GENERAL NOTICE

NOTICE 101 OF 2013

DEPARTMENT OF ENVIRONMENTAL AFFAIRS

NATIONAL ENVIRONMENTAL MANAGEMENT ACT,1998 (ACT NO. 107 OF 1998)

ENVIRONMENTAL IMPACT ASSESSMENT GUIDELINE FOR AQUACULTURE IN SOUTH AFRICA

I, Bomo Edith Edna Molewa, Minister of Water and Environmental Affairs, hereby give notice of my intention to publish Environmental Impact Assessment Guideline for Aquaculture in South Africa, under section 24J(a) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), set out in the Schedule hereto.

Members of the public are invited to submit to the Minister, within 30 (thirty) days after the publication of the notice in the *Gazette*, written comments of inputs to the following addresses:

By post to: The Director-General: Department of Environmental Affairs
Attention: Mr S Zondi
Private Bag X 447
Pretoria
0001

By hand at: 2nd Floor (Reception), Fedsure Forum Building, 315 Pretorius Street, Pretoria

By e-mail: szondi@environment.gov.za, or by fax to: 012 310 3688

Any inquiries in connection with the notice can be directed to Mr S Zondi at (012) 310-3169

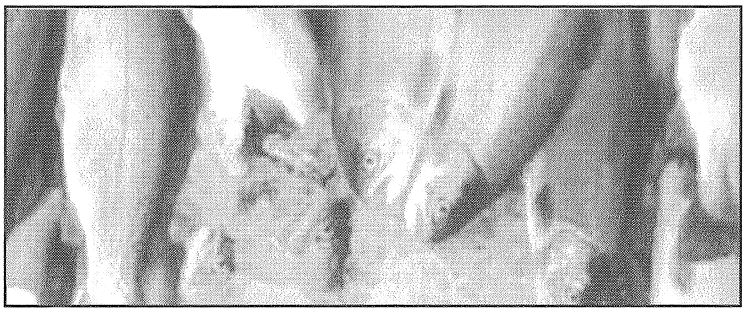
Comments received after the closing date may not be considered.

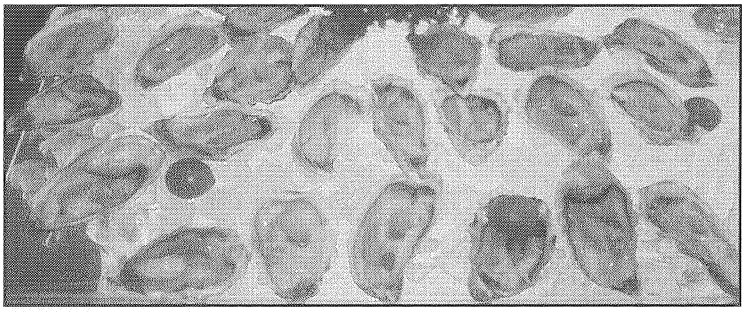
BOMO EDITH EDNA MOLEWA
MINISTER OF WATER AND ENVIRONMENTAL AFFAIRS

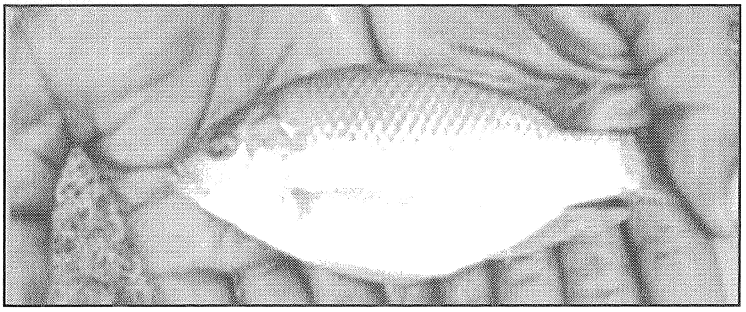
AQUACULTURE

environmental affairs
Department
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

EIA Guideline for Aquaculture in South Africa







2012

Compiled for the Department of Environmental Affairs by:
Etienne Hinrichsen from AquaEco

AQUA ECO

Department of Environmental Affairs:
EIA Guideline for Aquaculture in South Africa

Edition 1

Issued by: The Department of Environmental Affairs
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South Africa

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Please note: This document is intended as an information source and cannot take the place of legal advice in a specific situation governed by legislation.

Enquiries: All enquiries and comments should be addressed to:

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Department of Environmental Affairs
Private Bag X447
Pretoria, 0001
South Africa

Referencing: When referencing this document, it should be cited as follows:

Department of Environmental Affairs (2011): EIA Guideline for Aquaculture in South Africa, Department of Environmental Affairs, Pretoria.

ACKNOWLEDGEMENTS

This document has been compiled by Etienne Hinrichsen of AquaEco. The compilation was made possible through a collective effort in which various stakeholders in the South African aquaculture sector provided inputs, comments and overall direction.

The Department of Agriculture, Forestry and Fisheries is recognised for the role that it has played in providing strategic direction for the development of the aquaculture industry, while the Department of Environmental Affairs is acknowledged for creating a platform through which a more sustainable aquaculture sector can be developed. The project team from the Department of Environmental Affairs was coordinated by Mr Siyabonga Zondi.

PREFACE

The Department of Environmental Affairs has commissioned this ***EIA Guideline for Aquaculture in South Africa*** to assist stakeholders in the sector to comply with the environmental legislation that governs the development of aquaculture activities and to provide a basic background to integrated, responsible and sustainable environmental management practices.

The document does not provide all of the environmental management inputs that would be required for any specific project, but provides a starting point and framework for the implementation of more detailed management protocols. Likewise, the intention of the guideline is not to reproduce the entire legal process of authorisation, as this is captured in various guidelines that the Department of Environmental Affairs and other departments have made available and to which any prospective aquaculturist should also refer during the process of authorisation. This guideline depicts the outline of the authorisation process and indicates specific details that relate to aquaculture. Proper use of this guideline is as a generic reference.

This document has been compiled from the experiences of practitioners and authorities in South African aquaculture. It is further strengthened by literature on international best practice. To ensure a broad readership and usefulness the document has been compiled to assist all stakeholders ranging from government authorities at all levels, environmental practitioners, academics, existing aquaculturists, new entrants and entrepreneurs, NGO's and the general public.

EXECUTIVE SUMMARY

This EIA Guideline for Aquaculture in South Africa has been compiled by AquaEco on behalf of the Department of Environmental Affairs as a reference work that can be used by all stakeholders in the South African aquaculture sector. It provides guidance on the environmental authorisation process for aquaculture activities and provides a generic framework of good environmental management practices in the sector. The implementation of this guideline will assist with the creation of an environmentally responsible and more sustainable aquaculture industry.

The guideline is divided in various chapters. To ground the document the first chapter deals with the purpose, objectives and overarching principles, together with identification of its users and its legal standing. In order to ensure accessibility to the guideline and to elevate its usefulness for stakeholders that are new to the aquaculture sector, the second chapter provides information on aquaculture types, species typically farmed in South Africa and production trends, both locally and internationally.

The third chapter of the guideline deals with the environmental authorisation process for aquaculture activities. This encompasses the EIA authorisation process in terms of the National Environmental Management Act and the EIA regulations, supported by details on determining when environmental authorisations are required. In addition to the EIA requirements, the guideline provides particulars around the authorisation requirements in aquaculture underpinned by various environmental legal frameworks, including the Biodiversity Act, the Protected Areas Act, the Waste Act, the Integrated Coastal Management Act, the National Water Act, the Marine Living Resources Act and others. To facilitate compliance with all of these authorisation requirements, Section 16 of Chapter 3 provides stakeholders with a comprehensive authorisation checklist.

The fourth chapter of this guideline contains the generic good practices concepts that can be implemented in order to achieve greater environmental sustainability in the sector. These concepts are preceded by a section on integrated aquaculture planning, before being grouped into aspects related to the surrounding biophysical environment, the infrastructure environment, the production and husbandry environment and the social environment. Each of these groups deal with a number of concepts to which typical good practices are assigned.

The fifth chapter of this guideline deals with matters related to the auditing, decommissioning and the suite of environmental management tools that can be used in aquaculture. As a key tool, the required content of an Environmental Management Programme is provided.

Department of Environmental Affairs:
EIA Guideline for Aquaculture in South Africa

CONTENT

ACRONYMS AND ABBREVIATIONS

AIS	Alien & Invasive Species
ASC	Aquaculture Stewardship Council
BA	Basic Assessment
BAR	Basic Assessment Report
CA	Competent Authority
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMF	Environmental Management Framework
EMPr	Environmental Management Programme
EWT	Endangered Wildlife Trust
FAO	Food & Agriculture Organization
FEPA	Freshwater Ecosystem Priority Area
GAP	Good Agriculture Practice
GMO	Genetically Modified Organism
HACCP	Hazardous Analysis & Critical Control Point
I&AP	Interested & Affected Parties
ISO	International Standards Organization
MINMEC	Ministers and Members of Executive Council
MSDS	Material Safety Data System
NEMA	National Environmental Management Act
NEM: BA	National Environmental Management: Biodiversity Act
NEM: ICMA	National Environmental Management: Integrated Coastal Management Act
NEM: PAA	National Environmental Management: Protected Areas Act
NEM: WA	National Environmental Management: Waste Act
NWA	National Water Act
NGO	Non-Governmental Organization
OIE	Office International des Epizooties
PP	Public Participation
POS	Plan of Study
S&EIR	Scoping & Environmental Impact Report
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SANS	South African National Standards
SASS	South African Scoring System
SASSI	Southern African Sustainable Seafood Initiative
SR	Scoping Report
TOPS	Threatened or Protected Species
WESSA	Wildlife and Environment Society of South Africa
WWF	World Wide Fund for Nature

RELEVANT CONTACT DETAILS

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Aquaculture Association of Southern Africa	PO Box 71894 The Willows 0041 www.aasa-aqua.co.za

CHAPTER 1: INTRODUCTION

Globally the interest in aquaculture is growing rapidly, and although the sector is still small in South Africa, the accelerated global growth indicates the probability that such acceleration will occur locally. As fisheries resources are becoming increasingly vulnerable through over-utilisation and ecological degradation, the farming of aquatic organisms is becoming increasingly necessary to maintain supplies to a growing market. For this reason, it is probable that aquaculture will continue to develop in South Africa and it is therefore important that a guideline such as this be developed to ensure that this growth is conducted in an environmentally sound, responsible and sustainable manner.

1. PURPOSE AND OBJECTIVES OF THE GUIDELINE

This EIA Guideline for Aquaculture in South Africa has been commissioned by the Department of Environmental Affairs to assist with environmental and related authorisations and to provide a framework for sound environmental management in the sector. The guideline has been designed to provide a clear pathway towards better managing potential aquaculture impacts and to ensure that aquaculture development takes place within the environmental legal framework.

This guideline seeks to:

- Provide a better understanding of what aquaculture is and what the core functional and operational elements of aquaculture are.
- Align the EIA process and environmental authorisations to the specific nature of aquaculture.
- Identify all stakeholders across the aquaculture sector to empower these parties with the required EIA information and with the added purpose of ensuring comprehensive public participation during the application process for aquaculture authorisations.
- Identify and promote awareness of the potential positive and negative impacts associated with aquaculture.
- Present measures of mitigation to the potential impacts of aquaculture.

2. OVERARCHING PRINCIPLES

The overarching principles in this guideline are:

Participation

This principle recognises that all parties have a right to participate in the environmental management of aquaculture. Participation includes meaningful, timely and representative consultation with interested and affected parties (I&AP's) in order to arrive at effective and informed decision-making in the environmental authorisation process.

Freedom of Information and Transparency

This guideline strives to make relevant information freely available to all stakeholders in an open and transparent manner.

Sustainability

The guideline promotes actions and practices that focus on the conservation and sustainable use of natural resources, such that future generations have access to resources that are fit for use as provided for in the South African Constitution, 1996.

3. STRUCTURE OF THE GUIDELINE

This guideline is divided into five main chapters, these being:

Chapter 1: Introduction to the guideline.
Chapter 2: Background information on aquaculture types and the nature of the aquaculture industry.
Chapter 3: The environmental and other authorisation requirements for aquaculture.
Chapter 4: Key impacts and environmental management of these in aquaculture by means of good practice.
Chapter 5: Auditing, decommissioning procedures and environmental management tools.

4. USERS OF THE GUIDELINE

It is intended that this guideline be used by all people and parties associated with aquaculture in South Africa. The main users can however be grouped as follows:

Government

This guideline serves as an information document for government officials at national, provincial and local level. In this, government officials will use this document as a guideline both to the development and facilitation of aquaculture and as a framework to ensure that aquaculture initiatives are compliant with the environmental and related legislative frameworks. It is further intended that this document assist officials of competent and associated authorities that comment on and evaluate applications for environmental authorisation of aquaculture.

Sector Participants

The guideline has been compiled to assist current participants and new sector entrants to comply with the requirements of the applicable environmental legislation and to establish management practices that ensure environmental responsibility and sustainability. For this the guideline serves as a procedural framework for entrepreneurs, businesses and individuals that enter the sector.

Service Providers

All parties that provide services to the aquaculture sector can benefit by using the guideline as a framework to improve the nature of the services that are provided to the sector. This includes upstream services such as feed suppliers, veterinary services, technical consultants, etc. and downstream service providers such as processors, distributors and marketers.

Of particular importance is that this guideline be used by Environmental Assessment Practitioners (EAP's) that are employed to conduct environmental authorisation processes on behalf of participants in the aquaculture sector.

NGO's and other Interested Parties

All parties that have an interest in sustainable environmental management and the aquaculture sector in general, will find value in this guideline, specifically around its use as a reference work when formalising comments on proposed projects or opinions on existing aquaculture ventures.

Consumers

As the end user of aquaculture products it is envisaged that consumers will find value in this guideline in that it can be used as a yardstick against which the environmental responsibility of product suppliers can be measured.

5. LEGAL STANDING OF THE GUIDELINE

In South Africa the protection of the environment is governed by a range of resource-based legislation and by the Constitutional rights of all citizens to a protected environment that is not harmful to health or well-being. Therefore, all people have a legal obligation towards the protection and responsible use of the environment. Although this responsibility is bestowed upon all stakeholders in the aquaculture sector, this document serves only as a guideline towards the achievement of this responsibility. This guideline has been compiled to assist with compliance and to serve as a decision support tool related to the various legal frameworks that govern the development and operation of aquaculture. It is however not a legal instrument and should be used only as a guidance tool. In spite of the status of this guideline, its implementation does not in any way exempt the users thereof to comply fully with all relevant South African legislation.

CHAPTER 2: BACKGROUND TO AQUACULTURE

6. DEFINING AQUACULTURE

Aquaculture is defined as the propagation, improvement, trade or rearing of aquatic organisms (plant and animal) in controlled or selected aquatic environments (fresh, sea or brackish waters) for any commercial, subsistence, recreational or other public or private purpose.

Aquaculture does not include capture fisheries (or fisheries), which entails the harvesting of aquatic organisms from an environment in which no attempt has been made to manage or otherwise influence the organisms by containment, feeding or application of any husbandry techniques.

7. AQUACULTURE SYSTEMS

Due to the fact that aquaculture encompasses all farming practices in a water medium, a wide range of aquaculture types and techniques exist. Likewise, many different means of classification for these types exist, including classification by species, scale, environment, water use and more. Classification by production system is often used as a broad or general means by which aquaculture types are distinguished. In this regard aquaculture can be roughly divided into cage culture, tank culture (including raceway culture) and pond culture.

