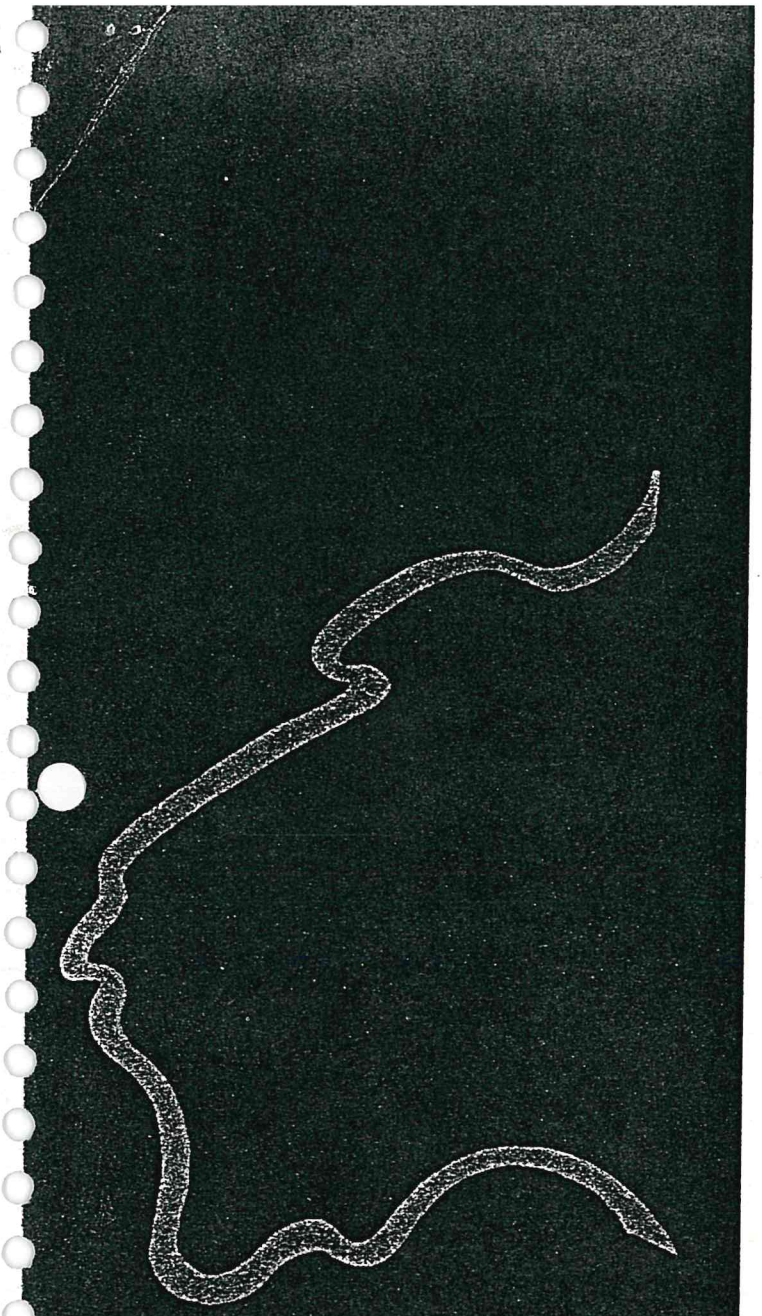

Environmental Protection Authority

Guidance for the Assessment of Environmental Factors

(in accordance with the Environmental Protection Act 1986)

Benthic Primary Producer Habitat Protection

No. 29

Draft

May 1998

Western Australia

FOREWORD

The Environmental Protection Authority (EPA) is an independent statutory authority and is the key provider of independent environmental advice to Government.

The EPA's objectives are to protect the environment and to prevent, control and abate pollution. The EPA aims to achieve some of this through the development of Environmental Protection Guidance Statements for the environmental impact assessment (EIA) of proposals.

In 1992, when the Environmental Protection Act 1986 was reviewed, a key sentiment expressed related to the uncertainty of outcome of the EIA process. The EPA addressed this concern by identifying priority factors for which EPA guidance and position statements needed to be developed to establish the grounds for judging the environmental acceptability of developments in advance of project planning and design.

This document is part of a series of documents being issued by the EPA to address this concern. The series is written to assist proponents, consultants and the public generally to gain additional information about the EPA's thinking in relation to aspects of EIA process. The series provides the basis for EPA's evaluation of and advice on development proposals subject to EIA.

This guidance statement has already undergone a scientific peer review and at this stage the EPA is seeking review specifically from key stakeholders. Later, the EPA will be releasing drafts of this guidance statement for broader public comment.

This draft guidance statement is entitled:

- Benthic Primary Producer Habitat Protection Guidance (No. 29).

This document is an overarching (or generic) statewide guidance statement and provides the context for a series of subordinate guidance statements derived from the overarching document. These subordinate guidance statements are designed to refer specifically to habitats dominated by seagrasses, corals, mangroves and algae (see Figure 1 in draft guidance statement). Subsequently, local annexes of these documents will be developed, on an as needs basis, to provide more specific guidance in relation to localised issues.

