

ENVIRONMENTAL CODE OF PRACTICE
for the
SUSTAINABLE MANAGEMENT of
WESTERN AUSTRALIA'S
PRAWN AQUACULTURE INDUSTRY



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 emphasise 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 of the 2009 Environmental Code of Practice prepared by the Department of Fisheries in conjunction with industry, the Aquaculture Council of WA and the Department of Environment and Conservation. (Published by DoF and ACWA)

Cover photos: Courtesy of Aquaculture Council of Western Australia

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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 Prawn 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.

¹ A 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 Prawn 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 Prawn 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 Prawn 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)*.

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

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

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 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 *EP 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 a Prawn farm or hatchery. 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 as 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 prawn farm construction and operation.

Land-based proponents **SHOULD** consult a soil scientist to determine soil characteristics of the site. Consultation with a consultant is also recommended if the site is frequently inundated by flood waters resulting from seasonal rainfall. A decision on whether the facility can be engineered to cope with these risks or if relocation would be a better option, needs to be made at this point.

Monitoring & Environmental Management Plan (MEMP), including collection and analysis of baseline data. Large scale projects of significant environmental impact will be referred to the EPA.

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.

A proposal submitted to an LGA **SHOULD** provide:

- A description of the project, including land area and any biomass to be held on site at any one time;
- A plan of the property on which the facility is to be located, showing boundaries, the location of existing facilities and proposed improvement including water and waste treatment and disposal facilities;
- A map showing any neighbouring dwellings within 1,000 metres of the aquaculture facility, any patches of remnant vegetation, any bores, wells, wetlands, surface water, drains or water courses within 500 metres of the site and any area of land to be used for waste disposal;
- A description of land form, soil types and contours (or details of land slope) and (if applicable) groundwater depth, quality and flow direction;
- Details of rainfall, evaporation and infiltration and runoff factors and their effects on-site drainage and waste and stormwater handling facilities;
- Identification of one-in-one hundred year flood levels (generally available from the DoW), or areas of flood prone land;
- Details of waste quantities produced, the method of treatment, recycling and disposal;
- Details of the land area to be used for waste disposal and a description of the land form; and
- Identification of any aboriginal archaeological sites or other significant areas.

The information does not have to be professionally drafted but the approvals process can be delayed unless the information provided is clear, unambiguous and provides an understanding of the proposed impact treatment and control methods.

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.

Water inlet and effluent pipelines and canals **SHOULD** be constructed in such a way as to interfere with public beach or waterway access as little as possible.

Where facilities are located behind security fencing, such fencing SHOULD be as unobtrusive as is practical (refer also Section 4.3 Visual Impacts).

Where facilities can be shared to reduce impacts, this SHOULD be considered.

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.

Licensees 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 Prawn Licensees 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.

Land-based facilities and support facilities often require extensive earthworks during the construction of buildings, hatcheries and grow-out unit. Licensees **MUST** ensure that care is taken to ensure that materials removed during construction or maintenance are disposed of in a way that will ensure no un-necessary additional damage to coastal land, dune fields or other sensitive areas.

Licensees **MUST** ensure that waste material and other by-products of construction or maintenance are disposed of in a way that does not cause additional environmental damage to the physical habitat in the vicinity of the farm or facility.

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*.

Licensees **SHOULD** consider noise control techniques including:

- Incorporating at the planning stage maximum distances between noise sources and sensitive places;
- Consult with LGA Environmental Health officers during planning stages to determine whether future power infrastructure provision may limit the need for generators;
- Muffling noisy equipment (e.g. air blowers and generators);
- Regular maintenance of machinery and equipment;
- Construction of vegetated buffer zones;
- Alteration to the number or type of equipment used;

- Operation of vehicles and plant at appropriate speed limits;
- Construction or use of appropriate noise barriers or noise attenuators; and
- Consultation with local government and developers to ensure buffer zones are adequate.

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 *Environment Protection Act*.

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 Land-base: Erosion, Surface & Storm Water Flows

Operational erosion control can result in significantly decreased suspended solids in the ponds or tanks and particulate phosphorous within discharge waters. Suitable advanced erosion control practices are also likely to lead to increases in profitability through a reduction in the maintenance costs associated with pond wall erosion.

