Department of
Primary Industries and
Regional Development

GOVERNMENT OF
WESTERN AUSTRALIA

ALBANY AQUACULTURE DEVELOPMENT ZONE

Management Framework

Version Control

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Contents

1 INTRODUCTION

1.1 The Management Framework

Aquaculture, particularly bivalve mollusc aquaculture, can be one of the lowest impact uses of marine waters that creates long-term social and economic benefits for local and regional communities. To be sustainable and expand while maintaining community support, marine aquaculture must operate in an environmentally responsible manner that is demonstrably consistent with the high value West Australian's place on the environment. This Albany Aquaculture Development Zone Management Framework (Management Framework) provides the mechanism to achieve these objectives.

The Management Framework is an operational document, which the Department of Primary Industries and Regional Development (the Department) developed principally to identify, manage, and mitigate risks of environmental impact that may be associated with aquaculture to safeguard environmental values. The document is designed as a common reference point for both industry and community. It aims to provide clarity to industry on the standard it will be held to and confidence within the community that aquaculture development within the Albany zone will not come at an unacceptable environmental cost (see Section 2 below).

The Department will review this Management Framework periodically, to ensure it is up-to-date and meets Government requirements and community expectations.

'Green' Aquaculture[1]

Molluscan shellfish aquaculture is, by definition, a 'green' industry. Shellfish growers are committed to water quality – the quality of their product and quality of the environment – from the day the molluscs spawn to when the consumer eats the finished product. Shellfish grown in approved, certified waters provide a safe, nutritious, healthy food source. In addition, the act of shellfish feeding (bio-filtering) improves water quality by removing particulates and unwanted nutrients from the water column.[2]

1.2 Aquaculture

The human population is expected to reach over 9 billion by 2050, posing significant challenges for supplying healthy, nutritious food to a population that will require an approximate 50% increase in the supply of high-quality food over that period. Globally, this must be achieved despite deteriorating natural resource bases, increasingly fully

[1] Alleway, H. K., Gillies, C. L., Bishop, M. J., Gentry, R. R., Theuerkauf, S. J., & Jones, R. (2019). The ecosystem services of marine aquaculture: valuing benefits to people and nature. BioScience, 69(1), 59-68.

[2] Shumway, S. E., Davis, C., Downey, R., Karney, R., Kraeuter, J., Parsons, J., ... & Wikfors, G. (2003). Shellfish aquaculture–in praise of sustainable economies and environments. World aquaculture, 34(4), 8-10.

exploited or depleted wild fisheries, depleted agricultural soils and increasing competition for farmland and inputs.

Fish and fish products, together with shellfish and seaweeds, are characterised as some of the healthiest foods available that have the lowest impact on the natural environment. For these reasons, seafoods are vital for regional, national, and global food security and nutrition strategies and have an important role in transforming food production into more sustainable systems.[3]

Australia is well positioned to take advantage of the opportunity presented by the rapidly-increasing global demand for premium seafood due to our sustainable competitive advantages, which include the relatively pristine marine environment, professionally managed natural resources, reliable supply chain and geographical proximity to the rapidly-expanding Asian middle class.[4] Australia is also well positioned to produce increasing quantities of highly nutritious, healthy seafood to feed its population, thereby improving food security by reducing reliance on imported products: Australia currently imports approximately 66% of total seafood consumed domestically.[5]

Aquaculture is the culture of aquatic plants and animals, mainly to produce food for human consumption, but can also be for re-stocking, ranching or stock enhancement of natural fisheries for commercial and recreational fishing; breeding ornamental fish, crustaceans, molluscs, corals, and plants for aquarium trade; producing raw materials for energy, biochemicals, biodegradable plastic alternatives, and pharmaceuticals; jewellery and fashion items (such as pearls and fish skin products).

With wild fisheries approaching maximum sustainable levels and many already being overexploited, aquaculture is increasingly important worldwide as a source of aquatic food and other products.[6] Aquaculture can reduce pressure on wild fisheries and terrestrial ecosystems by providing an affordable, nutritious and efficient source of animal protein to consumers.[7]

Most potential environmental impacts from aquaculture can be managed and negative impacts minimised or avoided through an understanding of natural processes, responsible management and effective selection of marine sites for growout farms.[8] Well managed and appropriately located aquaculture operations create a broad range of positive outcomes and interactions, providing the local environment and marine biome with positive ecosystem outcomes.[9]

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[3] Food and Agriculture Organization of the United Nations (FAO); 2020

[4] The Australian Seafood Industry and the Social Licence to Operate; Nuffield Australia Project No 1620; Davies, S., 2019

[5] Australian Department of Agriculture, 2017

[6] Australian and New Zealand Guidelines for Fresh and Marine Water Quality; ANZECC, 2000

[7] Improving Productivity and Environmental Performance of Aquaculture. Working Paper, Instalment 5 of Creating a Sustainable Food Future. Washington, DC: World Resources Institute. Waite, R. et al. 2014

[8] Guide for Sustainable Development of Mediterranean Aquaculture. Interaction between *Aquaculture and the Environment*. 2007

[9] Heidi K Alleway et al., The Ecosystem Services of Marine Aquaculture: Valuing Benefits to People and Nature, 2019

1.3 Aquaculture in Regional Australia

The aquaculture industry plays an important role in creating wealth and prosperity, particularly in regional communities through creation of jobs and increasing economic diversification.[10] In regional parts of New South Wales, Tasmania, and South Australia, oyster farming comprises an integral part of local economies, both directly through primary production revenue and employment and indirectly through relationships with and demand for service industries, post-harvest businesses and associates industry sectors such as tourism and hospitality.[11]

With raised awareness of the importance of supporting local industries, connecting with local food producers and buying food that has been produced in an environmentally sustainable way in a clean environment, the aquaculture industry in regional areas of Australia has been increasingly working with the tourism industry to provide visitors with aquaculture education experiences. Visitors are provided with the opportunity to meet local people running aquaculture operations, learn about the marine environment and how seafood is grown and cared for, and taste local seafood produce. Eating local, sustainably grown seafood is expected to add to the experience of visitors to Albany and the Great Southern region.

A study of the social impact of the oyster farming industry in the Eyre Peninsula, South Australia, found that oyster farming has had a positive effect on the social fabric of the region.[12] More young people are staying in coastal communities because of the availability of employment in the oyster sector. Other benefits identified by this study included better educational opportunities, increased community spirit, more social network linkages, increased community pride, and strengthened social capital, in addition to oyster farming being a tourist attraction.[13]

Shellfish farming has been conducted in Albany since 1991, when Ocean Foods International was established in Oyster Harbour. Shellfish species farmed in Albany to date have included Sydney Rock Oyster, Flat Oyster, Akoya Oyster and Blue Mussel.[14]

[10] Herreria, E., Woodhead, A., Tottenham, R., & Magpantay, C.; Social profile of people employed in the Agriculture, Forestry and Fishing Industries. *Rural Industries Research and Development Corporation Publication*, (04/122), 2004

[11] Social and Economic Evaluation of NSW Coastal Aquaculture. https://www.uts.edu.au/sites/default/files/fass-social-economic-evaluation-nsw-coastal-aquaculture-report.pdf?no-cache

[12] Pierce, J., & Robinson, G. (2013). Oysters thrive in the right environment: the social sustainability of oyster farming in the Eyre Peninsula, South Australia. Marine Policy, 37, 77-85.

[13] Social and Economic Evaluation of NSW Coastal Aquaculture 2015/302; Barclay, 2016

[14] Environmental assessments in support of shellfish farming in Albany, Western Australia; DPIRD/BMT, 2021

1.4 Bivalve Aquaculture

Bivalves feed on microalgae (phytoplankton) and suspended organic matter without requiring supplementary feeding. This results in shellfish aquaculture removing nutrients from the environment, improving water quality in areas with artificially high nutrient levels.

Of all species groups investigated in a study by Waite *et al*. (2014) examining sustainability and environmental performance of aquaculture, bivalve molluscs (such as oysters, clams, mussels and scallops) performed well across all environmental impact categories – environmental, social, resource-intensity, ethical and global warming.[15] Marine bivalve aquaculture requires no human-managed or manufactured feeds and can reduce water pollution.[15] The culture of marine shellfish, particularly bivalve molluscs such as oysters, is regarded as being among the most sustainable food production practices available, with very few, if any, harmful environmental impacts, provided that best management practices are followed.[16]

1.5 Department of Primary Industries and Regional Development

Primary industries in Western Australia (WA) – including agriculture, commercial fisheries and aquaculture – provide jobs and underpin a growing food industry and other agribusinesses. WA's fisheries also support a thriving recreational fishing sector and regional tourism. The Department works to protect the sustainability of natural resources and accelerate ongoing economic growth, job creation and regional development.

The WA State Government is committed to enabling and facilitating the development of a sustainable aquaculture industry. A strategic planning approach to aquaculture development is regarded as best regulatory practice and a key method of providing for industry growth while achieving ecologically sustainable development outcomes.[17]

One means of attracting investment is through establishment of aquaculture development zones. An aquaculture development zone is a designated area of water selected for its suitability for a specific aquaculture sector (such as marine finfish or marine shellfish). Aquaculture development zones provide "investment ready" areas of water with strategic environmental approvals and management policies already in place. This allows commercial aquaculture operations to be set up without the need for lengthy, complex, and expensive approvals processes.

Through the Department, the WA Government has created three aquaculture development zones in WA to facilitate the development of the marine aquaculture

[15] Improving Productivity and Environmental Performance of Aquaculture. Working Paper, Instalment 5 of Creating a Sustainable Food Future. Washington, DC: World Resources Institute. Waite, R. et al. 2014

[16] Shumway, S., Davis, C.V., Downey, R.A., Karney, R.C., Kraeuter, J.N., Rheault, R.B., & Wikfors, G.H. (2003). Shellfish aquaculture — In praise of sustainable economies and environments.

[17] Best practice framework of regulatory arrangements for aquaculture in Australia [Primary Industries Ministerial Council – 2005].

industry. These zones are in the Kimberley and Mid West regions and in waters off Albany in the Great Southern. To ensure the goal of ecological sustainability is achieved, the Department provides a Management Framework or equivalent mechanism for guiding and regulating aquaculture operations within the zones.

1.6 Overview of the Albany Zone

The Albany Zone was declared in two stages:

- Stage 1: Oyster Harbour area – declared in August 2020.
- Stage 2: Princess Royal Harbour and King George Sound areas – declared in December 2021.

The Albany Zone comprises areas in Oyster Harbour, Princess Royal Harbour (an area in Shoal Bay) and King George Sound (areas at Mistaken Island and Misery Beach (Figure 1).[18]

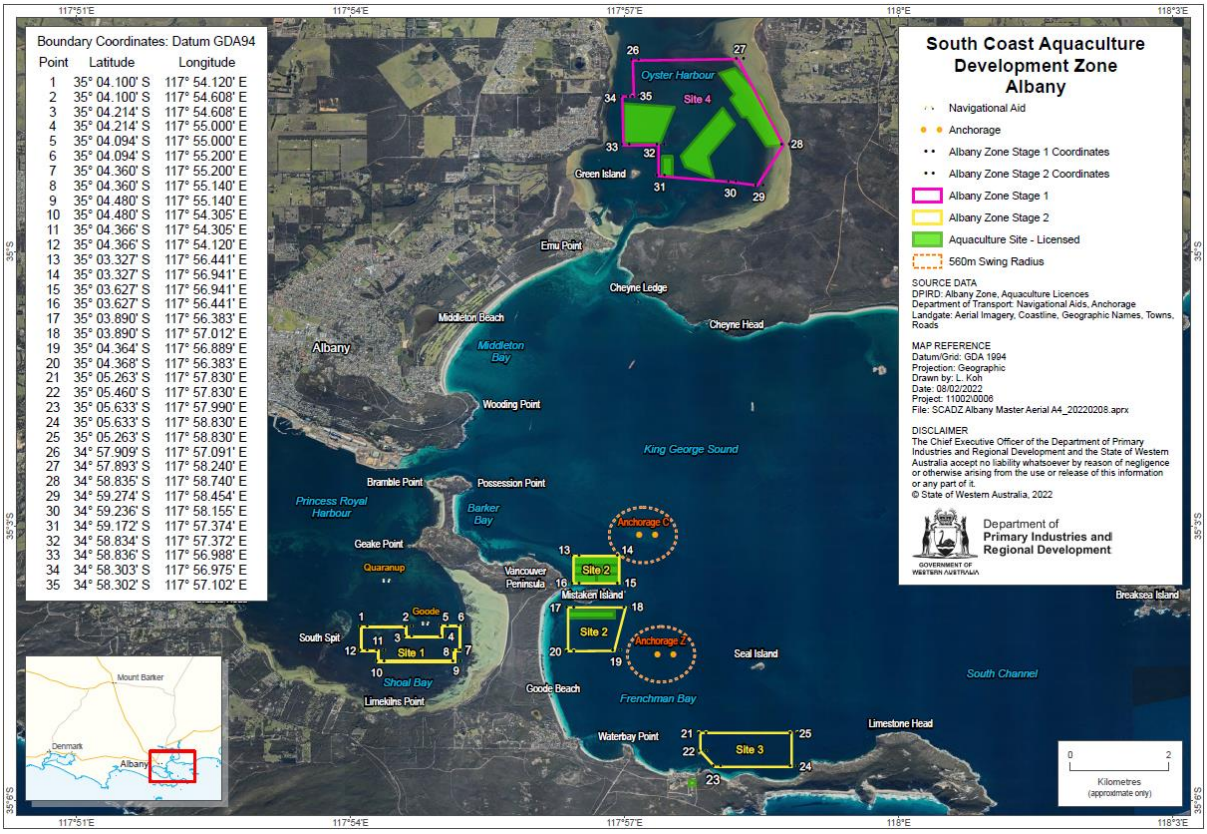

Figure 1 Declared areas of the Albany Aquaculture Development Zone

Sites in Oyster Harbour are under the care, control and management of the Minister for Fisheries (Minister).

[18] Maps of the Albany Zone and separate areas within it are available at: http://www.fish.wa.gov.au/Fishing-and-Aquaculture/Aquaculture/Aquaculture%20Zones/Pages/default.aspx

The Princess Royal Harbour and King George Sound sites are within the Port of Albany and are under the care, control and management of the Southern Ports Authority (SPA). Tenure in these areas will be provided, subject to SPA's and the Minister for Ports' approval, through a head licence to the Minister for Fisheries and sublicence to the licence holder.