This document is entitled "Draft" in that it is being developed by the EPA and is released for stakeholder review for six weeks.

I am pleased to release this document and encourage you to comment on it.

Bernard Bowen

Bernard Bowen
CHAIRMAN
ENVIRONMENTAL PROTECTION AUTHORITY

22 May 1998

ENVIRONMENTAL PROTECTION AUTHORITY GUIDANCE FOR THE ASSESSMENT OF ENVIRONMENTAL FACTORS

DRAFT GUIDANCE No. 29: BENTHIC PRIMARY PRODUCER HABITAT PROTECTION

How to comment on this document

This document is released for stakeholder comment for a period of 6 weeks. Your comments are welcome.

Please send your comments by 6 July 1998 to:

Mr Craig Manning
Environmental Officer
Marine Management Branch
Department of Environmental Protection
141 St Georges Terrace
Perth 6000

Tel: (08) 9222 7057
Fax:(08) 9321 5184

Further copies of this document are available by phoning Craig Manning on (08) 9222 7057.

Table of Contents

1. PURPOSE 1

2. OBJECTIVE 1

3. PREAMBLE 2

3.1 Primary producer habitats and their distribution in Australia . 2
3.2 The importance of benthic primary producer habitats 2

4. GUIDANCE 3

4.1 The environmental objective 3
4.2 Evaluation of alternatives 4
4.3 Ecosystem approach 6

5. GUIDANCE FOR NEW PROPOSALS .. 8

5.1 Categories of protection 8
5.2 Generic guidance for assessing the ecological implications of loss of key primary producer habitat in areas designated category C 8

6. APPLICATION - AREA AND TERM 12

6.1 Application area 12
6.2 Term of application 12

7. RESPONSIBILITIES 12

7.1 EPA responsibilities 12
7.2 DEP responsibilities 12
7.3 Proponents responsibilities 12

8. LIMITATIONS CLAUSE 12

9. DEFINITIONS 13

10. REFERENCES 14

FIGURES

1: Schematic representation of the hierarchical relationship between the overarching Benthic Primary Producer Habitat Guidance Statements for Environmental Impact Assessment (EIA). 5

TABLES

1: Cumulative impact criteria. 10

Guidance No. 29

Guidance for Benthic Primary Producer Habitat Protection

Key Words: coastal waters, marine habitats, primary producers, coral reefs, mangrove forests, seagrass meadows, algal reefs

1. PURPOSE

The purpose of this guidance statement is:

"To maintain the ecological integrity and biodiversity of marine ecosystems of Western Australia"

2. OBJECTIVE

The objectives of this guidance statement are:

(a) to protect the environment as defined by the Environmental Protection Act 1986 (EP Act 1986) with a focus on state coastal waters in the context of activities which may directly or indirectly affect key benthic primary producer habitats;

(b) to address the factor of uncertainty of outcome of the EIA process as raised in 1992 during the review of the EP Act 1986;

(c) to present to developers, proponents who have proposals subject to environmental impact assessment (EIA) and the general public, the Environmental Protection Authority's (EPA) position on activities which may directly or indirectly affect key benthic primary producer habitats;

(d) to assist in fulfilling the Western Australian Government's commitments to environmental protection as outlined in the State Conservation Strategy for Western Australia (DCE 1987), which is consistent with the objectives of the National Conservation Strategy for Australia (1984) and the World Conservation Strategy (1980), to:

* maintain essential ecological processes and life support systems;
* preserve genetic diversity; and
* ensure the sustainable usage of species and ecosystems.

(e) to ensure consistency of approach with the National Strategies for: Ecologically Sustainable Development (1992) and the Conservation of Australia's Biological Diversity (1996).

3. PREAMBLE

3.1 Primary producer habitats and their distribution in Western Australia

Western Australia has over 12,000 km of coastline extending from the cool-temperate waters of the south coast through to the warm-tropical waters of the Kimberley coast. The characteristic marine biological communities differ considerably along the length of the coast. In temperate waters the hard-substrate reef communities are characterised by kelps and other algae, and seagrass meadows occur in the sandy sheltered embayments and coastal lagoons. Progressing northward, corals become more common on the reefs and the tropical seagrasses appear on the sand and mud. Further north, mangrove communities appear on the muddy tidal flats and in creek mouths, and coral reefs dominate in offshore waters. These biological communities, and the substrates they form or grow on, are benthic primary producer habitats.

3.2 The importance of benthic primary producer habitats

The Biodiversity Working Party (1991) concluded that the single biggest threat to the maintenance of ecological integrity is habitat destruction. The plant and animal communities that form these habitats are central to the functioning of the ecosystem of which they are a part. Important ecosystem services provided by these habitats include the provision of food (primary production), substrate and shelter, and physical stability.

3.2.1 *Primary productivity*

The key marine plant components of these different habitats are collectively termed "primary producers". Through the process of photosynthesis these organisms produce organic matter from carbon dioxide, water and nutrients, using sunlight for energy. This organic matter is then available to be consumed as food either directly, or after it has been broken down into detritus, by animals higher up the food chain.

