SOUTH AUSTRALIA

ENVIRONMENT PROTECTION (MARINE) POLICY 1994

SUMMARY OF PROVISIONS

SCHEDULE 8

Water quality criteria for shellfish culture and harvesting
I Criteria for the protection of shellfish growing areas

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Water quality criteria for shellfish culture and harvesting
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Water quality criteria to minimise effects of fish farming on the surrounding environment

APPENDIX

Classification of waters according to beneficial uses

ENVIRONMENT PROTECTION (MARINE) POLICY 1994

Gaz. 27 October 1994, p. 1380[1]

[1] Came into operation 1 May 1995: cl. 2.

Citation

1. This policy may be cited as the *Environment Protection (Marine) Policy 1994*.

Commencement

2. The commencement date of this policy is the date of commencement of the Act.

Objects and Summary

3. The objects of this policy are to—

(a) set out guidelines that the Authority is required to have regard to in dealing with applications for environmental authorisations; and

(b) to do so (at least on an interim basis) by carrying over the guidelines established by the Marine Environment Protection Committee (MEPC) under the *Marine Environment Protection Act 1990*.

Summary

Any discharge to marine waters from an activity with an environmental authorisation will be governed by these guidelines. If the discharge was licensed under the *Marine Environment Protection Act 1990*, a "transition period", not to extend beyond March 25 2001, was provided for. This policy is intended to carry over the effect of the transitional provisions of the *Marine Environment Protection Act 1990*. All other discharges will be required to comply immediately. Dredging is a discharge for these purposes, as are flows from washdown areas, or from stockpiles or other polluted areas. Compliance is determined at a point of discharge, which is defined in this policy.

The quality of water which may be discharged is determined by the beneficial uses of the waters which receive that discharge. For South Australia the minimum requirement is set out in Schedule 7—to maintain aquatic ecosystems. Other schedules cover such beneficial uses as human recreation (which may or may not involve regular contact with the water), fish farming or more stringent protection for higher quality ecosystems. The requirements of Schedule 8—which deals with anti-fouling of boats—apply in all marine waters of the State.

Persons proposing an activity which would require an environmental authorisation under the *Environment Protection Act 1993* and which involves a discharge to marine waters should investigate what beneficial uses occur in the receiving waters, then consult the appropriate schedules in this policy. From the schedules and from knowledge of the proposed activity, identify the significant toxicants or physical changes that may appear in any discharge, compare them with the guidelines for those toxicants or physical changes which apply in the receiving waters; and develop a plan for compliance. The plan should include a program for monitoring, and arrangements for this to be verified by a person independent of both the licensee and the EPA.

Applications for new discharges will be advertised, and the public will be invited to comment on the application before licensing is considered. Such comment may include information on beneficial uses of the waters.

Interpretation

4. In this policy—

"**the Act**" means the *Environment Protection Act 1993*;

"**ambient concentration**" means concentration in waters apart from the effects of discharges from human activity;

"**ANZECC**" means the Australian and New Zealand Environment and Conservation Council;

"**ARMCANZ**" means the Agriculture and Resource Management Council of Australia and New Zealand;

"**beneficial use**" means any use of waters by the community that provides a benefit to the user without causing lasting damage to those waters or the resources in those waters;

"**environment improvement program**" means a program undertaken under section 54 of the Act as a condition of an authorisation issued by the Authority, with the objective of reducing environmental impact from the activity authorised;

"**environmental harm**" means one or more of the following:

(a) loss of seagrass or other organisms; or

(b) contamination of organisms; or

(c) contamination of naturally occurring sediment; or

(d) deposition of extra sediment; or

(e) any visual or measurable physical or chemical changes in the natural environment;

"**LOEL**" (lowest observed effect level) means the lowest level of concentration at which some effect is observed on the behaviour or physiology of a test organism;

"**mass load**" means the total quantity of a pollutant emitted from premises in one year;

"**median lethal concentration LC50**" means the concentration of material in water to which test organisms are exposed that is estimated to be lethal to 50 per cent of the test organisms. The LC50 is usually expressed as a time-dependent value (*e.g.*, the 24-hour or 96-hour LC50—the concentration estimated to be lethal to 50 per cent of the test organisms after 24 or 96 hours of exposure);

"**MEPC"** means the Marine Environment Protection Committee appointed under Part III of the *Marine Environment Protection Act 1990*;

"**mixing zone**" means an area of radius not exceeding 50 metres measured from the end of a pipe or from the first release point of any diffuser fitted to a pipe, provided that point of discharge or release point is at least 100 metres from the mean low water mark on the seashore at spring tides;

