final paragraph of page 31 where they state that; "***Assuming that the average of 57% downtime in salvage operations at Astrolabe Reef noted above is representative of the future conditions at the wreck-site the estimated time to complete the FWR would be between 5 and 10 years."*** However, as highlighted above in paragraph 3.3.4, it had already been stated in the BECA report that; "***There is no certainty as to what this would involve exactly, how it might be carried out and how long it would take. Assessing this alternative requires a number of assumptions.***"

Consequently, despite correctly identifying the difficulty of assessing the time taken for the FWR, a duration of 5 to 10 years is now chosen without any detail to support this assessment, most particularly the methodologies used to derive such a duration.

3.6.5 I think it more reasonable to state that if left alone, as proposed in the Base and PWR alternatives, the wreck itself will still be dispersing TBT and exposing copper clove debris from the deteriorating and mobile wreck sections.

3.6.6 Sub paragraph 10.2 "***Consideration of Full Wreck Removal Alternative***"[17] notes that a full wreck removal would not result in the restoration of the Reef to its pre-RENA state, considering that the medium and long term adverse effects of this alternative are more significant than the PWR alternative. It is stated that "***Heavy equipment would scrape and damage marine growth in the vicinity of the wreck and along each of the 16 or more anchor chains as the barges move with the tide and wind.***"

This assumes that the removal spread will be moored at site and does not contemplate any other methodology. Furthermore, no comparison is made of the damage to the marine growth each time the wreck sections deteriorate or move, nor does it take any account of the damage to the marine fauna of the wider dispersion of TBT paint flakes and copper clove exposure each time there is a weather event at site.

In addition, it is possible to moor a barge to anchor chains using suspended mid-line catenary buoys along the anchor chain[18]. This system is widely used in the offshore industry to safely raise anchor chains above sensitive areas (such as pipelines or reefs). The effect is that the catenary angle of the anchor chain is decreased, therefore moving the "touch-down" point of the chain further away from the moored vessel. This usually requires a longer scope of chain and often larger anchors but is widely used in the offshore industry and has been used in the salvage industry to ensure anchor chains are kept clear of sensitive reef structures.

[17] BECA report, Section B, Chapter 10,sub paragraph 10.2 page 31

[18] http://offshoremechanics.asmedigitalcollection.asme.org/data/Journals/JMOEEX/28168/003102j.1.jpeg

3.6.7 Under the heading of Natural Environment, 10.2.2, a. Water quality, is considered next, where it states; ***"Water quality would most likely be adversely affected from a mass release of contaminants, particularly copper, during operations to completely remove the wreck. The concentrations of contaminants would be higher than if the wreck was left to break down over time.***

The main concern during the FWR process would be a mass release of copper clove, most of which is still believed to be trapped in Hold 6. The cutting and removal operations would also result in increased turbidity, which would adversely affect the ecology in the vicinity. The continuing presence of these contaminants on the Reef following FWR may result in further adverse water quality effects."

The argument that small-scale piecemeal removal will cause an increased exposure of the copper clove cargo is a moot point (as previously discussed). It does not consider the wider dispersion of this cargo due to movement and break-up of the wreck and debris in the various weather events.

3.6.8 Under the subtitle, b Ecology, it states; "***The primary adverse effect associated with FWR may arise from the release of paint flakes containing TBT as a result of mechanical disturbance associated with cutting and movement of the hull and the movement of wreck debris."*** then explaining how, if TBT is released it has significant adverse effects up the food chain potentially resulting in long-term sub-lethal effects to animals at higher trophic levels. It then states that; ***"If tin-based coatings are present on the hull, this would significantly increase the extent of exposure for the adjacent marine environment over a short time period. While these effects may also be experienced as a result of the grounding, there would be a significantly greater potential for them to occur as a result of the FWR alternative."*** This section fails to mention that, with the movement and deterioration of the wreck hull sections during a future weather event, if these hull parts remain, could also result in the release of the paint flakes. This section of the BECA report then states; "***There is the potential for high load releases of contaminants, particularly copper clove, during FWR operations. The release of copper clove into the water column to***

eventually deposit in the sediments has the potential for a significant effect on the environment." As has been seen in the aftermath of the passage of tropical storm LUSI, the movement in the debris field has exposed the copper clove, albeit an apparent small patch, but something that may well be repeated at a future weather event. Finally, under this section, it states; ***"There is also the potential for damage to soft sediment and reef habitats from the mooring systems, barge legs (if used), and machinery that will be required for FWR operations, for example, as chains, equipment and pieces of the wreck are dragged over the sea floor."*** . This statement is based upon one methodology and has not considered other means such as DP vessels, using mid-line catenary buoys and jack-up rigs.

3.6.9 Under the heading of c. Marine mammals, it is stated that; "***FWR is considered to have the greatest overall effect on local marine mammals' distribution and use of Bay of Plenty waters."*** citing the 5-10 year FWR operation as a potential cause of migrating whales abandoning the use of the area altogether, or softening this bold statement by saying; ***"or at least until salvage activities cease."*** Firstly, the current salvage operations have been ongoing since October 2011, using similar noisemaking methodologies as proposed as the method for full wreck removal in this BECA report (e.g. chain cutting). I note that the Cawthron Institute in their report **"MARINE MAMMAL ASSESSMENT"** say that; ***"Given the regular sightings of fur seals and unknown dolphin and whale species currently being reported within the vicinity of ongoing Stage 2 work on the bow and debris/cargo recovery, (Appendix 2 – unpublished monitoring data), it is considered unlikely such noises from the wreck itself will have any adverse effect on local populations of marine mammals."*** In addition, BECA in their technical report titled **"Natural Character Assessment Proposal to Leave the Remains of the MV Rena on Astrolabe Reef",** have included an undated picture (Photo 8) which has the description of ***"View showing seals frolicking around the top of the Reef, about 10 metres from the reef top that dries at low tide.".*** Consequently, if after nearly three years of noisy activity at the wreck site, including the use of anchors and chains, chain cutting and lifting of large steel sections, has not resulted in the scaring off of marine mammals, then it is unreasonable that this particular statement has

been made in the BECA report. Secondly, there is no justification or explanation provided on how the FWR of 5-10 years is derived.