Due to the proximity of all the Albany Zone areas to Albany, aquaculture operations within the Zone have good access to local services, trades and social amenities. Located in the Albany Aquaculture Park in Frenchman Bay, the Albany Shellfish Hatchery is also well placed to supply seed stocks to commercial growout projects within the Albany Zone.

The site and species selection process, which includes careful consideration of environmental impact, has assessed the Albany Zone as being suitable for edible bivalve shellfish such as rock oysters, mussels and scallops.

1.7 Consultation and Communications

The Albany Zone development process involved a staged approach, including research of the physical environment to determine potential sites and species, followed by several rounds of consultation with stakeholders and local communities. Consultation with marine user groups led to modifications in the areas that were initially proposed.

The proposal was further refined through a series of independent research assessments to address issues raised in the consultation process.

The Albany Zone has been developed considering the needs of multiple users and strives to minimise any impact of aquaculture on other activities. Although shellfish farming will involve the physical siting of aquaculture gear, the layout will allow vessels to travel through the farms to carry out activities such as boating and recreational and commercial fishing.

Consistent with the Ecosystem Based Fisheries Management framework developed by the Department, periodic ecological risk assessments (ERAs) will be completed for the Albany Zone. The ERA process will be used as a review tool by the Department to assess the adequacy of its management practices for controlling the risk of ecological impacts arising from aquaculture activities within the zone. The risk assessment methodology utilised a consequence-likelihood analysis, which involves the examination of the magnitude of potential consequences from aquaculture activities and the likelihood that those consequences will occur given current management controls. Risk scores are developed in a workshop that involves stakeholders and subject matter experts.

The first ERA workshop is planned to be undertaken when licenses for the zone are granted and development plans for the zone finalized. Where risks remain unacceptably high despite current management practices, management practices will be adapted to better mitigate those risks and implemented through the Management Framework and DPIRD's legislative instruments.

The completed ERA report will be published as a Fisheries Research Report, and be publicly available through the Departments website.

To provide information on the issues raised and questions asked through the consultation process, the Department developed a Frequently Asked Questions (FAQ) document, which is available at:
http://www.fish.wa.gov.au/Documents/Aquaculture/Albany%20Aquaculture%20Development%20Zone%20FAQs.pdf

2 STRUCTURE AND PURPOSE

The Management Framework is integrated with, and supported by, a separate set of documents and instruments, which provide greater detail on the legislative, regulatory, monitoring and reporting requirements. Collectively, these documents and instruments regulate the aquaculture activities within the Albany Zone and guide specific approaches to environmental monitoring evaluation and management. The associated instruments and documents are set out below.

2.1 The Management Framework

The Management Framework is an operational document; its purpose is to:

- provide broad principles for management of the Albany Zone;
- guide the sustainable development of marine shellfish aquaculture;
- establish an overarching, integrated structure for managing aquaculture activities;
- provide clear, efficient and effective processes for monitoring, evaluating and reporting; and
- continuously improve the procedures used to manage the Albany Zone through an adaptive management strategy.

The adaptive management approach provides a structured, iterative process for decision making where uncertainties may exist. It also provides the opportunity to take advantage of new knowledge as it becomes available. The aim is to reduce the level of uncertainty over time through a continuous cycle of system monitoring, reporting, evaluating and implementing any necessary enhancements. In this way, the decision-making process meets current resource management objectives while actively accruing information needed to improve future management.

Aquaculture licence

The aquaculture licence authorises the aquaculture activity. Aquaculture licences include conditions in respect of:

- location and deployment of aquaculture gear;
- source of stock;
- health management and certification;
- disease testing;
- biosecurity measures;
- marking and lighting; and
- record keeping and reporting

Management and Environmental Monitoring Plan

A Management and Environmental Monitoring Plan (MEMP) identifies how an aquaculture operator will manage any potential risks to the environment posed by an aquaculture operation, with emphasis on environmental management and biosecurity. Requirements of a MEMP may include:

- measurements of growth and mortality rates;
- environmental monitoring and relevant response protocols;

- impact on other marine fauna and benthic communities;
- biosecurity; and
- audit mechanisms.

Port Management Plans for sites within the Port area

In addition to a MEMP, each licence holder with tenure in Princess Royal Harbour and King George Sound will be required to prepare port management plans for SPA's approval dealing with the licence holder's operations within the Port.

Aquaculture lease or sublicence

An aquaculture lease or sublicence provides tenure. In effect, they provide a "licence to occupy" the site for the purpose of aquaculture. They are different from a conventional land lease in that they do not provide exclusive possession of the area.

Consultants Reports and Research

Several other papers and reports have been completed by specialist consultants that have been used to inform, but do not form a part of, the Management Framework. These include:

- benthic habitat surveys (MScience and the University of WA (UWA));
- environmental assessments and impact modelling (BMT);
- marine mammal risk assessment (independent consultant); and
- seagrass impact mitigation and monitoring (UWA and independent consultants)

The principles contained within the Management Framework and the associated documents have been developed to ensure that shellfish production in the Albany Zone is sustainable and that its potential cumulative environmental impacts are understood and well managed.

2.2 Code of Practice

The Aquaculture Council of Western Australia (ACWA) has developed an *Environmental Code of Practice for the Sustainable Management of Western Australia's Mussel and Oyster Aquaculture Industry* (CoP). This document was last updated in 2013 and is currently under review by ACWA to capture changes in industry best practice and the adoption of new technologies. On completion of that review process, the updated terms of that CoP will, where relevant, be incorporated into this framework.

The ACWA CoP focuses on best practice through a documented environmental management system. It recommends a continual improvement requirement by the business through periodic reviews and evaluations to identify and implement opportunities for improvement.

Among its other objectives, the ACWA CoP provides a mechanism for environmental self-regulation of the mussel and oyster aquaculture sector as a valuable alternative to detailed regulation of every aspect of the industry's activity.

Compliance with the ACWA CoP is voluntary and considered to be outside (but supportive of) the legislative management framework.

3 LEGISLATION

The powers relevant to DPIRDs management of the Albany Zone are granted by the *Fish Resources Management Act 1994* (FRMA).

Sites within Princess Royal Harbour and King George Sound will also be subject to SPA's management and control under the *Port Authorities Act 1999* (WA) (Ports Act).

3.1 Aquaculture Licence and Tenure Approvals

Section 101A (2A) of the FRMA provides the power for the Minister to declare an area of WA waters (other than inland waters) to be an aquaculture development zone.

Section 92 of the FRMA provides the power for the Chief Executive Officer (CEO) of the Department to grant an aquaculture licence, which authorises the licence holder to conduct aquaculture in Western Australia.

As a result of amendments to the FRMA, there is a requirement that applicants for aquaculture licences demonstrate they have, or will have, appropriate tenure over the area proposed for the aquaculture activity. The form of tenure will vary depending on the location of the site:

- For sites in Oyster Harbour, tenure will be granted by the Minister through an aquaculture lease, issued under s.97 of the FRMA.

- For sites in Princess Royal Harbour and King George Sound, tenure will granted by a sublicence between the Minister, SPA and the licence holder.

An aquaculture licence authorises the specific aquaculture activity undertaken within a defined site, whereas an aquaculture lease or sublicence provides tenure for the specified area of land or water.

The legislative framework also allows for adaptive management to achieve management outcomes; for example, licence conditions may be imposed to add a condition to an existing aquaculture licence to set initial carrying capacity or stocking density limits. Conditions may also extend to matters such as applying performance criteria to address any instances of non-use of aquaculture sites.

The FRMA also establishes an environmental management and monitoring framework for all sectors of aquaculture. Under the provisions of s.92A of the FRMA, unless exempt under s.92A(4), applications for an aquaculture licence must be accompanied by a MEMP. The MEMP is the principal instrument by which the Department gives effect to this environmental management and monitoring framework. It relates, and is attached to, the aquaculture licence.

Contravention of a MEMP or condition of an aquaculture licence or aquaculture lease is an offence under the FRMA and penalties may apply. Further, the FRMA provides for the CEO to cancel, suspend or not renew an aquaculture licence. In this way, the

FRMA, through the MEMP, supports the *Environmental Protection Act 1986* (EP Act) by ensuring environmental risks are assessed and managed; and that suitable mitigation strategies are developed and adopted by each licence holder within the zone.

When proclaimed, the *Aquatic Resources Management Act 2016* (ARMA) will replace the FRMA and the *Pearling Act 1990*, to become the primary legislation used to manage fishing, aquaculture, pearling and aquatic resources in WA. When this occurs, the powers described above under the FRMA will be carried over to the ARMA.

3.2 Environmental Approval

An initial assessment by the Department of Water and Environmental Regulation (DWER) and the Environmental Protection Authority (EPA) concluded the bivalve shellfish species to be farmed in the Albany Zone are benign and hence very unlikely to adversely affect the environment.

This position is based on the Department having suitable environmental management and monitoring programs in place. The Department has existing legislative powers sufficient to ensure effective management and monitoring programs can be implemented, predominantly through licence conditions and the MEMP.

To support the ability to monitor and manage environmental impacts, the Department commissioned several studies, including a comprehensive assessment of the potential impacts of proposed aquaculture developments on the marine environment.[19] The initial environmental assessment study was updated to incorporate additional industry data on historical productivity in Oyster Harbour, thereby improving the accuracy of the modelling. This modelling indicated that aquaculture development within the zone carried low risk of significant environmental impact. As the zone becomes operational, ongoing data collection and assessment through monitoring programs and farm production data will be referenced against modelled data to confirm their predictive accuracy. Where deviations occur, management strategies will be reviewed, and industry consulted to mitigate impact and promote sustainable use of the zone.

Marine aquaculture projects that have, or are likely to have, a significant impact on matters of national environmental significance (MNES) are also subject to assessment under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This could occur should aquaculture activities within the zone set off any of the environmental triggers applicable to that legislation (for example, unacceptable impacts on rare and endangered species).

[19] Environmental assessments in support of shellfish farming in Albany, Western Australia; BMT 2021

4 ZONE MANAGEMENT AND OPERATIONS

4.1 Zone Manager

On behalf of the Minister, the Department is the zone manager for the Albany Zone. Among its other obligations, the Department is responsible for:

- the grant of aquaculture licences and administration of leases and sublicences within the zone (noting that leases are granted by the Minister and sublicences by the Minister and SPA);[20]
- ensuring the requirements specified in licence conditions, MEMPs and leases and sublicences are met;
- evaluating MEMP reports; and
- adaptive management through licence conditions or the MEMP, as appropriate.

4.2 Role of SPA for sites in Port area

For sites in Princess Royal Harbour and King George Sound, SPA will be involved in monitoring licence holders' compliance with the head- and sublicenses and Port standards and procedures. SPA also has powers under the Ports Act, which include powers to issue directions to a licence holder operating in the Port.

4.3 Species and Gear

4.3.1 Aquaculture Species

Shellfish farming has been conducted in Albany since 1991. Species that may be or are being farmed in the Albany Zone include the following.

- *Rock oysters*
  In line with scientific advice and aquaculture licence approvals from the Department, including *Saccostrea cucullata, Saccostrea glomerata*
- *Blue Mussels*
  In line with scientific advice and aquaculture licence approvals from the Department, including *Mytilus galloprovincialis*
- *Pearl oysters*
  In line with scientific advice and aquaculture licence approvals from the Department, including *Pinctada imbricata fucata* (Akoya oysters)
- *Scallops*
  In line with scientific advice and aquaculture licence approvals from the Department, including *Mimachlamys asperrima, Ylistrum balloti*

Other bivalve mollusc species may be added to aquaculture licences, following assessment and approval by the Department, and within Stage 2, SPA.

[20] The zone Site Allocation Policy will assist in determining the number, size and location of leases that may be established within the zone (refer the Department's website at www.fish.wa.gov.au).

4.3.2 Aquaculture Gear

Traditional oyster farming systems to culture oysters use stakes (also referred to as "sticks") driven into the seabed. Stick culture was superseded by the development of baskets for holding the oysters, which assisted in preventing predation and reducing labour inputs. Rows of posts made from wood or plastic are used to attach rope, forming "fence-lines", on which oyster baskets are suspended. Stick and fence-line culture systems are built in the inter-tidal zone.

Figure 2 - oyster basket on fixed 'fence-line' (inter-tidal) (SEAPA.com.au)

In recent years, floating oyster farming systems have been developed for deeper sub-tidal waters. These floating systems have the advantage of using fewer materials. They can be deployed in deeper water for increased flushing, higher growth rates and shorter time to market. Additionally, floating shellfish culture systems have a lower visual impact.

Sub-tidal surface lines consist of a series of floating baskets attached to surface culture lines. The culture lines are secured with anchors placed at either end. By using a floating culture line, the oysters are maintained just below the water's surface. They can be "flipped" (inverted) so the oyster baskets are on top and floats below to expose the basket to air for drying the oysters and baskets to discourage and remove biofouling.

All aquaculture gear must be located within the lease or sublicence boundary.[21]
Aquaculture gear must be used in such a way that it does not cause significant damage to any reef, coral or seagrass bed. Culture lines must be regularly inspected, with preventative maintenance carried out according to a planned schedule, replacing lines, droppers, basket fastenings, mooring fixtures and other associated gear before

[21] As defined in Part 1, section 4 of the FRMA;
"***aquaculture gear*** *means any equipment, implement, device, apparatus or other thing used or designed for use for, or in connection with, aquaculture —*
(a) whether the gear contains fish or not; and
(b) whether the gear is used for aquaculture or for navigational lighting or marking as a part of aquaculture safety,
and includes gear used to delineate the area of an aquaculture licence, temporary aquaculture permit or aquaculture lease".

age and wear-and-tear cause breakages. Regular preventative maintenance activities on the farm gear and equipment will minimise the risk to the environment and the risk of harming benthic ecosystems and marine fauna.

The design of all infrastructure must consider potential marine fauna interactions, particularly in relation to maintaining rope tension and the avoidance of features that may increase the likelihood of marine fauna entanglement or entrapment.

Aquaculture gear in Princess Royal Harbour and King George Sound is required to be approved by SPA and the Department.

4.4 Location and Separation of Aquaculture Gear

Licence holders granted a lease (or sublicence) must locate all aquaculture gear within the boundaries of the lease (or sublicence) according to aquaculture licence conditions and MEMPs approved by the Department. Where possible, areas of bare substrate (such as sand or mud) should be preferentially selected for installation of new anchors.

For sites in Princess Royal Harbour and King George Sound, the location of aquaculture gear will be subject to the Minister's and SPA's approval.