Erosion

The construction plan for any new aquaculture facility MUST manage erosion.

Licensees SHOULD consider control techniques including:

- Earthworks are minimised during any recognised wet or rainy season;
- The area disturbed is limited to the immediate construction area, especially with earthworks for pipes through sand dune areas;
- Appropriate methods (such as perimeter bunds) are used to prevent overland flow from entering the construction site;
- Appropriate methods are used to reduce erosion of topsoil from within the development site;

- Appropriate methods are used to reduce siltation of waterways (e.g. by using straw bales, silt fences or sediment traps);
- Stripped top soil is stored within a bunded area;
- Downstream conditions are checked for possible erosion and/or flooding due to concentrated flows;
- As soon as possible after construction top soil is placed over earthworks (e.g. pond walls or pipelines) with stabilisation and rehabilitation works including encouraging suitable vegetation to grow;
- Aerators are located to avoid pond bank erosion;
- The walls are of a suitable batter angle to reduce scouring and erosion;
- Where necessary protect pond walls or water canals from erosion below the water line;
- Walls exposed to prevailing winds and corresponding waves are adequately protected from erosion;
- Monitoring of the volume of sediment in each tank or pond at the end of each crop (this will provide a performance indicator for management changes);
- Pond and tank discharge structures are designed in such a manner to minimise the level of erosion resulting from the discharge of waters, with special emphasis on protecting drain walls from direct water impact and associated erosion; and
- Discharge to waterways are minimised or avoided at times when unacceptable erosion of creek or stream banks is likely to occur.

Surface & Storm Water Flows

The licensee SHOULD, where possible, control any interruption to the water flow within the region. These flows may be a consequence of seasonal flooding or storm surge flows due to cyclonic weather patterns, or if facilities are located near a coastline that has larger tidal ranges

Licensees SHOULD consider surface water flow control techniques including:

- Positioning of the proposed aquaculture facility in relation to surrounding water courses. This will require identification of regional water courses, river and stream flows including the levels and extent of any flooding;
- Evaluation of historical records for climatic and geological data to assist in determining an appropriate location for the facility; and
- Burying water supply or effluent pipelines below the land or seabed surface.

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 Water Resources

DoW released the *Water Quality Protection Note* (“WQPN 2”) for Aquaculture in 2006 (available on the ACWA website). This document applies where sensitive water resources are at risk of contamination from any commercial aquaculture premises that undertakes aquaculture. Applicants for on-land facilities MUST read and abide by the requirements set down in this document.

The location of sensitive waters and recommended management criteria may be obtained by contacting the nearest regional office of DoW.

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.

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

4.7 Terrestrial Habitat Effects & Native Vegetation Removals

The clearing of vegetation on the aquaculture site may be inevitable, but can be limited to the immediate site. There is only a problem if threatened species or wetlands are present, or primary

dune vegetation is disturbed. Seabed disturbance during the installation of a pipeline and intake or effluent outlets may attract fish or invertebrates; however, the footprint of the pipeline is small and is likely to be of little consequence.

Applicants **MUST** adhere to native vegetation clearing criteria as described in the *Environmental Protection (Clearing of Native Vegetation) Regulation 2004*. Clearing under these Regulations requires prior written approval of DER. Applicants **MUST** apply for, and receive, approval prior to commencing any clearing activities.

Significant information regarding habitat impacts **MUST** be included in any application and may require inclusion into the Management and Environmental Monitoring Plan (MEMP).

Areas of habitat will be affected by the construction and operations of an aquaculture facility; however, any direct impacts **MUST** remain within the licensed area and not affect surrounding areas.

Consideration of the amount of habitat to be affected by the operation **SHOULD** be considered against the total allowable for the region so within the existing protocols and assessment processes these impacts can be minimised.

If sites are located on private property, additional approval to remove native vegetation **MUST** be obtained through the owners.

