A. PROJECT TITLE

The re-use of offshore Infrastructure and platforms: Assessing the value to communities, industry and the environment.

B. PROJECT TEAM

Project Leader:	**Investigators:**
Dr Alison Lane *PO Box 25391, Wellington. 6146* *Email Address: dralisolane@gmail.com* *Telephone: 021 376664*	*Professor Simon Davy, Victoria University Wellington* *Dr Taciano Milfont, Victoria University Wellington* *Toka Walden, Toka Ltd.* *Stephanie Jervis, Elemental Environment Ltd* *Michael Guthrie, Elemental Environment Ltd*

C. ABSTRACT

Summarise what your proposal will achieve, including key **innovations**.

The project comprises two phases. Phase 1 will review environmental data available from offshore installations that have been in place for an extended period, and include a desktop study of potential risks and benefits to the environment of *in situ* marine structures. The study will consider marine species that are known or expected to utilise these structures over time, taking account of current commercial fish stock data, along with a comparison of global examples relevant to the New Zealand context.

Phase 2 will investigate whether *in situ* marine infrastructures have the potential to bring value to the Taranaki community where offshore structures are currently in place, and whether there is potential to "value-add" during decommissioning. For example, do these structures have potential to provide protection and enhancement of particular in-shore fishery resources or present tourism opportunities. The assessment of "value-add" potential will be achieved by conducting surveys of affected stakeholders—primarily people representing the fisheries, tourism and petroleum industries, together with iwi in the focal area.

D. RELEVANCE TO CHALLENGE OBJECTIVE

Demonstrate alignment with the Objective of project 2.2.2 "Methods to increase diversification in marine economies".

- ***Determine whether artificial marine infrastructures in New Zealand create useful habitat for marine organisms and influence local biodiversity***
- ***Determine whether, when these structures are removed, there are negative effects on local biodiversity***
- ***Determine whether these habitats provides new resource opportunities by increasing opportunities for commercial ventures following cessation of activities at the offshore installation***
- ***Investigate stakeholder willingness to utilise any new resource opportunities if they exist, or whether changing the weighting of values associated with decommissioning of structures potentially damages Social License to Operate (SLO),***
- ***Seek to understand if there is a potential for increasing cumulative SLO, i.e. marine industries working together to improve SLO rather than creating it per sector.***

E. INTRODUCTION

Insert background, rationale and key details of your proposed research, including gaps in the Challenge that your research will address. Include why your work is important to the Challenge Objective.

The rationale of using platforms and other oil- and gas- related infrastructure, such as cables and pipelines, as artificial reefs appears logical in some international examples. Fish are known to aggregate around offshore structures, hard substrates are colonised by invertebrate communities, and the communities that accumulate around active platforms can be high in biodiversity. With several offshore fields in New Zealand anticipated to reach the end of useful field life in the next few years, it is timely to consider their potential conversion into artificial habitat, and who and what might benefit from these structures being left *in situ* as an alternative to complete removal.

In overseas examples, including the Gulf of Mexico, loss of hard substrate has disrupted community dynamics, and the addition of new structures has been considered in some cases to provide valuable stepping stones for faunal dispersal (Macreadie *et al*. 2011). Artificial reef projects have been successful in a number of international case studies. The Alabama coastline has nearly 20,000 artificial reefs—mostly made of concrete, but also old ships and discarded construction equipment, and these have been cited as a major component in snapper recovery and improved fish stocks (e.g. Gallaway et al 2009; Claisse et al 2014).

However, while offshore structures may provide a boost to fish habitat and subsequent income to fisheries and tourism (including recreational fishing and diving), they alter community composition, which some stakeholders may consider a price not worth paying. Stakeholder concern is compounded by the fact that platforms are not pristine environments. Long-term contamination in the immediate surroundings may result from the leaching of heavy metals, and while not actually relevant to the decommissioning, can influence perceptions of their appropriateness. Further, contaminants may leach from the structures post-decommissioning, reducing or negating environmental benefit.

Once decommissioned, there is further stakeholder concern that responsibility for management of offshore structures transfers to the state, absolving oil companies of any ongoing costs, and leaving state tax-payers with the bill. This can make the concept unpopular among most stakeholders. To improve stakeholder support and alleviate concerns, there needs to be demonstrable ongoing value from the decommissioned structures and clarity around who owns future risks. There are further questions that need to be addressed regarding whether these structures actually boost fish populations or increase biodiversity in New Zealand, or act as fish aggregating devices, such that any real additional value could be gained from leaving these structures in place.