Cage culture refers to the use of net pens, while tank culture makes use of many different tank sizes, shapes, configurations and construction materials that range from plastics to concrete and glass. Pond culture mostly refers to earthen ponds, but includes the use of pond linings of various materials.

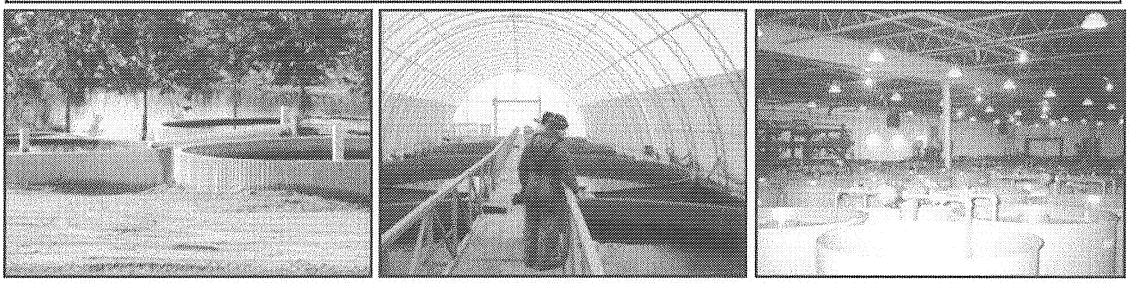
Classification of aquaculture by the intensity of production refers to extensive production as opposed to semi-intensive and intensive production, where the level of technology, capital expenditure, running costs, control, risk and volume of production per unit area typically increases from the less to the more intensive practices. Associated, but not necessarily linked to this, is the magnitude of production that can be broadly divided into small-scale operations (often subsistence ventures), medium scale enterprises and large-scale enterprises (occasionally referred to as industrial aquaculture).

Further classification is possible according to the nature of water use. In this regard differentiation can be made between closed systems where no (or very little) water is replaced, semi-open systems where water is supplemented or replaced from time to time and flow through or open systems where new water is continuously replacing water in the production system. In most cases the water entering into open or semi-open systems allows for the replenishment of oxygen and the removal of production wastes. In closed systems, oxygen (if required) must be added by other means, while production wastes are generally removed by continuous re-circulation and water filtration. Although there are exceptions, it is generally accepted that the degree of closure of an aquaculture system is related to the degree of potential environmental

impact and that completely open systems are less consistent with ecologically sustainable aquaculture.
Categorisation by species can be varied and includes typical species groups [e.g. finfish, shellfish (including crustaceans and molluscs), aquatic plants or algae] to typical user groups (e.g. ornamental use or fish for use as food).

Diagram 1: Examples of Various Aquaculture Systems

Examples of cage culture systems that range from small basic structures to large and technologically advanced production systems.



Examples of tank culture systems that range from outdoor circular tanks to technologically advanced indoor systems of various shapes and sizes.

Examples of pond culture systems that most often consist of earthen ponds of various sizes and shapes.

8. AQUACULTURE SPECIES

The species that are produced in South Africa can be broadly divided into freshwater and marine species. The following table provides an overview of these. The farming of exotic species (both those that are already found in the country and newly proposed species) require specific authorisation in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No 10 of 2004) (see Section 15.1).

Table 1: Main Aquaculture Species in South Africa[1]

Common Name	Scientific Name	Freshwater / Marine	Exotic / Indigenous	Notes
Common Carp	*Cyprinus carpio*	Freshwater	Exotic	Limited farming
Grass Carp	*Ctenopharyngodon idella*	Freshwater	Exotic	Low levels of specialist farming
Sharptooth Catfish	*Clarias gariepinus*	Freshwater	Indigenous	Widespread interest but limited farming
Rainbow Trout	*Oncorhynchus mykiss*	Freshwater	Exotic	Farmed in cold waters for angling and food
Brown Trout	*Salmo trutta*	Freshwater	Exotic	Limited farming for angling
Bass (Large and Smallmouth)	*Micropterus spp*	Freshwater	Exotic	Limited farming for angling
Nile Crocodile	*Crocodylus niloticus*	Freshwater	Indigenous	Widely farmed mainly for exported hides
Water Hawthorn	*Aponogeton distachyos*	Freshwater	Indigenous	Farmed in the Cape as a vegetable crop
Redbreast Tilapia	*Tilapia rendalii*	Freshwater	Indigenous	Limited farming in warm areas
Mozambique Tilapia	*Oreochromis mossambicus*	Fresh and brackish waters	Indigenous	Much farming interest, but limited production
Nile Tilapia	*Oreochromis niloticus*	Fresh and brackish waters	Exotic	Much farming interest with limited production
Mullet	Various	Fresh, brackish and marine	Indigenous	Limited farming around the coastline
Atlantic Salmon	*Salmo salar*	Fresh and marine waters	Exotic	Limited farming - possible future expansion
Various ornamental species	Various	Fresh and marine waters	Mainly exotic	Variety of species – many imported
Various seaweeds and water plants	Various (including *Ulva & Gracilaria)*	Fresh and marine waters	Indigenous and exotic	Farmed for various uses
Dusky Cob	*Argyrosomus japonicas*	Marine	Indigenous	Much farming interest and growing sector
Mediterranean Mussel	*Mytilus galloprovincialis*	Marine	Exotic but naturalised	Mainly limited to Saldanha Bay
South African Abalone	*Haliotis midae*	Marine	Indigenous	Largest contributor to aquaculture in SA
Pacific Cupped Oyster	*Crassostrea gigas*	Marine	Exotic but naturalised	Limited production for local consumption
Yellowtail	*Seriola lalandi*	Marine	Indigenous	Research and development

[1] *Note that new candidate species are continuously subjected to research and development and this list will change over time.*

Various other species have been farmed historically (e.g. eels and prawns), while many species could be candidates for future expansion of aquaculture in South African. These include scallops, urchins, clams, octopus and various finfish such as tuna, sole, White Stumpnose, Geelbek, White Steenbras, Grunter and Red Roman.

9. INTERNATIONAL AND LOCAL TRENDS

The current per capita consumption of food fish in the world has increased fivefold in the last four decades. When considering this in relation to the increased world population, it is clear that the demand for seafood and related products has grown significantly – to the extent that natural fishery supplies are not adequate to meet these needs. Aquaculture already supplies almost half of the global fish consumption and indications are that this contribution will show a steady increase.

Since the 1970's capture fisheries production has shown a global average increase of 1.2% annually, while aquaculture output has been growing at more than 6%. Terrestrial agriculture has shown a growth rate of 2.8% annually for the same period. In the last four decades global aquaculture output has increased tenfold compared to a factor of 1.6 times for capture fisheries and 3.1 times for terrestrial agriculture. This trend is set to continue as world fisheries production has effectively levelled off and the demand for fish continues to increase. This means that the shortfall in supply will have to come from aquaculture to maintain the global per capita consumption.

As the fastest growing global food production sector, aquaculture has become a sector of economic significance and many countries are gearing towards growth, development and increased outputs for local and export markets. Market forces, the diversification of the economic base, the sustainable utilization of resources and a quest for food security, drive this development. In this regard, aquaculture has developed into a diverse industry, with many countries participating in the production of more than 300 species of fish, shellfish, crustaceans and aquatic plants.

Forecast models for future global aquaculture output differ greatly, but at an expected annual growth rate of 4,5% between 2010 and 2030, the global aquaculture output will increase threefold (FAOSTAT, 2006). This compares well to the growth rates that were witnessed in traditional agriculture during the early twentieth century.

In spite of its vast natural and human resources, the participation of Africa in the global aquaculture sector is lacking and aquatic species indigenous to the continent have developed into species of international importance in countries outside of Africa. Developing countries from Southeast Asia and South America have secured significant participation and economic benefits from the sector, but African countries have been unable to do so.

The main constraints to aquaculture in African is the lack of infrastructure, absence of planning, poor governance, feed costs, access to and the cost of credit. In spite of these constraints, the African aquaculture output has shown a steady increase, outperforming other food production sectors on the continent. Africa is now widely recognised as a continent with vast new opportunities for aquaculture development.

10. SOUTH AFRICAN AQUACULTURE DEVELOPMENT

The development potential for aquaculture in South Africa is highly debatable and subject to constant revision. Yet, if guided by international trends, the newfound support from government, the growing need for integrated use of resources such as water and the socio-economic needs behind the diversification of food production, then the rapid growth of the aquaculture sector is inevitable.

In South Africa, as in many parts of the world, natural marine fisheries resources are under severe pressure. To meet the continued demand for fish and seafood this has to be supplied from sustainable aquaculture practices. Much debate has taken place around the use of fisheries resources to supply fish meal to aquaculture feeds, yet efforts are being made internationally to ensure greater sustainability as aquaculture continues to grow. Fish meal ratios for aquaculture production have decreased significantly, alternative (plant based) feeds are becoming more viable, while farming techniques and species choice have contributed to a more sustainable sector.

The South African climate (specifically the temperate and suboptimal climate for warm water species and the marginal conditions for cold water species), the scarcity of water and the high energy marine environment does make the continued development of aquaculture challenging. Yet, new marine and indoor technologies are being developed rapidly. The aquaculture landscape in South Africa is set to change as development continues to accelerate and expand into all nine of the provinces.

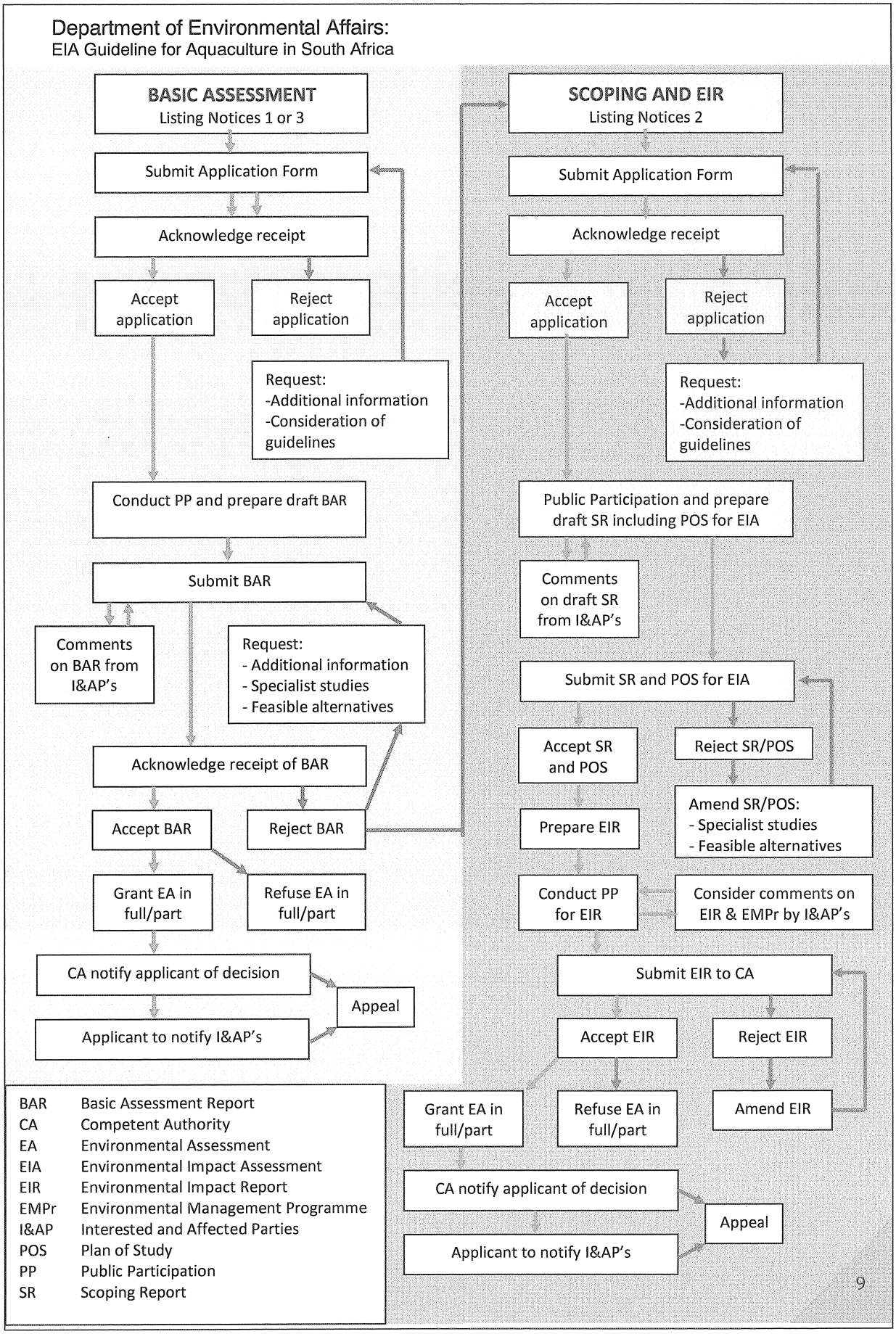
CHAPTER 3: ENVIRONMENTAL AUTHORISATIONS

11. DEFINING AN EIA

An Environmental Impact Assessment (EIA) is defined as a systematic process of identifying, assessing and reporting environmental impacts associated with an activity. An EIA can also be defined as a systematic process of examining the possible or potential environmental effects of a development.

In South Africa the EIA includes processes of Basic Assessment (BA) and Scoping and Environmental Impact Reporting (S&EIR). The difference between the processes relates to the nature of the proposed development in terms of its potential impact on the environment, and this is reflected in the level of detail of the information that is collected and accessed in each. Herein the BA process consists of a less rigorous assessment while S&EIR consists of a more onerous investigation of potential impacts.

The diagrams on the following page graphically illustrate the EIA process, both by means of BA (for activities in Listing Notice 1 and 3) and for S&EIR (for activities in Listing Notice 2). The origin of the Listing Notices is discussed in Section 12 hereafter.


Department of Environmental Affairs:
EIA Guideline for Aquaculture in South Africa
BASIC ASSESSMENT
Listing Notices 1 or 3
Submit Application Form
Acknowledge receipt
Accept application
Reject application
Request:
-Additional information
-Consideration of guidelines
Conduct PP and prepare draft BAR
Submit BAR
Comments on BAR from I&AP's
Request:
- Additional information
- Specialist studies
- Feasible alternatives
Acknowledge receipt of BAR
Accept BAR
Reject BAR
Grant EA in full/part
Refuse EA in full/part
CA notify applicant of decision
Appeal
Applicant to notify I&AP's
SCOPING AND EIR
Listing Notices 2
Submit Application Form
Acknowledge receipt
Accept application
Reject application
Request:
-Additional information
-Consideration of guidelines
Public Participation and prepare draft SR including POS for EIA
Comments on draft SR from I&AP's
Submit SR and POS for EIA
Accept SR and POS
Reject SR/POS
Amend SR/POS:
- Specialist studies
- Feasible alternatives
Prepare EIR
Conduct PP for EIR
Consider comments on EIR & EMPr by I&AP's
Submit EIR to CA
Accept EIR
Reject EIR
Amend EIR
Grant EA in full/part
Refuse EA in full/part
CA notify applicant of decision
Appeal
Applicant to notify I&AP's
BAR Basic Assessment Report
CA Competent Authority
EA Environmental Assessment
EIA Environmental Impact Assessment
EIR Environmental Impact Report
EMPr Environmental Management Programme
I&AP Interested and Affected Parties
POS Plan of Study
PP Public Participation
SR Scoping Report
9

12. LEGAL FRAMEWORK FOR AN EIA

The Constitution of the Republic of South Africa, 1996 states that every person has a right to an environment that is not harmful to health or well-being and that reasonable measures must be applied to protect the environment. This includes the prevention of pollution and the promotion of conservation and environmentally sustainable development, while promoting justifiable social and economic development.

