

## FINDING A PATH FOR BLUE GREEN INNOVATION

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### **Abstract**

#### **Our innovation:**

*Living Shorelines is an OceanWatch Australia program that aims to trial the use of oyster shell in the intertidal zone as a suitable natural substrate for oyster reef formation. In some circumstances this form of blue green innovation has been proven as instant fish habitat and as a means to limit bank erosion commonly addressed with more formal or engineered built structures. The program aims to develop a natural alternative form of bank stabilisation that is high in ecological values and reuses a waste product from the oyster and retail food industries.*

#### **The pathway:**

*There is a small but growing number of similar public benefit projects undertaken in marine and coastal locations that need to turn an academic idea into an on-ground trial and ultimately practical implementation. Seagrass friendly moorings, environmentally friendly seawalls, Cray weed plantings, rock fillets and artificial reefs are such examples.*

*The current assessment pathway is fairly well defined under the NSW Environmental Planning and Assessment Act 1997. We think the current process legitimately follows the necessary checks and balances required to risk assess new concepts however once proven the same processes are required to be revisited time and again. Add the necessarily permits, tenure arrangements and associated fees for the structures and the project quickly becomes uneconomic and unfeasible under the current natural resource management funding arrangements. Clearly where the projects are of a public benefit a new approach is required to assist these innovations be adopted more easily. Progress on that approach will be presented.*

## **Introduction**

This paper is written to provide an oversight of the journey we have travelled to instigate a blue green innovation in NSW. It is a journey others currently face with similar hurdles implementing environmental innovations in the marine and coastal sector. Our intention is to highlight the challenges and consider some practical collaborative solutions.

In the blue green innovation pathway, there are three broad phases:

- Concept(initial development of the idea)
- Development (trial period and proof of idea)
- Realisation (product finalisation and broad application)

It is primarily the transitional 'development' period between developing the concept and the final broad application of the innovation that can be most challenging.

The transition needs the key players at both ends - the academics and innovators at the concept stage, and the beneficiaries and users of the end product, to both contribute at the middle of the process.

## **The Living Shorelines program**

Shellfish reefs once formed the backbone of many temperate and subtropical estuaries, and while small populations continue to exist in most bays and estuaries, these are only a small fraction compared to the numbers seen prior to European settlement. In New South Wales, researchers estimate that over 85% of natural shellfish reefs have been lost due to pollution, sedimentation, disease and habitat loss or degradation from coastal development.

Living Shorelines is an OceanWatch Australia program to trial the use of bagged oyster shells in as a suitable natural substrate for oyster reef formation in intertidal areas. Bags are strategically pegged on the near-shore bed of waterways, providing a home for a multitude of marine animals and a surface on which free-swimming oyster larvae can settle. Over time, the oysters grow together to form a normal oyster reef, and the coconut fibre breaks down, leaving a restored ecology which provides multiple public benefits such as improved fish stocks, sediment capture and erosion mitigation.

The idea of using oyster shells to re-establish oyster beds is an established approach overseas but in Australia the practice of rebuilding reefs is in its infancy. The OceanWatch trials are an important step in proving the technique locally, improving environmental outcomes and developing opportunities for broader application.

Our innovation specifically sought to reverse a growing trend in habitat rehabilitation and restoration that utilises non-biodegradable materials such as geotextile or plastics as a form of stabilisation. The OceanWatch approach has deliberately sourced an alternative material that allows natural recruitment of oyster spat while still holding the precise elevation and shape to promote oyster growth.

### ***The aims and benefits of installing living shorelines***

1. The program has attracted widespread interest and awareness in bringing back fish. Recreational fishermen, commercial fishermen, oyster farmers, Landcare groups, landholders, State government agencies, indigenous stakeholders, natural resource managers, local councils and hospitality heavyweights have all been enthusiastically engaged to date. Collectively, a National shellfish restoration network is in place.
2. The product provides a “soft” method to improve the ecological functioning and quality of public marine space while also maintaining close to natural intertidal erosion control potentially saving millions of dollars of property and tonnes of sediment loss.
3. Developed a natural alternative form of bank stabilisation that is high in ecological value, visually acceptable and reuses a waste product from the oyster and retail food industries. In NSW it is estimated that the hospitality sector generates over 3,000 tonnes of oyster shell every year which typically ends up as landfill. Additionally, there is also a considerable volume of shell that is produced on oyster farms as a result of natural mortality during commercial cultivation. The program therefore represents a significant opportunity for beneficially re-use of what is currently considered a waste material.

