STATE WATER QUALITY MANAGEMENT STRATEGY

No. 6

Implementation Framework for Western Australia for the Australian and New Zealand Guidelines for Fresh and Marine Water Quality and Water Quality Monitoring and Reporting (Guidelines Nos. 4 & 7: National Water Quality Management Strategy)

GOVERNMENT OF WESTERN AUSTRALIA

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Minister's foreword

This document, the Implementation Framework for Western Australia for the Australian and New Zealand Guidelines for Fresh and Marine Water Quality and Water Quality Monitoring and Reporting, is part of the State Water Quality Management Strategy (SWQMS). It has been developed to implement the corresponding part of the National Water Quality Management Strategy (NWQMS) in Western Australia.

Implementation of this framework should go a long way to redressing where deteriorating water quality has occurred in Western Australia since European settlement. Implementation should also underpin the sustainable use of those water resources.

Communities throughout Western Australia are becoming increasingly concerned about the deterioration of water quality, especially since the onset of the drying climate in the South West of Western Australia some 20 years ago. This has impacted on aquatic ecosystems involving wetlands, rivers and caves. The problem has been further compounded by the damming of rivers and the insufficient allocation of water to the environment since European settlement.

Water quality management is a broad field that will require co-operation, support and commitment from all facets of the community. This framework shows how all members of the community can contribute in some way to the development of environmental values, environmental quality objectives and environmental performance benchmarks for each of the State's significant water resources over a period of time.

Long-term changes are needed within the community and industry to move towards the goal of sustainable water use in Western Australia.. It is the responsibility of all members of the community to work cooperatively towards this goal. We will only be able to address the problem of deteriorating water quality and move towards a more sustainable future if everyone accepts their role and responsibilities.

This framework is one step on a long road towards sustainability. It is about changing what we understand as acceptable behaviour in the use of our water resources. Everyone in Western Australia can help to implement this framework and, in the long term, redress water quality problems in Western Australia.

Hon Dr Judy Edwards
MINISTER FOR THE ENVIRONMENT

Summary

This framework has been developed to implement the National Water Quality Management Strategy Guidelines Nos. 4 & 7 for ambient waters in Western Australia. The scope of the framework relates primarily to environmental protection and some social matters. This framework should not be read as a legal or coercive framework. Implementation of the framework, will assist environmental protection policy formulation under Part III of the Environmental Protection Act 1986, and the setting of Ministerial and licensing conditions on activities subject to Parts IV and V of the Environmental Protection Act 1986.

The framework has been developed in co-operation with the Environmental Protection Authority (EPA). During its development, extensive consultation was undertaken with relevant stakeholders, including natural resource management agencies, industry, peak bodies, Conservation Council and the public. All issues raised by interested parties have been considered during the development of the framework.

The framework requires that:

- All significant water resources in Western Australia be defined spatially, on a priority basis;

- Through a thorough consultative process involving the community, **environmental values** (EVs) for water quality be developed for each significant water resource. An EV is a particular value or use of the environment important for a healthy ecosystem or for public benefit;

- For each EV, a set of broad **environmental quality objectives** (EQOs) be developed. An EQO should reflect the desired state of water quality;

- For each broad EQO, **environmental quality criteria** (EQC) - sometimes known as benchmarks - be set. EQC can comprise numerical values and/or narrative statements;

- For EQC, two thresholds may be set:

    (a) **Environmental quality guidelines** (EQGs). If a guideline is breached, then an investigation should be initiated against an environmental quality standard (EQS). Breaching an EQG does not automatically imply environmental problems but does imply a warning level; and

    (b) **Environmental quality standards** (EQSs). If a standard is breached, then a management response should be initiated to fix the problem and, if necessary, restore the environmental quality. Breaching an EQS implies that there is some risk of environmental problems occurring.

Where water resources are highly degraded, the use of interim remediation targets maybe used. This would usually apply to terrestrial water resources with significant salinity, euthrophication and sedimentation problems arising from diffuse source activities;

- The Australian and New Zealand Guidelines for Fresh and Marine Water Quality and Water Quality Monitoring and Reporting be used as default EQGs unless more appropriate information for local water resources is available;

- Environmental quality standards be developed specific to the water resource. They may be numeric or narrative. It is noted that there is no single methodology for developing standards from guidelines;

- The day-to-day water resource manager for water quality employ an **environmental management system** (EMS) for each significant water resource.

- The EPA signs off the EVs, EQOs - including EQC - and targets;

- The resource management agency has the day-to-day management responsibility for the resource; and

- The EPA evaluates the environmental performance of the day-to-day management agency against the EQOs and publicly reports to Government.

The cumulative outcome of systematically setting EVs and EQOs (EQC or targets) for each of the State's significant water bodies, and having appropriate monitoring, auditing and reporting procedures, should be sustainable water resources that meet the needs of the State, communities, and the environment.

The Government of Western Australia has endorsed this Implementation Framework and expects it to provide a policy basis for government agency and community management activities to protect and improve our water quality.

Contents

Page

Figures

1a. Overarching model used by the EPA for the protection of water resources as shown in the EPA Annual Report 2001-02 and agreed to by NRM agencies in 2001

1b. Broad process for setting EVs and EQOs (including EQGs, EQSs and targets)

2. Environmental Management System to Implement Guideline No. 4 (provided by the Australian Water Association).

3. Conceptual diagram showing the relationship between the two types of EQC on the left, with the associated environmental condition on the right. The diagram shows that the intensity of management response triggered by exceeding EQC depends on which type of EQC has been exceeded, which in turn reflects the level of risk of whether or not there is an environmental problem.

Appendices

1a. Partnership approach for implementing the framework

1b. Community involvement – A partnership approach

2. List of Government and non-Government stakeholders invited to be part of the development of the framework

3. An integrated approach to water management – a holistic approach

4. Sustainable development – a balanced approach

5. The Scientific Tools: Revised Guideline Nos. 4 & 7

6. Comparisons in terminology between Guideline Nos. 4 & 7 and the present approach used in Western Australia

7. Guideline trigger values or targets (diffuse source and severe pollution)

8. Important decisions that need to be made before using scientific management tools

9. Relationship between EVs and EQOs

10. Multiple lines of evidence

11. Components of an environmental management system

12. Use of reference sites to derive EQGs

1. Introduction

Water is a vital and precious resource and arguably the State's most important natural and renewable resource. All life depends on adequate water supplies for survival.

Over the past 150 years, development has affected the available quantity and quality of the State's water resources. In some cases, these changes have affected the long-term viability of the resources and their dependent anthropogenic and ecological uses. In addition to the decreasing amount of water available to the environment because of the damming of many rivers, the Western Australian State of the Environment Report (1998) documented the impacts that salinisation, eutrophication and sedimentation are having on many catchments. In particular, the report noted the relationship between poor water quality and loss of Western Australia's (WA) unique biodiversity.

The National Water Quality Management Strategy (NWQMS) notes that water management is a State responsibility. Future generations will rely on the State's water resources for their existence. Therefore, it falls to the State, acting in partnership with stakeholders and the community, to ensure good stewardship of its water resources.

In its 1997-8 annual report, the National Competition Council (NCC) - which supports the implementation of the Council of Australian Governments (COAG) Water Reform Agenda (1994) - stated:

> *'Water reform is an area that extends beyond competition policy matters to embrace social policy issues such as recognising the environment as a legitimate user of water. The Council has said that full implementation of the reform package (on water) could do more to benefit the broad community than any other single National Competition Policy measure.'*

The framework

Section 2 introduces the principles and practices to be followed in the implementation of the framework while **Section 3** provides some preliminary comments.

Section 4 is the core section and details how the framework will be implemented, who is involved and their responsibilities. Additionally, it sets out the policy instruments available for its implementation and its pertinence to environmental impact assessment and the licensing of prescribed premises.

Section 5 is the Conclusions.

The thrust of the framework emphasises that implementation of the guidelines will be successful only if all parties have ownership of the outcomes to be achieved. Essentially, what is required is an initiative from a lead agency such as the Department of Environment (DoE) to apply the framework to a few demonstration areas and report back to the Environmental Protection Authority (EPA) for discussion and review. Such areas could include the Swan-Canning river and Collie river catchments, the Gnangara Mound and South West Yarradagee Blackwood groundwater area, and the North West Shelf marine coastal area. This framework has already been followed during the development of the draft Environmental Protection Policy (EPP) for Cockburn Sound.

The framework recognises that many authorities, agencies, organisations, businesses, groups and individuals, including State and Local Governments, have important roles to play in water resource protection (Appendix 1a & b). The NWQMS (1992), which underpins this framework, notes that:

> *'… each State … will have its own approach to the way it involves local community groups in the development of water quality management plans; and*
>
> *'These various interests and levels of government need to be brought together to plan for and achieve sustainability of our water …'*

This framework offers stakeholders and the community a transparent, flexible and inclusive approach to implementing the NWQMS's Guideline Nos. 4 & 7.

The framework proposes a hierarchical set of steps (Figure 1a & b):

- Defining the spatial boundaries for all significant water resources in WA on a priority basis;
- Establishing environmental values (EVs) for each significant water resource consistent with the NWQMS Guideline No. 4;
- For each EV, establishing a set of broad environmental quality objectives (EQOs) to reflect the desired state of water quality consistent with the NWQMS Guideline No. 4;
- For each broad EQO, establishing more specific EQOs called environmental quality criteria (EQC), sometimes know as benchmarks. For EQC, two thresholds are set: environmental quality guidelines (EQGs) and environmental quality standards (EQSs); and
- Managing each significant water resource through the use of an environmental management system.

It is noted that where the water quality is highly degraded by diffuse source influences such as salinity, euthrophication and sedimentation, the application of the NWQMS Guideline No. 4 should be seen in the context of EVs and EQOs being aspirational. For such cases, the framework provides for the use of interim targets until the designated EV can be applied. These targets would be set through a community consultative process. When the aspirational EVs and EQOs are finally met, it is then appropriate to use EQGs and EQSs. It is noted, however, that Guideline No. 4 offers very limited guidance on salinity and euthrophication and no guidance on sedimentation.

When the framework is implemented, it should achieve the overall policy objective of the NWQMS, that is:

> *'… to achieve sustainable use of the State's water resources by protecting and enhancing their quality while maintaining economic and social development …'*

This framework should not be read as a legal or coercive framework. Rather, it should assist all parties involved in the protection and management of WA's marine, estuarine and freshwater resources. This includes the management of bore water in the metropolitan area as most water resources, be they surface or shallow groundwater, are interconnected. This interconnection can cause environmental problems to occur in areas remote from where over-extraction occurs. For instance, over allocation of groundwater causing significant drawdown can lead to the drying of wetland, riverine habitats and caves. Such drying can impact on the ecological food-chain and in turn impact on biodiversity over a wider area.

Consultation and the NRM Council

The framework has been developed following an extensive consultation process with all key government stakeholders including natural resource management (NRM) agencies, and peak bodies (Appendix 2) over the past two years. The framework was also released for a two-month public review (Dec 2002 - Feb 2003). All matters raised during this extensive consultation have been addressed during the development of the framework (EPA-WA, 2002 and 2003).

It is recognized that NRM groups (supported by the NRM Council) are currently identifying EVs, EQOs, and EQC in some areas and are involved in local management activities for a wide range of water resources. These activities should be consistent with this framework.

From hereon, the Australian and New Zealand Guidelines for Fresh and Marine Water Quality and Water Quality Monitoring and Reporting will be referred to as Guideline No. 4 & Guideline No. 7 respectively.

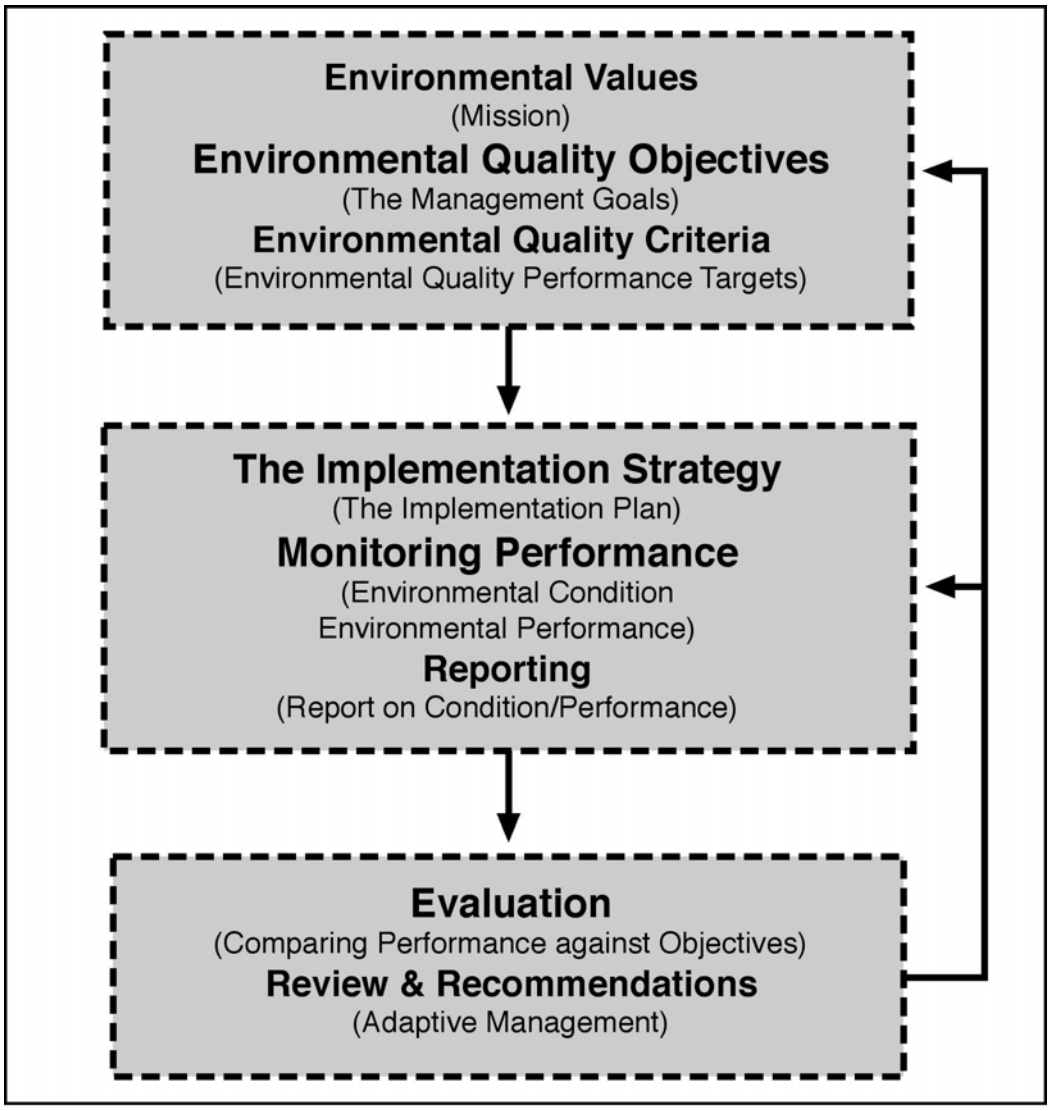

Figure 1a: Overarching model used by the EPA for the protection of water resources as shown in the EPA Annual Report 2001-02 and agreed to by NRM agencies in 2001

MODEL FOR PROTECTING WATER RESOURCES FOR ENVIRONMENTAL PURPOSES

TASK	EMS	PROCESS	WHO DOES IT?	WHO REVIEWS?
Environmental Values	Mission Statement	Social/Political	Lead Agency(s), Government-appointed Committee or Panel	EPA
Broad Environmental Quality Objectives	Broad Management Goals, including Benchmarks	Social/Scientific	Lead Agency(s), Government-appointed Committee or Panel	EPA
Specific Environmental Objectives (Guidelines, Standards and Targets)	Specific Management Goals, including Benchmarks	Scientific/Social	Lead Agency(s), Government-appointed Committee or Panel	EPA
Broad Implementation Strategy	Implementation Strategy	Bureaucratic	Lead Agency(s), Government-appointed Committee or Panel	
Local Implementation Plans	Implementation Strategy	Bureaucratic	Day-to-day Management Agency	
Monitoring, data Analysis and Reporting	Monitoring and Reporting	Scientific	Day-to-day Management Agency/Lead Agency(s) Committee or Panel	
Performance Evaluation and public reporting	Auditing	Bureaucratic	EPA Service Unit DE (Pt 4 & 5)	EPA
Reviewing and improving	Adaptive Management	Social/Scientific	Day-to-Day Management Agency/Lead Agency(s), Committee or Panel	EPA

Figure 1b: Broad process for setting EVs and EQOs (including EQGs, EQSs and targets)

Note: EPA's role is that of reviewing, auditing and reporting publicly to Government

2. Principles and practices to be followed when implementing the framework

Water resource protection may require specific sets of EVs and EQOs (EQC or targets) to be assigned to significant aquatic systems on a case-by-case basis. To this end, the principles and practices to be used for determining the above are:

- Community involvement – a partnership approach (Appendices 1a & b);
- An integrated approach to water management – a holistic approach (Appendix 3)
- Sustainability – a balanced approach (Appendix 4);
- As appropriate, review of EVs and EQOs (including EQC or targets) for significant water resources by EPA before submission to Government - (Figure 1b);
- Government endorsement of EVs and EQOs (including EQC or targets) as appropriate – Government coordination approach, and
- Performance auditing – an environmental management systems (EMS) approach (Figure 2).

