

ENVIRONMENTAL CODE OF PRACTICE
 for the
 SUSTAINABLE MANAGEMENT of
 WESTERN AUSTRALIA'S
 MUSSEL & OYSTER AQUACULTURE INDUSTRIES



CARING
 FOR
OUR
 COUNTRY



Government of Western Australia
 Department of Fisheries

Foreword

This is one of a series of Environmental Codes of Practice (Codes) prepared for the sustainable management of the Western Australian aquaculture industry. It allows industry members to demonstrate that they are operating within the principles of Ecologically Sustainable Development (“ESD”). These voluntary Codes also aim to increase Government’s and the broader community’s understanding of the WA aquaculture industry and to emphasize that industry members are aware of their obligations to the environment and the community. The Code also has relevance to aquaculture in other states and countries by providing benchmarking on environmental performance.

Earlier versions of these Codes were developed using the *National ESD Reporting Framework for Aquaculture* (“How-to Guide” Fletcher et. al 2004), generated by the Fisheries Research and Development Council subprogram in conjunction with the Aquaculture Committee of the Australian Fisheries Managers Forum and the National Aquaculture Council (the national peak industry representative body).

This Code has been revised and updated through funding from the Australian Government’s ‘*Caring for our Country*’ initiative which funds projects across the country to achieve national targets – projects that improve biodiversity and sustainable farm practices (www.nrm.gov.au/).

This is the revision and expansion of the 2003 Environmental Code of Practice prepared by the Western Australian Mussel Producers Association Inc., the Aquaculture Council of WA in conjunction with the Environment Australia (Department of Environment and Heritage). It includes an expansion to cover edible oysters. (Published by DoF and ACWA)

Cover photos: Courtesy of Aquaculture Council of Western Australia and Blue Lagoon Mussels.

Contents

1.0 INDUSTRY COMMITMENT TO SUSTAINABILITY	5
2.0 SCOPE OF OPERATIONS	7
3.0 LICENSING FOR ENVIRONMENTAL MANAGEMENT	7
3.1 Department of Fisheries (Lead Agency).....	7
3.2 New Applications.....	9
3.3 Local Government Approvals.....	10
3.4 Commonwealth Government	11
3.5 Annual Renewals and MEMP Reporting.....	12
3.6 Interactions with other Aquaculture Users	12
3.7 Interaction with Non-Aquaculture Users (Community Relations)	13
3.8 Native Title & Heritage Areas	13
4.0 FACILITY OPERATIONS AND RISK MANAGEMENT	14
4.1 Infrastructure installation, commissioning, operation & maintenance	14
4.2 Environmental Aspects and Risk Assessment	15
4.3 Visual, Noise, Lights, Air Quality, Dust & Odours.....	16
4.4 Sea-based: Tidal flows and Seafloor Erosion	17
4.5 Use of Energy & Raw Materials.....	18
4.6 Proximity to Sensitive Water Resources & Fauna/Habitats	18
4.7 Sea-bed Damage or Shading of Benthic Habitats.....	19
4.8 Navigation hazards.....	21
4.9 Decommissioning & Rehabilitation.....	21
5.0 MINIMISING IMPACTS ON THE ENVIRONMENT DURING PRODUCTION	22
5.1 Routine Operational Procedures & Annual Schedule.....	22
5.2 Wild or Domesticated Seedstock & Broodstock and GMOs.....	22
5.3 Natural Foods & Carrying Capacity	23
5.4 Health Management & Animal Welfare	23
5.5 Biosecurity, Translocation & Sanitation.....	26
5.6 Equipment Loss	28
5.7 Escape of Cultured Animals	28
5.8 Interactions with Threatened, Endangered & Protected Species	29
5.9 Behavioural Changes on Local Species.....	30
5.10 Biofouling of Structures.....	30
5.11 Hydrocarbons, Chemicals & Therapeutants	31

5.12 Emergency Procedures & Security	33
6.0 WATER QUALITY & WASTE MANAGEMENT.....	33
6.1 Water budget, inlet & effluent quality	33
6.2 Control of Sea-based Sediments from Waste Feed & Faeces.....	33
6.3 Stock mortalities, unsaleable product (culls) & processing wastes disposal	34
6.4 Sewage	35
6.5 Rubbish & pest control	35
7.0 REFERENCES.....	36
ANNEX 1: ENVIRONMENTAL POLICY	38

1.0 INDUSTRY COMMITMENT TO SUSTAINABILITY

This Environmental Code of Practice is the latest initiative of the Aquaculture Council of Western Australia to demonstrate the industry's commitment to sustainability. This Code is science-based and will be reviewed regularly with respect to changes in government requirements or community values. This continuous improvement approach further reflects industry's desire to remain at the forefront of good practice.

This Environmental Code of Practice:

- Will enhance aquaculture development in rural and regional Western Australia by bringing the standard of practice of farmers up to a specified acceptable level,
- Provides a mechanism for environmental self-regulation of WA aquaculture as a valuable alternative to detailed regulation of every aspect of the industry's activity,
- Suggests auditable environmental parameters that relate directly to Ecologically Sustainable Development objectives,
- Ensures transparency of the industry's operation with regard to its effects on the environment,
- Specifies the legal requirements including the licence condition imposed under the *Fish Resources Management Act 1994* ("FRMA") and the *Environment Protection Act 1986* ("EP Act") – this includes the new requirement of annual reporting of their Monitoring & Environmental Management Plan (MEMP¹) for their farm or facility. The MEMP requires a detailed environmental impact assessment, and
- Could lead to the development of a system of environmental accreditation for those enterprises seeking it, e.g. ISO 14001, Best Aquaculture Practice, Global GAP, Aquaculture Steward Council and others.

A Code of Practice is not a legal document; however, nothing in this Code exempts or varies the requirements of mussel and oyster aquaculture. Licensee is to comply with all their legislative requirements, specifically with the prevention or mitigation of environmental harm.

The focus is on best practice through a documented environmental management system (EMS) and recommends a continual improvement requirement where the business periodically reviews and evaluates its EMS to identify opportunities for improvement and their implementation.

An aquaculture business can demonstrate conformity with this Code by undertaking an Internal Audit (using the ACWA Audit Checklist which is available on the ACWA website: www.aquaculturecouncilwa.com) followed by a self-declaration by the Licensee.

¹A major requirement is for the Licensee to determine the operational objectives, performance measures and indicators that will be used to assess their business's performance against environmental management requirements. Most importantly is the requirement for the Licensee to make appropriately detailed justifications for the levels of activity chosen and the methods they will use to manage and monitor environmental impacts

A more robust and independent method is for the business to seek confirmation of its conformance by external parties, such as customers, government agencies or the peak industry body Aquaculture Council of WA (ACWA) using the ACWA Audit Checklist or other auditing tools. The person undertaking such an audit would be a qualified independent auditor approved by ACWA.

A third option is for the business to seek certification/registration of its environmental management system by an external organization (e.g. ISO 14001, or other international standard).

When followed and independently audited, this code provides assurance to all stakeholders, consumers and the general public, that Western Australia's mussel and oyster aquaculture is a responsible sector, one producing a range of products of which WA can be justifiably proud.

Through this Code participants in Western Australia's mussel and oyster aquaculture industries are encouraged to:

- Support industry research into environmental issues,
- Achieve and where practicable, go beyond compliance with all legislation and licence conditions,
- Ensure that products are produced, packaged, delivered, disposed of and recycled in an environmentally responsible manner,
- Minimise use of raw materials and energy,
- Design their production systems to minimise adverse environmental impacts,
- Take into consideration environmental impacts of new or expansion projects at the planning stage,
- Provide management and employees with appropriate levels of training and education; in environmental awareness,
- Require employees to accept responsibilities for environmental management as a part of their job description, and
- Conduct reviews at appropriate intervals.

Operating under this Code is likely to further reduce the potential environmental impacts of mussel and oyster aquaculture and improve the profitability of existing and new facilities through reduced operating costs. Performance-based monitoring ensures more appropriate criteria are imposed on individual licensees, which can ultimately save the industry significant costs.

Definition of terms: “**Must**” and “**Should**”:

- Where a recommendation in this Code is expressed using the word “**MUST**”, it is a statement reflecting existing legal obligation for licensees, who will already therefore be compliant with the appropriate provisions as a matter of law.

- Where a recommendation in this Code is expressed using the word “**SHOULD**”, it implies all Licensees are obliged to follow the recommendation if they wish to remain compliant with the provisions of this Code.

2.0 SCOPE OF OPERATIONS

It is the responsibility of the Licensee to describe the intended purposes of the business and to specify the particular operational practices to be adopted – this is termed the Scope of Operations.

A well written scope describes the:

- **Nature of the business’s activities, products or services,**
- **Scale of operations (such as annual production capacity),**
- **Location(s) where and the conditions in which it operates,**
- **Significant environmental aspects or impacts the business has identified for control, and**
- **Objectives² and targets for the business to manage its continual improvement.**

The scope also provides guidance on the level of detail of documentation which should be commensurate with the scale of operation, with a small owner/operator having minimal documentation, whilst larger operations employing many workers would require written documentation for its activities.