This proposal aligns with the Objective of the Sustainable Seas NSC (*Increase utilisation of our marine resources within environmental and biological constraints*), as it seeks to determine whether offshore infrastructure in New Zealand could provide for future fishing and tourism industries in a way that balances the needs of the oil and gas sector with the responsibilities of the state and the needs of future generations.

F. AIMS

Explain in a set of bullet points what your project will achieve.

1. Review two sets of environmental databases, and establish whether there are measurable spatial and temporal changes to ecological communities that inhabit offshore platforms and infrastructure, like pipelines and cables relative to control areas.

2. Provide a global contextual comparison of New Zealand marine legislation concerning decommissioning.
3. Engage marine industry stakeholders in a survey of potential benefits and/or harms from leaving infrastructure *in situ*.
4. Undertake a cost-benefit analysis (CBA) of leaving *versus* removing platforms and infrastructure, considering alternative use options (e.g. minimal environmental impacts versus cost and safety considerations).
5. Review the value attributes of re-using or removing infrastructure for Māori and other communities, and the fishing and marine tourism sectors given the weather constraints and distances offshore that platforms are in New Zealand.
6. Provide marine resource decision makers with a review of the costs, benefits and values to be considered during the decision-making process for decommissioning.
7. Develop a list of key considerations and issues that might be incorporated into the decision making around decommissioning, such as inputs to a Best Practicable Environmental Options (BPEO) Analysis.

G. PROPOSED RESEARCH

Details of work plan and methodology, including choice of study location. Max 1800 words.

We propose using a comprehensive case study as the vehicle for assessing the environmental and fiscal costs/benefits of leaving or removing marine platforms and other associated infrastructure generated by the oil and gas sector (i.e. cables and pipelines), and then assessing the community responses to decommissioning of oil and gas infrastructure.

The case study will focus on the Taranaki region. We will investigate the historical context behind decommissioning of platforms and infrastructure, including whether consent obligations have been grandfathered into the EEZ Act and the kind of commitments made by operators to the communities around what structures would stay and what would be removed.

Phase 1:

Part a (Pa): We have access two new datasets for long-term environmental monitoring and assessments in the area of offshore infrastructure and controls sites to look at changes in community composition through time in the Taranaki Basin. These datasets were provided by Shell Todd Oil Services New Zealand (STOS) and AWE Ltd[1], and include some Remotely Operated Vehicle (ROV) footage and the results from benthic sampling since 2006.

There are common protocols around using ROV footage, such as only analysing video or stills that are at a set distance from the bottom, when the camera is at the same angle and the ROV is moving at a constant speed. Video and stills are often obtained for other purposes, so sometimes the ROV stops to zoom in on things and this time needs to be excluded. Care needs to be taken to avoid double counting of individuals, which is not a problem for most invertebrates, but can be for fish. The methods used here follow Althaus (2009) and we analyse stills.

The major difficulty of standardising stills is that the viewing width is constantly changing. Some papers have overcome this by only examining an area of known size within the image. Althaus (2009) used standardised polygons superimposed over each still. Many video analyses focus on the time spent on different habitats or calculate an estimate of the area viewed. To observe fish, we will calculate the area of the video from screen grabs at 60 second intervals, work out an estimate of the area viewed,

[1] Both STOS and AWE are oil and gas companies operating in New Zealand in the Taranaki Basin.

but use the video continuously to identify and observe the fish. Difficulties of using ROV footage include the potential for some species to be attracted to or avoid the ROV. This is more relevant for fish, and we note the potential biases discussed by Stoner et al (2008).

Stills will be analysed using Coral Point Count with Excel extensions (CPCe), modified for a point count of percent cover or benthic diversity. CPCe is a Windows-based software (PC use only) that provides a tool for the determination of cover using transect photographs. A specified number of spatially random points are distributed on an image and the features underlying the points are user-identified. Coverage statistics are then calculated and the results sent to Excel spreadsheets automatically. CPCe can be used for image calibration and area analysis of benthic features. Excel sheets are automatically generated to summarise the area calculations for each image (Kohler and Gill, 2006). Taxa will be user-identified to genus level where resolution allows. Family identification will be used if resolution is poor.