To give effect to the Constitution, the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) was developed and promulgated as the primary environmental legislation. Amongst others, NEMA makes provision for the identification and assessment of activities that are potentially detrimental to the environment and which requires authorisation, based on the findings of an environmental assessment. NEMA is a national Act, which is enforced by the Department of Environmental Affairs (DEA). In the case of EIA's, this responsibility is most often assigned to Provincial Environmental Departments that act as the Competent Authority (CA).

To provide a legal framework for the EIA process the EIA Regulations are promulgated in terms of NEMA. These regulations include:

Regulation R 543 of 2010

The Environmental Impact Assessment Regulations that deal with the EIA process.

Regulation R 544 of 2010:

Listing Notice 1 that identifies all activities that are subject to Basic Assessment.

Regulation R 545 of 2010:

Listing Notice 2 that identifies all activities that are subject to Scoping and an Environmental Impact Report.

Regulation R 546 of 2010:

Listing Notice 3 that identifies activities that are subject to the requirement for an environmental authorisation due to their location.

Regulation R 547 of 2010:

The Environmental Management Framework Regulations that deal with the nature, process and content of Environmental Management Frameworks.

At the time of publication of this guideline, two correction notices (Government *Gazette No.* 33411: No. R. 660 of 30 July 2010 and Government *Gazette* No. 33842:

No. R. 1159 of 10 December 2010) had been promulgated and provide for amendments to the regulations above.

13. WHEN IS AN EIA REQUIRED FOR AQUACULTURE

Various activities from the regulations above (Listing Notices 1, 2 and 3) could apply or be related to aquaculture projects. The table that follows indicates the activities that are most likely to be triggered by aquaculture projects, meaning they require environmental authorisation by means of BA or by means of S&EIR. As aquaculture projects could encompass many secondary activities that may also be listed and which require authorisation, the onus to fully investigate all the activities in the applicable regulations remains that of the aquaculture proponent with the assistance of an Environmental Assessment Practitioner (EAP). Only the most pertinent activities have been indicated in the following table and the provisions related to some of these have been left out.

Table 2: Activities from Listing Notice 1 that could be triggered by aquaculture (requiring Basic Assessment)

No	Activity	Notes
4	*The construction of facilities or infrastructure for the concentration of animals for the purpose of commercial production in densities that exceed -* *(iii) 30 square metres per crocodile at any level of production, excluding crocodiles younger than 6 months.*	Applies to crocodile farming only (including the expansion or modification of crocodile farms to this level as per activity 31(iii) of Listing Notice 1).
6	*The construction of facilities, infrastructure or structures for aquaculture of:* *(i) finfish, crustaceans, reptiles or amphibians where such facility, infrastructure or structures will have a production output exceeding 20 000 kg but less than 200 000 kg per annum (wet weight);* *(ii) molluscs where such facility, infrastructure or structures will have a production output exceeding 30 000 kg but not exceeding 150 000 kg per annum (wet weight);* *(iii) aquatic plants where such facility, infrastructure or structures will have a production output exceeding 60 000 kg but not exceeding 200 000 kg per annum (wet weight);* *excluding where the construction of facilities, infrastructure or structures is for purposes of offshore cage culture in which case activity 7 in this Notice will apply.*	Applies to aquaculture of finfish, crustaceans, reptiles, amphibians, molluscs and aquatic plants (including the expansion or modification of aquaculture with these species to the stipulated levels as per activity 33 of Listing Notice 1).
7	*The construction of facilities, infrastructure or structures for aquaculture of offshore cage culture of finfish, crustaceans, reptiles, amphibians, molluscs and aquatic plants where the facility, infrastructure or structures will have a production output exceeding 50 000 kg but not exceeding 100 000 kg per annum (wet weight).*	Applies to all offshore cage culture (including the expansion or modification of offshore cage culture to this level as per activity 34).
8	*The construction of a hatchery or agri-industrial infrastructure outside industrial complexes where the development footprint covers an area of 2 000 square metres or more.*	Applies mainly to large hatchery complexes and certain high density industrial type aquaculture ventures (including expansion or modification of aquaculture activities to incorporate these scenarios as per activities 35 and 36 of Listing Notice 1).

14	*The construction of structures in the coastal public property where the development footprint is bigger than 50 square metres, excluding* *(i) the construction of structures within existing ports or harbours that will not increase the development footprint or throughput capacity of the port or harbour.*	Applicable to aquaculture for which infrastructure is required in coastal public property (e.g. pipelines or pump houses etc.) (including the expansion or modification of aquaculture activities to a level that incorporates such construction as per activity 43 of Listing Notice 1).
16	*Construction or earth moving activities in the sea, an estuary, or within the littoral active zone or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever is the greater, in respect of –* *(*various infrastructure*) but excluding:* *(a) if such construction or earth moving activities will occur behind a development setback line; or* *(b) where such construction or earth moving activities will occur within existing ports or harbours and the construction or earth moving activities will not increase the development footprint or throughput capacity of the port or harbour.*	Applies to all construction and earth moving for marine aquaculture in the sea, an estuary or within 100 metres inland from the high-water mark (including the expansion or modification of marine aquaculture to a level that incorporates such construction or earth moving as per activity 45 of Listing Notice 1).
18	*The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from:* *(i) a watercourse;* *(ii) the sea;* *(iii) the seashore;* *(iv) the littoral active zone, an estuary or a distance of 100 metres inland of the highwater mark of the sea or an estuary, whichever distance is the greater -* *but excluding where such infilling, depositing, dredging, excavation, removal or moving:* *a) Is for the maintenance purposes undertaken in accordance with a management plan agreed to by the relevant environmental authority; or* *b) Occurs behind the development setback line.*	Applies to all in-situ materials handling for aquaculture in a watercourse, the sea, an estuary or within 100 metres inland from the high-water mark (including instances where the expansion or modification of aquaculture incorporates such materials handling).
26	*Any process or activity identified in terms of Section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).*	At the time of publication of this guideline the applicable regulations identifying processes and activities in terms of Section 53(1) had not been promulgated. Yet, in terms of aquaculture the farming of any alien species (including indigenous species outside of their native range) should be regarded as a potential trigger of activity 26 of Listing Notice 1 (see also Section 15.1 below).
	Although not applicable to all aquaculture types the construction of large scale bulk water supplies (activities 9 and 37 of Listing Notice 1), aquaculture activities within 32 meters of a watercourse (activities 11 and 40 of Listing Notice 1) and large volume water storage (activities 12 and 41 of Listing Notice 1) may apply to certain aquaculture ventures. In addition to this the Department of Water Affairs (as a key commenting authority) may call for an environmental assessment on the grounds of aquaculture	In these cases any uncertainty should be referred to the CA for clarity.

	activities proposed within a 1:100 year flood line or within a 500 metre radius of a wetland.	

As indicated, an aquaculture project (new projects and the expansion or modification of existing projects) may encompass other listed activities that trigger the need for an environmental authorisation. This may relate to aspects such as the building of new access roads, land use changes, the release of Genetically Modified Organisms (GMO's) and more. Phased activities of which the initial phases are below the thresholds that trigger the requirement for an environmental authorisation, but which trigger this requirement over time, also require environmental authorisation prior to commencement of any particular phase (as per activity 56 of Listing Notice 1).

Table 3: Activities from Listing Notice 2 that could be triggered by aquaculture (requiring Scoping and EIR)

No	Activity	Notes
5	*The construction of facilities or infrastructure for any process or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent and which is not identified in Notice No. 544 of 2010 or included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case that Act will apply.*	This could apply to aquaculture in instances where water containing waste is released into the environment.
12	*The construction of facilities, infrastructure or structures for aquaculture of -* *(i) finfish, crustaceans, reptiles or amphibians where the facility, infrastructure or structures will have a production output of 200 000 or more kg per annum (live round weight);* *(ii) molluscs where the facility, infrastructure or structures will have a production output of 150000 or more kg per annum (live round weight);* *(iii) aquatic plants where the facility, infrastructure or structures will have a production output of 200 000 or more kg per annum (live round weight); excluding where the construction of facilities, infrastructure or structures is for purposes of offshore cage culture in which case activity 13 in this Notice will apply.*	Applies to aquaculture of finfish, crustaceans, reptiles, amphibians, molluscs and aquatic plants.
13	*The construction of facilities, infrastructure or structures for aquaculture of offshore cage culture of finfish, crustaceans, reptiles, amphibians, molluscs and aquatic plants where the facility, infrastructure or structures will have a production output of 100 000 or more kg per annum (live round weight)*	Applies to all offshore cage culture.

As with Listing Notice 1, an aquaculture project (new projects and the expansion or modification of existing projects) may encompass other listed activities that trigger the need for an environmental authorisation. This may relate to aspects such as the building of large storage dams (activity 19 of Listing Notice 2) or the alteration of 100 hectares or more of virgin soil to aquaculture (activity 16 of Listing Notice 2) and more.

Table 4: Activities from Listing Notice 3 that could be triggered by aquaculture (requiring at least a Basic Assessment)

No	Activity	Notes
12	*The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation.*	For this activity to be triggered it must relate to a specific geographical range that differs from province to province. Specific consultation with the regulations and the relevant CA are required to determine the areas that include endangered ecosystems, critical biodiversity areas, the

		littoral active zone or areas 100 metres inland from the high water mark of the sea or an estuary.
13	*The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation*	For this activity to be triggered it must relate to a specific geographical range that differs from province to province. Specific consultation with the regulations and the relevant CA are required to determine the areas that include biodiversity areas, ecological support areas, estuaries, protected areas, sensitive areas, areas near National Parks, areas declared in terms of International Conventions, within 1 kilometre from the sea, near watercourses, areas identified in terms of provincial plans, nature reserves and more.
15	*The construction of facilities, infrastructure or structures of any size for any form of aquaculture.* *(a) In an estuary;* *(b) In a Protected Area identified in the NEMPAA;* *(c) Areas on the watercourse side of the development setback line or within 100 metres from the edge of a watercourse where no such setback line has been determined.*	This applies to all forms of aquaculture irrespective of scale. In addition, this activity is also triggered by any expansion or modification of existing aquaculture activities in which the expansion or modification takes place within the areas as stipulated (including the expansion or modification of aquaculture within these areas as per activity 25 of Listing Notice 3).

Phased activities of which the initial phases are below the thresholds that trigger the requirement for an environmental authorisation, but which trigger this requirement over time, also require environmental authorisation prior to commencement of any particular phase (as per activity 25 of Listing Notice).

14. CORE CONCEPTS AND MATTERS IN THE EIA

As indicated, the intention of this guideline is not to reproduce existing guidelines on the EIA process. However, for all the users of this EIA Guideline for Aquaculture in South Africa, some of the core aspects of the EIA process are briefly outlined below.

The Competent Authority (CA)

The Competent Authority (CA) is that authority who is responsible for receiving and evaluating applications for environmental authorisation [refer to Chapter 2, Regulation 3 - 11 in the EIA Regulations (R 543 of 2010)]. For aquaculture the CA's will be the Provincial Environmental Departments in most instances[2]. Although the names of these CA's change, they are currently (at the time of publication) as follows:

[2] *The Minister determines the CA's in accordance with Section 24C of NEMA. In certain instances the CA may be the National Department of Environmental Affairs and this must be clarified with the applicable provincial and national authorities in all instances.*

Gauteng:

Department of Agriculture and Rural Development.

KwaZulu Natal:

Department of Agriculture, Environmental Affairs and Rural Development.

Limpopo:

Department of Economic Development, Environment & Tourism.

Mpumalanga:

Department of Economic Development, Environment and Tourism.

Northern Cape:

Department of Economic Development, Environment, Conservation and Tourism.

North West:

Department of Economic Development, Environment, Conservation and Tourism.

Free State:

Department of Economic Development, Tourism and Environmental Affairs.

Eastern Cape:

Department of Economic Development and Environmental Affairs.

Western Cape:

Department of Environmental Affairs and Development Planning.

The Environmental Assessment Practitioner (EAP)

A suitably qualified Environmental Assessment Practitioner (EAP) is required to perform the tasks associated with the respective EIA processes [refer to Chapter 3, Part 1, Regulation 16 - 18 in the EIA Regulations (R 543 of 2010)]. This person must be appointed and remunerated by the applicant wishing to have an aquaculture activity authorised and it is important that an EAP in an

aquaculture related application has experience in aquaculture authorisation processes.

Alternatives

Core to an environmental authorisation process is the assessment or evaluation of reasonable and practical alternatives. These could include alternative sites or project locations, layout alternatives, project design alternatives or technology alternatives. In aquaculture this could encompass the consideration of different production systems, different species and even aspects such as alternative feeds.

Public Participation (PP)

Public participation (PP) is a core and compulsory component of any environmental assessment [refer to Chapter 6, Regulation 54 - 57 in the EIA Regulations (R 543 of 2010)]. In PP all the potentially interested and/or affected parties (I&AP's) (including neighbours, local and district authorities, other government departments with applicable jurisdiction, NGO's, communities and the general public) are provided with an opportunity to provide inputs - both positive and negative, into any proposed project that is being subjected to an environmental authorisation process. In this process the I&AP's are furnished with project and process related information, provided with sufficient time to submit inputs and comments and informed of decisions taken in the authorisation process, together with information pertaining to their right of appeal to any decision.

Specialist Inputs and Specialist Studies

Certain potential environmental impacts or complex project designs or processes may require inputs from specialised professionals in an environmental authorisation process. Such inputs may be by means of commentary or by means of specialist studies. As a relatively new field that makes use of advanced technologies at times, specialist inputs may be required in certain aquaculture environmental authorisation processes, both to provide clarity around processes and potential impacts and also to ensure that adequate information is generated for I&AP's and to enable CA's to make informed decisions. Specialist studies are usually associated with S&EIR [refer to Chapter 3, Part 3, Regulation 32 in the EIA Regulations (R 543 of 2010)].

Environmental Management Programmes (EMPr's)

An essential component of an environmental authorisation process is the compilation and submission of an Environmental Management Programme (EMPr) (previously called an Environmental Management Plan or EMP). The required content is explained in Chapter 3, Part 3, Regulation 33 in the EIA Regulations (R 543 of 2010). The purpose of the EMPr is to document and plan the management approach that will best achieve the avoidance and minimisation of potential environmental impacts in the construction, operation and decommissioning phase. Chapter 4 contains many of the management

practices that would typically be included in such management plans. However, being a generic document, this guideline does not include specific details that may relate to the management requirements of a particular project.

Environmental Authorisation

At the completion of all the required submissions, the CA may issue an environmental authorisation that will contain a summary of the factors that have led to the decision, a description of the authorised activities and various conditions of authorisation to which the applicant or holder of the authorisation is legally bound [refer to Chapter 3, Part 4, Regulation 36 - 37 in the EIA Regulations (R 543 of 2010)].

Appeals

Any person or organisation has the right to appeal a decision made by a CA in the granting or refusing of an environmental authorisation, including sections and or conditions of such authorisations. In this regard it is the responsibility of the applicant and/or the appointed EAP to inform all I&AP's of decisions taken in the environmental authorisation process and to ensure that these parties understand the appeal procedures [refer to Chapter 7, Regulation 58 - 66 in the EIA Regulations (R 543 of 2010)].