3.0 LICENSING FOR ENVIRONMENTAL MANAGEMENT

It is the Licensee’s obligation to ensure the aquaculture business is operated according to all legal and regulatory requirements.

3.1 Department of Fisheries (Lead Agency)

As the lead agency for managing aquaculture, all applications for aquaculture licences in Western Australia are assessed, reviewed and issued by the **Department of Fisheries (DoF)** under the provisions of the *Fish Resources Management Act 1994 (FRMA)* and subsidiary legislation. A copy of the FRMA is available at: http://www.slp.wa.gov.au/legislation/statutes.nsf/main_mrtitle_345_homepage.html DoF has issued a number of guidelines and information documents on their requirements, for example *Fisheries Ministerial Policy Guidelines No. 8 Assessment of applications for authorisations for Aquaculture and Pearling in coastal waters of Western Australia* has been issued pursuant to Section 246 of the *Fish Resources Management Act 1994* and Section 24 of the *Pearling Act 1990 (Amended December 1998)*.

² These objectives are usually mentioned in the business’s **environmental policy** (refer to Annex 1 for more information).

Ministerial Policy Guideline No. 8 sets out the assessment process for aquaculture proposals in the aquatic environment within WA. The Aquaculture licence application process considers inputs from a wide range of stakeholders including any government department or agency which may have an interest in the location sought under an application. The process also considers inputs from other stakeholders including competing interest groups such as commercial and recreational fishermen, conservation groups, charter boat operators, tourist groups and local residents. The final decision for the granting of an Aquaculture Licence lies with the Chief Executive Officer of the DoF.

Monitoring and Environmental Management Plans (MEMPs) are now required under Section 92A of FRMA. Recent changes include:

- Applications for a new aquaculture licence must be accompanied by a MEMP (refer 3.2).
- Current licence holders **MUST** submit a MEMP by 30 November 2013, unless exempt under Section 92A (4) of the *Western Australian Fish Resources Management Act 1994* (refer to section 3.5)

The **Environmental Protection Authority (EPA)** has statutory obligations under Part III and Part IV of the *Environmental Protection Act 1986* to conduct environmental impact assessments, initiate measures to protect the environment from environmental harm and pollution. Large or environmentally significant aquaculture proposals (e.g. those in sensitive locations), are referred by DoF to the EPA for assessment.

In the case of land-based farming or support facilities, aquaculture also requires planning approval from the relevant LGA (refer 3.3).

Whilst most land-based sites are located on privately owned land, some require easements over State-owned land, particularly for water intake and outflow pipes. Although private ownership normally confers exclusive use of the actual culture or support facilities site, other stakeholders may well be affected by the pipeline easements over State land.

The **Department of Environment Regulation (DER)** and **Department of Parks and Wildlife (DPW)** are State government departments with broad responsibility for biodiversity conservation under the *Conservation and Land Management Act 1984* and for environmental regulation under Part V of the *Environmental Protection Act 1986*. This includes management of the State's national parks and marine parks, clearing of native vegetation, natural resource management, climate change actions, contaminated sites, preventing and responding to pollution, industry licensing and works approvals. These departments are also responsible for ensuring safety of marine mammals, e.g. dolphins, seals, whales, and migratory birds, in the vicinity of aquaculture facilities and for ensuring that the ongoing operation of any aquaculture facility is conducted responsibly and without detriment to the environment.

Department of Water (DoW) manages Western Australia's water resources. This is achieved through policy development for the best use of the state's water, providing water services, assessing and advising on how much water is available for use and the options to meet demand, encourages water conservation and promotes clever use of alternate water sources, integrates water planning and land use planning, and protect and improve water resources. DoW has a

significant input in the granting of aquaculture licences (land based) and in the conditions contained in those licences.

The **Department of Transport (DoT)** is responsible for ensuring that the aquaculture industry does not adversely affect the safe operation of the maritime industry in coastal waters. The locations of marine farms, being in areas frequented by large ocean-going vessels and smaller recreational vessels, have the potential to cause problems for those other stakeholders. With land-based farms, the locations of pipelines and intakes or outfalls also have the potential to cause problems for other stakeholders. It is the role of the DoT to ensure that the licensing process takes account of those issues and, if an aquaculture licence is granted, that adequate notice is provided to mariners of the existence of the aquaculture site and pipelines and that they are adequately marked to ensure the safety of all stakeholders. The DoT has established standards of lighting for aquaculture sites and those standards are normally adopted by the authority responsible for the management of the waters in which the facilities are located.

These Government agencies and others involved in the approval process are summarised in the ACWA document “*AUD-021 Register of Legal Requirements*” which is available on the ACWA website.

3.2 New Applications

Prior to the construction of any new facility, a comprehensive site evaluation and facility design test **SHOULD** be conducted to determine if the proposed site’s characteristics are suitable for the construction and sustainable operation of mussel and oyster farms or hatcheries. Impacts during the construction phase also need to be considered.

The application **SHOULD** comply with this Code.

Development approval **MUST** be obtained from the relevant local planning authorities before any construction work commences (refer 3.3).

Applicants **MUST** ensure appropriate and sufficient information is provided as part of any application for a new site or facility (or expansion of existing) which may include:

- How the location is suitable for the culture species and operations planned,
- How the area applied for is adequate and sufficient,
- How the culture equipment is designed to withstand local conditions (statements of its suitability) and to reduce impacts on the environment,
- Identify and assess all potential environmental impacts resulting from the construction and installation of infrastructure as well as during operations) e.g. potentially noisy equipment is housed to minimise noise impacts and there are appropriate controls for waste management),
- List appropriate controls for impacts on habitats (both aquatic and terrestrial), protected animal interactions, noise from equipment, vehicles and vessels and waste management,

- A draft MEMP. Refer to section 92A (2) of the *Fish Resources Management Act 1994* for MEMP inclusions. A link can be found in the references of this document and on the ACWA website,
- The facility's annual schedule of operations and routine operational procedures, and
- How other site-specific issues regarding impacts on habitats will be addressed such as:
 - evaluating the hydrologic features including tidal patterns, freshwater influences and flood levels, offshore currents and existing water uses as well as requirements for reuse/recycling,
 - existing water quality characteristics of waters (coastal, river, lake, ephemeral, flood zones) in the vicinity of the site,
 - the suitability of topography, soils and ecosystem for location and construction of farm structures,
 - acquiring long term climate records to determine the likelihood of drastic events such a flood, droughts, or severe storms that could negatively impact the project,
 - surveying the existing flora and fauna with particular concern for effects from the project on ecologically sensitive areas such as migration routes and nesting grounds or protected areas such as parks and refuges,
 - availability of appropriate services, for example freshwater, three-phase electricity, telephone and postal services, sewerage, road and rail services and veterinary assistance, and
 - considering alternatives to mitigate potential negative environmental impacts and to alleviate conditions not conducive to farm construction and operation.

Applicants MUST incorporate a baseline data-gathering exercise on sediment quality to inform the application assessment process as well as provide the basis upon which the MEMP will be prepared. The aquaculture farm will need to consider hydrodynamic modelling and ecological monitoring, including trigger points and management responses. In most cases, the provision of the information will require a suitably qualified and experienced environmental consultant. Large scale activities that require referral to the EPA will require additional information. There is currently no definition for 'large scale' operation or 'significant environmental impact' as each operation is currently assessed on a case by case basis. This is due to the variation of each type of operation and the sensitivity of the environment that the operation may impact.

Baseline data MUST be collected over a three-six month period, in some cases up to 12 month period, to take into consideration any seasonal variations and include sample collections possibly every four to six weeks over this period. Guidance statements relevant to the level of information required in applications for new marine sites are available from DoF.

3.3 Local Government Approvals

Local Governments have an input during the licensing process for applications on crown or private land. They have a right to ensure that any aquaculture proposal fits in with local objectives. Some Local Government Authorities ("LGAs") have a planning policy that includes the process of assessing an application for an Aquaculture Licence. In the absence of an

aquaculture policy, case-by-case decisions can be made, but such cases normally cause substantial delays in the decision-making process.

LGAs may seek advice from the DoF, DER and DoW as part of their approval process and will refer proposals to the DoW for advice where aquaculture facilities are located in public drinking water source areas, Waterways Management Areas or near sensitive water resources (such as rivers, estuaries and wetlands).

If there is the likelihood of significant environmental impact, the proponent and LGA have an obligation to refer the proposal to the EPA for formal environmental impact assessment. Such proposals will require additional information to ensure all aspects of nutrient and waste management are considered. In these cases the EPA may recommend that the aquaculture site can be operated only under certain specified conditions. A time frame and an appeals period are associated with this process.

Any land-based aquaculture or support facilities require planning approval from the relevant LGA. Thus, proposals MUST be initially submitted to the local government, where they will be assessed for consistency with town planning schemes, local planning policies and local health regulations. Some LGAs levy planning fees and charges.

