



Aquatic Biotechnology Sector Strategy



prepared for

Shoalhaven City Council

by

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1. Introduction

1.1 Purpose

The purpose of this strategy is to provide a clear direction for Shoalhaven City Council's (Council) involvement in the "Aquatic" Biotechnology industry sector. Aquatic Biotechnology involves the use of marine and freshwater based living systems (including the application and processing of bio resources linked to fresh or marine water) to develop or make useful products. Council intends to provide on-going support for existing, emerging and potential new Aquatic Biotechnology industries and this strategy provides a basis for that support.

The Aquatic Biotechnology sector is newly emerging in the Shoalhaven. A range of diverse sectors are coming together to form this industry in our region and Council looks forward to a continued positive and productive relationship with the Aquatic Biotechnology business sector and its industry participants.

1.2 How this Strategy Works

This *Aquatic Biotechnology Sector Strategy* is one in a series of industry sector strategies produced by Council's Economic Development Office (EDO). The need for industry sector strategies, and the subsequent requirement for Council to produce such strategies, is identified under both Council's *Delivery Program and Operational Plan*, as well as Council's economic development strategy "*Shoalhaven - an enterprising alternative*".

The *Aquatic Biotechnology Sector Strategy* is based on a series of strategies and actions to support and address issues within the *Aquatic Biotechnology* sector as a whole, or within individual segments of that industry.

The relationship between Council's strategic planning documents and this *Aquatic Biotechnology Sector Strategy* is shown in the flow chart at Figure 1.

Figure 1: Industry Sector Strategy Flowchart



1.3 Scope

This strategy seeks to outline the key elements of the Aquatic Biotechnology sector, and in doing so, to identify its market segments, trends and the history of Council's interventions in the industry. The strategy also aims to identify future interventions which Council can implement, or work in partnership with others to implement, over the strategy period of five years (2014-2019).

The strategy is laid out in five primary sections as follows:

- Section 1. Includes the purpose, scope and a brief overview of the Aquatic Biotechnology sector;
- Section 2. Provides a review of the existing situation within the Aquatic Biotechnology sector, broken down into more detailed market segments, and including recent trends and a review of Council's past involvement in each segment;
- Section 3. Identifies the strategic objectives for Council's future involvement in the Aquatic Biotechnology sector and the reasons for seeking to fulfil these objectives;
- Section 4. Establishes the future strategies and actions for Council (and others where applicable) in relation to the Aquatic Biotechnology sector; and
- Section 5. Summaries all actions and provides indicative priorities for their implementation.

¹ See <https://media.uow.edu.au/news/UOW164549.html>

1.4 Industry Overview

The Aquatic Biotechnology industry is a relatively new industry (globally, nationally and locally) that is emerging through the convergence of diverse sectors, many that are synonymous with the Shoalhaven. The world's aquatic ecosystems are facing a number of challenges, including overfishing, global climate change, sewage contamination and the introduction of invasive species. Team this with rising food security and animal and human health issues and the complementary relationship between aquatic sciences and biotechnology has blossomed. This innovative industry focuses on clean resources and advanced, efficient, cost effective processes to create useful products.

The development of this industry in Australia has been considered only sporadically over the last two decades, primarily in Tasmania - with reference to the growing of kelp, oysters, scallops and some other seaweeds¹ - and in South Australia - with reference to exploring international research opportunities in clean technology and marine bioproducts and the creation of a "blue economy" being the sustainable development of marine resources, including algae and sponges, as well as aquaculture and fisheries, for economic gain².

Not unlike the coastline of Tasmania and South Australia, it was the Shoalhaven's natural environment and particularly its clean water that played a central role in historically attracting the fishing and seafood industries to the area, including the oyster industry. This marked the early origins of an industry that would move into the Aquatic Biotechnology realm.

This clean, natural environment was also an attractant for the development of the University of Wollongong's (UoW) Marine & Freshwater Research Centre (SMFC) at the university's Shoalhaven Campus, in 2007. The SMFC created an initial 'hub' from which the Aquatic Biotechnology sector could grow. The strategic focus of the SMFC was in sustainable marine food production systems

² See <http://blogs.flinders.edu.au/flinders-news/tag/blue-economy/>

that support a health society, and that are sensibly integrated with the coastal and marine environment. The Centre has:

- ▶ developed pilot-scale, integrated, marine aquaculture systems with private industry;
- ▶ conducted research and development in collaboration with the aquaculture industries in three states;
- ▶ continued to work with the local water utility (Shoalhaven Water) and Council on leading strategies to maintain the clean coastal water resources;
- ▶ undertaken extraction and biorefinery research and development to identify unique and valuable extracts;
- ▶ implemented clinical trials to demonstrate the application of marine extracts to human health; and
- ▶ been a key driver of Seaweeds Australia, a new national network of research and industry partners to coordinate and drive the development of vertically integrated seaweed industries in Australia, as a way forward to achieving sustainable food production technology for the future.

The synergies between the scientific researchers and private industry in the Shoalhaven have continued to prosper, with a high number (in the context of a regional area) of industrial chemists employed in the Shoalhaven, primarily in private industry. Industrial chemists are an important link between the diverse sources of biomass and developing the opportunities of biorefinery products, for example those emerging from marine sources such as shellfish and seaweed or algae. Team this with the Shoalhaven's:

- ▶ proximity to markets in Sydney and the shipping hub of Port Kembla;
- ▶ popularity as a food and wine tourist destination;
- ▶ land availability and accessibility;
- ▶ strong stewardship and technology implemented for clean water resources; and

- ▶ biotechnology systems already being utilised locally by the Manildra Group. ...and the Shoalhaven finds itself not only in a position to explore opportunities in the aquaculture sector in places like Jervis Bay (especially mariculture), but is also in a position to diversify aquatic biotechnology industries with an aim to increase the investment in cutting edge technologies that are aligned with sustainable resources from our clean coastal zone.