Bank-side erosion comes in many forms with a combination of wind, tide and wave energy gradually wearing down the equilibrium that has held the bank and vegetation in place for many years. In locations where this is actively occurring, a combination of reducing the wave energy, trapping detritus in place and maintaining a niche habitat for vegetation stabilisation can lead to restoration. Whilst this approach is obviously not suitable to highly erosive sites, it can provide an alternative technique that allows for sediment accretion and reef formation. A living shoreline that balances ecological and engineering benefits.

### ***Material composition***

When using oyster shell for habitat restoration, the material and structure of the bag is an important factor in containing it in place and holding it at the correct tidal height for oyster colonisation. Where a linear type reef is sought to reduce wave energy in the intertidal zone, concrete blocks, geotextile sand filled bags or steel have often been used.

More natural refinement can include utilising the chemical and physical properties of an oyster shell. In the USA, where oyster reef restoration projects have been deployed for the last 15-20 years, the recognised technique is to use plastic mesh netting, much like an onion bag. Momentum is gathering for oyster reef restoration projects in Australia and we have an opportunity to set a superior benchmark by using alternatives to non-bio-degradable plastics and polymers.

The use of coir (coconut fibre) is a key innovation in the Living Shorelines program. Coir is an exciting improvement because it is a natural fibre bag that breaks down as a new reef forms. Part of the trial program is to monitor how fast it breaks down under Australian climatic and intertidal conditions.

### ***Reducing our reliance on plastics***

It is recognised that the engineering fraternity looks for products that are standardised in terms of quality, replication, price and product reliability. The use of non-endemic, non-biodegradable materials in rehabilitation projects becomes less attractive however when we seek to maximise aesthetic, ecological and cultural values, or when maintenance and decommissioning costs are factored in to the cost-benefit analysis.

The range of environmental interventions that are socially acceptable in Australia addressing erosion tend to favour hard set and forget solutions.

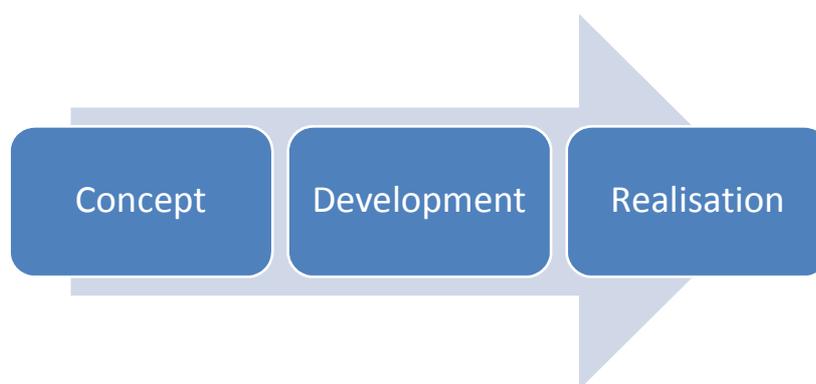
Through the OceanWatch Living Shoreline program, we aim to trail the use of a 'softer' erosion control technique, which could also result in the restoration of intertidal oyster reefs. Clutch has been provided as a substrate at the correct tidal height that is contained within a natural fibre bag that breaks down as a new reef forms. Breaking down too early means the shell is left unconsolidated losing its physical and biological properties. Coir fibre (Coconut) was investigated as the most likely and available material fit for purpose. How fast it breaks down under intertidal conditions in the Australian climate is not well documented and remains unknown.

The program aims to trial the methodology behind successful reestablishment including navigating planning approvals and permits required to successfully roll out the project on public lands.

### **How a great idea becomes a reality**

At OceanWatch, we aim to reduce the amount of plastic entering the marine environment to maximise marine ecological health and improve the productivity of marine resources.

The intent of the Living Shorelines program, like many other innovative initiatives, is to develop a concept and a product to a point where other entities have the confidence to invest and replicate the initiative, under their own auspices, into the future.



OceanWatch is the 'start up' in the process. Government and perhaps environmental or community organisations will be the custodians of the program in the longer term. This means that public authorities have a particular interest in the success of the Living Shorelines program and will benefit through support during the development phase.

Public authorities, in particular are encouraged to support the program because (a) it invariably requires access to public land and (b) they have the capacity to streamline the approvals processes and to reduce the cost of delivering the numerous public benefits of the program.

There is a particular way that public authorities can facilitate the delivery of public benefits through the Living Shorelines program, and this paper explains the role that is needed.

### ***Bridging the transitional period. Progress ... up to a point***

Three sites in Sydney harbour have been installed for four months with another three awaiting approval. Adaptive management has been applied early as it was clear that the breakdown of the coir material was occurring faster than the ability of oysters to colonize and stabilise the reef. A poor spat catch last year and/or oyster mortality due to a range of environmental variables shows the importance of maximising oyster husbandry conditions.