The results of annual benthic monitoring data, including species abundance and diversity indices, will be compiled for each location and related to ROV data for the same area to develop a more comprehensive picture of the overall environmental habitat value and use. Changes in species abundance through time will be analysed in PRIMER 6 (Clarke and Warwick 2001), and using R.

Part b (Pb): We will complete a desktop study looking at how effective converting platforms and infrastructure into artificial marine habitats has been in overseas examples. This literature report will analyse the New Zealand case in the international context. We explore the environmental benefits, if they exist, using the information from Part a, and establish what ecosystem services[2] are being provided by such artificial environments. We also examine the role of the Company[3] post-decommissioning when structures are left on the seafloor, including an assessment of who owns the infrastructure and who would be responsible in the event of future environmental issues. This literature review will also include an examination of historical consents in the Taranaki Basin, the community involvement in the process, if any, and the current status of the processes.

Cost Benefit Analysis (CBA):

The costs of removing offshore structures or modifying them for remaining in place can be relatively easily assessed through engineering estimates. However, many of the benefits or potential negative outcomes of either of these courses of action will be harder to estimate in pure economic terms.

Where the cost or benefit can be assessed in economic terms it will be done using standard discounted cash flow techniques with discount rates reflecting the long-term and sovereign level nature of the decisions (i.e. lower than typical commercial rates). The economic value of the benefits and/or negative impacts over time will be derived, where possible, from scientifically sourced peer-reviewed research references (be that local or international references).

Where the cost or benefit of an action (or inaction) cannot be reasonably assessed in economic terms then its impact will be ranked against the economic impacts using a relative scale. That cost or benefit will then be carried through the Cost Benefit Analysis as if it had its relative economic impact.

The probability of occurrence/success of all outcomes occurring as a result of actions (or inaction) taken with an offshore structure will be one of the targeted outcomes of the overall project. The final

[2] For a definition of Ecosystem Services we refer to "Ecosystem Services in New Zealand" (edited by John Dymond and published by Manaaki Whenua Press).

[3] "Company" in this context refers to any Oil and Gas Operator involved with the decommissioning of infrastructure.

assessment of a particular course of action will be derived from a matrix of Impact (economic and non-economic) versus Probability of the various outcomes and compared to alternative courses of action.

Marine Mammals use of platforms and structures:

The presence of marine mammals in the Taranaki Basin is documented and maintained in the Department of Conservation database, and the data are already well summarised by Dawson et al (2008) and Berkenbusch et al (2013). This includes sighting data from offshore installations in the Taranaki Basin and allows for assessment of the potential aggregation or avoidance of offshore structures by marine mammals. Instead of re-analysing marine mammal data, we will review the information currently available on how different marine mammals utilise the Basin, including the area around offshore installations, and incorporate the information into our ecological assessments and CBA. We will overlay sightings and maps of habitat variability, and perform simple correlation analysis as per Redfern et al (2006). This information will help to inform both the potential ecological benefit of structures and is also relevant to potential tourism value generated by the presence of these species as well as the intrinsic value of marine mammal species to stakeholders.

Phase 2:

We intend to use the baseline established throughout the ecological and literature review processes to inform our Māori and other stakeholder workshops. To initiate this process we will hold a series of hui in the region and create a cultural impact report on how decommissioning is currently being viewed in the Taranaki region.

In addition to Māori cultural, environmental and economic values, we investigate the cultural, environmental and economic values of other community groups in the region. To do this, we will first conduct an analysis of media coverage of decommissioning in the Taranaki region (e.g. Kesten et al 2014; Maydell and Milfont 2010).

The media analysis will be followed by exploratory-type focus groups (e.g. Lake et al 2012) to identify the salient beliefs and also the risks and concerns related to decommissioning within the community. Some of the focus groups will incorporate fishing and tourism representatives to establish whether they consider additional value can be added to their industry through the ongoing use of off-shore infrastructure. Results from the media analysis, focus groups and Part a, will inform the development of a survey-based experimental study addressing the question of whether providing information about the potential benefits or risks of decommissioning affects support for leaving offshore structures. Following the method employed by Evans, Milfont and Lawrence (2014), we will compare support for decommissioning among community members who receive a varying amount of information regarding the potential benefits and risks of decommissioning to a matched control group that does not receive any information.