These six principles and practices reflect those proposed in the NWQMS. However, two of the above are particularly related to the EPA's functions (Figure 1b). They are the 'review' and EMS approaches. Both approaches are important as they not only reflect the EPA's functions (scrutinising, auditing and public reporting) but also meet the community 'watchdog' expectation of the EPA

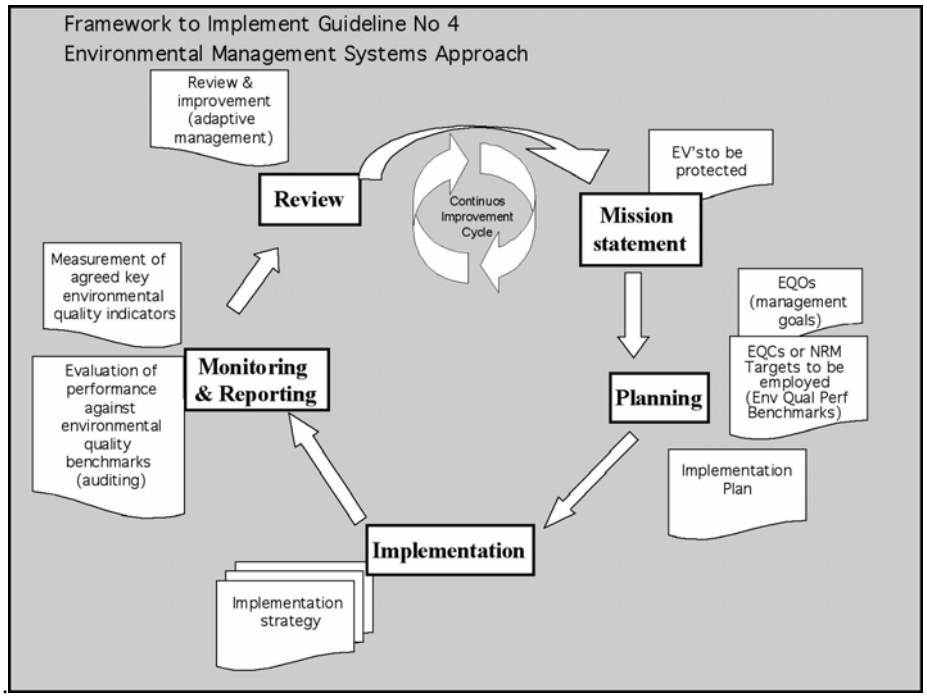

Figure 2: Environmental Management System to Implement Guideline No. 4 (provided by the Australian Water Association).

3. Comments regarding the framework

3.1 Understanding Guideline Nos. 4 & 7

It is important to understand the nature and context of Guideline Nos. 4 & 7 and their relationship to the framework. In this regard, some significant matters raised during the stakeholder consultation period included:

- Strict science approach versus the partnership approach (Appendix 5);
- The intertwining of science with implementation policy; and
- Inconsistency between implementation policy matters in Guideline No. 4 with the practical policies and principles approach of the NWQMS.

3.2 Terminology used in the framework compared to that used in Guideline Nos. 4 & 7

The NWQMS notes that its implementation should be flexible and adaptable to local situations. Accordingly, the framework uses its own terms as presented in the draft EPP for Cockburn Sound (Appendix 6). While consistent use of terms across Australia is highly desirable, differences in terminology may occur on an 'as needs' basis. For instance, Section 4 uses EQGs and EQSs when water quality is generally good and is to be maintained at existing levels (e.g. marine environments). These terms are not strictly used in the NWQMS Where water quality is poor and the guidelines are either irrelevant or grossly exceeded, it is more appropriate to use targets (e.g. in saline catchment and eutrophied estuaries) rather than guidelines in the first instance. This approach offers water resource managers the flexibility to address the broad range of issues confronting them, given the diversity of water bodies in WA.

3.3 Selection of environmental values

The most important step in the framework is the selection of EVs for each significant water resource. The setting of EVs is partly a community exercise (Figure 1b). This decision determines the subsequent approach to protecting each resource and can be the most contentious step because of its subjectivity and competing stakeholders' interests. This decision has a cascading effect on the selection of appropriate EQOs (EQC or targets).

EVs endeavour to reflect the wishes of all interested parties and are derived through a co-operative process. Some parties confuse EVs with EQOs. It should be noted that an EV could be established immediately (or could be aspirational) as it is a statement of philosophy (vision) relating to the beneficial use of the environment. Similarly, an EQO that underpins an EV may not necessarily be achievable immediately or in the short-term. For this reason, the framework uses the guideline trigger values from Guideline No. 4 for ambient waters of good quality while targets are used for areas that have persistently poor water quality following years of neglect (Appendix 7).

3.4 Use of Guideline No. 4 for the protection of pristine waters

Guideline No. 4 was written largely in response to the deterioration of freshwater quality and - to a lesser extent - marine water quality, especially on the eastern seaboard of Australia. Guideline No. 4 is concerned with addressing the issue of improving poor water quality where possible and is most useful when dealing with point source contamination. Hence the appropriateness of setting EVs for pristine areas needs clarification.

There is a tendency among some to automatically assume that the highest level of protection should be applied to areas that are deemed pristine. Unless a pristine area is deemed to have a high conservation and/or high ecological value, such an assumption

should not be made automatically. If that assumption were correct, the ramification would be that most of WA's pristine coastline would be potentially quarantined from most anthropogenic activities. The corollary of this is that some areas that are already disturbed but have very high conservation and/or ecological value may not be given the appropriate level of protection.

3.5 Benefits of this framework

This proposed approach is shown conceptually in Figure 3. It captures the lower (EQGs) and upper (EQSs) bounds of the 'uncertainty' associated with assessing the risk of an environmental problem. The intensity of management response triggered by not meeting a criterion depends on whether it is a guideline (EQG) or a standard (EQS), which in turn reflects the degree of surety of whether or not there may be an environmental problem. Most importantly, the accompanying management response is staged, which allows flexibility to use risk-based assessment and management approaches, and the opportunity to determine local EQGs or issue specific EQSs as necessary. This approach offers surety to both operators and regulators as it reduces the likelihood of a management response being triggered too early, which could place an unnecessary burden on the operator, or triggered too late to prevent serious or irreversible damage from occurring.

Another benefit is that it distinguishes between water bodies of good and poor water quality and uses guideline trigger values to protect the former while targets are used to remediate the latter. Notwithstanding this, the guideline trigger values should always be used in the back calculation of the upper limit for waste discharges from point sources (see Section 4.5 below).

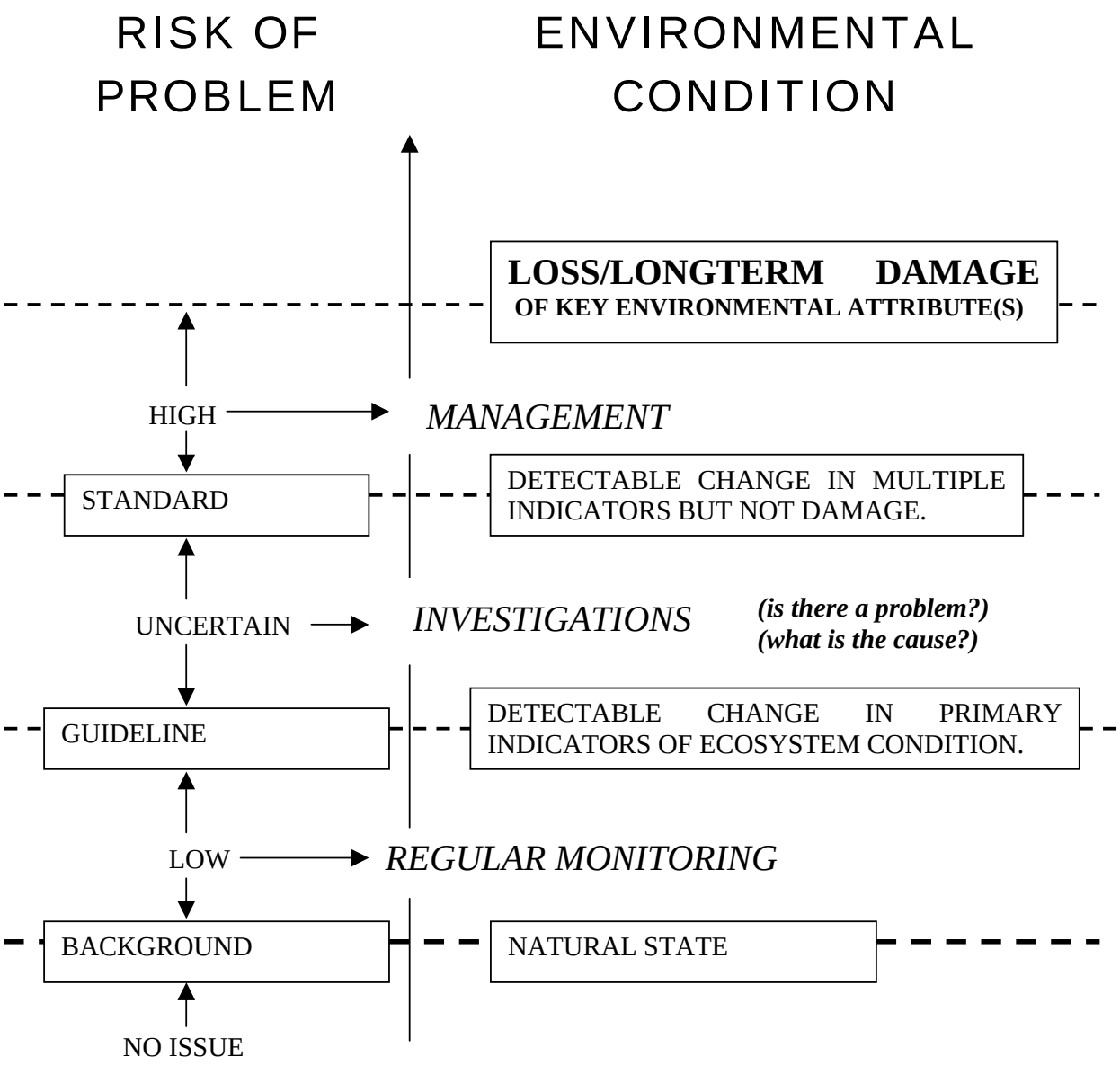

Figure 3: ***Conceptual diagram showing the relationship between the two types of EQC on the left, with the associated environmental condition on the right. The diagram shows that the intensity of management response triggered by exceeding EQC depends on which type of EQC has been exceeded, which in turn reflects the level of risk of whether or not there is an environmental problem.***

4. Framework to implement Guideline Nos. 4 & 7

4.1 Introduction

Figure 1a sets out the model through which Guideline Nos. 4 & 7 would be implemented for each significant water resource. Figure 1b outlines who is responsible for each activity. The proposed framework also discusses the responsibilities of the lead government agencies, the EPA, regulators, proponents of new proposals, and operators of prescribed premises.

4.2 Responsibilities of the lead agency(ies) as appointed by Government

Figure 1b shows where the lead agency is involved in implementing the framework.

STEP 1 Determining Environmental Values (EVs) for EPA Review and Endorsement

(a) The first decision that needs to be made for the protection of a water body is the establishment of EVs that stakeholders and the broad community wish to protect.

An **environmental value** means a particular value or use of the environment that is important for a healthy ecosystem or for public use, welfare, safety or health which requires protection from the effects of pollution, waste discharges and deposits (ANZECC & ARMCANZ, 2000) (Draft EP Cockburn Sound Policy 2001). Several environmental values may be designated for a specific water body. Environmental values could be either ecological or social.

The lead agency(ies) for the day-to-day management of each significant water body should consult, in a transparent and open manner, with all stakeholders and the community to establish appropriate draft EVs (Appendices 1a & b and 8). The resulting draft EVs should reflect a holistic (Appendix 3) and sustainable (Appendix 4) approach to water resource management.

(b) The lead agency should refer to the EPA the set of draft EVs for each significant water body, accompanied by a synopsis of the consultation undertaken with stakeholders and the community. This synopsis should include stakeholder and community concerns regarding the draft EVs.

For most water bodies, be they marine or freshwater, stakeholders and the general community may desire a range of EVs to be protected. The desires of all stakeholders may not always be complementary. In such circumstances, the EPA would expect the lead agency, in its synopsis, to offer a solution to potential concerns.

For extensive water bodies, the area for which a specific EV would apply should be spatially defined (e.g. river reaches, catchments, coastlines), to minimise potential difficulties when defining the corresponding EQOs.

It is noted that EVs apply throughout the protected area for Cockburn Sound in the draft EPP. In addition, a number of EQOs have been set. In the case of EV for 'ecosystem health', three levels of protection have been spatially defined. This matter is discussed in step 6c below.

(c) Where there are residual concerns, the EPA may consult further before advising Government on a suitable set of EVs.

STEP 2 Determining Environmental Quality Objectives (EQOs) for EPA Review and Endorsement

(a) For the protection of each EV, an appropriate set of EQOs would need to be set.

An **environmental quality objective** means a specific management goal for a part of the environment. EQOs can be either ecologically based (by describing the desired level of health of the ecosystem) or socially based (by describing the environmental quality required to maintain specific human uses) (Draft EP Cockburn Sound Policy 2001).

(b) The lead agency should consult the community, stakeholders and scientific experts to select suitable draft EQOs. For instance, if the EQOs relate to ecology or biodiversity, the Department of Environment (DE) should consult the Department of Conservation and Land Management (CALM) and its constituents. CALM has developed ecological and biodiversity baseline data for much of WA. Alternately, CALM could act as one of the joint lead agencies. Likewise, if EQOs relate to fisheries, the Department of Fisheries and its relevant stakeholders should be consulted. This approach would apply to every other relevant government agency.

(c) The lead agency should submit to the EPA the set of draft EQOs accompanied by a synopsis of the consultation undertaken with all involved parties and indicate the timeframe for implementation. This synopsis should include concerns raised regarding the draft EQOs.

(d) Where there are residual concerns, the EPA may consult further before advising Government on a suitable set of EQOs.

STEP 3 Determining Environmental Quality Guidelines and Standards (Criteria) or Targets for EPA Review and Endorsement

(a) Successful implementation of the framework relies on the lead agency's ability to measure environmental quality against environmental quality standards (EQSs) and, if appropriate, trigger management responses (Figure 3) when, monitoring shows that environmental quality does not meet agreed benchmarks. Environmental Quality Criteria (EQC) and targets are environmental 'benchmarks' or specific objectives designed for this purpose. The EQC and targets, therefore relate to *ambient* environmental quality and underpin broader objectives.

Environmental quality criteria means the numerical values or narrative statements that serve as benchmarks to determine whether a more detailed assessment of environmental quality is required (these criteria are termed environmental quality guidelines), or whether a management response is required (termed environmental quality standards) (Draft EP Cockburn Sound Policy 2001).

A **target** means the numerical value or narrative statement that serves as long- or short-term benchmarks. The long-term target should equate to the guideline trigger value in Guideline No. 4 for a chosen EV.