Duration of an EIA

Feedback from CA's on aspects of the environmental authorisation processes (both BA and S&EIR) are subject to specific timeframes. Given these timeframes and the time it takes an EAP to prepare all the aspects in an environmental authorisation process, a BA process may take 6 months or longer to complete, while a S&EIR may take 12 months or longer. These timelines may be extended by inadequate submissions, information shortages, appeals and requirements for other authorisations (see Section 15 below). The considerable time required for an environmental authorisation process makes it essential for aquaculture project developers to commence with the applications well before the desired project commencement date. No development may take place prior to the issue of the environmental authorisation. Choosing to ignore the need for such an authorisation or commencing with activities not yet authorised could lead to severe fines and/or imprisonment as contemplated in Chapter 8, Regulation 71 in the EIA Regulations (R 543 of 2010), read with Section 24F of NEMA.

15. OTHER LEGISLATION AND AUTHORISATIONS

Although this guideline is focussed on the EIA processes related to aquaculture, a number of additional environmental legal frameworks and authorisations apply to the sector. Apart from constituting a legal requirement, successful completion of the EIA process itself often depends on compliance with these additional requirements.

15.1. NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT

The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) or NEM:BA provides for, among others, the management and conservation of biological diversity and the components of such biological diversity, the sustainable use of indigenous biological resources, and the fair and equitable sharing of benefits arising from bio-prospecting.

In effecting the Act, two regulations impact on aquaculture activities and these are briefly discussed below:

The Threatened or Protected Species Regulations, 2007 (TOPS Regulations)

These regulations govern restricted activities undertaken with listed threatened or protected species. Such restricted activities that apply to aquaculture include the import, export, possession, breeding, killing, transport and trade of these organisms. Undertaking these activities with a threatened or protected species requires an application to the National Department of Environmental Affairs (in terms of marine aquaculture species) and the applicable provincial issuing authority (in terms of other species) for a TOPS permit. An authority may require a risk assessment to be undertaken as part of the application, while certain provinces have specific requirements that relate to specific provincial legislation that may be applied in addition to the TOPS regulations.
Of particular interest in aquaculture is the requirement for a TOPS permit in the case of the following species that have been listed as "*Protected*"[3] in the List of Critically Endangered, Endangered, Vulnerable and Protected Species, 2007[4]:

- South African Abalone (*Haliotis midae*)
- White Steenbras (*Lithognathus lithognathus*)
- Nile Crocodile (*Crocodylus niloticus*)

The species above are the only aquaculture candidates that have also been captured in Table 1 (Section 8) of this guideline, which depict current aquaculture species in South Africa. It is however advisable that the use of any other (new) indigenous candidate species in aquaculture be checked against the requirement for a TOPS permit and/or a permit from the applicable provincial issuing authorities.

The Alien and Invasive Species Regulations, 2009 (AIS Regulations)

At the time of publication of this aquaculture guideline, the AIS regulations had not been promulgated due to the lack of certain legal provisions in NEM:BA.

[3] *A "Protected" species includes species which are of such high conservation value or national importance that they require national protection.*
[4] *At time of publication, the TOPS regulations and the associated lists of species were being amended. It is therefore prudent for any aquaculture proponent to remain abreast of such amendments that may affect permitting requirements.*

The 2009 draft version of these regulations is likely to change and although a brief overview of these draft regulations are included here, it is advisable that any aquaculture venture proposing the use of alien or invasive species, whether the species is currently present in South Africa or not and including indigenous species proposed for use outside of their native range, should attain further advice in terms of permitting and authorisation from the applicable provincial conservation - or national authorities (specifically the Department of Environmental Affairs) or adequately qualified professional service providers.

The 2009 draft regulations govern restricted activities undertaken with alien and listed invasive species. Such restricted activities that apply to aquaculture include, amongst others, the propagation, movement, trade and release of these organisms.

At the time of publication of this aquaculture guideline, the AIS regulations had been approved by MINMEC for publication and implementation. The approved regulations however provide only for regulation of key priority listed invasive species according to different categories; namely species listed and regulated as Category 1a, meaning listed invasive species requiring compulsory control, and Category 1b, meaning species regulated by an invasive species management programme. This was due to lack of certain enabling provisions in NEMBA, which include the provision to exempt listed invasive species from permit or risk assessment requirements for the carrying out of restricted activities and to prohibit restricted activities involving listed invasive species. The result is that the draft maps produced for invasive fish species, for the regulation of these species by area, cannot be implemented at this stage.

To address the above shortcomings in NEMBA, DEA have initiated a process of urgent amendments to NEMBA. The AIS regulations and species list will only be amended to include species regulated by area and species regulated by activity, once the NEMBA amendments are assented to by the President.

Pending the publication of the new regulations in this regard, the principal approach promoted by this guideline is that any proposed alien or invasive species should only be considered after consultation with the applicable provincial conservation - or national authorities (specifically the Department of Environmental Affairs) or adequately qualified professional service providers.

Although certain provinces have specific additional requirements that relate to specific provincial legislation that may be applied in addition to the AIS regulations, a standardised risk assessment framework has been promulgated (in terms of NEM:BA) and must, as a minimum, include:

- Information regarding the relevant species, including:
    - The taxonomy of the species, including its class, order, family, scientific name (if known), genus, scientific synonyms and common names of the species.
    - The originating environment of the species, including climate, extent of geographic range and trends.

- Persistence attributes of the species, including reproductive potential, mode of reproduction, dispersal mechanisms and undesirable traits.
- Invasive tendencies of the species elsewhere and taxonomic predisposition.
- The history of domestic propagation or cultivation of the species, introductions and the extent of naturalization.
- Nutritional or dietary requirements of the species and, where applicable, whether it has a specialist or generalist diet.
- The ability of the species to create significant change in the ecosystem.
- The potential to hybridize with other species and to produce fertile hybrids.

- Information regarding the restricted activity in respect of which the permit is sought, including:
  - The nature of the restricted activity.
  - The reason for the restricted activity.
  - The location where the restricted activity is to be carried out.
  - The number and, where applicable, the gender of the specimens of the species involved.
  - The intended destination of the specimens, if they are to be translocated.
- Information regarding the receiving environment, including:
  - Climate match.
  - Habitat.
  - The presence of natural enemies, predators and competitors.
  - The presence of potentially reproductive compatible species.

Furthermore, a risk assessment as contemplated above must identify:

- The probability that the species will naturalize in the area in which the activity is to be carried out or in any other area elsewhere in the Republic.
- The possible impact of the species on the biodiversity and sustainable use of natural resources of:
  - The area in which the restricted activity is to be carried out.
  - In any other area elsewhere in the Republic.
- The risks and potential impacts on biodiversity by the species to which the application relates.
- The risks of the specimen serving as a vector through which specimens of other alien species may be introduced.
- The risks of the method by which a specimen is to be introduced or the restricted activity carried out serving as a pathway through which specimens of other alien species may be introduced.
- Any measures proposed in order to manage the risks.

The risk assessment must also consider:

- The likelihood of the risks being realized.
- The severity of the risks and consequences of the realization of the risks for other species, habitats and ecosystems.

- The potential costs associated with the control of the species to minimize harm to biodiversity.
- Options for minimizing the potential risks.
- Management of the potential risks.

15.2. NATIONAL ENVIRONMENTAL MANAGEMENT: PROTECTED AREAS ACT

The National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) or NEM: PAA governs, amongst others, the protection and conservation of ecologically viable and sensitive areas in the natural landscape and seascape, including the management of these areas in accordance with National norms and standards. These protected areas are defined in the Act as:

- Special nature reserves, nature reserves (including wilderness areas) and protected environments.
- World heritage sites.
- Specially protected forest areas, forest nature reserves and forest wilderness areas declared in terms of the National Forests Act, 1998 (Act No. 84 of 1998).
- Mountain catchment areas declared in terms of the Mountain Catchment Areas Act, 1970 (Act No. 63 of 1970).

In terms of aquaculture it is recognised that certain marine aquaculture activities could affect or take place in or in close proximity to certain marine protected areas and sensitive estuaries, while inland aquaculture could be associated with catchment or other conservation worthy environments. In accordance with the Act, these areas are subject to a management plan, which is implemented by a management authority. Although the Act makes provision for commercial and community activities such as aquaculture in protected areas, this must be done in accordance with the management plan. Proposals for aquaculture projects in protected areas will require consultation with the management authority, while such authorities must be included as stakeholders in an environmental authorisation process for any proposed aquaculture project in close proximity to protected areas.

Many of the large public dams and estuaries in South Africa have been recognised as protected areas in terms of this Act. The use of these dams or estuaries for aquaculture is therefore subject to this Act.

15.3. NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT

The National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) or NEM: WA governs, amongst others, waste minimisation, recovery, re-use, recycling, treatment, disposal and integrated waste management. A number of listed waste management activities have been promulgated in Government Notice 718 (2009) and require authorisation by means of either a BA or a S&EIR process as contemplated in the EIA regulations (refer to Sections 11-14). Although few of these listed waste

management activities are directly applicable to aquaculture, the onus to fully investigate all the waste activities remains that of the aquaculture proponent with the assistance of his/her appointed EAP. Of importance is that a waste management licence application and authorisation (by means of BA) is required for the disposal of domestic waste (typical to aquaculture facilities) in areas that are not serviced by municipal waste disposal services.

15.4. NATIONAL ENVIRONMENTAL MANAGEMENT: INTEGRATED COASTAL MANAGEMENT ACT

The National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008) or NEM: ICMA sets out an integrated approach to managing and conserving coastal resources to promote social equity and regulate these resources, whilst protecting the natural ecology. Amongst others, the purpose of the Act includes the determination of the coastal zone, provisions for the coordinated and integrated management of the coastal zone and for the preservation and protection of the coastal ecology.

The coastal zone is defined as the area comprising coastal public property (mainly Admiralty Reserve and land below the high water mark), the coastal protection zone (an area along the inland edge of coastal public property), coastal access land (which the public may use to gain access to coastal public property), special management areas and includes any aspect of the ecology on, in and above them. Marine aquaculture is often wholly or at least partially practiced within this zone.

The Act requires users of coastal public property, owners and occupiers of land, coastal managers and other responsible persons to take reasonable measures to avoid causing adverse effects on the coastal environment and to ensure that any South African's right of access to the coastal public property is upheld.

Through the Act it is not intended that a new authorisation and assessment process be implemented in addition to the BA or S&EIR processes in terms of the EIA regulations. The Act does however provide additional factors and criteria which the competent authority must consider when issuing environmental authorisations for activities affecting the coastal zone. The Act also deals with the manner in which coastal public property is let, leased and through which limited use rights over coastal property are granted through concession (as is often required for marine aquaculture projects, including the property required for intake and effluent pipelines).

Of particular importance to marine aquaculture is that the Act sets integrated procedures for regulating the disposal of effluent water into estuaries and the sea. As effluent is defined as any liquid discharged into the coastal environment as waste, most marine aquaculture entities will require authorisation for such discharges by means of a Coastal Waters Discharge Permit. All existing effluent discharge pipelines (including discharges previously authorised under the National Water Act) will also require re-application for a Coastal Waters Discharge Permit.

15.5. NATIONAL WATER ACT

The National Water Act, 1998 (Act No. 36 of 1998) or NWA recognises that water is a scarce and unevenly distributed national resource that belongs to all people. The Act deals with the equitable allocation of water within a framework of water resource management that aims towards the sustainable use of water for the benefit of all users. Amongst others, the purpose of the Act is further to ensure that water resources are equitably and sustainably protected, used, developed, conserved, managed and controlled in a manner which ensures the meeting of basic human needs and the facilitation of social and economic development.

Section 21 of the NWA identifies the types of water uses recognised under the Act. In terms of aquaculture, the following water uses are relevant:

- 21 (a) taking water from a water resource.
- 21 (b) storing water.
- 21 (c) impeding or diverting the flow of water in a watercourse.
- 21 (f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit.
- 21 (g) disposing of waste in a manner which may detrimentally impact on a water resource.
- 21 (h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process.
- 21 (i) altering the bed, banks, course or characteristics of a watercourse.

As the primary resource on which aquaculture depends, the lawful use of water is of utmost importance. The NWA makes provision for such lawful use through different entitlements (authorisations) as provided for in Section 22 of the Act. These include:

- Allowing water to be used by virtue of being classified as a Schedule 1 use (this being the use of water for basic domestic needs and which will include lawful use of water mainly for very small scale aquaculture projects).
- Allowing water to be used by virtue of the fact that it is an existing lawful use as defined in the Act. This is a water use that was legally sanctioned before promulgation of the NWA.
- Allowing water to be used by means of a general authorisation (through which certain water use types are permissible in certain areas). This involves reference to the most recently promulgated general authorisations and registration of the water use with the Department of Water Affairs (DWA).
- Allowing water to be used by means of a licence for which an application to the DWA is required.

15.6. MARINE LIVING RESOURCES ACT AND MARINE AQUACULTURE RIGHTS

Although there is some duplication between the National Environmental Management: Integrated Coastal Management Act and the Marine Living Resources Act, 1998 (Act No. 18 of 1998), this Act provides, amongst other, for the conservation of the marine ecosystem, the long-term sustainable utilisation of marine living resources and the orderly access to exploitation, utilisation and protection of certain marine resources.

Although there is little direct reference to marine aquaculture, the Act indicates the need for the issue of a right for any person wishing to engage in mariculture or operate a fish processing establishment. This right is obtained by means of application to the Department of Agriculture, Forestry and Fisheries, Branch: Fisheries, Chief Directorate: Aquaculture Economic Development, Directorate Sustainable Aquaculture Management.

A marine aquaculture right is valid for 15 years and specific permits are required in order to utilize the right, depending on the marine aquaculture activity to be carried out. The current array of available permits (which is annually reviewed and updated) is contained in the list hereafter, but the onus to ensure that all marine aquaculture permitting requirements have been met rests with the proponent and it is advisable that the Directorate for Sustainable Aquaculture Management be consulted in this regard:

- Permit to engage in ranching activities of marine species (currently applicable to abalone ranching only).
- Permit to collect broodstock for marine aquaculture activities.
- Permit to operate a marine aquaculture fish processing establishment.
- Permit for a local fishing vessel engaged in marine aquaculture related activities.
- Permit to engage in marine aquaculture activities: grow-out.
- Permit to possess broodstock and operate a hatchery.
- Permit to transport marine aquaculture fish or any product thereof.
- Permit for the local sale of undersized cultured marine aquaculture products, such as abalone and kob where size restrictions are imposed by the Marine Living Resources Act, 1998.
- Permit for commercial import and export, including the permit for import of juvenile and larval oyster seed.
- Permit to import marine ornamental organisms.
- Requirements associated with monitoring in the South African Molluscan Shellfish Monitoring and Control Programme, when there is intent to farm any shellfish for human consumption.

These permit requirements are generally applicable after an environmental authorisation has been granted and are broadly supported by numerous guideline documents, protocols, best practices and species specific measures that are available from DAFF.

15.7. OTHER LEGISLATION AND PERMITTING

A number of secondary permitting and/or authorisation requirements apply to aquaculture activities. Although many of these requirements are applicable to aquaculture activities in addition to the environmental authorisation requirement, particular attention should be paid to the requirements of provincial ordinances during an environmental authorisation process. In certain provinces these ordinances are overseen by the assigned EIA authorities (see Section 14), but in others they are administered by conservation bodies such as Cape Nature, Ezemvelo KZN Wildlife Services and the Mpumalanga Tourism and Parks Agency. In certain provincial ordinances the introduction of any aquatic organism and the establishment of any aquaculture facility require approval from the relevant provincial administrative authority, while in certain coastal provinces authorisation or permitting is required for beach access. As it is obligatory that these organisations be included as I&AP's in any environmental authorisation process within their particular provinces, further obligations in terms of the relevant ordinances will be addressed. The collecting of inland (freshwater) broodstock, transport and holding of fish is generally addressed by such provincial ordinances.