3.6.10 Under the paragraph titled Social Effects, 10.2.3, it states in a. Social impact; “***Following full removal some people may feel that their experience of the coastal environment is improved because it is a ‘clean’ environment. However, it is not possible in any FWR scenario to remove all vestiges of the grounding and there will be debris and material that remain buried, dispersed or lodged in the Reef and are too difficult, or even impossible, to remove.”*** Before considering the public’s perception of what a full removal means, they should also be advised on what the Base or PWR alternatives also mean in respect of the debris field. The exclusion zone has restricted public access to the Reef since October 2011. Once the Reef is open for public access, with any of the three alternatives, they will view the status of the Reef and any items of RENA remaining and I have no doubt that there will be specific public interest to view the underwater status of the wreck and Reef immediately at this time. Consequently, rather than just describing what the public perception might be, I feel it would be more appropriate for detailed underwater videos of the wreck site to be part of this resource consent application, with an explanation how the debris field changes after weather events. Under the sub-title of b. Recreation, again it states that there will be no recreation and tourism access to the Reef for approximately 5-10 years with the FWR, but the justification for this timescale is not provided.

3.6.11 In the sub-paragraph titled c. Navigation safety, it states that during full removal operations floatable cargoes could be released that may pose a navigation risk citing the release of plastic beads during a weather event as an example of where containment measures put in place were breached. This is unreasonable to use such as an example as the plastic beads are believed to be neutrally buoyant and do not constitute a navigation hazard. Whilst there will be a measure of containment in place during wreck removal operations, the same cannot be said if the wreck is left in situ as preferred under the PWR. If floatable materials do still remain in the wreck then they are just as likely to be released during a weather event as during a wreck removal operation. Although, crucially, with the latter, the containment measure should increase the possibility of recovering any floatable materials.

3.6.12 The sub-paragraph titled d. Human health, also considers the risk to health and safety and the report advises:

“***The total removal of the wreck and cargo has the greatest risk to health and safety of the three alternatives. The risk is increased as a result of the extended duration of activities at the site and the hazardous nature of those activities.***”

It would appear that the greatest concern here is diver safety at depth; however it should reiterated that there are alternatives to using divers, for example Remote Operated Vehicles (ROV) which are used regularly in both the offshore and salvage industries. The stern section is now lying at a depth which is not safely accessible, at least in part, by commercial air divers.

3.6.10 This section is summarised as follows; “***In summary the FWR alternative significantly extends the duration of operations at the Reef and thus the length of time the exclusion zone would remain in place. There would also be:***

- ***Significant human health concerns regarding undertaking an operation in the dynamic environment of the Reef at depths of up to LAT -56m***
- ***There are greater effects of damage to the environment and the environment would take a longer time to recover***
- ***The operation may also have an adverse effect on sensitive elements in the environment, such as marine mammals.***

However, of most concern is that the FWR alternative is likely to result in a mass release of TBT from the ship’s hull and copper clove from the container in Hold 6 as the ship is broken up for removal.”

I am unable to differentiate between the effects of the ship being broken up into smaller pieces for removal and that of the wreck and debris field breaking up into smaller pieces and/or moving due to a weather event if left under the Base or the preferred PWR alternatives.

3.7 Comparison of Alternatives

3.7.1 Section 11 of the BECA report compares the alternatives using similar headings as those considered in the three alternatives discussed within the report. I do not intend to discuss this section in detail as the contents have already been raised in the previous sections of this report. Sub paragraph 11.5 contains the summary of the consideration of risk, in Table 6.

3.7.2 In paragraph 11.6, after considering the risks and effects associated with removing or leaving the remains of the wreck, BECA state that the preferred alternative is the PWR alternative and that; ***"The PWR alternative provides for as benign an environment as is practicable without the extended duration of occupation (and exclusion zone) that would result from FWR. FWR would also result in significantly increased risk and uncertainty at little or no additional benefit to the environment."***

However, this fails to mention the risks to the environment from dispersion, by natural break-up, of both the TBT and the copper clove from the aft section with the PWR. The BECA report then states that; "***The Base Alternative was not preferred because, although it mitigates most of the risks identified in the same way as the PWR alternative, it had potential long-term risks to the environment from effects which were not effectively remedied or mitigated, including release of flotsam and debris and increased risk to recreational divers."***

I am unable to agree entirely with the selection of the preferred option, particularly in respect to the TBT and copper clove issue covered earlier throughout this report. I am also concerned that the assessment on the PWR selection is based on the existing methodology being used at site, the BECA report fails to consider or reasonably assess any other alternative wreck removal options.

3.7.3 In Part C, Consideration of Effects over Time, a Table, 7, is included which compares the long-term potential effects over 20 years (long-term), 5-20 years (medium-term) and 5 years (short-term) of the PWR and FWR alternatives. The comparison between the PWR and FWR is then summarised in paragraph 12.2. The summary comparison between the PWR and FWR alternatives is presented as a graph (Figure. 4) which compares the potential for adverse effects to the time taken to achieve recovery. The report advises that from the graph[19] it is derived that; ***In the longer term it is considered that the state of the environment under both alternatives will be approximately equivalent and that this will be similar, if not slightly better than, the "pre-Rena" environment if the potential for increased habitat complexity and biomass is taken into account."*** I find it extraordinary that such a conclusion can be arrived at from two coloured lines on a graph. I assume that this conclusion is arrived at due to the extensive time scale of 5-10 years being used for the FWR. Additionally, it is inconceivable that it can be concluded that the environment will be "***slightly better***" than the pre-Rena environment. Each and every time a weather event affects the reef, the wreck sections will further deteriorate and move, dispersing more and more TBT and exposing copper clove to a wider area, in addition to the physical damage to the flora each time the wreck sections are scraped along the reef.

