Sustainability, principles, and public good legislation.

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1. Overview

This paper is a submission to the House of Representatives Environment and Heritage Committee inquiry into public good legislation.

While the approach used in this submission appears somewhat discursive, it aims to highlight the exceptionally difficult role governments will have if they accept a serious responsibility for the establishment of truly sustainable government programs and regulatory frameworks. The discussion revolves around three complex issues: (a) the limitations of a democratic form of government, (b) the exceptional difficulties involved in managing cumulative effects, and (c) the value of sustainability principles in developing natural resource management programs.

In brief, this paper argues that achieving sustainability not only involves setting and measuring physical sustainability targets, but also involves establishing, implementing, and auditing the use of sustainability principles across whole-of-government programs. It is further argued that the difficulty in doing this has been seriously underestimated, and that current approaches to sustainable management do not face up to the fact that achieving real sustainability will involve prejudicing the immediate interests of today's citizens (ie: voters) in real and substantial ways - in the interests of protecting both the planet's non-human occupants and future generations of humans. This presents a dilemma for a democratic political system where politicians must face re-election within short time-frames, where non-humans and future generations do not vote.

Governments can either face up to these very difficult issues, or alternatively adopt the more traditional ('pragmatic') approach of focussing on assessing the adequacy of the State's natural resource management programs – within 'extended' short-term parameters. The latter approach, which I recommend against (but which I believe is the most likely outcome) will see Australia (along with the rest of the planet) move inexorably towards global environmental catastrophe

This paper is divided into a number of sections. Section 2 discusses the failings (in the context of sustainability) of our best political system: democracy. Section 3 (the longest section by far) examines issues surrounding the assessment and measurement of program sustainability, within the context of the management for freshwater resources. I use this example, as it is the sector I am most familiar with. Section 3 concludes that the failings of democracy may, to some extent, be counteracted by the rigorous adoption of sustainability principles, so Section 4 proposes firstly a broad set of model principles to be used across whole of government programs, and secondly a more focused set of principles which could be used within an industry sector: in this case, the example chosen relates to the management of freshwater resources and ecosystems. Section 5, very briefly, draws conclusions and makes recommendations.

Material placed in the document's appendices provides crucial background to the paper's arguments. Appendix 1 examines the inability of humans to accept the notion of impending planetary catastrophe in a realistic and responsive way. Appendix 2 looks at a global future in which a growing human population, and its expanding resource demands, meets the physical limitations of what now seems like a small planet. Appendix 3 examines the issue of the management of the cumulative effects of incremental development in some detail, focussing on the example provided by the freshwater industry. Cumulative effects can only be managed by setting 'hard' limits to development. Setting such limits within a world characterised by an expanding human

population, coupled with growing per-capita resource demands, and underpinned by an economic framework committed to infinite growth, presents particularly difficult challenges.

The Murray Darling Basin Commission (MDBC) is an Australian agency charged with developing frameworks for the sustainable management of a huge part of the continent, including northern Victoria. In the interests of examining a modern approach to sustainability, Appendix 4 critically examines an aspect of the MDBC's work, and concludes that the Commission's approach to sustainable management is fatally flawed. Unfortunately, the Commission's approach is typical across the Australian natural resource sector. Appendix 5 looks briefly at "second generation" sustainability principles, including the Hanover, and Natural Step principles.

2. Sustainability: cultures, institutions, and cumulative effects.

Our evolution from tribal hunter-gathers has provided humans with a remarkable ability to respond to immediate challenges. We react well to short-term problems in our immediate vicinity. As a species, however, we do not have strong abilities to construct effective social responses to long-term or global crises. Around the planet are the remains of massive stone structures which testify to the collapse of sophisticated civilisations. I believe that, in many cases, the collapse of these civilisations was driven by the destruction of water, soil and biological resources, brought about through the inability of the societies to control the cumulative effects of incremental development. We face the same dilemmas today – however this time global, rather than regional life-support systems are at stake.

Our survival on this planet depends on our ability to construct cultural and institutional mechanisms which will compensate for our inherited focus on short term immediate issues. This is the challenge we must face today (see Appendix One).

We need to start thinking about two ideas: the intelligence of humans as individuals, and the intelligence of the societies which humans create. The first is something which stems from our evolutionary inheritance, and is developed within the opportunities and constraints of our cultures, and particularly the education systems within those cultures. However the second is something which is entirely the result of the cultures and institutions which humans have created.

Working within teams focused on short-term goals, the individual intelligence of humans has provided the technology we see around us today. This technology, powered by the use of fossil fuels, has enabled us to build societies of great opportunity, unparalleled within the history of our species. This technology has also placed in our hands the ability to destroy the life-support systems of our planet.

Looking around me, I cannot help but marvel at the achievements of our species. However, it also appears to me that the intelligence of our societies is out of step with the power which now lies within our hands. The intelligence of our societies is something we have created, and it does not match the task of managing the planet.

The cultures and institutions we have now put in place are propelling this planet to ecological catastrophe (see Appendix Two). While it may be a mistake to oversimplify matters, I believe it can be said that the most significant failings of our political systems and their resource management frameworks are two-fold:

- their focus on short term objectives, and
- their failure to control cumulative impacts.

The most prosperous countries today (with a few notable exceptions of very small, resource-rich nations) are democracies, characterised by elected politicians, free press, and viable opposition parties. Looking at alternative methods of governing nation-states, we see kingdoms, dictatorships, socialist republics, and puppet democracies. Accepting that democracies are the best of this group, we must face the fact that democracies, with election periods generally in the 3-5 year range, inherently accentuate short-term priorities.

With around 200 nation-states, attempts at the coordination of global resource management issues centre around global trade[1], economic[2], environmental[3] and social agreements[4]. However, underpinning this entire framework is a reliance on (not to say reverence for) Keynesian economics – a system of accounting and planning focused on short-term horizons, and an addiction to growth. While the most prosperous of the world's nation-states are also mixed economies relying heavily on free market approaches, markets are (as Amory Lovins has said) a good servant, but a poor master and a worse religion. The success[5] of mixed economies lies in the ability of markets to direct human self-interest in efficient and effective ways, while protecting the immediate needs of the human community. However, in spite of the work of environmental economists over the last three decades, there has been little change in the ability of economic theories current at national and global levels to accommodate external environmental costs, or extend planning horizons past the scale of a few years. The economic paradigm lying behind key global agreements, like the General Agreement on Tariffs and Trade, still rests on the concept of infinite growth in the economies of the world.

The cumulative effects of incremental development have proved, almost without exception, impossible for societies to manage - given our existing reliance on democratic government and Keynesian economics, with their built-in focus on the short-term. The issue of the management of cumulative effects cannot be properly understood without considering the mechanisms of *the tragedy of the commons*, and *the tyranny of small decisions*. Appendix 3 addresses these mechanisms within the context of the management of freshwater resources.

Within this context, Appendix 3 concludes that the only way cumulative impacts can be managed is by establishing firm limits, or caps, on development *well before problems arise*. If limits are set only after significant problems appear, it is already too late to save many catchment values. The history of the Murray Darling Basin appears to add weight to this conclusion.

Taking this conclusion to the larger field of natural resource management, the conclusion still holds – on the catchment, nation-state or global scale. In order to protect long-term values for future generations, and for the non-human inhabitants of the earth, cumulative effects must be controlled. The only way to control these effects is through the enforcement of limits (or caps) on development – *ahead of need*.

However, these caps will prejudice the immediate interests of today's citizens – undoubtably in ways which are significant, sometimes fundamentally so. And, within our democratic system, today's citizens can vote, while future generations, and the planet's non-human inhabitants, cannot vote. Given that decision-makers (politicians) are accountable to voters at elections held around every four years (a time-frame well outside that of most sustainability issues) this presents a dilemma.

Moreover, given that cumulative effects advance in small incremental steps over a period of time, the impact of each step will almost certainly be insignificant when assessed against the wider scheme of things. In this context, establish caps to limit incremental development *will undoubtably* appear unfair to each individual affected. Cumulative effects will *never* be controlled until we develop cultures which recognise

that these apparently unfair decisions *are fundamental necessary* to control cumulative effects.

It appears that the best system for nation-state governance that we have devised contains a major flaw. A flaw, indeed, that will lead the planet incrementally towards environmental catastrophe. And it is really not a question of "will"; it is happening now. Democracy is leading the planet towards catastrophe.

This situation seems difficult enough. However it is made even more difficult by the fact that the economic paradigms underpinning political programs remain, in spite of the best efforts of environmental economists, focused on infinite growth.

The silent statues of Easter Island, and the depauperate ecology of the island behind their morning shadows, bears mute testimony to the power of short term planning. As humans, are we locked into repeating the mistakes of earlier societies, this time on a grand scale?

3. The assessment and measurement of program sustainability

3.1 Introduction:

It is argued that assessing the sustainability of policies and programs (relating to natural resource management) must involve a two-pronged approach - where both aspects undergo rigorous scrutiny during program design, monitoring and evaluation phases.

Firstly, sets of values, indicators and indicator targets must be established, predicted, measured and evaluated. Where evaluation indicates that targets are not being met, the design and implementation of policies and programs must be reviewed and improvements must be made.

Secondly, of equal importance is the examination of the processes which are designed and implemented through policies and programs. These processes must embody sustainability principles. These principles have been established and are undergoing conceptual evolution. Management processes must be evaluated against these principles, and where gaps are demonstrated, changes must be made.

Water ecosystems and resources are used as examples. Many of the assumptions underpinning traditional water management programs where once correct, but are no longer correct. As the validity of underlying assumptions has disintegrated, water managers have tended to cling to existing processes, rather than embrace change. Achieving sustainability must involve questioning of traditional management concepts, and a commitment to change.

3.2 Background:

Australian governments at all levels (Federal, State and local) are committed to sustainability - often expressed broadly in ecological, economic and social terms.

According to the *National Strategy for Ecologically Sustainable Development* 1992:

> Ecologically Sustainable Development (ESD) represents one of the greatest challenges facing Australia's governments, industry, business and community in the coming years. While there is no universally accepted definition of ESD, in 1990 the Commonwealth Government suggested the following definition for ESD in Australia:

- '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 for the benefit of future generations. To do this, we need to develop ways of using those environmental resources which form the basis of our economy in a way which maintains and, where possible, improves their range, variety and quality. At the same time we need to utilise those resources to develop industry and generate employment.

3.3 Approach:

Measuring the sustainability of natural resource management programs (and proposed changes to processes or programs) presents important challenges.

In this paper, the management of water ecosystems will be used as an example. Around Australia, many major lakes, waterways and aquifers are seriously degraded, and are continuing to degrade. The links between our vision of sustainable management and what actually occurs on the ground are the management processes and programs we put in place.

How are we to assess and measure the extent to which these processes and programs meet our sustainability objectives?

Firstly, if we are to assess our success at achieving sustainability, we must be able to measure outcomes. Without measurement, we have no way of reaching a conclusion - other than by endless semantic argument. To measure something, we must establish benchmarks, and these benchmarks must in turn rest on reference points.

Secondly, we must also consider time-scales. Having selected an indicator which we take as representing one aspect of our sustainability program, if that indicator degrades over time, that suggest our program is not sustainable. But what timescales do we use? A decade? A century? A millennium? Within this context, how do we handle natural variation in the chosen indicators?