Marine aquaculture operations will invariably require land-based support facilities such as feed or equipment stores, maintenance areas, workshops, laboratory, accommodation and offices, so access to these buildings as well as appropriate utilities and services (water, electricity, communications, etc.) SHOULD be assessed prior to leasing or purchasing a site.

3.4 Commonwealth Government

Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) administers the export of Australian animals and plants and their products through the *Wildlife Protection (Regulation of Exports and Imports) Act 1982*. All aquaculture products fall under that legislation and, as such, exporters MUST satisfy Environment Australia that its operation meets all of its provisions. Legislation now requires a greater level of proof that the operation of any industry satisfies the environmental standards administered by SEWPaC. The principle of Ecologically Sustainable Development (ESD) is a prime concern for SEWPaC, ensuring that any developments do not include activities or processes which cannot be reasonably assimilated by the environment and by the populations of animals with which such developments interact, either directly or indirectly.

Food Standards Australia and New Zealand (FSANZ) is a bi-national Government agency. FSANZ develop and administer the *Australia New Zealand Food Standards Code*, which lists requirements for foods such as additives, food safety, labelling and GM foods (refer to link at rear of report). Enforcement and interpretation of the Code is the responsibility of state and territory departments and food agencies within Australia and New Zealand.

The **Australian Department of Agriculture, Fisheries and Forestry's (DAFF)** role is to develop and implement policies and programs that ensure Australia's agricultural, fisheries, food

and forestry industries remain competitive, profitable and sustainable. The **Australian Quarantine and Inspection Service (AQIS)** is a department within DAFF, responsible for managing quarantine controls at our borders to minimise the risk of exotic pests and diseases entering the country through import inspection and certification, and to meet requirements of different export markets for Australian products in terms of health and export certification. To import aquaculture feeds, and or feed ingredients, an import permit **MUST** be obtained prior to importing the feed. See references for link to DAFF website.

3.5 Annual Renewals and MEMP Reporting

Licences are subject to annual fees and conditions set by the DoF and possibly the LGA in which the culture site is vested. Retention of an aquaculture licence depends, to some extent, on the applicant's justification for the area, with emphasis on what will be produced and over what time period. Conditions applied to aquaculture licences ensure that the community will draw some benefit from the allocation of public facilities (e.g. beach easements) to aquaculture licence applicants. The renewal of an aquaculture licence is currently an annual event and is a right, provided that the licensee continues to perform according to the licence conditions.

A major requirement of the legislation is the annual report on the Management and Environmental Monitoring Plan (“MEMP”).

The WA Department of Fisheries has a policy requiring all Licensees appropriately use their aquaculture sites or relinquish them after a period of inactivity (this does not refer to aquaculture on free hold properties). This policy ensures that the community receives the best return for the allocation of such areas of water. Thus Licensees **MUST** demonstrate that land and/or water allocated to them is being used appropriately.

Licensees **MUST** collect and retain specified information on their operations and to sign off that they have been acting in accordance with MEMP, licence conditions and the intent of this Code.

DoF will require licensees of aquaculture activities to provide results of the MEMP in an annual report. DoF will analyse these reports and report summary results to DER. DoF may in some circumstances require an independent audit of MEMPs.

The Licensee **SHOULD** (in some cases **MUST** i.e. biosecurity) ensure all farm employees are aware of their obligations to comply with the requirements specified in this Code and in other legislation (this is also covered in Section 7.8 Competency & Training).

3.6 Interactions with other Aquaculture Users

As the aquaculture industry grows, there will be a need for strategic aquaculture planning and zoning. Distances between facilities and support facilities will require consideration to minimise disease transfer (covered in the farm's biosecurity plan, refer Section 5.5) as well as avoid / minimise the alienation of large areas of waters or lands.

As part of the application process (Section 3.1), the proponent as well as existing Licensees SHOULD (MUST depending on the location) consult with DoF on their plans for regional carrying capacity options, Area Management Zones, Catchment Management Plans, zoning, etc.

3.7 Interaction with Non-Aquaculture Users (Community Relations)

Unfortunately negative attitudes prevail among some sectors of the community particularly with regard to access and amenity values of areas close to farms. The area of sea and/or land occupied by facilities could cause a perception, by some, that the industry occupies an excessively large area, and this perception could cause opposition towards the industry in some quarters.

The operation of marine facilities can affect other groups such as indigenous, recreational and commercial fishers, by limiting their access to some waters – this is termed ‘Alienation’. Likewise, land-based facilities or support facilities are often close to areas of water for which there is a multitude of potential uses, mainly as recreational and occasionally other professional activities such as tourism, fishing, yachting and shipping (navigation issues are discussed in Section 4). Additionally, these would likely be located behind security fencing and would deny access to other stakeholders; similarly intake and outfall pipelines or canals running across beaches or the banks of waterways would also interfere with public access, however, usually this is undertaken on privately-owned or leased land.

As part of the application process (Section 3.1), the proponent MUST consult with existing user groups and regulatory bodies prior to finalising their Aquaculture Licence applications, to identify the main conflicts and areas of interest as early as possible. Where possible, these conflicts SHOULD be resolved at an early stage.

For operating farms, the Licensee SHOULD ensure that aquaculture facilities utilise their allocated areas to the maximum sustainable level and avoid conflicts of space allocation with other stakeholders.

Sound public relations and education efforts SHOULD be practiced by the aquaculture industry to ensure that the local communities are well-informed about all relevant aspects of the industry and thus ensure that they continue to receive significant support from the local population.

3.8 Native Title & Heritage Areas

WA Native Title (State Provisions) Act 1999, seeks to ensure that any developments after the enactment of that legislation recognise pre-existing Aboriginal connections with the location where such developments are planned. Thus future developments would have to take account of Native Title requirements.

Other state and federal legislation requires that any planned developments take account of other features which are considered to be of historical value. The likelihood of such areas being found within existing aquaculture sites is considered extremely remote.

Licenseses **MUST** comply with legislation associated with Native Title and Heritage Areas. Before any new developments are allowed to proceed, the local Aboriginal communities and other community groups are consulted through the Ministerial Policy Guideline (“MPG 8”), through the WA Department of Fisheries. MPG 8 is a comprehensive assessment procedure for each aquaculture development proposal in coastal and marine waters to establish what, if any, Heritage Areas of special significance exist in the region, and steps taken to avoid conflicting with them. This includes an analysis by departmental staff, a public comment phase and, where necessary, it may trigger an environmental assessment under the State’s *Environmental Protection Act 1986*. A copy of MPG 8 can be downloaded from http://www.fish.wa.gov.au/Documents/ministerial_policy_guidelines/fmpg008.pdf.

4.0 FACILITY OPERATIONS AND RISK MANAGEMENT

Information presented in this section aims to assist mussel and oyster Licenseses identify the associated potential environmental issues of their activities. Operational requirements are also included to assist farmers meet their general environmental duty of care requirements through the control of these issues.

4.1 Infrastructure installation, commissioning, operation & maintenance

Infrastructure, plant and equipment **MUST** be suitable for the intended purpose and comply with existing regulatory requirements. This includes appropriate surveys for boats or vessels, and licences for moving plant & equipment such as tractors, forklifts or trucks.

All infrastructure, plant and equipment **SHOULD** be manufactured to meet or exceed site-specific operational requirements.

All infrastructure, plant and equipment **SHOULD** be installed in accordance with manufacturer’s instructions, where these are available, using appropriately qualified and experienced installers or technicians.

The design of floating culture equipment (e.g. pens, longlines, rafts, etc.) **SHOULD** be determined according to site conditions.

Moorings and anchor lines **SHOULD** be of a type compatible with the culture system (pen, longline or other floating installations etc) being used.

Moorings and anchor lines **SHOULD** be consistent with the type of seabed at the site.

Moorings and anchor lines **SHOULD** be designed, constructed and installed by a qualified specialist (e.g. mooring engineer) to withstand stresses imposed by local tidal and, or, water movement.

Every mooring and anchor line component SHOULD be inspected according to a regular and recorded plan.

The site SHOULD be sheltered and not overly exposed to strong prevailing winds or significant wave action. Exposed sites (such as those offshore) require culture equipment that are suitably specified for site conditions (such as maximum expected wave height and period).

Depending on the depth of the bottom of the culture equipment and the prevailing currents, at least 2m clearance between the bottom and the sea floor at low tide SHOULD be maintained to minimise any deposition of wastes under the culture equipment. In areas of very high tidal variation, exemptions may be considered by DoF.

4.2 Environmental Aspects and Risk Assessment

All industries and other human activities affect the environment in which they occur. Society accepts that such activities have a cost in terms of changes which will inevitably happen; however there is an expectation that reasonable attempts are made to mitigate against the adverse changes.

The key issue in this process of risk assessment is the ecological sustainability of any developments or changes, and the management of any identified risks through the development of a robust Environmental Management System (EMS).