3.2.2 *Substrate and Shelter*

Benthic primary producer habitats have three-dimensional structure which provides a substrate for growth of sedentary forms and shelter for the juveniles and adults of the more mobile forms. They also support sediment-dwelling animals that feed on the organic matter produced within the benthic primary producer habitats.

3.2.3 *Physical stability*

Many benthic primary producer habitats assist in stabilising soft subtidal and intertidal sediments and shorelines. Mangroves stabilise and protect coastal margins and reefs dissipate wave energy and protect inshore areas.

Clearly, benthic primary producer habitats are critical to the ecological functioning of coastal marine systems. Research has shown that the ecological value of these habitats can be both regionally and locally variable. For example, at a regional scale, the biogeographic distributions of the main benthic primary producer habitats do not necessarily match the distribution of higher order organisms that utilise these habitats. Dugongs, for instance, feed almost exclusively on seagrasses, and favour the carbohydrate rich species such as *Halophila*. The southerly limit of dugong distribution on the west coast is Shark Bay. *Halophila* occurs in Shark Bay but also occurs further south and outside the dugong's normal range, for example in Geographe Bay. While *Halophila* has intrinsic value in terms of its role as a primary producer in both locations it has an additional value in Shark Bay as a food source for dugong in particular, and this must be

considered in environmental impact assessment. At a more local scale, seagrass meadows located near or distant from estuaries or oceanic currents may have very different values in terms of fish nursery function for example.

The common thread is that the abundance, diversity and productivity of plant and animal life associated with these habitats is generally much greater than adjacent 'bare' areas. Coral reefs are highly productive and, along with tropical rainforests, are thought to be the most diverse living systems in the world.

As described above, the function and composition of these habitats will differ from place to place and for different ecosystem types. The key to this guidance statement is that there are generic principles for assessing proposals which have the potential to affect the key primary producer habitats directly or via the ecological processes that sustain them.

4. GUIDANCE

This guidance statement:

a) outlines the generic principles the Environmental Protection Authority will adopt with respect to proposals that may affect marine benthic primary producer habitats generally; and,

b) provides the generic framework which links to the more specific guidance for each key benthic primary producer type (see Figure 1).

4.1 The environmental objective

The environmental objective of the Benthic Primary Producer Habitat Guidance is:

"To maintain the integrity of the marine ecosystems of Western Australia to support the widest possible range of environmental values while recognising the current and projected future uses."

The EPA considers the ecological integrity of the state's coastal waters to be a fundamental environmental value requiring a high level of protection and which should be considered in terms of ecosystem structure and function (ANZECC, 1992). Practically all other environmental values and societal uses of our coastal waters are dependent in some way on maintaining the ecological integrity of the environment.

Unlike much of the land environment of our state, our coastal waters are not privately owned and although we obtain food from the ocean, marine farming (aquaculture) is not widespread. Apart from Cockburn Sound and the Albany Harbours, most of the marine environment is in very good condition and the key benthic habitats are intact (DEP, 1997).

In relation to the ecological integrity of the terrestrial environment, extensive areas in the south west of Western Australia have been cleared for agriculture and the natural perennial vegetation complexes have been replaced with annual crops. In the process we have unwittingly compromised ecological integrity on a vast scale. However, this experience should be used as an incentive to be proactive and avoid the same scenario for the marine environment. Too much clearing of native vegetation has changed the water balance and caused salt-laden groundwater tables to rise with an associated loss of previously arable land to salt scalding. Clearing of native vegetation has equivalent effects on ecological integrity in the terrestrial environment as does the loss of benthic primary producer habitats in the marine environment. Much time and effort has

been required to gain general acceptance of the fact that these problems have resulted from too much clearing and that this in turn arose from a lack of understanding of the key ecological processes and the long term consequences for the landscape. In response, a 30-year program (the State Salinity Action Plan) has had to be implemented, which involves, inter alia, extensive revegetation, in an attempt to halt the rate of land degradation and restore the basic elements of ecological function. At best we may end up with an environment that is 'tolerable' in the long-term, but certainly not one that we would call 'desirable'.

This guidance statement has been produced so that we might avoid the problems experienced in the terrestrial environment and better facilitate sustainable use of the marine environment. By strictly limiting habitat loss and managing the marine environment with the fundamental objective of maintaining ecological integrity, we have an opportunity to ensure that a similar scenario to that described above for the terrestrial environment does not occur in the marine environment.

The threats to ecological integrity of the marine environment can be broadly grouped into three categories: (i) interruption to recruitment processes; (ii) the direct and indirect effects of waste discharges; and (iii) direct removal or indirect loss of key ecosystem components.

The first threat '*interruption to recruitment processes*' relates to changes in the sources or availability of propagules for recruitment (eg. upstream reefs) and is addressed through the establishment and wise management of a comprehensive and representative system of marine reserves (New Horizons in Marine Management policy, 1994).

The second threat '*the direct and indirect effects of waste discharges*' is addressed through the designation of environmental quality objectives and criteria (e.g. regulations under a State Coastal Waters Environmental Protection Policy; Figure 1) to guide impact assessment and regulation based on monitoring and application of the OECD Pressure:State:Response model (DEP, 1996).