While the Aquatic Biotechnology industry and related sectors may continue to grow in an ad-hoc manner within the Shoalhaven, the development of an effective strategy for the coordination of the sector has the potential to generate greater efficiencies, synergies between uses, and ultimately greater investment, employment generation and economic development.

These benefits will make the Shoalhaven an even better place to live and conduct business. But for these benefits to be realised the area's unique 'resources' must be maintained and supported. This will ensure opportunities for the Aquatic Biotechnology industry to prosper can be grasped in the future. These opportunities are explored throughout this *Aquatic Biotechnology Sector Strategy*.

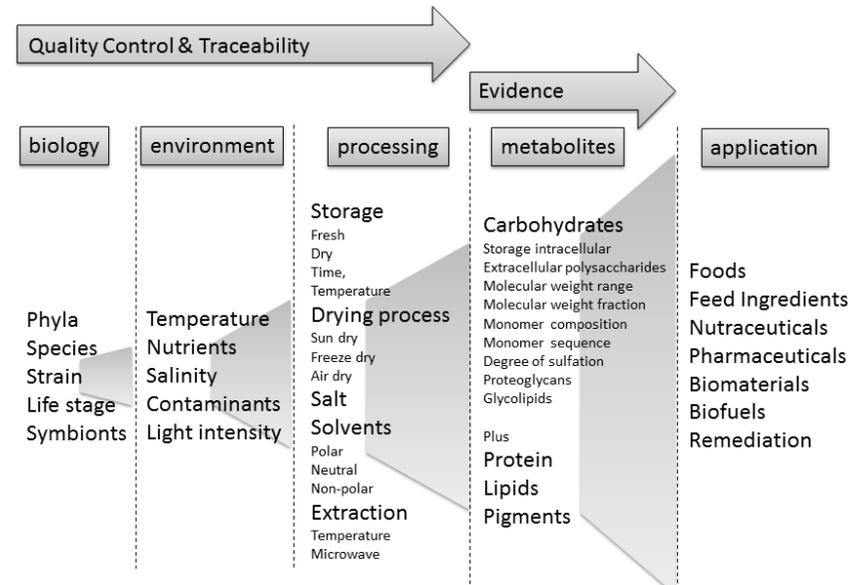
2. Existing Situation

This section provides a review of the various market segments that exist within the Aquatic Biotechnology sector in the Shoalhaven. These include:

- Aquatic Phycology Research & Development** – Phycology is the scientific study of algae. This includes research into marine bioresources such as a host of diverse components that are important for future high technology applications. These have been pursued through local research and cutting edge applications are emerging, especially linked to the new biomass of algae and seaweed;
- Nutraceuticals** – are products derived from food sources that provide extra health benefits over and above the basic nutritional value found in foods. Nutraceuticals compete with pharmaceuticals which are chemical substances or compounds manufactured for similar health purposes but are generally preventative or management in application ;
- Aquaculture** - includes the farming and raising of ocean and freshwater animals and plants. This includes land based, water based and tank based activities;
- Gastronomy** – is the study of food, with a particular focus on gourmet cuisine. The Shoalhaven is excelling in its reputation as a region of cuisine and fine foods; and
- Waste/ Energy Reduction & Bio refining** – involves the re-use and integration of resources generated by a bio industry and bio refining process systems, including innovative Shoalhaven Water projects.

It is noted that across these segments a unique opportunity exists in the Shoalhaven to create integration between segments as part of a whole of process system. This would assist in realising commercially viable industry

opportunities and is shown in the diagram below.



Source: Diagram provided by Pia Winberg - 2014

These market segments are detailed in the following sub-sections.

This section also provides a number of case study “boxes”, which outline examples of best practice, industry snapshots and other issues relevant to Aquatic Biotechnology in the Shoalhaven. These case studies are examples primarily from within the LGA that provide a positive reflection of the potential within the Shoalhaven.

It is noted that there are other market sectors that may emerge (such as biofuels) in the Aquatic Biotechnology Industry but this document focuses on the most viable, existing sectors within the Shoalhaven.

2.1 Aquatic Phycology Research & Development

Historically, Australia has been a leader in algal applications and currently there are many research developments in algal applications happening in Australia. International interest in algal applications in Australia is strong due to our unique algal biodiversity, landscape and biogeography that lend itself to algal industry development. On this basis the 5th Congress of the International Society for Applied Phycology - ISAP 2014 – is being held in Sydney in June 2014.

Aquatic research and development was cemented in the Shoalhaven in 2007, with the establishment of the Shoalhaven Marine and Freshwater Research Centre. UoW and private industry have been involved with Aquatic Biotechnology research in the region for some time. A particular area of focus has been in seaweeds and their extracts. Seaweed extracts are already commonly used in goods as diverse as fertiliser, toothpaste, skin care products, paint, ice cream and salad dressing. However, research in the field of glycobiology – the study of complex sugars called glycans in living organisms – is showing that seaweed has a major role to play in the development of new and biologically active materials for medical treatments³. This research is being conducted at the Intelligent Polymer Research Institute (IPRI) of UoW. A collaboration between IPRI and the start-up operation Venus Shell Systems Pty Ltd is delving into how the properties of seaweeds can be harnessed for medical research, particularly in 3D printed implants and for cell compatible materials with bioactive properties.

Other local research being conducted by UoW involves a pilot study of 130 inmates at the South Coast Correctional Centre who volunteered to see whether good nutrition, and in particular omega-3 fats, have a positive impact on behaviour. The study is being conducted as it is recognised that the source and the benefits of omega-3 oils needed to be aligned for the sake of human health and sustainable ocean production and to date, the study has demonstrated that

³ See <https://media.uow.edu.au/news/UOW164549.html>

the marine Omega-3 blood index is positively correlated with reduced aggressive behaviour.