To estimate the type and quantum of changes which may occur as a result of aquaculture production, all component activities associated with site selection, design, construction and operations SHOULD be examined in detail, to determine whether the predicted changes are necessary, desirable, or whether they can be mitigated against or even prevented.

Applicants and Licensees MUST undertake a detailed Risk Assessment and determine the significant environmental aspects or issues for their operations or activities. Many of the potential environmental risks/hazards are described in this Code, and both the DoF Aquaculture Branch and ACWA have publications which adequately describe the process of risk assessment and risk management (e.g. Fletcher 2004).

For example, environmental issues associated with the construction and operations of land-based facilities may include machinery and equipment noise, ecological issues such as impacts on vegetation (both aquatic and terrestrial for support facilities), animal interactions and general waste. With respect to managing the seabed and associated habitats for marine aquaculture, Licensees could undertake biomass and/or feed limitations or routine water quality and sediment monitoring as stated in the MEMP.

Licensees MUST incorporate specific monitoring criteria and strategic management responses in the MEMP to ensure their activities are managed so they will not result in unacceptable impacts to the environment.

4.3 Visual, Noise, Lights, Air Quality, Dust & Odours

Visual

Aquaculture facilities can operate near centres of human habitation or leisure activities. Their associated buildings, grow-out tanks or pens, sheds and pipelines may be considered unsightly by some people and so there is a need to mitigate against the visual impact of facilities and support facilities in the interests of the attitude of the community towards them.

The dominant visual issue for aquaculture sites is likely to be from activities occurring at a distance of less than one kilometre from the site. This will be reduced if appropriate culture infrastructure is used, for example the use of low-profile buildings that blend in with natural surroundings, the use of environmentally compatible colours, or by utilizing natural topography to hide structures where possible.

Farms **SHOULD** seek to minimise impacting visual amenity by ensuring appropriate consultation with local stakeholders during project development.

Local communities **SHOULD** be surveyed to determine existing resource use patterns and whether there are specific areas where the facility **SHOULD** not be located.

Where possible, operators **SHOULD** use low visibility, dark coloured netting and equipment as well as undertaken regular maintenance to minimise visual impacts.

Where it makes commercial sense, sharing of infrastructure between adjacent farms **SHOULD** be considered.

Noise

Noise could be of concern to neighbours or protected wildlife during construction as well as operation of an aquaculture facility. With marine facilities noise will likely emanate from the large boats used to install moorings and infrastructure and during feeding, grading or harvesting operations. With a land-based facility issues can include noisy machinery (e.g. pumps) or devices (e.g. bird scarers) and their effects neighbours or sensitive fauna. Another important consideration is the effects of noise on workers.

Licensees **MUST** be aware of and observe the Noise Regulations under the *Environment Protection Act*.

Service infrastructure, such as land-based facilities, is covered by regulations; however, vessels accessing the marine based site are not. Marine Licensees **SHOULD** contact the Department of Transport (Marine Safety) for advice on minimizing noise emanating from vessel noise.

Marine Licensees **SHOULD** minimise noise disturbance to cetaceans, seals and turtles from operations. Advice can be sought from the Department of Environment Regulation (DER).

Licensees **SHOULD** operate vehicles and boats at appropriate speed limits to assist in reducing noise emissions and maintenance of noisy equipment.

Lights

Lighting around land-based facilities is primarily required for operational purposes but this is unlikely to be much of an issue in regards to impacting sensitive species. Likewise with lighting around marine facilities which is primarily required for navigational purposes. However, Licensees SHOULD try to address any concerns raised by other stakeholders.

Air Quality, Dust & Odours

The placement of most facilities will generally be away from any residential areas; however, it is important to consider whether the operation of the facility includes sometimes smells or odours from mortalities, back flush water, processing wastes, etc.

Licensees MUST be aware of and observe the Air Emissions Regulations under the *EP Act 1986*.

Licensees may wish to treat sludge or net waste into a biosolid. During storage, these solids can degrade and produce dangerous levels of hydrogen sulphide, methane and hydrogen gases.

Therefore, Licensees SHOULD consider control techniques including:

- Minimise the amount of sediment to be disturbed,
- Allow tanks or pond sediment to dry sufficiently prior to disturbance,
- Not disturbing net fouling wastes or sediments that are likely to be odorous when wind direction and strength will carry the odour to sensitive places,
- Consult with local government and developers to ensure adequate buffer zones or windbreaks around working areas are provided, and

4.4 Sea-based: Tidal flows and Seafloor Erosion

The type and amount of hydrodynamic data needed for a marine site will vary depending on the local and regional annual variations in conditions. Sufficient data needs to be collected for input into relevant models to obtain suitable predictive forecasts of water flows. Guidance is available from DoF.

Licensees SHOULD prevent erosion of the seafloor or deflection of food supply (i.e. algae and plankton) from large-scale or significant changes to water circulation patterns of currents and tidal flows arise from their aquaculture operations.

Licensees SHOULD consider control techniques including:

- Except where exemptions by DoF apply, facilities are located away from rock outcrops or coral bottom or seagrass beds (except for AB ranching),
- The culture equipment and moorings are located to allow an adequate flow of clean water through the nets, longlines & droplines, baskets, bags and ropes,
- Use of specialised anchoring systems to reduce the foot-print on the seafloor,
- Moorings, anchor warp and its attachments do not drag on the bottom causing erosion or damage to epiphytes,
- Water currents are sufficient to flush away wastes from beneath the culture equipment to minimise localized sediment build-up. In instances where this is not possible, fallowing regimes will be required,

- A regular maintenance schedule to ensure that all attachments are inspected and replaced routinely, minimising the chance of equipment breaking free, and
- The bottom of suspended culture equipment has a minimum clearance of at least 2m above the seafloor (unless prior approval from DoF for farms in areas with large tidal ranges).

Bivalve farmers SHOULD maintain a minimum distance between longlines and culture units (e.g. drop lines, mesh panels, baskets and bags, artificial habitat) to ensure that adequate food reaches all sections of the facilities and that has the effect of ensuring that there is little chance of affecting water flow through their farms.

4.5 Use of Energy & Raw Materials

It is important for aquaculture facilities to consider future energy consumption and its energy efficiency rating. Responsible energy management involves Licensees and their employees being aware of energy usage and patterns.

Licensees SHOULD isolate and remedy energy wastage and minimise unnecessary energy usage. Licensees are encouraged to use alternative power sources, including solar and wind power.

Licensees SHOULD consider their carbon consumption and emissions when assessing their operations (both inputs and outputs).

Licensees SHOULD consider methods to minimise use of raw materials (metals, wood, cement, etc.)

4.6 Proximity to Sensitive Water Resources & Fauna/Habitats

Section 3.8 discusses Native Title and Cultural Heritage Areas.

Sensitive Fauna & Habitats

The DER SHOULD be consulted for its position for the assessment of large-scale operations or those adjacent to sensitive habitats.

Applicants and Licensees MUST consider whether their applications or operating facilities are located close to:

- Sensitive fauna (e.g. migratory seabirds, seals and turtles);
- State Parks, Wetlands or Marine Conservation Reserves;
- Habitats associated with sensitive ecological communities (e.g. coral); or
- Breeding colonies of protected species. For example two bird-breeding sites are located near sectors of the Albany region mussel industry – a Pelican rookery on Green Island in Oyster Harbour and a Penguin rookery on Mistaken Island in King George Sound. Both islands are Class 1A Nature Reserves. Approval by DOF and Albany Port Authority has allowed mussel leases within close proximity of these islands.

No bird breeding sites are known to exist within a distance of the Cockburn Sound mussel industry which would cause interference with breeding birds. The Houtman Abrolhos Islands, the main site of pearl producers, are an A-class nature reserve which aims to protect coral reef and island habitats and minimise human impact.

Applicants and Licensees **MUST** ensure appropriate information is provided in their MEMP on:

- Details of the benthic habitats within and adjacent to the proposed site;
- Details of the sensitive species found associated with these habitats; and
- Data, where available, on likely sensitive species, potential interactions and management responses.

In managing the site and associated habitats, Licensees **MUST** work in accordance with their licence conditions and monitoring protocols. These may include:

- Abiding by any biomass and, or, feed limitations;
- Use of non-harmful methods to exclude protected wildlife (e.g. fences, nets, etc.);
- Location of facilities or transport roads/seaways an adequate distance from any rookeries to ensure that no interference with their breeding occurs;
- Reduction of vehicle or vessel speeds close to breeding areas during breeding periods; and
- Undertaking routine water quality and sediment monitoring as stated in the MEMP

Marine Protected Areas and World Heritage Areas

At present there is a marine finfish lease and several pearling leases within Marine Parks; and pearl licences in Shark Bay that are located within a World Heritage Area. The current standards under which the industry operates are considered likely to be adequate to permit most aquaculture based on natural feeds to continue within the general use areas of Marine Parks and World Heritage Areas.