H. RESEARCH ROLES

Researcher	Organisation	Contribution
Dr Alison Lane		*Project leader; marine ecologist, looking at changes in the benthic community composition through time, and changes in fishing community composition through time and commenting on the risks and benefits to these marine communities from the re-use of marine infrastructure. Regulatory oversight.*
Simon Davy	*Victoria University Wellington*	*Oversight of data analysis, report and peer reviewed articles review*

Taciano Milfont	*Victoria University Wellington*	*Oversight of community engagement, including design and interpretation of media analysis, focus groups and experiment, and primary supervision of Masters student. The key responsibility of the MSc student will be to run the media analyses, with Dr Milfont assisting.*
Toka Walden		*Vision Matauranga: Māori engagement and interpretation, support and liaison*
Stephanie Jervis	*Elemental Group*	*Marine mammal biologist, looking at marine mammals that utilise marine structures, and commenting on risks and benefits to them from the re-use of marine infrastructure*
Michael Guthrie	*Elemental Group*	*Report writing and literature review, data compilation and analysis, data management review of the regulatory comparison*
Andrew Revfiem	*Elemental Group*	*Cost benefit analysis*
Student Intern[4]		*Changes in community composition through time*

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I. LINKAGES AND DEPENDENCIES

Explain how your research complements, but does not overlap with research already funded within the Challenge. Please note particular projects that your research complements, and any inter-project linkages.

We consider that our proposal maps well with currently funded research and interlinks with many projects, without doubling up on research in progress. We use new and innovative datasets, case studies and researchers to compliment the Challenge Research Plan. Specific links are:

Links to 1.1.1 "*Review existing Māori and stakeholder engagement in marine science…"* as we look at the involvement of Māori and other stakeholders in a specific case study of marine consenting, but our proposal differs as we consider how past engagement practices have been grandfathered into new legislation.

Very strong links to 1.2.1 "*Frameworks for achieving and maintaining social licence*", where we use a specific case study to discuss whether it is possible to build a multi-layered idea of social licence by including multiple marine industries.

Links to 2.1.2 "*Mauri Moana, Mauri Tangata, Mauri Ora…"* because we evaluate the trust built up around our social, cultural and spiritual connections with the sea, and we investigate whether a varying set of social drivers can influence Māori (and other stakeholder) values.

Strong links to 2.1.3 "*Measuring ecosystem services and assessing impacts*", as we investigate whether specific changes in ecosystem service delivery affects the values people derive from cumulative marine industries.

Potential links to 3.3.2 "*Innovatively improved pathways*" as we see a relationship developing between our research team and the research team of this project, to investigate the potential for improved Māori partnership and participation in future marine management.

[4] We have applied to the Callaghan Institute for a student intern to work on the project over summer. Callaghan contributes $7,200 towards development of a student for 400 hours, where pathway to market can be demonstrated.

Finally, strong links to 2.2.2 "*Methods to increase diversification in marine economies*". If we can demonstrate fiscal benefits to a sector that is our 4th largest export (after dairy, meat and wood), with a value of around $2.2 billion (PEPANZ 2016), within environmental and biological (and cultural) constraints, we will be adding value to the marine economy. Secondly, if we can prove the idea that there may be added value to be gained to the tourism and fishing sectors from safe decommissioning practices, we would be adding diversity to the marine economy. Finally, this type of social research breaks down barriers, whether real or perceived, to the commercialisation of ideas, and adds to the diversification of marine industries.

J. RISK AND MITIGATION

Highlight risks to the success of your proposal and demonstrate mitigation measures.

Iwi and community participation is a both a key strength and key weakness to the project. To mitigate the risks, we have key personnel on the team: Toka Walden, with powerful community connections and experience in gaining engagement in the marine consent process, and Taciano Milfont, who specialises in engaging with communities around science communication. One of the risks of talking to stakeholders in theoretical terms about decommissioning that has not yet occurred is that it can invoke an emotional response. It will be important to have good output from the ecological part of the study before initiating the stakeholder engagement activities so there is some substantial content with which to frame the discussions.