3.7.4 The summary also advises:

"The FWR alternative is likely to result in increased adverse effects on the environment for the duration of the works at the site. Some of these effects, such as the release of TBT and copper into the environment, also have the potential to endure for a much longer period in the environment. This alternative is also likely to result in further damage to the Reef as the wreck is cut down and removed."

[19] BECA report, Section C, Chapter12,sub paragraph 12.2 page 52

Whilst it is accepted that any cut-down wreck removal will inevitably result in a release of ***some*** TBT during the cutting and rigging operations, the act of FWR will remove the remainder of the TBT from the Reef. Simply leaving the wreck in situ, as in the PWR alternative, will result in ***all*** the TBT still on the hull remaining within the Reef environment. The weather effects have likely caused uncontrolled releases of both TBT and copper clove and are likely to continue to do so each and every time the wreck sections move. In time ***all*** of the TBT will inevitably be dispersed into the Reef environment.

3.7.5 The final two paragraphs of the summary comparison section are an attempt to justify the scales of the graph included as Figure 4 of the BECA report. However, the down-time quoted as an average of 57% of the time to date and an estimate of up to 80% of the time for some of the additional works (though without any in-depth analytical assessment) is based, I believe, on the present methodology. The small-scale piecemeal is particularly susceptible to weather downtime, the use of smaller moored barges will inevitably suffer from the vagaries of the Bay of Plenty weather. Fixed jack-up systems and/or DP operated crane vessels do not suffer from such extensive downtime periods. Whilst some work will be affected by severe weather systems the advantage of either Jack-up or DP is that they do not require the long lead-time for demobilising/re-mobilising to site. A DP-based system will leave the site when the conditions become too adverse for holding station and can rapidly re-mobilise to site when the conditions allow. A jack-up based system would only have to demobilise in all but the worst conditions at site.

4. COMMENTS

LOC has been asked to respond to a series of questions which are detailed within section 1.1.2 of this report. Section 4 of this report considers these questions based on the information presented within the BECA document. The section below follows the order in which the questions are asked in section 1.1.2.

4.1 ***A General Assessment of the Proposed Removal Techniques***

4.1.1 It should be noted that, in this BECA report, three alternatives are proposed for dealing with the wreck; the Base Alternative i.e. effectively leaving the wreck as it is, the Partial Wreck Removal (PWR) i.e. the Base Alternative but in addition removing everything to below -1m LAT, removing diving hazards and reducing the debris field and then monitoring the wreck site, and Full Wreck Removal (FWR), that is, removing the structures and debris greater than about 1m². Consequently, given that the bow is said to have now been addressed, the upper section of the accommodation already removed, the only remaining "removal" activities intended for the PWR are the reduction of the debris field and to remove the diving hazards. This, by its nature, is a piecemeal removal and remains ongoing. Consequently, whilst I have commented on this area in the questions below, but the focus for any more substantial removal, i.e. of the hull parts, is only the FWR alternative. Although not specifically stated, this BECA report implies that the FWR alternative would follow the same or similar methodology, or technique, as currently being used, which is estimated, would take between 5 to 10 years. However, the derivation of this duration or its potential cost is not provided. The current main RSF spread in New Zealand that has been used, and is being used, for the PWR alternative is as follows: -

RESOLVE COMMANDER and RMG 280 – An ocean-going tug (78 tonnes, bollard pull) with an anchor handling capability and 70m length dumb barge with 280 tonne crawler crane.

RESOLVE GLADIATOR and RMG 1000 – An ocean-going tug (72 tonnes bollard pull) with an anchor handling capability and a 91m length dumb cargo barge.

RESOLVE MONARCH and RMG 500 – An ocean-going anchor handling tug of 152 t bollard pull and a 350 ton sheerleg barge.

All the barges require anchors to spread-moor around the Reef.

4.1.2 **“*Are these techniques within the range of techniques that would usually be used, or as appropriate for use, in the present circumstances?*”**

There are many options available for wreck removal. It is not uncommon for the salvage industry to custom design and develop, highly-engineered solutions to complex wreck removal scenarios. Over the years, both LOC and TMC have had active involvement in just such highly-engineered, highly-technical solutions.

The present method of wreck reduction is low-tech, low-cost and largely dependent upon human intervention (divers below water and previously surface cutters above water). Floating assets are limited to 4-point moored barges. This spread’s greatest limitation is the environmental effects at the Reef. It has been stated in the BECA report that there has been about 57% weather downtime with the current methodology. In the Metocean report entitled **“ASTROLABE REEF METOCEAN CONDITIONS. Wave, ocean current and wind statistics”**, included as part of this resource consent application, is a table (Table 4.4) showing the Monthly and annual total significant wave height exceedence probabilities. It is noticeable that the annual exceedence in this table is 52.23% for significant wave heights of greater than 1m. Given that, with the present spread on site, better sea conditions are needed for heavy lifts, then it is understandable that 57% weather downtime has been experienced. That is, from this table, the current spread appears to require operating sea conditions of about significant wave height of 1m or less. It therefore follows that, if a spread on site could operate in conditions of higher sea states, there would be less weather downtime, therefore reduced duration for operations. A spread including assets such as dynamically positioned vessels of shallow draught, with heave compensated cranes of substantial capacity, or jack-up rigs which take the working platform away from the most of the sea wave effects, are possible options.