The "Benthic Primary Producer Habitat Guidance" (this guidance statement) addresses the third threat to ecological integrity associated with '*direct removal or indirect loss of key ecosystem components as a result of human activity*'.

4.2 Evaluation of alternatives

Benthic primary producer habitats generally occupy a relatively small proportion of coastal ecosystems (often < 20 %), with the remainder comprised of relatively low productivity/diversity habitats (eg sand and mud). As such, there is generally quite wide scope to design proposals to avoid or minimise impacts on these corner-stone communities. The EPA places great importance on protecting key benthic primary producer habitats and expects that proponents will conduct a thorough appraisal of all options that would avoid affecting these communities before presenting a proposal for evaluation that would involve the direct or indirect loss of these key ecosystem components.

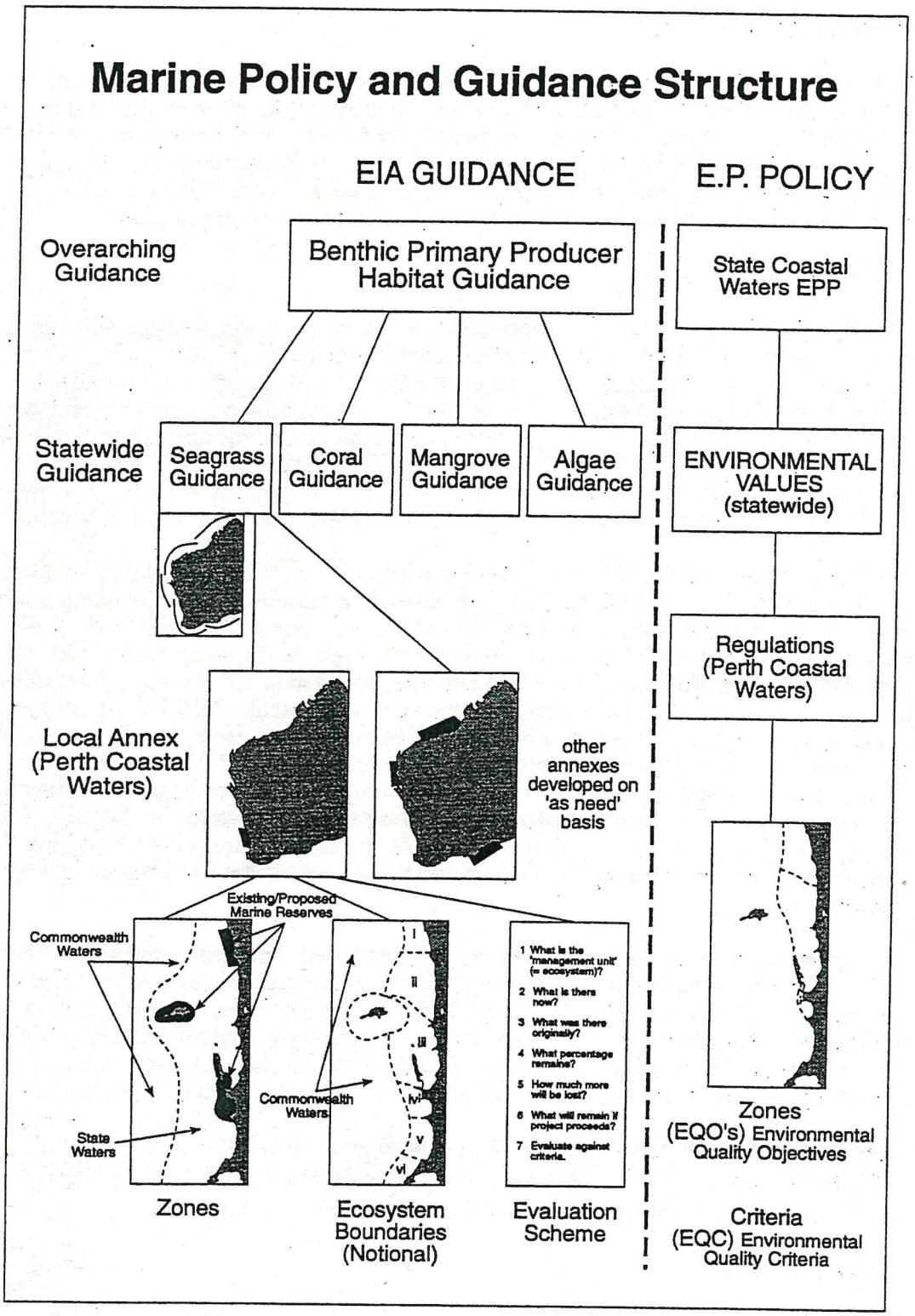

Figure 1. Schematic representation of the hierarchical relationship of the Benthic Primary Producer Habitat Guidance Statements for Environmental Impact Assessment.

(Note: The parallel structure for the proposed State Coastal Waters Environmental Protection Policy (EPP), which deals with waste discharges is also shown.)