It is noted that the setting of EQC (guideline trigger values and management response standards) is a complex matter and may vary significantly between locations. In some locations (e.g. catchments and estuaries), it may be more appropriate to set targets (Appendix 7). However, for the purpose of licensing waste discharges into catchments or estuaries from prescribed premises, Guideline 4 would be used for back-calculating acceptable discharge quality (Section 4.5).

(b) For many areas, Guideline No. 4 provides the basis for developing and applying EQC. However, the varying degrees of confidence and uncertainty regarding the guidelines in Guideline No. 4 must be recognised. This uncertainty and how it will be addressed is a key consideration for regulators, managers, operators and the community alike. Where there is uncertainty, conservative judgements should be made; uncertainty is not an excuse for 'no action'.

(c) For significant water bodies, EQC or targets would be established through the EPA using one of three processes outline under the EPA's responsibilities (Section 4.3).

STEP 4 Environmental Management Systems

Having established the EVs and EQOs (including EQC or targets) for a significant water resource, the lead agency should then establish an **environmental management system** (EMS) to ensure that the water body is managed properly (Figure 2).

An EMS should include the following elements:

- EVs to be protected (the mission statement);
- EQOs to be protected (the broader management objectives);
- EQC or targets to be employed (the specific management objectives: or performance benchmarks);
- The Implementation Plan (implementation strategy);
- Measurement of agreed key environmental quality indicators (monitoring);
- Evaluation of performance against environmental quality benchmarks (auditing); and
- Review and improvement (adaptive management, continuous improvement).

Each EMS would need to be reviewed and endorsed by the EPA.

STEP 5 Selection and Application of Environmental Values From Guideline No. 4

Appendix 8 should be referred to regarding the importance of setting EVs.

(a) Six EVs are recognised in Guideline No. 4. They are:

- Aquatic ecosystems;
- Primary industries (irrigation and general water uses, stock drinking water, aquaculture and human consumption of aquatic foods);
- Recreation and aesthetics;
- Drinking water;
- Industrial water; and
- Cultural and spiritual values.

Appendix 9 clarifies the difference between EVs and EQOs. In brief, an EV is a beneficial use of the environment while an EQO is goal or objective to be achieved to ensure that that use is protected.

(b) All stakeholders and community should be aware that Guideline No. 4 only offers specific environmental quality guidance for the first four EVs.

(c) The result from protecting all of the EVs for a given water body should reflect the broader stakeholders' and community's aspirations (desires and ethos) for its use (Holistic Approach [Appendix 3] & ESD [Appendix 4]).

(d) The level of environmental quality required to maintain each EV may be different. For areas where more than one EV applies, it may be necessary to manage environmental quality to the level required by the most conservative EV (e.g. in most casesin WA, if the EV for drinking water is to

be protected, then all other EVs would normally be protected).

(e) Because the determination of EVs is a social-political process (Figure 1b), EVs may change with time in response to changes in social expectations and circumstances. Hence, the suitability of selected EVs should be reviewed at regular intervals.

STEP 6 Selection and Application of Environmental Quality Objectives (EQOs)

(a) EQOs are equivalent to management goals (broad and specific) described in Guideline No. 4. EQOs describe precisely the attributes to be protected in an area so that the designated EVs are protected.

(b) For most water bodies, whether marine or freshwater, a range of EVs would be protected. Hence, a corresponding range of EQOs would also be established. It is appropriate that management first focuses on the EQOs requiring the highest water quality. If they are met, the EQOs for the remaining EVs should also be met.

(c) For expansive and partly modified water bodies, it is suitable to have a range of spatially separated broad EQOs for the same EV. For instance, the EV 'ecosystem health' is proposed in the draft EPP for the whole of Cockburn Sound. To underpin this EV, three broad EQOs (high, moderate and low levels of protection) have been chosen to spatially cover the Sound. This recognises current social expectations and environmental attributes. The three equivalent sets of specific EQOs that underpin the broad EQOs are the guideline trigger values (EQGs) taken from Guideline No. 4.

(d) The designation of EQOs in catchments and terrestrial water bodies (lakes, rivers and estuaries) is likely to be much more complex than that for Cockburn Sound. As commercial and social pressures increase seaward along major catchments, so do the societal and stakeholders' needs and aspirations. An example would be the Swan-Canning catchment. Not only should the catchment be spatially divided into different levels of ecological protection, it should also be divided into discrete management units. Further, because of the wide range of water quality in the catchment, the EQOs should include a mix of time-related targets and guidelines. Time-related targets would be used where there are serious problems within a management unit that could not be resolved in the short-term. Guidelines would be used in management units where water quality is adequate to meet current aspirations.

(e) Upstream water quality invariably influences downstream water quality, and diffuse source contamination is much more difficult to manage than point source contamination. Accordingly, lead agencies should take a holistic approach and ensure that all objectives for all management units within a system/catchment are compatible.

(f) For the EV 'ecosystem health', the level of environmental quality to be achieved for an area would be related its ecological and conservation value and its present degree of modification. Guideline No. 4 offers ecological guidelines (Guideline No 4, Ch 3, p3, 1-10 and Tables 3.4.1 & 3.4.2, p3, 4-5 to 3, 4-11) for three levels of protection. The question of which set of ecological guidelines should be used would be negotiated on a case-by-case basis with stakeholder and community involvement. It is noted that many of the decisions are subjective. For instance, for Cockburn Sound, three sets of EQOs have been negotiated for the EV 'ecosystem health'. They apply to:

- The high protection area which accounts for approximately 95% of the Sound;
- The moderate protection area adjacent to developments and

which accounts for approximately 5% of the Sound; and
- The low protection areas adjacent to a number of industrial discharge points.

Unlike the Cockburn Sound example, terrestrial systems are likely to be far more complex because:

- The main freshwater issues in WA are salinisation, eutrophication and sedimentation, all of which largely emanate from diffuse sources and none of which are dealt with to any great extent in Guideline No. 4;
- WA's river systems are subject to significant long- and short-term climatic change resulting in erratic water flows and flushing;
- Poor water quality in general usually arises from diffuse source problem;
- Spatial limitation causing effluent discharges to form chemical barriers across rivers hindering the movement of some aquatic biota;
- The environment's incapacity to assimilate wastewater;
- Downstream users of waterways have the same right to good quality water as those upstream;
- There are ever increasing demands on water resources for consumption purposes, including those for drinking water and irrigation;
- Freshwater resources are more susceptible to diffuse source contamination because of a lack of flushing; and
- A large number of small stakeholders perceive that they have a 'prior right' to water use and discharge facilities in accordance with their needs based on historical practices.

Accordingly, the selection of EQOs would need to be considered on a case-by-case basis, as would decisions regarding the use of guidelines or targets, or a mix or both (Appendix 7).

(g) When drafting EQOs, the lead agency, stakeholders and community should not assume that pristine areas are 'high conservation or ecological value' areas. Nor should they assume that areas of 'high conservation or ecological value' are necessarily pristine. If those assumptions were the case, vast lengths of Western Australia's coastline could be quarantined from anthropogenic change. Further, areas already impacted that have 'high conservation, ecological or social value' may not be afforded the appropriate level of protection in the future simply because they were considered a modified environment.

(h) Just as for EVs, EQOs should be reviewed by the lead agency in conjunction with the EPA on a regular basis.

STEP 7 Selection and Application of Environmental Quality Guidelines and Standards (Criteria)

(a) For the purpose of ensuring that EVs are protected and broad EQOs are meaningful, scientific guidelines (EQGs) and standards (EQSs) or time-related targets (benchmarks) could be embodied into EQOs. These benchmarks can be used in the monitoring and assessment of management areas.

(b) As noted in Step 6, it is much easier to adopt guidelines direct from Guideline No. 4 for marine waters than it is for estuarine and freshwaters. This is specifically relevant to WA as the three main problems in terrestrial water are salinity, euthrophication and sediments. Guideline No. 4 only offers broad and generalised guidance relating to these matters. The use of time-related targets rather than an

attempt to use guidelines should always be considered for highly degraded areas (Appendix 7). The long-term target, however, would normally be the guideline trigger values given in Guideline No. 4 for a designated EV, unless a more appropriate local guideline has been developed in the meantime. Shorter-term targets (interim targets) would serve as benchmarks against which progress towards the long-term target would be audited. Accordingly, where targets are adopted, the use of guideline trigger values and standards would be redundant except for the purposes of licensing prescribe premises (Section 4.5) until the long-term target is achieved.

(c) Where the setting of EQGs and EQSs is appropriate, they can be set through three policy options outlined in Section 4.3.

Environmental Quality Guidelines (EQGs)

(d) An EQG is a specific objective. If exceeded, a management action would need to be undertaken.

An **EQG** means a numerical value or narrative statement which, if met, indicates there is a high probability that the associated environmental quality objective has been achieved.

An EQG signifies the 'lower error bound' of the zone of uncertainty associated with environmental monitoring (Figure 3). If ambient monitoring shows an EQG has been met, then there is a high degree of certainty that the overall EQO has also been achieved. However, if the EQG has not been met, a management response would be triggered. The response would be risk-based and investigative in nature.

(e) Where sufficient local environmental or ecological data exists, local guidelines would be adopted in preference to the default guideline trigger values in Guideline No 4.

How do we use EQGs?

(f) An example of the use of EQGs is given in the draft EPP for Cockburn Sound. While the EV 'ecosystem health' has been set for all of Cockburn Sound, three EQOs have been adopted (high, moderate and low level of protection) and they are reflected in the chronic exposure guideline trigger values taken directly from Guideline No. 4.

(g) If a guideline trigger value is exceeded, the management body would initiate a series of investigations against the EQS as laid out in the draft EPP for Cockburn Sound. If the investigation indicates that there is no problem, the data from the investigation could be used to develop local guidelines as alternatives to those in Guideline No. 4. If the results indicate that there is a problem, the management body would take appropriate action to investigate the causes to ensure that the EQOs would not be compromised.

(h) Where guideline trigger values provided in Guideline No. 4 are referred to as low reliability guidelines, they would not be used in any rigorous manner, but rather as supporting information only.

(i) Where a guideline trigger value in Guideline No. 4 is a reiteration of public health guidelines, it would be viewed as an EQS (see below). These guidelines relate to human health (e.g. Australian Drinking Water Guidelines [NH&MRC, 1996 or later], microbiological standards for contact recreation, and the Australian and New Zealand Food Authority food standards for contaminant levels in seafood [ANZFA, 2002]). The Health Department would manage matters relating to those guidelines.

Environmental Quality Standards (EQS)

(j) An EQS is a specific objective that should never be exceeded. If it is exceeded, management action would need to be implemented.

An **EQS** means a numerical value or narrative statement beyond which there is an unacceptable risk that the associated environmental quality objective has not been achieved and a management response is triggered.

(k) Where interim target would be used, it is inappropriate to use an EQS until the long-term target (EQG) is met (see Item b above and Appendix 7). Targets could be viewed as rehabilitation targets that are agreed to by the majority of, if not all, stakeholders.

(l) Where it is appropriate to set EQSs, an EQS signifies the 'upper error bound' of the zone of uncertainty associated with environmental monitoring against the EQOs (Figure 3). Item (g) above indicates how EQSs are related to EQGs in the draft EPP for Cockburn Sound. If an EQS is not met, then a management body - in consultation with key stakeholders and decision-making agencies - should respond immediately. The response should focus on identifying and eliminating the causes of reduced environmental quality (i.e. source control) but may also require in-situ remedial work to be undertaken. The management response should be selected after considering the cost-effectiveness of a range of options and would have timelines and performance reviews built in.

(m) EQSs are linked to specific socially-based EQOs and/or to specific levels of protection for ecologically-based EQOs. An EQS does not need further refinement to take account of local factors. It is set at a level where, if exceeded, there is a significant and unacceptable level of risk that the EQOs will not be met. For highly degraded areas, it is more appropriate to set targets rather than use EQGs and EQSs, except for the purposes of licensing prescribed premises (Section 4.5).

(n) It is preferable to use a 'multiple lines of evidence' approach for EQSs as it adds confidence to decision making. Where possible, an EQS should indicate that there is a persistent problem and that one point source is largely responsible before management action is imposed on a third party (Appendix 10). Clearly, this matter becomes very complex, especially where diffuse and multiple-source contamination takes place in catchments and estuaries. Hence, it is imperative that the issuing of wastewater discharge licences under Part V of the EP Act 1986 by the Department of Environment be consistent with Ministerial Conditions and EPA's policies, EVs, EQOs (EQC) set for relevant water bodies.

(o) For protection of ecosystem health, an EQS would largely be based on biological effects and underpinned by an EQG. An EQS should use biological/ecological indicators of ecosystem health, as well as bioavailable estimates of the more traditional chemical measures. This composite approach incorporates both the risk-based decision frameworks and the integrated monitoring and assessment strategies recommended in *ANZECC & ARMCANZ* (2000a). Biological/ecological indicators are selected according to a conceptual model of the cause-effect pathway developed for the site, and should include a key ecological indicator (e.g. seagrass as an indicator for nutrient enrichment where water clarity is shown to be influenced by phytoplankton biomass). The EQS should be set at a level that signifies detrimental change to, but not loss of, the key ecological indicator. However, for some highly disturbed systems where key ecological indicators have already been significantly impacted, the EQS may need to be set at a level that sets a limit to any further losses or adverse changes.

(p) See Item (i) above for where Guideline No. 4 relates to public health matters.

4.3 Responsibilities of the Environmental Protection Authority: Assessing EVs, EQOs, EQCs as proposed by the lead agency for significant water resources

Policy Options for Implementing EVs, EQOs and EQC for Significant Water Resources

It can take a considerable time to publish specific catchment and coastal zone policies. Some aquatic environments are currently under sufficient pressure that speedy policy responses are appropriate. Hence, using the principle of 'adaptive management' as espoused in the NWQMS, any of the following three policy approaches may be chosen to give broad formal effect to agreed EVs, EQOs, EQC and associated environmental management systems (EMS) (Appendix 11). These options include:

- An Environmental Protection Policy (EPP) (a whole of Government Policy);
- A Cabinet-endorsed policy; or
- An EPA-endorsed policy.

Regardless of which policy approach is adopted, it should be used in the spirit of 'cooperation and partnership' as espoused in the NWQMS. The policies need not necessarily be regulatory instruments because point source industrial wastewater discharge to the environment can be managed through Pt IV and V of the EP Act 1986.

It is recognised that some Government agencies have their own formal and informal management policies that have not been endorsed by the above bodies. For the purposes of environmental policy consistency across agencies, where policies are inconsistent with this framework, those inconsistencies should be rectified.

Policy Options

(a) Environmental Protection Policy (EPP)

An EPP is initiated by the EPA. The EPA would identify EVs, EQOs and EQC to be adopted under the policy, and the areas where they apply. To this end, the EPA would consults widely when drafting an EPP. As the drafting progresses, stakeholder and community views are considered. The drafting process involves legal drafting by Parliamentary Counsel and is submitted to the Minister for the Environment for wider public circulation. To that end, the Minister consults with affected parties before making a decision. If approved, the EPP is gazetted and then tabled in Parliament.

(b) Government Endorsed Policy

Another policy approach is for the EPA to follow a similar process to that above, but without the statutory steps. Instead, the EPA would submit the draft policy to the Minister for the Environment for Cabinet's consideration. In this case, there are two mechanisms for seeking community and stakeholder comment. One is for the EPA to release the draft for public and stakeholder comment before submission to the Minister for the Environment. The other is for Cabinet to endorse the draft for public and stakeholder review before finalisation.

This general approach is being used for the development and publication of the SWQMS series. Cabinet endorsed the first of that series, The Framework (SWQ1), in 2001.

(c) EPA Published Policy

A third policy approach is for the EPA to publish its own policies. Such a policy would normally involve community and stakeholder consultation. In this case, the final document would reflect the EPA's thinking as to how it would assess aquatic matters that it advises Government on. While such a policy would have no statutory power, it is likely to have broad community support. The advantage of having this policy approach is that policies are more easily finalised, can be reviewed at a time convenient to the EPA and hence can be more responsive to new information, circumstances and changing community views.