Yet another pilot study carried out in the Shoalhaven by Algae.Tec Ltd, has shown that the growth and processing of algae for use in nutraceuticals is now economically viable on a commercial scale in the region. This development is showcased in Case Study No. 1 below.

2.1.1 Trends

Within the context of Aquatic Research & Development, key broad based trends include:

- ▶ The establishment and ongoing annual growth in membership of the International Society for Applied Phycology.
- ▶ Increasing interest in personal dietary intake and overall health, as well as the high level of importance Australian's place on research into what they are eating, as evidenced by the ABS Australian Health Survey conducted in 2011-2013⁴.

2.1.2 Past Strategies and Actions

Council has had some involvement in strategies and actions to support Aquatic Research & Development in the Shoalhaven, including:

- ▶ Making available Shoalhaven Water's former STP to be converted to production or prototype testing facility for aquatic biotechnology production.
- ▶ Playing the role of an active stakeholder in the establishment of the Marine & Freshwater Research Centre at the UoW Shoalhaven Campus.

⁴ Australian Health Survey: First Results (ABS Catalogue no. 4364.0.55.001)

- ▶ Participating in regional, state or national forums to develop relationships and enhance synergies between researchers and the Shoalhaven.
- ▶ Actively maintaining the clean waters of the region through land use controls and careful monitoring.

CASE STUDY No. 1 – Algae.Tec Ltd

Algae.Tec Ltd is an advanced algae products company focused on commercialising technology that produces algae to manufacture sustainable products including proteins and oils such as biofuels.

They were founded in 2007 with offices in Atlanta, Georgia and Perth, Western Australia. Two years ago Algae.Tec conducted a pilot project in the Shoalhaven, in association with the Manildra Group and the University of Wollongong’s Marine & Freshwater Research Centre. The pilot project utilised the carbon dioxide produced at the Manildra plant (in Bomaderry) in bioreactors to accelerate the growth of algae.

As a result of the success of the pilot project they are now establishing their first dedicated, commercial, zero waste facility to grow and process algae in South Nowra. Algae.Tec chose the Shoalhaven because of its many algae specialists, proximity to Sydney and Port Kembla and the moderate climate and temperatures that the area enjoys all year round. The project now represents a \$100 million investment that will create 100 jobs over a 4 year period. Initially, the algae grown and processed at the South Nowra facility will be used to produce nutraceuticals, or high protein dietary supplements.



2.2 Nutraceuticals

Nutraceuticals form part of the complementary and alternative medicine industry, which in Australia is worth \$4 billion in revenue and is forecast to grow by 5% in 2013-14⁵. While nutraceuticals have traditionally been developed by pharmaceutical companies, they are now being produced by large food companies which are less regulated and more accessible to small start-up businesses that may be looking to break into the nutraceuticals area. This trend could align well with the approach to algae growth and processing that is occurring in the Shoalhaven by enabling smaller research and trial opportunities to quickly develop into much larger operations.

The focus on algae based nutraceuticals in the Shoalhaven, as opposed to pharmaceuticals, skin care products and the like, also relates to the availability of traceable, high quality algae. Nutraceuticals are a product that require high quality algae as Case Study No. 1 highlights. This case study represents the first commercial investment in an algae growth and processing plant in the area, but in the context of the forecast growth in the Australian nutraceutical industry, the demand to establish more commercial growth and processing of algae in the Shoalhaven would appear to be substantial.

The Shoalhaven’s interest in nutraceuticals extends from algae to other biomass sources already being utilised by private companies. Examples include:

- ▶ Probiotec - that manufacture and distribute a diverse, high quality range of prescription and over-the-counter nutraceuticals, complementary medicines and specialty ingredients; and
- ▶ Nowra Chemicals which has a processing facility aligned with natural cosmetic and cosmaceuticals.

⁵ Alternative Health Therapies Market Research Report- ANZSIC X0015, Oct 2013.

2.2.1 Trends

Within the context of Nutraceuticals, key broad based trends include:

- ▶ Continued growth of the complementary and alternative medicine industry, both internationally and within Australia.
- ▶ Increased demand for algae as large food companies become more involved in the production of nutraceuticals, as opposed to it just being the domain of pharmaceutical companies⁶.

2.2.2 Past Strategies and Actions

While Council has to date not had direct involvement in the nutraceuticals industry with respect to Aquatic Biotechnology, Council does support the industry through provision of networking opportunities for relevant businesses either located in the Shoalhaven or looking to establish in the Shoalhaven. Many Shoalhaven based businesses play an active role in this sector segment, including Algae.Tec, Flavourjen, Venus Shell Systems, Probiotec and Nowra Chemicals. These businesses have laboratory facilities based in the areas and an emphasis on clean food technologies.

2.3 Aquaculture

This industry can be broadly divided into two areas, land based and water based aquaculture, and with each providing the potential for the production of both fresh water and marine animals and plants.

In the Shoalhaven, an established water based aquaculture industry exists, incorporating the oyster industry in the Shoalhaven/Crookhaven estuary and river systems. Blue Mussels, scallops and oysters also used to be cultured within Jervis Bay. Potential exists to improve and facilitate expansion of this existing

industry through a range of production and environmental improvements, including mobile oyster culture as referenced in Case Study No.2.

In 2010, an online information portal for four key oyster growing locations in NSW (including the Shoalhaven) was established via a partnership between oyster growers, researchers and relevant state agencies. The portal collates the various environmental data collected by the oyster industry and shares this data with relevant stakeholders, including the oyster growers of the Shoalhaven. Such collaborative projects are of great benefit to the industry.

Land based aquaculture is a much smaller industry on the NSW South Coast, with few relatively small scale producers of fish. However, there are a number of potential opportunities that have been identified for the development of more large scale sustainable aquaculture systems. Work has been undertaken to assess the *Environmental and Socio-Economic Considerations for Aquaculture in Jervis Bay NSW*⁷, concluding that extensive shellfish or sea-weed aquaculture in Jervis Bay should be supported. In this regard, the Fisheries NSW is now in the final stages of an application process to license up to 50ha of Jervis Bay for the purposes of growing marine algae and shellfish.