4.3 Ecosystem approach

An ecosystem approach acknowledges the linkages between the physical, chemical and biological components of the environment and the various time and space scales over which these linkages apply. Issues such as cumulative impact, intergenerational equity and maintenance of biodiversity can only be addressed if the interconnectedness of our aquatic ecosystems and the temporal and spatial scales of these connections are recognised. This guidance uses this principle to assess the threats to ecological integrity associated with loss of key ecosystem components.

4.3.1 *Management Unit boundaries*

The 'ecosystem approach' is dependent on defining a specific geographic area or 'management unit'. There is no accepted scientific method for determining ecosystem or management unit boundaries. As a result, the position of the boundaries and the resultant size and shape of the management unit will be largely determined arbitrarily and hence will be the subject of debate. Similar problems are faced in the management of economic and social systems. However, setting boundaries will be unavoidable if the issue of cumulative impacts is to be addressed. For these reasons it will be important to ensure that the process that leads to the determination of boundaries is rigorous, transparent and defensible.

ANZECC has coordinated the development of an Interim Marine and Coastal Regionalisation for Australia (IMCRA) to provide a framework for planning sustainable resource use and biodiversity conversation (IMCRA Technical Group, 1997). While the present regionalisation products for inshore waters are at the meso-scale (100s-1000s of km), the IMCRA proposes the need to consider and define smaller ecological units at the local or micro-scale (10s-100s kms) and the site or pica-scale (<10 km), both to assist in developing a system of representative marine reserves and to assess the ecosystem impacts of marine use and development proposals. For the purposes of considering the impact of habitat loss on ecological integrity, management units will need to be much smaller than the 'bioregions' (and possibly even the 'local' ecosystems) described in IMCRA Technical Group (1997). Nonetheless, it may be possible to utilise future outcomes of the IMCRA process to assist in defining the management units required to implement this guidance framework.

To provide some guidance in the interim, it is proposed that management unit boundaries will, in the first instance, be defined to take into account physical characteristics such as bathymetry and position of offshore reefs/islands, substrate type, water circulation patterns and biological attributes such as habitat types. It is strongly recommended that where ever possible, other variables at finer levels of detail such as the dispersal ranges of benthic primary producers or of their dependant fauna, are considered in this determination.

The configuration and areal extent of the management unit will be dependent on these and other aspects, but generally, the configuration will be geomorphologically determined and the area will be in the order of 10's to a few 100's km^2.

4.3.2 *Cumulative impact*

Cumulative impacts are defined as the sum of all human-induced impacts that have occurred since European habitation of Western Australia (approximately 200 years BP). Cumulative impact as used here relates to impacts on benthic habitats and does not include changes to habitat caused by natural catastrophic disturbances such as severe storms. A critical element of the guidance is to express the cumulative impact as the percentage of

benthic habitat lost, and this highlights the importance of appropriately defining the extent of the management unit, as described above.

It would be impossible to accurately quantify all of the changes that have occurred over the last 200 years because of a lack of records. However some records (eg. photographic records) exist which can assist in assessing gross change over the last 50 or so years, which is the period over which most impacts of this type are likely to have occurred. Similarly, knowledge of the conditions required to support various types of benthic habitat has improved in recent years. For example, under certain circumstances it is possible to predict with reasonable confidence that a given area is 'seagrass habitat' or 'coral reef habitat' based predominantly on physical characteristics and geographic setting. In this sense it would be considered to be 'potential' areal extent of habitat.

For instance, we know from experience that temperate seagrass meadows are restricted to relatively shallow, low-energy environments with adequate light levels year round. Therefore it is extremely unlikely, at least over the last 200 years, that temperate seagrass meadows would have been present in high energy environments subject to ocean swells, or at water depths where mean light availability is below certain critical levels. The corollary is that we can predict with reasonable confidence that there has been a loss of habitat, when human activity has changed any of these conditions to below the survival threshold for that habitat type (eg. dredging to below a critical water depth).

4.3.3 *Reversible/Irreversible change*

The EPA considers that the principle of 'intergenerational equity' is important and consequently requires that irreversible change be avoided or minimised. The re-establishment of key primary producer habitat once lost is dependent on many different factors. The relative re-establishment potential can vary according to species and according to habitat. For the purposes of this guidance, and to be consistent with the stated condition of maintaining intergenerational equity, a loss of habitat is considered irreversible if natural re-establishment takes longer than 2-3 decades.

4.3.4 *Biodiversity*

Biodiversity is a relevant factor in most environmental impact assessments and one that is difficult to address, particularly in the marine environment where there is a paucity of information on species/assemblage distribution, and many remain undescribed. From the little we do know however, it is clear that benthic primary producer habitats are areas of high biological diversity. Therefore, protecting ecological integrity, and primary producer habitats in particular, will favour the maintenance of biodiversity.

5. GUIDANCE FOR NEW PROPOSALS

5.1 Categories of protection

Three categories of protection are recognised in the state's coastal waters with respect to primary producer habitats. The following is a brief description of those categories and the EPA's operational (environmental) objectives for those areas with respect to the key primary producer habitats.