To afford a "soft start" and assist in the sustainable management of bivalve stock in the Albany Zone, licence holders will develop and install new culture areas with a minimum 20-metre spacing between each sub-tidal floating line and minimum 10-metre spacing between each inter-tidal row, or row centres when multiple lines are used in each row. For clarity, this spatial restriction will only be applied to licences granted following the declaration of the Albany Zone; it will not be applied to sites for which licences were granted before the declaration of the Albany Zone.

A minimum buffer zone of 20 metres will be applied between different licence holders to separate culture areas.

4.5 Biomass and Production Limitations

Due to the dynamic nature of estuaries and bays where shellfish aquaculture generally occurs, it is becoming widely recognised that there is no "one-size-fits-all" when determining maximum stocking densities and biomass or carrying capacity. The Department has therefore adopted a more contemporary adaptive management approach to managing production.

This management framework does not place limits on production. Instead, the Department will apply an adaptive management approach to production limits within the Albany Zone. Estuarine environments are highly dynamic, with significant variations in nutrient inputs occurring weekly, monthly, seasonally and from year to year, depending on rainfall, stormwater run-off and other inputs, such as nutrient run-off from agriculture.

Due to the development of agriculture in the catchment areas of the Kalgan and King rivers, which discharge into Oyster Harbour, the nutrient levels and phytoplankton concentrations are higher than the natural state.

Within the estuary, nutrient and phytoplankton concentrations vary significantly driven by factors including currents, wind conditions, tides, bathymetry, mixing, dispersion and geographic location of nutrient sources.

Shellfish feed by filtering phytoplankton and particulate organic matter from the environment, thereby facilitating the reduction of unnaturally high concentrations of nutrients originating from land-based anthropogenic sources.

Environmental monitoring programs, including monitoring requirements in the MEMPs of licence holders, will ensure production levels are sustainable and do not adversely affect the surrounding environment. Monitoring requirements for the Albany Zone are detailed generally within Section 5.

Consistent with the principles of adaptive management, as additional environmental monitoring data are generated it is possible that the Department may impose additional, or fewer, controls in the future. Any changes will be evidence-based and made in consultation with stakeholders including licence holders. The purpose of any such changes will be to maintain the total zone production potential, while avoiding any significant negative environmental impact and complying with environmental standards.

Figure 3 -Cultured oysters in oyster farming basket[22]

Stocking densities must be informed by observations on growth rates, health and condition of oysters. In principle, the production of the Albany Zone and the individual areas within it will be determined by the efficiency of individual operators. This approach promotes innovation and efficiency in aquaculture operations, while providing management flexibility and a framework that protects the supporting marine

[22] Photo credit – Roger Barnard, 2019

environment. Extensive licensed areas with broad line spacings and low line density per hectare in the Albany Zone will assist in the dispersion of organic matter; facilitate more even bio-deposition; minimise light attenuation and potential impacts on seagrass habitat.

Figure 4 – 'High-density' Oyster Farm leases, Merimbula, NSW (left); 'Low-density' oyster leases, Oyster Harbour, Albany WA (right)[23]

4.6 Feed Inputs

Oysters are filter feeders; therefore, their culture does not require supplementary feed input, instead relying entirely on natural food sources. In this way, no "new" nutrients will be added to the environment through shellfish aquaculture. Rather, plankton biomass will be converted into shellfish biomass and ultimately removed from the system, so reducing overall nutrient levels within the zone.

4.7 Sustainable Culture Practices

Shellfish growers do not generally use synthetic chemicals, fertilisers, pesticides, or pharmaceuticals on the animals cultured. If chemicals are used, for example for cleaning equipment, their use will be managed in accordance with industry-wide protocols with consideration to the environment, food safety and worker safety.[24] The use of anti-foulants on aquaculture gear that are copper-based or contain tributyl tin (TBT) is prohibited.

The only interventions during growth are cleaning, air-drying and grading oysters. Grading involves the removal of oysters from baskets on lines, cleaning of biofouling from oyster shells, grading or sorting oysters based on size, transferring the oysters into clean baskets to allow for space to grow within the basket until the next grade, and the deployment of these oysters back onto the culture lines on the sites.

[23] Photo credit – Roger Barnard, 2019

[24] Mussel and Oyster Code of Practice, Aquaculture Council of Western Australia, 2013

Shellfish Aquaculture delivering ecosystem services

Shellfish habitats, such as oyster reefs, provide important high-value functions through filtration, denitrification, stabilisation of sediments and shorelines, and the creation of habitat for associated species (Grabowski *et al.* 2012). But shellfish habitats also represent some of the most degraded marine ecosystems in the world and traditional restoration efforts can require large sources of public funding, take decades to achieve, and may, in some instances, be impossible, given the presence of continued stressors. Accordingly, commercial shellfish mariculture could provide a valuable counterpart to the delivery of a wide range of ecosystem services.[25]

Figure 5 – Oyster farm on aquaculture lease, Oyster Harbour, Albany, WA[26]

[25] Alleway, H. K., Gillies, C. L., Bishop, M. J., Gentry, R. R., Theuerkauf, S. J., & Jones, R. (2019). The ecosystem services of marine aquaculture: valuing benefits to people and nature. BioScience, 69(1), 59-68.

[26] Photo credit – Roger Barnard, 2019

4.8 The Western Australian Shellfish Quality Assurance Program

As filter feeders, oysters and other bivalve molluscan shellfish can bio-accumulate bacteria, viruses, toxins, heavy metals, chemicals and other harmful substances that may be present in the waters in which they grow. Consumption of these substances can lead to an increased risk of foodborne illness.

Aquaculture licence holders in the Albany Zone growing bivalve molluscs for human consumption are therefore required to follow guidelines from the Department, the Australian Shellfish Quality Assurance Program (ASQAP), and the Western Australian Shellfish Quality Assurance Program (WASQAP).

WASQAP is a Government–Industry co-operative program designed to assure the food safety of shellfish. Under the requirements of WASQAP, routine sampling and analysis of seawater and oyster flesh from shellfish aquaculture farms are required to monitor bacterial loadings, bacteria type, pesticides, inorganic contaminants, toxic algae levels, and metals in the oyster tissue before any product is to be harvested for domestic and, or, export markets.

The WASQAP Industry Manual applies to all bivalve molluscan shellfish species (including but not limited to; oysters, cockles, clams, mussels, pipis and un-eviscerated scallops), commercially harvested or handled for the purpose of human consumption regardless of whether they are harvested from the wild or from marine or land-based aquaculture facilities. The shellfish industry is responsible for complying with WASQAP and providing a safe food product.

Incorporated into WASQAP is a phytoplankton monitoring protocol used to predict marine biotoxins in shellfish. Phytoplankton monitoring is mandatory in WA for all commercially harvested shellfish growing areas under the Marine Biotoxin Monitoring and Management Program (MBMMP), under WASQAP regulation. A combination of phytoplankton and flesh tests is used to monitor for biotoxin activity. Commercial areas are sampled fortnightly during harvest periods for biotoxin activity, and if mandated trigger values are reached for several species, flesh testing is invoked immediately.

Further information on this program can be found on the Departments website at:
http://www.fish.wa.gov.au/Fishing-and-Aquaculture/Aquaculture/Shellfish-Quality-Assurance-Program/Pages/default.aspx

4.9 Acquiring Broodstock and Juveniles

To ensure sustainability and protection of the surrounding environment, spat (juvenile shellfish) will only be sourced from licensed, approved facilities, such as the Albany Shellfish Hatchery or by natural settlement on aquaculture gear.

Generally, before being moved from an approved hatchery, batches of spat must be health-tested and have a health certificate issued by the DDLS.

Species authorised under the Aquaculture Licence issued to the operator of the Albany Shellfish Hatchery and grown at that facility before being moved to Oyster Harbour, Princess Royal Harbour or King George Sound will not require a health certificate unless one is requested in writing by a Department Pathologist.

Broodstock will be only acquired from an aquaculture site authorised under an aquaculture licence, or under an exemption issued by the Department authorising broodstock collection. Any collection of wild broodstock will restricted to quantities that can be sustained without negative impacts to ecological values and comply with conditions on the licence or exemption issued by the Department.

Aquaculture survival rates are usually greater by several orders of magnitude compared with survival rates in the wild; consequently, aquaculture uses relatively small numbers of broodstock for breeding. Mollusc species are highly fecund and therefore require very few broodstock to produce large quantities of harvestable shellfish from their progeny. For example, one daily catch limit of 20 oysters from WA's recreational fishing rules has the potential to produce more than 50 million oyster eggs.

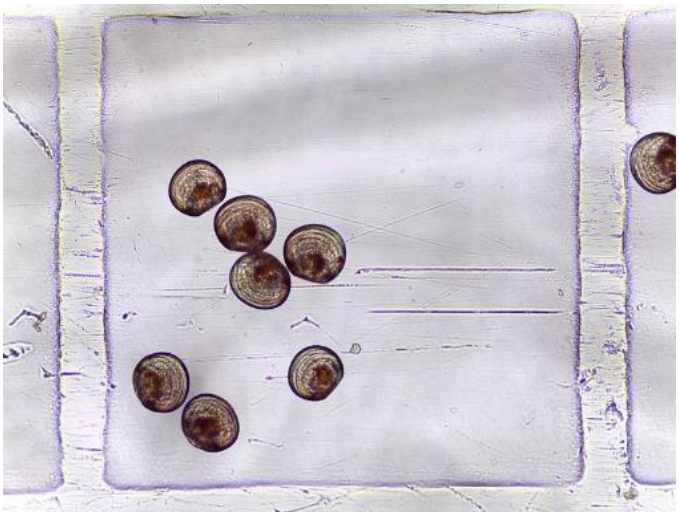

Figure 6 – Hatchery-cultured bivalve larvae viewed using a microscope[27]

4.10 Marking and Lighting in Oyster Harbour

Applications for grant of new aquaculture licences and leases in Oyster Harbour, and for variation of existing aquaculture licences in that area, must be accompanied by a Marking and Lighting form.

Applicants are required to provide information describing infrastructure, sea state and tidal information, atmospheric conditions, and vessel traffic within or near the proposed or existing site.

The Department of Transport (DoT) uses the information to recommend a category that specifies appropriate marking and lighting parameters for the site area.

[27] Photo credit - Roger Barnard

Marking and lighting categories for existing sites in Oyster Harbour may be re-evaluated for variations and renewals where previous assessments may be outdated, or navigational safety conditions change.[28]

Within Stage 2 areas, marking and lighting requirements are determined by the SPA Harbour Master. During the assessment of applications for the grant or variation of aquaculture licences within Stage 2, the standard process described above will be followed, including consultation with DoT, with final written approval being provided by the SPA Harbour Master.

4.11 Non-Exclusive Access

The use of State waters for aquaculture does not confer an exclusive access right. Persons other than aquaculture licence holders may enter the Albany Zone, although they are not permitted to interfere in any way with aquaculture gear or operations. A person who interferes with aquaculture gear commits an offence under the FRMA.[29]

4.12 Performance Criteria

The Department will monitor the performance of aquaculture operators within the Albany Zone against the terms of their aquaculture licence and lease (or sublicence), MEMP reporting requirements and Aquaculture Development Plan (ADP).

To ensure appropriate use of waters within the Albany Zone, performance criteria will be identified in an Aquaculture Development Plan (ADP) associated with each aquaculture lease (or sublicence). Developed by the aquaculture licence holder or applicant, an ADP outlines the proposed development objectives, including any staging, milestones and associated growth in production capacity. An ADP must demonstrate and quantify realistic and achievable timeframes and key milestones and provide supporting rationales.

Where a licence holder does not meet the performance levels provided in the ADP, the lease (or sublicence) may be terminated and the corresponding licence cancelled.[30] In that event, the relevant site may be reallocated.

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[28] Evaluating and Determining Categories of Marking and Lighting; http://www.fish.wa.gov.au/Documents/aquaculture_licencing/marking_and_lighting_guidance_statement.pdf

[29] Section 172 of the FRMA provides:
"*A person must not —*
(a) remove fish from any fishing or aquaculture gear; or
(b) interfere with any fishing or aquaculture gear,
unless the person is the owner of the gear or is acting with the authority of the owner or has some other lawful excuse.
Penalty: In the case of an individual, $25,000 and imprisonment for 12 months. In the case of a body corporate, $50,000."

[30] Under the provisions of s.99(3) of the FRMA, if an aquaculture lease is terminated or expires, an aquaculture licence authorising the activity being carried out in the leased area is cancelled.

4.13 Compliance and Reporting

Licence holders must comply with the arrangements outlined in this Management Framework including licence conditions, MEMPs and any other management controls imposed by any relevant statutory or government authority (including SPA) from time to time in relation to the licence holder's activities in the zone.

Licence holders should have their internal audit mechanisms documented and conduct regular internal audits to ensure compliance with the requirements for that document. Independent audits are more robust and the recommended approach.

Department Compliance Officers may undertake periodic inspections of aquaculture licensed sites to ensure adherence to licence and lease (or sublicence) conditions and MEMP requirements. The number and type of inspections undertaken is usually dependent on the outcomes of compliance risk assessments that take into account a range of issues, including the likelihood and consequence of events such as:

- stock disease outbreaks;
- stock escapes;
- interactions with commercial, recreational and customary fishers;
- failures to comply with site marking and lighting provisions; and
- non-compliance with environmental impact and, or monitoring requirements.

The contacts for the relevant reporting procedures are:

Disease, pest, suspected disease and unusual mortalities, fish escapes:
Report to the Department as soon as practicable (and within 24 hours) by calling (all hours) 1300 278 292 and provide the level of mortality, signs of disease or pest or reason for suspecting the presence of a disease or pest.

MEMP report and exceedance of an environmental monitoring trigger value:
Report to aquaculture@fish.wa.gov.au

5 ENVIRONMENTAL MANAGEMENT AND MONITORING

Improving the environmental performance of individual aquaculture facilities has been a principal focus for managers and industry for several decades.[31] Reducing negative impacts to achieve greater sustainability is a recurring challenge, but it also drives innovation and improvement of best-management practices.[32]

Collectively, this Management Framework, the aquaculture licence conditions, the requirements of the MEMP and aquaculture lease (or sublicence) conditions will ensure that likely environmental impacts are properly monitored, managed and mitigated.

It is the responsibility of each licence holder to manage their environmental impact, consistent with their licence and lease (or sublicence) conditions and MEMP requirements. Licence holders must ensure competency in environmental sampling and timely reporting of results. For some environmental factors, the Department will undertake the baseline and initial operational environmental monitoring. This will be undertaken for those factors best assessed at a broad spatial scale, where cumulative impact is possible and response may require zone-wide management actions.