The *Ulladulla Future Park* concept has also been developed over a number of years, incorporating an integrated aquaculture facility with associated value-adding tourism, research and educational potential. The *Future Park* site is the former Ulladulla Sewage Treatment Site, which was operated and decommissioned by Shoalhaven Water in November 2005. The Park provides a unique opportunity to showcase modern sustainable aquaculture techniques with business feasibility studies showing that a profitable business can be established following some initial capital input. The site continues to be maintained and monitored by Shoalhaven Water.

⁶ Russiano, B, and Thistlewaite, P 2013, 'Nutraceuticals: Big Pharma or Big Foods Next Big Growth Area', *Pharmaceutical Market Europe Online Journal*.

⁷ Prepared by the Australian Government Fisheries Research and Development Corporation (June 2010).

However despite the apparent capacity and viability of various aquaculture projects, there has only been relatively small scale investment to date. Shoalhaven Water, Fisheries NSW and Marine Parks Authority NSW have created and maintain a clean water resource that is renowned both state-wide and nationally, and is ready to be further utilised in the context of this industry.

CASE STUDY No. 2 – McAsh Oysters & Ulladulla Oyster Bar

McAsh Oysters operate a 22ha oyster farm in the Clyde River and retail their oysters at the Ulladulla Oyster Bar and major East Coast Australian cities. The ‘clean’ marine environment on the South Coast was the ‘drawcard’ for the marine scientist that started McAsh Oysters.

McAsh Oysters have modernised the existing oyster farm through the use of mobile, floating recycled plastic baskets and posts and the installation of a high speed automatic grader. They are using the latest technologies and sustainable single seed cultivation to produce a hand packed, high quality, graded Sydney Rock Oyster product.

The company is now focusing on growing the business to export their oysters (as well as selling them locally), due to the strong overseas demand for high quality, branded Sydney Rock Oysters. At this stage, the Clyde River is ‘export approved’ but logistics and the need for an ‘export approved’ packing facility are hurdles McAsh Oysters is currently addressing in a bid to continue to grow the high quality oyster industry on the South Coast.



2.3.1 Trends

Within the Shoalhaven, there are a number of trends with relevance to the aquaculture market. These include:

- ▶ Shoalhaven Marine and Freshwater Research Centre, provided a much greater impetus for further development of this industry sector.
- ▶ Continued recognition of the high quality seafood produced in Australia, for both the domestic and international markets.
- ▶ Increasing reliance on aquaculture to provide for demand in seafood to avoid degradation of natural systems.
- ▶ Continued demand for oysters, including those produced in the Shoalhaven.
- ▶ Future potential for large scale seaweed aquaculture to provide for carbon off-sets.
- ▶ Council and specifically Shoalhaven Water for the utilisation of the assets of a former STP at Ulladulla.
- ▶ Recognition of the potential (including on-going support research) for the implementation of a range of aquaculture facilities and ventures in the Shoalhaven including the *Ulladulla Future Park* and Jervis Bay developments discussed above.

2.3.2 Past Strategies and Actions

Council has worked with both the existing and potential future aquaculture markets within the Shoalhaven. Such initiatives include:

- ▶ Funding assistance to provide a baseline study for the environmental and socio-economic consideration for aquaculture in Jervis Bay (Published June 2010).
- ▶ Continued lobbying of State and Federal Governments to assist in the development of a viable land based aquaculture industry in the Shoalhaven.

- ▶ Shoalhaven Water’s support for the launch of the Shoalhaven Oyster Inc. marketing and branding launch.
- ▶ Shoalhaven Water’s provision of a specific monitoring budget as a contribution to the Oyster Quality Assurance Program.

CASE STUDY No. 3 - Venus Shell Systems Pty Ltd

Venus Shell Systems (VSS) is a new Australian company with a background in sustainable marine ecosystem research and health and medical science. VSS was founded with the vision to contribute to the sustainability of coastal communities, to aid global socio-economic progress and to produce products that address global health challenges. They believe that seaweed has historically contributed in this way, but that the west “lost touch” with the health benefits of seaweed. VSS want to ensure seaweeds are on the menu again, with the benefits of providing new food alternatives and creating a sustainable industry with positive employment and health outcomes.

VSS cultivates seaweed by sequestration of clean sources of CO₂ and nitrogen, while delivering a new and nutritionally rich food source with important protein, marine Omega-3 and minerals from the ocean. Dr Pia Winberg, the Director of VSS, has spent much time determining which species of seaweed are suited to Australian conditions. The seaweeds selected must 'tick the boxes' for good productivity and remediation, consistent biomass and consistent quality, and offer opportunities for new high-value markets in Australia. Importantly – the taste, colour and texture of their seaweed provides an addition to the palette of ingredients for innovative chefs.



2.4 Gastronomy

Algae and seaweed have probably been eaten by humans as long as our species has existed. The earliest historical record of seaweed consumption goes back to 3000 BC in China, and there is good evidence the Irish and Scots have eaten seaweed for at least 4,000 years.

Australians are just beginning to understand how beneficial seaweed and algae can be. Combine this with a growing number of innovative chefs/ restaurants and the Australian attraction to living on/ visiting the coast, and the South Coast of NSW is well placed to make better use of seafood and algae in gastronomy.

The cook book titled “The Coastal Chef” will be launched at the 5th Congress of ISAP being held in Sydney later this year. The book takes some of the world’s leading seaweed and algae producers and partnering them with some of Australia’s most innovative chefs from the South Coast and beyond. The book also features the Shoalhaven coastline.