4.4 Responsibilities of the EPA's Service Unit: advice to proponents on environmental impact assessment

STEP 1 Understanding EPA's Service Unit's relationship with the EPA and Proponents

(a) The EPA's Service Unit advises the EPA on the environmental acceptability of new proposals assessed under Pt IV of the EP Act 1986. The EPA considers the Service Unit's advice, consults with others (including specialist technical advice as appropriate) makes independent decisions from EPA's Service Unit, and advises Government as appropriate.

(b) The Service Unit gives advice to proponents by preparing scoping documents for new proposals. As apart of this advice, the EPA Service Unit would draw a proponent's attention to the relevant policies, EVs and EQOs (EQC and targets) used to assess the proposal in the Environmental Impact Assessment (EIA) process. Where there are no formal policies, EVs and EQOs, the EPA Service Unit and the proponent would agree upon interim or notional performance benchmarks for the purposes of project design and assessment. This provides a basis for proponents and the EPA to ensure that any potential contaminant-related impact resulting from a development remains within acceptable bounds.

STEP 2 Use of Guideline No. 4 for determining EVs for Ecological Protection

(a) Proponents and regulators should understand that while Guideline No. 4 offers different levels of ecological protection (e.g. 99%, 95%, 90% and 80% species protection for toxicants: Table 3.4.1, pp 3.4-5 to 10), environmental quality is a continuum ranging from pristine to highly disturbed conditions. Hence, assigning a level of protection to a water resource (see Guideline No. 4, pp 3-1-10 to 31-13) and applying Guideline No. 4 for ecological protection is somewhat subjective. Accordingly, assigning a level of protection is a matter for discussion between proponents, the EPA Service Unit and the EPA before Guideline No. 4 is used for project design and assessment.

STEP 3 General Use of Guideline No. 4 for the Protection of the Freshwater Environment

(a) The 1998 Western Australian SoE Report stated that the major pressures affecting inland waterways are salinisation, loss of fringing vegetation, eutrophication, sedimentation, and contamination. Over extraction of water from the environment is also a major issue. Given the drying climate over the past 20 years in the South-West of WA and the damming of watercourses for stock, industrial and potable supplies, this problem is likely to worsen. The pressure on many waterways is further accentuated because of their ephemeral nature, vegetation clearing in their catchments, and acidification and fertilisation of surrounding land from commercial fertilisers. This in turn is likely to have a profound effect on biodiversity and abundance of aquatic life especially in the South-West of WA. Hence, the EPA Service Unit, when discussing new project design with proponents, should ensure that new proposals do not compromise further the quality and quantity of water in the South-West of WA.

(b) There should be a presumption against new proposals that would lead to a significant physical or chemical change in the freshwater environment resulting from wastewater discharge. Notwithstanding the above, if a proponent proposes to dispose wastewater into a freshwater resource,

the proponent would have to demonstrate that it has investigated:

- The alternatives of recycling and reusing water in its process; and
- The feasibility of irrigation of the wastewater to land.

If the above are regarded as unfeasible by the proponent, the proponent would have to demonstrate that discharge of wastewater to a water resource would not impact on the formal or notional EVs, EQOs and EQC designated to that resource.

STEP 4 Specific Use of Guideline No. 4 for New Proposals

(a) When a proponent first discusses a new proposal with the EPA's Service Unit, it would inform the proponent of any formal policies, EVs and EQOs (including EQC and targets) relevant the proposal area. Where policies, EVs and EQOs have not been established, the EPA's Service Unit would indicate the likely environmental issues that would need to be addressed in the proposal and set interim/notional EVs and EQOs (including EQC) for the purpose of project design and assessment.

For public health-related EVs and EQOs, the EQGs provided in Guideline No. 4 would be used as EQSs (see Step 4.2, Item p). For the maintenance of ecological health, the following points provide a guide for setting an appropriate level of protection and equivalent EQGs.

(b) **Near-pristine areas with high conservation and/or ecological value areas**

It is generally expected that a proposal for the above area would not cause any detectable ecological or chemical changes in its surrounds. This level of protection is designated as 'high conservation/ecological value systems' in Guideline No. 4 (p3.1-10). Where resources are not available to establish background conditions for toxicants, the guideline trigger values in Table 3.4.1 covering the protection of 99% of the species would be considered as default EQGs. As a guide, no area in Cockburn Sound falls into this category. Areas around Ningaloo Reef and Shark Bay may fit this category.

(c) **Pristine areas with high ecological value but undefined formal conservation value**

Generally, a proposal for the above area would be acceptable so long as there was no significant ecological change. This level of protection is designated as 'slightly to moderately disturbed' in Guideline No. 4 (p3.1-10). In such an area, the ambient water quality guidelines for toxicants in Table 3.4.1, covering the range of protection for 95-99% of the species, should be used as default EQGs. The exact guidelines may have to be determined by the EPA on a case-by-case basis, depending on background conditions. For physio-chemical and nutrient-related parameters, EQGs would be developed using percentiles of the natural distribution for each parameter at a suitable reference site (Appendix 12).

(d) **Slightly to moderately disturbed areas with moderate ecological and conservation value**

Generally, a proposal for the above area would be acceptable if it complied with the EQGs in Guideline No. 4 for 'slightly to moderately disturbed systems' (see Tables 3.4.1 & 3.4.2, pp3.4-5 to 11). Given that this level of protection is likely to be relevant to many proposals assessed under Pt IV of the EP Act 1986, it is highly desirable that local EQGs be used (or developed) as an alternative those in Guideline No. 4.

(e) **Slightly to moderately disturbed areas with moderate to low ecological and conservation value**

Generally, a proposal for the above area would be acceptable if it complied with the EQGs in Guideline No. 4 for 'slightly to moderately

disturbed systems' (see Tables 3.4.1 & 3.4.2, pp3.4-5 to 11) for most discharge parameters. For the remainder, the EQGs for 'highly disturbed systems' (see Tables 3.4.1 & 3.4.2, pp3.4-5 to 11) would apply. The decision on what mix of guidelines to be used would be decided by the EPA on case-by-case basis. Given that this level of protection is likely to be relevant to many proposals assessed under Pt IV of the EP Act 1986, it is highly desirable that local EQGs be used (or developed) as an alternative to those in Guideline No. 4.

(f) **Highly disturbed areas with little conservation and ecological value**

Many areas in this category are already subject to widespread diffuse source contamination (salinisation, eutrophication and sedimentation). This matter is dealt with in Appendix 7, which discusses the merits of targets versus guideline trigger values.

For contaminant discharges similar to those contaminants in the ambient waters, the discharge should not cause any material effect to the time-related targets agreed for that area (see Tables 3.4.1 & 3.4.2, pp 3.4-5 to 11).

For the remainder of contaminants, the EQGs for 'highly disturbed systems' would apply (see Tables 3.4.1 & 3.4.2, pp 3.4-5 to 11).

Mixing and buffer zones

(g) The use of mixing and buffer zones may be acceptable in some marine areas (Guideline No. 4, p3.1-10). The water quality in the buffer zone should not be worse than the 90% species protection levels as given in Table 3.4.1 (pp 3.4-5 to 10). The level of acceptable environmental quality in the mixing zone will need to be addressed on a case-by-case basis. For instance, where human pathogen loads are high, some social EQOs may not be maintained. For the maintenance of ecosystem integrity, the level of protection that should apply, as a minimum, are the 80% species protection values for those chemicals identified as potentially bioaccumulating or bioconcentrating substances (Guideline No. 4, Table 3.4.1, pp 3.4-5 to 10). The existence of a mixing zone around an outfall does not necessarily infer that any or all of the designated EQOs be excluded from the area.

The draft Cockburn Sound EPP refers to the matter of EQOs in mixing zones, otherwise known as low protection zones. A low protection zone allows for further reduction in the level of ecological quality to be met, but no EQO is excluded. For instance, the draft EPP for Cockburn Sound would expect that the EQOs would be met for:

- Primary and secondary recreation;
- Aesthetics;
- Aquaculture; and
- Aquatic food at the end of a discharge pipe.

However, the draft EPP allows operators of prescribed premises to apply to the EPA for an exemption. If it were granted, discharge license would reflect this.

The topic of mixing zones is discussed briefly in Guideline No. 4 (Section 2.2.2 of Volume 1, pp 2-17, and Appendix 1 of Volume 2).

Notwithstanding the above, the framework recognises that one of the most contentious matters for industry is the provision for mixing zones. When a proposal involving a mixing zone is submitted to the EPA for assessment, the proponent would need to demonstrate the need for a mixing zone. The proponent would also need to give reasons why it should not be seen as a method of discharging inadequately treated effluent to the environment. The EPA would then make recommendations to the Minister for the Environment on the acceptability of such a proposal. If the Minister for the Environment

accepts the EPA's recommendations, the resulting Ministerial Conditions would reflect the EPA's recommendations. In turn, the DoE issue licence condition for that proposal under Pt V of the EP Act 1986, consistent with the Ministerial Conditions.

4.5 Responsibilities of DoE: advice to licensees of prescribed premises under Pt V, EP Act 1986

STEP 1 Understanding the DoE's Role as Regulator/Licensor

(a) The DoE has a regulatory role (pollution prevention) under Pt V of the EP Act 1986. Accordingly, it issues licence conditions on discharges to the ambient environment from prescribed premises.

STEP 2 Discharge of Wastewater to Terrestrial Water Resources

(a) The DE will use Guideline No. 4 when issuing licenses to operators that discharge effluent to ambient waters. Licensees should note that discharging wastewater to the terrestrial water resources is generally more problematic than discharging to the marine environment. This matter has already been partly addressed in Section 4.2 (step 6f) above.

STEP 3 Notional, Interim, and Formal EVs, EQOs and EQCs

(a) Where policies, EVs and EQOs (including EQCs and targets) have not been established for a significant water body and discharge of treated effluent maybe acceptable, the DE would use notional or interim EVs and EQOs (including EQC) for the purposes of licensing prescribed premises.

The DoE's objectives, through its licensing role and in collaboration with the licensee, would be to ensure that both EQC are not exceeded and that total loads of contaminants discharged to the environment are kept as low as reasonably practicable.

Accordingly, licence conditions involving notional or interim EVs, EQOs and EQC would be conservative, recognising the limited data normally available, and would be consistent with the precautionary principle.

(b) For the purposes of determining appropriate licence conditions, the EQC would be used to determine the maximum permissible concentrations of a substance in an effluent that would still protect the designated EVs. This is done by back-calculation from the relevant EQC, taking into consideration the dilution and mixing (if permitted by the regulatory agency) that occurs in the receiving environment, contaminant filtration in soils, dispersion characteristics, and background concentrations etc.

(c) Licence conditions would also reflect the different types of EQC and the different management responses they trigger (see Monitoring Section below). For example, a licence may include a *Licence Limit* based on back-calculation from the EQG, or from the EQS when it is a numerical standard.

A licence may also include a *Licence Target* that provides an operational target for dischargers to ensure the discharge quality remains below a determined value. The *Licence Limit* , however, is the discharge level that should not be exceeded, and may attract enforcement action if exceeded.

(d) If effluent quality remains below the *Licence Target*, then ambient monitoring requirements may be relaxed. If effluent quality exceeds the *Licence Target* but remains below the *Licence Limit*, a routine monitoring program (see Monitoring

Section below) would be required to provide surety that the ambient EQG is not being exceeded. If ambient environmental monitoring shows the EQG to be exceeded, then the monitoring focus could be shifted to assessing environmental quality against the EQS. The costs of defining and then monitoring against the EQS are likely to be higher than those costs associated with monitoring against the EQG. Instead of expending resources on defining and monitoring against the EQS, the discharger would be encouraged to reduce discharge levels so that contaminant levels in the ambient environment fall below the EQG. This is particularly pertinent for discharges to waterways and estuaries that are already stressed.

4.6 Responsibilities of DoE: monitoring advice to stakeholders that discharge or intend to discharge wastewater to the environment (Guideline No. 7)

STEP 1 General comment regarding discharge of wastewater to the aquatic environment

(a) Monitoring of the ambient environment is generally undertaken to gather information that can be used to assess the health of a system or to improve understanding of how the system works. Since it can be an expensive exercise, those organisations charged with this responsibility generally need to focus their resources on waters with identified or suspected problems, such as declining or poor water quality. In most cases, the problem or issue threatening a water resource is already known, and the resources available for ambient monitoring can be further focused on the relevant parameters.

STEP 2 Who Monitors the Ambient Environment?

(a) Given that this management framework is about building partnerships, monitoring the ambient environment could involve any individual/organisation within the partnership. However, prime responsibility for monitoring the ambient environment rests with Government agencies. Even so, if multiple lines of evidence identify a particular organisation - government or private - affecting the ambient water quality, it would be expected that that organisation would become more involved in ambient water quality monitoring until the offending activity is rectified.

STEP 3 Use of Guideline No. 7

Guideline No. 7 provides a useful set of standards to assist stakeholders to design consistent monitoring programs and collect comparable data that can be integrated across broad regions.

Like all natural systems, the aquatic environment is subject to a high degree of natural variability that must be taken into account in any environmental decision making process. Ideally, long-term baseline monitoring programs would be established to take into account natural variability. Also, impact-monitoring programs should have sufficient sensitivity to identify adverse and unnatural trends in the environmental quality indicators, providing early warning of environmental degradation before the EQG - and in particular, the EQS - are exceeded and, in time, to reverse the trend and protect designated EVs.

Many potentially confounding problems associated with the inherent natural variability of the environment can be minimised by deriving EQC for specific regions and/or seasons and monitoring accordingly, or by including one or more reference sites. Reference sites are used either as controls (i.e. an unaffected site identical to the test site) for comparison with an affected site. This way, local or site-specific effects can be isolated from regional/global scale changes and influences (e.g. climate), or the reference site can be a target condition to aim for. For some environmental quality indicators, the inclusion

of reference sites is essential to enable any inferences to be drawn about an impact site (e.g. biological indicators) or to derive site-specific criteria (e.g. physical and chemical stressors).

It is essential that the period of time between detecting an adverse trend and effecting the appropriate management response is factored in by key stakeholders during design of the monitoring program. In other words, it is no good implementing a monitoring program to detect an unacceptable effect one year in advance if it takes five years to implement a suitable management response.

Sediment and biota tend to integrate the often intermittent or pulsed exposure to toxicants through the water column over time. Therefore, concentrations in sediment and biota are likely to provide a better measure of potential ecological effects at that site. The use of 'water quality' criteria may therefore not always be the preferred approach for monitoring toxicants in the environment due to the intense spatial and temporal frequency of sampling required, and other technical difficulties (e.g. analytical detection limits). In these situations, routine monitoring would focus on the more integrative measures of exposure such as sediment quality and quality of filter-feeding organisms. This monitoring could be considered surveillance monitoring and is a check to ensure environmental quality is as expected. If, however, this monitoring shows criteria have not been met or there are adverse trends in key parameters and the cause is unknown, then more detailed water quality monitoring may be required.

Nutrient concentrations in marine waters are also highly variable and influenced by a range of factors, including biological uptake, and therefore provide limited guidance for managers. The more appropriate indicators of environmental stress caused by nutrient enrichment are related to the biological effects (i.e. indicators, such as periphyton and phytoplankton biomass, along the cause-effect pathway).

STEP 4 Decision criteria for determining when the EQG and EQS are not met and the EQOs not achieved

In most circumstances, there would be insufficient confidence to trigger a management response if a single data point marginally exceeded an EQC. Therefore, when comparing monitoring data with the EQG and EQS, relatively simple statistical approaches are generally used to determine when a management response is triggered. These approaches are based on those outlined in Guideline No 4 although, for some health related criteria, the Health Department of WA may recommend alternative approaches. In general, the approaches for the physical and chemical indicators identify both frequent and infrequent broad-scale exceedances and frequent localised exceedances of the criteria, but ignore infrequent localised exceedances.

Firstly, for those EQG or EQS that are based on actual biological effects data (e.g. toxicants): if the 95th percentile of the sample data for a defined sampling area from one sampling run, or from all runs over an agreed period of time (e.g. season or year), exceeds the designated criteria, then it is considered to have been exceeded (either for the area or for the site). For other EQG or EQS, it is the median of the sample data that is compared against the criteria. This aims to maintain an acceptable level of environmental quality over broad areas.

Secondly, if either the 95th percentile or median (whichever is appropriate) of the sample data from an individual site over an agreed period of time (e.g. season or year) exceeds the designated criteria then it is considered to have been exceeded. This is to protect the environment from localised but frequent exceedances of the EQCs.