To achieve a successful comparison between social values regarding the re-use of marine infrastructure before and after identification of environmental benefits and a CBA, the results of any changes in community structure need to be disseminated into the communities which may be affected. To do this, PEPANZ, the industry body representing the Oil and Gas sector, have committed a specialist communications team member to assist with developing a multi-sectoral SLO. However, this in itself poses the risk that the study may appear to be "captured" by industry, with the dual effect of discouraging people from participating, or discouraging acceptance of the findings of the study. This risk is mitigated via having a range of experts from different backgrounds on the project team.

We note that the scope of the project is broad with ambitious expectations of what can be achieved given the time and resources available. The research team has the capacity and the capability to deliver on this work programme, but will actively manage the risk throughout the life of the project through careful milestone monitoring.

K. CO-FUNDING AND INDUSTRY SUPPORT

Demonstrate your co-funding and in-kind support, and outline your pathway to industry uptake.

- In kind support from OMV NZ Ltd for staff time to the Project Team**.**
- **In-kind support from Anadarko at $37,500 for staff time to contribute Alan Seay to the Project Team.** Mr Seay is Anadarko's New Zealand Country Manager, but he specialises in strategic communications, stakeholder relations, advocacy, government relations, media

liaison; media training; relationship building and development; writing, and change communications.

- **In-kind support from PEPANZ of $12,500 in staff time to contribute to communication around Social Licence to Operate.**
- In-kind support from New Zealand Maori Tourism in facilitating access to Maori tourism ventures that stand to gain from future tourism opportunities.
- In-kind support from Shell Todd Oil Services Ltd[5] in allowing access to environmental databases and staff time to contribute to review of project documentation.
- In-kind support from AWE Ltd in allowing access to environmental databases.
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L. VISION MĀTAURANGA (VM)

Describe whether and how your proposal is relevant to the marine management interests of Māori, and/or how it incorporates mātauranga Māori. Also outline how you plan to involve Māori in your proposal.

Vision Mātauranga not only applies Māori knowledge to sustainable use of rawa taiao but it also creates meaningful relationships between iwi, researchers and the industry.

Our aim is to identify successful approaches to sustainable resource use by exploring the relationship of iwi with the sea. Our initial research indicates that "*Companies have approached iwi in the past and have stated clearly that any pipes, chains, ropes or infrastructure installed on the seafloor will be removed. A common catch phrase by the Company is that we will leave it the way we found it*."

However, options also exist for industry to leave some structures *in situ*, or trench and bury them rather than retrieving them and removing them to landfill, and this also will have implications for mātauranga Māori. This proposal aims to review how Māori cultural values can be incorporated during decommissioning. We will investigate whether there is a sense of broken trust in the Māori community, and if so, whether trust can be re-established.

We will have the conversation in Taranaki, where decommissioning is a live topic, and where iwi have already been involved in various engagement processes. We aim to empower Māori (and other stakeholders) early in conversations around what kinds of alternative/additional marine industries they might see as being valuable to future generations of marine users. One of our key team members recently coordinated the iwi engagement for a major marine consent. His experience opens the door for meaningful dialogue on Māori marine resource values.

M. CONSENTS AND APPROVAL

Does your proposal require any marine consents or ethics approvals? If so, do you have them in place? If not, outline the processes required and demonstrate they can be achieved within the time frames and budgets requested.

The proposal does not require any marine consent.

Human ethics approval will be acquired via Victoria University Wellington to ensure the iwi and other community engagement aspects of the research are in line with best practice.

N. DATA MANAGEMENT

Describe your data management plan.

[5] Subject to final approval by all Joint Venture Partners

We will have access to some proprietary data that will not be available in the public domain after the project ends. This data will be secured and retained by the owners of that information, but any meta-analyses will be the IP of the project and therefore available in the public domain. Other than confidential data used in the study, we maintain a FAIR approach to data management: Findable, Accessible, Interoperable, Reusable.

- Findable – Easy to find by both humans and computer systems and based on mandatory description of the metadata that allows the discovery of interesting datasets;
- Accessible – Long term storage so data can be easily accessed and/or downloaded with well-defined license and access conditions, whether at the level of metadata, or at the level of the actual data content;
- Interoperable – Ready to be combined with other datasets by humans, as well as computer systems;
- Reusable – Ready to be used for future research and to be processed further using computational methods.

The individual responses of Maori and other stakeholders will not be made publically available, and only the results of our analysis will be released into the public domain.

All our data is secured via encrypted databases in the cloud. Relevant metadata will be kept associated with our data files to facilitate the FAIR approach.

Q. REFERENCES

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