In many cases, economic considerations preclude the establishment of sufficient sampling points (in time or space) to allow the use of statistical techniques which can assign probabilities to trends. This is particularly the case in the water environment, where a particular indicator can vary widely due to natural variation in environmental variables, such as weather.

Thirdly, we need to make decisions on which *conditions* relating to our environment are most important, and to what extent we are prepared to consciously allow certain conditions to deteriorate to facilitate our objectives in other areas (economic growth, for example). In some cases we appear to have little choice. For example, are we to specify a condition relating to our Murray waterways: "carp free"? Is this practical or achievable?

Fourthly, will benchmarks be enough? Given that we want some way of assessing the sustainability of the processes and programs which we are *now* developing, and given that uncertainties regarding future circumstances make it difficult, in many instances, to confidently predict whether our chosen indicator is going to remain stable (which presumably we might want) or slightly degrade (in which case our program is not sustainable in the long term) - can we rely simply on our predictions of the "likely" effect of our program on these indicators?

I suggest that, in assessing the degree to which our present processes and programs achieve sustainability, we need to make a series of decisions, and these decisions *must incorporate both measurable targets, and criteria applicable to mechanisms (or process elements) deriving directly from our philosophies.*

In relation to programs of measurement, these decisions must encompass:

- the essential qualities, or values, which we are seeking to protect and pass on to future generations;
- the indicators which we chose to measure these values. One value, for example, may have several indicators;
- the benchmarks we are going to apply to the indicators, and the methods by which we will establish reference points for these indicators;
- given that knowledge about the environment will change, possibly in major ways, how can we provide for benchmarks which have not yet been thought of?
- the timescales we are going to apply to our predictions and measurements;
- the design of monitoring programs where we believe we can apply statistical techniques to assign probabilities to the measurement of indicators;
- the methods we are going to use to predict the effects of our chosen processes and programs on our set of indicators; and
- the uncertainties involved in these methods, and the way we will account for these uncertainties.

In relation to embodying our processes and programs with sustainable philosophies, we must ensure that our principles (which, of course, may be interpreted widely depending on the temporal and spatial horizons of our conceptualisation of "sustainability") *do, in fact, permeate our processes and programs*.

So: - the assessment of sustainability must encompass both (a) prediction and measurement of the stability of indicators, *and* (b) assessment of process/program principles.

The principles of sustainable development have received a great deal of attention over the last thirty years, and many clear statements of principle can be found to guide the choice of principles to fit a particular program.

Let us examine how this approach might apply to the management of freshwater ecosystems:

3.4 Assumptions underlying traditional water management policies and programs

The degraded (and still degrading) circumstances of many major waterways can in part be attributed to nine important assumptions underlying Australian water management frameworks. Three of these assumptions relate to the cumulative impacts of incremental water infrastructure development:

- although very large dams were subject to environmental assessment, it was assumed that *small and medium-sized dams* needed only cursory assessment on a case by case basis - no assessment of the catchment's capacity to support increasing numbers of small dams was thought to be necessary. In other words, it was assumed that "the little ones don't matter";

- similar assumptions were made concerning *small users* of surface and groundwaters, and the *construction of levee banks*. These escaped catchment-based strategic assessments on the basis that "little ones don't matter";
- it was assumed that the harvesting of surface flows *away from watercourses* did not need to be controlled - that these flows comprised a minor proportion of total surface flows and that their harvesting (through channelling surface flows into farm dams) did not matter to overall catchment flows;
- it was assumed that landholders should, by and large, *be allowed to place dams across small watercourses*, on the basis of generally cursory case-by-case assessments and licensing arrangements - ie: that it was unreasonable for State water agencies to ask landholders to pay the additional costs involved in off-stream dams;
- it was assumed that the plants and animals living in the streams would look after themselves, and that no particular attention was needed regarding the provision of a *guaranteed environmental flow* to keep them alive;
- it was assumed that, while the need to protect biodiversity necessitated the development of systems of *representative reserves* conserving key examples of terrestrial and marine ecosystems, it was *unnecessary and impractical* to apply the concept of representative reserves to freshwater ecosystems;
- it was assumed that the provision of fish passage facilities was either impractical, uneconomic, or unnecessary;
- it was assumed that *groundwaters and surface waters were somehow separate*, and could be managed independently; and finally:
- it was assumed that there was no need for rigorous program implementation, compliance auditing and enforcement; that illegal dams, bores, off-takes and levee banks would be minor and insignificant features in overall water management programs.

While the Council of Australian Governments (COAG) water reform agenda signalled the death of some of these assumptions (concerning environmental flows, for example) others live on, to a large extent unscathed by the agenda. I argue below that, while many of these assumptions were once correct, this is no longer the case, and it is dangerous to make *any* of these assumptions in the development of State water management frameworks. I believe that, as far as the freshwater ecosystems of Australia are concerned, it is a key challenge of the next decade to reverse *all* of these assumptions.

3.5 The management of freshwater ecosystems: values and indicators

Considering the matter of values and measurable indicators, we must (a) predict the effect on values and indicators of our chosen policies and programs, and (b) design monitoring systems to assess the achievement of the objectives of these policies and programs, using these values and indicators.

3.5.1 Decide on the essential qualities, or values, which we are seeking to protect and pass on to future generations

Many values may be chosen. For example, the National Water Quality Management Strategy uses six general environmental values:

- aquatic ecosystems
- aquaculture and human consumers of aquatic foods
- agricultural water
- recreation and aesthetics
- drinking water

- industrial water

3.5.2 Decide on the indicators which we chose to measure these values.

Taking one of these values, aquatic ecosystems, let us consider the issue of indicators.

Many indicators can be used to measure the ability of water to sustain aquatic ecosystems.

We can chose dissolved oxygen as an indicator. In predicting the effects of our policies and programs, we will need to set targets or objectives which we will seek to achieve. At the very least, if one of our objectives is to maintain the stream in its present condition, we will seek to stabilise or improve dissolved oxygen.

However, dissolved oxygen varies diurnally (with the variation of day/night photosynthetic processes), and is affected by a variety of external factors, such as water temperature, stream flow rate, and leaf fall - which can vary seasonally (regularly) and irregularly (due to weather changes - flood or drought, or due to unpredictable and rare events such as bushfires.

The monitoring program we design must take account of these factors if our measurements are to have meaning over time. Ideally, we would wish to design a monitoring program with sufficient samples in time and space to allow us to use statistical techniques. At the end of the day, we need to specify a confidence level. One of our objectives might be: "to at least maintain current dissolved oxygen levels, within a 95% confidence limit".

We must chose a comprehensive set of indicators to assess value. In the case of the aquatic ecosystem value, it is conceivable that dissolved oxygen could be well within target limits, even though most aquatic fauna had died.

Monitoring programs must incorporate, wherever possible, indicators which integrate physical, chemical and perhaps biological variation. In this case, we would presumably need to incorporate a macroinvertebrate condition index, based on an equivalent reference measure. This is the mechanism used by the AusRivAS invertebrate sampling protocols.

An policy / program objective might be: "to maintain or improve the AusRivAS condition index for sampling points throughout this catchment".

3.5.3 Decide on the benchmarks we are going to apply to the indicators, and the methods by which we will establish reference points for these indicators

However, we must consider the condition of the ecosystem - is it pristine or modified? We will need to apply different criteria to assess the meaning of indicator measurements.

In the case of our dissolved oxygen indicator, benchmarks are available for both pristine and modified streams, thanks to the complex scientific and consultative exercise behind the ANZECC *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.

If we have chosen an indicator outside the scope of these guidelines (and this will certainly occur regularly) the guidelines offer a systematic approach to determining indicator targets or objectives - where there is reliable and relevant data.

In relation to integrative indices such as the AusRivAS data, benchmarks depend on reference sites. Given the possibilities of long term changes (such as climate change, or ozone depletion) it is important - as far as possible - to have reference sites subject to minimal human interference, or in some cases, stable human interference levels.

The maintenance of long-term reference sites in areas subject to complex human disturbance becomes difficult or impossible due to the complexity of inter-related effects and repercussions. To the greatest extent possible, systems of representative freshwater ecosystems must be identified, selected and protected from human interference to the greatest degree possible (Nevill 2000a).

At present there is no Australia-wide agreement on the classification of ecosystem type which would allow a consistent national approach to establishing representative freshwater reserves. However, the Interim Biogeographic Regionalisation of Australia does provide a rough framework to use as a base, in combination with type classifications of rivers, wetlands and aquifers.

A project to develop such an approach, in combination with Commonwealth assistance to States to develop comprehensive freshwater system inventories (extending existing wetlands inventories to encompass streams and aquifers) is an urgent necessity.

3.5.4 Given that knowledge about the environment will change, possibly in major ways, how can we provide for benchmarks which have not yet been thought of?

Ten years, or a hundred years down the track, it is almost certain that increasing knowledge about ecosystems, combined with different emerging problems and issues, will result in the selection of indicators which we haven't yet thought of.

Reference areas provide the only mechanism we have which will allow useful benchmarks to be established for such indicators. Freshwater reference areas must encompass rivers, wetlands and aquifers. The wide definition of "wetlands" used by the Ramsar Convention provides a guide in this regard.

Such reference areas must be comprehensive, adequate and representative, and the definition of these terms used by the Regional Forest Agreement process provides a template for use in freshwater.

3.5.5 Decide on the timescales we are going to apply to our predictions and measurements.

What does sustainability mean? We must decide on the timescales we are going to apply to our predictions and measurements. Ten years? A hundred years? A thousand years? These three "round figures" are probably the most useful.

Are we achieving sustainability if our dissolved oxygen, and our AusRivAS indicators remain stable over 10 years? The answer may well be: "maybe".

I suggest that in designing our policies and processes, we need to use *all* these three broad timescales. In terms of designing and implementing monitoring programs to assess the achievement of sustainability, other short-term goals must be set. Realistically, 5, 10 and 20 year timescales may be the most useful for most indicators.

3.5.6 the design of monitoring programs where we believe we can apply statistical techniques to assign probabilities to the measurement of indicators

For each value, and for each indicator within the suite of indicators chose to represent each value, monitoring programs should be designed which - in advance - anticipate the need to set confidence limits on outcomes.

Where resources do not allow the implementation of monitoring programs which will allow confidence levels to be established, this must be clearly stated in all relevant documents covering the design, implementation and reporting of monitoring results.

Where confidence levels cannot be set, trends should nevertheless be anticipated and measured. Program targets, by necessity, will need to be set in absolute terms - these will usually be indicator value ranges.

3.5.7 Decide the methods we are going to use to predict the effects of our chosen processes and programs on our set of indicators

For each value, and for each indicator within the suite of indicators chose to represent each value, methods must be chosen and described (in policy / program design documentation) which are used to predict the effects of our chosen processes and programs on our set of indicators.

In the case of dissolved oxygen, for example, catchment management programs to stabilise soil erosion in both riparian and broadscale farmland may result in a decrease in water nutrient levels. These nutrient levels will in turn affect algae growth, which in turn will affect diurnal dissolved oxygen cycles.

These effects, due to their complexity, cannot be predicted accurately. However, I believe that they must be predicted, and this must be done and reported clearly and publicly, with all key assumptions explicitly stated. Only by such an approach will predictive methods improve, and opportunities for predictive model refinement and data collection will appear.

Predictive models are improving, however, the growth of more sophisticated models usually feed on better data. Unless this data is available, the increasing technical accuracy of the models is wasted.