Consequently, a number of alternatives to the above low-tech, low-cost option do exist. Greater cost options will limit human intervention and focus on high-end engineering methodologies with high-cost floating assets. The alternatives can be categorised as follows:-

a. Low-tech, high-cost floating asset removal (large crane/sheer-leg used for wreck grabbing).

b. High-tech, high-cost floating asset removal (utilising specialist underwater cutting equipment (chain and/or wire cutting) for removal of large sections of wreck.)

c. High-tech, high-cost floating asset removal (utilising DP dive support vessel, using divers to pre-cut and medium sized crane (fitted to DP vessel) for removal of medium sized sections.)

The alternative strategies described above rely upon the use of advanced equipment which may not readily be available in New Zealand. However, such equipment is available globally and may well be readily available in South East Asia. Distance is not a barrier and it is not unusual for salvage companies to mobilise equipment around the World. In fact it has been LOC’s experience that this can be expected.

Use of high-tech alternatives such as jack-up platforms would require a full seabed analysis to be undertaken to ensure that such a platform could safely be positioned on or around the reef area and gain access to the wreck sections. Alternatively, an assessment would have to be made should a Dynamically Positioned (DP) crane barge be used to guarantee that the vessel could be safely positioned in the prevailing conditions and still ensure suitable outreach.

The present methodology, although basic, has proven to be an extremely effective way forward. There are many advantages to using a simplified method for wreck removal; from the outset daily costs of personnel and spread are known, however, significantly, the unknown is the time scale due to weather down time. It is now evident, with the movement of the stern section into deeper water that this proposed method is reaching the end of its

useful capability and, as such, alternative solutions should be sought although these methods can still be effective on the bow section remnants and the debris field.

4.1.3 **“*Will SONAR need to be used as part of a removal process and if so, what type and how extensively?*”**

SONAR is not required to be used as part of the wreck removal process per se. However, it may be required to undertake periodic assessments of the wreck, debris fields and surrounding reef structure. The equipment best suited for this purpose is the Multi-Beam Echo-Sounders (MBES). This equipment is known as Multi-Beam equipment and provides a very accurate 3D image of the area being surveyed.

A multi-beam echo-sounder is a device typically used by hydrographic surveyors to determine the depth of water and the nature of the seabed. Most modern systems work by transmitting a broad acoustic fan shaped pulse from a specially designed transducer across the full swath acrosstrack with a narrow alongtrack then forming multiple receive beams (beamforming) that is much narrower in the acrosstrack (around 1 degree depending on the system). From this narrow beam a two way travel time of the acoustic pulse is then established utilizing a bottom detection algorithm. If the speed of sound in water is known for the full water column profile, the depth and position of the return signal can be determined from the receive angle and the two-way travel time.

4.1.4 **“*Comment on the stated environmental consequences or likely environmental effects of the use of proposed techniques (for example, likely effects on the physical damage to the reef, to the sea floor, on sediment, and/or the remaining cargo). Please include the effects of additional moorings that might be required on the reef and the likelihood of other parts of the sea floor being used to set down parts of the wreck (as was recently required with the accommodation block, during the removal process) and the effects that these matters have (if any).*”**

Whilst shallow draughted (about 2.5m) the outreach of the current sheer legs on site (RMG 500), with a lifting capacity of 350 tonnes, is about 24m, which could restrict its capability of accessing some of the loose parts of the bow section in the shallow areas of the Reef, although could easily access other loose bow section parts and the main hull. However, this sheer leg may be too small to lift some parts of the bow sections and is too small for the aft section without their further cutting up into smaller pieces; all of which will take considerable time and diver intervention.

The mooring systems presently used at site are traditional drag-embedment anchors. These anchors rely on the act of pulling the anchor along the seabed allowing the “tripping-palm” to act on the seabed and force the anchor flukes to penetrate the seabed structure. Once embedded, the anchor relies on friction, suction and the mass of the seabed above and “in-front” of the embedded anchor. Inevitably, drag-embedment anchor cause disruption to the seabed and sediment layers penetrated. In addition, to minimise the size of the anchors being used, additional mass is incorporated into the mooring assembly with the addition of anchor chain. The chain adds to the holding power of the anchor selected by adding mass (along the seabed and as a result friction and suction) but also ensures that the anchor shaft is not lifted (causing the anchor to trip) in a seaway.

The greater use of anchors and chains then the greater the likelihood of damage to the reef structure. In some areas of the World, such as the Great Barrier Reef and the Florida Reef Systems, such mooring systems would not be allowed in a salvage process. The anchors and chains can and do cause long-term damage to the reef structure.

However, as described in paragraph 3.6.6 of this report there is a solution to this dilemma. The use of midline catenary buoys effectively reduce the angle of catenary and take the “touch-down” point of the anchor chain away from the moored vessel. Any number of these midline catenary buoys can be used; they simply require a longer scope of anchor chain to be deployed. The use of such mooring systems would result in the anchors being deployed off the reef structure (though they may still have a minor impact on any flora/fauna within the seabed/sediment that actual anchor penetrates). The

anchor chain is kept suspended above the reef structure and therefore does not cause any physical damage to the reef.

The alternative solutions/methodologies briefly discussed at paragraph 3.7.5 above would negate the use of anchors. However, to provide a balanced viewpoint, a jack-up would inevitably cause some damage to the reef structure where the legs contact the seabed area.

Similarly, any sections of the wreck that may be lifted and then set back down again have the potential of causing localised damage to both the flora and fauna of the reef structure. This may only perceived as minimal, however it is highly likely that there will be localised impact. It should be noted that the proposed methodology is implied to be the current technique; piecemeal removal. Consequently, environmental effects will be the same as experienced to date. However, should any of the sections contemplated in the paragraph be sections of the lower hull, then the risk of additional dispersion of TBT also exists.