We have now used a cement additive to glue the oysters together in a loose matrix removing the necessity of the structure's success to rely on the coir fibre bag longevity. While the outcome of success using this method will take a further 12 months, handling following application meant many of the bonds were broken before installation.

Spat availability, distribution and timing in Sydney harbour is somewhat unknown and research conducted by Macquarie University shows it fluctuates. In order to maximise success we moved to a process whereby some of the bags were installed on the Shoalhaven River to be seeded and grown out on or around active oyster leases, before being returned to their final location in Sydney harbour. The success of this additional step will be evaluated also with time.

It is assumed oyster growth will be prone to disease and that over the years these factors will play a life and death cycle. Having trials in multiple estuaries will factor in some of the variables associated with unknown locational differences all of which impact on structure success.

Lastly but importantly, aside from the engineering and scientific challenges the program has needed to work through the planning approval pathway. Who needs to provide permission if OceanWatch- an NGO with no statutory authority - seeks to undertake these environmental maintenance works on public land? Which permits apply to work in the intertidal zone moving oyster shell around the state? These questions have significantly challenged and delayed OceanWatch and the local and state government professionals seeking to assess approval pathways following a prescribed process more attuned to 'normal' private development.

### **The regulatory regime**

There is a small but growing number of similar public benefit projects undertaken in the marine space that need to turn an academic idea into an on-ground trial with further adoption if successful. Seagrass friendly moorings, environmentally friendly seawalls, Cray weed plantings, rock fillets and artificial reefs are such examples.

The Living Shorelines installations are 'development' under the Environmental Planning and Assessment Act, and therefore need to consider the multitude of regulatory requirements and environmental planning instruments that comprise the NSW planning system.

Living Shorelines installations are also established on public land, either government freehold or Crown land, and therefore require the agreement of the public land owner for the works and any on-going occupation of the land.

The Living Shorelines installations also require authorisation from DPI Fisheries under (part 7) of the Fisheries Management Act 1994.

Because Living Shorelines installations are water-based development, there is also a need to have the impact on navigation assessed by NSW Roads and Maritime Services.

Works such as Living Shorelines installations are not well served by the prevailing assessment and management arrangements. This is particularly the case when someone other than a public authority proposes to undertake work on public land. It is recognised that making a general arrangement to facilitate private works on public land is a fraught area. We do not propose that.

It is acknowledged that there is always a tension between a desire for simplicity in regulatory arrangements by bundling developments into a common pool and applying one rule vs the inevitable complexity that comes with separate 'bespoke' treatments for each form individual form of development.

What we need to recognise is that the regulatory burden acts as a significant disincentive for organisations involved in the 'concept' stage of blue-green innovation projects to move the project into the development and realisation stages. What we equally recognise is that the planning regime and the arrangements for the occupation and use of public land, including submerged land, is much more accommodating for works by public authorities.

The obvious answer, it seems, is to leverage the natural advantage enjoyed by public authorities within the various regulatory regimes, and the natural advantage of entities such as OceanWatch in the advancement of innovative concepts. Both players have a mutual interest in the success of the program. Collaboration will be necessary to bridge the gap that currently impedes progress at the middle transitional stage of the process.

The challenge is therefore how we make arrangements to facilitate works which have an environmental and social benefit without overturning principles of regulatory simplicity and while maintaining appropriate checks and balances.

The solution requires a willingness on the part of public authorities to take a more active role in the transitional period between concept and realisation. Leaving it to the NGOs or private sector to bring environmentally and socially beneficial programs to a point of mainstreaming will impede delivery of public benefits.

Most public authorities are created for the express purpose of achieving beneficial public outcomes. Many are also the custodians of public assets, such as land. Blue green innovators, like OceanWatch, simply need public authorities to recognise the crucial role that they have in the process. We need public authorities to step into the transition stage

within the Concept-Development-Realisation sequence to enable good ideas to be proven and transferred to the public sector for longer term ownership.

Some specific solutions are detailed below.

## **Specific challenges and possible solutions**

### ***The planning system***

If public authorities acknowledge the public benefits of projects such as Living Shorelines, but elect to simply wait for someone else to assume the role of proponent within the planning system, then entities such as OceanWatch will face a major impediment. The costs, time and complexity of preparing a development application for the installation of bagged oysters becomes a barrier to research bodies which typically do not have the funding, capacity or governance role related to long term ownership and management.