These are general approaches that may need to be modified for particular situations. For example, if there are insufficient data to calculate the 95th percentile, then the recommended approach is to trigger an appropriate response if any sample does not meet the criteria.

Where biological indicators are used to assess environmental quality, it will be necessary to select control sites for comparison with impact

sites, and to determine acceptable effect sizes (i.e. the maximum amount of change considered acceptable in a biological indicator). Consideration should be given to both Type I error (probability of concluding that the effects size has been exceeded when in fact it has not) and Type II error (probability of concluding that the effect size has been achieved when in fact it hasn't). The actual effect size and decision criteria selected for any particular indicator will need to be determined on a case-by-case basis so that natural variability is taken into account. Guidance on the selection of appropriate effect sizes and the determination of suitable Type I and Type II error rates is provided in Guideline No. 4 (Section 3.2 and Chapter 7).

In all cases, if an exceedance occurs then the key stakeholders (e.g. regulators, environmental managers or relevant community groups) should be immediately informed and an appropriate management response initiated. Management responses may include further investigation against the EQS if an EQG has been exceeded, or development and implementation of strategies to reduce contamination if an EQS had been exceeded.

More detailed information on the design and implementation of programs to monitor environmental quality and the interpretation of monitoring data can be found in Chapter 7 of Guideline Nos. 4 & 7.

Conclusions

The framework set out in this document will be used to implement the NWQMS Guideline Nos. 4 & 7 for the protection of significant water resources. Where other complementary processes exist (or are being developed, such as for NRM), this framework would be used in those circumstances for the protection of WA's significant water resources.

The framework:

(a) Links Guidelines Nos. 4 & 7 with the relevant headpowers of the Environmental Protection Act (1986) and related activities:

- Environmental Protection Policies (Part III);
- Environmental Impact Assessment (Part IV); and
- Licensing of prescribed premises (Part V).

(b) Emphasises the importance of developing a cooperative, transparent and flexible partnership with all involved parties when implementing Guideline Nos. 4 & 7. The partnership should include:

- Involved government agencies;
- Interested communities;
- Industry;
- Landholders and water users;
- Environmental groups; and
- Special interest groups.

(c) Notes that setting EVs (beneficial uses) and EQOs, (EQC [EQG and EQSs] or targets) for all significant catchments and coastal zones is fundamental to good water quality management. The total effect of setting the above and incorporating them into an EMS for each significant water body is the essence of this framework.

(d) Indicates how Guideline Nos. 4 & 7 could be adopted as EQGs for a variety of environmental circumstances. It notes that for highly modified environments that require rehabilitation, target setting maybe more appropriate than using guideline trigger values. It also notes that the use of bio-indicators may be also more valuable than simply using guideline trigger values.

(e) Outlines the roles and responsibilities of the EPA, the EPA Service Unit, and lead government agencies including the Department of Environment. Additionally, it offers advice to proponents for new proposals subject to EIA and operators of prescribed premises that may wish to discharge wastewater to the environment.

(f) Applies to a large range of aquatic environments. Accordingly, several mechanisms are jointly proposed for its implementation. They include:

- Environmental Protection Policy (a whole of Government Policy);
- Cabinet-endorsed policy; and
- EPA-endorsed policy.

If Guideline Nos. 4 & 7 are implement using this framework, the NWQMS's objective:

> *'… to achieve sustainable use of the State's water resources by protecting and enhancing their quality while maintaining economic and social development …'*

should be met in WA.

Glossary of Terms

Term	Definition
Ambient waters	All surrounding waters, generally of largely natural occurrence.
Anthropogenic	Produced or caused by humans.
Aquatic ecosystem	Any watery environment from small to large, from pond to ocean, in which plants and animals interact with the chemical and physical features of the environment.
Assimilation	The incorporation of absorbed substances into cellular material.
Assimilative capacity	The maximum loading rate of a particular pollutant that can be tolerated or processed by the receiving environment without causing significant degradation to the quality of the ecosystem and hence the environmental values it supports.
Biodiversity	The variety and types of naturally occurring like. This encompasses genetic, species, and ecosystem levels at the local and regional scale.
Contaminant	Biological (e.g. bacterial and viral pathogens) and chemical (see Toxicants) introductions capable of producing an adverse response (effect) in a biological system, seriously injuring structure or function or producing death.
Decision framework	A series of steps for tailoring guideline trigger levels to a specific site or region and for assessing water quality by considering the local or regional environmental factors that will modify the effect of the particular water quality parameter. The decision frameworks or trees begin with the simplest steps and finish with the most difficult and expensive.
Diffuse source	In relation to pollution means multiple small sources spread over a wide area.
Ecological integrity	The ability of an ecosystem to support and maintain key ecological processes and organisms so that their species compositions, diversity and functional organisations are as comparable as possible to those occurring in natural habitats within a region.
Environmental management systems	Environmental management systems provide the management, administrative and monitoring framework which ensures that an organisation's environmental risk is minimised and its environmental policy - together with associated objectives and targets - are achieved. Stages in an EMS, based on the ISO 14000 series, comprise commitment to a policy; planning which includes evaluation of relevant regulatory framework; setting objectives and targets; establishing a management program (EMP); definition of personnel and responsibilities; identifying training needs; establishing and maintaining EMS documentation; emergency and preparedness and response procedures and establishing operational controls; and carrying out audits and reviews including monitoring and review (ARMCANZ & ANZRCC 1995. NWQMS, Guideline No 16 B, Effluent Management Guidelines for Dairy Processing Plants.
Environmental quality criteria	Numerical values or narrative statements that serve as benchmarks to determine whether a more detailed assessment of environmental quality is required (these criteria are termed environmental quality guidelines), or whether a management response is required (termed environmental quality standards).
Environmental quality guideline	A numerical value or narrative statement which if met indicates there is a high probability that the associated environmental quality objective has been achieved.
Environmental quality objective'	A specific management goal for a part of the environment and is either ecologically based by describing the desired level of health of the ecosystem or socially based by describing the environmental quality required to maintain specific human uses (Draft EP Cockburn Sound Policy 2001)**.**

Environmental quality standard	A numerical value or narrative statement beyond which the associated environmental quality objective has not been achieved and a management response is triggered.
Ecologically sustainable development	Development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.
Environmental values	**EP Amendment Bill 2002:** Environmental value means – (a) a beneficial use; or (b) an ecosystem health condition **EP Act 1986:** Beneficial use means use of the environment, or of any portion thereof, which is – (a) conductive to public benefit, public amenity, public safety, public health or aesthetic enjoyment and which requires protection from the effects of discharges of wastes or of emissions of noise, odour or electromagnetic radiation; or (b) identified and declared under section 35 (2) to be a beneficial use to be protected under an approved policy. **EP Amendment Bill 2002:** Ecosystem health condition means – a condition of the ecosystem which is – (a) relevant to the maintenance of ecological structure, ecological function or ecological process and which requires protection from the effects of emissions or of activities referred to in paragraph (a) or (b) of the definition of "environmental harm" in section 3A(2); or (b) identified and declared under section 35 (2) to be an ecosystem health condition to be protected under an approved policy.
Guideline trigger values	These are the concentrations (or loads) of the key performance indicators measured for the ecosystem, below which there exists a low risk that adverse biological (ecological) effects will occur. They indicate a risk of impact if exceeded and should 'trigger' some action, either further ecosystem specific investigations or implementation of management/remedial actions.
Indicator	A parameter that can be used to provide a measure of the quality of water or the condition of an ecosystem.
Licensed premises	A residential, industrial or other premises of any kind whatsoever and includes land, water and equipment, licensed under Part V of the EP Act 1986.
Mixing zone	An explicitly defined area around an effluent discharge where the effluent is actively diluted with the ambient water.
Target	A 'Target' means the numerical value or narrative statement that serves as long- or short-term time related benchmarks. The long-term Target should equate to the guideline trigger value in Guideline No. 4 for the chosen EV.
Performance indicators	These are the indicators used to assess the risk that a particular issue will occur (they are used in the guideline packages to compare against the trigger levels). They are generally median (or mean) concentrations in the ambient water, and may be stressor and/or condition indicators.
Pollutant	Any matter or thing that could have the potential to alter, directly or indirectly, the environment to the detriment of the environmental values.
Pollution	Direct or indirect alternation of the environment – (a) To its detriment or degradation; (b) To the detriment of any environmental value; or (c) Of a prescribed kind, that involves an emission.

Potable water	Water suitable, on the basis of both health and aesthetic considerations, for drinking or culinary purposes.
Practicable	Reasonably practicable having regard to, among other things, local conditions and circumstances (including costs) and to the current state of technical knowledge.
Quality assurance (QA)	The implementation of checks on the success of quality control (e.g. replicate samples, analysis of samples of known concentration).
Quality control (QC)	The implementation of procedures to maximise the integrity of monitoring data (e.g. cleaning procedures, contamination avoidance, sample preservation methods).
Risk	A statistical concept defined as the expected likelihood or probability of undesirable effects resulting from a specified exposure to known or potential environmental concentrations of a material. A material is considered safe if the risks associated with its exposure are judged to be acceptable. Estimates of risk may be expressed in absolute or relative terms. Absolute risk is the excess risk due to exposure. Relative risk is the ratio of the risk in the exposed population to the risk in the unexposed population.
Safety factor	A number used to provide an extra margin of safety beyond the known or estimated sensitivities of aquatic organisms. Often applied when sufficient information about the toxicity, particularly the chronic toxicity, of a particular substance is not known.
Social value	A particular value or use of the environment that is important for public benefit, welfare, safety or health and which requires protection from the effects of pollution, waste discharges and deposits.
Stakeholder	A person or group (e.g. an industry, a government jurisdiction, a community group, the public, etc) who have an interest or concern in something.
Sustainable development	Development that provides economic, social, and environmental benefits in the long-term, having regard to the needs of living and future generations. Defined by the World Commission on Environment and Development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Thus, the satisfaction of human needs and aspirations is the major objective of development. Sustainable development considers both the living and non-living resource base with regard for conservation and the advantages and disadvantages of alternative courses of action for future generations. It allows the use of depletable resources in an efficient manner, with an eye to the substitution of other resources in due course. Sustainable development calls for much more emphasis on conserving natural systems and the resource base on which all development depends; a greater regard for equity within society at present and between rich and poor nations, with particular regard to the world's poor; and a planning-horizon that goes well beyond the needs and aspirations of those alive today. It requires an integration of environmental, social, and economic considerations in decision-making.
Trigger values	These are the concentrations (or loads) of the key performance indicators measured for the ecosystem, below which there exists a low risk that adverse biological (ecological) effects will occur. *They indicate a risk of impact if exceeded and should 'trigger' some action, either further ecosystem specific investigations or implementation of management/remedial actions.*

Acronyms

ANZECC	Australian and New Zealand Environment and Conservation Council
ANZFA	Australia New Zealand Food Authority
ARMCANZ	Agricultural and Resource Management Council of Australia and New Zealand
CALM	Department of Conservation and Land Management
COAG	Council of Australian Governments
DE	Department of Environment: It is an amalgamation of the Department of Environmental Protection and the Water and Rivers Commission
ESD	Ecologically sustainable development
EQC	Environmental Quality Criteria
EQG.	Environmental Quality Guideline
EQO	Environmental Quality Objective
EQS	Environmental Quality Standard
EV	Environmental Value
ICM	Integrated catchment management
NHMRC	National Health and Medical Research Council
NWQMS	National Water Quality Management Strategy
SoE	State of Environment
EPA	WA Environmental Protection Authority
WC	WA Water Corporation
WHO	World Health Organisation
WQG	Water Quality Guideline
SWQMS	State Water Quality Management Strategy
SWQ1	SWQMS - No1: Framework for Implementation

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Appendix 1a

Partnership approach for implementing the framework

Who would be involved in the implementation partnership?

The establishments of partnerships and their functions is dealt with in detail in the NWQMS's Implementation Guidelines (1998) and the draft SWQMS (Document 1; SWQ1, 2001). The proposed partnership would comprise of:

- Involved State and Local government agencies including NRM groups;
- Interested communities;
- Industry;
- Landholders and water users;
- Environmental groups; and
- Special interest groups.

Who are the Government agencies in the partnership and what are their roles?

SWQ1 notes the Government has the prime responsibility for water quality management in WA. Key Government agencies involved in water quality regulatory processes include:

Department of Agriculture (NRM agency);

Department of Conservation and Land Management (NRM agency);

Department of Environmental Protection (NRM agency);

Department of Fisheries (NRM agency);

Department of Health;

Department of Minerals and Petroleum (Some NRM responsibilities);

Department of Planning and Infrastructure;

Office of Water Regulation; and

Water and River Commission (NRM agency).

Representative of these agencies comprise the Senior Review Panel, which is developing the SWQMS.

The individual roles and responsibilities of the above agencies are set out in SWQ1.

How Does Local Government assist in the partnership?

SWQ1 notes that local government has a key responsibility through its management of land use, zoning and development approvals. Ensuring land uses are compatible with water quality management objectives is critical to sustainability of water resources. Local government has also operational

responsibilities including road building and maintenance (e.g. storm water management) and the management of land owned or vested in local government.

How Does the Community assist in the partnership?

SWQ1 notes that regional coordination groups would be established by lead agencies on an 'on-needs' basis to address regionally significant problems. These groups would be open and accessible to community involvement in decision-making. Their aim would be to ensure that on-ground community programs and Government programs and priorities are properly integrated.

Community and Industry Advisory Committee

SWQ1 notes that a Community and Industry Advisory Committee will be established and will be involved in the development and implementation of water quality management programs. The main purpose of the Community and Industry Advisory Committee would be to ensure involvement of the community and industry in the drafting of EVs, EQOs, and EQC or targets. In addition, the Committee may have a role in the development of local guideline and water quality management programs.

The Community and Industry Advisory Committee would be chaired by the Water and Rivers Commission and would consist of regular and occasional members from the water user groups, service organisations and community groups. Regular members would be invited to attend all meetings while occasional members would be invited to attend those meetings where issues may be of significant interest to their organisations. Regular members will include representatives from:

- Conservation Council of WA;
- Australian Water and Wastewater Association;
- Aboriginal and Torres Strait Islander Commission;
- Chamber of Commerce and Industry;
- Chamber of Minerals and Energy;
- Community representatives;
- Regional Development Council;
- Western Australian Municipal Association; and
- Water Services Association of Australia

Occasional members would include representatives from:

- Local Governments;
- Land Conservation District Committees;
- Local conservation groups;
- Local Integrated Catchment Management groups;
- Kwinana Industry Council;
- Australian Institute of Petroleum;

- Motor Trade Association of Western Australia;
- WA Farmers Federation;
- Pastoralists and Graziers Association;
- Western Australian Vegetable Growers Association;
- Western Australian Fruit Growers Association; and
- Local Waterways Management Authorities.

Linkage between the above groups

SWQ1 notes that the linkage between the activities of local community based catchment groups and Government agencies would occur through the development of regional and sub-regional strategies and endorsement by Government agencies. Through that linkage much of this present framework would be implemented. Accordingly, lead agencies would communicate this present framework to their constituents, stakeholders, and the above groups (see Section 4.2). It would be the responsibility of the lead agency to distil out, through consensus where possible, draft EVs, EQOs and EQC or targets for EPA to review and endorse.

Finding ways forward between groups in the partnership on matters of concern

Where matters need to be resolved between Government agencies, it is appropriate that the Senior Review Panel address these matters in the first instance. For example, if the Department of Fisheries had planning concerns, it could raise these concerns with the Department of Planning and Infrastructure directly as both agencies are Panel member. Similarly, for non-Government agency stakeholders and interested parties, they should convey their concerns to the lead Government agency on the Senior Review Panel and seek resolution.

Appendix 1b

Community involvement – A partnership approach

National Water Quality Management Strategy (NWQMS) Guideline No 3 (Implementation Guidelines; Appendix A, pp32) presents steps to develop catchments and coastal waters management plans with stakeholder and community Involvement. These steps are given below as guidance only for implementing Guideline No 3. Notwithstanding that, Guideline No 3 has been signed off by Western Australia as an appropriate approach for community and stakeholder involvement.

STEP 1 Identify the planning region

Planning regions for water quality management should be based on natural areas. Within major natural catchments, there is also need to take account of 'social catchments' characterised by close linking of social interests that may include:

- economic activities;
- upstream/downstream catchment interactions;
- regional cultural identity; and
- administrative areas.