5.1.1 *Category A*

Category A: Areas of extremely high conservation significance; areas not designated category 'B' or 'C'. Existing or proposed marine nature reserves and sanctuary zones in marine parks would be examples of Category A areas.

"The operational objective of the EPA is that no development should take place in this area, nor should there be any development elsewhere that would cause a direct or indirect loss of benthic primary producer habitat or ecological integrity of this area."

5.1.2 *Category B*

Category B: Areas of high conservation significance; areas not designated category 'A' or 'C'. The majority of zones in existing or proposed marine parks and marine management areas would be examples of Category B areas.

"Development proposals should conform with the operational objectives of minimum indirect disturbance and no loss of benthic primary producer habitat.

5.1.3 *Category C*

Category C: Areas of moderate conservation significance; areas not designated category 'A' or 'B'. Areas within State jurisdiction such as ports or industrial complexes and not identified as having a high conservation significance would be examples of Category C areas.

"Development proposals should conform with the operational objectives of preventing the avoidable destruction of benthic primary producer habitat, and cumulative (total) losses should be kept within strict limits (see Table 1), whilst recognising uses designated prior to the formulation of this guidance."

5.2 Generic guidance for assessing the ecological implications of loss of key primary producer habitat in areas designated category C

The following evaluation scheme should be applied for assessing the ecological implications of a proposal in a category C area that may result in the loss of key benthic primary producer habitat.

An evaluation scheme to assess the environmental impact associated with a proposal which, if implemented, may result in direct removal or indirect loss of key ecosystem components is presented in Section 5.2.1. A worked example of how the scheme would be applied is presented in section 5.2.4. The evaluation scheme is based on cumulative changes within a defined management unit and includes determining the areal extent of benthic primary producer habitat (i) prior to all human-induced disturbance, (ii) existing at the time of the proposal and (iii) remaining after implementation of the proposal. It is important to note that this scheme should only be

applied after all alternatives (ie. to direct removal or indirect loss of key ecosystem components) have been evaluated (see section 4.2) .

Steps 1-6 are designed to provide the information required to assess the proposal against the cumulative impact criteria (Table 1).

Steps 7-9 describe three outcome scenarios.

5.2.1 *Evaluation scheme*

Steps in the acquisition of information required for assessment

1. **What is the 'management unit'?**
   Define an appropriate management unit boundary, taking into account key physical and biological ecosystem attributes such as bathymetry and position of offshore reefs/islands, water circulation patterns, habitat/substrate types and energy/material flows.
   (generally 10's- few 100's km^2)

2. **What is there now?**
   Determine the current areal extent of the primary producer habitats in the management unit and determine the dominant primary producer habitat(s) for that ecosystem. This can be achieved through analysis of suitable aerial photographs or remotely sensed data with an appropriate level of ground-truthing of habitat types. The key habitats are likely to be those that occupy the most area. Evaluate the potential for reversibility of change for the key primary producer habitats as outlined in section 4.3.3. More detail is provided in the statewide policies for each key benthic primary producer habitat type to assist in the determination of reversibility.

3. **What was there originally? (Pre-existing conditions)**
   Establish a best estimate of the areal extent of key primary producer habitat(s) that existed (pre-existing conditions - conditions existing prior to European habitation) in the management unit to establish the baseline for cumulative impact assessment. This process may include assessing 'potential' habitat taking into account knowledge of habitat requirements. This approach will be particularly useful where habitats are subject to episodic but severe natural disturbance (eg. coral reefs in the Pilbara) or where the distribution is naturally dynamic and changes may be gradual but significant (eg. *Posidonia coriacea* seagrass meadows on Success Bank).

4. **What percentage remains?**
   Express the current areal extent of each key primary producer habitat (or the potential habitat) in the management unit (from 2 above), as a percentage of pre-existing conditions (from 3 above) and not including the current proposal.

5. **How much more will be lost?**
   Determine the area (or potential area) of each key habitat type in the management unit that would be directly and indirectly lost by the proposal and express as a percentage of pre-existing conditions (from 3 above).

6. **How much would have been lost in total if project proceeds?**
   Re-determine the cumulative loss in areal extent of each key primary producer habitat in the management unit to include the direct and indirect impacts of the current proposal and express as a percentage of pre-existing conditions (from 3 above). Note that this is an

additive approach and provides a way of viewing the proposal from a cumulative impact perspective.

5.2.2 *Evaluation against criteria.*

In order to evaluate the proposal, the EPA will compare the predicted cumulative loss in the areal extent of each key primary producer habitat in the management unit (from 6 above) with the criteria in Table 1.

Table 1. Cumulative impact criteria.

Category of Change	Maximum Cumulative (Total) Impact Criteria
Irreversible	≤ 5 %
Reversible	≤10 %

5.2.3 *Possible evaluation outcomes.*

Three possible outcomes of this evaluation are as follows.

7. **Irreversible change criterion not exceeded.**
If the re-determination (in 6 above) results in ≤5% irreversible cumulative loss of key primary producer habitats from pre-existing conditions (as in 3 above) then the proposal is acceptable as presented.