3.5.8 Identify the uncertainties involved in these methods, and the way we will account for these uncertainties

We live in an uncertain world, and this uncertainty must be recognised in the design of policies and resource management programs, and in monitoring and reporting arrangements designed to assess the effectiveness of these policies and programs.

If monitoring shows a that, within a 95% confidence level, dissolved oxygen has declined by 5% over 10 years, what does that mean?

Where a monitoring program shows a declining indicator over a 5 year period, but without a confidence level, what does that mean?

In a world of limited resources, funding should be allocated both on the matter of uncertainty, but also on the matter of threat. Where important threats appear, and uncertainty is high, monitoring and assessment programs must be increased, and if necessary precautionary preventative or remedial action must be taken.

Conversely, where threats are low, a greater degree of uncertainty is acceptable.

3.5.9 Summary: prediction and monitoring of indicators

In considering the matter of values and measurable indicators, we must (a) predict the effect on values and indicators of our chosen policies and programs, and (b) design monitoring systems to assess the achievement of the objectives of these policies and programs.

Even where data is inadequate, and the science is shaky, clear decisions must be made and articulated in the eight areas discussed above.

Sets of values, indicators and indicator targets must be established, predicted, measured and evaluated. Where evaluation indicates that targets are not being met, the design and implementation of policies and programs must be reviewed and improvements must be made.

Such an approach is, I believe, the only way to provide a framework for the sustainable management of natural resources which can be justified, argued, measured and reported.

And built on by those that follow us.

3.6 The management of freshwater ecosystems: principles and processes

Firstly, this section identifies three sets of principles which need to be incorporated in the water management processes embodied in sustainable policies and programs. These three sets relate to (a) ecological sustainability, (b) environmental management systems, and (c) administrative principles applicable to scientific and consultative management frameworks. It is argued that these principles have been accepted broadly within current Australian management paradigms.

Secondly, a hypothetical nation-state management framework for water resources is assessed against these principles.

Thirdly, it is suggested that more detailed catchment-scale management frameworks should be assessed against these principles. This suggestion is not developed in detail in this paper.

3.6.1 What principles need to be applied?

The principles of sustainable development have evolved over a long period of time. Concerns over the protection of the environment have undoubtably been expressed for thousands of years. Many recent expressions of these principles can be found within international statements and agreements (Nevill 2000b).

The management processes we use today must take sustainability principles into account. Moreover, they must embody other principles broadly accepted within current management frameworks, such as those relating to stakeholder consultation, or quality assurance. For the purposes of this discussion, principles are limited to those relating to:

- sustainability (drawn from Commonwealth and Victorian documents),
- government administration (drawn from Australian environmental assessment documents), and
- environmental management (drawn from accepted international environmental management system processes) are examined.

These principles, along with additional discussion, can all be located in Nevill 2000b, and form a minimum base for the establishment of operational principles.

More "advanced" principles are available, and should be used once processes are handling the basic set of principles well. Advanced principles include:

- the Wingspread Principles;
- the Hannover Principles, and
- the Natural Step Principles.

These can be found listed on the USA Department of Energy website: http://www.sustainable.doe.gov/overview/principles.shtml .

3.6.1.1 Sustainability principles

Principle of integration of economic, social and environmental considerations

(1) Sound environmental practices and procedures should be adopted as a basis for ecologically sustainable development for the benefit of all human beings and the environment.

(2) This requires the effective integration of economic, social and environmental considerations in decision making processes with the need to improve community well-being and the benefit of future generations.

(3) The measures adopted should be cost-effective and in proportion to the significance of the environmental problems being addressed.

The precautionary principle

(1) If 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.

(2) Decision making should be guided by--

(a) a careful evaluation to avoid serious or irreversible damage to the environment wherever practicable; and

(b) an assessment of the risk-weighted consequences of various options.

Principle of intergenerational equity

The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

Principle of conservation of biological diversity and ecological integrity

The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making.

Central to the conservation of Australia's biological diversity is the establishment of a comprehensive, representative and adequate system of ecologically viable protected areas, integrated with sympathetic management of all other areas, including agricultural and resource production systems.

Principle of improved valuation, pricing and incentive mechanisms

(1) Environmental factors should be included in the valuation of assets and services.

(2) Persons who generate pollution and waste should bear the cost of containment, avoidance and abatement.

3) Users of goods and services should pay prices based on the full life cycle costs of providing the goods and services, including costs relating to the use of natural resources and the ultimate disposal of wastes.

(4) Established environmental goals should be pursued in the most cost effective way by establishing incentive structures, including market mechanisms, which enable persons best placed to maximise benefits or minimise costs to develop solutions and responses to environmental problems.

Principle of shared responsibility

(1) Protection of the environment is a responsibility shared by all levels of Government and industry, business, communities and the people of Australia.

(2) Producers of goods and services should produce competitively priced goods and services that satisfy human needs and improve quality of life while progressively reducing ecological degradation and resource intensity throughout the full life cycle of the goods and services to a level consistent with the sustainability of biodiversity and ecological systems.

Principle of product stewardship

Producers and users of goods and services have a shared responsibility with Government to manage the environmental impacts throughout the life cycle of the goods and services, including the ultimate disposal of any wastes.

Principle of wastes hierarchy

Wastes should be managed in accordance with the following order of preference--

(a) avoidance;

(b) re-use;

(c) re-cycling;

(d) recovery of energy;

(e) treatment;

(f) containment;

(g) disposal.

Principle of integrated environmental management

If approaches to managing environmental impacts on one segment of the environment have potential impacts on another segment, the best practicable environmental outcome should be sought.

Principle of compliance enforcement

Enforcement of environmental requirements should be undertaken for the purpose of--

(a) better protecting the environment and its economic and social uses;

(b) ensuring that no commercial advantage is obtained by any person who fails to comply with environmental requirements;

(c) influencing the attitude and behaviour of persons whose actions may have adverse environmental impacts or who develop, invest in, purchase or use goods and services which may have adverse environmental impacts.

4.6.1.2 Principles of good government

Participation
The process should include adequate participation of all stakeholders.

Transparency
EIA should be conducted through an established process. All elements of the process should be clearly understood by all participants.

Certainty
The process should have clear objectives, be consistent, and be conducted within agreed time-frames.

Accountability
Decision makers within government need to be able to provide clear and detailed reasons for their decisions to all stakeholders. Appeal provisions to an independent authority should exist. The EIA process should cover the life of the proposal, through project design, construction, operation and finally decommissioning: project operators must be accountable for commitments made during project approval.

Members of the public should therefore be given--

(a) access to reliable and relevant information in appropriate forms to facilitate a good understanding of environmental issues;

(b) opportunities to participate in policy and program development.".

Integrity
Decisions need to be based on the best available information, and all relevant factors need to be taken into account by decision-makers. Where impacts are uncertain, outcomes should rely on sound risk assessment and management.

Cost-effectiveness
The process should meet its objectives while imposing the least cost to participants. Accreditation of State government processes by the Commonwealth is a key mechanism for avoiding unnecessary duplication of approval processes.

Flexibility
The process should be able to accommodate proposals varying in type, scope of impact, and complexity. Flexibility is desirable in terms of the form of EIA process, issues to be addressed, process time-frames, and degree of public participation.

Practicality
The process should recognise community concerns, commercial realities, best practice technology, and scientific uncertainties.

3.6.1.3 Principles of environmental management

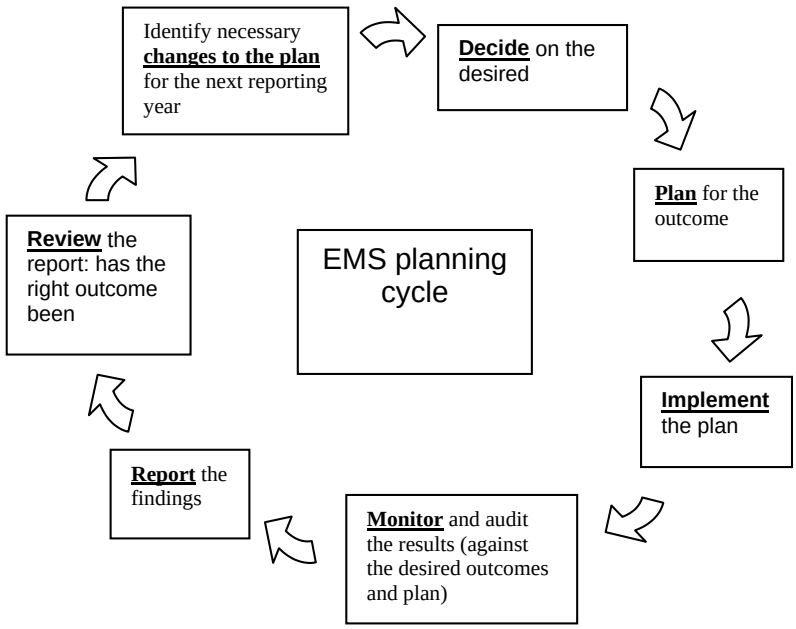
Environmental Management Systems are procedural planning methods described by the ISO 14,000 series of standards (International Standards Organisation).

The 'principles' listed in the ISO documents are a combination of principles and mechanisms. Examination of the philosophy embodied in the systems suggests that the three key principles on which the framework is constructed are:

- producer responsibility
- quality assurance, and
- continual improvement.

Feedback is a key element of the framework, and this is implicit in the use of the word "system" which, in its engineering definition, incorporates feedback as an essential element. The EMS process can be illustrated as a loop: **Figure 1**:

The first step in the iterative process, of course, is to 'decide on the desired outcome'.



Producer responsibility

The very reason for undertaking the EMS planning process is a recognition that responsibility for the environmental effects of a product or service doesn't stop at the factory gate. Responsibility exists, all-be-it in an increasingly shared fashion, from cradle to grave.

An ongoing responsibility for these environmental effects is accepted as the spatial and temporal settings widen. The environmental effects of, say, a battery, extend past its creation, through its use, and into its life after death - whether it be re-cycled or disposed of in a landfill.

The producer responsibility principle can be stated in a variety of ways. One definition is: "The recognition of continuation of responsibility for the environmental effects of products and services by the producer. While such responsibilities become increasingly shared by users and beneficiaries of the products or services, they continue to exist, and should be recognised and accounted for by the original producer".

Quality assurance

Stated simply, the principle of quality assurance is that "quality is not an accident". The quality assurance principle can be stated: "in the management of complex systems, processes and programs, their success in achieving the desired outcomes cannot be taken for granted, but must be carefully planned, monitored and evaluated".

Continual improvement

The iterative planning process on which environmental management systems is based offers the possibility of not only achieving the initial objectives, but of re-evaluating these objectives in the light of changing technology, scientific knowledge and community expectations.

The 'principle of continual improvement' can be stated: "producers of environmental effects need to establish planning frameworks which will allow continual improvement in environmental performance over time, and circumstances and knowledge change".

3.6.2 A hypothetical nation-state management framework

A number of essential elements need to be incorporated in government programs in order to protect freshwater biodiversity. These include:

- A natural resource accounting framework;
- Environmental impact (risk) assessment (EIA) requirements for new proposals;
- A system of State-owned and managed protected areas, or nature conservation reserves, complemented by privately-owned reserves;
- A water management framework (legislation, policy and infrastructure); and
- Land use planning (LUP) requirements, largely implemented through local government.