Within a social catchment, a significant number of stakeholders representing different interests need to be actively committed to catchment management if it is to be successful. If strong interest exists only at a sub-catchment scale, efforts should be initially focused there, using promotion of local achievements to stimulate action in other areas.

For coastal waters, the plan may be based on ecosystem boundaries that are commonly determined on the basis of transport systems (e.g. circulation), biological processes and community groups along the coast.

STEP 2 Develop appropriate mechanisms for stakeholder involvement

The key stakeholders span across the range of relevant interests. Once a core stakeholder group has been formed, it should have the responsibility to refine an involvement process suited to local circumstances and the available resources.

STEP 3 Assess the resource and scope the range of issues to be addressed

Stakeholder discussions should consider both the planning region and the scope of the issues to be addressed by the management plan.

If key stakeholders are interested in only a narrow range of issues, it may be necessary to focus on these initially, while facilitators may seek to draw out a recognition of interdependent problems or processes.

STEP 4 Identify the background information about the resource

Identify the basic background information which provides the limits for ecologically sustainable development of the resource in the region, including water sources, the natural quality and quantity variability, and the region's climatic variability.

STEP 5 Identify the environmental values of waters in different parts of the catchment

With the assistance of catchment planners and technical specialists, stakeholders should identify the current EVs and future EVs that may be needed and achievable. These judgements will be interim, pending detailed assessment.

Two crucial and inter-related judgements are needed:

1. What forms and levels of extractive use of water (drinking, agriculture, industry) may be required from different sections of waterway, taking account of water conservation measures, potentially available flows, economic development and ecological impacts?

2. What forms and levels of non-extractive use of water (ecosystem protection, fishing, swimming, boating, viewing) may be achievable in different sections of waterway, taking account of competing extractive demands and the discharge of contaminants?

Assessment of potential extractive demands will require modelling of the catchment system in relation to its hydrology, analysis of user demands and policy options for water management.

Assessment of non-extractive uses requires a combination of surveys of current and potential user demand and assessment of current habitat values and restoration potential.

Local stakeholders' knowledge of recreation patterns and their perceptions of the relative ‘naturalness’ of different sections of waterway, supplemented by simple 'objective' surveys, have been found to provide a sound basis for broad-scale assessment of non-extractive uses.

While tentative nominations of EVs to be protected will be determined through the consultative process, final recommendations will need to take account of scientific and economic assessments. Conversely, scientific and economic assessments will be needed to inform the consultative process.

STEP 6 Identify water quality problems and associated factors affecting environmental values

A balanced approach recognising the range of factors affecting EVs of water and waterways is needed. Water quality will often be only one of several major categories of environmental constraints. For example, stream flow, riparian vegetation and streambed stability are major determinants of aquatic habitat potential.

A related consideration is that water quality in itself may not be a strongly motivating concern. Land managers will be primarily interested in issues affecting management of their land, rather than the effects of their management on waterways.

From the perspective of a community interest in water quality, the challenge is to encourage a 'positive' recognition of the links between the productivity of land and associated water quality issues, for instance, links between water quality and clean agriculture and also between water quality and regional economic development. The concept of best management practices can be useful in this context. Best management practices are described in more detail in the NWQMS Guideline No. 9 *Rural Land Uses and Water Quality*.

Local stakeholders will be keen to reduce water quality problems that affect them, e.g. irrigators who are affected by upstream water quality.

Other NWQMS guidelines that may give relevant information include *Guidelines for Urban Stormwater Management* (Guideline No 10), *Guidelines for Sewerage Systems-Effluent Management* (Guideline No 11), and the series of effluent management guidelines for industries such as piggeries, tanneries, wineries and distilleries etc (Guidelines Nos. 16 –20).

STEP 7 Determine where and from what sources degradation of water quality is occurring

In most parts of Australia, available water quality data has been inadequate to identify with any confidence or accuracy the contributions of sub-catchments and contaminant sources to total contaminant loads in different sections of a waterway.

A combination of fixed-site monitoring at a small number of sites and self-monitoring of effluent discharges will provide information on the contribution of relatively regular point-source discharges to total catchment loads, but the remainder has sometimes been uncritically attributed to the effects of agriculture and forestry activities.

At least rough estimates should be obtained of the contaminant contributions from stream and catchment erosion, agricultural runoff, as well as urban and industrial wastewater. Event sampling as well as ambient water quality monitoring will enable pollutant loads to be estimated.

Assessment of the contributions of sediment and associated phosphorus from in-stream and off-stream erosion requires specialist skills. However, at a coarser scale, sub-catchment water quality can provide a strong indication of overall diffuse contributions.

Land manager and community involvement in assessing the quality of water draining from sub-catchments offers great potential for raising awareness of water quality issues and a commitment to action.

Simple technologies can be used by non-specialists to assess with reasonable accuracy the level of water quality indicators including turbidity, conductivity and phosphorus.

STEP 8 Determine local water quality objectives

It may be convenient to divide the planning region into a number of geographic segments or sub-catchments with distinctive combinations of environmental values and management activities.

Sets of local water quality objectives can be established for each sub-catchment.

The following process can be used to develop objectives:

- determine the water quality required to protect desired environmental values
- assess the difference (gap) from current water quality
- assess the cost of necessary management actions
- resolve the acceptable quality/cost trade-off relative to protected environmental values.

The second step is the most relevant one at this stage of the process; interaction will be needed at a later stage to arrive at a final decision.

Guideline No 4, should be used to provide general guidelines (default values and objectives) for setting of water quality objectives in relation to environmental values. Where more appropriate guidelines and objectives are available, they should be used in preference to the default values.

However, within this general framework, the development and justification of local water quality objectives can present a substantial scientific and decision-making challenge. This is particularly so for indicators such as phosphorus and nitrogen for which Guidelines 4 specify a broad band of potentially acceptable levels.

Local or comparative evidence of threshold levels of environmental impact (e.g. eutrophication) is needed to guide objective setting for such indicators. The cost implications of such critical indicators will also impinge on whether wide safety margins are acceptable.

Normally, concentration objectives for different water quality indicators will be used. However, for various cumulative (conservative) contaminants, such as salt, phosphorus and some toxicants, load objectives may also be desirable.

Load objectives need to be assessed in relation to either some specified point on a waterway or for a particular water body where the cumulative load may have a significant impact, e.g. provide a sufficient nutrient loading to generate an algal bloom.

They provide a potential criterion for determining acceptable contributions to the total load from different sources.

STEP 9 Identify technical options and assess implementation mechanisms for management action

Technical advisers will play a vital role in identifying potential management actions in different areas and assessing their potential effectiveness. The advisers' credibility within the local community will be crucial in enabling constructive interaction between technical and lay participants.

Advisers may offer a list of options, with an assessment of their potential effectiveness, which may be added to, interpreted and utilised by the stakeholder groups.

Stakeholder groups will have a major role in developing management options to improve water quality. It is at this point that the critical choice between mechanisms must be resolved, via:

- regulation
- market mechanisms
- education
- co-operative action
- some creative amalgam. – an innovative combination of the above?

For example, while changes in certain land management practices may be relevant technical options, the means of introducing these changes warrants careful attention to ensure the concerns of the local community are not overridden.

Factors that influence the choice of specific management actions include:

- availability of relevant technologies
- efficiency of relevant technologies
- familiarity with relevant technical practices
- availability of necessary administrative and management resources
- cost of implementation
- political acceptability of management and cost-sharing arrangements.

STEP 10 Identify priority areas and time targets for water quality improvement

Two questions will help set priorities:

1. Which actions will lead to the greatest improvement in environmental quality?

2. What should be the timetable for these improvements?

The potential social and ecological benefits of improved quality in different areas and implementation feasibility will be major considerations.

Depending on the magnitude of the gap as assessed in Step 7 and the feasibility of implementation, staged time targets will be needed to work towards long-term water quality objectives.

STEP 11 Assess potential environmental effects of different management actions

Some form of modelling of the environmental effects will be necessary to enable assessment of associated benefits.

Quantitative modelling may be used if there are resources available. Modelling tools should be designed to assist decision-making, not to display technical sophistication. They should therefore:

- provide a focus for developing a shared understanding of system dynamics and management scenarios
- provide an integrative perspective of key sub-systems
- incorporate key dynamic (hydrological) processes
- provide useful information on relevant performance indicators
- enable examination of relevant management options in relation to historic system conditions
- provide an appropriate level of spatial and temporal resolution
- have realistic data requirements
- enable at least partial calibration and verification of the model against key parameters
- be capable of refinement as knowledge of system behaviour increases
- be comprehensible and fairly transparent to lay users.

STEP 12 Assess the potential ecological, economic and social impacts of different management actions

The environmental effects of various management actions, as well as associated effects, need to be assessed in terms of their impacts or costs and benefits relative to ecological, economic and social values.

STEP 13 Formulate broad management strategy options to achieve different environmental objectives or targets

Three or four distinct, strategic options, including 'do nothing', should be presented for consideration by key stakeholders, the wider community and decision makers. They may cover a range of issues, including:

- long-term objectives and staged targets for environmental quality
- favoured implementation tools
- level of planning detail
- cost-sharing arrangements
- available public resources
- levels of private cost
- co-ordination and administrative arrangements.

The social and economic implications of different environmental goals will be a crucial factor. However, the most sensitive aspect will be the potential impacts upon different interest sectors.

The allocation of sectoral 'reduction targets', the means of achieving the targets, and costs for different groups will be important issues.

The impact of each of the options on point source and non-point dischargers, and on urban and rural communities, is also likely to influence stakeholder responses.

Choosing the best option is essentially a matter of politics. Which matters can be resolved by consensus between stakeholders? Which matters will be referred to the ultimate decision makers?

STEP 14 Evaluate the cost-effectiveness and associated impacts of alternative management strategies

There should be an evaluation of the overall effectiveness, costs and other impacts of options.

Costs of the options will be needed, but many categories of impacts will be qualitative only. Comparison of the options will be both quantitative and qualitative.

STEP 15 Formulate a management strategy

The assessment and refinement of management options is usually an interactive process.

Various implications of potential options are progressively identified and a preferred strategy or combination of actions drafted.

Resource constraints will generally mean different elements of the strategy need to be staged to reach nominated objectives.

Staged targets will provide a framework for adaptive management, priority-setting for action programs being adjusted as progress is assessed.

The management strategy will contain the various options with their advantages and disadvantages. The preferred option will be nominated.

STEP 16 Release water quality management strategy for public comment

Public comments will help to extend and refine the evaluation of the potential impacts of the management strategy. A reasonable time, say three to six months, should be provided to enable considered responses to be prepared.

STEP 17 Finalise and then submit water quality management strategy to government for approval

For significant water bodies, it is anticipated that a formal process of establishing EVs, EQOs and EQC will be followed over a period of time. The steps involved in this process is laid out in Section 4 of the main text. Cross-portfolio implications will generally warrant consideration by either Cabinet or the appropriate Cabinet Committee.

STEP 18 Develop local water quality management plans for priority areas in conjunction with related land and water management planning

Responsibility for developing local management plans should be devolved to appropriate working groups or government agencies as nominated by Government.

STEP 19 Implement management strategy (including local water quality management plans)

The lead agenty(ies), body, working group, panel, committee etc nominated by Government should co-ordinate implementation, as it deems appropriate to meet the overall NWQMS objective:

'to achieve sustainable use of the State's water resources by protecting and enhancing their quality while maintaining economic and social development'.

STEP 20 Monitor effects of implementation of the strategy and adjust action plans

The lead agency(ies), body, working group, panel, committee etc nominated by Government should undertake progressive review of the strategy, drawing upon agency and community water quality monitoring and in-depth evaluation of pilot initiatives.

Appendix 2

List of Government and non-Government stakeholders invited to be part of the development of the framework

Government Stakeholders:

Aboriginal & Torries Strait Islander Commission
Department of Agriculture (Natural Resource Management Agency)
Department of CA L M (Natural Resource Management Agency)
Department of Environmental Protection (Natural Resource Management Agency)
Department of Fisheries (Natural Resource Management Agency)
Department of Health
Department of Indigenous Affairs
Department of Local Government and Regional Development/
Regional Development Council WA
Department of Minerals and Petroleum Resources Department for Planning and Infrastructure
EPA Service Unit
Office of Water Regulation
Water and Rivers Commission (Natural Resource Management Agency)
Water Corporation
Western Power

Non Government Stakeholders:

Aquaculture Council of WA (Inc)
Aquaculture Development Council
Australian Petroleum Production & Exploration Association Ltd (APPEA)
Australian Water Association
Busselton Water
Chamber of Commerce and Industry of WA
Chamber of Minerals & Energy of WA Inc
Conservation Council of WA
Kwinana Industries Council
Pastoralists and Graziers Association of WA (Inc)
Urban Development Institute of Australia
WA Aboriginal Native Title Working Group
WA Farmers Federation of WA (Inc)
WA Fishing Industry Council
WA Municipal Association
Unions WA

Members of the Public:

No submission was received from a member of the public. However, six stakeholder made additional submissions. They were:

BP Refinery, Kwinana
CSBP, Kwinana
National Competition Council
Urban Development Institute of Australia
Water and Rivers Commission
Western Australian Farmers Federation

Appendix 3

An integrated approach to water management – a holistic approach

An Integrated Approach To Water Management – A Holistic Approach

Integrated resource management considers all aspects of the resource use - the social, economic, environmental and other impacts. It embraces:

- a holistic approach to natural resource management within catchments, marine waters and aquifers with water quality considered in relation to land use and other natural resources;
- co-ordination of all the agencies, levels of government and interest groups within the catchment; and
- community consultation and participation.

Integrated Catchment Management (ICM) otherwise know as Total Catchment Management (TCM), is the 'umbrella' for sustainable natural resource management.

It provides the framework for the community, industry and all levels of government to work together to overcome environmental and resource management problems.

Development of catchment-based plans and strategies is central to ICM.

These include the control of point sources of pollution, influence of future land use and where appropriate, the adjustment of existing land use practices to reduce diffuse source pollution.

Plans will promote cleaner production through better housekeeping, best management practices and operational processes that minimise harmful environmental impacts from the beginning to the end of the production process. These plans should integrate ecological and conservation issues within the preferred implementation framework.

The same concepts can be applied to the management of coastal waters. These waters are affected by land-based activities, strategic planning, active partnership, integrated approach, balance of social, economic and environmental impacts, and adaptive management as well as actions on the shoreline and in the sea.

These five key themes may be applied in a systems approach to water quality management.

Strategic planning

Policies, planning and action should be linked to achieve an agreed vision or outcome. The processes which lead to outcomes should be kept in perspective. Notwithstanding that, the following elements are necessary in any water resource strategic plan:

- setting of integrated objectives and priorities to protect the environmental values (beneficial uses) of fresh and marine water bodies;
- design of management options to directly or indirectly influence environmental outcomes, and which may have complementary benefits (eg wastewater treatment and wetland rehabilitation); and
- co-ordination of action plans for different aspects of resource management initiated by government, industry, landholder and community organisations.

Active partnership

Collaboration among key stakeholders is encouraged to generate credibility, commitment and co-operation. Establishing conflict-mediating processes are important.

Integrated approach

Effective assessment of impacts and variables, which affect water quality and overall catchment health, requires a holistic approach. The emphasis is primarily technical and implications of catchment conditions and management actions are directly relevant. At times, skills in resolving conflicts will be required. Key aspects of an integrated approach include:

- analysis of aspects of the catchment system (eg water quality, stream flows, riparian conditions) impinging upon relevant values or uses of waterways;
- assessment of the ecological, economic and social values or beneficial uses of waterways and related impacts of management actions; and
- monitoring of environmental conditions and related socio-economic factors.

Balance of social, economic and environmental impacts

Evaluation of the overall merits of alternative combinations of technical solutions and implementation devices is required. The evaluation must identify options to balance social, economic and environmental impacts with respect to:

- the efficient use of public and private economic resources;
- the effectiveness of actions in achieving desired outcomes;
- the equitable distribution of costs and benefits; and
- progress towards sustainable systems of production.

Adaptive management

Effective catchment management depends upon a reasonable understanding of:

- major factors influencing water quality in the catchment or coastal waters; and
- the impact of past changes and development on current water quality.