4.1.5 **"*Comment on the owner's assessment of the operational environment, including the assumed operational delays, and how long the proposed techniques would take?*"**

The BECA report advises that the down-time average for the removal to date is 57% of the time, in addition the report estimates down-time of up to 80% for some of the additional works (though without any in-depth analytical assessment). However, it should be noted that this down-time is based on the existing low-tech methodology. The small-scale piecemeal removal operation was always going to be susceptible to weather downtime; the use of smaller moored barges will inevitably suffer from the vagaries of the Bay of Plenty weather.

The BECA report provides the methodology for FWR, where it estimates the time-scale for FWR at 5-10 years, and uses this throughout their assessments of the risks associated with RENA. However, the derivation of this duration is not provided and, as BECA have stated in their explanation of FWR; ***"There is no certainty as to what this would involve exactly, how it might be carried out and how long it would take. Assessing this***

alternative requires a number of assumptions." I can only assume that this 5 to 10 year estimate includes a 57% weather downtime, which is based upon a spread whose operating limits are significant wave heights of 1m or less. A jack-up rig, if it can be engineered to a location on the wreck site to undertake the necessary works, will be almost immune to anything other than the most extreme sea states. However, the nature of the Reef may severely restrict its capability of accessing all parts of the wreck site. However, a dynamically positioned heavy lift crane vessel, with heave compensated crane, could operate effectively around the Reef without the need for use of anchors, and they are often outfitted with accommodation and dive spreads. These have been used in salvage operations, the most recent of which, where LOC was involved, is the wreck removal of the West Atlas jack-up rig from the Montara platform off the north-west shelf in Australia in 2008. I have provided more details on this below, but the asset used was the JASCON 25. This vessel had a DP3 capability and has the ability to conduct lifting operations in seas of up to 3m significant wave height. Whilst it is appreciated that it would not undertake all its operations in such sea states, it is worth noting that, according to the Metocean data, at the Astrolabe Reef sea states in excess of 3m occur only 2.44% of the time annually, which is a substantial improvement on the 52.23% exceedence of significant wave heights of 1m or more, which the current spread is apparently limited to. However, for any accurate assessment of such an operation to estimate the timescale, it can only be reasonably undertaken by conducting detailed engineering of the various options.

4.1.6 **"*Assessment of the safety issues that are likely to arise by the use of the proposed techniques, including how dangerous these techniques are.*"**

The biggest safety issue throughout the operation to date has been that of diver safety. The Astrolabe Reef is a volatile locations and the weather in the Bay of Plenty variable, at best. Diving is regarded as a high risk activity, more so than most other areas of employment. The United Kingdom Health and Safety Executive (HSE) include the following in one of their Guidance documents.

"Diving is perceived by many as a dangerous occupation and is considered by HSE to be "high hazard". The fatal accident rate for the Offshore and Inland/Inshore sectors has typically been in the region of 20 – 40 per 100,000 - considerably higher than construction or agriculture. The fatal accident rate for all diving at work activities is estimated at 6 – 7 per 100,000."

As a result of such statistics diving is controlled throughout the World by the relevant regulatory authority controlling such activity. Whilst high-risk it is risk manageable. Most international diving operators are members of one of two principal diving bodies, Association of Diving Contractors International (ADCI) or International Marine Contractors Association (IMCA), both of whom set down guidelines for operations, from the number and qualifications of the people, to the types, quantity and testing of equipment.

However, as a result of cyclone LUSI, large areas of the stern section are now beyond safe air diving depths for commercial divers. Therefore this safety issue is now negated. It is highly unlikely that saturation diving would be used as a primary method for removal of the stern section (though it may be an option) due to the strict guidelines in place within the two diving associations discussed above.

The other risks mentioned in the BECA report are all manageable risks. Statistically the RENA removal operation to date has been excellent with very few accidents/incidents reported. This is down to the excellent risk management and regulatory oversight provided throughout the RENA incident life cycle.

4.1.7 **"*Is the present exclusion zone sufficient for proposed removal techniques? Do they consider it would need to be bigger or could it be smaller*?"**

The existing exclusion zone was reduced to 2 nautical miles in 2012 there have been very few incursions throughout the life time of the exclusion zone and this may be an indication of how effective the limited exclusion zone is at present. On the basis of the existing flotilla used on the operation to date the exclusion zone appears to be fit for purpose. Allowing for the additional moored craft that TMC have indicated within the BECA report I see no reason

why the existing exclusion zone should not be sufficient for the additional craft proposed. Should alternative proposals be considered, such as DP based operation it may well be that the zone can be reduced in size. The standard exclusion zones around offshore installations are generally limited to 500 metres and these appear to be satisfactory in the majority of cases.

4.1.7 **“*If Possible, please comment on the likely costs?*”**

It is not simple to estimate the likely costs of an operation without first undertaking an in-depth analysis of an additional tender process. The BECA report states that the costs to date of the RENA operation (salvage, recovery and clean-up works) exceed US$350 million. However, the low-cost, low-tech approach used to date has proven that, daily low-cost does not always ensure low overall costs. The existing methodology has been extremely vulnerable to time delays which some of the higher cost, high-tech solutions may not be. LOC has wide ranging experience of some very high-tech solutions undertaken over the years; TRICOLOR US$54 million, CP VALOR US$44 million, OCEAN VICTORY US$52 million, ROKIA DELMAS US$73 million, CALIFORNIA US$44 million and WEST ATLAS US$130 million. In addition, published figures for other high tech solutions include; MSC NAPOLI US$135 million, NEW FLAME US$177 million, HYUNDAI 105 US$57 million and B OCEANIA US$55 million.