4.7 Sea-bed Damage or Shading of Benthic Habitats

The establishment of a marine farm involves minor seabed disturbance during the installation of anchors for longlines or moorings or wooden posts for shellfish. The seabed recovers to its original state quite rapidly and, apart from the presence of the anchors, no evidence of a long-term effect has been observed.

Aquaculture infrastructure can cause shading of habitats such as seagrass, seaweed, coral or mangrove communities resulting in a decrease in the intensity of light reaching the bottom due to the presence of culture equipment or increased turbidity. Shading can also be caused by an increase in epiphytic growth on the seagrass fronds, seaweeds or corals caused by nutrient enrichment.

Some Licensees are currently required to monitor some minor areas of seagrass with their farm boundaries.

Sediments provide a good indication of the dynamic nature of the site. As a general rule, sites SHOULD be selected with good water flows, adequate depth and coarse sediments.

Damage to benthic habitats such as coral or mangrove communities MUST be avoided.

Licensees SHOULD be familiar with water quality parameters for their stock and be able to recognize visual and behavioural indicators of poor water quality.

Licensees SHOULD consider control techniques including:

- No unacceptable impacts are detectable outside the licensed area;
- Environmental monitoring is carried out to recognize and mitigate any possible negative impacts on mangroves and other ecologically important ecosystems. The parameters measured and the monitoring interval may be varied, depending on the system, species and stage of development and the MEMP; and
- Should any parameters depart from the acceptable range, steps are immediately taken to identify the problem and affect a remedy as soon as possible.

Removal of any abandoned or disused cultural equipment in the existing operational farm MUST be undertaken.

Input of nutrients or particulates from facilities could affect benthic plant or animal communities underneath marine sites or in the immediate vicinity of the outfall of land-based sites. So long as nutrient input is controlled, and the majority of particulates are removed, ecological impacts are likely to be small and, if present at all, would be restricted to an extremely small area near the vicinity of the outfall. Other concerns can be modification of the sediments or structural disturbance of the seabed (these are discussed in Section 4.4).

Change in Habitat Structure FADs

The presence of net pens, longlines and other culture units creates an artificial structure in the water column where there was none previously. The establishment of fish aggregation devices (FADs) is permanent for the life of the farm, but the modification of the bottom is generally considered to be temporary.

The establishment of bivalve longlines and droppers, or racks, baskets or barrels provides an increased surface area for plants and animals which require a hard surface to which to attach. Some algae are known to develop on bivalves during the culture period, but it rarely reaches significant biomass per dropper. No seagrasses have been observed growing on bivalve longlines. Any settlement and development of algae is of a temporary nature in as much as the epibiota is removed during harvest and returned to the water.

Licensees SHOULD have a monitoring system in place to monitor changes in habitat structure within area affected by the farm and take appropriate action as deemed necessary under the requirements of the MEMP.

4.8 Navigation hazards

Marine aquaculture involves the installation of floating infrastructure and underwater mooring or anchoring systems (including pipelines) in areas that could pose an increased navigational hazard. These facilities are therefore required to install surface marking and lighting that complies with a prescriptive standard.

Licensees **MUST** comply with the *Guidance Statement for Determining Categories of Marking and Lighting for Aquaculture and Pearling Leases/Licenses (2009)*, refer to link at rear of Code, and lodge it together with the Application for an Aquaculture Licence at DoF. Consultation may be required with Department of Transport and the local Port Authority.

Leases **SHOULD** be located outside of favoured navigation routes and avoid areas where there may be a risk of vessels running into it, particularly at night. The farm may also incorporate a mooring site for vessels.

Aquaculture leases do not confer exclusive access to the lease area; therefore, other marine users are allowed to navigate/access the site. Providing a navigable pathway through large sites **SHOULD** be considered for the safety of the other users and to prevent equipment losses.

Navigation lights and others markers **MUST** be maintained.

4.9 Decommissioning & Rehabilitation

Processes need to be in place in the event that the site ceases to operate as an aquaculture facility and rehabilitation is required.

In some cases, Licensees holding an aquaculture lease, as stated in Section 97 of the *Fish Resources Management Act 1994*, **MUST** deposit a bond with the Western Australian Department of Fisheries which will cover site clean-up costs in the event that the site is abandoned.

Licensees **SHOULD** consider control techniques including:

- Give consideration to culture equipment choice based on ease of decommissioning and rehabilitation;
- Develop a Rehabilitation Plan for their site within two years of approval, 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 and LGAs and any relevant Port Authority. This plan would thus provide interested parties with more certainty that industry understands its obligations;
- Either deposit a bond with the Western Australian Department of Fisheries, or to maintain an insurance policy which will cover site clean-up costs in the event that the site is abandoned; and
- Ensure that natural vegetation in degraded and abandoned aquaculture sites is rehabilitated.

5.0 MINIMISING IMPACTS ON THE ENVIRONMENT DURING PRODUCTION

Except for the bivalves (pearls, mussels & oysters) aquaculture species generally require supplementary feeding. This addition of feed into the culture system will contribute to an increase in nutrient levels in the water and, or, sedimentation in ponds or tanks resulting from excess feed and faeces. The release of nutrients into the environment can lead to algal blooms or the growth of epiphytes on aquatic vegetation. Sedimentation can affect the composition and function of benthic fauna and flora as well as infaunal communities, result in the formation of anoxic sediments and, or, the smothering of aquatic vegetation.

5.1 Routine Operational Procedures & Annual Schedule

Each licensed site SHOULD have documented flow charts or procedures (commensurate with size of operation) for all major stock or husbandry activities undertaken, including duration of production cycle, culture unit preparation, stocking, feeding, grading, health control, harvesting, etc.

Scheduling of major production operations including monitoring (water quality, sediment & other environmental), internal audits or inspections, routine maintenance, staff training, and testing of various plant & equipment SHOULD also be detailed.

5.2 Wild or Domesticated Seedstock & Broodstock and GMOs

The mussel industry collects wild spat at two main locations as the only source of its production stock, whilst pearl farmers can collect (under a quota system) large shell for holding before seeding with a nucleus. All other culture species are hatchery bred.

Wild broodstock

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

Wild broodstock or seedstock MUST be collected without adversely affecting the wild population or other components of the local environment which interact with the culture species and in accordance with license conditions and other legislative requirements.

Hatchery production of aquaculture seedstock allows the possibility of selective breeding and domestication of the breeding lines. This source of seedstock could have a genetic impact on wild populations if they escaped and were able to interbreed.

The use of selectively-bred seed stock **MUST** be checked with DoF before stocking in the culture units – this will be subject to the species, location of the farm, specific licence conditions and for compliance with the State biosecurity plan (prepared by DoF).

GMOs

The Western Australian aquaculture industry believes that Genetically Modified Organisms (GMOs) **MUST** not be cultured. The manipulation of ploidy (e.g. triploid) in some species (e.g. finfish and shellfish) is recognised as a valuable tool to avoid spawning during production. The industry supports a precautionary approach to genetic research and that potential benefits and risks are currently being investigated.

5.3 Natural Foods & Carrying Capacity

The culture of bivalves such as mussels, edible oysters and non-maxima pearl oysters does not use supplementary feeds for its stock, relying entirely on natural food sources. These filter feeders are net extractors from the water; the main component of food is phytoplankton, with small proportions of the ingested food being comprised of small planktonic animals, eggs, bacteria, and small organic detritus particles in the water column.

They remove an unknown, but considered minor, proportion of the plankton compliment in a region, and return most of it to the water as faeces, or pseudo faeces, a large proportion of which are probably water-soluble and therefore may rapidly re-enter the food chain. No additional food is supplied to culture filter feeders so all nutrient in and around the farm is naturally occurring. Accordingly, there is not likely to be any net effect on the nutrient regime associated with filter feeder production.

The ability of environments to support dense populations of cultured filter feeders varies with the nutrient status and the regions are managed accordingly by the farmers and growers. For example, Cockburn Sound is technically a heavily enriched environment supporting high numbers of filter feeders, while King George Sound and Warnbro Sound are oligotrophic – i.e. very nutrient-poor.

The effects of filter feeder farming on the nutrient and phytoplankton status of waters supporting the farms **MUST** be determined within the MEMP.

In nutrient poor areas, or regions with several neighbouring farms, Licensees **SHOULD** consider developing guidelines on the configuration of culture equipment and possible buffer zones between farms. For example, with mussel farming, the density of longlines used, with a normal load of maturing mussels, is 5-10 longlines per hectare; each longline is approximately 100 metres long.

5.4 Health Management & Animal Welfare

Disease prevention rather than disease treatment is the basis of health management on aquaculture facilities. This ensures a focus on all the critical control points along the production pathway and the identification of cost-effective opportunities to reduce the risk of disease related losses.

Inappropriate husbandry is a major cause of disease in aquaculture, causing cultured animals to lose condition, with an increase in susceptibility to pathogens resulting. The application of best industry practices is seen as the best way of maintaining the health of cultured abalone. This also serves to minimise any risk, which is already judged to be low, of transferring any such problems to the ecosystem.