While it is recognised that an optimal knowledge and information base for catchment management is not available, there is usually sufficient information to identify and quantify the important local water quality issues. Key requirements are:

- a sound overview of the effect of various activities on water quality, making maximum use of existing knowledge;
- a shared understanding by managers and stakeholders; and
- good 'feedback' systems to monitor responses to management action.

Appendix 4

Sustainable development – a balanced approach

Arguably the most important of this framework's principles is sustainable development. Embodied in sustainable development is the balanced approach. If adopted properly, and all other things being equal, sustainable development should ensure that Western Australia's water resources are sustained, both in terms of their environmental, social and economic value, now and in the future.

The National Strategy for ESD (1992) identified core objectives and guiding principles designed to achieve the goal of development that improves the quality of life in a way that maintains the essential ecological processes on which life depends.

The NWQMS Implementation Guidelines (1998) notes:

These (ESD) guiding principles and core objectives need to be considered as a package. No objective should predominate over the others; and

A balanced approach is required that takes into account all these objectives and principles to pursue the goal of Ecologically Sustainable Development.

The ESD Strategy identified core objectives and guiding principles designed to achieve the goal of development that improves the quality of life in a way that maintains the ecological processes on which life depends.

The core objectives of ESD are:

- to enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;
- to provide for equity within and between generations; and
- to protect biological diversity and maintain essential ecological processes and life-support systems.

The guiding principles of ESD are:

- that decision making processes should effectively integrate both long and short term economic, environmental, social and equity considerations;
- where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;
- the global dimension of environmental impacts of actions and policies should be recognised and considered;
- the need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised;
- the need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised;
- that cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive measures; and

- that decisions and actions should provide for broad community involvement on issues, which affect them.

These guiding principles and core objectives need to be considered as a package. No objective should predominate over the others.

A balanced approach is required that takes into account all these objectives and principles to pursue the goal of ESD.

In the case of water resource management, the National Strategy for Ecologically Sustainable Development says that *'the challenge is to develop and manage in an integrated way, the quality and quantity of surface and groundwater resources and to develop mechanisms for water resource management which aim to maintain ecological systems while meeting economic, social and community needs.'*

These principles, which are accepted by the Commonwealth, State and Territory governments and local government, are central to the management guidelines of the Strategy being developed for activities that have significant impacts on water quality.

Appendix 5

The Scientific Tools: Revised Guideline Nos. 4 & 7

NWQMS's application of Sustainable Development and that in Guideline Nos. 4 & 7

Sustainability for water resource protection is not a pure science, rather it is a set of judgements made by a broad partnership of interested parties expressing their wishes and having them endorsed by Government.

Notwithstanding the above, one tool for assisting such judgements is scientific methodology. To this end, the revised Guideline Nos. 4 and 7 offer much assistance. However, some potential inconsistencies emerge when reconciling sustainability as espoused in the NWQMS Approach (1992) with policy statements on sustainability as espoused in the Guideline No 4. For instance, the National Approach (1992) states the following goal:

"To achieve sustainable use of the nation's water resources by protecting and enhancing their quality while maintaining economic and social development";

and should be read in the context of:

"The community' desire to have water resources managed to a particular level will have economic, social and environmental impacts'

Guideline No. 4 deals with the guiding principle in a much narrower way. For instance, Guideline No. 4 states (p1-5):

The Guidelines for Fresh and Marine Water Quality are primarily based on the philosophy of ecologically sustainable development (ESD). The Australian National Strategy for Ecologically Sustainable Development (ESD Steering Committee 1992) defined ESD as:

[development] using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future can be increased. Put more simply, ESD is development, which aims to meet the needs of Australians today, while conserving our ecosystems to the benefit of future generations.

Scope of Guideline No 4: Environmental Values (Beneficial Uses)

Guideline No. 4 offers narrative and numerical guidelines for the protection of ambient waters supporting four EVs. The EVs cover 'aquatic ecosystems', 'primary industries', 'recreational water quality and aesthetics', and 'drinking water'. That is certainly not to suggest that water may not be protected for other legitimate beneficial uses such as industry (Figure 1). For instance, the NWQMS Implementation Guidelines (1998) makes significant reference to a broader range of uses including intake water for industry. In doing so, it captures more fully the broader spirit of the balanced and holistic approach of the NWQMS and ESD.

In the above context, application of Guideline No. 4 needs to be applied flexibly especially since many of the guidelines are generic and have been derived elsewhere using exotic species in laboratory toxicological experiments. Accordingly, this means that the Guideline No. 4 may offer better guidance for protection of EVs and subordinate EQOs in some regions and localities than for others.

• Protection of aquatic ecosystems - General ecosystems - Production of edible fish, crustacea and shellfish - Water associated wildlife • Recreational water quality and aesthetics - Primary contact - Secondary contact - Visual use (enjoyment) - maintenance of landscape vegetation • Raw water for drinking water supplies • Primary Industry	Agricultural water use - Irrigation - Livestock - Farmstead water supplies Industrial water use - Generic processes (heating, cooling) - Hydro-electric power generation - Textile industry - Chemical and allied industry - Food and beverage industry - Iron and steel industry - Tanning and leather industry - Pulp and paper industry - Petroleum industry

Figure 1 Environmental Values

Public Health Matters in Guideline No 4

The drinking water guidelines and some of the recreational and aesthetic guidelines that appear in Guideline No. 4 are reiterations of the National Health & Medical Research Council's (NH&MRC) guidelines. The implementation of NHMRC guidelines would be adequately managed by the Health Department under its legislation.

Industrial Intake Water and Guideline No 4

During the revision of Guideline No 4, industry, through the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), noted that it did not require intake water quality guidelines to be developed as its activities were site and industry specific. This is why, with the exception of primary industry, the Guideline No. 4 make little reference and offers no guidance with respect to Industrial intake water quality. Accordingly, the framework outlined in Section 4 of the main text offers no guidance for the protection of water for industrial purposes. Notwithstanding that, it is expected that water used presently by industry should be protected from degradation.

Cultural Importance of Water Guideline No 4

Reference is made in Guideline No. 4 to 'Cultural Importance' because New Zealand considered that the matter be raised in Guideline No. 4 (Section 2.1.3, pp 2-6 & 7). Guidelines No. 4 offers no specific guidance in this regard. Accordingly, this framework remains silent on this matter.

Misconceptions Regarding the Application of the Guidelines No 4 and 7

Some consider that Guidelines Nos. 4 & 7 should be implemented in a rigid manner, and failing to do so would lead to environmental impacts. Currently, the various policies, principles and guidelines comprising the NWQMS are being implemented in a variety of way across Australia. For implementation purposes in Western Australia, it is noted that none of the NWQMS Guidelines, including the Guidelines Nos. 4 & 7 are:

- mandatory instructions but rather guidelines;
- for use as proxies for ambient water standards unless justified in the public arena and endorsed by Government (read definition of Water Quality Standard in conjunction with Water Quality Objective – pp A-18-19, Guidelines No. 4);

- for use in areas referred to as ‘mixing zones’ (see Section 2.2.2, p 2-17, Guidelines No. 4);
- effluent treatment standard (see Section 2.2.3, 2-18, Guidelines No. 4) and
- effluent discharge licensing conditions..

In other words, Guidelines No. 4 and to a lesser extent No. 7 are to0 be viewed as a set of narratives and numbers which, if adopted as either EQOs, local guidelines or local standards are likely to protect their corresponding EVs for ambient waters.

Appendix 6

Comparisons in terminology between Guidelines Nos. 4 & 7 and the present approach used in Western Australia

The proposed framework is similar to that presented in the draft EPP for Cockburn Sound. It is important to understand, however, that the terminology proposed in the framework differs from that used in Guidelines Nos. 4 & 7. That should not mean that the outcomes from both processes would be dissimilar. Figure 1 below compares the equivalent terminology of both approaches.

Whilst there are significant differences between the equivalent terms below, specific attention is drawn to the term standard. There is a significant departure in meaning between the use of this term in Guideline No. 4 compared to that proposed in this framework. Guidelines No. 4 recognises that a standard may have social and economic considerations embedded in them and hence is not necessarily a scientifically based standard. In other words, it is a negotiated parameter. However, such a standard, once agreed upon, can be legally enforced. On the other hand, this proposed framework uses standards as scientific statements that should not to be exceeded, and if exceedance occurs, it is likely to lead to detectible ecological changes.

In this framework guidelines and standards are generically know as Environmental Quality Criteria (EQCs) and sometime referred to as performance benchmarks. These benchmarks can be numbers, narratives or bioindicators of health conditions.

It is also noted that there are varying degrees of confidence and uncertainty with respect to many of guidelines in Guideline No. 4. Hence regulators, managers, operators and the community alike need to be aware of this when applying Guideline No. 4.

Guidelines Nos. 4 & 7	**WA Draft EP Cockburn Sound Policy (2001)**
Environmental Value ***Particular values or uses of the environment that are important for a healthy ecosystem or for public benefit, welfare, safety or health and that require protection from the effects of pollution, waste discharges and deposits. Several environmental values may be designated for a specific waterbody.***	Environmental Value ***Particular value or use of the marine environment that is important for a healthy ecosystem or public benefit, welfare, safety or health and which requires protection from the effects of pollution, waste discharges and deposits. Two types of environmental value are considered ecological and social.***
Management Goal *Long-term objectives that can be used to assess whether the corresponding environmental value is being maintained. They should reflect the desired levels of protection for the aquatic system and any relevant environmental problems*	Environmental Quality Objective *A specific management goal for a part of the environment and is either ecologically based by describing the desired level of health of the ecosystem or socially based by describing the environmental quality required to maintain specific human uses.*
Water Quality Guidelines *Numerical concentration limits or narrative statements recommended to support and maintain a designated water use.*	Environmental Quality Guideline *Numerical value or narrative statement which if met indicates there is a high probability that the associated environmental quality objectives declared under 7(2) has been achieved.*
Water Quality Objective *A numerical concentration limit or narrative statement that has been established to support and protect the designated uses of water at a specified site. It is based on scientific criteria or water quality guidelines but may be modified by other inputs such as social or political constraints*	Environmental Quality Standard *Numerical value or narrative statement beyond which the associated environmental quality objective declared under clause 7(2) - has not been achieved and a management response is triggered.*

Figure 1: Examples of the different uses of terms in Guidelines Nos. 4 & 7 with their equivalents in the Draft EPP for Cockburn Sound.

Appendix 7

Guideline trigger values or targets (diffuse source and severe pollution)

The State of the Environment Report (1998) noted that many of the water bodies in the South west of Western Australia are severely impacted by salinity, eutrophication and sedimentation. The causes and extent of these problems are well understood and there is general agreement regarding the long-term solutions. The SOE Report also offers suitable responses to address these matters. Example of the above are given below in the context of the use of guidelines or targets

Collie River/Wellington Dam: Drinking Water

The Wellington dam was built on the Collie River for the purposes of irrigation and water supply for local communities. The SOE Report (1998) noted that the average salinity of the Collie River was 790mg/l (Table 1) compared to 500mg/l required for potable water. The SOE Report also noted that salinity increased significantly since 1965. It is understood that the increase has flattened out recently following revegetation of parts of the catchment.

If one were to set EVs for the Wellington dam water body, the most conservative EV would most likely be for potable water. The day-to-day water resource manager and the Department of Health would manage this as it is a public health matter. To meet salinity standards for public health, one solution could be to mix the Wellington Dam water with better quality water from elsewhere. However, over the years the dam has attracted campers and other recreational users that are thought to be responsible for increased bacterial levels in the water. If one were to disinfect the water for potable purposes one would need to address the matter of discharge of disinfection by-product.

Instead of using Guideline No. 4 trigger values to manage dam water, it would be more useful to take a holistic approach to catchment management. To this end, it would be appropriate to set short, medium and long-term time related targets, the long-term target being the guidelines for drinking water. Because the long-term target would relate to public heath, it would become a standard when the target is achieved. Such a long-term management approach would invariably go a long way to addressing other problems such as turbidity, eutrophication, land clearing, misappropriate recreational landuses, disinfecting potable water and the discharge of waste products to the Collie river.

Swan – Avon River: Salinity

The SOE Report (1998) notes 'In all water bodies that become saline, the biodiversity of life that can live in them decreases'. Fringing vegetation dies, leading to weed invasion and bank erosion, or is replaced with salt-tolerant species. Given the uniqueness of the Australian flora and fauna, loss of biodiversity is an urgent matter. The report notes that the average salinity of the Swan –Avon River was 5835mg/l, approximately 12 times for that for potable water. This is likely to have had a significant effect on the catchments biodiversity.

Given the population distribution throughout the catchment and the diversity of land uses, it would be appropriate to divide the catchment into segments for the purposes of management. This has been done for all of the catchments in New South Wales. For each segment, EVs and EQOs would be set ensuring that EVs in the upper catchment would not compromise those in the lower catchment.

Given that the upper reaches of the Swan-Canning system should be suitable for potable purpose while the waters in the lower reaches should be suitable for estuarine activities, a mix of targets and guideline trigger values would be appropriate depending on the EVs, extent of existing problems, and whether contamination emanates from point or diffuse source. However, wastewater discharges to the system occurs from prescribed premises, the Licensing Branch of DE would use Guideline No. 4 for back calculating licensing conditions for relevant contaminants.

Murray River: Sedimentation

The SOE Report (1998) notes that '…..sedimentation is a serious environmental issue that reduces water quality and biodiversity and increases the likelihood of flooding'. Sediment loads from erosion in catchments is a major source of nutrients causing eutrophication in the South West of Western Australia. Figure 1 shows that the problem of sedimentation is widespread due to erosion resulting from land clearing, pastoral and some mining activities. Accordingly, most matters relating to sedimentation (turbidity, transport of substances adsorbed onto sediment particles e.g. nutrients and trace elements), would need to be dealt by setting achievable time related interim and long-term targets.

Estuaries: Eutrophication

The SOE Report (1998) notes that '…in the South West of Western Australia only seven estuaries out of 22 have low nutrient levels (Figure 2 below). Much has been made of the eutrophication of the Peel Harvey System and the Swan-Canning System. However, Fig 2 shows that many of the rivers are moderate to highly eutrophied. For instances, approximately 4/5 of the Blackwood river fall into this category. The report also notes that most important sources of nutrients are fertilisers from broad acre application. Given the linkage of nutrient distribution, land practices and sediment movement and environmental water flows, eutrophication would need to be dealt by setting achievable time related interim and long-term targets.