5.1 Environmental Factor Analysis

Within estuaries and nearshore marine environments, variations in physical and biochemical water quality parameters occur over a range of temporal and spatial scales and are influenced by myriad factors. For example, phytoplankton levels at a fixed site within an estuary can vary by orders of magnitude over the space of several days based on the intensity of sunlight, the availability of nutrients and interaction of temperature, tide and wind.[33] This background variability represents a significant challenge to any environmental monitoring program that aims to identify impacts and support management decisions. The Department has therefore been careful in its selection of analytes and environmental indicators. Where possible, relatively stable metrics will be selected for baseline and continuing monitoring programs to reduce the impact of natural variability on impact assessment.

5.1.1 Anthropological Influences in the Albany Harbours

Seventy percent of Oyster Harbour's catchment has been cleared for agriculture, much of which occurred from the 1960s to the 1990s[34]. The extent of the clearing can be seen in Figure 7, with approximately 300,000 hectares (3,000 km²) of the Oyster Harbour catchment area cleared. Most of this land is used for broadacre farming and can be subject to the application of nitrogenous and phosphatic compound fertilisers.

[31] Hall SJ, Delaporte A, Phillips MJ, Beveridge M, O'Keefe M., 2011; Blue Frontiers: Managing the Environmental Costs of Aquaculture.

[32] Theuerkauf et al., 2021; Habitat value of bivalve shellfish and seaweed aquaculture for fish and invertebrates: Pathways, synthesis and next steps

[33] Hubertz, E.D., Cahoon, L.B. Short-term variability of water quality parameters in two shallow estuaries of North Carolina. *Estuaries* **22,** 814–823 (1999).

[34] DWER 2021, Oyster Harbour – Miaritch (Miyaritj) – Condition of the estuary 2016-19, Department of Water and Environmental Regulation, Western Australia

A small but significant percentage of these nutrients leaches into run-off and is discharged into Oyster Harbour via the King and Kalgan rivers.[35]

The majority of the catchment is above the recommended guidelines for total nitrogen (TN) and, or, total phosphorus (TP) according to the ANZECC 2000 guidelines for south-west lowland rivers (Figure 8).

A publication on the historical native flat oyster beds on the south coast of WA by Cook *et al*. (2021)[36] described the demise of the oyster beds in Oyster Harbour and Princess Royal Harbour from extensive overfishing for approximately 40 years from the mid-1800s. Other compounding factors leading to the dramatic decline of oysters included the removal of settlement substrate and land clearing in the catchment area, leading to increased sedimentation rates.

The catchment of Princess Royal Harbour has been extensively modified, and includes industrial, urban and agricultural land uses. Historically, significant volumes of contaminated effluent were discharged into the harbour, leading to a multiagency response that included extensive studies of water and sediment quality, benthic habitats and a temporary closure of the western end of the harbour for fishing from 1984 to 1992 [37][38][39][40].

[35] D'Adamo, N. & Western Australia. Environmental Protection Authority. (1991). Circulation of Oyster Harbour. Perth, W.A : Environmental Protection Authority

[36] Cook, Peter A., et al. "Historical abundance and distribution of the native flat oyster (Ostrea angasi) in estuaries of the Great Southern region of Western Australia help to prioritise potential sites for contemporary oyster reef restoration." *Marine and Freshwater Research* 73.1 (2021): 48-56.

[37] Talbot, Victor. "Mercury levels in biota and sediments of Princess Royal Harbour, Albany, Western Australia: interpretation and management implications." *Journal of coastal research* (1990): 545-557.

[38] Environmental Protection Authority (1990) Albany Harbours Environmental Study 1988-89, Bulletin 412. February 1990, Perth, WA

[39] Hillman, K., Lukatelich, R.J., Bastyan, G. and McComb, A.J.,. 1991. “Water quality and seagrass biomass, productivity and epiphyte load in Princess Royal Harbour, Oyster Harbour and King George Sound.”

[40] Bastyan, G.M., Deeley, D.M., White, K.S. and Paling, E.I.,. 1996. Seagrass and Macroalgal Distribution in Princess Royal and Oyster Harbours, Albany Distribution and Comparisons with Previous Surveys: Report to the Water and Rivers Commission. Perth, Western Australia. : Marine and Freshwater Research Laboratory, Institute for Environmental Science, Murdoch University.

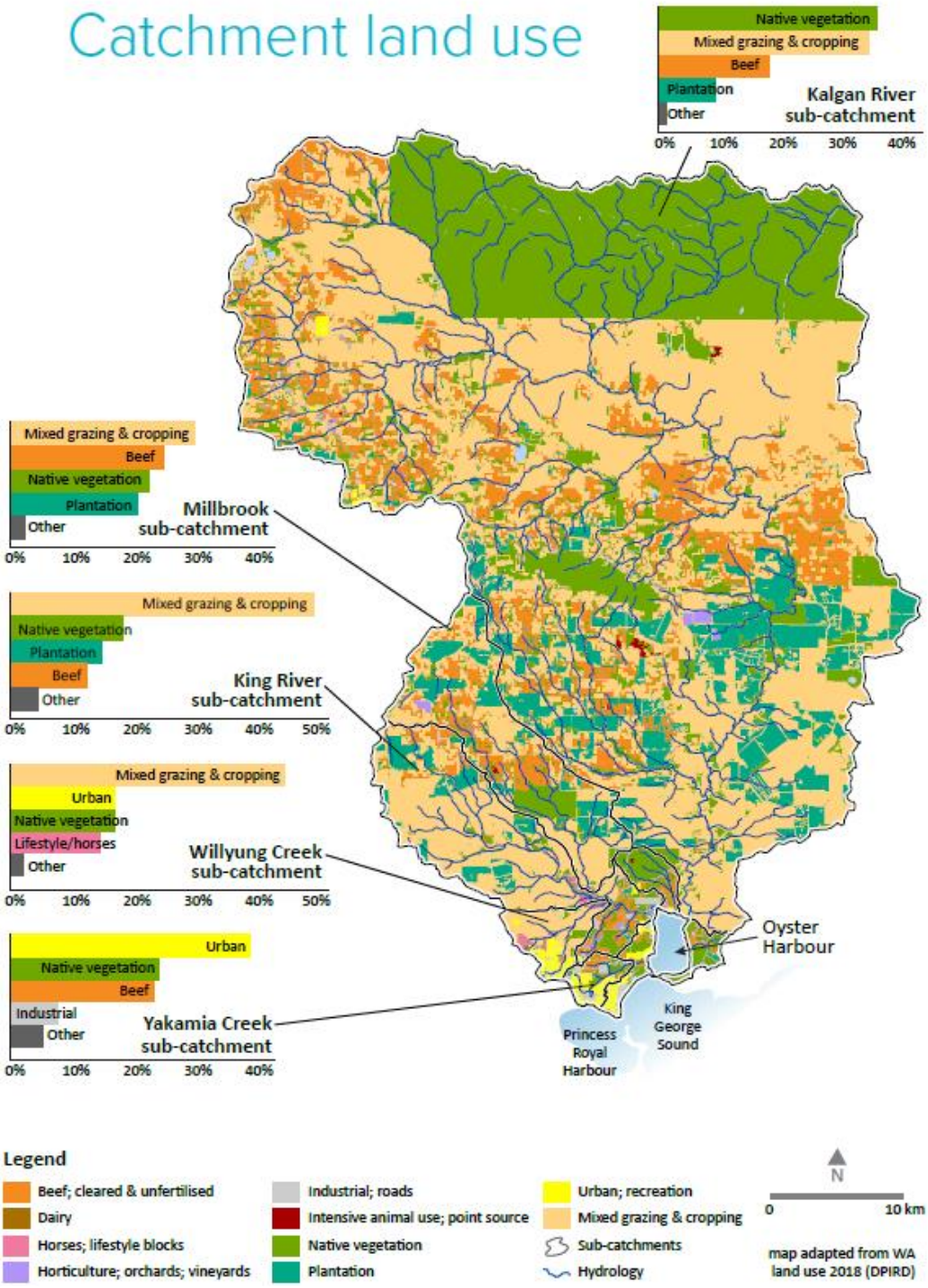

Figure 7 - Oyster Harbour Catchment Area land usage map (DWER, 2021) showing ~70% of the catchment is dedicated to agriculture (mixed grazing and cropping, beef)

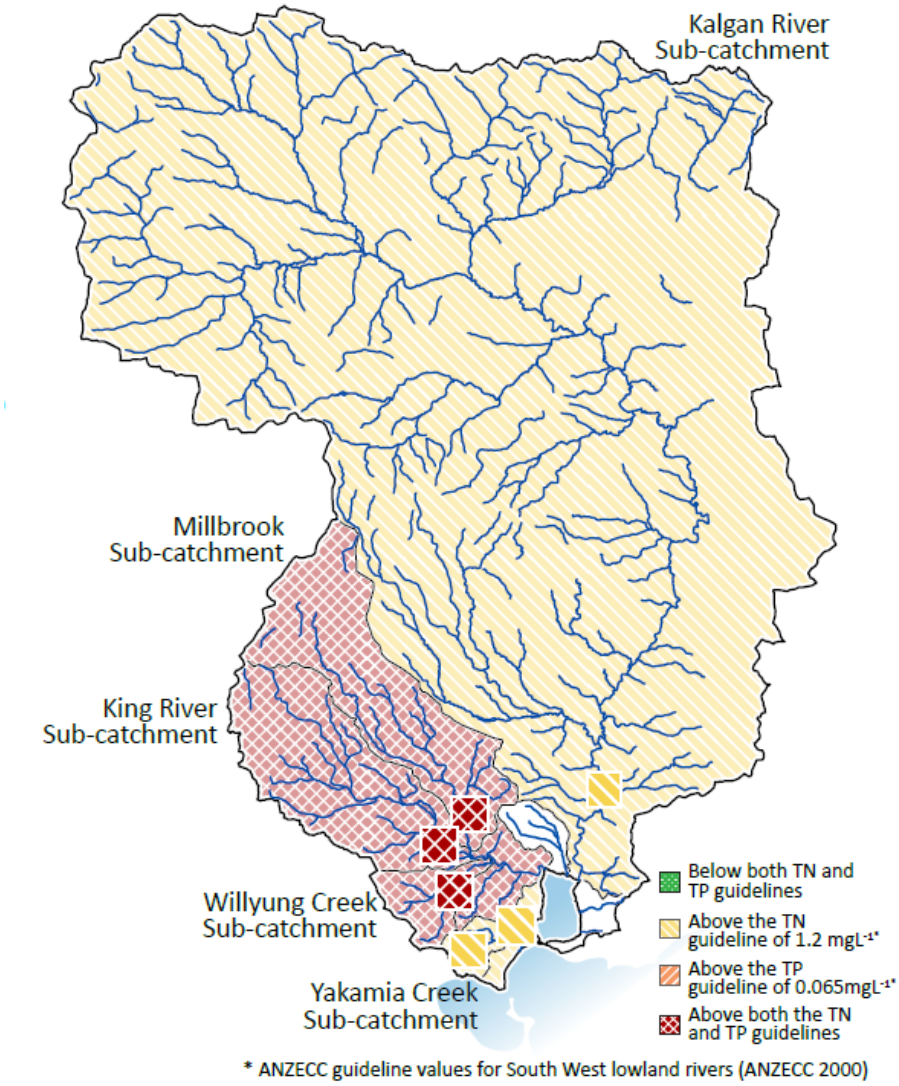

Figure 8 - Oyster Harbour catchment area (DWER, 2021) showing Total Nitrogen (TN) and Total Phosphorus (TP) ANZECC water quality guidelines exceedance

5.1.2 Water Quality

Oyster Harbour, Princess Royal Harbour and King George Sound are linked, but unique water bodies. The salinity of both harbours is usually close to that of marine waters; however, Oyster Harbour in particular can change seasonally with fluctuation of inflowing freshwater leading to stratification in both salinity and temperature. The summer profile of Oyster Harbour demonstrates a marine (36 to 37 ppt), fully mixed water column, well-oxygenated (7 to 8 mg.L^{-1}) and with temperatures of around 20ºC. The typical winter profile can vary to include shallow surface layer of lower salinities following catchment rainfall and salinities ranging from 6.7 to 34 ppt[41]. It is estimated that total replacement of the harbour volume by typical strength forcings (winds, tides and density currents) is in the order of 10 days.

Princess Royal Harbour receives relatively low rates of freshwater discharge due to the absence of a large catchment and rivers and is in effect a large marine embayment

[41] Thomson, C, 2018, Regional Estuaries Initiative, Estuary Condition Report: Oyster Harbour 2016/17, Department of Water and Environmental Regulation, Western Australia

rather than an estuary[42]. It rarely experiences periods of stratification and has a water exchange period of 10 – 20 days.

King George Sound waters are almost always marine and well mixed, with only occasional freshwater plumes flowing from Oyster Harbour during periods of high river discharge. Water clarity in King George Sound is generally clear with very good light penetration; however, it can be variable and is most turbid during winter when discharges from the main rivers in the area flow into Oyster Harbour and then into the northern end of the Sound[43].

Further water quality monitoring results (for nutrients, chlorophyll-A and phytoplankton) for Oyster Harbour can be found in the 'Estuary Condition Reports' produced by DWER in 2018 and 2021.

As of October 2021, the Department has deployed four real-time loggers in Oyster Harbour, adding to the environmental data collected by other agencies. The loggers measure temperature, salinity, dissolved oxygen and pH. Figures 10 and 11 provide examples of the graphical outputs of the loggers, as a three-hour moving average, over a seven-day period.