To illustrate, let us imagine that Australia has nine State jurisdictions rather than eight. The ninth, named “Great Southern Land” or GSL for short, could be a large island lying not far from Tasmania.

Examining the five key elements listed above in more detail, we find some important differences between the situation in GSL and the existing situation in the rest of Australia.

3.6.2.1 A natural resource accounting framework

The State's natural resource accounting framework starts with the explicit recognition that natural assets belong both to the present and the future. There is also explicit recognition of the intrinsic value of these resources, irrespective of the needs of humans.

To manage any resource, it is necessary to keep track of stocks and flows. Audits must be undertaken at regular intervals, and reports prepared. Stock inventories must include information on condition. Reports must reconcile and explain changes which have taken place.

Within a bioregional framework, GSL has prepared a comprehensive inventory of *all* freshwater ecosystems, encompassing value benchmarks, condition indices, catchment boundaries, and environmental flow requirements. This latter category is not limited to river flows, but includes requirements on *groundwater flows* where these are relevant to the health of ecosystems dependent on groundwater. The inventory is utilised by State-of-the-Environment reports, and by the State’s EIA and LUP frameworks.

Where they are inter-connected, surface water and groundwater resources are managed together, as a single resource (see below). Stocks and flows or both resources are measured and estimated. Aquifer recharge areas are identified and protected, and flow rates estimated. The interchanges between surface and groundwater flows are studied and modelled, and the quality of groundwater monitored and reported.

Corporations which use significant natural resources, including large farming operations, are required to include "earth accounts" in every annual report.

3.6.2.2 Environmental assessment requirements

The State's framework for the assessment of environmental impacts and risks operates under the requirements of separate statutes governing: (a) major projects, (b) water,

and (c) local government landuse planning procedures. Use of the precautionary principle is explicitly required at all levels.

Environmental assessment frameworks need to be able to manage proposals of varying type and scale in flexible, efficient and effective ways. As is standard practice in other Australian States, GSL's framework utilises a "gold-plated" procedure (with full public consultation) for large and significant proposals, while relying on less costly and faster procedures within the LUP framework to deal with the far more numerous smaller proposals.

However, recognising that the cumulative effects of incremental small-scale development can have major environmental effects, GSL has put in place specific requirements for proposals where cumulative effects are likely to be important. The construction of farm dams and levee banks, surface water diversions, groundwater abstractions, and native vegetation removal, are among activities identified on the State's "cumulative effects list". *None of these activities can take place unless they comply with a catchment master plan prepared for each major catchment* using integrated catchment management principles. In order to manage the *tyranny of small decisions* effect (Odum 1982), there are no "exceptions" clauses.

Under the master plan, caps must be placed on water diversions and abstractions (of *both* groundwater and surface water, where these systems are interconnected), total storage capacity of dams, number and location of on-stream dams, levee bank construction, and vegetation clearance in each sub-catchment. Where there is insufficient data to accurately determine cap size, statutes require that a precautionary approach must be taken.

The environmental assessment processes applying to major water infrastructure proposals must examine the direct and indirect effects of *both* the infrastructure itself (eg: a dam) *and* proposals (eg: large scale irrigation proposals) on which the economics of the infrastructure depend.

3.6.2.3 A system of State-owned protected areas complemented by private reserves;

The GSL State government has established a comprehensive, adequate and representative reserve system protecting 15% of each major *terrestrial*, *marine* and *freshwater* ecosystem. Representative freshwater ecosystem 'types' have been identified and listed using layers of geomorphic, hydrologic and ecologic templates – applied within each Interim Biogeographic Region of Australia (IBRA) region. From this inventory of freshwater ecosystems, representative rivers, wetlands and aquifers have been selected for "protected area" status. Certain ecological communities of extreme importance (such as springs containing unique endemic biota) are *entirely* protected (that is, 100% of the existing ecological community is protected), and stringent precautionary safeguards are applied to their nurturing catchments and aquifers.

The reserve system includes value indices attached to each reserve (international, national, state, regional, local). These value indices are used to trigger different levels of EIA or LUP procedures in cases where a proposal may threaten the values of a reserve through indirect effects.

LUP procedures, where necessary, are used to protect the catchments and buffer zones of reserves.

GSL has established a system of *Natural Rivers*, protected under the GSL *Natural Rivers Act*. This Act is similar to Victoria's *Heritage Rivers Act 1992*. It protects rivers, or sections or rivers, valued for ecological, geomorphological, wilderness, recreational, landscape and historic/cultural reasons. At least one good example of each major river type has been marked by this legislation as "never to be dammed", recognising that fish passage provisions, and environmental flow regimes, can never be fully effective in protecting a full suite of ecological values. The Act, in addition to establishing statutory

freshwater reserves, provides high-value rivers outside the reserve system with an additional degree of protection through triggering comprehensive and precautionary strategic environmental risk assessments before new water-based developments can occur.

Incentives and support services are offered to private landholders to encourage the conservation management of private land. The reserve system incorporates international obligations under Ramsar, World Heritage, and other treaties.

3.6.2.4 A water management framework (legislation and infrastructure)

The GSL water management framework provides for State and private roles in water harvesting, storage and sale. It includes controls and incentives for efficient use. It removes incentives and structures in previous legislation which were aimed to assist in "recovering" agricultural land from "swamps". It requires surface and groundwater environmental flows to have "first priority" over available water in years of low rainfall, and requires the government to develop provisional water allocation plans in each subcatchment within major river basins, *including both surface and groundwater*.

Recognising the principle of quality assurance as a key sustainability principle, GSL statutes require State and local governments to undertake audits and related compliance programs, and to report the results of such programs to the public. Extensive use is made of the internet for public reporting.

The water allocation plans within subcatchments form a part of the *catchment master plan* referred to above.

The framework also provides for comprehensive, publicly available information on the size, use and health of the water resource, including both surface and groundwater. Inexpensive and convenient public access is available to information on all water allocations and diversions, the position, function and environmental effects of all dams and weirs, the contents of all catchment master plans, and water auditing and compliance programs.

Groundwater and surface water resources are the responsibility of a single government agency, and groundwater and surface waters fall within the scope of a single piece of legislation: the GSL *Water Act*. The Water Act contains an objective and a list of principles (including an expanded list of sustainability principles - Nevill 2000a). The Act requires that all stakeholders with a direct role in the management of the water resource must act to further the objective of the Act, and take into account the principles listed in the Act.

No new dams or weirs are permitted without fish passage provisions, and all obsolete weirs have been removed. Every attempt is made to ensure fish passage facilities work as well as practical.

Extraction of groundwater is only permitted in compliance with *water allocation plans* which take account of both surface and groundwaters within a major catchment, and which have been prepared by catchment working groups representing *all* stakeholders, including non-human stakeholders.

These catchment working groups operate within a statutory framework provided by the State, which guides and constrains their operation. The water allocation plans form part of the *catchment master plan* prepared for the catchment basin. These plans *must* be considered by local government in land use planning decisions (see below).

3.6.2.5 Land use planning (LUP) requirements

In line with normal practice, GSL's LUP requirements are carried out largely by local government, within a framework provided by the State. The LUP framework provides for the development of land use zoning plans, and facilitates the development of catchment master plans by the community. The LUP framework includes special

purpose State strategies (such as the GSL wetlands policy and the biodiversity policy) and requires that land use zoning and catchment master plans must be compatible with these policies. Consequently these plans embody conservation strategies which rest in part on bioregional inventories.

The GSL wetlands policy (recognising the historic degradation of the wetland resource) requires "no net loss" of wetland habitat. Any proposal which impacts adversely on wetland habitat must develop compensatory proposals, perhaps at spatially different but ecologically similar sites. Any artificial compensatory wetland must be at least 50% larger than the wetland destroyed, must mimic the natural wetland as closely as possible, and must include ongoing maintenance funds to cover such matters as routine pest control, condition monitoring, and reporting provisions. Under the wetlands policy, freshwater ecosystems listed in the inventory are categorised by value and significance, and appropriate requirements are placed on the LUP framework to ensure special protection for the catchments of high value wetlands, as well as the inclusion of minor wetlands in the ICM planning framework.

GSL's biodiversity legislation considers threatened species, communities and ecosystems. The legislation primarily targets threatening processes, but also provides protection for "critical habitat" through the LUP framework – impacting on both public and private land.

The LUP framework also embodies strategic planning provisions for the specific protection of the *values* of State reserves (on public land) and critical habitat (on private land) as well as habitat created and protected under voluntary landholder agreements. According to statute, land use plans, and catchment master plans, must take these values into account.

Local government land use planning decisions, and the actions of the State government, must take into consideration the relevant catchment master plan, and must be compatible with the objectives of that plan, and the objectives of the Water Act. As mentioned above, the catchment management plan is checked and endorsed by an independent panel advising the minister before becoming legally 'active', and the objectives of the plan must be developed within the framework specified by the GSL State government.

3.6.2.6 Coordination of programs

In order to coordinate programs over the five areas listed, the State has established a degree of harmony within different pieces of legislation, and the different programs established under these statutes. This has been achieved by establishing general objectives and principles covering all State programs, and reflecting these objectives and principles within two key on-ground planning frameworks: local government land use planning, and catchment planning developed under the guidance of a small number of State Catchment Management Agencies (established under the authority of the State's *Catchment Act*).

This coordinated approach is modelled on frameworks which have been developed in Tasmania (which has an over-arching system of objectives within a suite of legislation known as the *Resource Management and Planning System*) and New South Wales and Victoria - which have well developed catchment management frameworks based on statute.

Specifically, the key components of GSL's framework are:

- incorporation in the (primary) Planning and Approvals Act a schedule of objectives and principles;
- reflecting these objectives and principles in each statute governing areas of natural resource management (including the five key areas listed above); and

- requiring decision makers to give effect to these objectives and principles in their decisions. These decision makers include: (a) State government in directing and funding State-wide programs; (b) local government in developing planning schemes and in implementing planning schemes though approval decisions, and (c) catchment agencies in developing and implementing catchment master plans (and the component plans which make up the catchment master plans).

3.6.3 Assessment of the hypothetical framework against its design principles

In designing the process framework, an attempt has been made to incorporate key principles of sustainability, environmental management, and good government. But has this been successful? A check must be carried out.