2.4.1 Trends

Within Shoalhaven, there are a number of trends with relevance to gastronomy, including:

- ▶ A strong food, wine and culinary tourism base built on access to local produce.
- ▶ An increasing number of high profile restaurants successfully operating in the Shoalhaven.
- ▶ Continued in-migration of baby boomers and visitors who have a strong interest in food and wine and patronise restaurants and contemporary eateries.
- ▶ *Slow Food Shoalhaven* continue to sponsor local producers at international events, such as Terra Madre in Italy.

2.4.2 Past Strategies and Actions

Council has worked with both the existing and potential future gastronomy markets within the Shoalhaven. Such initiatives include:

- ▶ Continued support for *Slow Food Shoalhaven* and local Growers Markets.
- ▶ Establishment of *Fresh Harvest*, a database and network of local producers.
- ▶ Development of the South Coast Farm Gate Trail associated with the Hawkesbury Harvest initiative.
- ▶ Initial preparation of the Agribusiness Hub concept where all forms of related businesses can come together and collectively grow.

2.5 Sustainable By-product/ Resource Utilisation

In the context of this document, waste can generally be described as a by-product that is no longer required after the completion of a process. It is commonly known that waste creation is increasing world-wide at an alarming rate, and therefore any possible re-use of a waste product has positive environmental, social and economic benefits.

One such example is the award winning Reclaimed Effluent Management Scheme (REMS) scheme is one of the largest and more complex water-recycling schemes undertaken by an Australian local government water authority, being Shoalhaven Water. The scheme provides up to 2000 million litres of reclaimed water for beneficial purposes rather than disposing of it into the environment, including farm irrigation and clean water for aquatic biotechnology opportunities, and is featured in Case Study No. 4.

Another example of sustainable by-product reuse in the Shoalhaven is the utilisation of carbon dioxide and nitrogen, which are often waste products that create an ongoing disposal cost for many companies. One method of use is in the area of seaweed and algae cultivation, which uses the sequestration of clean sources of carbon dioxide and nitrogen to generate a faster growth rate.

CASE STUDY No. 4 – Reclaimed Effluent Management Scheme

The unique Reclaimed Effluent Management Scheme (REMS) is being developed in two stages and will utilise up to 80% of the reclaimed water from six Shoalhaven Water wastewater treatment plants. The treated water is used to irrigate local dairy farms, golf courses and sporting fields, whilst also providing the treated water to industry.

Substantial innovations in the design of the long standing scheme greatly reduced construction and operating costs from original estimated for the initial stages that commenced operation in 2001.

The objectives of REMS include:

- To re-use up to 2,000 million litres of reclaimed water for beneficial purposes rather than disposing of it into the environment;
- To supply high quality irrigation water to the region's farmers to improve their sustainability; and
- To provide sufficient water to irrigate local sporting facilities and golf courses.

The successful scheme includes an upgrade component that will effectively double the daily reclaimed water supply managed by REMS.



One of the biggest manufacturers in the Shoalhaven is The Manildra Group, who create carbon dioxide and nitrogen as a result of fermentation and the burning of fuel to create wheat based products. The Manildra Group turns some of their waste into a biogas that can be reused in bio refinery processes, but there remains excess carbon dioxide and nitrogen.

The Aquatic Biotechnology sector provides an opportunity to utilise this waste product, reducing its release into the atmosphere and creating a win-win situation for those industries involved. . The primary reason this can occur in the Shoalhaven is because of the clean, quality resources being input by both industries. This is highlighted in Case Study No. 5.

2.5.1 Trends

There are a number of trends with relevance to waste reduction, including:

- There is a growing movement, both internationally, nationally and locally towards ‘zero waste’, reducing environmental impact and converting industry by-products into something useful.
- Increasing technological advances, such as the development of bio-technology as discussed throughout this document, increasingly enables the reuse of by-products previously thought of as “waste” materials.

2.5.2 Past Strategies and Actions

Council supports and encourages waste reduction in the business sector, as part of a suite of environmental initiatives. Such initiatives include:

- Partnering Southern Councils Group in the establishment and ongoing operation of the *Business Treading Lightly* program, which helped businesses in the Illawarra and South Coast to reduce their ecological footprint.
- Maintaining a *Shoalhaven Sustainable Business* database or network.
- Substantial innovations in the design of the scheme greatly reduced construction and operating costs from original estimated.
- Shoalhaven Water’s ongoing commitment to the provision of clean water and the Reclaimed Effluent Management Scheme.

- Working with local businesses to manage waste streams and develop products and technologies to further process any wastes into useable products such as industrial feedstocks.

CASE STUDY No. 5 – The Manildra Group

The Manildra Group (Manildra) was established in 1952 with the purchase of a single flour mill in the town of Manildra, in Western NSW. The company expanded into the Shoalhaven in 1970 and is now the largest user of wheat for industrial purposes in Australia, processing some 1 million tonnes of wheat per annum.

Over the last 50 years Manildra pursued vertical integration of its processing and as a result diversified the product range to include flour, pre-mixes and products derived from flour such as modified starches, glucose syrups, maltodextrine, gluten, specialty protein products and ethanol. These products are all produced from wheat via various bio refining techniques.

Because Manildra is focused on new global applications of bio technology, the company is always investigating different ways to maximise the use of their resources. One such investigation includes the possible complementary use of Manildra’s waste (carbon dioxide and nitrogen) to accelerate the growth of high quality algae/ seaweed.



3. Strategic Objectives

This section establishes Council’s strategic objectives for the Aquatic Biotechnology sector. These strategic objectives provide an outline of Council’s future involvement and commitment to this important industry sector and its potential for economic and jobs growth in the Shoalhaven.

The strategic objectives consider the current situation, trends and past involvement of Council within the Aquatic Biotechnology sector as outlined in Section 1.4 and Section 2, whilst ensuring a pragmatic and focused approach to Council’s future involvement in the sector. The strategic objectives and a brief explanation of their importance are set out in Table 1 below.