Where reasonable and practicable, the following practices **SHOULD** be complied with when constructing a land-based farm:

- Boundaries of the construction area are clearly marked prior to the commencement of vegetation clearing;
- Roads for construction access are constructed to minimise vegetation clearance;
- Farms are not built in places where it is impractical to correct site-related problems such as highly-acidic (acid sulphate), organic or permeable soils if considering; and
- Perennial native vegetation buffers are retained or re-established between any land-based aquaculture facility and sensitive water resources.

Licensees **SHOULD** consider control techniques including:

- Ongoing impacts on habitat (e.g. trampling around the site, smothering of habitat) are identified and managed (reference may be needed to “whole of catchment” objectives);
- No unacceptable impacts are detectable outside the licensed area. If any negative impacts are recorded, appropriate management strategies are implemented to rectify this;
- Environmental monitoring is carried out to recognise 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.

Restoration of any abandoned or disused pond in the vicinity of the existing operational farm MUST be undertaken.

4.8 Soil Quality, Acid-Sulphate Soils & Dredge Spoil

Whether the soil on site is prone to acid sulphate incursions or other such problems MUST be determined during the site selection and design phase to ensure that, no acid sulphate soils are activated on the site. The *National Strategy for Acid Sulphate Soils* sets out the framework to improve understanding of coastal acid sulphate soils (CASS). Prospective applicants can contact DER and DAFWA for information regarding locations of CASS.

Soil testing may be required depending on the scale of the operation and will be assessed by DoF and/or the EPA on a case by case basis.

Applicants, if required, SHOULD test the soil characteristics, such as pH and clay content. A qualified soil scientist may be required for this. Any testing SHOULD identify the soil profile, the particle grading relevant to each of the strata, the classification of the soils in the strata plus other relevant physio-chemical parameters. Except as otherwise indicated in AS1726 Geotechnical site investigations, the minimum investigation requirements SHOULD include:

- The properties of the foundation materials in containment areas;
- The properties of the materials to be used in the embankment fill;
- The permeability of the fill materials to be used in containment structures;
- The settlement properties of the foundation materials if there is a risk of settlement during or after construction; and
- The strength properties of the foundation and fill materials.

Pond soils SHOULD be prepared prior to the pond being filled as poor preparation may result in the deterioration of the soils during the crop. This can result in the release of nutrients and toxic compounds to the water column. This can lead to stress for the fish and possible environmental problems.

Additional information can be sourced from the document *Guidelines for constructing and maintaining aquaculture containment structures* (QPI&F 2007).

4.9 Freshwater Extraction & Salinisation of Water Table

Applicants SHOULD determine the location of seasonal creek flow lines, maximum and minimum flood levels and the length of time for any land inundation.

Aquaculture facilities SHOULD not divert essential water flows from critical ecosystems.

Licensees SHOULD consider control techniques including:

- Avoiding impacts on water adjacent to mangroves or other critical ecosystems;

- Using appropriate methods to prevent overland flow from entering the site. This could include use of perimeter bunds;
- Using appropriate methods to reduce siltation of waterways by the use of straw bales, silt fences or sediment traps;
- Checking downstream conditions for possible erosion and, or, flooding due to concentrated flows; and
- Placing topsoil over pond walls and suitable vegetation encouraged to grow on the pond walls and batters. Other erosion protection methods could also be considered.

Saline Water Discharge & Seepage

The salinisation of the freshwater table due to saline discharge from pump-ashore facilities or seepage of saline water could occur from culture tanks or earthen ponds. Inland culture is also possible in areas with sources of saline water and effluents from such facilities can lead to salinisation.

Tank and pond construction **SHOULD** be of materials (e.g. concrete, HDPE or other thick plastic sheeting, fibreglass, or some other non-porous material) that do not allow water to seep through them.

Licensees **SHOULD** ensure freshwater aquifers are not contaminated with effluents and that freshwater from wells is not used to dilute seawater supplies.

4.10 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

Wild broodstock

The abalone, prawn, pearl and marine finfish sectors of the aquaculture industry require access to wild broodstock animals for hatchery production of juveniles. Currently, most broodstock animals are collected under licence close to existing facilities. Collection of Marron from the wild requires a harvest licence and Yabbies can be harvested from farm dams with a current licence (refer to DoF website for more information, link at rear of report).