In short, the entity with the long term interest needs to step forward at this point to become the proponent. An entity such as OceanWatch would have the capacity to assist the public authority, or to undertake the installations on behalf of the public authority. At some point, however, the care, control and management needs to transfer to the long term asset manager. Theoretically, a body such as OceanWatch could obtain planning consent, arrange approvals from authorities such as RMS and DPI Fisheries, and negotiate the license or lease for occupation of public land, and then transfer the tenure and management to a public authority. This is, however, an extremely cumbersome arrangement. It is much simpler, and least cost to all parties, if the planning authorization, aquatic ecology and navigation approvals, and tenure arrangements were undertaken by a public authority (with assistance from OceanWatch) in the first instance.

The provisions of the planning system in NSW enable public authorities to determine many projects under Part 5 of the Environmental Planning and Assessment Act. The quality of environmental assessment is not diminished but the structure of the determination process is much simpler.

The methods and structural elements of installing bagged oysters do not vary greatly between locations. They are always installed in similar water depth and there are a range of technical considerations which are common to most locations. OceanWatch can assist public authorities in their assessment and determination by making standard technical information available to the proponent authority. This will reduce the burden on the relevant public authority.

The choice of public authority proponent does not make a significant difference from a planning process perspective but in terms of tenure, the relevant landowner has the simplest pathway. The relevant landowner of the submerged land on which Living Shorelines installations are placed will typically be RMS for Sydney Harbour and the major NSW ports, NPWS for some intertidal protected areas and generally DPI Lands elsewhere. For that reason, the proponent, and therefore the nominated determining authority should generally be RMS or DPI Lands, or where relevant NPWS.

In the event that RMS or DPI Lands do not act as the proponent for Living Shorelines installations, other public authorities such as local councils are an alternative.

All of the above public authorities, however, offer a significantly advantage over reliance on a research body such as OceanWatch as the proponent for installations such Living Shorelines.

## ***Tenure***

A public or private entity looking to use or occupy a parcel of Crown or other public land needs to enter into a lease or licence to lawfully occupy that land. The lease or licence generally contains conditions on governance, land owner requirements for notification, maintenance and a range of other matters more suited to developments such as wharves or related facilities. There are also substantial fees payable annually and the lease or licence has a usual term of typically 10 years to perpetuity. Survey fees are passed on to the lessee. Independent legal advice is also considered sensible before entering any such contract.

Not only are these costs prohibitive for research bodies but the presumed long term interest is also misplaced. Research funding does not typically provide for long term ownership or occupation of land in perpetuity and hence the capacity of a research body to enter long term lease or licence contracts is impractical.

The objective of the trials is to enable a relevant public authority to deliver a public benefit related to the organisation's purpose. As a matter of principle, it seems unreasonable that a public authority should place the cost and regulatory burden for delivering that public benefit upon a research body such as OceanWatch.

Generally research bodies aiming to improve the environment and not actually "occupy" an area of public land should not be confronted by the same regulatory and cost structure as a private entity seeking to conduct works on public land for private benefit.

## ***Other approvals and advice***

Living Shorelines projects typically trigger the need for an approval from DPI Fisheries relating to the impact of the structures on marine ecology, and advice to the landowner or proponent from RMS regarding the navigation impacts, if any.

There is scope for both of these procedures to be significantly streamlined for recurrent installations under the Living Shorelines program.

It may be possible, for example, to codify advice and approvals and avoid the need for continual case-by-case detailed assessment if the materials and techniques for installation become standardised. It should be possible, for example, for a navigation impact advice to be conducted as a desktop analysis, given that navigable waterways are generally well surveyed and depths at which oyster bags are placed will be consistent.

## ***Recommendations:***

1. That RMS and DPI Lands act as the proponent for Living Shoreline installations on their respective land.
2. That, in the absence of RMS or DPI Lands as proponent, other public authorities such as local councils act as proponent.
3. That if local councils assume the role of proponent, then the land owner authorities - RMS and DPI Lands - should reduce the regulatory burden and

costs of local councils installing Living Shorelines works on RMS or DPI Lands land.

4. That if local councils assume the role of proponent, then the approval authorities - RMS for navigation and DPI Fisheries for aquatic ecology - should reduce the regulatory burden and costs of local councils installing Living Shorelines works.
5. Regardless of which body is the proponent, streamline the procedures for navigation advice and aquatic ecology impact assessment.

### **Postscript**

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### **References**

<http://www.oceanwatch.org.au/community/current-programs/>

[http://www.sydneycoastalcouncils.com.au/salty\\_communities](http://www.sydneycoastalcouncils.com.au/salty_communities)