Table 1: Aquatic Biotechnology Sector Strategic Objectives

Strategic Objective	Reason
Strategic Objective 1: <i>To advocate for and coordinate the establishment of an Aquatic Biotechnology industry hub in the Shoalhaven.</i>	To encourage and support the growth of an industry sector that is suited to the Shoalhaven, due to the Shoalhaven’s clean environment, proximity to Sydney/ Port Kembla, existing tertiary and business support networks and strong coastal tourism base.
Strategic Objective 2: <i>To work with existing leaders in the Aquatic Biotechnology industry within the Shoalhaven to establish networks and opportunities to grow the industry.</i>	To ensure that growth in the industry sector translates into tangible benefits for existing and future businesses through coordination, dialogue and facilitation, and to strengthen businesses that may share mutual benefits.
Strategic Objective 3: <i>To work co-operatively with tertiary institutions to identify and pursue opportunities for growth in the Aquatic Biotechnology industry in the Shoalhaven.</i>	To ensure that Council has a close understanding and opportunity to assist with current barriers to further investment by tertiary institutions and student placements in government organisations, including Council.
Strategic Objective 4: <i>To educate the community as to the social, economic, employment, and environmental benefits that can be achieved through establishing the Shoalhaven as an Aquatic Biotechnology industry hub.</i>	To ensure that the benefits of Aquatic Biotechnology can be broadly understood to encourage local communities to accept new business opportunities, and therefore support their applications/ approvals processes and overall establishment.
Strategic Objective 5: <i>To undertake promotional activities, including appropriate marketing, conference attendance and trade show participation, to affirm the Shoalhaven as a key location for Aquatic Biotechnology activities.</i>	To ensure that Council is accessing relevant potential new businesses within the Aquatic Biotechnology industry that may establish in the Shoalhaven, at the same time as keeping up with best practice in the sector.
Strategic Objective 6: <i>To maintain the sense of clean water and clean coastline synonymous with the Shoalhaven.</i>	To protect, and where possible enhance, the provision of and access to clean water and clean coastline, which is integral to the establishment and longevity of the Aquatic Biotechnology sector.

4. Strategies, Actions and Priorities

This section establishes the strategies, actions and priorities for Council (and others where applicable) in relation to the Aquatic Biotechnology sector.

The term “strategies” is used to describe the overarching activity to be undertaken, lead or instigated by Council, and which may utilise existing industry groups, project partners and others to assist in their implementation. “Actions” are the actual steps in undertaking the strategies, and are provided in a form that can be measured and reported on. Timing and responsibilities have been provided for indicative purposes.

The actions and strategies within this section seek to directly address and relate to the Strategic Objectives identified in Section 1, as well as considering the issues and trends identified in Section 1.4 and Section 2.

4.1 Whole of Aquatic Biotechnology Sector Actions and Strategies

The following strategies are applicable to multiple or all market segments of the Aquatic Biotechnology sector.

Strategy 1: Develop an Aquatic Biotechnology expansion group/ committee to oversee the binding together and growth of the sector in the Shoalhaven

Purpose: To provide oversight and advice to Council officers and others to assist in the effective implementation of the necessary infrastructure and resources to ensure Aquatic Biotechnology can continue to grow in the region.

Related Strategic Objectives:

- ▶ Strategic Objective 1: To advocate for and coordinate the establishment of an Aquatic Biotechnology industry hub in the Shoalhaven.
- ▶ Strategic Objective 2: To work with existing leaders in the Aquatic Biotechnology industry within the Shoalhaven to establish networks and opportunities to grow the Industry.

Proposed Actions:

<i>Action</i>	<i>Timing</i>	<i>Responsibility</i>
<p><i>Action 1.1</i> - Establish an Aquatic Biotechnology sector expansion group/committee with representative from:</p> <ul style="list-style-type: none"> • Council; • University of Wollongong; • Aquatic Biotechnology business operating in the Shoalhaven; and • Seafood/ Aquaculture Industry <p>To meet regularly to establish/ develop the brand “Blue BioTech Shoalhaven”, create an agreed vision, discuss key issues and barriers to the expansion of Aquatic Biotechnology in the Shoalhaven, link with international research and technologies and build relationships with like-minded people/ organisations.</p>	Short-term	Council (EDO)

<i>Action</i>	<i>Timing</i>	<i>Responsibility</i>
<i>Action 1.2</i> – Establish leading global standards including new potential sustainable products that have commercial opportunity.	Ongoing	All

Monitoring: Group/ Committee established and meetings held quarterly (or as otherwise required).

Strategy 2: Facilitate cross-promotion of Aquatic Biotechnology opportunities across other sectors in the Shoalhaven

Purpose: To ensure that potential for cross-benefits between key sectors can be explored to the mutual benefit of various parties.

Related Strategic Objectives:

- ▶ Strategic Objective 1: To advocate for and coordinate the establishment of an Aquatic Biotechnology industry hub in the Shoalhaven.
- ▶ Strategic Objective 2: To work with existing leaders in the Aquatic Biotechnology industry within the Shoalhaven to establish networks and opportunities to grow the industry.
- ▶ Strategic Objective 3 - To work co-operatively with tertiary institutions to identify and pursue opportunities for growth in the Aquatic Biotechnology industry in the Shoalhaven.

Proposed Actions:

<i>Action</i>	<i>Timing</i>	<i>Responsibility</i>
<i>Action 2.1</i> - As required, facilitate consultation between the expansion group/committee and others where opportunities exist for co-operation around various issues.	Ongoing	Council (EDO)

Monitoring: Six-monthly updates to Council for 2 years then annually, in association with Strategy 1.

Strategy 3: Establish project funding requirements to seek grant funding to support the establishment of the Aquatic Biotechnology Industry Sector in the Shoalhaven

Purpose: To identify and support the types of projects that will assist with the establishment of the Aquatic Biotechnology Industry Sector in the Shoalhaven.