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 Supplementary or Formulated feeds

A number of culture species such as Finfish, Prawns, Abalone (not including Abalone ranching), Marron and Yabbies require supplementary feeding, usually with formulated pellets. Adding feed into the culture system may contribute to an increase in nutrient levels in the water column and, or, sedimentation resulting from excess feed and faeces. The release of nutrients into the marine or freshwater 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 in faunal communities, result in the formation of anoxic sediments and, or, the smothering of seagrass, corals and other aquatic vegetation.

Feeding methods and products vary considerably according to the species cultured, biomass, operating environment and operator preference. Licensees **SHOULD** plan and manage feeding strategies to optimise FCR and productivity and minimise the associated nutrient levels in discharge waters.

Where a licensed Australian feed manufacturer is not used, Licensees **MUST** meet the regulations of the **Australian Quarantine and Inspection Service (“AQIS”)** on the importation of fish feeds and feed ingredients.

Fishmeal and other processed ingredients **MUST** not come from overseas (untested) terrestrial animals or from the same family as the stock. This is an AQIS requirement.

Likewise, feeds made from uncooked organisms (such as fish, chicken, crustaceans, ETC.) **MUST** not be used due to the threat of disease. This is an AQIS requirement.

All suppliers or manufacturers **SHOULD** provide traceability information for all ingredients and diet breakdowns, especially the use of fish meals, fish oils and the sources and amounts of land-based animal proteins.

Licensees **SHOULD** only use feed suppliers or manufacturers who continually monitor and review levels of undesirable substances in feed and ensure these levels are within legislative limits.

Licensees SHOULD support the development and use of alternate feeds that reduce the need for feeds based on fish products by replacing them with vegetable products (such as those from oilseeds, microbial proteins etc).

Where this is practical, feed from genetically modified organisms (GMOs) or their products SHOULD not be used.

Licensees SHOULD ensure that they use feeds that have been formulated specifically for the species and the life stage of the species, to which they offer the feed.

Licensees SHOULD regularly review the specifications and use of diets with their supplier to effect improvement in performance where possible.

Licensees SHOULD consider feed control techniques including:

- Purchase fresh and kept for no more than a few months;
- Use a feed with the least amount of dust/fines possible;
- Maintain the quality of feeds by storing in a cool, dry place;
- Store feed in a manner that will not attract pest species;
- Do not use contaminated or wet/mouldy feeds;
- Use a quality feed with a suitable water stability;
- Use a feed with a level of phosphorous below 2%;
- Use a feed which provides an optimal protein/energy balance; and
- Use a feed which has a high percentage of digestible ingredients.

All farmers SHOULD have a feed management plan, which includes (but not be limited to) guidance on:

- Feeding the correct feed size for the stock;
- Feeding the correct amount of feed to any stocks, in the proper manner and over the correct periods;
- Regular monitoring of feed conversion efficiency (following sample weighing) and assessment of whether feeding protocols and guidelines are effective;
- Consideration of the use of feedback loop feeding systems since these improve conversion efficiency, decrease environmental impact and generally ensure that the feed is used as efficiently as possible; and
- To comply with world's best practice, regularly monitoring feed wastage using technology such as underwater cameras or sensors.

Expired or spoiled feed SHOULD be composted or used as agricultural fertiliser at appropriate levels that does not result in nutrient overloads on application sites. If feed is to be composted or used as fertiliser, consultation with the appropriate management authorities is required to ensure environmental regulatory compliance.

Issues of waste feeds, faeces and their effects on sedimentation in the marine environment are discussed in section 6.2.

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.

For mild infectious diseases with a potential to spread within a farm, culture units **SHOULD** be quarantined and the conditions treated according to best practice; for a seriously infectious disease that may spread widely, culture systems **SHOULD** be isolated, remaining stock **SHOULD** be harvested and the culture system disinfected without discharging the water.

When disease occurs in a culture system, transfer of culture equipment, stock or water to other culture systems **SHOULD** be avoided.

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, soil or sediment, shelter, shade and an adequate supply of high quality water at all times).