It is very difficult to estimate a “total” cost of any operation (bow, stern or debris field) without undertaking a full analysis of any proposed methodologies following a further tender process. However, we have made enquiries within the market for various craft, equipment and dive teams for such an operation and these are presented below:

A suitably sized DP3 vessel with heave compensated crane (800 tonnes at 30 metres) is likely to cost in the region of $200,000-$250,000 dependent upon market forces (the day rates are driven specifically by availability of assets globally). A work class ROV and operators is between $12,500 and $20,000 dependent upon 12 or 24 hour operation, as such two work-class ROVs and full 24 hour teams would cost around $40,000/day. A saturation dive team, diving bell and habitat is likely to cost around $50,000-$60,000/day

dependent upon availability of resources. A suitable tug and flat-top barge to receive recovered sections of scrap would be in the region of $15,000-$20,000/day, again dependent upon availability. If we consider the higher end of all costs, it is likely that a day rate of $370,000/day could be expected for a DP3 vessel, saturation dive system and team, two work-class ROVs and reception barge and assisting tug.

To enable a full assessment to be made of the likely total costs, a further assessment of weather downtime would have to be made on the basis of the lifting capability of the DP3 crane vessel. Given that our research has shown that such vessels are often capable of working in H_s 3 metres, the weather analysis shown in Metocean data show that downtime could be as low as 3%, as such the spread would not be affected to the extremes estimated in the BECA report. The lifts would require an engineered analysis to be undertaken for each lift and an impact study undertaken of the likely downtime periods for a fuller assessment to be made.

4.2 ***Are There Other Techniques, Or Other Types of Techniques, That Could Be Used?***

As advised above at paragraph 4.1.1 the salvage industry is reactive, creative and inventive. Solutions can be custom engineered to suit the problem in hand. Over the years the salvage industry has benefited greatly from the transfer of technology widely used in the offshore industry and this technology and capability has been successfully used on a number of occasions in the salvage industry. The examples given below are previous wreck removal operations and show the diverse capability of engineered solutions:

4.2.1 "M.V. TRICOLOR", the TRICOLOR was a pure car carrier that was involved in a collision in the English Channel resulting in the vessel capsizing and sinking in 30 metres of water. The vessel was carrying approximately 3,000 cars at the time.

Upon completion of the removal of the hydrocarbons under the original LOF/SCOPIC contract, an invitation to tender (ITT) was prepared and a consortium of salvage companies, namely; Smit Salvage, SCALDIS Salvage,

URS and Multraship were awarded the contract to remove the wreck and cargo in their entirety.

The methodology selected by the contractors was to pass a tungsten-carbide coated cutting wire under the wreck and make eight separate cuts from the bottom up (port side to starboard side – the vessel was laying on its side). Once cut into nine sections, lifting bollards were placed in strategically cut orifices and sheerlegs used to lift the sections and place them onto large flat-top barges.

The wreck sections were then towed to Zeebrugge where they were cut up and disposed of in an environmentally approved method.

The photographs at Figures 3 and 4 below show the operation. Figure 3 shows a jack-up barge and a sheerleg positioned either side of the wreck, these were used to drill under the wreck and place the cutting wires and then used to cut the wreck into sections. Figure 4 shows two large sheerlegs being used to place the second lifted section on to the barge for transportation to Zeebrugge.

Figure 3: Sheerleg and Jack-up cutting the wreck

Figure 4: Sheerlegs lifting the second cut section

The photograph below at Figure 5 shows a giant wreck grab that was used in conjunction with one of the sheerlegs to remove very large sections of wreckage from the wreck and debris field. This equipment was used after the main wreck sections had been lifted.

Figure 5: Giant wreck grab in use

4.2.2 M.V. “C.P. VALOUR”, CP VALOUR was a 1,000 TEU gearless container vessel which ran aground during a storm in an isolated bay on the island of Faial in the Azores Islands. This was a very remote location in a small group of islands in the middle of the Atlantic Ocean. Little or no equipment was available locally and all equipment used for the wreck removal had to be brought to the islands.

Upon completion of the removal of marine pollutants, including hydrocarbons and dangerous goods (contained in some of the containers) and whilst under a LOF/SCOPIC contract and ITT was prepared for the total removal of the wreck and all remaining cargo.

Svitzer Salvage were awarded the contract and mobilised a jack-up barge with a large 400 tonnes SWL revolving crane (and accommodation) together with two flat-top barges, supporting tugs and other equipment.

The cargo was discharged using the crane onboard the jack-up and transferred to one of the barges. There the cargo was sorted and intact cargo delivered ashore for transfer to the respective owners whilst damaged cargo was repacked into containers for delivery to owners or disposal. Simultaneously the accommodation was emptied and scrapped in situ using specialist cutting teams. As the cargo was being removed from the cargo holds removal of the upper steel from the decks was simultaneously being undertaken. With the vessel suitably lightened the remaining wreck was towed from the grounding site for disposal.

Figure 6: Jack-up barge removing cargo from the wreck

Whilst the above photograph at Figure 6 gives the impression that this was a benign area, this in fact is somewhat misleading. The methodology was

selected considering the vagaries of the weather at this location and Figure 7 below shows conditions often experienced at the site.

Figure 7: Exposed location of the grounding site

4.2.3 M.V. CORAL BULKER, CORAL BULKER was a handy-sized bulk carrier which dragged anchor and ran aground off the coast at Viana Do Castelo in Northern Portugal. The vessel was fully laden with sawn timber and woodchips below deck and logs on deck.

Upon completion of removal of the hydrocarbons under the original LOF/SCOPIC contract and ITT was prepared for the total removal of the wreck and all cargo.