Principle	**Process elements**	**Can improvements be made?**
social, economic and environmental integration	Hierarchical decision-making tiers allow for integration of different values through Commonwealth, State, local government and catchment plans, all operating within objectives and principles established by statute.	
precautionary	Catchment master plans must set precautionary caps on catchment development, before significant problems emerge.	Application of the precautionary principle could transfer 'onus of proof of sustainability' on to the developer.
intergenerational equity	This principle explicitly underlies the statutory objectives of the State planning framework.	
ecological integrity	The State's reserve framework, coupled with its planning mechanisms, is intended to protect ecological integrity.	
economic incentives		Room for improvement here.
shared responsibility	Planning and reporting framework embodies shared responsibility.	Catchment planning groups could be funded from a catchment landholder or water user levee
product stewardship		Irrigators to pay saline drainage levees?
waste hierarchy		Need mechanisms for reducing saline drainage
integrated environmental management	Impact / risk assessment of major water infrastructure projects requires economic and environmental assessments of both the infrastructure proposals and the irrigation proposals on which the project's economic viability depends. The tiered decision-making structures, with catchment master plans at the 'bottom' provide a general mechanism for integrated environmental management.	

compliance enforcement	Compliance enforcement programs are in place, and compliance audits are undertaken.	Need programs to remove all illegal dams
Principle	**Process elements**	**Can improvements be made?**
participation	Consultative community / stakeholder mechanisms for developing and reviewing catchment master plans provide for participation.	
transparency	All plans, licences and permits are available for public scrutiny..	Meetings of planning groups at all levels should be open to public observers, given prior notice. Observers must not participate in the meetings
certainty	The approval process is well understood and publicly accessible..	Decisions must be made within given timeframes
cost-effectiveness	Cost effectiveness must consider the benefits of a planning system where precautionary steps help avoid major future costs of environmental degradation.	
flexibility	The hierarchical approach of the planning framework, coupled with EIA requirements balanced against both the size of the proposal and its likely impact provide a flexible approach to assessing impacts and risks.	
practicality	The use of the precautionary approach coupled with basic planning frameworks leans towards practicality. "No development" is always a practical alternative.	
producer responsibility	Those who benefit by using water resources also contribute directly to the planning processes, and contribute funds to run these processes.	As above: irrigators to pay saline drainage levees?
quality assurance	Management programs have clearly stated general objectives AND measurable performance indicators. Monitoring and reporting programs assess performance. Programs must adapt to poor performance.	
continual improvement		Room for improvement here?

The result has been that a rigorous check of the process against the design principles has revealed a number of short-comings. Once identified, these can be remedied.

It is essential that all policy and program development assess the degree to which design processes embody design principles. Process elements must be subjected to rigorous scrutiny, if the desired outcome of sustainable management is to be achieved. Quality is not an accident.

3.6.4 Scrutiny of detailed catchment-scale processes.

To achieve sustainability, all management processes must be subjected to examination to ascertain the extent to which they embody principles of sustainability, as well other principles running alongside sustainability, such as those of good government and environmental management discussed above.

While this will not be attempted in this paper, Appendix One illustrates how more detailed catchment-level processes could be designed to incorporate these principles, within the more general nation-State framework described above.

3.7 Measuring and assessing sustainability: conclusion

Achieving sustainability will be an on-going and evolving process. However, certain elements, or building blocks, are now available.

Designing ecologically sustainable programs must have at least two central thrusts.

Firstly, values must be identified, and sets of indicators chosen to represent these values. Policies and programs now in place, and those currently being designed, will affect these indicators. In some cases, where the natural systems or mechanisms under study are simple and amendable to modelling, and where sufficient accurate data is available to support modelling, it will be possible to accurately predict the ways in which management programs will affect indicators, at least in the short term.

In many cases such accurate predictions will not be available, at least at any reasonable cost. Nevertheless, I have argued that these predictions must be made, in quantitative terms wherever meaningful. Moreover, such predictions must not only be made, but must be clearly articulated, monitored and reviewed.

Where sustainability performance targets are not being met by monitoring programs, management must be reviewed and improved.

Long-term benchmarks are necessary, and an essential part of their establishment will involve comprehensive, adequate and representative systems of freshwater ecosystem reserves. Such reserves must encompass rivers and streams, wetlands, and aquifers - in fact encompassing the full range of "wetlands" covered by the Ramsar Wetlands Convention definition.

Secondly, performance targets alone will not be enough. Management processes, at all scales, must be designed to incorporate principles of sustainability, along with concomitant principles such as those of good government and environmental management. Once designed, processes must be subject to rigorous examination to ascertain the extent to which they do in fact embody these principles.

4. Model statutory objectives and principles

It has been argued above that democracy, as an technique of nation-state governance, contains a fatal flaw. Protecting the planet for the benefit of future generations and non-humans can only be achieved by placing strict limits on development. These limits are absolutely critical in the management of cumulative effects, yet the limits will not only damage the immediate interests of today's voters, but they will also appear unfair, as the nature of cumulative effects is such that the immediate impacts of each small development will appear insignificant in the larger context.

It has also been argued above that the only way in which sustainability programs will be effective is to rigorously apply sustainability principles. Each government program must be audited against these principles.

The 'model' provisions contained in this section have been derived by modifying and amalgamating sections of Tasmania's *Water Management Act 1999*, the NSW *Water Management Act 2000*; and Victoria's *Environmental Protection (Livable Neighbourhoods) Bill 2000*.

They are presented here as a model for the development of objectives and principles applicable both to: (a) a whole-of-government natural resource management framework (like the Tasmanian Resource Management and Planning System), and (b) water legislation lying within that broader framework. Objectives and principles are hence presented in two main parts:

Section 4, Part One

Objectives and principles of GSL's Resource Management and Planning System

LAND USE PLANNING AND APPROVALS ACT: SCHEDULE 1 - OBJECTIVES

PART 1a OBJECTIVES OF THE RESOURCE MANAGEMENT AND PLANNING SYSTEM

1. The objectives of the resource management and planning system are -

   (a) to provide the sustainable development of natural and physical resources and the maintenance of ecological processes and genetic diversity; and

   (b) to provide for the fair, orderly and sustainable use and development of air, land and water; and

   (c) to encourage public involvement in resource management and planning; and

   (d) to facilitate economic development in accordance with the objectives set out in paragraphs (a), (b) and (c); and

   (e) to promote the sharing of responsibility for resource management and planning between the different spheres of Government, the community and industry in the state.

2. In clause 1(a), "sustainable development means managing the use, development and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic and cultural well-being and for their health and safety while -

   (a) sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations; and

   (b) safeguarding the life -supporting capacity of air, water, soil and ecosystems; and

   (c) avoiding, remedying or mitigating any adverse effects of activities on the environment.

PART 1b - OBJECTIVES OF THE PLANNING PROCESS ESTABLISHED BY THIS ACT

The objectives of the planning framework established by this Act are, in support of the objectives set out in Part 1 of this Schedule -

3.

(a) to require sound strategic planning and co-ordinated action by State and local government; and

(b) to establish a system of planning instruments to be the principal way of setting objectives, policies and controls for the use, development and protection of land; and

(c) to ensure that the effects on the environment are considered and provide for explicit consideration of social and economic effects when decisions are made about the use and development of land; and

(d) to require land use and development planning and policy to be easily integrated with environmental, social, economic, conservation and resource management policies at State, regional and municipal levels; and

(e) to provide for the consolidation of approvals for land use or development and related matters, and to co-ordinate planning approvals with related approvals; and

(f) to secure a pleasant, efficient and safe working, living, and recreational environment for all residents of, and visitors to the State; and

(g) to conserve those buildings, areas or other places which are of scientific, aesthetic, architectural or historical interest, or otherwise of special cultural value: and

(h) to protect public infrastructure and other assets and enable the orderly provision and co-ordination of public utilities and other facilities for the benefit of the community: and

(i) to provide a planning framework which fully considers land capability.

PART 1c PRINCIPLES OF THE RESOURCE MANAGEMENT AND PLANNING SYSTEM

4. The principles of the resource management and planning system are -

4A. Principle of integration of economic, social and environmental considerations

(1) Sound environmental practices and procedures should be adopted as a basis for ecologically sustainable development for the benefit of all human beings and the environment.

(2) This requires the effective integration of economic, social and environmental considerations in decision making processes with the need to improve community well-being and the benefit of future generations.

(3) The measures adopted should be cost-effective and in proportion to the significance of the environmental problems being addressed.

4B. The precautionary principle

(1) If 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.

(2) Decision making should be guided by--

(a) a careful evaluation to avoid serious or irreversible damage to the environment wherever practicable; and

(b) an assessment of the risk-weighted consequences of various options.

4C. Principle of intergenerational equity

The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

4D. Principle of conservation of biological diversity and ecological integrity

The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making.

Central to the conservation of Australia's biological diversity is the establishment of a comprehensive, representative and adequate system of ecologically viable protected areas, integrated with sympathetic management of all other areas, including agricultural and resource production systems.

4E. Principle of improved valuation, pricing and incentive mechanisms

(1) Environmental factors should be included in the valuation of assets and services.

(2) Persons who generate pollution and waste should bear the cost of containment, avoidance and abatement.

(3) Users of goods and services should pay prices based on the full life cycle costs of providing the goods and services, including costs relating to the use of natural resources and the ultimate disposal of wastes.

(4) Established environmental goals should be pursued in the most cost effective way by establishing incentive structures, including market mechanisms, which enable persons best placed to maximise benefits or minimise costs to develop solutions and responses to environmental problems.

4F. Principle of shared responsibility

(1) Protection of the environment is a responsibility shared by all levels of Government and industry, business, communities and the people of GSL.

(2) Producers of goods and services should produce competitively priced goods and services that satisfy human needs and improve quality of life while progressively reducing ecological degradation and resource intensity throughout the full life cycle of the goods and services to a level consistent with the sustainability of biodiversity and ecological systems.

4G. Principle of product stewardship

Producers and users of goods and services have a shared responsibility with Government to manage the environmental impacts throughout the life cycle of the goods and services, including the ultimate disposal of any wastes.

4H. Principle of wastes hierarchy

Wastes should be managed in accordance with the following order of preference--

(a) avoidance;

(b) re-use;

(c) re-cycling;

(d) recovery of energy;

(e) treatment;

(f) containment;

(g) disposal.

4I. Principle of integrated environmental management

If approaches to managing environmental impacts on one segment of the environment have potential impacts on another segment, the best practicable environmental outcome should be sought.

4J. Principle of enforcement

Enforcement of environmental requirements should be undertaken for the purpose of:

(a) better protecting the environment and its economic and social uses;

(b) ensuring that no commercial advantage is obtained by any person who fails to comply with environmental requirements;

(c) influencing the attitude and behaviour of persons whose actions may have adverse environmental impacts or who develop, invest in, purchase or use goods and services which may have adverse environmental impacts.

4K. Principle of accountability

(1) The aspirations of the people of GSL for environmental quality should drive environmental improvement.

(2) Members of the public should therefore be given--

(a) access to reliable and relevant information in appropriate forms to facilitate a good understanding of environmental issues;

(b) opportunities to participate in policy and program development.".

Section 4, Part Two:

Part 2a. Objectives of the Water Management Act

6. (1) The objectives of this Act are to further the objectives of the resource management and planning objectives and principles of the resource management and planning system of the State, as specified in Schedule 1, and in particular to provide for the use and management of the freshwater resources of the State having regard to the need to:

(a) promote sustainable use and facilitate economic development of water resources in accordance with the principles of ecologically sustainable development; and

(b) recognise and foster the significant social and economic benefits resulting from the sustainable use and development of water resources for the generation of hydro-electricity and for the supply of water for human consumption and commercial activities dependent on water; and

(c) maintain ecological processes and genetic diversity for aquatic ecosystems; and

(d) provide for the fair, orderly and efficient allocation of water resources to meet the community's needs; and

(e) increase the community's understanding of aquatic ecosystems and the need to use and manage water in a sustainable and cost efficient manner; and

(f) encourage community involvement in water resource management; and

(g) to encourage continual improvement through the provision of procedures for implementation, enforcement, evaluation, and review.

(2) It is the obligation of the Minister, the Secretary, a water entity and any other person on whom a function is imposed or a power is conferred under this Act to perform the function or exercise the power in such a manner as to further the objectives specified in subsection (1) and in Schedule 1.