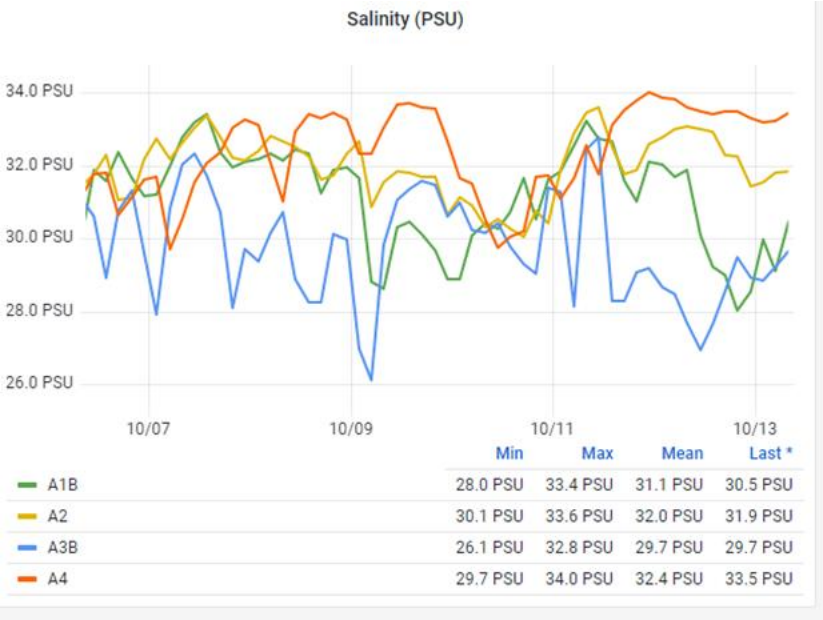

Figure 9 - Salinity of Oyster Harbour, October 2021

[42] Brearley, A. (2005). *Ernest Hodgkin's Swanland: estuaries and coastal lagoons of south-western Australia*. UWA Publishing.

[43] Ecologia (2007) Albany Iron Ore Project Public Environmental Review, Albany Port Expansion Proposal. EPA Assessment No. 1594. Prepared for the Albany Port Authority by Ecologia Environment, Perth, Western Australia

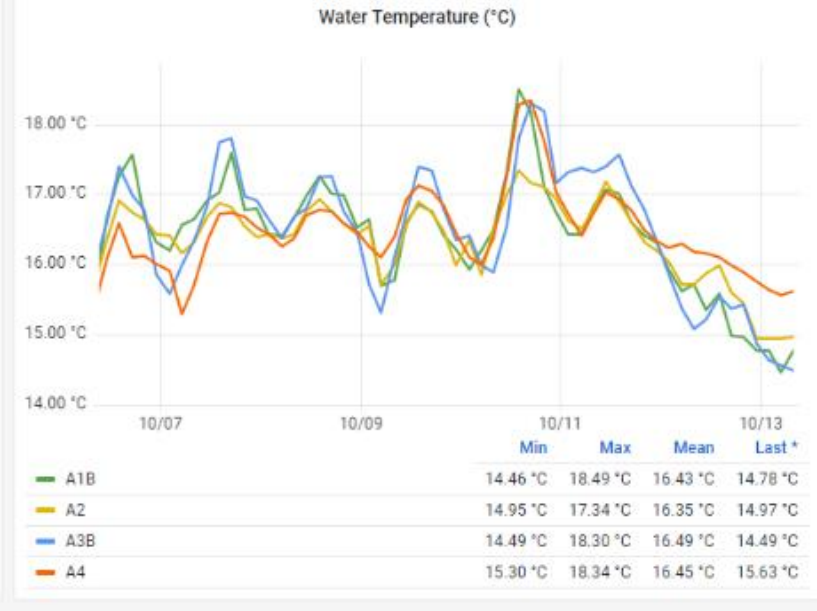

Figure 10 - Water temperature of Oyster Harbour, October 2021

5.1.3 Sediments

Elevated sediment loading and changes in the magnitude and frequency of sediment deposition can dramatically alter seabed habitats critical for invertebrates, including nursery habitats for juveniles and adults.[44] The sediments within the zone vary from predominantly medium white sands in King George Sound[45] to finer-grained sediments with higher organic content in the deeper depositional areas of Oyster Harbour and Princess Royal Harbour.

A study by MScience during its benthic survey of the zone found that the sand in Oyster Harbour was dark in colour and quite different from sand at other sites near Albany, such as Vancouver Bay, Frenchman Bay and Gull Rock.[46] The dark colour of the sand in Oyster Harbour could be attributed to decades of silt and sediment deposition derived from cleared land in the catchment area run-off following heavy rainfall events.

In 2021, BMT completed independent modelling to determine the risk of benthic nutrient enrichment.[47] Modelled bio-deposition rates from within the Albany Zone were compared to actual rates from studies completed in other Australian states and internationally. The model found that the risk of benthic nutrient enrichment in the Albany Zone was relatively low in the winter months, but higher in summer when flushing and current movement are generally reduced. Impacts (if any) are therefore

[44] Thrush, S. F., et al. "Muddy waters: elevating sediment input to coastal and estuarine habitats." *Frontiers in Ecology and the Environment* 2.6 (2004): 299-306

[45] Albany Iron Ore Project Public Environmental Review, Albany Port Expansion Proposal. EPA Assessment No. 1594, Ecologica, 2008.

[46] South Coast Aquaculture Development Zone Investigation: Phytoplankton and Habitat Studies; MScience, 2019

[47] Environmental assessments in support of shellfish farming in Albany, Western Australia; BMT 2021

expected to be transient and mitigated during the passage of natural storm events (which occur mainly in winter).

5.1.4 Tides, Currents and Waves

Because the waters of Oyster Harbour are protected from ocean swell wave energy by headlands on either side of the narrow channel at Emu Point, the primary wave energy in Oyster Harbour is generated from wind-driven waves, as opposed to ocean swell. The height of these waves is generally less than one metre.

A comprehensive study by D'Adamo (1991) describes the internal mixing and circulation of Oyster Harbour.[48] The study also investigated the mechanisms of water exchange between the estuary and the oceanic embayment of King George Sound. There are various mechanisms driving the currents within Oyster Harbour, with tidal flows being the primary source of water movement. Freshwater influx into the estuary and wind strength and direction also play an important role in circulation within Oyster Harbour.

Because the momentum of tidal flows is significantly dampened over the shallows due to bottom friction, the flow tends to be weaker over the shallows and stronger in the central, deeper regions. The eastern shallows are dominated more by wind drift than tidal influence. An important process in Oyster Harbour associated with currents and tides is a saline “wedge”, which is driven upstream during spring tides. The saline wedge can travel up to four kilometres within a 12-hour period, where resident harbour water is driven towards the northern end of Oyster Harbour.

Water circulation in Princess Royal Harbour and King George Sound is primarily wind driven. Tides are relatively weak with a neap spring tide of 1.1 m. Wind driven circulation in King George Sound is predominantly anti-clockwise in summer and clockwise in winter [49].Mills and D’Adamo (1993)[50] found that up to 30 million m³ of water transits to and from Princess Royal Harbour within 8 hours of rising tides and 16 hours of falling tides. Water passes through the entrance of the Harbour at current speeds of up to 0.5 m/s.

Waves and currents can be affected by aquaculture infrastructure and equipment in the marine environment. Field studies of mussel farms in New Zealand show reductions in current velocity and changes in current direction directly adjacent to the mussel farm longlines, but beneath the lines the currents were not affected. Keeley *et al*. 2009 found no evidence in the Marlborough Sounds that the impact marine farms have on waves were affecting ecological habitats shoreward of the sites.[51] Due to the footprint of the aquaculture gear (culture lines and baskets) making up a small proportion of the water column, impacts on the surrounding environment from changes to waves and currents are unlikely, and the level of risk is considered low.

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[48] D'Adamo, N. & Western Australia. Environmental Protection Authority. (1991). Circulation of Oyster Harbour. Perth, W.A : Environmental Protection Authority

[49]Mills DA, Brady KN (1985) Wind driven circulation in Princess Royal Harbour and Oyster Harbour, Results from a Numerical Model. Prepared for Department of Conservation and Environment. Mills DA,

[50] D’Adamo N (1993) Water circulation and flushing characteristics of Princess Royal Harbour, Albany. Environmental Protection Authority, Perth.

[51] Forrest, B. M., Keeley, N. B., Hopkins, G. A., Webb, S. C., & Clement, D. M. (2009). Bivalve aquaculture in estuaries: review and synthesis of oyster cultivation effects. *Aquaculture*, *298*(1-2), 1-15.

5.1.5 Epibenthos and Seagrass

Benthic communities, or the epibenthos, play important roles in maintaining the integrity of marine ecosystems and the provision of ecosystem services.[52] Marine benthic communities are important for the maintenance of biological diversity by providing structurally complex and diverse habitats on the seabed, refuge for vulnerable life-history stages of aquatic organisms and a varied and increased food supply. In WA, benthic primary producer communities form the foundation of many of the coastal food webs, which in turn support productive and economically important fisheries.

In 2019, the Department contracted MScience to undertake a seagrass study of for the proposed Albany Zone areas (Figure 11). The study forms part of the environmental baseline study that informs this Management Framework. The Department also contracted BMT to complete an impact assessment for the Albany Zone, including modelling the expected impact on seagrass in terms of permanent and recoverable loss (Figure 14).

More recently, in February 2022, the Department contracted the University of Western Australia (UWA) to undertake more detailed seagrass surveys at the Albany Zone sites, using state-of-the-art side-scan sonar, underwater video-tow camera footage and drone aerial imaging.

These comprehensive bodies of work provide the Department with baseline data on seagrass distribution and health within the zone.

Seagrass communities in the Albany Harbours have been the subject of ongoing study since the 1960’s, when the first assessments were carried out. This work has highlighted the impact of effluent discharge, dredging and changes in catchment land on seagrass coverage and density. This work is discussed for each of the Albany Zone areas in the following section.

[52] Ecosystem services are the benefits to humans provided by the natural environment; for example, plants clean the air, bacteria decompose wastes and aquatic plants and shellfish clean water.

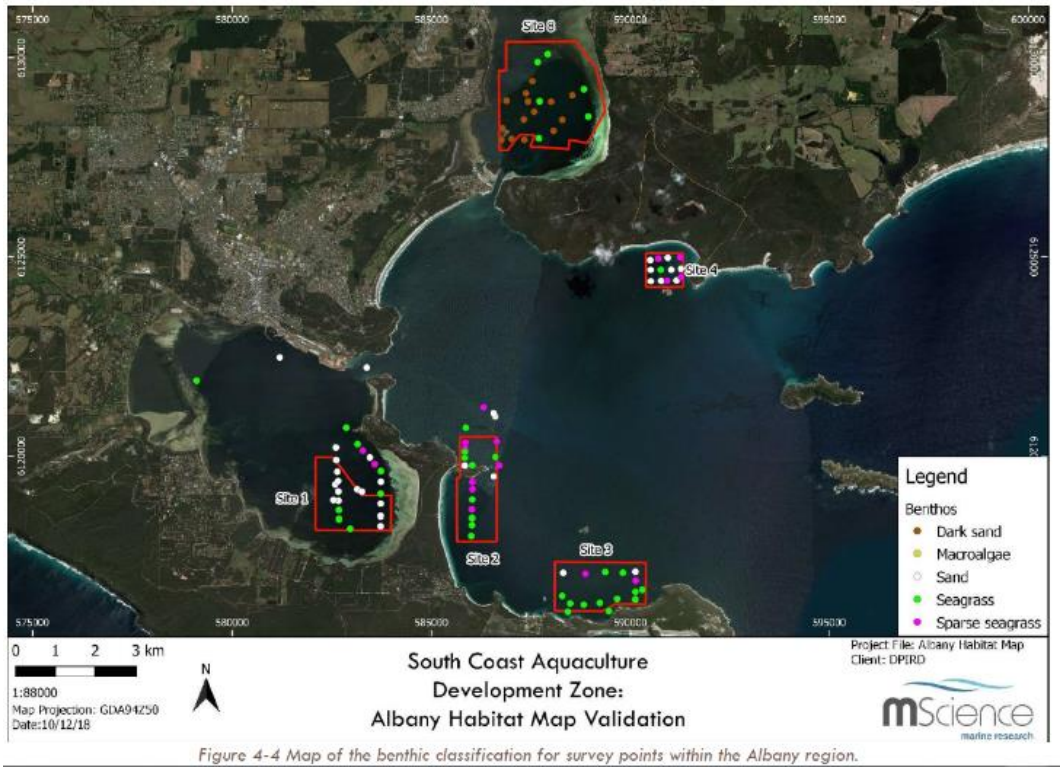

Figure 11 - Map of benthic classification for Albany Aquaculture Zones[53] Note that zone areas indicated in this figure are not representative of the final declared zone.

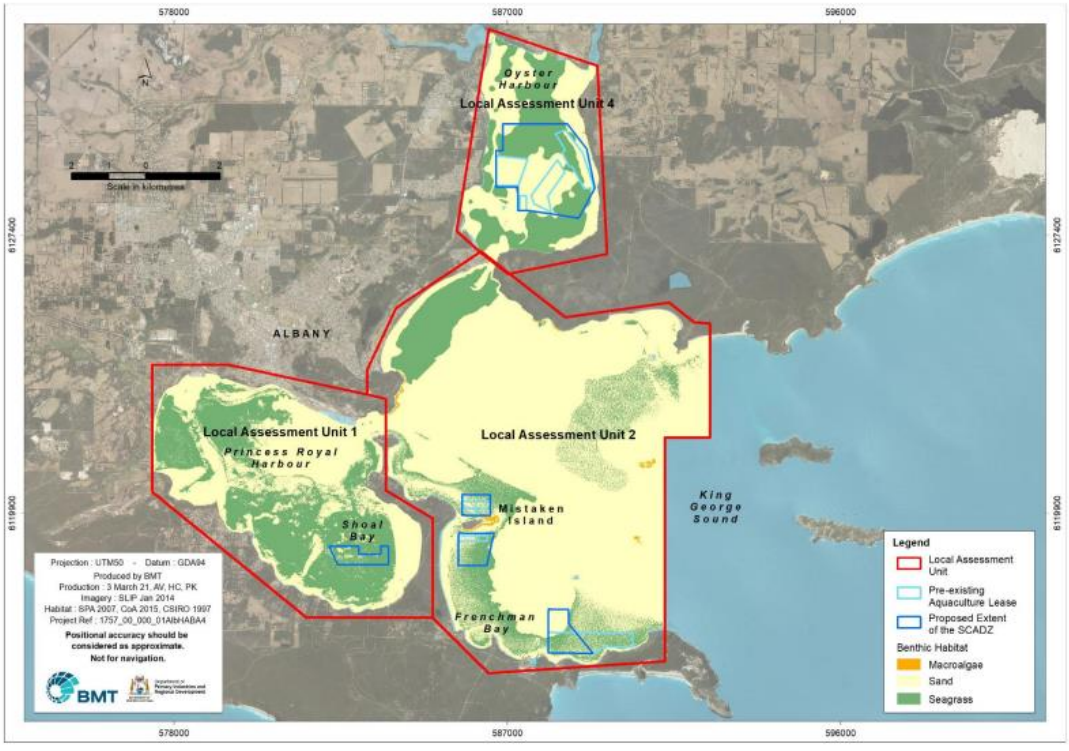

Figure 12. Current benthic habitat coverage within the Albany Zone (source: BMT 2021). Note that zone areas indicated in this figure are not representative of the final declared zone.