As a national custodian, the South African National Parks Board (SANParks) should also be included as a potential I&AP in authorisation processes for aquaculture projects in close proximity to national parks. Prominent NGO's such as the World Wide Fund for Nature (WWF), the Endangered Wildlife Trust (EWT) and the Wildlife and Environment Society of South Africa (WESSA) must also be considered as potential I&AP's.

The use of land that is appropriately zoned for aquaculture, agriculture or industrial use in terms of relevant town or regional planning schemes is important. This could be dealt with through applications for re-zoning or consent use, which is administered at local level. Related to this aspect is the correct and adequate provision of civil services such as waste collection, water provision and treatment of waste water.

Where any aquaculture activity is planned or operated in proximity to potential heritage sites (including graves, building older than 60 years, archaeological and paleontological sites etc.) consultation with the applicable heritage resources agencies is required to ensure compliance with the National Heritage Resources Act, 1999 (Act No. 25 of 1999).

It is important that adequate consideration is given in aquaculture to compliance with the Animals Protection Act, 1962 (Act No. 71 of 1962) and the related codes of practice that ensures animal welfare. This includes ensuring that production animals are free from hunger, fear and distress, injury, pain, illness, discomfort and that they are able to express their natural behaviours.
Other permitting requirements for aquaculture activities relate to obtaining veterinary clearances and authorisations for the export and import of organisms (Animal Diseases Act and the Animal Health Act), the use of registered feeds and the meeting of legal requirements related to end product or food safety.

16. AUTHORISATION CHECKLIST

In order to facilitate compliance by all perspective aquaculturists and aquaculture developers, the following assistive checklist has been compiled.

Table 5: Checklist to Aquaculture Authorisation Requirements

Authorisation	Legal Reference	Aquaculture Type	Relative Timing
Environmental authorisation.	National Environmental Management Act and EIA Regulations (Regulations 543 of June 2010).	All aquaculture types that trigger activities listed in Regulations 544, 545 or 546 of June 2010 (with due consideration of correction notices: R660 of 30 July 2010 and R1159 of 10 December 2010).	Prior to any activities taking place.
Authorisation for use of threatened or protected species.	National Environmental Management: Biodiversity Act, Threatened and Protected Species Regulations and Provincial Ordinances	Any proposed aquaculture activity with a threatened or protected species.	Prior to any activities taking place and in conjunction with environmental authorisation.
Authorisation for use of alien or invasive species.	National Environmental Management: Biodiversity Act, the Alien and Invasive Species Regulations and Provincial Ordinances.	Any proposed aquaculture activity with an alien or invasive species.	Prior to any activities taking place and in conjunction with environmental authorisation.
Authorisation for aquaculture activities in or adjacent to protected areas.	National Environmental Management: Protected Areas Act.	Any proposed aquaculture activity in or adjacent to protected areas.	Prior to any activities taking place and in conjunction with environmental authorisation.
Waste licencing.	National Environmental Management: Waste Act.	All aquaculture that trigger the listed waste management activities in Regulation 718 of 2009.	Prior to any activities taking place and in conjunction with environmental authorisation.
Authorisation of aquaculture in coastal zones.	National Environmental Management: Integrated Coastal Management Act.	All aquaculture activities in the coastal zone and specifically for the discharge of aquaculture effluent into the coastal zone.	Prior to any activities taking place and in conjunction with environmental authorisation.
Water use authorisation.	National Water Act.	All aquaculture water uses that are recognised by Section 21 of the Act.	Prior to any activities taking place and prior to or in conjunction with environmental authorisation.
Marine aquaculture rights.	Marine Living Resources Act.	For all marine aquaculture.	After having obtaining environmental authorisation, but before any activities commence. Note the need for related permits.
Other permitting.	Various.	For all aquaculture types as required.	Related to heritage matters, inland transport, veterinary matters, product safety etc.

CHAPTER 4: ENVIRONMENTAL MANAGEMENT

17. THE SCALE OF POTENTIAL IMPACTS OF AQUACULTURE

As with any human development, aquaculture poses certain risks to the environment if not implemented along principles of sustainability. Although it is known that aquaculture can lead to significant environmental impacts, especially when practiced at large scale and where production takes place in environmentally "*open*" systems, the environmental risk profile of present-day aquaculture is however comparatively low. It is therefore important to recognize the relatively minor contribution of aquaculture impacts related to the scale and degree of impacts in global agriculture, human population growth and industrial development. Nevertheless, aquaculture impacts can cause environmental damage in certain instances if left unchecked and unmanaged. This section of the EIA and Environmental Management Guideline looks at certain generic good practices that can be applied in the planning and operation of aquaculture ventures to ensure greater environmental sustainability.

In general, the impacts of aquaculture relate to effects on water, its direct and indirect impacts on biodiversity and ecosystems and the effects of disease. Other effects such as impacts on wild fish stocks (through seed or broodstock collection or harvesting for fish meal for fish feeds), aesthetic disturbance and the cumulative impact of aquaculture together with other users of natural resources and water also need to be considered. Most of the potential negative impacts of aquaculture can however be mitigated effectively through planning, including inter alia proper site and technology selection and sound management. Viewing this degree of effective mitigation with the positive social and economic aspects of aquaculture is important when evaluating environmental risks associated with the sector, especially in light of the fact that that aquaculture can play an important role in matters such as food security, economic development and alleviation of pressures on natural fisheries.

18. INTEGRATED PLANNING

Integrated, flexible and detailed planning is required to ensure the successful authorisation and sustainable operation of an aquaculture venture. In this process the resource as well as social and ecological issues should influence the concept formulation to the same extent as the technical and financial matters. This planning should be based on a feedback process in which designs and plans are continuously tested against the applicable resource and - , social and ecological matters so that the concept can be modified to best achieve a proposed venture or project in which negative impacts can be avoided or minimised. The following sections highlight certain environmental planning matters.

18.1. MACRO-PLANNING

People, economic activities, social needs, infrastructure and natural resources are not evenly distributed across the landscape and these variations impact directly on economic growth, social justice and the ability of the natural environment or ecology to support human activities.

No definite zoning or macro-planning initiatives have been developed specifically for aquaculture, but there is a strong drive towards the recognition and development of aquaculture nodes (especially for marine aquaculture). Nevertheless, it is important to consider applicable overarching macro-planning structures and frameworks (such as spatial development plans, integrated development plans and the range of available geographic biodiversity information resources[5]) when planning and positioning a new aquaculture venture. This consideration is best achieved through consultation with local, regional and provincial authorities that oversee such planning frameworks.

18.2. MICRO-PLANNING AND SITE SELECTION

Although the criteria for the selection of offshore marine and onshore (marine and freshwater) aquaculture sites differ greatly, the aim in site selection for aquaculture is based on the selection of an area that will be economically viable, socially acceptable and ecologically sustainable. The following are a few of the considerations in terms of environmentally responsible aquaculture site selection and planning:

Legal Tenure to Land and Water

As aquaculture activities require both land and water, the planning for a new venture must consider its requirements in terms of land ownership or other legal tenure. Legal access to water of sufficient volume and quality is also required (see Section 15.5).

Physical Suitability and Access

The resources upon which aquaculture depend are often located in relatively inhospitable areas (e.g. mountain areas for trout farming, exposed coastal zones for pump-ashore marine aquaculture and open water sites for cage culture). For this reason it is imperative to ensure that aquaculture sites are suitably and safely accessible.

Apart from considering the climatic, geological and topographical suitability when locating and planning aquaculture, consideration must be given to hydrological aspects such as flooding, tidal actions and currents.

[5] *These information resources, maintained by the South African National Biodiversity Institute (SANBI), include maps for invasive alien species, maps of Freshwater Ecosystem Priority Areas (FEPA's), provincial spatial biodiversity plans that identify critical biodiversity areas and ecological support areas and maps of marine ecosystem priority areas.*

Service and Infrastructure Needs

Aquaculture projects require adequate services and infrastructure such as roads, electricity, water, solid waste removal and sewage services. It is important that these services are catered for or included in the planning of any venture.

Environmental Capacity and Value

The capacity of the receiving environment relates to the degree to which environmental services (e.g. assimilation of nutrients) are available in a sustainable manner. For aquaculture, the required environmental service capacity relates to many aspects ranging from water requirements, nutrient assimilation capacities, social capacities, etc. These natural resources and services often have multiple users that require consideration in planning.

The environmental value of a proposed site can be defined by many aspects that include species diversity, biodiversity, levels of endemism, land use, heritage, social values, aesthetic value, robustness of the environmental services, nature of the resources and more. All of these aspects must be brought into consideration, predominantly in site and technology selection and thereafter in the planning and development of an aquaculture venture. The South African National Biodiversity Institute (SANBI) maintains a wide range of environmental geographic information resources that should be consulted in this regard and should be used to determine aspects that include proximity to Freshwater Ecosystem Priority Areas (FEPA's), critical biodiversity areas, ecological support areas, threatened ecosystems, protected areas and the ecological role of the site in its regional context.

Of importance is that the potential impacts of aquaculture also be seen in context to the cumulative impacts of other activities (other users) and the effects that such cumulative impacts could have on environmental health and the environmental capacity.

Social Aspects

Access to human resources in terms of availability, empowerment, qualifications, experience and proximity must be assessed before any aquaculture development.

As operating any project in disharmony with surrounding communities is likely to contribute significantly to long-term failure, the potential social effects of aquaculture must be considered in planning.

Economic Aspects

The availability and sustainability of financial resources to undertake an aquaculture venture is a budgetary issue that is not addressed in this guideline, apart from cautioning against the potential environmental risks posed by any aquaculture ventures which fail due to a shortage in financial resources. It is

also important to note that many aquaculture ventures are predisposed to financial failure due to a misinterpretation or misunderstanding of the importance around resource assessment and integrated best practice planning.

Scale

In planning, the scale of operations are an important consideration, determined by many factors that include the financial means, the location, the limitations posed by husbandry, the availability of stock, the markets, the required technologies and more.

Feasibility

As with the economic aspects above, this guideline does not address matters related to feasibility. However, as feasibility related aspects (e.g. transport and logistical constraints, the availability of markets, competition and more) can cause direct and indirect environmental impacts, aquaculture proponents are cautioned in this regard.

In South Africa a lack of proper feasibility planning around fingerling or spat needs and aquaculture feeds is a major contributor to aquaculture failure, which could have environmental consequences.

19. THE SURROUNDING BIOPHYSICAL ENVIRONMENT

19.1. MANAGING SPATIAL IMPACTS

Generally, the potential aesthetic impacts related to aquaculture are limited, but need consideration from the perspective of all stakeholders. Regardless of the production system and extent of an aquaculture development's footprint, land is required. The potential spatial impacts of aquaculture relate mainly to multiple land uses, land use and biodiversity planning and aesthetic matters.

Aquaculture activities are often situated in ecologically important riparian or coastal zones and areas rich in water, rich in biodiversity and which are important to tourism and important from a water and ecological resource and service management perspective.

Good practices for spatial planning include:

- The selection of aquaculture sites that are less environmentally sensitive and with as little conflict as possible with natural processes, biodiversity and ecosystem functionality. FEPA's, critical biodiversity areas, ecological support areas, threatened ecosystems and protected areas should be avoided. For inland aquaculture preference should be given to selection of sites related to sub-quaternary catchments in which invasion and establishment of alien fish species has already taken place.

- The selection of aquaculture sites that do not pose land and resource use conflicts with other users and that conflicts posed by other users is considered fairly and with due consideration of all development rights.
- The incorporation of all stakeholders in the environmental authorisation process to ensure that all users of land, water and natural resources in and around a proposed project site can provide inputs into spatial matters.
- The use of unobtrusive structures in the design and construction of aquaculture facilities (including the use of unobtrusive colours).
- The positioning of aquaculture facilities so that they fall outside of the line of general sight where they can cause aesthetic impacts.

19.2. VEGETATION (FLORA)

Vegetation management refers mainly to the approach required in dealing with the vegetation within and around aquaculture facilities. Good practices for the management of vegetation include:

- Insofar as is practically possible, only indigenous vegetation should be used on and around aquaculture facilities. Alien, but especially invasive species should be avoided and removed by means of an active and on-going alien vegetation control programme. In this regard special care should be taken around the introduction and use of invasive aquatic plants that are often found on freshwater fish farms.
- Where virgin or sensitive vegetation occurs on or in proximity to aquaculture projects, access to these areas should be limited where possible.
- Cut, trimmed, mowed and felled vegetation must either be removed to a suitable disposal site or composted on site for further application. Cut vegetation can also be used as brush pack in the control of erosion, but care must be taken to prevent the spread of seed of alien species in this manner. The burning of vegetation is discouraged, unless done under favourable climatic conditions and with the permission of the local disaster or fire management services.

19.3. NON-PRODUCTION ANIMALS (FAUNA)

Apart from the impacts related to the introduction of aquaculture organisms, an aquaculture project may also impact on fauna through its presence and operational activities in any particular environment. These impacts could be caused by environmental changes, which could be caused by changes in water quality or quantity and by impacts on predatory animals.

Impacts related to predatory animals usually occur as a result of predators taking advantage of aquaculture facilities to obtain easy prey. While the intention is to prevent predator access to aquaculture facilities, predator conflicts could lead to the uncontrolled killing or injury of these animals.

Good practices for the management of fauna include:

- Wherever practically possible, and where animals do not pose a risk to the aquaculture facilities, they must be accommodated and be granted freedom of movement and existence. Catching of wild animals, by any means, is illegal if done without the required permit and should not be considered unless authorised or done in conjunction with the relevant delegated authorities.
- Where electrified and other fences are used, these should be of a design that does not injure, harm or kill animals.
- Infrastructure (dams, channels etc.) must be designed and built in such a manner so as to prevent drowning, injury, harm or death of animals.
- Unless specifically permitted no animals may be shot, trapped, killed, bewildered, injured, poisoned or harmed in any manner. Acceptable deterrents may be used to discourage animals from entering into or inhabiting access to aquaculture facilities.
- No animals (including predatory animals) may be poisoned. The only exception to this is in the responsible control of vermin, in which case recognised poisons may be used in the prescribed manner.
- Aquaculture feeds and other production resources that may attract animals should be stored in such a manner so as to prevent access and so as to prevent animals from becoming trapped, killed or harmed.
- Operators must ensure that feed and equipment stores do not become overrun with rodents or other pests. A responsible control program for such vermin must be implemented.
- Where trapping of predatory animals is required, only traps that do not cause harm to the animals should be used. Such trapping must be done in consultation with local conservation authorities and in accordance with welfare guidelines.
- Where netting is used to keep birds from entering into aquaculture facilities or where predator nets are used around cage culture facilities, the netting should be clearly visible and prevent entanglement, injury or death.

19.4. SOIL MANAGEMENT

Ignorance of the importance of soil management in and around aquaculture can cause significant infrastructure damage, stock loss and negative environmental impacts. Good practices for the management of soil include:

- All soils must be stable, protected from erosion and maintained as a suitable growth medium for natural vegetation where applicable.
- Where vegetation is removed, this should be done in a phased manner to prevent unnecessary destabilisation and erosion.
- When undertaking any earthworks, the topsoil must be stripped separately and retained for later re-use. Topsoil stockpiles must be stable and free of invasive alien vegetation.
- Following the exposure of any soils for construction, shaping or other activities, a suitable vegetation cover must be established if appropriate. Where

appropriate, straw stabilisation or hydro seeding with environmentally compatible plants may also be used to prevent erosion.