Licensees SHOULD seek input from the Senior Fish Pathologist at the Western Australian Department of Fisheries, on diseases and disease management

Emphasis SHOULD be put on improved health through improved husbandry, controlled origin of stock, monitoring of water quality and ecological conditions at the farms.

Each farm SHOULD identify a specialist experienced in aquatic animal disease and medicine usage who is available to provide advice at short notice in case of a disease outbreak.

Licensees SHOULD compile a facility-level Health Management Plan that is reviewed and updated regularly. Note that the WA Department of Fisheries does not require a Health Management Plan within the MEMP reporting framework. Licensees may decide to integrate their Health Management Plan into their Biosecurity Plan, which IS a reporting requirement within the MEMP.

The Health Management Plan SHOULD consider:

- Name, contacts, qualifications and responsibilities of the facility's fish health expert (can be on staff, on contract or available on a fee-for-service basis);
- Husbandry practices;
- Seasonal factors and stock planning, including stock densities;
- Culture unit preparation and equipment hygiene;
- Responses to adverse environmental conditions;
- Water quality management;
- Feed management;
- Stock health surveillance and quarantine;
- Animal welfare (including at the transport and harvesting stages)
- Farm record keeping;
- Likely or potential notifiable diseases;
- Emergency response plan dealing with disease outbreaks and mass mortalities; and
- Treatments and use of chemicals.

Licensees SHOULD consult the Aquavetplan for information relevant to each major disease specific to their licensed species and incorporate this into their Health Management Plan.

Where any potentially toxic or bio-accumulative chemical treatment has been used, the culture waters SHOULD not be discharged to the natural environment until such compounds have naturally decomposed to a non-toxic form or they have been removed from the water.

Any person undertaking aquaculture (i.e. Licensees and all employees) MUST notify the Department of Fisheries of the presence or suspicion of any notifiable disease within 24 hours of becoming aware of any disease or condition that the person cannot identify, or within 14 days if the disease is identified but has not been eradicated.

Mortalities SHOULD be handled and disposed of in accordance with a Health Management Plan to minimise the risk of disease transmission by exercising good hygiene procedures for farm personnel, their clothes and operational equipment.

Mortalities SHOULD be counted and recorded, and where possible, identified by cause.

Licensees SHOULD reduce the risk to stock health associated with birds and other predators by adherence to appropriate predator control measures, ensuring secure storage of feeds and good feeding practice that minimises waste.

Culture system design and management SHOULD minimise the risk of spread of disease between farm stock and from farm stocks to natural stocks.

The control of predation as well as the risks with the entanglement of wildlife, especially protected species, is covered in Section 5.8.

Stocking Density & Biomass

Determining a stocking density appropriate for the species being farmed and the surrounding environment is fundamental to running a profitable, sustainable business.

Optimum stocking density depends on culture technique and location. Licensees SHOULD avoid overstocking as this leads to stress, resulting in reduced growth rates and potential disease problems.

Only fit and healthy juveniles SHOULD be transported and used to stock culture units.

Transportation SHOULD avoid unnecessary stress to the juveniles including monitoring and management of oxygen and carbon dioxide levels, toxins (nitrogenous wastes), temperatures and pH and hardness in freshwater systems.

The stocking density SHOULD be monitored in relation to health, stock behaviour and water quality to ensure that stock welfare is not compromised, with immediate attention being given to any problems that arise.

Licensees SHOULD consider the following when calculating stocking densities:

- Aeration capacity;
- Water exchange capacity;

- Feed quality or availability in the case of bivalves and Abalone ranching;
- Impacts of increased metabolic wastes; and
- Disease implications (see above).

Aquatic Animal Welfare Plan

The Licensee and the employees all **SHOULD** understand their responsibilities in regard to animal welfare, and how this also needs to be incorporated into the husbandry techniques used at the aquaculture facility.

The Licensee **SHOULD** prepare an Aquatic Animal Welfare Plan based on the National Aquaculture Council's Aquatic Animal Welfare Guidelines. This can be a section within the Health Management Plan.

The culture systems **SHOULD** be designed with the consideration of the stock's welfare in mind (e.g. stocking density and an adequate supply of high quality water at all times).

Different species have different tolerance to time out of water but the time **SHOULD** not be so long as to produce signs of distress. Even for tolerant species, times **SHOULD** be reduced when the air temperature is particularly high or low.

Stock **SHOULD** be transported in a way that minimises any possible impact on their welfare.

5.5 Biosecurity, Translocation & Sanitation

With the exception of species such as Yabbies, Golden Perch, Silver Perch, Murray Cod and Rainbow Trout, most aquaculture species used in WA facilities are indigenous to Western Australia meaning there is low risk of altering a gene pool associated with translocation of wild caught broodstock or seedstock between catchments or bioregions. However, there is still a need to consider the transmission of diseases due to the translocation of selectively bred stock (control methods are discussed in section 5.7).

To protect the biodiversity of the WA ecosystems, a translocation policy between regions is currently being developed by the DoF. Culture species as well as equipment and infrastructure will be covered by this policy.

Site separation is a key policy issue with DoF especially for marine farms. Leases within gazetted aquaculture zones are likely to be managed through a management plan as a single area for biosecurity purposes.

Marine or freshwater pests, defined as “animals or plants which are out of place and constitute a nuisance to the industry or the local environment” abound in around the world. The movement of equipment, gear and culture species between sites can possibly result in the transfer of marine or freshwater pests or weeds

Applicants and Licensees **MUST** address Biosecurity as a component of their MEMP application or annual renewal for approval by the DoF.

Licensees **SHOULD** seek input from the Biosecurity Section of DoF or the Senior Fish Pathologist at the Western Australian Department of Fisheries, on biosecurity.

Licensees **SHOULD** use continually review and update their Biosecurity Plan and associated protocols to prevent, control and eradicate diseases to preserve human, animal and environmental health.

Licensees **SHOULD** consider mitigation measures to reduce the risk of disease due to the proximity of another farm. These include:

- Selection of species that have a higher tolerance to disease;
- Careful site selection;
- Only stocking culture units with healthy and appropriately sized stock;
- Regular grading;
- Monitoring stock behaviour;
- Monitoring of water quality;
- Monitoring of feed quality and freshness (when formulated feeds are used);
- Cleaning and disinfection of equipment;
- Removal of mortalities and monitoring of mortality rates;
- Discouraging predators;
- Maintaining high-level husbandry skills, especially when handling stock; and
- Maintaining appropriate stocking densities.

Licensees **SHOULD** consult provisions of relevant legislation for all movements of aquaculture equipment into and around WA. Movements within a region will be considered by DoF on a case-by-case basis depending on the distance covered.

Sanitation & Disinfection of Equipment

When using chemicals all current manufacturers' instructions and health and safety guidelines **MUST** be followed at all times, as sanitisers or disinfectants in higher concentrations can be dangerous to personnel and the environment.

Surfaces and equipment **SHOULD** be thoroughly cleaned, with detergent if necessary to remove visible organic material especially grease or fats, prior to disinfection as the presence of organic material during the disinfection process impairs the effect of the disinfectant. Much of the infectious material may be removed or inactivated at this important stage.

All removable items, including culture units, ropes, lines, buoys, culture nets and harvesting equipment, **SHOULD** be cleaned and disinfected according to the manufacturers' instructions (if applicable). For many types drying in sunlight is sufficient.

These used items **SHOULD** be transported in sealed containers and be tagged and logged on arrival at the designated dirty area of the culture equipment washing station to ensure they are kept separate from clean equipment.

As a minimum annually, the bottoms of pens, vessels, barges, aerators and other equipment in the water SHOULD be scraped clean, using divers if necessary, and disinfected down to and including the waterline.

Operators SHOULD consider removing all organic debris from diving suits, waders and other protective equipment with an appropriate detergent and rinsing in clean water. They SHOULD then be immersed in freshwater containing iodophor (minimum 100 mg/L free iodine) or an equally effective disinfectant for 20 minutes. Alternatively, gear SHOULD be heat treated by immersing equipment in clean freshwater so that the gear is maintained at a minimum of 55°C for at least five minutes.

5.6 Equipment Loss

Equipment loss may be experienced by Licensees as a result of extreme weather events and flooding, or by theft.

Licensees MUST have systems in place to identify equipment loss and recovery; this may include reporting to and working with relevant local, State and Commonwealth authority. For example loss of navigational markers MUST be replaced as soon as practical and theft of equipment should be reported to the police.

5.7 Escape of Cultured Animals

All aquaculture operations experience losses of livestock for various reasons, most occurrences are very small involving only one or two individuals. However, concerns are often held that cultured species which, are not naturally found in a region, may escape to establish feral populations, to the detriment of other naturally occurring species and communities.

The environmental risks associated with escapees differ depending on the type of system used, the species farmed, the scale and intensity of the operation and the management practices employed. As discussed above in section 5.5, the primary risks are associated with the aquaculture of non-native species; however, this is undertaken in Western Australia except for species including, but not limited to, Yabbies, Golden Perch, Silver Perch, Murray Cod and Rainbow Trout for which the DoF has developed specific control guidelines.