[53] South Coast Aquaculture Development Zone Investigation: Phytoplankton and Habitat Studies; MScience, 2019

Oyster Harbour

Between monitoring events in 1962 and 1988, 80% of the seagrass cover was lost in Oyster Harbour, with the lowest levels observed in the late 1980s[54]. The main cause was enrichment causing excessive epiphyte growth and resultant light reduction. High nutrient levels were attributed to extensive catchment clearing and expansion of agricultural activities in the post-war period.[55]

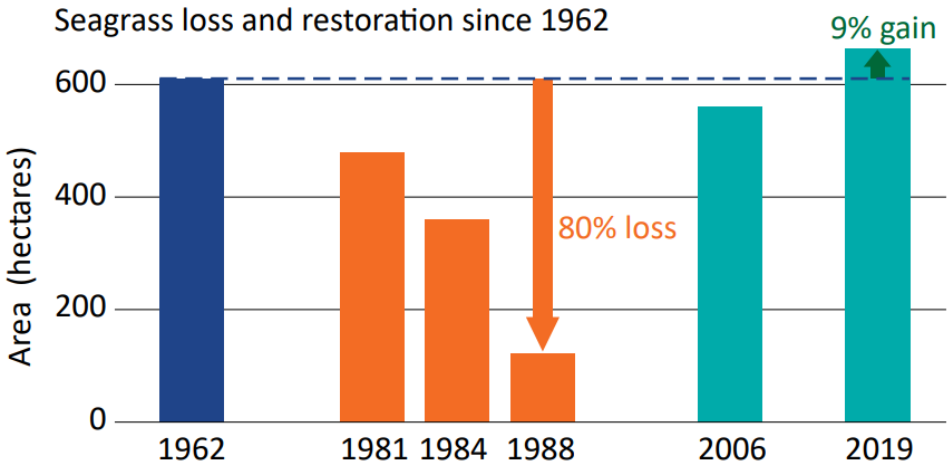

Figure 13 - Seagrass Area in Oyster Harbour, 1962 - 2019[55]

Recent surveys of seagrass in Oyster Harbour has shown a significant recovery of habitat, with seagrass now covering an area of 663 hectares – nine per cent more than in 1962. The recovery is due to the improvement of catchment management practices, and a sustained 20-year seagrass transplanting effort.[55]

[54] Environmental Protection Authority 1990a, Albany Harbours Environmental Study (1988-1989), EPA, Perth.

[55] Oyster Harbour - Condition of the estuary, 2016-2019, DWER (2021)

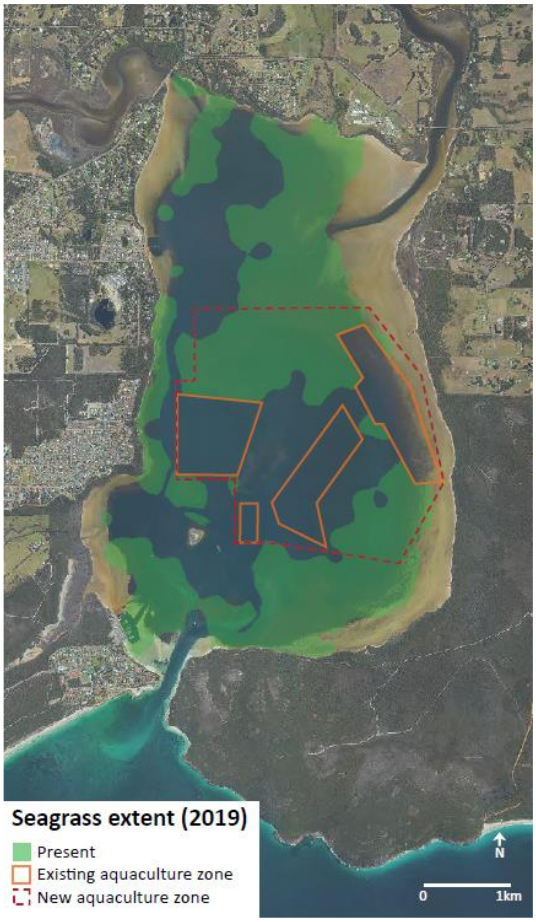

Figure 14 – Oyster Harbour Seagrass Distribution[56]
Note: existing aquaculture areas were not surveyed

Figure 14 shows the extent of the seagrass meadows in Oyster Harbour in 2019 in relation to existing sites and the new Oyster Harbour area of the Albany Zone, which covers an area of 196 hectares of seagrass habitat. This is 30 per cent of the seagrass area mapped in 2019 and includes meadows of seagrass which were transplanted as part of the restoration effort.

The main seagrass species found in Oyster Harbour are:
- *Posidonia australis*,
- *Posidonia sinuosa*; and
- *Amphibolis antarctica*

In Oyster Harbour, *P. australis* and *P. sinuosa* predominate in the shallow regions less than five metres deep.[57]

Aquaculture development in the expanded aquaculture development zone will be managed to ensure protection of the valuable seagrass habitat.

[56] Oyster Harbour - Condition of the estuary, 2016-2019, DWER (2021)
[57] South Coast Aquaculture Development Zone Investigation: Phytoplankton and Habitat Studies; MScience, 2019

Figure 15 – Seagrass with epiphyte growth[58]

A key driver of seagrass distribution is the amount of sunlight within the wavelength range necessary for photosynthesis (photosynthetically active radiation, or PAR) reaching the seabed, which is affected by seabed depth and water clarity.

At the bay or ecosystem scale, water filtration by bivalves could result in water clarity improvements that can increase the overall distribution of submerged aquatic vegetation.[59,60] The extent of epiphyte growth present on seagrass beds is a second limitation of seagrass health. Epiphyte growth is natural, though densities can increase in response to elevated nutrient levels. As epiphyte density increases, light availability to the underlying seagrass is reduced.

In 2021, epiphyte levels in Oyster Harbour were assessed as having “medium” cover in the estuary, representing an increase on the previous monitoring event in 2019.[61]

Apart from seagrass, common macroalgal species in Oyster Harbour consist of:

- Green algae species, including:
  - *Cladophora prolifera*,
  - *Chaetomorpha* spp.,
  - *Enteromorpha* spp.; and
  - *Ulva* spp.

- Brown macroalgae species, including:
  - *Cystophyllum muricatum,*
  - *Hormophysa spp. and*
  - *Hormosira banksii*

- Common red algae, including free-floating *Gracilaria* species.

[58] Photo credit – Roger Barnard, 2017

[59] Filgueira R, Byron CJ, Comeau LA, et al., 2015; An integrated ecosystem approach for assessing the potential role of cultivated bivalve shells as part of the carbon trading system

[60] Theuerkauf et al., 2021; Habitat value of bivalve shellfish and seaweed aquaculture for fish and invertebrates: Pathways, synthesis and next steps

[61] Oyster Harbour - Condition of the estuary, 2016-2019, DWER (2021)

In respect of effect of aquaculture on seagrass in shallow intertidal areas, an existing licence holder has free-floating long-line shellfish aquaculture gear that has been in place in Oyster Harbour at water depths between 0.5 and 1.0 metres (Lowest Astronomical Tide) for two years. Figure 17 shows healthy seagrass populations growing underneath these bags.

Figure 16 Healthy seagrass populations growing beneath aquaculture gear in Oyster Harbour.

Princess Royal Harbour

Princess Royal Harbour seagrass beds have undergone significant change since at least the 1960's. Seagrass mapping studies identified a significant decrease in seagrass cover between 1962 and 1981–84 related to point source nutrients from industry and urban sources, and turbidity from harbour dredging [62]. Recovery of seagrasses has been recorded following changes to effluent discharge into Princess Royal Harbour[63] and has been supported by transplantation projects, although large mats of the epiphytic algae *Cladophora prolifera* remain [64].

In Princess Royal Harbour, the Shoal Bay site is predominantly located over seagrass. The extent and health of these beds is currently being assessed as part of the baseline data collection project discussed below.

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[62]Hillman, K., Lukatelich, R. J., Bastyan, G., & McComb, A. J. (1991). Water quality and seagrass biomass, productivity and epiphyte load in Princess Royal Harbour, Oyster Harbour and King George Sound.

[63] Bastyan, G.M., Deeley, D.M., White, K.S. and Paling, E.I.,. 1996. Seagrass and Macroalgal Distribution in Princess Royal and Oyster Harbours, Albany Distribution and Comparisons with Previous Surveys: Report to the Water and Rivers Commission. Perth, Western Australia. : Marine and Freshwater Research Laboratory, Institute for Environmental Science, Murdoch University.

[64] Bastyan, G.R., Cambridge, M.L.,. 2008. "Transplantation as a method for restoring the seagrass Posidonia australis." *Estuarine, Coastal and Shelf Science, 79(2)* 289-299.

Potential impacts on seagrass at the Shoal Bay site are expected to be similar to those at the Oyster Harbour site, though the impact of propeller scour and trampling is expected to be less given the greater depth of seagrass beds in Shoal Bay compared to some areas within Oyster Harbour.

King George Sound
In King George Sound, both sites (Mistaken Island and Misery Beach) are located over seagrass. These sites are deeper than those in Oyster Harbour and Princess Royal Harbour, reducing the likelihood of direct impacts, other than the initial installation of mooring systems for aquaculture gear. A previous study on the impact of mussel aquaculture on seagrass at Mistaken Island found no clear evidence of impact in any of the metrics used[65].

5.1.6 Fishes

An environmental study for the Albany Port Expansion project identified 203 finfish species occurring in the marine environments of Oyster Harbour, Princess Royal Harbour and King George Sound.[66] These species include endangered, threatened and protected (ETP) finfish, which include a variety of sharks, rays, and syngnathids (pipefish, seahorses and sea-dragons). Most syngnathid species inhabit shallow, sheltered coastal waters. Several of these species occur in Oyster Harbour.

There is no evidence that shellfish aquaculture poses a significant risk to these species. Care will be taken during grading, cleaning and handling to return unharmed any fish or crustaceans that have found their way into the baskets back into the ocean as quickly as possible.

5.1.7 Seabirds and Avifauna

The shallow nearshore regions of Oyster Harbour and Princess Royal Harbour are of particular importance as feeding areas for water birds. Numerous migratory bird species, such as waterfowl, sanderling, red-necked stint and common greenshank use the various inlets and creeks on the south coast, including Oyster Harbour, as foraging and refuge areas.[67]

An internal review of risks associated with operations in the Albany Zone on seabirds found that, provided operators are effective in managing plastic pollution, the risk to seabirds was low. Licence conditions related to plastic pollution management will be applied for all licence holders within the zone.

All licence holders must report negative interactions (entanglement, collision and, or mortality) between aquaculture gear and avifauna in the MEMP report.

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[65] Jernakoff, P. 2001. A Quantitative Assessment of the Environmental Impacts of Mussel Aquaculture on Seagrass. FRDC report 99/229 , Perth: IRC Environment.
[66] Ecologia (2007) Albany Iron Ore Project Public Environmental Review, Albany Port Expansion Proposal. EPA Assessment No. 1594. Prepared for the Albany Port Authority by Ecologia Environment, Perth, Western Australia
[67] MScience 2018. South Coast Aquaculture Development Zone Site Investigation. Unpublished report MSA267R02 to Department of Primary Industries and Regional Development, Perth Western Australia, pp75

5.1.8 Marine Mammals

The Department engaged an independent consultant to complete a risk assessment for impact of aquaculture activities in the Albany Zone on marine fauna, including whales, dolphins, sea lions and seals. Previous entanglement incidents at sites within KGS have resulted in the development of site specific monitoring and response plans for affected licence holders. All licence holders with aquaculture licences granted or varied within Albany Zone sites in KGS will be required to develop a clear management plan to manage this risk, including an incident response plan, as part of their MEMP.

Licence holders are required to report any negative interactions with marine mammals to DBCA via the Wildcare Helpline (08) 9474 9055 as soon as practicable, ensuring notification within 24 hours of discovery of the incident. Any incidents involving entanglement must be reported immediately to allow for a timely response by DBCA staff. Aquaculture operators are expected to follow instructions by DBCA if safe to do so, including standing by the incident until DBCA crews arrive, and assisting if requested.

A follow-up investigation will be launched by the relevant licence holder into the cause of the incident, including specialist advice. The investigation will be documented and submitted for review to the Department, and for sites within Stage 2, SPA. Based on the findings of the investigation, management actions will be taken to prevent or minimise the likelihood of event recurrences and DBCA advised of the outcome.

All licence holders must report negative interactions between aquaculture gear and marine mammals in the MEMP report.

5.2 Environmental Quality Management Framework

Some principles and elements of the Environmental Quality Management Framework (EQMF) developed by the EPA, which have been applied through this Management Framework, are underpinned by the Values and Objectives identified in the EPA Statement of Environmental Principles, Factors and Objectives (2016b) and the MEMP development framework published in DPIRD (2013).[68, 69]

5.2.1 Values and Objectives

Under the EQMF, Environmental Values (EV) are particular values or environmental uses important for a healthy ecosystem or for public benefit, welfare, safety or health and which require protection from the effects of pollution, waste discharges and deposits.

In Western Australia, there are five EVs: Ecosystem Health, Fishing & Aquaculture, Recreation & Aesthetics, Cultural & Spiritual and Industrial Water Supply. This Management Framework relates to the EVs for Ecosystem Health, Fishing and Aquaculture and Recreation and Aesthetics. By protecting these Values, it is assumed

[68] EPA (2016b) Statement of Environmental Principles, Factors and Objectives. Western Australian Environmental Protection Authority, Perth Western Australia
[69] http://www.fish.wa.gov.au/Documents/Aquaculture/memp_guidance_statement.pdf

the Cultural and Spiritual and the Industrial Water Supply Values will be protected as a consequence.

5.2.2 Levels of Ecological Protection

Each of the EVs has a corresponding suite of Environmental Quality Objectives (EQOs). EQOs are high-level management objectives that describe what must be achieved to protect each EV. Except for the EV for Ecosystem Health, the EQOs are applied equally, irrespective of the way the marine environment is utilised. The EV for ecosystem health is unique because it recognises that not all areas can achieve (or retain) high to maximum levels of ecosystem protection and that some areas must instead be given either moderate or low ecological protection status with corresponding limits of acceptable change.