Titan Salvage was successful in winning the contract. They undertook cargo discharge using large 350 tonnes SWL cranes positioned on the breakwater before stripping out and removing the accommodation block. Upon completion of cargo discharge and accommodation removal, the engine room was lightened, the hull was cut into two sections and the four cranes were removed.

The hull sections were then rigged with 3-inch chains and 12 Titan hydraulic chain pullers were used to pull the sections through 180˚ upside down onto the breakwater (clear of the sea) to allow them to be cut up and disposed of.

The two photographs at Figures 8 and 9 below show the operation in progress.

Figure 8: Fore Part of the Wreck during early stages of Parbuckle operation

Figure 9: Fore Part of the Wreck showing chain pullers on shore

4.2.4 WEST ATLAS was a jack-up Mobile Offshore Drilling Unit (MODU) that was drilling through the Montara Wellhead platform off the Australian North West coast. During the drilling operation the well suffered a blow-out which proved to be uncontrollable and during attempts to stem the blow out the well ignited. The jack-up MODU was destroyed in the subsequent fire.

An ITT was prepared for the total removal of the jack-up MODU. A joint venture between Svitzer Salvage and Seatrucks (an Australian offshore construction company) was successful and the consortium was successful in removing the rig in its entirety whilst maintaining the integrity of the wellhead platform.

The primary asset used during the operation was the DP crane barge JASCON 25. Salvors removed debris from the wreck before using a strand-jack system to lower the jack-up to sea level before jacking the legs clear of the seabed.

The photograph below at Figure 10 below shows the JASCON 25 in DP mode alongside the MODU and wellhead platform.

Figure 10: JASCON 25 in DP Mode next to MODU WEST ATLAS

4.2.5 TSHD CRISTOFORO COLOMBO was a trailer suction hopper dredger (TSHD) which grounded on the south west coast of Sakhalin during a typhoon. A LOF/SCOPIC contract was agreed between Sakhbasu (Russian Salvage Contractor) and Smit Salvage to refloat the dredger.

Salvors agreed to charter another dredger to cut an access channel from deep water to the grounding site; the cut rock was used to provide a bund around the wreck. The bund would be closed off, water pumped in to refloat the casualty and then when repositioned the bund would be opened to allow the dredger to egress through the cut deep water channel.

Prior to completion of the cut channel/bund operation, a second storm dispersed the cut rock and back-filled the channel. Despite various alternative proposals the salvage was abandoned and a wreck removal contract agreed with Sakhbasu. The wreck was cut up in situ and disposed of.

The photographs at Figures 11 and 12 below show the extent of the dredging operation. In addition the second the dredger can be seen at the sea side of the wreck cutting the access channel. The photograph shows how close they operation was to completion prior to the second storm which destroyed the bund and back-filled the channel.

Figure 11: Rock cuttings being pumped ashore to construct the bund

Figure 12: Rock cutting dredger in background

4.2.6 M.V. CALIFORNIA was a Panamax bulk carrier fully laden with iron ore. The vessel was involved in a collision in the Malacca Straits resulting in the vessel sinking in the busy traffic separation scheme.

Salvors, Smit, were initially contracted to remove the hydrocarbons and other pollutants from the vessel. Upon completion of the oil removal an ITT was prepared for its removal later agreed to be a partial removal (to -31 metres CD) of the wreck to ensure safety of navigation in the area. Mammoet Salvage was successful in their bid.

Mammoet designed, commissioned and constructed a purpose-built cutting barge for the operation. The barge, using hydraulic linear winches reeved through deck tackles, was capable of undertaking horizontal and vertical chain cuts to the wreck via an innovative multi-directional sheave arrangements mounted onto the bow of the barge. Manageable sections were then lifted using a Sheerleg and placed onboard barges for transportation ashore. The removed wreck sections were cut up ashore and disposed of.

The photograph at Figure 13 below shows the barge deck arrangement, including winches, sheaves and cutting chains.

Figure 13: Mammoet specialist cutting barge

4.2.7 M.V. MSC NAPOLI was a 4,419 TEU cellular container carrier which suffered structural failure in bad weather off the English Channel. This resulted in the engine room flooding which put the vessel at severe risk of sinking. A decision was made by the UK authorities to allow the vessel to be deliberately grounded in Lyme Bay off the South coast of England.

A contract was placed with Smit Salvage to remove all hydrocarbons and marine pollutants from the vessel, including dangerous cargo (1,684 tonnes). All hydrocarbons, pollutants and cargo were removed from the vessel. The wreck was then cut into two sections using explosives. The fore section was towed to a shipyard where it was cut up and disposed of. An ITT was then prepared for the removal of the stern section in situ.

A consortium of Dutch salvors formed a company, Global Response Maritime who was successful in the tendering process. The removal of the stern section was undertaken using an innovative system of barge mounted hydraulic chain pullers (two barges). These were placed either side of the stern section, chains were placed under the wreck section and the stern was then jacked upwards to allow access by surface cutters to the newly exposed steel. The wreck section was cut down piece-meal and disposed of ashore.

The two photographs below at Figures 14 and 15 below show the container removal operation and the stern section between the two jacking barges.