Part 2b. Principles of the Water Management Act

5 Water management principles

(1) The principles set out in this section are the water management principles of this Act, and include the principles of ecologically sustainable development referred to in the objects of the Act.

(2) Generally:

(a) water sources, floodplains and dependent ecosystems (including groundwater and wetlands) should be protected and restored and, where possible, land should not be degraded, and

(b) habitats, animals and plants that benefit from water or are potentially affected by managed activities should be respected, protected and (in the case of habitats) restored, and

(c) the water quality of all water sources should be protected and, wherever possible, enhanced, and

(d) the cumulative effects of all activities with significant impacts on water resources and dependent ecosystems must be assessed, managed, evaluated and reviewed, and

(e) geographical and other features of indigenous significance should be protected, and

(f) geographical and other features of major cultural, heritage or spiritual significance should be protected, and

(g) the long-term social and economic benefits to the community should be maximised, and

(h) the principles of adaptive management should be applied, which should be responsive to monitoring and improvements in understanding of ecological water requirements.

(3) In relation to water sharing:

(a) sharing of water from a water source must protect the water source and its dependent ecosystems, and

(b) sharing of water from a water source must protect the basic landholder rights of owners of land, and

(c) sharing or extraction of water under any other right must not prejudice the principles set out in paragraphs (a) and (b), and

(d) climatic variability must be explicitly accounted for in sharing arrangements.

(4) In relation to water use:

(a) water use should avoid or minimise land degradation, including soil erosion, compaction, geomorphic instability, contamination, acidity, waterlogging, decline of native vegetation or, where appropriate, salinity and, where possible, land should be rehabilitated, and

(b) water use should be consistent with the maintenance of productivity of land in the long term and should maximise the social and economic benefits to the community, and

(c) the impacts of water use on other water users should be considered and minimised.

(5) In relation to drainage management:

(a) drainage activities should avoid or minimise land degradation, including soil erosion, compaction, geomorphic instability, contamination, acidity, waterlogging, decline of native vegetation or, where appropriate, salinity and, where possible, land should be rehabilitated, and

(b) the impacts of drainage activities on other water users should be avoided or minimised, and

(c) the historic damage to wetlands through drainage and levee bank construction should be recognised, with a view to avoiding future damage.

(6) In relation to floodplain management:

(a) floodplain management must avoid or minimise land degradation, including soil erosion, compaction, geomorphic instability, contamination, acidity, waterlogging, decline of native vegetation or, where appropriate, salinity and, where possible, land must be rehabilitated, and (b) the impacts of flood works on other water users should be avoided or minimised, and (c) the existing and future risk to human life and property arising from occupation of floodplains must be minimised.

(7) In relation to controlled activities:

(a) the carrying out of controlled activities must avoid or minimise land degradation, including soil erosion, compaction, geomorphic instability, contamination, acidity, waterlogging, decline of native vegetation or, where appropriate, salinity and, where possible, land must be rehabilitated, and

(b) the impacts of the carrying out of controlled activities on other water users must be avoided or minimised.

(8) In relation to aquifer interference activities:

(a) the carrying out of aquifer interference activities must avoid or minimise land degradation, including soil erosion, compaction, geomorphic instability, contamination, acidity, waterlogging, decline of native vegetation or, where appropriate, salinity and, where possible, land must be rehabilitated, and

(b) where linked, surface and groundwater resources need to be managed together in integrated ways, and

(c) the impacts of the carrying out of aquifer interference activities on other water users must be avoided or minimised.

(9) In relation to environmental protection:

(a) the complexity of natural processes and water-dependent ecosystems must be recognised, and the need for harmony, as far as possible, between these processes and imposed management regimes should be encouraged (the principle of minimal impact management);

(b) the principles for the provision of environmental flows, as agreed within the Council of Australian Governments Water Reform Framework, should be recognised and applied, and

(c) it should be recognised that humans are one of many species on this planet, and that other species, particularly water-dependent species in relation to this Act, have a right to coexistence with humans on this planet.

5. Conclusions and recommendations

The arguments developed in this paper involve an examination of three main elements:

- the tyranny of small decisions (or the deceptive power of cumulative effects);
- the limitations of a democratic system of government; and
- the role of sustainability principles.

Given that the cumulative effects advance in small incremental steps over a period of time, the impact of each step will almost certainly be insignificant when assessed against the wider scheme of things. In this context, establish caps to limit incremental development *will undoubtably* appear unfair to each individual affected. Nevertheless, the as time passes, the cumulative effects of hundreds or thousands of incremental steps results in major environmental degradation. Cumulative effects will *never* be controlled until we develop cultures which recognise that these apparently unfair decisions *are fundamentally necessary* to control the long-term damage caused by this incremental process.

The arguments developed in this paper conclude that democracy, as an technique of nation-state governance, contains a fatal flaw. Protecting the planet for the benefit of future generations and non-humans can only be achieved by placing strict limits on development. These limits are absolutely critical in the management of cumulative effects, yet the limits will not only damage the immediate interests of today's voters, but, by their very nature, they must also appear unfair. . This presents a dilemma for a democratic political system where politicians must face re-election within short time-frames, where non-humans and future generations do not vote. The dilemma is

heightened by the fact that our economic paradigm is still locked into the need for continual (indeed infinite) growth.

This presents a particularly intractable situation, although not one without hope. I have argued above that the only way in which sustainability programs will be effective is to rigorously apply sustainability principles. These principles, if accepted by the voting public, and rigorously implemented, will transcend the self-interest and short-term timeframes which are the fatal flaws of democracy. Each government program must be audited against these principles. However, beyond this task lies the issue of persuading the majority of the voting public of the importance of protecting the future, and of the inherent difficulties, particularly, with the management of cumulative effects.

This is where public good legislation has a role to play: in promoting and cementing sustainability principles so that they become an effective constraint on the democratic process.

The principles I have used in this paper are what I term "first generation sustainability principles". I have not moved on to a discussion of "second generation principles", as the immediate goal must be to incorporate the first generation principles into government programs. Second generation principles are, however, briefly discussed in Appendix 5.

Governments can either face up to these very difficult issues, or alternatively adopt the more traditional ('pragmatic') approach of focussing on assessing the adequacy of the State's natural resource management programs – within 'extended' short-term parameters. The latter approach, which I recommend against (but which I believe is the most likely outcome) will see Australia (along with the rest of the planet) move inexorably towards global environmental catastrophe

I would appreciate being included in any further consultations you may undertake, and I would be happy to address the committee with a telephone linkup if this is desirable. I would also like to be included in any discussions which might include the issue of the formulation of a draft statement of environmental principles.

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7. Appendices

Appendix One:

The inability of humans to accept the notion of impending planetary catastrophe:

Excerpts From "It's a Matter of Survival" (pp 39-41 & 235-238)
Anita Gordon & David Suzuki, Allen & Unwin Australia Pty Ltd, 1990.

There is a strange phenomenon that biologists refer to as "the boiled frog syndrome". Put a frog in a pot of water and increase the temperature of the water gradually from 20°C to 30°C to 40°C…to 90°C and the frog just sits there. But suddenly, at 100°C, something happens: the water boils and the frog dies.

Scientists studying environmental problems, particularly the greenhouse effect, see "the boiled frog syndrome" as a metaphor for the human situation: we have figuratively and in some ways literally, been heating up the world around us without recognising the danger.

Psychologist Robert Ornstein, co-author of "New World, New Mind", points out that those people who have been sounding warnings receive the same response from us as would someone attempting to alert the frog in danger of a rise in its water temperature from say 70°C to 90°C. If the frog could talk, he would say, "There's no difference, really. It's slightly warmer in here, but I'm just as well off". If you then say to the frog, "If the heat keeps increasing at that rate, you will die", the frog will reply, "We have been increasing it for a long time, and I'm not dead. So what are you worried about?"

"Our situation is like the frog's" says Ornstein. Today, despite the fact that researchers using the most sophisticated atmospheric monitoring equipment in the world are telling us that our future is at risk, we – as individuals and as governments – ignore or minimise the warnings.

The frog has a fatal flaw, explains Ornstein. Having no evolutionary experience with boiling water, he is unable to perceive it as dangerous. Throughout their biological evolution, frogs have lived in a medium that does not vary greatly in temperature, so they haven't needed to develop sophisticated thermal detectors in their skin. The frog in the pot is unaware of the threat and simply sits complacently until he boils.

Like the simmering frog, we face a future without precedent, and our senses are not attuned to warnings of imminent danger. The threats we face as the crisis builds – global warming, acid rain, the ozone hole and increasing ultraviolet radiation, chemical toxins such as pesticides, dioxins, and polychlorinated biphenyls (PCBs) in our food and water – are undetectable by the sensory system we have evolved. We do not feel the acidity of the rain, see the ultraviolet radiation projected through the ozone hole, taste the toxins in our food and water, or feel the heat of global warming except, as the frog does, as gradual and therefore endurable. Nothing in our evolutionary experience has prepared us for the limits of a finite world, one in which a five degree climate change over a matter of decades will mean the end of life as we have known it on the planet.

How did we come to this? How did we plan our own obsolescence? The answer lies in millennia of human history, a surprisingly brief chapter in the chronicle of the planet. You can see just how brief if you use a standard calender to mark the passage of time on Earth. The origin of the Earth, some 4.6 billion years ago, is placed at midnight January 1, and the present at midnight December 31.

Each calender day represents approximately 12 million years of actual history. Dinosaurs arrived on about December 10 and disappeared on Christmas day. Homo sapiens made an appearance at 11:45pm on December 31. The recorded history of human achievement, on which we base so much of our view of human entitlement, takes up only the last minute of that year.

The dinosaurs had a fortnight of supremacy on this planet before they were eradicated by some environmental catastrophe. We have had 15 minutes of fame. And in that short period we have transformed the world. In fact, Homo Sapiens has managed to extinguish large parts of the living world in a matter of centuries.

We think we no longer need nature. We create economic and religious worldviews that put man’s enterprise at the centre of the universe and layer it with sacred truths that we know now are neither sacred nor true. But the point may be that nature does not need us. There are those who mourn our loss of nature, a loss of natural beauty we see around us, but the real loss may go unmourned – the real loss may be us. Nature will survive; humanity runs the risk of being written out of the picture. There are scientists who see all life on Earth as a living whole. British biologist James Lovelock calls the concept "Gaia", after the Greek goddess of the Earth. That theory states that the sum total of all living organisms behaves as a single system, that the entire Earth is a living, breathing, self-regulating entity.

Our sojourn – or myth of it – as managers of the Earth, following a biblical imperative to have dominion over and act as the stewards of the planet, is at an end. We do not stand supreme. We stand outside. Darwin was wrong: if is not the fittest who will survive, it is the fit-ins.

This is a test for humanity. Will we degenerate into territorial creatures struggling for power, land, and survival, or will we emerge with a new collective image of ourselves as a species integrated into the natural world? In times of crisis, people have pulled together and forgotten their mistrust and petty rivalries. They’ve sacrificed and worked to change their lives. There has never been a bigger crisis than the one we now face. And we are the last generation that can pull us out of it. We must act because this is the only home we have. It is a matter of survival.

Appendix Two

The resources of planet earth are not sufficient to cater for the path which humans are now taking.