Related Strategic Objectives:

- ▶ Strategic Objective 1: To advocate for and coordinate the establishment of an Aquatic Biotechnology industry hub in the Shoalhaven.
- ▶ Strategic Objective 4: To educate the community as to the social, economic, employment, and environmental benefits that can be achieved through establishing the Shoalhaven as an Aquatic Biotechnology industry hub.

Proposed Actions:

<i>Action</i>	<i>Timing</i>	<i>Responsibility</i>
<i>Action 3.1</i> – Through the expansion group/ committee establish a clear outline of the projects that are eligible for grant funding and that could support the industry sector and to ensure that Council is ready to make submissions whenever available.	Short-term	Council (EDO)

Monitoring: Six-monthly updates to Council for 2 years then annually, in association with Strategy 1.

Strategy 4: Promote Aquatic Biotechnology in the Shoalhaven at a global level

Purpose: To ensure that relevant stakeholders are aware of the Shoalhaven’s presence in the Aquatic Biotechnology industry sector.

Related Strategic Objectives:

- ▶ Strategic Objective 1: To advocate for and coordinate the establishment of an Aquatic Biotechnology industry hub in the Shoalhaven.
- ▶ Strategic Objective 5: To undertake promotional activities, including appropriate marketing, conference attendance and trade show participation, to affirm the Shoalhaven as a key location for Aquatic Biotechnology activities.

Proposed Actions:

<i>Action</i>	<i>Timing</i>	<i>Responsibility</i>
<i>Action 4.1</i> – To establish/ develop the brand “Blue BioTech Shoalhaven”.	Short-term	Council (EDO)
<i>Action 4.2</i> – Promote Aquatic Biotechnology to relevant stakeholders, through sponsoring and attending the 5th Congress of the International Society for Applied Phycology in Sydney in June 2014.	Short-term	Council (EDO)
<i>Action 4.3</i> – To identify like opportunities in association with industry participants to further develop the industry over time, by supporting integration of the industry capacity.	On-going	Council (EDO)

Monitoring: Level of interest and follow up enquiries generated by attendance at the conference. Reporting on events to form part of updates to Council.

4.2 Phycology Research & Development Actions and Strategies

The following strategies are applicable to the Phycology Research & Development market segment of the Aquatic Biotechnology sector.

Strategy 5: Continue to promote the University of Wollongong and Aquatic Biotechnology Research

Purpose: To ensure that the university continues to attract local students and that there is a continued research focus on Aquatic Biotechnology.

Related Strategic Objectives:

- ▶ Strategic Objective 3: To work co-operatively with tertiary institutions to identify and pursue opportunities for growth in the Aquatic Biotechnology industry in the Shoalhaven.

Proposed Actions:

<i>Action</i>	<i>Timing</i>	<i>Responsibility</i>
<i>Action 5.1</i> – Promote UoW courses that relate to Aquatic Biotechnology at all relevant career expos etc.	Ongoing	Council (EDO)/ UoW
<i>Action 5.2</i> – Provide relevant Council data to UoW in support of Aquatic Biotechnology research being carried out in the Shoalhaven.	Ongoing	Council (EDO/ Strategy Planning)

Monitoring: Number of students from the local area studying in fields that relate to Aquatic Biotechnology.

4.3 Nutraceuticals Actions and Strategies

The following strategies are applicable to the Nutraceuticals market segment of the Aquatic Biotechnology sector.

Strategy 6: Promote Aquatic Biotechnology occurring in the Shoalhaven to Nutraceutical companies

Purpose: To ensure that relevant markets are aware of the Shoalhaven’s presence in the Aquatic Biotechnology Industry sector.

Related Strategic Objectives:

- ▶ Strategic Objective 5: To undertake promotional activities, including appropriate marketing, conference attendance and trade show participation, to affirm the Shoalhaven as a key location for Aquatic Biotechnology activities.

Proposed Actions:

<i>Action</i>	<i>Timing</i>	<i>Responsibility</i>
<i>Action 6.1</i> – Promote Aquatic Biotechnology to relevant markets, including the growing nutraceutical market within Australia at any relevant expos or business events.	Ongoing	Council (EDO)

Monitoring: Six-monthly updates to Council in association with Strategy 1.

4.4 Aquaculture Actions and Strategies

The following strategies are applicable to the Aquaculture market segment of the Aquatic Biotechnology sector.

Strategy 7: Facilitate the establishment of further aquaculture in the Shoalhaven

Purpose: To assist in the development of aquaculture and associated employment and Aquatic Biotechnology opportunities.

Related Strategic Objectives:

- ▶ Strategic Objective 4 - To educate the community as to the social, economic, employment, and environmental benefits that can be achieved through establishing the Shoalhaven as an Aquatic Biotechnology industry hub.
- ▶ Strategic Objective 5 -To undertake promotional activities, including appropriate marketing, conference attendance and trade show participation, to affirm the Shoalhaven as a key location for Aquatic Biotechnology activities.
- ▶ Strategic Objective 6 - To maintain the sense of clean water and clean coastline synonymous with the Shoalhaven.

Proposed Actions:

<i>Action</i>	<i>Timing</i>	<i>Responsibility</i>
<i>Action 7.1</i> – Continue to lobby state and local government to ensure any aquaculture applications, such as the application to license up to 50ha of Jervis Bay for the purposes of growing marine algae and shellfish, are assessed in a timely and reasonable manner.	Short Term	Council (EDO/ Strategy Planning)
<i>Action 7.2</i> – Shoalhaven Water continue to provide a clean water resource for the purposes of aquaculture.	Ongoing	Council (Shoalhaven Water)
<i>Action 7.3</i> – Promote aquaculture as part of the local agribusiness sector.	Ongoing	Council (EDO)

Monitoring: Council reporting as required.