Figure 14: Container removal from MSC NAPOLI

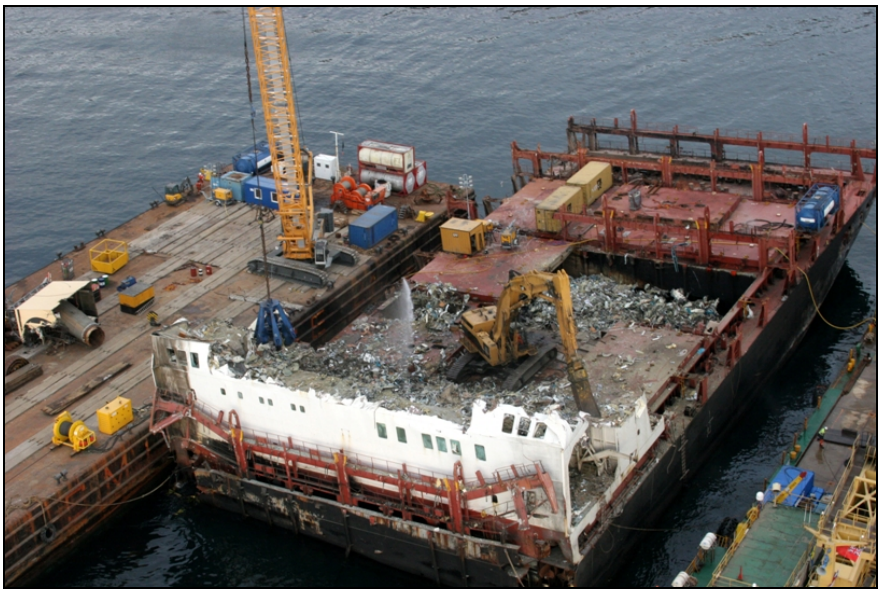


Figure 15: MSC NAPOLI Stern section jacked up between two barges

4.2.8 While there are other cases of specific recovery operations, which are not detailed above these clearly indicate how the industry is capable of creating suitable solutions to complex operations and what is possible when attempting to successfully recover seemingly inaccessible wrecks.

The Russian submarine KURSK suffered a series of explosions which resulted in the submarine sinking in 108 metres of water. The submarine was recovered by a salvage consortium after having the warhead section of the submarine removed whilst on the seabed.

Another example using advanced technology was of a Japanese fishery research vessel in collision with a United States submarine where the EHIME MARU sank in 610 metres of water. The vessel was successfully recovered by another salvage consortium in order to allow the recovery of fatalities from the wreck.

The tanker PRESTIGE sank 250 miles off the French coastline in 4,000 metres of water. 13,000m^3 of crude oil was recovered from the wreck at this significant depth using a successful combination of very advanced offshore exploration technology and well established salvage techniques. A similar method was also used on the tanker SOLAR 1 in the Philippines in 634m water depth.

What is evident from the above case studies is that the salvage industry is increasingly innovative and reactive to requirements on a case-by-case basis. Furthermore, it can be seen that the solution to some problems does not always necessitate high-tech, high-cost solutions. The foregoing examples clearly indicate that it is unreasonable and unusual for parties to continue to maintain that the removal of the RENA wreck is technically impossible.

5. CONCLUSIONS

5.1 The BECA report proposes three alternatives for the wreck of RENA, namely; Base, Partial (PWR) and Full (FWR). It is the conclusion of the report that the Base alternative is the minimum required to achieve the requirements of the MTA notices issued by MNZ and the FWR option would create greater damage to the Astrolabe Reef. As such, the owner’s preferred option is for the PWR option (Base plus additional work) and then a consent application under the RMA.

5.2 I am of the opinion that the BECA report does not provide for a balanced viewpoint in respect to the FWR option as it appears only to consider the present low-tech method that has been used to date for removal of parts of the wreck and debris. Numerous other methodologies exist which can be customised to provide a solution that will achieve FWR.

5.3 The weather within the Bay of Plenty and in particular around Astrolabe Reef has proven to be unpredictable and onerous and has impacted on the time taken to undertake the work to date. However, this has particularly affected the craft used to undertake the work (low-tech, moored barges). I am of the opinion that a fuller assessment of the alternative methods should be undertaken and the output used to compare against the existing low-tech method presently being employed.

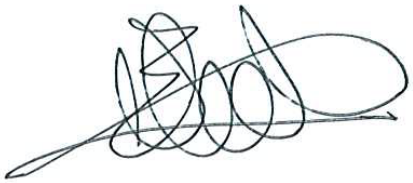
5.4 The BECA report somewhat side steps the TBT and copper clove cargo issue by surmising that the copper cargo is “missing” and assumed entrapped within the wreck and that the TBT poses less of an impact to the environment by being left as-is as opposed to be being removed. I am unable to agree with either of these conclusions. A patch of the copper cargo has been exposed during a weather event and is accessible for recovery and each weather event causes movement and degradation of the wreck causing potential uncontrolled dispersion of the TBT.

5.5 It is evident that cyclone LUSI had a major impact on both the wreck and debris fields. Therefore it is not unreasonable to conclude that each and every major weather event will have a similar impact.

5.6 On a similar vein, the report assesses the risk to entanglement within the wreck and debris fields to social divers. Despite the assurances of the BECA report that these risks have been mitigated by partial removal it is not clear how this will be maintained after each weather event. It is my opinion that this issue can and could become a major problem should the exclusion zone be removed and access granted to social divers.

5.7 Any wreck removal operation, no matter how large or small, will inevitably have some impact on the localised environment, however this needs to be balanced against the longer term impacts of the leaving the wreck in situ. My own assessment from the BECA report at this time is that both the TBT and copper clove pose a far greater risk to the environment than that created in the short term by any wreck removal operation.

5.8 As with any wreck removal operation, the reasonableness of any removal notices needs to be considered. Whilst not part of the scope of this report (but discussed within the BECA report) the risk to navigation has been all but negated. However, at this stage I am unable to say the same for the risks to the environment. It may be that a fuller assessment of the more diverse wreck removal options would allow me to make a more balanced view of this.



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Appendix A

BECA Report “VOLUME THREE – Background and Consideration of Alternatives”

Appendix B

MNZ Weekly SITREP, Dated 25 April 2014.

Appendix C

TMC Report “M.V. RENA – Options for Long Term”