The EQMF allows for the competing environmental, societal and industrial uses of the marine environment and allows for small, localised effects, while aiming to maintain overall environmental integrity (EPA 2016a[70]). This is important in the context of this Management Framework, which includes strategies to monitor and manage any reduction in environmental quality beneath and immediately adjacent to the Albany Zone aquaculture sites, while maintaining broader regional environmental quality.

[70] Environmental Protection Authority 2016, Technical Guidance – Protecting the Quality of Western Australia's Marine Environment, EPA, Western Australia.

Table 1 - Key elements of ecosystem integrity and their limits of acceptable change

Key element	Limits of acceptable change	Level of protection			
		Max	**High**	**Mod**	**Low**
Ecosystem processes (e.g. primary production, nutrients cycles, food chains)	Ecosystem processes are maintained within the limits of natural variation (no detectable change)	✓	✓		
	Small changes in rates, but not types of ecosystem processes			✓	
	Large changes in rates, but not types of ecosystem processes				✓
Biodiversity (e.g. variety and types of naturally occurring marine life)	Biodiversity as measured on both local and regional scales remains at natural levels (no detectable change)	✓	✓		
	Biodiversity on a regional scale remains at natural levels although there may be moderate changes in variety of biota at a local scale			✓	
	Biodiversity on a regional scale remains at natural levels although there may be significant changes in variety of biota at a local scale				✓
Abundance and biomass of marine life	Abundances and biomasses of marine life vary within natural limits (no detectable change)	✓	✓		
	Small changes in abundances and/or biomasses of marine life			✓	
	Large changes in abundances and/or biomasses of marine life				✓
The quality of water, biota and sediment	Levels of contaminants and other measures of quality remain within limits of natural variation (no detect. change)	✓			
	Small detectable changes beyond limits of natural variation but no resultant effect on biota		✓		
	Moderate changes beyond limits of natural variation but not to exceed specified criteria			✓	
	Substantial changes beyond limits of natural variation				✓

5.2.3 Level of Ecological Protection Applied to Albany Zone

The EQO for maintenance of ecosystem integrity requires the spatial definition of up to four levels of ecological protection (LEP) – maximum, high, moderate and low. The EPA provides aspirational environmental targets for two types of marine-based aquaculture: intensive sea-cage systems requiring pelleted feed inputs; and passively fed systems such as shellfish and abalone ranching systems, which do not require feed inputs.

Guidance for passive systems propose they should be managed to achieve a high level of ecological protection. The objective for a high level of ecological protection is to allow for small measurable changes in the quality of water and sediment but no resultant effect on biota nor any changes to wider ecosystem processes, biodiversity or abundance and biomass of marine life beyond the limits of natural variation.

Under this framework, shellfish farming operations will be undertaken with the expectation that farming will impart negligible to small changes in the quality of water and sediment immediately beneath the farming infrastructure, while having no discernible effect on the environment beyond the lease (or sublicence) boundaries.

Environmental modelling undertaken for this project (BMT 2021) predicted that any measurable impacts would be minor and highly spatially constrained.

Based on these underlying principles, areas within the Albany Zone will be managed to meet the EPA objectives for a high level of ecological protection area (HEPA).

5.2.4 Environmental Quality Criteria

The Management Framework outlines the approaches to monitoring and management designed to protect the EPA's EQO for ecosystem integrity. The extent to which the EQOs for a high LEP have been achieved will be assessed against a suite of Environmental Quality Criteria (EQC).

The two levels of EQC are set out below.

- Environmental Quality Guidelines (EQGs) are threshold numerical values or narrative statements which if met indicate there is a high degree of certainty that the associated environmental quality objective has been achieved. If the guideline is not met then there is uncertainty as to whether the associated environmental quality objective has been achieved and a more detailed assessment against an environmental quality standard is triggered. This assessment is risk-based and investigative in nature.

- Environmental Quality Standards (EQSs) are threshold numerical values or narrative statements that indicate a level which if not met indicates there is a significant risk that the associated environmental quality objective has not been achieved and a management response is triggered. The response would normally focus on identifying the cause (or source/pressure) of the exceedance and then reducing loads of the contaminant of concern (that is, source/pressure control) and may also require *in situ* remedial work to be undertaken.

Figure 18 illustrates the conceptual framework for applying the EQC.

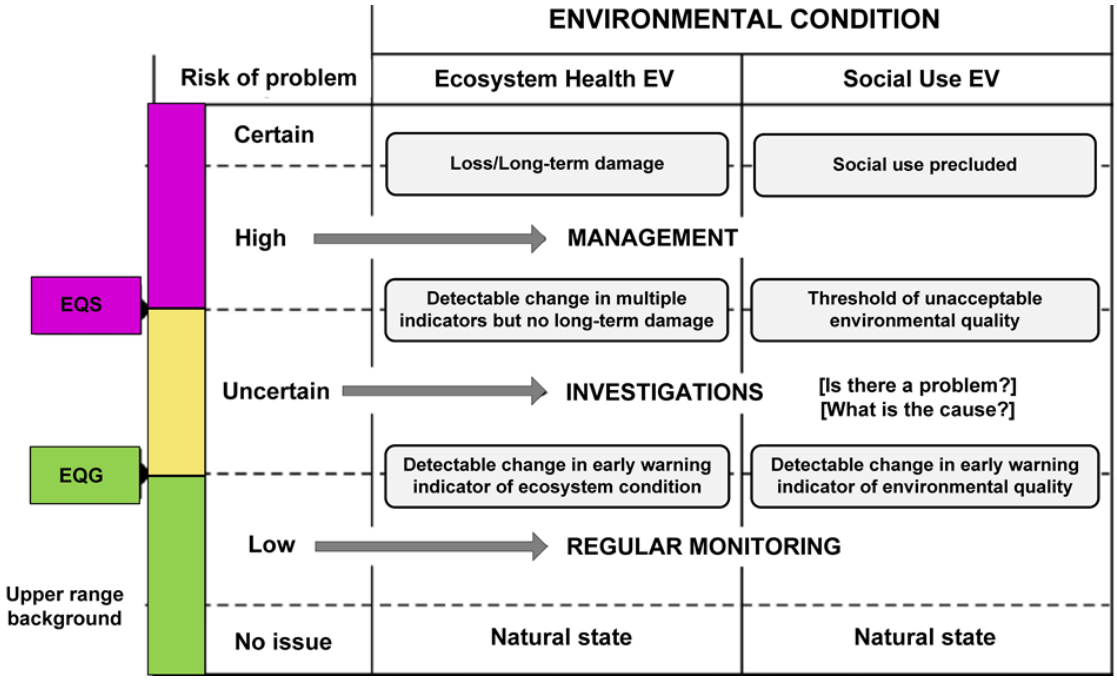

Figure 17 Conceptual framework for applying the environmental quality guidelines and standards

Note: Adapted from Figure 3 (page 14) of EPA (2016a)

The EQC outlined in this section are based on the cause-effect pathways identified in Figure 18 and drawn on a suite of clear, readily measurable indicators (Table 2). The EQC are highly conservative and, by meeting these triggers, it is expected that the EQOs for the other EVs (Fishing and Aquaculture, Recreation and Aesthetics, Cultural and Spiritual and Industrial Water Supply) will also be met.

Table 2 Measurable indicators used to derive environmental quality criteria. Note that only compliance monitoring metrics have numeric triggers. Triggers, where relevant, are described in tables 3 and 4.

Source / Cause	Monitoring	EQG indicator	EQS indicator
Nutrient enrichment	Water quality[a]	Phytoplankton total cell count Dissolved oxygen	Farm production metrics
	Sediment Nutrient	Sediment total nitrogen Sediment total phosphorus	Seagrass shoot density
Direct impacts on benthic habitat	Benthic habitat and communities	NA	Calculated loss of seagrass
Shading and smothering	Benthic habitat and communities	Epiphyte density Bio-deposition	Seagrass shoot density

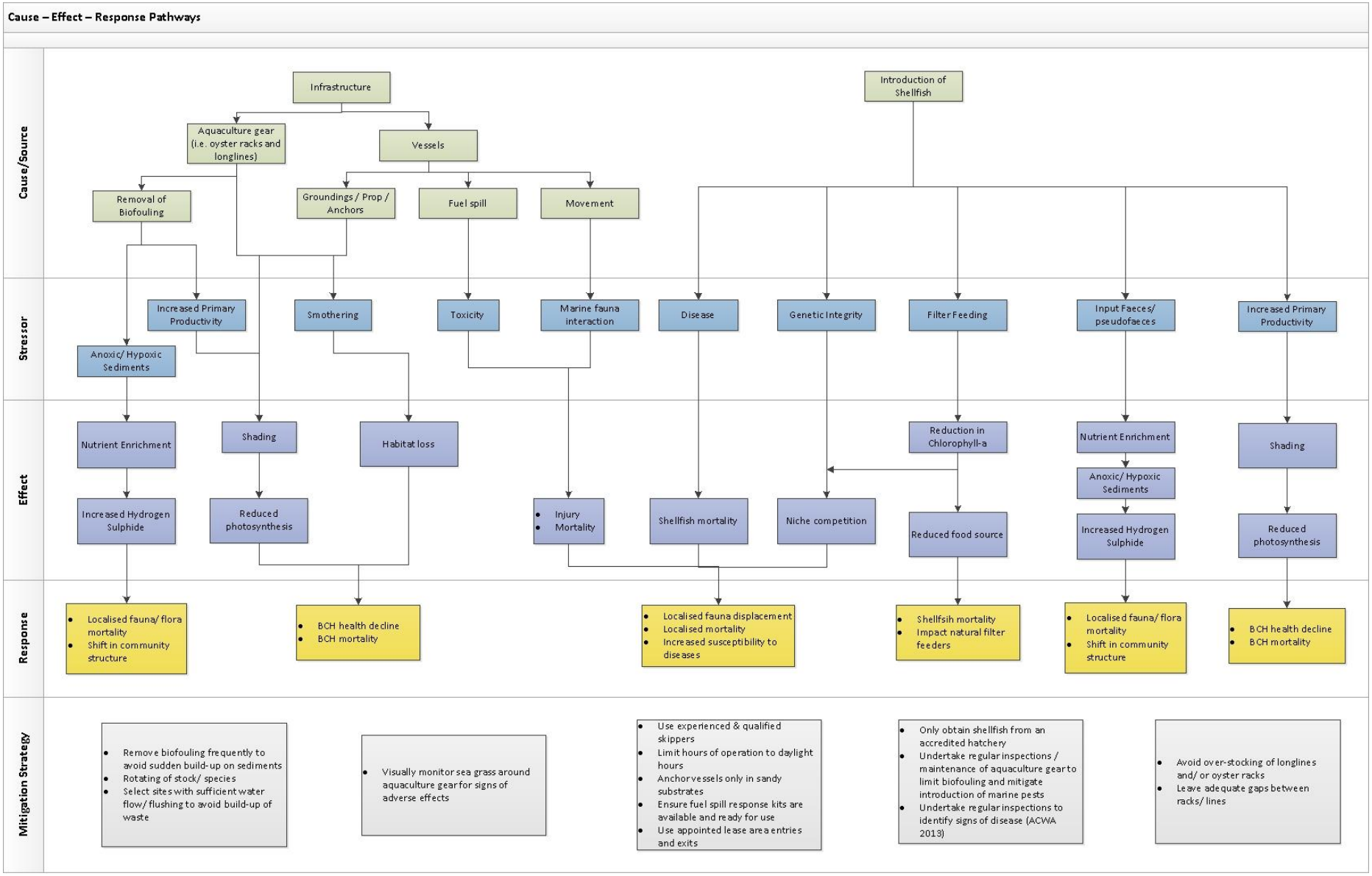

Figure 18 Relevant cause-effect pathways for potential risk activities associated with the Albany Zone

5.3 Environmental Monitoring Parameters

The Department will take a conservative approach to zone management that ensures relevant environmental parameters are monitored. Farming and environmental systems are dynamic, so matching operational change with the environment health outcomes requires an adaptive management approach. The Department will therefore review the suitability of the monitoring program regularly, with reference to new data and stakeholder feedback.

The program will include contextual and compliance monitoring.

5.3.1 Contextual Monitoring

The objective of the contextual monitoring is to record relevant data to assist understanding the zone, which may inform the creation for formal EQS and, or EGQ in future. Findings from contextual monitoring may also result in changes to MEMPs or zone management. These data will be collected by licence holders within the zone and reported in their annual MEMP report.

Water Quality

As indicated previously, increasing shellfish aquaculture may have a positive impact on water quality within the Albany Harbours due to the considerable increase in the quantity of filter feeders present within the system. Given that naturally occurring filter feeders compete for this resource, it is appropriate to ensure that this factor is monitored to ensure that phytoplankton is not depleted to an extent that there is a risk to ecological integrity. Phytoplankton counts from the WASQAP monitoring program will included in the MEMP report to help identify spatial trends in phytoplankton abundance and assemblage composition around farmed areas.

Farm Production Data

Throughout their life cycle, farmed shellfish will be monitored, cleaned, and checked for signs of sub-optimal health and growth. Bivalve molluscs are recognised as a sensitive biological indicator species for monitoring environmental changes. Measuring and assessing shellfish growth and survival rates, together with physiological condition metrics, will assist in monitoring the health of Albany's marine environment.

It will be a requirement for each licence holder to capture operational data and provide them to the Department through their annual MEMP reports. These data are:

- total biomass;
- mean cohort size metrics, stocking densities and growth rates;
- mortalities; and
- time to harvest.

The Department will use these data as an indicator of the carrying capacity of the areas in the Albany Zone and consequently to inform management practices to ensure sustainability. If trends become apparent in these data that indicate exceedance of the

systems carrying capacity, then the Department may apply controls on production levels in consultation with licence holders, consistent with its adaptive management strategy.

5.3.2 Compliance Monitoring

Compliance monitoring metrics will be assessed against formal triggers to ensure that environmental impacts are identified, and suitable management responses are initiated where necessary.

Water Quality

Monthly reading of surface (0.5 m from surface) and bottom (0.5 m from benthos) dissolved oxygen (DO) readings from an impact site and reference site nominated within the licence holders MEMP must be taken. Any reading under 60% will trigger further investigation by license holders to identify the extent and depth of low DO waters.

Sediment

While modelling from BMT predicted that there was a very low likelihood of significant impact to sediment quality under farmed areas within the zone, it did recommend undertaking an initial monitoring program to confirm the modelled level of impact. The Department will follow this recommendation by undertaking baseline and annual monitoring of sediments at impact and reference sites. This monitoring will occur within Stage 1 sites where the risk was modelled to be highest.