- Barren soils should be tilled, treated with fertiliser or compost and vegetation cover encouraged and irrigated.
- The upper contours of aquaculture facilities (and at intervals on the lower contours of large or steep sites), should have stormwater cut-off trenches. Water must exit stormwater trenches below the production facilities in a manner that does not cause downstream erosion or degradation. Soil in the stormwater trenches must be protected from secondary erosion by means of suitable flow speed inhibition. This can be done by stone packing, vegetation establishment, brush packing or through the channel design characteristics.
- Where applicable, slopes with a gradient exceeding 1:3 should be protected from erosion. This can be accomplished with indigenous vegetation cover, brush packing, sand bagging, retaining walls, log stepping, rock packing etc. The chosen method will depend on the availability of materials and the degree of instability.
- Whenever cut and fill practices are used the resulting slopes should not exceed 1:3, unless otherwise specified.
- Any erosion must be treated without delay.
- Paths and roads must be formalised and stabilised against erosion by means of suitable materials, compaction and functional design. Stormwater cut off trenches can be used to prevent erosion.
- Where slipways, pontoon launches, jetty ramps and similar water-soil interfaces are used for aquaculture purposes, these should be stabilised to prevent soil erosion caused by water of waterlogged conditions.

19.5. SENSITIVE AREAS

Many aquaculture facilities are established alongside sensitive ecological areas such as tidal zones, the coastal zone, reefs, estuaries and estuarine functional areas, water tributaries, wetlands, catchment areas, rivers, etc. In order to achieve good practice, the following points should be considered:

- Where possible, avoidance of these sensitive areas is a first priority.
- The largest possible portion of sensitive areas should be protected, while construction and operation footprints should be minimised in accordance with approved master plans.
- Where ecological services are employed directly in aquaculture production (e.g. where offshore cages depend on marine ecosystems for the removal of wastes), particular care must be taken in ensuring that such ecologies and the related biodiversity is not disturbed in an unsustainable manner.
- In general, access to sensitive areas surrounding aquaculture facilities should be kept to a minimum and employees should be educated to their sensitivity. Sensitive areas should be demarcated as no-go areas.
- Sensitive areas should not be used as storage areas or sites for old, disused or periodically disused equipment.
- Sensitive areas should not be used for the dumping of waste of any nature (including vegetation matter such as mowed grass).

- Natural features such as outcrops, rock faces, trees and natural vegetation should be protected when found in proximity to aquaculture facilities.
- All historical buildings, all fossils, archaeological and paleontological materials, graves and burial grounds, wetlands, mountain catchments, forests, dune habitats and inter-tidal zones are protected by law and may not be disturbed in any manner without authorisation to do so.

19.6. FIRE MANAGEMENT

Fire is a potential risk to all aquaculture facilities. This fire risk must be minimised, while the necessary emergency procedures and emergency equipment to deal with fire, must be on-hand and in a working order at all times. Good practices for the management of fire include:

- An appropriate number of fire extinguishers and fire fighting equipment must be available at aquaculture facilities. In particular, working fire fighting equipment must be available where hydrocarbon fuels or other flammable substances are stored and used.
- All "*hot*" works (welding, gas cutting, etc.) must be done with a working fire extinguisher close on hand.
- Employees should be made aware of the fire risks associated with smoking and dedicated smoking areas should be provided.
- Fire should not be used for the incineration of waste, unless this has been specifically authorised.
- A fire contingency plan must be developed and made known to all employees. This plan must include the location and operation of fire fighting equipment, the identity of a responsible and trained staff member that will act as the fire marshal, the contact numbers of fire fighting and emergency services and the site evacuation procedures.
- Contact numbers for the nearest fire fighting and emergency services must be clearly displayed in an accessible area.
- Where aquaculture facilities are surrounded by vegetation, care should be taken against natural fires by means of fire breaks and the provision of appropriate fire fighting equipment.

19.7. NOISE, LIGHT AND ODOURS

Noise generation by aquaculture activities is generally minimal, but can become a disturbance when the activities take place in close proximity to human settlements. Likewise, odours are generally not problematic in aquaculture, except in certain processing activities, in certain instances in the cleaning of production facilities and filters or when ponds are laid fallow. Excessive light pollution is generally limited in aquaculture and lights are usually used for security purposes only. Good practices for the management of these aspects include:

- Where appropriate and practically possible, pumps, aerators and other noise generating devises should be equipped with a sound dampening cover.

- All pumps, aerators and other noise generating devices (including motor vehicles) should be in good working order to prevent excessive noise.
- The use of noise dampening methods such as the planting of windrows should be considered if noise generation becomes excessive.
- All employees should be made aware of the fact that unnecessary noise, light and odour pollution should be prevented by means of responsible conduct.
- Where practically possible the source of potential light or noise pollution should be placed in areas where they will cause the least possible disturbance.
- Above average noise generation should be limited to normal business hours.
- If odours are generated from any aquaculture facilities, efforts should be made to limit the impact on surrounding settlements, communities and operations. This can be done by taking cognizance of wind direction and speed, ensuring that odour generating activities are completed in as short a space of time as possible and by ensuring that any dead aquaculture organisms (or unused feed) are disposed of responsibly.

20. THE INFRASTRUCTURE ENVIRONMENT

Aquaculture operations require a certain degree of infrastructure and service arrangements that range from access routes, sewage, electricity supplies and refuse removal. Generally, service related impacts from aquaculture activities are limited, especially if development takes place in a manner that makes use of existing service infrastructure and within areas of existing development.

20.1. AQUACULTURE PRODUCTION SYSTEMS

The aquaculture sector employs a range of production techniques in many different culture systems that range from tanks to ponds, cage culture systems and more. It is important that all aquaculture systems be managed with the interest of the production organisms and the surrounding environment in mind. Good practices for the management of production systems include:

- Production systems should be designed and constructed in a manner that allows for the safety of employees and the surrounding environment, as well as the safety and welfare of the farmed organisms.
- Aquaculture production systems should be structurally sound and not leak unnecessarily.
- Aquaculture systems should be readily accessible for daily operations.
- Aquaculture systems should be designed and constructed in a manner that prevents the escape of production organisms. All piping and in – or outflow points should be fitted with suitable strainers or screens.
- Where electricity is used, the electrical installations must be safe and regularly maintained.
- Where cover netting is used, this must be of a type that does not pose a threat to animals. Consideration must be given to mesh size, colour, structure, rigidity, UV and weather resistance.

- Where ponds or tanks are used, consideration must be given to aspects associated with drainage (e.g. receiving areas for drainage water and drainage efficiency), with inflow and outflow control and with the prevention and control of flooding or overflow. In marine culture, seawater should not be discharged into the terrestrial environment.
- Pond walls and sides must be of a suitable slope and construction to prevent erosion (including wind and wave erosion).
- Rooting trees should not be planted close to ponds and moles and crabs should be controlled to ensure pond soil stability.
- Aeration apparatus (e.g. agitators, paddlewheels, etc.), pumps and water inlets should be placed and managed so as to prevent internal erosion of ponds and dams.
- Cage systems must be positioned to prevent the potential for obstruction to vessels and boating traffic. Cages must be clearly marked and offshore systems must be fitted with the necessary beacon lighting.
- Cages, their flotation and cage anchor lines must be designed to withstand severe weather conditions and general wear and tear. Structural elements should be subjected to regular inspection.
- Cage platforms must be kept in good order (clean, free of unnecessary equipment, etc.) and must provide a safe working environment. The necessary safety equipment (e.g. life rings) must be kept on the platform in an accessible position.
- Cage netting must be kept clean, free of algal growth and free of any damage that could lead to the escape of fish or the penetration of predators. No chemicals may be used for the cleaning of cage nets, unless approval is obtained from the relevant authorities.
- Where possible, cage units may be moved from time to time to lessen the localised build-up of organic sediments.
- Shellfish rafts, drags and lines must be positioned to prevent the potential for obstruction to vessels and boating traffic. Where applicable, these rafts, drags and lines must be clearly marked and fitted with the necessary beacon lighting.
- Rafts, drags and lines must be inspected regularly to ensure integrity of the structure and anchorage.
- Raft platforms must be kept in good order (clean, free of unnecessary equipment, etc.) and must provide a safe working environment. The necessary safety equipment (e.g. life rings) must be kept on the rafts in an accessible position.

20.2. ROADS, ACCESS AND SECURITY

Access to aquaculture facilities should be controlled for security reasons and to prevent the uncontrolled movement of individuals and vehicles that may cause ecological degradation. Good practices for the management of these aspects include:

- Where possible, access routes to aquaculture facilities should be fitted with a gate or other form of access control. Prohibition of entry for unauthorised persons should be displayed and enforced.

- Where applicable, perimeter fences and boundaries should prevent access to unauthorised persons.
- Facilities and stores should be kept locked when a site is not occupied.
- Roads must be maintained in a stable, dust free condition by compaction, watering, grading and asphalt coverage where necessary. A stable, erosion free driving surface must be created. The creation of multiple tracks and the incremental increase of road width, through not keeping to and maintaining the existing roads, should not be allowed.

20.3. BUILDINGS AND STORAGE

To ensure that the nature and structural characteristics of buildings and storage areas are environmentally compatible, consideration should be given to these aspects in design and construction. Good practices for the management of buildings and storage include:

- Unauthorised access to buildings and stores should be controlled to prevent theft and vandalism.
- Buildings should be regularly maintained so that they remain structurally safe and aesthetically acceptable.
- Responsible rodent and vermin control programs must be employed in buildings and storage areas.
- Sufficient ventilation must be provided in buildings and stores.
- Buildings and stores must be equipped with the necessary fire fighting and first aid equipment and the applicable emergency contact numbers clearly displayed.

20.4. ELECTRICITY AND COMMUNICATIONS

Communication networks and electrical installations must be managed and maintained in a condition that is safe to the environment and the people working in and around any aquaculture facilities. Where service providers are responsible for electrical supplies or communication facilities, these providers must be inducted to ensure that they undertake their activities in a safe and environmentally responsible manner.

20.5. DOMESTIC WATER, SEWERAGE AND ABLUTION FACILITIES

This section deals with the water supplies outside of that required by the aquaculture production activities. This includes water supplies for sewerage systems, landscaping, general washing, drinking, etc. Good practices for the management of these aspects include:

- Where water is not provided by a service provider, care must be taken that supplies are adequate (in volume and quality) and that the extraction thereof is

legally compliant and from a source of suitable quality. An adequate supply of safe drinking water must be ensured.

- Water for landscaping should be used sparingly and, where possible, be sourced from aquaculture discharges or from grey water generated by washing and other non-sewerage activities.
- Water must be used sparingly. Taps must be closed when not in use, while taps and pipes must be maintained to prevent leakage and waste.
- Non-hazardous wash water must be led into the sewerage system (where appropriate and legal to do so) or disposed of in areas where there is no potential for environmental risk.
- If water has been contaminated with hazardous chemicals, it may not be released into the environment. This water must be kept in conservancy tanks for disposal at suitable hazardous chemical disposal sites.
- Provision must be made for the responsible management and treatment of sewerage. The first choice would be for linkage into a formal sewerage system, failing which the use of sewerage conservancy or bio-remedial systems of adequate capacity and functionality may be considered. In rural areas, French or soak-away systems may be used if this is done responsibly and without contamination to groundwater resources.
- Conservancy, bio-remedial, French or soak-away systems should not be located in water rich areas. Generally, these systems should be at least 50 meters from any aquaculture production water and preferably downstream from production activities.
- Sewerage infrastructure should be well planned, well maintained and the layout thereof mapped.
- Sewerage pipes must be buried at an appropriate depth so that they do not interfere with the surface activities, while remaining practically accessible for maintenance and repair.
- Conservancy tanks must be emptied regularly to prevent overfilling or spillage.
- The use of recognised biological accelerators in conservancy tanks and soak-away systems is recommended.
- Ablution facilities must be kept in a clean, neat and hygienic condition.
- Hazardous chemicals, dead aquaculture organisms and other non-sewerage materials may not be dumped into sewerage systems.

20.6. REFUSE AND WASTE

Aquaculture produces various waste streams, which can be categorised as follows:

- General waste (fish feed bags, paper, plastic, glass, etc.).
- General organic waste from landscape maintenance.
- Production related organic waste (old feed, dead aquaculture organisms and material / sludge removed from filtration and sump units).
- Sewerage and non-production related waste water.
- Production related waste or effluent water.
- Post production and processing waste.
- Hazardous waste materials and chemicals.

Waste management must be formalised to ensure that it does not cause pollution and potential environmental degradation. Good practices for the management of these aspects include:

- General waste must be collected into suitable water, wind and animal proof waste containers so that it can be removed to a disposal site on a regular basis. All waste management activities, including waste removal service providers and the sites used for waste disposal must meet the necessary legal requirements.
- Where possible, general waste should be separated into glass, paper and plastics so that these can be recycled.
- Waste should not be allowed to litter aquaculture facilities or the surrounding areas and waste containers should be emptied regularly to prevent overfilling.
- A culture of waste reduction, collection and recycling must be instilled with all employees by means of guidance and example.
- Vegetation matter from landscaping activities must be removed to a suitable disposal site or composted for later use.
- The following approach applies to production related organic waste:
    - Old feed should be disposed of via composting (for small volumes) or via a formalised waste disposal system (for large volumes).
    - Small numbers of dead organisms can be disposed via a subterranean pit, dug out in an area that is poor in groundwater. Each disposal must be followed by copious amounts of lime and one pit should not receive more than 30 kg of biomass per month. Large volumes of dead organisms can be disposed of by incineration if done responsibly, safely and with prior notification to local and district authorities and surrounding landowners. Certain local and district authorities also have facilities for the disposal of such organic matter.
    - Filter waste should preferably be composted and not disposed of via postproduction water resources. Due to the potential for contamination of soil or groundwater with salt the composting of marine aquaculture filter wastes must be done with care.
- Where postproduction and processing waste (e.g. intestines, gills, heads, blood, shells, etc.) is generated, it should be dealt with in one or more of the following manners:
    - For small volumes (i.e. less than 50 kg. per week), a system of liming and burying or incineration (with authorisation) may be employed, provided that this does not cause groundwater pollution or other impacts of significance (e.g. health risks, odours, etc.).
    - For large volumes (i.e. more than 50 kg. per week), it is recommended that a silage system be employed, which can liquefy and stabilise waste material by grinding and lowering the pH. This silage can then be incorporated into fertilisers or animal feeds.
    - A suitable bulk service provider may be contracted to remove processing waste.
    - Waste may be removed to a recognised disposal site equipped to deal with the waste type.
    - Waste may be incinerated, provided that it is formalised and legally compliant.

  - Shellfish waste should be responsibly recycled back into the environment.
- Hazardous waste (e.g. expired chemicals) must be disposed of via an approved hazardous waste disposal site.