8. **Reversible change criterion not exceeded.**
If the re-determination (in 6 above) results in ≤10% reversible cumulative loss of key primary producer habitats from pre-existing conditions (as in 3 above) then the proposal is acceptable as presented.

9. **Criterion exceeded - reject and redesign.**
If the re-determination (in 6 above) results in >10% reversible cumulative loss or >5% irreversible cumulative loss from pre-existing conditions (as in 3 above) then it is likely the EPA would find the proposal is unacceptable as presented and would require modification to reduce the cumulative loss to ≤10% for habitats where change is reversible and ≤5% where change is irreversible. This could involve redesign of the development and/or using proven mitigation techniques to replace the component of the habitat loss (net cumulative loss to not exceed percentages specified). It should be noted that this may involve replacement at a ratio of greater than 1:1 to offset the inherent risk in achieving successful and full restoration and hence increase the probability of success.

5.2.4 *Worked example.*

To assist in following the evaluation scheme, a brief outline of a hypothetical proposal is presented below, followed by the calculations at each step of the evaluation scheme, and the final outcome of the assessment. A future scenario is also described.

(i) *Setting and brief outline of the proposal*
The proposed development is situated within a semi-circular bay with a 4 km radius, sheltered by a coral barrier reef approximately 4 km offshore measured at the shoreline in

the centre of the bay. It is a Category C area. A port and an associated access channel were built in 1970 taking 89 ha of habitat. A second channel was dredged in 1983 to allow for port expansion, removing a further 13 ha. A sewage outfall caused the indirect loss of 58 ha between 1965 and 1970. A proposal is presented in 1997 to develop a recreational marina which, if built, would cause the unavoidable loss (after evaluating alternatives) of 20 ha of habitat.

(ii) Calculations

Step 1: **What is the 'management unit'?**

The physical characteristics of the 'bay', the water circulation patterns and the distribution of benthic habitats provide a good basis to define the bay as the management unit. It has an area of approximately 25 km^2 or 250,000 ha.

Step 2: **What is there now?**

Areal photographs are used to map the benthic habitats. Corals are dominant and 1840 ha of coral habitat is estimated to occur in the management unit. After careful appraisal it is determined that the change could be considered to be 'reversible' for the purposes of applying this guidance.

Step 3: **What was there originally?**

The management unit currently contains 1840 ha of coral habitat, and some 160 ha had been lost previously, so the original habitat is estimated to have been 1840 ha + 160 ha = 2000 ha.

Step 4: **What percentage remains?**

The amount of coral habitat remaining expressed as a percentage of the habitat there originally, is $^{1840}/_{2000}*100 = 92\%$

Step 5: **How much more will be lost?**

The additional amount of coral habitat that will be lost from the management unit if the development proceeds, expressed as a percentage of the habitat there originally, is $^{20}/_{2000}*100 = 1\%$

Step 6: **How much would have been lost in total if project proceeds?**

The percentage remaining in the management unit if the development proceeds is 92% - 1% = 91%. Therefore the cumulative percentage loss would be 100% - 91% = 9%.

(iii) Evaluation of current proposal:

The resultant cumulative loss of key primary producer habitats from pre-existing conditions is less than 10% and hence complies with the cumulative loss criterion for 'reversible' change (Table 1). On that basis the proposal would be consistent with the EPA's objective of maintaining ecological integrity and would be considered acceptable from this perspective.

(iv) Evaluation of a subsequent proposal:

Consider the scenario where the recreational marina described above was built in 1998 and a new proposal was put forward in 1999, which, if implemented would cause the loss of an additional 40 ha of coral habitat. This amounts to 2% of the pre-existing habitat. If allowed to proceed, this development would result in a total cumulative loss of 11% of key primary producer habitats compared to pre-existing conditions. This would exceed the

cumulative loss criteria for reversible change and hence the proposal would be unacceptable on the basis that it would be inconsistent with the EPA's objective of maintaining ecological integrity and would need to be re-designed to comply with the EPA's objectives.

The above example illustrates how the losses are additive and that once the cumulative impact limit is reached, further development that would cause the loss of habitat would be, by definition, unacceptable. The example also highlights that it is in the greater interest of both current and future generations for each proponent to ensure that all attempts are made to avoid the loss of key habitats.

6. APPLICATION - AREA AND TERM

6.1 Application area

This guidance applies to proposals within the coastal waters of the state of Western Australia, nominally the areas within three nautical miles seaward of the territorial baseline, and landward from the territorial baseline to the mouths/entrances of rivers and estuaries.

6.2 Term of application

The guidance may be changed by the EPA at any time without notice and will be reviewed within five years.

7. RESPONSIBILITIES

7.1 EPA responsibilities

The EPA will apply this guidance in making decisions about whether or not to assess any proposal for use which could impact upon Benthic Primary Producer Habitat, and in any assessment of such proposals.

The EPA will recommend to the Minister the imposition of these requirements following its assessment of the proposals for which it is a relevant factor.

7.2 DEP responsibilities

The Department of Environmental Protection will assist the EPA in applying this guidance in environmental impact assessment and conduct its own functions under the Environmental Protection Act in accord with the guidance.