Significant, sustained changes in sediments may be attributable to shellfish aquaculture when culture area sampling sites are affected whilst reference sampling control sites are not. The Department will then act with licence holders to address and mitigate the impact. Potential actions could include reducing stocking densities or allowing the affected area to fallow.

Benthic Habitat – Seagrass

The comprehensive body of baseline data that the Department has compiled will allow for a high level of confidence in detecting system-wide changes in seagrass health and abundance, as well as quantifying zone-specific impacts. The monitoring method used to identify impact will vary depending on the depth of water in recognition that different impact pathways apply based on water depth.

At all depths, there is a recognized risk of impact due to the installation of aquaculture gear. The mooring system that industry will use (helical screw anchors without chains) is recognised as best practice due to its limited environmental footprint when compared to traditional anchors or concrete blocks. Despite this, ongoing monitoring of mooring systems will be undertaken to quantify the initial impact of anchor installation and the subsequent recovery of seagrass within that footprint. This will be quantified through the collection of photo quadrats and assessment of percentage cover.

In shallower waters the most significant risk to seagrass will be related to physical damage from farm operations. Best practice will see operators avoiding unnecessary activity within shallow seagrass areas during low tides, trimming outboards appropriately, and using suitable shallow draft vessels. In these shallow areas, aerial photographs taken using a drone will provide an effective means of quantifying any loss of seagrass coverage.

In the deeper sections of the leased (or sublicensed) areas, the primary risks associated with aquaculture production will be related to light availability, which may be impacted by either increased epiphyte growth and, or bio-deposition, or from shading by aquaculture gear. Impact will be monitored through the annual completion of shoot density counts and epiphyte and bio-deposition monitoring at fixed control and reference sites.

5.4 Environmental Monitoring Program

Table 3 Stage 1 - routine monitoring plan

Parameter			Analytes/Factor	Frequency	Trigger
Water Quality			Total cell counts (phytoplankton)	As required under WASQAP MBMMP	N/A
			DO surface and bottom	Monthly DO	Any site reading <60% DO at surface and, or bottom
			Farm production metrics	Annual	N/A
Sediment[1]			Total nitrogen Total phosphorous	Annual	Median nutrient concentration at any impact site is greater than the 80th percentile of control site data.
Benthic habitat	Direct Impacts	Mooring systems	Repeated measures photo quadrat located over randomly selected mooring anchors	Annual	At the time of sampling: Identified cumulative loss against baseline is greater than 0.43 ha over the Oyster Harbour aquaculture sites.[a]
		Shallows (<2.0m water depth)	Drone aerial photography for assessment of percent cover and density		
	Indirect Impacts	>2.0m water depth	Shoot density assessment within repeat measures quadrats at control and impact locations. Assessment of epiphyte density and seagrass health collected during shoot density assessment		Median shoot density within a site at any given depth is less than 5th percentile of control site shoot density for that depth. Median score for a site exceeds the previous score for that site by 2 or more, or exceeds the Y1 scores for that site by 2 or more..[b]

[a] *These figures are derived from the estimated Zones of High Impact in BMT (2021)*

[b] *Rating system described in the Albany Aquaculture Development Zone Stage 1 Seagrass and Sediment Monitoring Plan. Y1 scores refer to scores determined for the site based on the data collected in the first year of monitoring.*

Table 4 - Stage 2 routine monitoring plan

Parameter			Analytes/Factor	Frequency	Trigger
Water Quality			Total cell counts (phytoplankton)	As required under WASQAP MBMMP	N/A
			DO surface and bottom	Monthly DO	Any site reading <60% DO at surface and, or bottom
			Farm production metrics	Annual	N/A
Benthic habitat	Direct Impacts	Mooring systems	Repeated measures photo quadrat located over randomly selected mooring anchors	Annual	Identified cumulative loss against baseline is greater than 0.09 ha over the Mistaken Island and Misery Beach sites
		Gear scour	Video transects oriented parallel to aquaculture gear and directly adjacent to it. Collected using towed video or SCUBA.		Identified cumulative loss against baseline is greater than 0.24 ha over the Shoal Bay sites.[a]
	Indirect Impacts	Bio-deposition, epiphyte density and seagrass density	Video transects oriented parallel to aquaculture gear and directly adjacent to it. Collected using towed video or SCUBA.		Median score for a site exceeds the previous score for that site by 2 or more, or exceeds the Y1 scores for that site by 2 or more. The inverse applies for seagrass density.[b]

[a] *These figures are derived from the estimated Zones of High Impact in BMT (2021)*

[b] *Rating system described in the Albany Aquaculture Development Zone Stage 2 Seagrass Monitoring Plan. Y1 scores refer to scores determined for the site based on the data collected in the first year of monitoring.*

5.4.1 Impact and Control Sites

Locations for water quality sampling will be included within the MEMP for DO, and MBMMP for total cell counts. Sampling locations should be tailored to each farmed area based on the orientation of gear, depth of the site and prevailing currents.

The locations of impact sites may change over time as areas are stocked and fallowed. As a guide, sites should be located up and down current of stocked areas, allowing for assessment of water quality entering the site against water quality exiting the site. Where this method is followed, notes must be taken on the apparent surface currents and the stage of the tidal cycle at time of sampling (i.e., ebb or flood tide).

The sampling plans and methods used for benthic habitat and sediment sampling within Stage 1 and 2 are provided within the respective sampling plans for those areas.

5.4.2 Records and Reporting

Exceedance of the DO trigger must be reported to the Department within 24 hours of detection using aquaculture@dpird.wa.gov.au to enable a timely investigation and response.

Licensees will submit a MEMP report summarising the results of the environmental monitoring program to the Department annually in accordance with the licence conditions.

The main body of the MEMP report will include:

- Site plan including the location of all aquaculture gear at the time of reporting;
- Any environmental monitoring as described in the MEMP, including trend analysis against previous years data where relevant;
- Marine fauna interactions; and
- Any significant changes in operational procedures (i.e., fallowing, installation or removal of gear, production methods etc.).

Records associated with the farm operation and performance shall be included as an Appendix to the MEMP report.

5.5 Environmental Response Protocols

The following actions and mitigation measures that mat be taken in response to identification of environmental impacts or risks to aquaculture such as low DO waters.

1 Increased testing and analysis to determine the impact area affected, potential consequences, duration, and source.

2 Following environmental impacts being identified, and aquaculture activities confirmed or suspected as the cause or source of impact, modifications to culture systems and, or, reduction of stock from an affected area will be the first remedial action.

3 Further monitoring, with increased frequency, will be undertaken to determine efficacy of remedial actions. If the impacts persist, subsequent additional de-stocking and removal of infrastructure and equipment of the area will be undertaken, followed by further monitoring.

4 If the impact persists, and there is a risk of long-term detrimental effects on the surrounding ecosystem, complete removal of the infrastructure, equipment, and stock from the leased (or sublicensed) area affected will be actioned.

5.5.1 Impact Recovery Monitoring

After an impact event, management of remediation will be determined in consultation with licence holders, and in stage 2, following the requirements of the head- and sublicence. Relocation, de-stocking and, or, fallowing of aquaculture sites may be undertaken in response to an identified environmental impact. If changes are made to stock management, ongoing monitoring will be required to capture the transition from impacted to remediated conditions.

Monitoring will be undertaken seasonally at quarterly intervals. To assess recovery, data from recovery sites will be compared against those from baseline or reference sites, using appropriate statistical methods. Where relevant, the licence holder will be required to report results of the recovery monitoring to the Department on a quarterly basis, until it can be demonstrated that an appropriate level of environmental recovery has been achieved and is being maintained.

5.5.2 Removal and Recovery of Aquaculture Gear

Licence holders should develop a Rehabilitation Plan, outlining actions that will be taken if decommissioning is required. Items to be covered in the Rehabilitation Plan could incorporate input from State Government agencies, LGAs and the Port Authority.

In the event of a major storm that results in damage to aquaculture gear, licence holders will be responsible for retrieving any infrastructure and equipment damaged or adrift.

If a lease is terminated or expires, Section 101 (1) of the FRMA allows the CEO to direct the former lease holder to clean up and rehabilitate the former leased area and s.101(2) allows the CEO to complete clean up and rehabilitation works and recover reasonable costs from those works as debt due to the State from the former lease holder. Similar requirements are imposed in the sublicence for sites in Princess Royal Harbour and King George Sound.

6 BIOSECURITY

The FRMA requires all aquaculture licence holders (unless exempt under section 92A(4)) to have a MEMP, which includes biosecurity procedures.

In addition to the biosecurity principles outlined in this management policy, the biosecurity procedures outlined in the licence holder's MEMP must include, but are not limited to:

- a biosecurity management plan and associated procedures developed from the latest version of the national Aquaculture Farm Biosecurity Plan: Generic Guidelines and Template (https://www.awe.gov.au/agriculture-land/fisheries/aquaculture/farm-biosecurity-plan); and, or,
  the National Biosecurity Plan Guidelines for Australian Oyster Hatcheries (https://www.awe.gov.au/sites/default/files/sitecollectiondocuments/animal-plant/aquatic/oysters.pdf);
- aquaculture gear and vessels used (such as maintenance, disinfection processes between sites and inspections);
- stock movement procedures and record keeping;
- biosecurity emergency procedures; and
- disposal of waste (such as dead shellfish, diseased, contaminated or infected stocks).

The Albany Zone will be treated as one biosecurity unit due to the proximity of aquaculture areas and the interconnected water bodies of Oyster Harbour, Princess Royal Harbour and King George Sound. In their MEMPs licence holders are required to outline procedures for reducing the risk of disease or pest transfer between sites within the Albany Zone, according to national biosecurity plan guidelines.

6.1 Disease and Pest Management

Disease and pest prevention, rather than treatment, is vital in any aquaculture operation, but even more so in an aquaculture zone where aquaculture operations may be located in close proximity to one another.

In addition to the procedures and protocols outlined in individual MEMPs and biosecurity management plans, licence holders must comply with the following minimum requirements.

- All stock must be accompanied by a health certificate before being moved into the Zone according to licence conditions, except where an alternative arrangement is in place such as for spat obtained from the Albany Shellfish Hatchery.

- A stock health monitoring program that records mortalities reported as a percentage of total stock held, as set out in the MEMP, must be implemented

- Each licence holder must appoint a biosecurity manager, who will be responsible for ensuring biosecurity measures are implemented.

6.2 Actions in the Event of a Disease or Pest Outbreak

If a disease or pest outbreak is suspected, the following actions must be undertaken.

- The licence holder must report any suspicion or presence of disease according to section 6.3 below.

- The use of any veterinary medicines or chemicals must be in accordance with the *Veterinary Chemical Control and Animal Feeding Stuffs Act 1976*, including that the product must be prescribed by a veterinarian or approved by the Australian Pesticides and Veterinary Medicines Authority and administered in accordance with the recommended dosages.

- The licence holder must comply with relevant provisions of regulation 69 of the *Fish Resources Management Regulations 1995* (FRMR); that is:
  - the holder of the licence must take all reasonable precautions to prevent the spread of any pest, disease or condition in fish at the place where aquaculture is carried out under the licence;
  - where the holder of the licence is aware or suspects that fish at the place where aquaculture is carried out under the licence are affected by any disease or condition, that person must ensure that no water is discharged from the site to a natural waterway without the prior written approval of the CEO; and
  - the holder of the licence must ensure that fish at the place where aquaculture is carried out under the licence that the holder is aware of, or suspects, is diseased or contaminated is not removed from the site without the prior written permission of the CEO.

Reasonable precautions to prevent the spread of pests or disease should include:
- restricting vessel movements and equipment between individual sites;
- if a vessel or equipment needs to be moved between locations, then measures must be implemented to reduce the likelihood or pest or disease transfer through biofouling; and
- disinfecting equipment, vessels and barges down to and including the waterline prior to movement.

6.3 Reporting Suspicion or Presence of Disease or Pest

Under r.69 of the FRMR and standard aquaculture licence conditions, licence holders are required to report if they become aware of suspect that any fish at the site are affected by disease or any significant or unusually high levels of fish mortality, caused by disease or otherwise.

The process to report is set out below.

1 Report to the Department as soon as practicable (and within 24 hours) by calling (all hours) 1300 278 292, providing the level of mortality, signs of disease or reason for suspecting the presence of a disease or declared pest.

2 Follow the directions of DPIRD's Diagnostics and Laboratory Services (DDLS) in relation to providing reports, samples of fish, or any other relevant item.

3 Collect, retain, and provide suitable samples of the fish for confirmatory testing as instructed by the DDLS.

6.4 Aquatic Pest Reporting

If marine pests are suspected or identified, a photograph must be taken of the pest and a sample collected, if that is possible without further spreading the pest. The sample must be marked with information regarding the date, time and GPS location. Photo location and timestamp features on a smart phone should be used where possible. All information should then be reported to FISHWATCH on 1800 815 507 as soon as reasonably possible or emailed to aquaticbiosecurity@dpird.wa.gov.au

Photograph it
- Photograph before any preserving or refrigeration.
- Photograph the entire sample undisturbed and include surroundings.
- Photograph the sample close up; use an object for scale – ruler, coin, thumb.

Record it
- Location - GPS coordinates if possible.
- Date.
- Size – use object for scale.
- Colour.
- Water depth where found.
- Environment (beach, rock pools, in weed, in water, river, attached to structure).

Collect it
- Collect a sample or samples, of different sizes. Take care not to release or spread further.
- Store the sample(s) in a zip-lock plastic bag or plastic container.
- Complete a label with a pencil (date, collector's name, location, other records as above).
- Place the sample in an Eski or fridge. Do not freeze it (unless there is no other way to preserve it).

For further advice about the best ways to preserve samples for analysis, contact aquaticbiosecurity@dpird.wa.gov.au or call (08) 9203 0111.

Report it
Report through any of the following:
- FishWatch on 1800 815 507, especially if samples have been collected.
- Aquatic Biosecurity on (08) 9203 0111 or aquaticbiosecurtiy@dpird.wa.gov.au
- Local DPIRD office.

7 ADDITIONAL INFORMATION

The Management Framework is an operational document that, among other objectives set out in Section 2.1, aims to manage the sustainable development of marine shellfish aquaculture in the Albany Aquaculture Development Zone and continuously improve the procedures the Department will use to manage the Zone through an adaptive management strategy.

The Management Framework will be updated as additional information is generated and the aquaculture industry develops.

The Department welcomes comments from all interested parties including the community and stakeholders.

Comments may be addressed to:

Aquaculture Manager
Email: steve.nel@dpird.wa.gov.au

Aquaculture Management Directorate
Email: aquaculture@dpird.wa.gov.au