20.7. HANDLING CHEMICALS AND FUELS

Various chemicals, medicinal substances or treatments (including hormones, anaesthetics, disinfectants etc.) and hydrocarbon fuels are used in aquaculture. These chemicals could pose environmental threats such as toxic contamination, damage to the ecology, bioaccumulation and more. Aquaculture chemicals are also a significant factor which influences safety, consumer acceptance and the marketability of products. Good practices for the management of these aspects include:

- Care must be taken in the storage and handling of all chemicals and hydrocarbon fuels (petrol, diesel, oils, etc.). In certain instances the methods of storage are prescribed by the South African National Standards (SANS) or by other legislation such as the Occupational Health and Safety Act.
- Only recognised and registered chemicals may be used as treatments, medicines, herbicides, insecticides, pesticides and for other purposes. The use of chemicals must be responsible and in accordance with the prescribed application methods. Material Safety Data Sheets (MSDS) or medicine datasheets must be readily available and referenced during use, storage and disposal.
- Bait type pesticides should be used with care to prevent poisoning of non-target species.
- Chemicals must be stored in a dry, well ventilated, secure and lockable area, which is in compliance with the Occupational Health and Safety Act and other applicable legislation. Only authorised employees may have access to such stores.
- Chemicals should be recorded in a chemical and medications register, indicating the date of purchase, batch number, use and expiry date. Expired products and empty chemical containers must be disposed of responsibly at a recognised disposal site for these materials and according to the directions provided in the MSDS or datasheet.
- It is recommended that chemicals and fuels not be used near water, or in water logged areas, as this poses a particular threat to biodiversity and aquatic ecosystems (this excludes chemicals and treatments that are specifically for use in water).
- Fuels must be stored in suitable containers in a safe and lockable storage facility that allows for the containment of any spillage. Storage methods for small and bulk volume fuels are prescribed by the SANS.
- Mixing or handling areas for treatments or chemicals and filling areas for fuels must allow for the containment, treatment or removal of any spillage. Non-spill funnels should be used and these may not be cleaned in a manner that causes environmental contamination.
- Absorbents and remedial materials should be available and used on any spills.

- Care must be taken to ensure that fuel devices do not leak. Any leaks must be repaired without delay and the necessary hydrocarbon absorbents used on contaminated areas.
- Protective gear and clothing must be provided to employees that work with dangerous chemicals and treatments (as per the Occupational Health and Safety Act.
- Working fire fighting equipment must be available in and around any chemical and hydrocarbon fuel stores.
- Aquaculture operators should be encouraged to reduce their reliance on therapeutic chemicals through the use of sound husbandry practices aimed at disease and stress prevention. More emphasis should be placed on preventive measures where the use of chemicals is a last resort when other measures have proved to be inadequate.
- Responsible use of therapeutics and treatments in aquaculture is characterised by:
    - Chemical application based on an accurate diagnosis.
    - The use of an appropriate compound and application method.
    - Chemical dosage for the minimum effective time.
    - The keeping of records and evaluation of treatments.
    - An awareness of potential chemical residues.
- Chemicals should be used for specific and not general purposes. The use of chemical cocktails should not be permitted.
- Where required, assistance should be sought from an aquaculture veterinarian in the use of therapeutics and treatments.
- Dosages, application methods and the resultant outcome of all treatments should be known and recorded in a treatment register.
- In the use of chemicals, consideration must be given to the potential for residues and the need for withdrawal periods before marketing and consumption of the aquaculture products.
- Employees should be trained in the handling and use of chemicals and they should be provided with the required protective gear.
- To prevent the development of disease resistance, the prophylactic use of antibiotics should be avoided.
- Only recognised, environmentally safe and copper free anti-fouling agents are allowed for use as anti-fouling agents to keep cage culture nets clean.

21. THE PRODUCTION AND HUSBANDRY ENVIRONMENT

21.1. SUSTAINABLE PRODUCTION CAPACITIES

The capacity of the receiving environment for aquaculture is a measure of the ability of the natural resources and ecological services to accommodate the activity sustainably.

Although production volumes are determined by many factors (e.g. markets, production space, feed, etc.), it is often limited, from an environmental perspective, by the availability of space, oxygen and water. Whatever the limiting factor, it is important to operate within sustainable production capacities to prevent environmental degradation. Good practices for the management of production capacities include:

- To prevent environmental degradation through aquaculture generated water pollution, it is recommended that the sustainable production capacities of an operation be determined in relation to the available water resources.
- Where water discharge takes place, care must be taken that the legal water quality criteria are met. Where applicable, some form of postproduction water treatment can also be used (e.g. sedimentation or filtration).
- Forward planned and suitable species and system specific stocking densities should be maintained in relation to the availability of resources such as water and with due consideration of animal welfare.
- For cage culture, consideration must be given to cage positioning to make optimal use of suitable environmental factors (e.g. water displacement), while preventing pollution by overshooting the assimilative or ecological capacity (which can be calculated through an assimilative or carrying capacity model). Organic material from cage culture may enrich a benthic ecosystem, resulting in increased biological oxygen demand and the formation of anoxic sediments and a reduction in macro-fauna biomass, abundance and species composition. The degree of severity of such benthic impact is determined by many factors, which include the amount of freeboard under a cage system, local currents or water displacement ratios and more.
- In determining sustainable production capacities, it is important that a distinction be made between "*contamination*" and "*pollution*". Contamination is a trait of aquaculture, but this does not necessarily imply that aquaculture causes pollution. The boundary between these regimes is defined by many factors that include the robustness of the receiving environment and the degree of environmental change that is acceptable.
- It is important that the environmental capacity for aquaculture be monitored and re-determined on a continuous basis to support decision-making and adaptive management.

21.2. WATER AND WATER MONITORING

Aquaculture activities add nutrients, metabolites and other wastes to the water column, which creates the potential for water quality deterioration. These impacts could include the creation of eutrophic zones, fluctuations in dissolved oxygen, algal blooms, changes in species composition and more. Good practices for the proper management of water include:

- The use of water in aquaculture must be legally authorised in terms of the National Water Act (for inland waters), or the Marine Living Resources Act and the National Environmental Management: Integrated Coastal Management Act (for coastal waters) or other legislation that may apply.
- Ideally, the quality of water that enters an aquaculture facility should be comparable with the quality of water that exits the operation. Failing this, the discharge water must be within the quality standards stipulated by the applicable authority that has authorised the use of water.
- In certain instances, the treatment of discharge water may be required to achieve the stipulated discharge quality criteria. Such treatment may include

sedimentation, decantation, biological oxidation, filtration (chemically, physically and biologically), water recycling, nitrification, foam fractionation, carbon absorption, ion exchange, algal systems, ozone and more. Materials removed by water treatment and filtration should be used for composting (where appropriate) or disposed of responsibly.

- Where practical, nutrients or suspended solids can be removed by filter-feeding organisms (e.g. oysters and mussels) or aquatic plants. The use of discharge water for irrigation or in hydroponics can also be beneficial to the environment.
- Where practical, the regular moving (site rotation) of cage culture systems may reduce localised water quality impacts.
- Feeding must be strictly controlled through a specific feeding regime that maximises feed conversion efficiency, limits direct feed wastage and above normal faecal and metabolite releases from the production organisms.
- Samples of the inlet and outlet water of production facilities should be analysed for the following constituents (this being the minimum set of constituents which may be supplemented by conditions set through authorisations and licences):

    - pH.
    - Temperature (°C).
    - Dissolved Oxygen (mg/l).
    - Ortho- and Total Phosphate as Phosphorous (mg/l).
    - Nitrate as Nitrogen (mg/l).
    - Nitrite as Nitrogen (mg/l).
    - Ammonia as Nitrogen (mg/l).
    - Chemical Oxygen Demand (mg/l).
    - Biological Oxygen Demand (mg/l).
    - Electrical Conductivity (mS/m).
    - Suspended Solids (mg/l).

- For inland cage culture the resource inlet water, the water in which the production takes place and the downstream water should be sampled and analysed for the abovementioned constituents. For marine cage culture, or inland cage culture on large water bodies, samples should be taken at strategic points that represent scenarios for the baseline (i.e. uncontaminated) conditions and the post-impact conditions. This may consist of multiple sampling points.
- Water quality analyses should be conducted at least once in six months (or as prescribed by the applicable approvals, authorisations or licences).
- Where significant water quality impacts are detected, this can be addressed by lowering the stocking densities, correcting the feeding rates, feed types and feed management, by increasing water displacement or by the moving of cage culture operations.
- Where practically possible (i.e. where aquaculture is located on a freshwater stream or river) a South African Scoring System (SASS) assessment should be conducted upstream and downstream of the facilities at least once a year. Likewise, water related impacts in marine aquaculture can be detected by monitoring species densities and composition in the surrounding water column and the benthic environment.

21.3. SPECIES AND ESCAPE

The introduction of non-native or genetically different (including hybrids, genetically modified organisms and improved strains) aquaculture species into an environment could cause significant ecological disturbances, the introduction of new diseases, invasion and genetic pollution. This coupled with the unseen and unpredictable ability of some species to escape, makes the choice and management of aquaculture species important. Good practices for the proper management of species include:

- Where possible, preference should be given to locally indigenous and non-threatened species for aquaculture as opposed to alien, extralimital and invasive species for farming in controlled production environments.
- Prior to the commencement of any aquaculture activities, use of the target species must be authorised in terms of the applicable legislation.
- When stocking aquaculture organisms, care must be taken to prevent secondary species from being accidentally introduced with the target species.
- No live organisms, marine or freshwater, may be transported to or from aquaculture facilities without a transport permit from the applicable provincial or national authorities.
- Unless specifically authorised, broodstock or organisms for farming may not be collected from the wild.
- Aquaculture species that are able to hybridise should not be farmed together, while species that are able to hybridise with indigenous species in the surrounding environment should not be used as production candidates.
- Where practical, the potential for genetic impacts should be established and if found to be significant, such species should be avoided.
- Prior to the purchase and stocking of any organisms, the disease and parasitic status and risk of the species must be investigated in context to the area from which it originates, the area to which it will be taken and the degree to which any potential disease may pose a threat to the surrounding environment.
- Adequate steps must be taken to prevent the escape of production organisms, especially from the hatchery environment where individual organisms may be very small. In this regard, regular inspection of production infrastructure and escape barriers is important. Escape barriers may include netting, grids, screens, strainers, sand and other filters, predator ponds, chemical treatment areas, soak away systems, etc. Barriers should be adequate to prevent escape during flooding, overflows and during other unforeseen circumstances.
- In cage culture the integrity of the nets should be inspected regularly and safety nets used to prevent the escape of fish during stocking, harvesting, sampling and grading.
- Generally, aquaculture species are propagated from a tailored gene pool and thus not suitable for restocking or supplementation of natural stocks.

21.4. FEEDS AND FEEDING

Feed and feed management is a primary cause of direct and indirect pollution of water resources used for aquaculture. The management and responsible use of feed is not only an important environmental consideration; it is also a key factor in determining

the financial viability of most aquaculture ventures. Good practices for the management of feeds and feeding include:

- Only registered aquaculture feeds should be purchased from recognised feed companies that produce high quality feeds of which the ingredients, composition and manufacturing methods are known.
- Feeds should be balanced, low in phosphorous and the nutrients should be highly attainable through digestion and absorption.
- Feeds should be low in inedible fines (dust) and should be water stable.
- Feed producers should provide the date of manufacture, information pertaining to the ideal storage conditions and estimated shelf life.
- Where practical, a feed traceability programme should be employed in which the batch of feed can be matched to a specific feeding period and a specific batch or cohort of fish.
- Feed stores should be lockable to prevent theft.
- Feed should be stored and used on a "*first-in-first-out*" basis to prevent unnecessary aging and deterioration in quality.
- Feed storage areas should be well ventilated, dry and free of vermin that can damage, contaminate and consume feeds. Dampness and heat can also damage feeds.
- It is good practice to store feeds on individually stacked pallets that can allow for full ventilation of feed bags that would otherwise be in direct contact with floor and wall surfaces.
- Feed types and feeding strategies are specific to each species, to the culture conditions, climate and growth stage. In this regard, feed types and feeding rates should be recorded daily so that feed conversion efficiency can be calculated and monitored.
- Water quality monitoring should be correlated and checked against feeding rates and production biomass so that adjustments can be made to the feeding program if required.
- Palatable feeds of the correct pellet or grain size should be used to ensure low levels of feed loss. Other factors such as feed position (e.g. floating or sinking), water stability and feeding time of day must also be considered to minimise feed wastage.
- Feeding tempo and methods should be suited to the specific species, while feed distribution in a production unit must be even to ensure that all individuals are fed.
- Uneaten feed is a sign of over-feeding and this should be corrected on the feed program.
- Employees that are responsible for feeding should be well trained in feed application so that they can detect subtle changes in feeding behaviour. If feeding is not active it may be necessary to suspend, delay or modify the feeding program.
- Water current speed, flow rate, turbidity, barometric pressure, oxygen levels, wind, territorial behaviour and other factors may influence feeding and thus the feeding strategy should be flexible and adaptive to ensure optimal intake and minimal wastage.

- Where automated or demand feeding devices are used, care must be taken to prevent over feeding and the feed application must be monitored in relation to production performance.
- The harvesting of kelp for the feeding of abalone must be legally sanctioned and done in a manner that prevents localized stripping of the resource. Likewise, other natural feed resources must be used sustainably.
- Where unprocessed feeds are used (e.g. trash fish or vegetable matter), special care must be taken to prevent over feeding and the maintenance of water quality.
- Where fertilization is used to enhance algal and plankton blooms on which aquaculture organisms may feed, this must be done within the capacity of the water resource and in a manner that prevents the release of enriched water to the surrounding environment.

21.5. DISEASE MANAGEMENT, TREATMENTS AND MORTALITIES

Aquaculture disease is a threat, not only because of its potential impact on production, but also due to the potential of infecting other organisms in the environment. Disease should be managed around prevention and prepared strategies for treatment. If mortalities occur (natural, through disease or other factors) the management thereof is important to prevent environmental impacts. Good practices for the management of these aspects include:

- South Africa subscribes to the Aquatic Animal Health Code, issued by the Office International des Epizooties (OIE) and therefore this international disease code applies. None of the identified diseases in this code are permitted and are notifiable by law. If an identified disease is detected, the nearest State Veterinarian must be informed immediately.
- No aquaculture organisms should be introduced from an unrecognisable source or a source for which the disease status cannot be verified.
- No live organisms, marine or freshwater, may be transported to or from aquaculture facilities without a transport permit from the applicable provincial or national authorities.
- Prior to the purchase and stocking of any organisms, the disease and parasitic status and risk of the species must be investigated in context to the area from which it originates, the area to which it will be taken and the degree to which any potential disease may pose a threat to the surrounding environment. In certain instances the introduction of aquaculture organisms may require specific veterinary assessments, treatments and quarantine measures.
- When new juveniles or broodstock are introduced, it is advisable that these be quarantined to diagnose, investigate, monitor and treat potential diseases and parasites. This should be done under supervision of a veterinary professional.
- Aquaculture operators should monitor the health status of aquaculture organisms as part of the daily operational activities. This includes water quality monitoring and the monitoring of the production conditions in addition to symptomatic monitoring of behaviour that should be supported by sampling, diagnostic dissection, microscopic investigation and more.