Licensees MUST follow local, State and Commonwealth regulations governing animals that may be imported, cultured or sold under authorisation.

Licensees MUST have site-specific contingency plans (Escape Emergency Plans) that describe actions to be taken in the event of any major stock escapes. Guidance on what to do in the event of an escape is provided in the *Fish Resources Management Regulations 1995*. The use of any recapture nets requires authorisation of the CEO of DoF.

Licensees SHOULD use best management practices to prevent escapes including obeying regulations, considering the effects of the sites (frequency of storm events, degree of exposure), minimizing risks during stock transfers, using strong and durable materials for culture unit construction and regularly inspecting and adjusting the infrastructure to ensure no tears or openings.

Whilst bivalves are not motile animals, they can fall off their culture units if the mass becomes excessive relative to the strength of their byssus threads. Heavy sea conditions may also cause the loss of product. The bivalves fall to the seabed below the farms here they are usually quickly consumed by stingrays or other benthic predators. Licensees SHOULD conduct regular inspections of the seabed around the farms to recover any significant bunches of stock whose loss is detected during harvest, and to recover ropes, droppers and other culture equipment beneath the farms.

5.8 Interactions with Threatened, Endangered & Protected Species

Farms, especially in marine environments, are exposed to a variety of predators, which can cause considerable stock loss, reduction in feeding activity and/or damage to culture equipment. Some predators also present a risk to farm staff, especially crocodiles, sharks, seals, snakes and poisonous jellyfish.

The primary management objective for prevention of predators is to control predation through their exclusion and the subsequent reduction of interactions. If these predators are protected species, this may require a different management response and subsequent reporting.

Ministerial Policy Guideline 8, which guides the decision-making process on applications for Aquaculture Licences, requires that aquaculture projects do not adversely affect local wildlife.

Except for seals around marine finfish farms, interactions with marine mammals such as whales, dolphins and dugongs, are infrequent for marine aquaculture; such interactions are always initiated by the animals and appear to be based on curiosity. With seals, whilst most interactions are likely to be predatory. However, to date on Western Australia aquaculture farms, there have been no recorded deaths from entanglement for marine mammals or reptiles (turtles and crocodiles), only unconfirmed entanglements. In other states, poorly maintained and loosely hung predator nets are the largest cause of entanglement to marine life such as sharks, diving birds and seals.

Licensees MUST use a Wildlife Interaction Avoidance Plan to ensure proper procedures are adopted to reduce the impact of predators on farmed stock as well as negative impacts from the farm on the predators and other protected species. Monitoring of interactions with protected wildlife would be included in the facility's MEMP.

Adequate predation exclusion barriers and/or management strategies SHOULD be incorporated within the Wildlife Interaction Plan from the planning stage and regularly monitored or reviewed for effectiveness during operations.

Licenses SHOULD keep all infrastructure in good order and avoid unnecessarily loose nets, lines or ropes.

Bird and predator netting SHOULD be highly visible (i.e. of sufficient twine diameter and not monofilament), cover the entire culture unit and of a mesh size that reduces the risk of entanglement (for example bird nets with a mesh size of less than 50mm across the bar).

Licenses MUST identify the likelihood of interactions with threatened, endangered and protected species and from this risk assessment prepare and practice controls.

A “Marine Mammal Entanglement Plan” currently exists within the Department of Parks and Wildlife (DPW) Nature Conservation Division, and MUST be invoked in the event of a mammal entanglement in aquaculture equipment. It contains the Standard Operating Procedure for all Cetacean entanglements. People who see an entangled or beached whale SHOULD keep a safe distance from the animals and contact DPW's Wildcare Helpline on **(08) 9474 9055** or Marine Emergencies on **(08) 9483 6462**. ACWA is developing a Code of Practice for Whale Interactions.

All rubbish SHOULD be placed in dedicated waste bins, which have tight lids and be secured to stop them being blow over.

5.9 Behavioural Changes on Local Species

Floating culture units such as pens or longlines and infrastructure on the seafloor (e.g. anchors, posts, water intakes or effluent pipelines) can act as fish aggregation devices (FAD) by providing localised sheltered areas. Abalone ranching habitat will also create localised sheltered areas.

Mussel harvesting activities inevitably produce a substantial amount of washing water which exits over the side of the vessel, carrying with it a large amount of very small particles, including small crustaceans and other edible animals and plant. Small to medium fish typically congregate around the vessel at these times, and their presence often attracts larger fish.

All water intake pipelines SHOULD be screened to prevent the accidental intake of fish or other organisms. Biofouling of these is discussed in Section 5.10.

The quantity of feed delivered to farmed stock SHOULD be based on regular stock body weight measurements (to establish biomass) and observations of stock feeding behaviour to ensure minimal feed remains uneaten, therefore reducing the waste feed available to wild finfish and other species.

5.10 Biofouling of Structures

Biofouling removal from culture equipment, aerators, moorings and anchors, and intake and effluent pipelines can be problematic, especially for facilities located in tropical waters. There is

a need to deal with the material when it is removed without placing restrictive barriers onto Licensees in order to minimise environmental impacts.

Where relevant, the Biosecurity Plan SHOULD include an Integrated Biofouling Management Plan incorporating both non-toxic chemical mechanical control methods. Such plans may need to deal with multiple species and requires an understanding of the life cycles of fouling organisms so that control mechanisms strategically break the fouling organism's life cycle and prevent or reduce colonization levels. Maximum density thresholds for triggering biofouling organism control responses may be included.

Copper-based or other toxic antifoulants SHOULD not be used.

The problem of biofouling is greatest with the mussel industry; it also needs to be controlled during oyster and pearl culture. Sediments accumulate on the bunches of mussels during their lives on the droppers; that sediment is derived entirely from the water which passes through the facilities and is composed of dead plankton and other biological matter, and also contains fine particulate sediments which settle out of the water at times of low current movement. Thus it is acceptable to return the sediments to the water during washing or harvesting of bivalves since all of the material was derived from natural processes on the farm. A short-term local increase in turbidity occurs during this time, but does not appear to have caused any change in general background turbidity on the farm sites.

The feeding of bivalves is an extractive process where a minor amount of nutrient is retained by the animal and the remainder is excreted back into the water where it originated. The pseudo faeces, which are composed of particles filtered from the water but which are of the wrong size for ingestion by the bivalves, are rejected as bundles which sink to the bottom in a low energy regime and become part of the sediment, available for ingestion by other organisms. Set spacing between longlines ensure that the accumulation of any particulate matter from faeces or pseudo faeces is limited to a small area either side of the longlines.

Sediments, composed of dead plankton and other fine particulate matter, SHOULD be returned to the water during bivalve processing which is best undertaken whilst steaming back to shore from the leases.

Bivalve farms SHOULD be located over soft sediment seafloor communities where the addition of small amounts of particulate matter is unlikely to have a detrimental effect on the existing biota. Active scavenging by finfish and seabed animals assists in turning over the waste biological matter.

5.11 Hydrocarbons, Chemicals & Therapeutants

A variety of chemicals may be used in the aquaculture industry to treat and, or, control various diseases, parasites or to facilitate production. Use of chemicals SHOULD be managed in

accordance with industry-wide protocols and this ensures consideration is given to the ramifications on the environment, food safety and worker safety.

Medications & treatments

As discussed in Section 5.4, a Health Management Plan SHOULD be prepared with veterinary advice so that the application of preventative measures and treatments (for example vaccination, fungal control, parasite control, etc.) is kept to a minimum and to ensure that any such use does not adversely affect the local environment.

Cleaning & Disinfection

Cleaning and disinfecting regimes MUST not adversely affect the surrounding environment or the water downstream. This is discussed in more detail in Section 5.4.

Antifoulants

As discussed in Section 5.10, copper-based or other toxic antifoulants SHOULD not be used.

Container disposal

All chemicals and their containers MUST be stored, used and disposed of in accordance with manufacturer's instruction, MSDS and local, State and Commonwealth requirements and legislation.

Fuel Spillages

Most equipment used on aquaculture facilities is powered by electricity and, thus, produces no direct environmental threat (greenhouse gas emissions are another issue). Some machinery is, however, powered by petrol or diesel back-up generators so normal precautions regarding fuel spillage SHOULD be undertaken.

Applicants SHOULD consider the need for a protective containment berm or bunds around storage fuel tanks that retains leakage or tank contents spillage in the event of connection or hose failure.

Bulk storage of petroleum in above ground and underground tanks is controlled by regulation and relevant information MUST be obtained from the relevant state government department before construction or installation.

Refuelling and use of hydrocarbon-powered, farm machinery MUST be practiced in such a way as to minimise the opportunity for a spill to occur which could result in pollution of the aquaculture equipment and the local environment.

Refuelling at sea or in other waterways SHOULD be avoided unless appropriate spill measures are in place.

Some emergency responses for chemicals are discussed in Section 5.12.