Stock **SHOULD** be purged (no feed provided) for no longer than 24 hours before harvest.

Following harvest, slaughtering **SHOULD** be carried out in a way that is fast and humane (i.e. result in rapid and irreversible loss of consciousness).

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** 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.

Operators **SHOULD** minimise the risk of horizontal transmission of disease by avoiding simultaneous carriage of fresh feed and waste feeds or mortalities on-board vessels, trucks or other modes of transport.

Following draining, the culture units, tanks, ponds or raceways **SHOULD** be washed with high pressure hoses and left to dry for at least 2-4 weeks. In some ponds earth moving equipment is required to remove the dried sediments.

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.

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.

Licensees **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).

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, birds and other species.

Feed bins **SHOULD** be covered to discourage interactions with birds, rodents and other pests.

Daily collection of mortalities **SHOULD** be undertaken to lessen the attraction of predators to farms.

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.

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.

Regular physical removal of marine fouling **SHOULD** be undertaken as required to ensure efficient functioning of culture systems.

Licensees **SHOULD** consider washing nets and other equipment away from the farm site to reduce discharge of dislodged biofouling organisms.

Licensees **SHOULD** coordinate biofouling control actions with any surrounding farmers to reduce the risk that poorly managed facilities could act as a fouling organism reservoir.

If the farm appears to be the predominant locus for a pest organism, Licensees **SHOULD** reduce levels of infestation by removing the fouled equipment and allowing pest populations to return to baseline levels.

On land biofouling wastes **SHOULD** be collected and disposed of in appropriate facilities.

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.

A veterinary prescription is required for all Prescription Only Medicines. In the case of in-feed medicines this **MUST** be provided by a Medicated Feeding Stuff (MFS) prescription. Off-label use of therapeutants for culture species is prohibited, unless the therapeutant is prescribed by a veterinarian.

Licensees **MUST** not feed culture species synthetic antibiotics, synthetic amino acids and growth enhancing substances.

Licensees **SHOULD** ensure clear instructions for medication, dosage rate and administration are obtained and communicated to the staff responsible for treatment.

Where treatment is necessary it **SHOULD** be initiated without delay, subject to obtaining the necessary approvals, to ensure good welfare and medicine management.

The recommended course of treatment at the correct dosage **SHOULD** always be completed. However, in the event of being unable to complete the course due to adverse weather conditions or where stock welfare would be compromised, treatment may be terminated. Where treatment is terminated early this **SHOULD** be recorded and advice sought from the veterinary surgeon.

To ensure the end of medication is accurately determined, the feed bin or hopper **SHOULD** be cleaned to avoid contamination of non-medicated feed.

Licensees **MUST** comply with all requirements for medicine withholding periods prior to the harvest of culture species for human consumption. In general, the withdrawal period is specified on the MFS prescription or advised by the veterinary surgeon.

Operators **MUST** demonstrate that stock harvested for human consumption is free of unacceptable residues of all of the veterinary medicines and treatments used in their production.

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.

Chlorine **SHOULD** not be used as a disinfectant in earthen ponds or waterways.

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

Land-based aquaculture facilities can utilise large quantities of seawater or freshwater in their culture tanks, raceways or ponds.

Freshwater Use

The use of freshwater (e.g. river or ground water) for aquaculture operations is regulated with due regard to the ecological costs or impacts on the watersheds and basins where they are located, the need for freshwater supplies for human consumption and the supply of water for other activities.

Seawater Use

Apart from the addition of feeds and nutrients (dealt with in section 5.3) and the resultant solid wastes, little happens to that water before it is returned to the sea. In some cases, slight increases in water temperature may occur as it passes through a farm, but this is unlikely, in most cases, to significantly impact the environment.

For seawater pump-ashore facilities, a budget of annual and seasonal water requirements **SHOULD** be developed and regularly reviewed and updated.

Water quality

Any wastewater discharged into the environment from land-based aquaculture operations **MUST** be of an acceptable level and in line with the State Water Quality Management Strategy.

Discharged wastewater **MUST** not exceed the assimilative capacity of the receiving waters therefore adequate measures **SHOULD** be taken to minimise the outflow of nutrients.