- It is advisable that a health assessment be conducted on aquaculture facilities by an aquaculture veterinarian, at least twice a year or as directed through the conditions of any particular authorisation.
- Although medical treatment should never replace sound husbandry and hygiene, treatment of aquaculture diseases must nevertheless be done by recognised methods and where applicable, under the guidance of a qualified aquaculture veterinarian. All treatments must be recorded in detail to reflect the date, treatment methods, substances, dosages and outcome.
- If a disease breakout occurs, production systems should be isolated from each other and the surrounding environment. If required, a qualified aquaculture veterinarian should be consulted to assist with further management inputs and treatments.
- Where possible, the following practices can be implemented to reduce the risk of aquaculture disease:
    - Screening or quarantine of broodstock for known pathogens and parasites.
    - Appropriate treatment of broodstock prior to entering the hatchery environment.
    - Isolation and separation of production sectors with independent water supplies and equipment.
    - Installation and use of foot baths and hand washing facilities for employees.
    - Regular disinfection of equipment and working areas.
    - Restrictions on access to foreign vehicles and people.
    - Management of bird and predator populations that could be disease carriers.
    - Minimizing the potential for disease vector hosts to enter the aquaculture system.
- As it is not possible to eliminate all bacteria and parasites from an aquaculture facility, disease management requires a holistic approach, which includes the management of water quality, hygiene, feed, stocking densities, stress, predators, husbandry techniques and more.
- If mortalities are detected, the behaviour of the remaining stock must be monitored carefully. If large numbers die, the first step is to check the physical and chemical characteristics of the water and thereafter the possibility of disease. Orderly and daily notes must be kept of the numbers of dead organisms, cause of death and the behavioural patterns of the population as a whole.
- If production animals are injured or diseased to a point that causes excessive suffering, humane euthanasia must be performed.
- Any dead organisms must be removed and disposed of in a manner that minimizes the spread of diseases. The equipment used to remove mortalities must be cleaned and sanitized.
- Where large scale mortality occurs, samples should be sent to an independent veterinarian for assessment of the causative agents.

21.6. GRADING, MOVING AND HARVESTING

Aquaculture organisms are regularly graded for uniformity in size, growth monitoring and the prevention of cannibalism. As with stocking and harvesting, this requires a degree of handling, which must be done in a manner that causes the least possible stress or injury and which eliminates the potential of escape. Good practices for the management of these aspects include:

- No live organisms, marine or freshwater, may be transported to or from aquaculture facilities without a transport permit from the applicable provincial or national authorities.
- Grading and moving should be preceded by a period of starving to aid in stress reduction. Metabolites and faecal matter also have the potential of fouling the water in which organisms are moved.
- Where possible, grading and moving should be done in water and at lower temperatures to reduce metabolic rates and stress.
- Grading, moving and harvesting equipment and techniques should not cause unnecessary injury and stress and should be adequate to prevent escape.
- Harvesting and killing must be done by the most humane method possible and with equipment that does not cause unnecessary injury and stress. Animals must be rendered unconscious (not immobilised or sedated) immediately before slaughter by means of acceptable food-grade anaesthetic or an appropriate electrical or mechanical stunning device.
- When fish are graded and moved on a cage culture system, netting should be placed between the working surface and the cage net to prevent the escape of any fish that are accidentally dropped during handling.

21.7. POSTPRODUCTION PROCESSING AND MARKETING

This guideline is not intended to provide a detailed framework for postproduction, processing and marketing matters. However, as these aspects are related to aquaculture production, certain environmental management concepts have been included. Much of the handling and processing of aquaculture products are guided by national and international codes of practice, laws, health standards and quality control procedures that depend on the nature of the product, the level of processing, market requirements and needs of the consumers. Good practices for the management of these aspects include:

- Where applicable, depuration or purging could be used to remove pathogens, chemical or treatment residues and taints from aquaculture products.
- Aquaculture products should be handled with care to prevent deterioration of quality. Phyto-sanitary responsibility must be maintained throughout the harvest and marketing chain and potential contact with microbiological contaminants should be eliminated.
- The harvest cycle, processing and marketing chain should be kept as short as possible and end products should be chilled or frozen as soon after processing as possible.

- Where applicable, processing should be done in a chilled environment and under roof.
- Employees involved in processing should be trained for the task and be fully briefed on the phyto-sanitary risks associated with personal hygiene.
- A high degree of phyto-sanitary and hygienic cleanliness should be maintained in any processing area or plant.
- Wastewater from processing activities should be strained, filtered and disposed of via a capable sewerage system or another legally sanctioned route of discharge.
- Where practically possible, all processing waste should be ensiled by grinding and lowering the pH so that a stable liquid is formed which can be incorporated into fertilisers or animal feeds. Where this is not possible, the burying or incineration of waste material may be employed, provided that these actions are legally sanctioned and not detrimental to the environment.
- Where applicable and appropriate, the use of management systems and standards such as Hazard Analysis and Critical Control Point (HACCP), the South African National Standards (SANS) and the International Standards Organisation (ISO) can contribute greatly to postproduction phyto-sanitary and other matters.
- Certain markets require traceability of products, in which case aquaculture operators are required to record and provide details of the origin of stocks and feeds and of the manner in which the products were farmed. Such traceability protocols are becoming increasingly important in globalised aquaculture.
- In South Africa, a number of aquaculture species have been included into the Southern African Sustainable Seafood Initiative (SASSI) of the World Wide Fund for Nature (WWF). This initiative provides a database in which species are graded into a green, orange or red group according to the sustainability of their harvest or farming practices. South African aquaculture species such as land-based stocks of Dusky Cob (*Argyrosomus japonicus*), Blue Mussel (*Mytilus galloprovincialis*), Pacific Oyster (*Crassostrea gigas*) and Rainbow Trout (*Oncorhynchus mykiss*) have been classed as green, while cage farmed Dusky Cob (*Argyrosomus japonicus*), cage farmed Yellowtail (*Seriola lalandi*), South African Abalone (*Haliotis midae*) and African Sharptooth Catfish (*Clarias gariepinus*) have been classed as orange. A number of imported aquaculture species and candidate species are also classed, but currently no aquaculture species farmed in South Africa are classed as red. It is important to note that the SASSI initiative is not a production system based eco-label such as that provided by international organisations such as the Aquaculture Stewardship Council (ASC), Global Good Agriculture Practice (GAP) and others.

21.8. KEEPING OF PRODUCTION RECORDS

Comprehensive records are a cornerstone to the viability of any operation and apart from their submission to the applicable authorities (where required), it is an important component of good practice. Such records will ensure that matters are dealt with in an orderly and logical fashion, which could prevent unnecessary environmental impacts. Good practices for the management of record keeping include:

- Farm records should be written or electronically logged in a logical and tidy manner. Record should be safely kept and accessible for daily management and reference.
- Where possible, farm records should be supported by authorisations, permits, photographs, water quality analysis reports, disease or diagnostic reports, incident reports, MSDS's and other information that may be of assistance.
- As a guideline, farm records should include the following:
    - Dates of all entries.
    - Identification of the person who made the entries.
    - Climatic and water quality data.
    - Water quality analysis records.
    - Copies of all applicable permits, authorisations and protocols.
    - A copy of the environmental and other appropriate management plans.
    - Detailed and up to date stock registers of the farm.
    - Production sampling records.
    - A detailed feed program together with records of the feed stocks.
    - A mortality record.
    - Health records and diagnostic reports.
    - Chemical and treatment application records.
    - Chemical registers indicating stocks, MSDS's, purchase and expiry dates.
    - A complaints register.
    - A daily diary of significant events, incidents, feed response, etc.

22. THE SOCIAL ENVIRONMENT

The potential positive social impacts of aquaculture development include:

- The creation of employment.
- The creation of local business opportunities for entrepreneurs.
- The development of previously absent aquaculture skills in surrounding communities.
- The creation of food security.
- The supply of local fish products to the tourism trade.
- The sustainable use of natural resources for livelihood creation.

The potential negative social impacts of aquaculture development include:

- The potential conflict around shared resources, mainly water resources.
- The potential conflict with other land users such as agriculture, tourism, mining etc.
- The competition with capture fisheries in local markets.

22.1. EMPLOYEE FACILITIES AND EMPLOYMENT CONDITIONS

The conditions under which employees work are part of the environmental footprint of any aquaculture activity. Good practices for the management of employment include:

- Provision must be made for clean and accessible ablution facilities for both sexes.
- Provision must be made for clean drinking water for all employees.
- An area should be provided where employees may store personal goods and belongings. This area must be safe, shaded, dry and provide adequate privacy and protection from inclement weather for people and their belongings, or for people while they are eating and resting.
- Protective gear must be provided for certain tasks and for handling of chemicals.
- Aquaculture facilities should carry first aid equipment and at least one employee should be trained in first aid provision. Relevant emergency service contact numbers should be clearly displayed at all facilities.
- Basic legal employment conditions (i.e. for working hours, minimum wages, etc.) must be followed to ensure the maintenance of employment rights.
- Employees must be provided with opportunities for training and furtherance of skills. For responsible aquaculture, basic training in the following aspects would also be advantageous:
    - Environmental awareness.
    - Feeding and feed management.
    - Water quality management and monitoring.
    - Sustainable aquaculture husbandry and welfare.
    - Biosecurity and disease management.
    - Aquaculture ecology.
    - First aid and fire safety.
- All employees should be sensitised to their responsibilities in terms of environmental protection and management through dedicated training sessions.

22.2. COMMUNITIES AND NEIGHBOURS

Aquaculture activities can influence surrounding communities at various levels. It is important to manage these interactions in such a manner that the communities become allies rather than display any resentment. Good practices for the management of surrounding communities include:

- When aquaculture facilities are planned the surrounding communities must be informed and they should be provided with an opportunity to voice concerns or support.
- Once established, communities must be informed of the on-going aquaculture activities adjacent to the areas in which they live and work.
- Whenever possible, new employees should be sourced from the surrounding communities in preference to importing personnel from further afield.
- Where possible, outside contractors should be sourced from local communities.

- Efforts should be made to encourage aquaculture and environmental awareness by allowing and facilitating visits by schools and other community groups.
- Where practically possible, discounted aquaculture products or by-products should be made available to local communities.

22.3. DEALING WITH COMPLAINTS

As with any development, aquaculture facilities will be subject to complaints at some stage. Some of these may be caused by a lack of understanding, but others may be of importance. Nevertheless, complaints must be dealt with appropriately to ensure due consideration to the complainant and to ensure public and environmental safety. Good practices for the handling of complaints include:

- All complaints must be recorded in a well-kept complaints register with details of the nature of the compliant, the person or organisation that lodged the complaint, the date and the name of the responsible person dealing with the complaint.
- Complaints must be fully investigated and the outcomes and actions documented, implemented, monitored and communicated to the complainants.

CHAPTER 5: AUDITING, DECOMMISSION AND OTHER

23. AUDITING AND REVIEW

Internal auditing of aquaculture activities through monitoring and adaptive management should be supported by periodic independent or external audits to determine the level of compliance with any specified standard, good practice or environmental management programme. Such audits can be enforced as a condition of any authorisation and in particular as a condition of an environmental authorisation.

The aim of an audit is primarily to:

- Check the degree to which a facility meets a set of predetermined standards.
- Check that proper records are kept.
- Determine the effectiveness of specifications in the predetermined standards.
- Aid in logical communication and feedback between aquaculture proponents and the applicable authorities.
- Recommend changes and updates to the predetermined standards.

Good practices for conducting audits include:

- It is advisable that at least one person should be tasked to take responsibility for internal monitoring and auditing and that the remaining employees are made aware of the requirements, standards and procedures.

- Internal auditing can be done by means of a checklist based exercise that is completed at set intervals.
- Internal audit results should be orderly stored and communicated to all employees, so that corrective actions may be taken.
- When external auditors are appointed it is advisable that they have knowledge and experience in environmental auditing, environmental management and in aquaculture.
- The results of any external audits should be communicated to any authorities that may have stipulated a requirement for such an audit. Copying audit results to other key authorities or key interested or affected parties is good practice.
- All audits should inform changes to an environmental management programme. In this regard an audit should be used to identify aspects in an environmental management programme that may not be applicable, that may be impractical, out-dated or that are not adequately addressed. These aspects should be amended.

24. DECOMMISSIONING OF AQUACULTURE

Aquaculture projects are terminated from time to time for a number of reasons. This section deals with the best practices that can be taken in the event of project termination:

- As many aquaculture projects are subject to specific statutory authorisations, the applicable authorities must be informed when activities are terminated. In addition to this, the onus remains on the proponent to determine whether any of the decommission activities in themselves trigger the requirement for an environmental authorisation (see Section 12 and 13).
- At decommissioning, all aquaculture organisms must be removed responsibly (e.g. by sales, donations or humane killing). This eliminates the risk for redistribution into areas where they are not ecologically compatible.
- Any insecure or unsafe infrastructure should be demolished at decommissioning. Alternatively, the responsibility for all infrastructure must be handed over to the landowner or appropriate third party. Rubble, including supply piping, fencing and cabling from any demolition activities must be appropriately disposed of before the area is stabilised and vegetated.
- Where infrastructure has been removed, the receptiveness of the soil for re-vegetation should be enhanced by means of ripping, topsoil application or the use of fertilisers and compost. Quick growing, indigenous plant species that provide stability should be established. In this regard a landscape design plan for approval by the applicable authorities may be required.
- To ensure that decommissioning and rehabilitation is acceptable, an external audit should be conducted, the results of which should be copied to the applicable authorities.

25. ENVIRONMENTAL MANAGEMENT TOOLS

A number of environmental management tools can be used towards achieving best practices in aquaculture. These tools include:

- The EIA process itself. This can be supported by environmental risk and various other assessment methods.
- Geographic information systems such as biodiversity and ecosystem maps, including maps of FEPA's, provincial spatial biodiversity plans, biodiversity sector plans for municipalities indicating critical biodiversity areas and ecological support areas and maps of threatened ecosystems.
- Environmental method statements, checklists, registers, audits and audit results, incident and complaints registers, site diaries, photographic records etc.
- Environmental education of employees.
- Contingency plans that contain details of the actions to be taken in addressing environmental emergencies and the people responsible for these actions. These could include contingencies for aspects such as water pollution, disease, escape or fire and more.
- One of the most important environmental management tools is the EMPr, which is a requirement for submission with an application for environmental authorization. In this regard, implementation and compliance with the EMPr becomes a condition of authorization and is therefore legally binding. Much of the environmental management and good practice content of this guideline can be used to formulate and compile a project specific EMPr. In terms of the EIA Regulations (R 543 of 2010), the content of an EMPr must include:
    - Details of the practitioner who prepared the EMPr and the expertise of this practitioner in this regard.
    - Information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified, including environmental impacts or objectives in respect of:
        - Planning and design.
        - Pre-construction and construction activities.
        - Operation or undertaking of the activity.
        - Rehabilitation of the environment.
        - Closure and decommissioning where relevant.
    - A detailed description of the aspects of the activity that are covered by the EMPr.
    - An identification of the persons who will be responsible for the implementation of the management and mitigation measures contained in the EMPr.
    - Proposed mechanisms for monitoring compliance with and performance assessment against the EMPr and reporting thereon.
    - As far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including, where appropriate, concurrent or progressive rehabilitation measures.
    - A description of the manner in which it intends to:

- Modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation.
- Remedy the cause of pollution or degradation and migration of pollutants.
- Comply with any prescribed environmental management standards or practices.
- Comply with any applicable legal provisions regarding closure, where applicable.
- Comply with any legal provisions regarding financial provisions for rehabilitation, where applicable.

- Time periods within which the measures contemplated in the EMPr must be implemented.
- The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking the operations.
- An environmental awareness plan describing the manner in which:
  - The applicant intends to inform his or her employees of any environmental risk which may result from their work.
  - Risks must be dealt with in order to avoid pollution or the degradation of the environment.
- Where appropriate, closure plans, including closure objectives.

CHAPTER 6: CONCLUSION

The primary objective of the EIA Guideline for Aquaculture in South Africa revolves around equipping the aquaculture sector and other stakeholders with the required approach to deal with environmental management matters, so that potential environmental impacts can be reduced. Following the principles in this guideline will result in the development of environmentally sustainable projects and ultimately an environmentally responsible aquaculture sector for South Africa.