Rivers	**Proportion of Catchment Cleared (% in 1986)**	**Current Salinity (mg/l TSS)**	**Trent – Rate of salinity increase since 1965 (mg/l/y)**
Frankland River	56	2760	74
Kent River	40	2087	58
Swan-Avon River	75	5835	*
Greenough River	50	4908	*
Blackwood River	85	1760	58
Collie River	24	790	24
Murray River	75	2260	93
* Insufficient data to form trend			

Table 1: Salinity in representative rivers for affected areas of the State (SOE Report 1998) and area affected by salinity

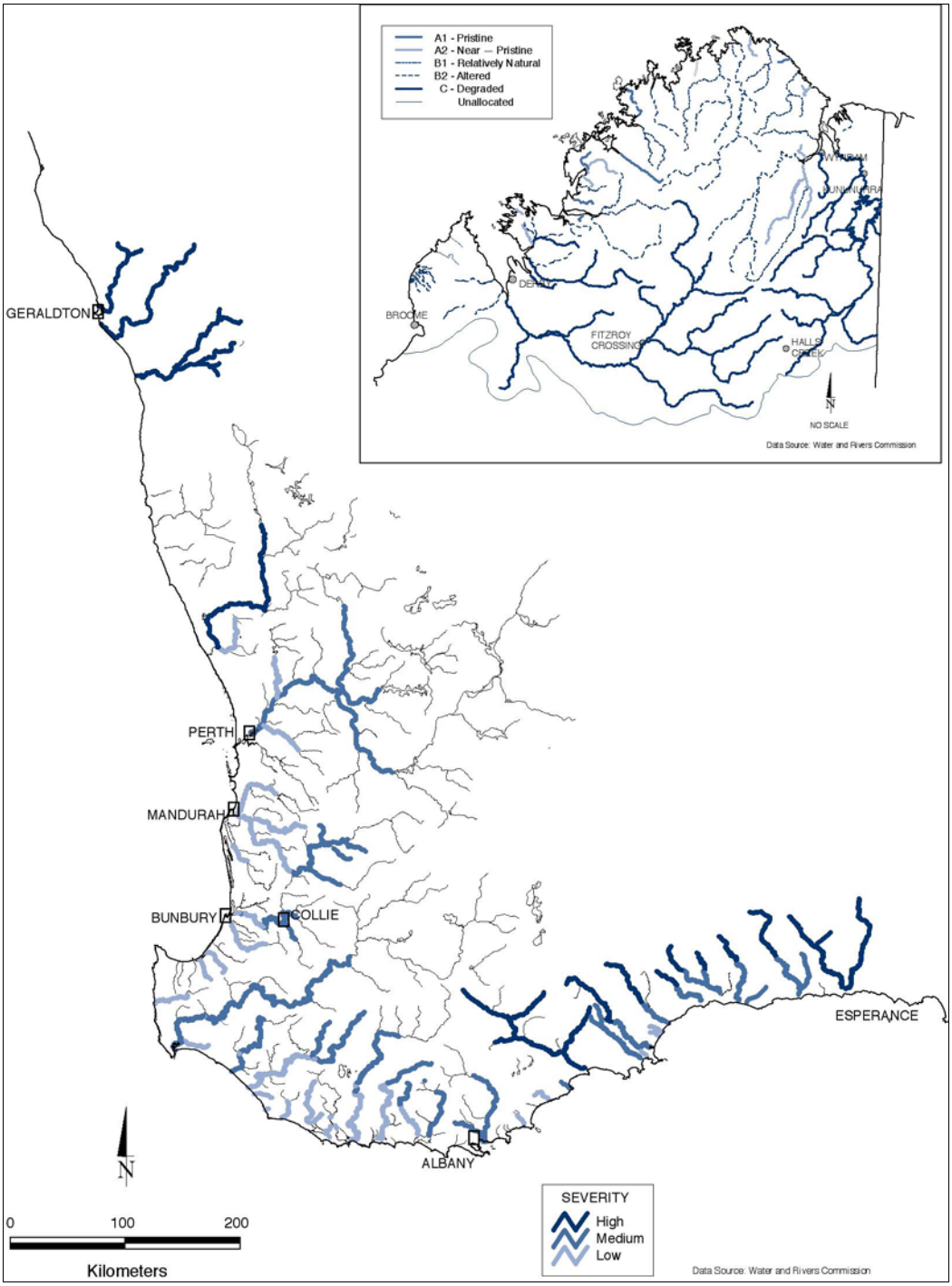

Figure 1: ***Severity of sedimentation in rivers of the State currently known to be the most affected by sedimentation (SOE Report 1998) and area affected by sedimentation***

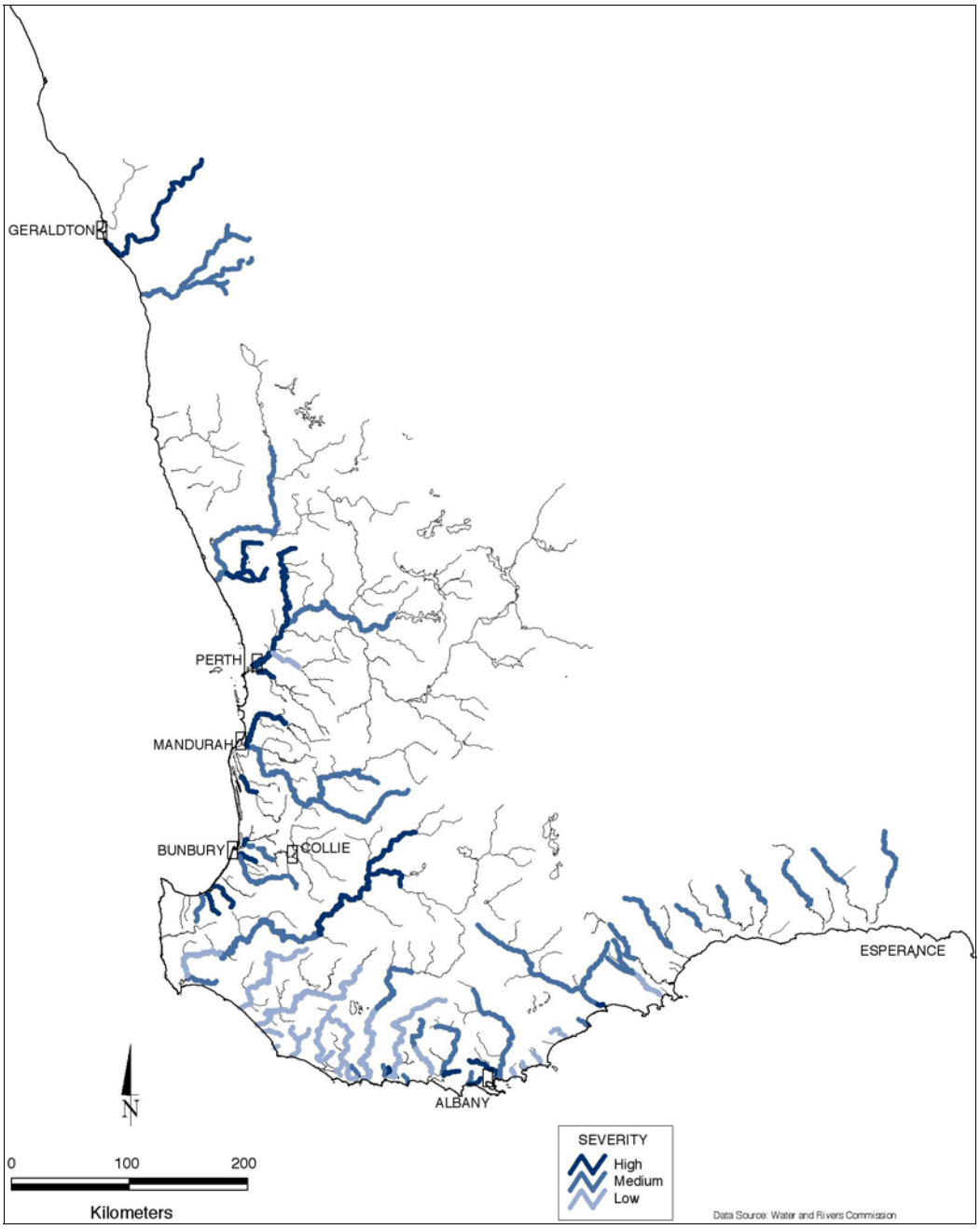

Figure 2: ***Severity of nutrient loads to various waterbodies in the State (SOE Report 1998)***

Appendix 8

Important decisions that need to be made before using scientific management tools

This framework recognises that before applying scientific requirements to a management area, it is necessary to address three significant questions. These questions are largely social in nature and are:

- what EVs (beneficial uses) do the community and stakeholders wish to protect for a designated management area?

  It is noted that this answer need not be restricted to the four EVs as set out in Guideline No. 4. In the first instance, it is for the partnership of involved parties to offer their views to EPA regarding the beneficial uses for their environment. This matter will become more important as NRM takes hold in Western Australia. The range of EVs in Guidelines No. 4 are likely to be too restrictive when trying to articulate the range and nature of matters that affect the community. For instance, one of our most beneficial land uses in Western Australia is for wheat growing. The wheat belt coincides with areas affected by dryland salinity. For the community in the wheat belt to feel that they are part of the decision making process for EVs, they would need EVs relevant to their daily activities, otherwise they may very well consider that NRM is being imposed on them from outside.

- what time scale does the partnership consider necessary for EQOs to be met for agreed EVs?

  For an area with significant ecological attributes, the answer might be 'immediately'. However, for a highly modified area the partnership may wish to adopt a 'continuous improvement' approach over a much longer timeframe. The answer to this question will have a direct bearing on the EQOs chosen as a staged approach maybe appropriate. This matter has been dealt with in Appendix 7.

- how much degradation is acceptable?

  In the case of the partnership agreeing that some degradation in an area is acceptable, the question of 'how much degradation is acceptable?' needs to be answered. To this end, the application of the principle of 'Intergenerational Equity' espoused in the principles of ESD is appropriate.

Once decisions relating to these three questions are made, the framework allows for spatially defined EVs and subordinate EQOs to be set. Notwithstanding the above, science plays a part in the above decision-making, especially for determining EQC and targets but its role should not be over estimated.

Appendix 9

Relationship between EV and EQOs

There is some confusion regarding the meanings of an EV and EQO.

An EV is an agreed beneficial use for the environment. For instance, one EV is 'Ecosystem Health'. The setting of an EV is a philosophical agreement arrived at between involved parties. Implicit in that agreement is the notion that the EV would be protected. It is equivalent to a 'mission statement or vision' in an EMS (Appendix 12). Accordingly, it is unnecessary to state in the EQOs that the maintenance of an EV is an objective. This clouds the boundaries between an EV and an EQO. In fact, for many of the freshwater and estuarine systems in WA, they would need to be improved considerably rather than be maintained at their present level

An objective (EQO) is a narrative or numerical statement that supports an EV. If all the objectives supporting an EV are met for a particular waterbody, there is a very high probability that the EV would be protected. This matter is dealt with in the NWQMS Policies and Principles Document No 2. A broad EQO would usually refer to the level of protection designated for a water body. It is normally a subjective judgement with some philosophical basis. It can in the form of a narrative. More specific objectives may refer to items (bioindicators) that need protection. It may be in the form of a narrative or numerical statement and may or may not be linked to a timeframe for achievement (depends on the current state of the ecosystem). Specific EQO are usually the performance benchmarks (EQC or targets) that need to be achieved. Unlike an EV, an EQO could embrace the notion of 'no net loss', 'trade-offs', 'offsets' etc. EVs on the other hand are fixed agreed uses for the environment.

As an example, for the EV referred to as 'Ecosystem Health', it is unnecessary to note that in the objective that the EV is to maintain or improved. That is axiomatic and related to the current state of the system. This is implicit in the level of protection ascribed to the water body. For instance, three levels of protection are suggested in Guideline No. 4 (High conservation/ecological value, Slightly to moderately disturbed ecosystems and Highly disturbed ecosystems). The more specific EQOs underpin the broad EQO. They are the EQGs that correspond to the desired level of protection.

It should be noted that 'Ecosystem Health' does not fit into neat categories as above, rather it forms a continuum. Accordingly, the selection of EQOs is subjective and an infinite number of sub categories could be chosen on a case-by-case basis. This has been the case for the draft EPP for Cockburn Sound where three broad objectives have been chosen (high, moderate and low areas of protection). The alternative approach for highly modified systems as espoused in this framework is the use of targets. In that case interim targets would be equivalent to interim objectives while the long-term target would correspond to the guidelines in Guideline No. 4 for the desired level of protection (Appendix 7).

Appendix 10

Multiple lines of evidence

In area where contributions of contaminants are from a variety of point and non-point sources and there is a wide range of receiptor organisms in the ambient waters, it may be difficult to correlate exceedances of an EQC with a particular industrial discharge practice. An example could be the discharge of nutrients from a point source into a eutrophied catchment, estuary or embayment.

From a day-to-day management point of view, a *'multiple lines of evidence'* and a *'persistence line of evidence'* approach would be used for evaluating *'cause and effect relationships'* for environmental quality. Not until multiple lines of evidence have persisted over a reasonable time period would a trigger response be formally invoked by the management body on an individual operator of a prescribed premise. Notwithstanding that, the management body would however, trigger a more general response to address the matter in the first instance.

The general thrust of this framework is to take a multiple lines of evidence approach through the application of EQG and EQS that use indicators along the cause-effect pathways for each contaminant. For instance, an EQS could be defined in terms of agreed biological responses to the stressor(s) of concern, e.g. persistent phytoplankton blooms. This approach avoids triggering major management responses following one-off unexplained events. A management response should only be triggered if it can be shown that the relevant EQS has not been met and the source/cause of the impact has been identified. This approach offers surety to operators and regulators alike, in that it reduces the likelihood of a management response being triggered too early, which could place an unnecessary burden on the operator, or triggered too late to prevent serious or irreversible damage from occurring.

Appendix 11

Components of an environmental management system

The following is referenced set of items that an organisation should consider as part of its EMS if it were to adopt an international system such as ISO 14000. Regardless of the business or activity, the components are very similar.

Principles and Elements for Successful Environmental Management.

There are five environmental management system principles within ISO 14004:

- **Commitment and Policy:** An organisation should focus on what needs to be done - it should ensure commitments to the environmental management systems and define its policy.
- **Planning:** An organisation should formulate a plan to fulfil its environmental policy.
- **Implementation:** For effective implementation, an organisation should develop the capabilities and support mechanisms necessary to achieve its environmental policy, objectives and targets.
- **Measurement and Evaluation:** An organisation should measure, monitor, and evaluate its environmental performance.
- **Review and Improvement:** An organisation should review and continually improve its environmental management system, with the objective of improving its overall environmental performance.

Sayre, D. (1996). Inside ISO 14000: The Competitive Advantage of Environmental Management. St Lucie Press, Florida, US. pp 232. State Reference Library: 658.408 SAY

The three categories of activities of an organisation according to ISO 14000

- Activities to prevent pollution and conserve resources. These activities apply to new capital projects, process changes, property management, new products, and packaging;
- Daily management activities. Management assures conformance to internal and external requirements. Management also attempts to increase efficiency and to continuously improve performance; and
- Strategic management activities. It is management's responsibility to anticipate and respond to changes in environmental requirements.

Sayre, D. (1996). Inside ISO 14000: The Competitive Advantage of Environmental Management. St Lucie Press, Florida, US. pp 232. State Reference Library: 658.408 SAY

What does an Organisation's Environmental Policy means and what should it contain

An environmental policy is a statement by an organisation of its intentions and principles for environmental performance. It is the framework for action and sets environmental objectives and targets. Policy establishes a sense of direction within set parameters and aims for the 'overarching' goal of environmental performance.

ISO 14000 suggest the following elements should be in a policy:

- The organisation's vision, core values, beliefs and mission;
- Requirements of interested parties;
- Communication with interested parties;
- Continual improvement opportunities;
- Interactive alignment with other organisational policies and elements; and
- Recognition of local and regional conditions.

Sayre, D. (1996). Inside ISO 14000: The Competitive Advantage of Environmental Management. St Lucie Press, Florida, US. pp 232. State Reference Library: 658.408 SAY

Components for an EMS for Natural Resource Management

Having established the EVs, EQOs and EQCs or targets for a significant water resource, the lead agency would establish an EMS to ensure that the water body is managed properly. The EMSs would include the following elements:

- EVs to be protected (Mission Statement)
- EQOs to be protected (The Broader Management Objectives)
- EQCs or targets to be employed (The Specific Management Objectives: Performance Benchmarks)
- The Implementation Plan (Implementation Strategy);
- Measurement of agreed key environmental quality indicators (Monitoring)
- Evaluation of performance against environmental quality benchmarks (auditing); and
- Review and improvement (adaptive management, continuous improvement).

Appendix 12

Use of reference sites to derive EQGs

In some circumstances, use of specific numerical guidelines from Guideline No. 4 may be inappropriate. However, it may also be difficult to establish local guidelines. This has been the case for the draft EPP for Cockburn Sound. In such circumstances, and as suggested in Guideline No. 4, it may be useful to use data from reference site(s) and link it back to the site under management. Reference sites need to have similar ecological attributes to that of the management area and be in as good condition as possible.

Guideline No. 4 does not infer that the EQO for the management area is to rehabilitate it to a condition similar to that of the reference site. Guideline No. 4 offers percentile benchmark guidance on how the two areas might be linked (e.g. median of test site to lie between the 20^{th} and 80^{th} percentile of natural distribution for a biological parameter to capture natural variability at the reference site). To apply generic percentiles to link all reference sites and their associated management areas across Australia would be problematic because the environment is a continuum and not a set of discrete modified areas and reference sites. Each area has its own individual attributes. Hence, where the lead agency cannot achieve a consensus between stakeholders regarding the percentile linking a reference site(s) and management areas, the EPA would form its own judgement and advise Government accordingly.

To take into account natural background conditions, EQGs for toxicants can also be established as a percentile of the natural background concentrations (e.g. 80^{th} percentile for slightly to moderately disturbed ecosystems).

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