7.3 Proponent responsibilities

Where proponents demonstrate to the EPA that these guidance requirements are accountably and enforceably incorporated into proposals, the assessment of such proposals is likely to be facilitated.

8. LIMITATIONS CLAUSE

This guidance for environmental impact assessment statement has been prepared by the Environmental Protection Authority to assist proponents and the public. While it represents the contemporary views of the Environmental Protection Authority, each proposal which comes before the Environmental Protection Authority for environmental impact assessment

will be judged on its merits. Proponents who wish to deviate from the contents of this document should therefore provide justification for the proposed departure.

In addition to the objective with respect to primary producer habitats, the EPA will also have objectives for other factors that would need to be considered before the assessment can be completed.

9. DEFINITIONS

Algae	Group of single-celled, filamentous, or fleshy non-flowering aquatic plants
Assemblage	Recognisable grouping or collection of individuals or organisms.
Bathymetry	The measurement of ocean depths to determine the sea floor topography.
Benign	Harmless.
Benthic	Living upon or in the sediment of the sea.
Biodiversity	The variety of all life forms: the different plants, animals and micro-organisms, the genes they contain and the ecosystems they form. It is often considered at three levels: genetic diversity, species diversity and ecosystem diversity.
Community	Ecologically, any naturally occurring group of different organisms sharing a particular habitat.
Ecological integrity	The physical, chemical and biological components of an ecosystem and the interactions between these components, being in a sound, undiminished and unimpaired state.
Ecosystem	Unit including a community of organisms, the physical and chemical environment of that community, and all the interactions among those organisms and between the organisms and their environment.
Environmental quality objectives (EQOs)	The long-term goals of an environmental management programme in relation to the maintenance of ecological and societal values of natural systems.
Environmental quality criteria (EQC)	The scientific benchmarks upon which a decision may be made concerning the ability of an environment to maintain certain designated environmental quality objectives.
Habitat	The natural home of a plant or animal.

Intergenerational equity	Availability to future generations of at least the range of natural resources and opportunities available to the present generation.
OECD	Acronym for the "Organisation for Economic Co-operation and Development."
Management Unit	A specific geographical area which provides the most effective boundaries for management of cumulative environmental impacts on marine habitats.
Photosynthesis	A process, operating in chlorophyll containing plants, which uses solar energy to convert carbon dioxide and water into carbohydrate.
Primary Producers	Organisms (largely green plants) which can manufacture organic substances (food) from simple inorganic substances
Propagule	Any part of a plant or animal capable of growing into a new organism.
Recruitment	The addition of new individuals to an existing population or habitat.
Seagrass	Submerged flowering plants that mainly occur in shallow marine areas and estuaries.
Sedentary	Confined to one spot.
Species	Generally regarded as a group of organisms that resemble each other to a greater degree than members of other groups and that form a reproductively isolated group that will not normally breed with members of another group.
Substrate	The layer immediately underneath something or to which it is attached.

10. REFERENCES

Australian and New Zealand Environment and Conservation Council (1992). National water quality management strategy. Australian water quality guidelines for fresh and marine waters. Australian and New Zealand Environment and Conservation Council.

A National Conservation Strategy for Australia (1984), Australian Government Printing Service, Canberra, A.C.T.

A National Strategy for Ecologically Sustainable Development (1992), Australian Government Printing Service, Canberra, A.C.T.

Biodiversity Working Party (1991). The conservation of biodiversity as it relates to ecologically sustainable development. ESD Secretariat, DASETT, Canberra.

Department of Conservation and Environment (1987). A State Conservation Strategy for Western Australia, a sense of direction. Department of Conservation and Environment, Perth, Western Australia. Bulletin 270.

Department of Environmental Protection (1996). Southern Metropolitan Coastal Waters Study (1991-1994) Final Report. Department of Environmental Protection. Report 17.

Department of Environmental Protection (1997).Environment Western Australia 1997. Draft State of the Environment Report for Western Australia. Department of Environmental Protection.

IMCRA Technical Group (1997). Interim Marine and Coastal Regionalisation for Australia: an ecosystem-based classification for marine and coastal environments. Version 3.2. Environment Australia, Commonwealth Department of the Environment, Canberra.

World Conservation Strategy (1980), Living Resource Conservation for Sustainable Development: International Union of Conservation of Nature and Natural Resources, Switzerland.

New Horizons in Marine Management policy (1994). Government of Western Australia.

The National Strategy for the Conservation of Australia's Biological Diversity (1996). Commonwealth Department of Environment, Sport and Territories, Canberra, A.C.T.

Index

Draft Guidance **May 1998**
Preliminary
Guidance
Interim Guidance
The Guidance

Status Not signed-off by EPA at this stage.

Citation This draft EPA guidance statement cannot be cited at this time but is used by the EPA for the purposes of environmental impact assessment (EIA) with respect to this factor.

Acknowledgments The EPA would like to acknowledge the independent peer reviewers who have contributed to the refinement of this guidance statement.

Contact officer Mr Craig Manning, DEP (08) 9222 7057