4.5 Gastronomy Actions and Strategies

The following strategies are applicable to the Gastronomy market segment of the Aquatic Biotechnology sector.

Strategy 8: Work co-operatively to maintain the Shoalhaven as a major Food & Wine Tourist Destination

Purpose: To assist in the development of Aquatic Biotechnology related gastronomy through supporting the food & wine industry in the Shoalhaven.

Related Strategic Objectives:

- ▶ Strategic Objective 4 - To educate the community as to the social, economic, employment, and environmental benefits that can be achieved through establishing the Shoalhaven as an Aquatic Biotechnology industry hub.
- ▶ Strategic Objective 5 -To undertake promotional activities, including appropriate marketing, conference attendance and trade show participation, to affirm the Shoalhaven as a key location for Aquatic Biotechnology activities.

Proposed Actions:

<i>Action</i>	<i>Timing</i>	<i>Responsibility</i>
<i>Action 8.1</i> – Continue to promote the Shoalhaven as a culinary or food & wine tourist destination.	Ongoing	Council (EDO / Tourism)

Monitoring: Council reporting as required.

4.6 Waste Reduction Actions and Strategies

The following strategies are applicable to the Waste Reduction market segment of the Aquatic Biotechnology sector.

Strategy 9: Work co-operatively with the EPA and others as required

Purpose: To assist with identification of opportunities for waste streams to be diverted to the Aquatic Biotechnology industry sector where possible and feasible.

Related Strategic Objectives:

- ▶ Strategic Objective 4 - To educate the community as to the social, economic, employment, and environmental benefits that can be achieved through establishing the Shoalhaven as an Aquatic Biotechnology industry hub.
- ▶ Strategic Objective 5 -To undertake promotional activities, including appropriate marketing, conference attendance and trade show participation, to affirm the Shoalhaven as a key location for Aquatic Biotechnology activities.

Proposed Actions:

<i>Action</i>	<i>Timing</i>	<i>Responsibility</i>
<i>Action 9.1</i> – Continue to involve and educate relevant state and local agencies in relation to Aquatic Biotechnology practices through active engagement and education.	Ongoing	Council (EDO/ Waste Services)

Monitoring: Council reporting as required

5. Summary of Actions and Priorities

This section provides a summary of all actions proposed within this *Aquatic Biotechnology Industry Sector Strategy*. These actions are arranged by indicative timing and with consideration of the priorities of Council. In this respect, Council priorities will continue to be based on economic development and opportunities for jobs growth. Whilst all strategies and actions are considered important, actions with a higher priority will be progressed in the first instance where resourcing constraints exist.

Table 2: Short-Term Actions (2014)

<i>Action</i>	<i>Current Priority</i>
<p><i>Action 1.1</i> - Establish an Aquatic Biotechnology sector expansion group/committee with representative from:</p> <ul style="list-style-type: none"> • Council; • University of Wollongong; • Venus Shell Systems and/ or other Aquatic Biotechnology business operating in the Shoalhaven; and • Seafood/ Aquaculture Industry <p>To meet regularly to establish/ develop the brand “Blue BioTech Shoalhaven”, create an agreed vision, discuss key issues and barriers to the expansion of Aquatic Biotechnology in the Shoalhaven, link with international research and technologies and build relationships with like-minded people/ organisations.</p>	<i>High</i>
<p><i>Action 3.1</i> – Through the expansion group/ committee establish a clear outline of the projects that are eligible for grant funding and that could support the Industry sector and to ensure that Council is ready to make submissions whenever available.</p>	<i>Medium</i>
<p><i>Action 4.1</i> – To establish/ develop the brand “Blue BioTech Shoalhaven”.</p>	<i>High</i>

<i>Action</i>	<i>Current Priority</i>
<p><i>Action 4.2</i> – Promote Aquatic Biotechnology to relevant stakeholders, through sponsoring and attending the 5th Congress of the International Society for Applied Phycology in Sydney in June 2014.</p>	<i>High</i>

Table 3: On-going (or as required) Actions

<i>Action</i>	<i>Current Priority</i>
<p><i>Action 1.2</i> – Establish leading global standards including new potential sustainable products that have commercial opportunity.</p>	<i>High</i>
<p><i>Action 2.1</i> - As required, facilitate consultation between the expansion group/committee and others where opportunities exist for co-operation around various issues.</p>	<i>High</i>
<p><i>Action 4.3</i> - To identify like opportunities in association with industry participants to further develop the industry over time by supporting integration of the industry capacity.</p>	<i>High</i>
<p><i>Action 5.1</i> – Promote UoW courses that relate to Aquatic Biotechnology at all relevant career expos etc.</p>	<i>High</i>
<p><i>Action 5.2</i> – Provide relevant Council data to UoW in support of Aquatic Biotechnology research being carried out in the Shoalhaven.</p>	<i>High</i>
<p><i>Action 6.1</i> – Promote Aquatic Biotechnology to relevant markets, including the growing nutraceutical market within Australia at any relevant expos or business events.</p>	<i>Medium</i>
<p><i>Action 7.1</i> – Continue to lobby state and local government to ensure any aquaculture applications, such as the application to license up to 50ha of Jervis Bay for the purposes of growing marine algae and shellfish, are assessed in a timely and reasonable manner.</p>	<i>High</i>

Action	Current Priority
<i>Action 7.2</i> – Shoalhaven Water continue to provide a clean water resource for the purposes of aquaculture.	<i>High</i>
<i>Action 7.3</i> – Promote aquaculture as part of the local agribusiness sector.	<i>High</i>
<i>Action 8.1</i> – Continue to promote the Shoalhaven as a culinary or food & wine tourist destination.	<i>High</i>
<i>Action 9.1</i> – Continue to involve and educate relevant state agencies in relation to Aquatic Biotechnology practices.	<i>Medium</i>