There are now around 5.9 billion people on this planet. By the year 2045, given current population growth projections, there are going to be 10 billion. That's only about one generation away: the lifetime of our children. Currently the population of the 'developed' countries is about 2.2 billion: people with fridges, cars, air conditioning, telephones, clean running water... Most people in the Third World don't have any of these things, but they want them.

Does the planet have the resources to supply 10 billion people with the lifestyles that we enjoy in Australia, or the UK, or the USA? Does the planet have the capacity to assimilate the wastes such a lifestyle would produce? The answer is "NO". In fact, the planet is struggling to meet the demands of the wealthy 2.2 billion, and the aspirations of the rest.

Across the globe, desertification as semi-arid marginal lands are overgrazed. The great fish-stocks of the world are being 'mined' rather than used sustainably. The awe-inspiring rainforests of the Amazon are being cleared to provide beef for north American and European hamburgers. The soils of the hilly country of southeast Asia are being destroyed by forest clearing and short-term agriculture. Fragile coasts and wetlands all around the planet are suffering under increasing population pressures: for example, it has been reported that over 70% of the Philippines coastal reefs have been seriously damaged by the use of explosives for fishing. What could be more short-sighted? Yet governments do not act...

And in rich countries like Australia, oblivious to the wider destruction of our planet, we continue to squander the earth's resources. More cars, TVs, phones, clothes, gadgets... and garbage.

The expanding resource demands of a growing population are simply stretching the planet's life-support systems to the limit. The warnings of population scientists[6] go largely unheeded. While the work of designers such as Amory Lovins[7] point the way to major increases in resource-use efficiency and effective pollution control, they do not address the fundamental issues of the management of cumulative effects within economic and political frameworks focused on the short term.

We are destroying this planet. We are destroying the home we leave behind for our children. And we are exploiting the poor of the Third World, while our Australian government refuses to sign a trade agreement which links the protection of human rights with international trade!

The single biggest issue the world faces over the next decade is that of environmental stewardship. We have to take responsibility for our actions, knowing their wider ramifications. And we have to insist, through our buying power and our vote, that corporations and governments take their share of responsibility too.

And, as voters, we have to insist that our governments put in place strategic systems for managing the planet – strategic systems which incorporate the needs of future generations of humans, and the needs of the planet's plants and animals.

David Suzuki (1999:252) Naked ape to superspecies (extract)**:**
The facts are in and the conclusions undeniable. We know about the amount of the world's forests being cut down annually, the physical changes in the atmosphere, the spread of toxic pollutants, the depletion of the oceans, and rising human numbers and

their demands. It's clear that we're pushing this planet's ability to support us, its ability to generate clean air, water, productive soils and energy faster than we can use them up. It's also clear that we have very little time left to come up with new ways of living and new ways of using and sharing what we have. Denying that there is a serious problem, or giving in to a sense of impotence or hopelessness, is to render a catastrophe inevitable.

We have to fight despair. Nelson Mandela must have been sorely tempted to give up during his quarter-century of confinement, and East and West Germans must have wondered whether the Berlin Wall and the border between them could ever come down. Yet Mandela and the Germans triumphed over apartheid and division because they persisted and never abandoned hope. The ecological crisis now under way demands that we cling to hope and continue to strive to avoid eco-collapse.

Human beings are often at their best when responding to immediate crises - car accidents, house fires, hurricanes. We are less effective in the face of enormous but slow-moving crises such as the loss of biodiversity or climate change. When the crisis is environmental and global, we feel not only frightened and overwhelmed, but also insignificant and helpless.

Appendix Three

Cumulative impacts and the need for strategic planning in water resource planning.

The purpose of this Appendix is to explore the issue of managing cumulative effects. The key mechanisms of the tragedy of the commons, and the tyranny of small decisions are examined within the context of the water resource industry.

A3.1 Strategic planning frameworks

In spite of the best intentions of State conservation departments and State water management agencies, the success of programs aimed at ensuring river and wetland health has been generally disappointing. In the Murray-Darling basin, partial implementation of integrated catchment management[8] (ICM) programs has not only failed to protect the health of natural water systems, but has allowed the over-allocation of the water resource for consumptive uses[9]. Having said this, I argue that ICM does provide the only procedural framework capable of handling cumulative effects, and encompassing biodiversity conservation concerns.

ICM has been formally endorsed and supported by the National Water Quality Management Strategy (NWQMS). The COAG water reform agenda, in theory, requires the development of State ICM systems. However, in some States (Tasmania, for example) ICM planning has not followed the NWQMS guidelines, has little formal endorsement or financial support by State government, and the ICM plans which are developing do not consider environmental flows or biodiversity issues. Those produced up to the close of 1999 did not even consider environmental values as set out in Tasmania's statutory water quality policy.

In other States (NSW, for example) The State government has a formal ICM (TCM) program grounded in legislation, and ICM plans being developed are wider in scope and potentially more useful from the point of view of river and wetland health, than in most other jurisdictions.

However, two extremely powerful mechanisms, the *tyranny of small decisions*, and the *tragedy of the commons*, undermine the effectiveness of these plans during their implementation.

A3.2 The tragedy of the commons

The setting for the tragedy of the commons (Hardin, 1968) is that of a public resource ("the commons") subject to private use. Excessive use of the resource will cause its degradation.

For example, public land may, by right or by tradition, be available to shepherds for grazing their flocks. If the flocks are small in comparison to the resource, the land will sustain little (perhaps no) damage. However, if the price the shepherd receives for his produce is more than enough to compensate for the rent (all things considered) there will be an incentive to increase the size of his flock.

As grazing pressure increases, the land will start to degrade. But the profit the shepherd makes from his extra sheep accrues directly to him, whereas the cost of the damage the sheep cause to the commons is born by the whole community. For the person who makes the decision (the shepherd) the profit from the extra sheep will tend to outweigh his share of the cost, until the commons becomes highly degraded and sheep start to die.

The profit one farmer makes from using the water in his dam accrues to him directly; the costs of the degradation to the river system are born by the whole community.

So… mechanisms are necessary to ensure sustainability of use. We all know that. But when we look at the Murray-Darling, we know these mechanisms have failed.

Why have they failed? And are the mechanisms which are now in place more likely to be effective?

A3.3 The tyranny of small decisions

The tyranny of small decisions (Odum 1982) is to some extent an extension of the tragedy of the commons. It has to do with the way public agencies, charged with the management of a public resource, make decisions about the use of this resource.

Firstly it is common for such agencies to have a charter aimed at protecting the sustainable value of the resource (the commons, if you like). Secondly, it is also standard practice for such agencies to have a list of considerations to be taken into account when making decisions, and one consideration will, of course, relate to the interests of applicants wishing to undertake developments.

Thirdly, in any strategic plan, there are almost always discretionary clauses available to the responsible agency. Activity X is not to be permitted, except in special circumstances…

The mechanism of the tyranny of small decisions relates to the *smallness* of the effects, and their cumulative nature. The degradation of the resource resulting from one small decision is so small, in the overall scheme of things, that it is difficult to identify, and almost impossible to predict in quantitative terms. Now, if it is impossible to measure, surely, surely… it cannot be weighed against the pressing interests of the applicant?

As an example, let us say a local municipality develops a plan relating to a small estuary. Fifty percent of all fringing mangroves have already disappeared. Their role in nutrient recycling and the provision of habitat is recognised. There is to be no further clearing of mangroves. The strategy is accepted. The following year, the Major's brother purchases a property adjacent to the water. He applies to build a jetty. Yes, clearing of mangroves is prohibited, but there is a discretionary clause, and, after all, only a small area is involved… So the jetty goes ahead. And, two months later, another, and another… Ten years later, only a few scattered mangroves survive as reminders of the shoreline which once was…

This mechanism, of course, applies to catchments. What harm can just one more farm dam do…?

A3.4 Cumulative impacts; new directions in strategic planning

Large water infrastructure proposals *may* be effectively dealt with through State EIA mechanisms, given comprehensive inventories of State freshwater ecosystems. However, the above discussion suggests that existing EIA mechanisms *cannot* be relied on to produce "strategic" outcomes, even with such inventories, when the cumulative effects of small-scale incremental development are considered. From personal experience, I suggest that an examination of State farm dam assessment procedures will add weight to this concern.

As a society, we are not behaving in a rational way when it comes to the management of cumulative effects. We subject a proposal to build a large dam (say 100 GL) to intense scrutiny. Yet we allow the development of 1000 small to medium-sized dams

over a 20 year period, with only the most cursory assessment procedures. These smaller dams, when assessed in total, may have a greater environmental impact than the single large dam we have examined so closely. The same can be said for wider cumulative issues: the gradual expansion of human society - its roads, farms, factories, mines, fishing vessels - across the face of the planet.

I believe that the *only* way to ensure effective protection of river and wetland health in the face of the cumulative impacts of incremental infrastructure development, is to build the management of cumulative effects, including biodiversity protection measures, explicitly into ICM planning. In most Australian States, environmental flow programs are beginning to enter ICM frameworks; but this is not enough. Within each ICM catchment, areas and values related to freshwater biodiversity must be clearly identified, and the precautionary principle[10] must be applied in their protection. Precautionary actions must be taken to control the abstraction of both surface and groundwater, the construction of impediments to fish passage, and in some cases land use within the catchment – in order to protect catchment biodiversity.

This is not currently happening in any Australian jurisdiction. Advances are being made, but they do not go far enough. New South Wales probably has the best statutory framework for managing cumulative effects, but it is not being enthusiastically applied to manage cumulative effects, and here the question of the timing of catchment caps is critical (see the discussion of NSW programs below). Western Australia has a poor legislative framework, but a good policy approach to setting catchment water allocation limits well before the catchment becomes stressed. However, again, the application of this policy approach appears to be falling short of its ideals and intent (see the discussion of WA programs below).

Managing cumulative impacts depends, at the end of the day, on drawing 'lines in the sand'. Limits on development must be set, and set well ahead of serious problems. These limits must be precautionary, and must be absolute. In my view, the only mechanism which can set such limits, and still achieve adherence to accepted sustainability and democratic principles, is integrated catchment management. Without exception[11], the current situation is that Australian jurisdictions are setting catchment limits *only* where significant water management problems already exist. Such an approach will never succeed in managing cumulative effects, or in protecting freshwater biodiversity.

Further detail on the process steps in establishing and implementing caps to control cumulative impacts is set out at http://www.netspace.net.au/~jnevill/Model-water-frameworks-1.doc .

When good scientific evidence is available, precautionary caps and moratoriums can be relaxed in favour of more carefully prepared restrictions. However, if precautionary caps are not put in place in the interim, the lessons of the past clearly indicate that biodiversity values will be lost in favour of short-term economic considerations.

Appendix Four:

Integrated Catchment Management in the Murray-Darling Basin 2001-2010

The Murray Darling Basin Ministerial Council (MDBMC) published *"a draft statement of commitment by community and governments on the future management of the natural resources of the Murray-Darling Basin*" in September 2000. A three-month period for public comment was provided. The document is available from the Murray Darling Basin Commission's website. This appendix is based on my submission to the MDBMC.

The document presents a veneer of courageous and committed rhetoric. However, underneath this veneer lies a cringing, superficial and conceptually flawed approach. Unfortunately, this document provides an example of an approach to the management of natural resources which is common globally today, and is presented here to indicate the difficulty faced by agencies whose charter specifically includes the development of sustainable management frameworks.