As part of the MEMP Licensees **MUST** monitor and manage the water quality within their site to ensure impacts do not occur outside of the licensed area.

Licensees **MUST** monitor parameters identified in the MEMP in waters being discharged from the facility.

Discharged water **SHOULD** be of equal or better quality to the intake water and there **SHOULD** be no significant impact of effluents from facilities on surrounding ecosystems or other aquaculture operations.

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

6.2 Control & Disposal of Land-based Sediment, Sludge & Dredge Spoil

Through feeding, erosion of banks or releases of faeces and other wastes onland aquaculture facilities can increase the level of solids and other particulate wastes in the effluent waters and Licensees need to implement management strategies to minimise this potential risk. Sedimentation ponds and biological or mechanical filters are usually used to reduce organic and inorganic wastes, however, these methods still result in sediments or sludges which need to be removed from the system. Likewise the construction or dredging of inlet or effluent canals results in dredge spoil which also needs appropriate disposal. The amount of salt in the sediments or spoil increases the problems with saline water culture systems.

Licensees **MUST** ensure no harmful substances (such as chemical contaminants, nutrient or salt leachates and pathogens) are discharged into surrounding waters or land during disposal of dredge spoil, sludges and sediments.

Licensees **MUST** store or dispose of the sediments or spoils in accordance with the practices set out in the DER guidelines so that potential environmental impacts from erosion and leachate are minimised.

Land-based facilities using saline water **SHOULD** consider the use of sedimentation ponds on effluent outlets, in addition various devices such as drum filters or channel filters are available.

Licensees **SHOULD** also consider the use of sedimentation ponds on effluent outlets.

Drainage of ponds **SHOULD** be carried out carefully or barriers used, to reduce quantities of organic sediment flowing into channels, to minimise re-suspension of sediments and to prevent excessive water velocities.

Licensees **SHOULD** communicate any timing of drainage from their facilities to other farmers in the same area.

Licensees **SHOULD** analyse pond sediments and document this to optimise management measures.

With brackish or saltwater culture systems on removal from raceways, ponds or tanks, the sediment **MUST** be stored in a designated disposal area or spread as top soil in appropriate crop or pasture areas. Licensees **MUST** ensure the storage areas have the following properties:

- The floor of the designated storage area is impermeable (e.g. HDPE liner) or sufficiently compacted to minimise nutrients leaching into groundwater;

- Methods (such as perimeter bunds) are used to prevent overland flow from entering the designated storage area (or crop/pasture area) and resulting in unacceptable levels of sediment/top soil erosion; and
- Methods are used to reduce erosion of the sediment from within the storage area (or crop/pasture area) and subsequent siltation of waterways (such as using cropping, hay bales or sediment traps).

In places where the inlet water supply is highly turbid, a primary sedimentation reservoir **SHOULD** be constructed for removal of suspended solids to prevent their sedimentation and accumulation in canals and ponds. Some facilities have two settlement ponds to allow for the drainage and drying out of one pond, while the other is being used.

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

Licensees **SHOULD** operate the facility using best practice techniques to minimise potential sediment impacts. These include the use of stock rotation, fallowing or resting of sites, management of stocking densities in relation to site water flow, and site selection that considers depth and sediment type characteristics. Fallowing is commonly used to rest a site for a long enough period for its sediments to return to its pre-stocking physical and chemical condition – this may take 12-18 months depending on the sediment characteristics and location.

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.

Licensees **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.

Licensees **MUST** not select any land-based site for disposal of stock without gaining the necessary approvals from LGAs (in some areas there could also be the possibility of disturbing Aboriginal heritage sites and, or, artefacts).

Harvesting & Processing Wastes

Only primary processing is authorised as part of an Aquaculture Licence. This basic processing includes voiding or purging stock for live transport or sale, slaughtering, washing of crustaceans, chilling or freezing and final packing for storage or transport.

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

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.

Licensees of land-based operations **MUST** contact the LGA for guidance on appropriate mechanisms to deal with sewage and grey water wastes for disposal at a 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, and other unusable culture equipment in sealed containers for disposal at facilities approved by local Shire Council. 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/markings_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.