5.12 Emergency Procedures & Security

Sites **SHOULD** be monitored by the Licensee for any unauthorised entry to ensure stock are not stolen or that breaches in biosecurity occur, with changes to security regimes made as required.

Licensees **SHOULD** consider the regular, at least annual, testing and review of their Emergency Response Plan for all major potential emergency situations on the farm. These could include emergency evacuation, fire, flooding, vehicle or vessel collisions, injured person, man over board, mass stock mortality, bulk chemical or fuel spillage, etc.

Spill kits, clean up equipment (brooms, shovels & buckets) and disposal or storage containers **SHOULD** be regularly checked for readiness.

Alarms, fire extinguishers, fire blankets and other fire fighting equipment (e.g. CO₂ in vessels) **MUST** be checked at least 6-monthly for readiness.

All farm employees **SHOULD** be aware of the Emergency Response Plans and participate in debrief sessions to determine the effectiveness of the plans.

6.0 WATER QUALITY & WASTE MANAGEMENT

The discharge of water in many aquaculture operations is considered to carry an environmental risk due to the likelihood of such water containing higher levels of nutrient than the surrounding waters. This is due mainly to the addition of formulated feed which is practiced in the aquaculture of many species of finfish, crustaceans and abalone.

The higher than natural stocking densities maintained can also cause problems.

A wide range of solid wastes can also result, including biofouling removed during maintenance or cleaning, as well as dead stock and other debris. These wastes must be controlled to ensure that the surrounding area is not impacted by them.

Licensees **MUST** ensure that their activities do not cause unacceptable changes in the water quality on and around their farms.

6.1 Water budget, inlet & effluent quality

Wastes such as biofouling material **SHOULD** be buried or disposed of away from the farm sites.

6.2 Control of Sea-based Sediments from Waste Feed & Faeces

Licensees **SHOULD** educate farm staff in appropriate methods to identify and mitigate sedimentation concerns.

6.3 Stock mortalities, unsaleable product (culls) & processing wastes disposal

Mortality & Culls Disposal

All aquaculture operations experience mortalities of stock or harvest unsaleable stock for various reasons.

Arrangements with local government for normal and worst-case mortality disposal requirements **SHOULD** be agreed in advance of being required.

Licenseses **SHOULD** consider mortality control techniques including:

- Minimizing stress to stock during inspections and dead stock collections;
- Taking prompt remedial action in accordance with the Veterinary Health Plan to deal with any health or welfare problems (in consultation with a veterinary surgeon or fish health expert when appropriate); and
- Keeping full records of each inspection, to include the number of mortalities removed, and the likely cause of death as determined by a suitably competent person. Mortalities can then be subtracted from estimated population totals to maintain an inventory for each culture unit and the facility

To minimise any transfer of disease, equipment used to remove dead or moribund stock **SHOULD** be disinfected between culture units and after prior to storage, by dipping into an approved food grade disinfectant.

Dead mussel shells and biofouling organisms **SHOULD** be disposed of over a wide area outside the leases following harvest and processing;

Harvesting & Processing Wastes

Licenseses may undertake harvesting, washing, shucking and chilling (primary processing) at sea but any additional processing **MUST** take place at an approved facility on land.

Stock **SHOULD** be chilled as rapidly as possible after harvesting to ensure the freshness of the product.

Cleaning of biofouling and dead shells from bivalve farms is undertaken at sea and the collected wastes **SHOULD** be spread away from the farm sites; this organic matter decomposes with a short time to be included in the seabed sediments. Pearl shells are usually taken ashore for sales as mother-of-pearl.

Secondary processing (such as cooking and other types of value adding) **MUST** be in purpose-built processing facilities using “HACCP” (Hazard Access Critical Control Points) for food safety under the national *Food Standards Code*.

Such facilities **SHOULD** be licenced by the Department of Health and local government authority as applicable.

6.4 Sewage

Human sewage **MUST** not be used for any type of aquaculture.

All sewage transport containers **SHOULD** be sealed and securely tied down to prevent spillage during transport to the licenced disposal site.

At sea or in waterways Licensees **MUST** comply with DoT which requires that all sewage and grey water on the vessels and barges is collected and disposed at an on land licenced disposal site.

6.5 Rubbish & pest control

Section 5.11 discusses the issues around the use and disposal of chemicals, hydrocarbon fuels and other hazardous substances.

Most non-biological or non-chemical waste matter from the aquaculture farms or facilities as well as normal 'household' wastes (such as food scraps, papers, plastic packaging, etc.) can usually be disposed of at the local rubbish tip or dump. Regular removal is important to prevent local build-up of material and rubbish which can attract pests.

Licensees, to ensure the health and safety of staff and stock on aquaculture farms, **SHOULD** ensure that regular pest control is undertaken, pest occurrences are noted and responded to, equipment is regular checked and contracted technicians are licensed with appropriate insurance coverage.

Licensees **SHOULD** consider conducting at least an annual systematic review of farm or facility operations to develop and improve their waste management plan. Recycling of many materials is strongly encouraged.

Licensees **SHOULD** collect all feed bags, packaging materials, waste rope and netting, broken buoys and other unusable culture equipment and return it to shore in sealed containers for disposal at facilities approved by appropriate regulatory authorities. Recycling of these materials is strongly encouraged.

7.0 REFERENCES

Australian Quarantine and Inspection Service (AQIS)

<http://www.daff.gov.au/aqis>

AS/NZS ISO14001:2004 Environmental management systems – requirements with guidance for use.
Standards Australia 26 pages.

<http://www.iso.org/iso/home.htm>

Department of Agriculture, Forestry and Fisheries (DAFF)

<http://www.daff.gov.au/>

Department of Agriculture, Fisheries and Forestry - Aquavet Plan

<http://www.daff.gov.au/animal-plant-health/aquatic/aquavetplan>

Department of Water *DoW Water Quality Protection Note (“WQPN2”) for Aquaculture*

<http://www.water.wa.gov.au/PublicationStore/first/84605.pdf>

Environmental Management System Tool (2009) – Publication by the Department of Environment, Water, Heritage and the Arts.

<http://www.environment.gov.au/sustainability/government/ems/publications/pubs/ems-tool.pdf>

Fisheries Management Paper No. 229 - Finfish Aquaculture In Western Australia: Final ESD Risk Assessment Report For Sea-Cage And Land-Based Finfish Aquaculture. Published by Department of Fisheries, October 2008.

[Refer to ACWA website for PDF.](#)

Fisheries Management Paper No. 233 - Finfish Aquaculture In Western Australia: Final ESD Management Report For Marine Finfish Aquaculture. Published by Department of Fisheries, June 2009.

[Refer to ACWA website for PDF.](#)

Fisheries Ministerial Policy Guidelines No. 8 Assessment of applications for authorisations for Aquaculture and Pearling in coastal waters of Western Australia Issued Pursuant to Section 246 of the Fish Resources Management Act 1994 and Section 24 of the Pearling Act 1990 (Amended December 1998).

http://www.fish.wa.gov.au/Documents/ministerial_policy_guidelines/fmpg008.pdf

Fish Resource Management Act 1994. WA Department of Fisheries.

http://www.slp.wa.gov.au/legislation/statutes.nsf/main_mrtitle_345_homepage.html

Food Standards Australia & New Zealand (FSANZ) Act 1991.

<http://www.foodstandards.gov.au/>

Guidance Statement for Determining Categories of Marking & Lighting for Aquaculture and Pearling Licences/Leases (2010)

http://www.fish.wa.gov.au/Documents/aquaculture_licencing/marketing_and_lighting_guidance_statement.pdf

Guidelines for constructing and maintaining aquaculture containment structures (QPI&F 2007).

http://www.daff.qld.gov.au/documents/Fisheries_Aquaculture/Construction-Containment-Structures-Guidelines.pdf

National ESD Reporting Framework for Aquaculture, How to Guide – Version 1.1 (Fletcher et al 2004) published by FRDC & EA (now Dept. SEWPaC).

<http://www.fisheries-esd.com/a/pdf/ESDHowtoGuideAquaculture.PDF>

National Strategy for Acid-Sulphate Soils

http://www.mincos.gov.au/_data/assets/pdf_file/0003/316065/natass.pdf

National Water Quality Management Strategy

<http://www.environment.gov.au/water/policy-programs/nwqms/>

Western Australian Department of Fisheries (WA DoF)

www.fish.wa.gov.au/

ANNEX 1: ENVIRONMENTAL POLICY

The value of the environmental policy is well summarised in the *AS/NZS ISO14001:2004 Environmental management systems – requirements with guidance for use*:

“The environmental policy is the driver for implementing and improving an organization's environmental management system so that it can maintain and potentially improve its environmental performance. This policy should therefore reflect the commitment of top management to comply with applicable legal requirements and other requirements, to prevent pollution and to continually improve. The environmental policy forms the basis upon which the organization sets its objectives and targets.”

In consultation with members and other stakeholders, ACWA has developed a template environmental policy to assist industry members to develop their own policy. Licensees are encouraged to check this on the ACWA website.