Rhetoric
The document is subtitled: "Delivering a sustainable future". Clearly, we expect a heavy emphasis on sustainable principles and management.

On the title page we find the statement: "We the community and governments of the Murray-Darling Basin commit ourselves to do all that needs to be done to manage and use the resources of the Basin in a way that is ecologically sustainable".

On page four, we find a commitment: "We will be prepared to make hard decisions".

So far so good…

Cringe
Page four contains the heading: "Our principles". Given the rhetoric, one might expect to find strong commitment to a comprehensive set of sustainability principles.

The section starts will the statement: "We agree, in a spirit of partnership, to *abide by* the following principles". (My emphasis). Not "embrace" but "abide by". Why would these words have been chosen? The answer is perhaps revealed by examining the principles themselves.

The most universally accepted statement on the principles of sustainable development is the Rio Declaration on the Environment and Development (1992). Here 27 principles are listed. While many of these apply to a nation-State context, and would be out of place in the Basin document, we would expect to see the core principles applicable to the management of natural resources listed here.

Principle Four of the Rio Declaration is the first principle listed, under the heading "Integration". Principle 22, on indigenous participation, is found under the heading "Informed decision making". However, where is Principle Three, on the needs of future generations? Where is Principle Seven, on ecological integrity? Where is Principle Eight, linking ecological sustainability with demographic policies? Perhaps most importantly, where is Principle 15, the Precautionary Principle - already embraced by all Australian States and the Commonwealth, and listed in dozens of key strategic documents? (Stein 1999).

Where is Principle 16 (polluter pays)? And where is Principle 17, on environmental impact assessment? The assessment of the cumulative effects of development is a key issue in the Basin.

And where is a commitment to the national environmental flow principles? (ANZECC 1996?)

The answer, I suggest, lies in an attitude of cringe permeating the substance of the Basin document.

The document's list of principles can also be compared unfavourably with a recent list of principles developed by the Victorian Environment Protection Authority for inclusion in legislation (see Nevill 2000a). For example, the Basin document contains no commitment to the waste hierarchy principle, even though saline wastes are one of the biggest problems the Basin faces.

Under the heading: "Making choices" we find the statement: "Many of the changes will involve trading wealth between communities and individuals". Importantly, there's no mention of trading wealth between the existing community and future generations - which, I suggest, is the core issue. The economic basis of regional communities in the Basin is foundered on the unsustainable use of the Basin's natural resources. Unsustainable utilisation must be wound back, at the expense of the financial viability of existing enterprises - or let future generations pay the price. Why isn't this clearly stated? Cringe, I suggest.

Again, on page four, we find a statement which reads: "Even if we stopped using the Basin's natural resources immediately, water quality would continue to decline, and land would continue to degrade." A few fundamental words have been omitted: "in the short term". The statement, presented without this rider, is misleading, and creates an impression that "forces beyond our control are at work". Why would these words appear in the Basin document? Are we trying to make excuses for a half-baked and superficial approach? Again, I suggest this is indicative of the cringe underlying the Basin document.

Superficial

Fundamental issues affecting the long-term sustainability of the Basin's economy are either treated by the most superficial reference, or ignored completely.

The degraded (and still degrading) circumstances of the Basin's waterways can in part be attributed to nine important assumptions underlying traditional water management frameworks. Three of these assumptions relate to the cumulative impacts of incremental water infrastructure development:

- although very large dams were subject to environmental assessment, it was assumed that *small and medium-sized dams* needed only cursory assessment on a case by case basis - no assessment of the catchment's capacity to support increasing numbers of small dams was thought to be necessary. In other words, it was assumed that "the little ones don't matter";
- similar assumptions were made concerning *small users* of surface and groundwaters, and the *construction of levee banks*. These escaped catchment-based strategic assessments on the basis that "little ones don't matter";
- it was assumed that the harvesting of surface flows *away from watercourses* did not need to be controlled - that these flows comprised a minor proportion of total surface flows and that their harvesting (through channelling surface flows into farm dams) did not matter to overall catchment flows;
- it was assumed that landholders should, by and large, *be allowed to place dams across small watercourses*, on the basis of generally cursory case-by-case assessments and licensing arrangements - ie: that it was unreasonable for State

water agencies to ask landholders to pay the additional costs involved in off-stream dams;

- it was assumed that the plants and animals living in the streams would look after themselves, and that no particular attention was needed regarding the provision of a *guaranteed environmental flow* to keep them alive;
- it was assumed that, while the need to protect biodiversity necessitated the development of systems of *representative reserves* conserving key examples of terrestrial and marine ecosystems, it was *unnecessary and impractical* to apply the concept of representative reserves to freshwater ecosystems;
- it was assumed that the provision of fish passage facilities was either impractical, uneconomic, or unnecessary;
- it was assumed that *groundwaters and surface waters were somehow separate*, and could be managed independently; and finally:
- it was assumed that there was no need for rigorous program implementation, compliance auditing and enforcement; that illegal dams, bores, off-takes and levee banks would be minor and insignificant features in overall water management programs.

While the Council of Australian Governments (COAG) water reform agenda signalled the death of some of these assumptions (concerning environmental flows, for example) others live on, to a large extent unscathed by the agenda (NCC 1999). While many of these assumptions were once correct, this is no longer the case, and it is dangerous to make *any* of these assumptions in the development of Basin water management frameworks. I believe that, as far as the freshwater ecosystems of Australia are concerned, it is a key challenge of the next decade to reverse *all* of these assumptions.

The Basin document fails to tackle any of the assumptions listed above in any convincing way, with most issues ignored completely. The best coverage is given to environmental flows, but even here, commitments are general and superficial. No-where in the document is there a clear commitment to implement the ANZECC environmental flow principles.

Conceptually flawed

Tragedy and tyranny

Two fundamental mechanisms lie at the heart of much of the degradation of the Basin's resources: the tragedy of the commons (Hardin 1968), and the tyranny of small decisions (Odum 1982).

These mechanisms are ignored in the Basin document.

A consideration of these mechanisms may have led to the development of general proposals to manage their impacts, including the development of cumulative effect management programs, and compliance audit and enforcement programs.

Focus on integration of groundwater and surface water management may also have been another outcome of a focus including these mechanisms.

Current strategic concepts

The Basin document does not use current strategic concepts in common use for natural resource management. For example, the *value / indicator / objective* framework used on the National Water Quality Management Strategy is not utilised (ANZECC 2000), and confusing terminology is introduced on page 7 where the word "outcome" is used in place of "value".

The *pressure / response* framework used in National and State *state of the environment reporting* is also not used in the Basin document. (State of the Environment Advisory Council 1996).

The use of such concepts could have allowed the development of strategic programs within existing and understood logical frameworks.

Planning for sustainability

It has been argued that assessing the sustainability of policies and programs (relating to natural resource management) must involve a two-pronged approach - where both aspects undergo rigorous scrutiny during program design, monitoring and evaluation phases.

Firstly, sets of values, indicators and indicator targets must be established, predicted, measured and evaluated. Where evaluation indicates that targets are not being met, the design and implementation of policies and programs must be reviewed and improvements must be made. These concepts are incorporated into the Basin document, and form a substantial part of its general thrust.

Secondly, of equal importance is the examination of the processes which are designed and implemented through policies and programs. These processes must embody sustainability principles. These principles have been established and are undergoing conceptual evolution. Management processes must be evaluated against these principles, and where gaps are demonstrated, changes must be made (Nevill 2000b).

This second aspect to the planning of sustainable management programs remains entirely unexplored within the Basin document.

Exploration of these issues could have led, for example, to a strategic discussion of sustainability benchmarks, and a commitment to establish comprehensive, adequate and representative systems of freshwater ecosystem reserves (Nevill 2000c).

Summary

In the Basin document's favour, it does attempt to establish a framework to facilitate consistency of management throughout a large river basin spanning five major jurisdictions. This is ambitious and important.

However, in spite of its rhetoric, the document is superficial and conceptually flawed. Of perhaps even greater concern is evidence of an cringing underlying attitude, hardly indicative of the strength of purpose which will be necessary to reverse existing and continuing environmental degradation within the Basin.

Overall, the document fails to establish a strategic direction capable of managing the very pressing issues the Basin faces over the next few decades.

Appendix Five
Second generation sustainability principles

The following principles are among those that have been developed to help guide sustainable development efforts. For more information, visit the USA Department of Energy website, or check the information on 'environmental principles' on the Only One Planet website.

Wingspread Principles
These principles were developed by attendees of the 1998 Wingspread conference, "Communities in Harm's Way: A Leadership Dialogues on Designing Disaster-Resistant Settlements," to help communities and government agencies enhance sustainability in disaster-prone communities. The principles include a checklist for disaster mitigation and a policy action framework.

The Hannover Principles
The Hannover Principles is a 70-page philosophical tract, written by architect William McDonough, which outlines a sustainable design philosophy for buildings, cities, and products. Within the document, nine principles have become known as the "Hannover Principles."

The Natural Step Principles
Natural Step is an international movement, which began in Sweden, that is dedicated to helping society reduce its impact on the environment and move toward a sustainable future.

The Earth Charter Benchmark Draft
A draft set of principles, developed by the Earth Charter, in collaboration with Green Cross International, that serves as a universal code of conduct for the transition to sustainable development. Background information on the Earth Charter also is available at this site.

8. Endnotes:

[1] For example, the General Agreement on Tariffs and Trade (GATT).

[2] Refer, for example, to the work of the World Economic Forum, or the G7 Group.

[3] For example, the Rio Declaration, and Agenda 21.

[4] Such as the International Declaration of Human Rights, or the agreements reached under the auspices of the International Labour Organisation.

[5] That is the success from strictly local, short term perspectives.

[6] For example, in relation to global issues, see works by Anne and Paul Erhlich, and David Pimentel. For a book on the Australian population issue, see: Birrell R, Hill D and Nevill J (1984) *Populate and Perish*; Fontana, Sydney.

[7] See the Rocky Mountains Institute website: http://www.rmi.org/ .

[8] Integrated Catchment Management (ICM) is used in this paper in preference to the related phrase Total Catchment Management (TCM).

[9] In the Murray-Darling Basin (Australia's largest river basin) if all existing water allocations were implemented, 90% of the average natural flow would be diverted. The Basin now experiences drought level flows three years out of every four, compared to one in twenty years under natural circumstances (Commonwealth of Australia 1998:22). In spite of gross over-allocation of the water resource, the Murray-Darling Basin Ministerial Council has difficulty implementing a cap on water usage (Murray-Darling Basin Ministerial Council 1998; Murray-Darling Basin Commission 1998)

[10] At the United Nations Conference on the Environment and Development ('The Earth Summit') held in Rio de Janeiro in 1992, a series of principles on environment and development were adopted (the Rio Declaration on Environment and Development). This included Principle 15, commonly known as the 'precautionary principle':

In order to protect the environment, the precautionary approach shall be widely applied by the States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

Subsection 3.5.1 of the *InterGovernmental Agreement on the Environment* (COAG 1992) in addition to including the above definition, adds the following as a means of clarifying Australia's application of the principle:

In the application of the precautionary principle, public and private decisions should be guided by:

(1) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

(2) an assessment of the risk-weighted consequence of various options.

Justice Paul Stein has addressed the question of the application of the principle in Australian jurisdictions (Stein P 1999).

[11] It remains to be seen how the WA process, which shows promise, will be applied in practice.