"**NATA**" means the National Association of Testing Authorities;

"**National Guidelines**" means the *Australian Water Quality Guidelines for Fresh and Marine Waters* issued by ANZECC in November 1992 under the National Water Quality Management Strategy (ISBN 0 642 18297 3);

"**National Water Quality Management Strategy**" means all documents carrying that title and the authorisation of the ANZECC, ARMCANZ or NHMRC;

"**NHMRC**" means the National Health & Medical Research Council of Australia;

"**‰**" means parts per thousand by weight for solids dissolved in water;

"**point of discharge**" means the end of a pipe, or the first release point of any diffuser fitted to a pipe. If the discharge is through a channel it means the first point in the channel where the water level is affected by tidal movement, provided that the point of discharge must be at or beyond the boundary of the premises where the activity is carried on that is subject to environmental authorisation;

"**redox**" means a measure of the tendency of a body of water or of sediment to promote either chemical oxidation or reduction of substances;

"**SA Guidelines**" means the *Guidelines for Licensing Discharges to the Marine Environment* (incorporating the 'Water Quality Guidelines for Estuarine and Marine Waters of South Australia'), issued by the Office of the Environment Protection Authority in November 1993 (ISBN 0 7308 2677 5);

"**supernatant water**" means the water from which settleable solids have been removed in a settling pond or by a similar method;

"**USEPA**" means the United States Environmental Protection Agency.

Background

5. (1) The Marine Environment Protection Committee was established by the Environmental Protection Council, and appointed under Part III of the *Marine Environment Protection Act 1990* to advise the responsible Minister on the preparation of regulations and other statutory instruments for the purposes of that Act, and to provide general advice to the Minister in respect of the granting of licences under that Act.

(2) Draft Water Quality Guidelines for Estuarine and Marine Waters of South Australia were released for public comment in January 1991. From the public response, MEPC prepared a set of guidelines for licensing dated August 1992.

(3) In November 1992 ANZECC released its *Australian Water Quality Guidelines for Fresh and Marine Waters*. The relevant elements were taken up in the SA Guidelines released in November 1993.

(4) The guidelines developed were based on water quality criteria which set out the minimum quality required for particular beneficial uses of waters. Those beneficial uses are described in Schedules 1 to 10 of this policy. The conditions applied in relation to a discharge under an environmental authorisation will be determined in part by the beneficial uses designated by the Authority for the receiving waters.

(5) Each beneficial use has qualitative and quantitative criteria which are required to support the beneficial use. Several beneficial uses may be designated for one water body, and high quality water for one use still may not allow for others. For example, waters may support high quality ecosystems (Schedule 6) but carry more faecal bacteria than is consistent with human contact recreation (Schedule 2).

(6) Some waters may have a quality better than that necessary to maintain the designated beneficial uses. Environmental authorisations should include conditions to maintain the quality of such waters.

(7) The water quality guidelines in this policy are to be used to establish limits on pollution for persons holding environmental authorisations.

Acceptable concentrations of toxicants

6. (1) Criteria in Table 1 allow the Authority and water quality managers to decide if the quality of waters is sufficient to protect the beneficial uses designated or sought for those waters. Most of the schedules of beneficial uses refer to this table.

(2) The criteria in Table 1 are to be used in the following way:

(a) the criterion figures for malathion, methoxychlor and mirex are absolute maxima which are never to be exceeded;

(b) the criterion figures for DDT, aldrin/dieldrin, endosulfan, endrin, heptachlor, selenium and silver are not to exceed the acute criteria at any time and are not to exceed the chronic criterion as an average over any period of 24 hours;

(c) criterion figures for all other toxicants listed in Table 1 are not to be exceeded for more than 1 hour per 3 years in the case of acute criteria, and are not to be exceeded more than 4 days every 3 years in the case of chronic criteria. The criteria in Table 2, for substances listed in Appendix II of the *Pollution of Waters by Oil and Noxious Substances Act 1987*, are to apply as chronic criteria, not to be exceeded more than 4 days in every 3 years;

(d) at the point of discharge, concentration of residual **oily waste**—including any components of asphalt solutions, fuel oils, lubricating oils, distillates, gas oils, blending stocks, petrol, kerosene, jet fuel or naphtha—must not exceed 15 mg/L at any time, and must average less than 8 mg/L over any sampling schedule set out in a monitoring program approved as part of a condition of licence.

(3) Criteria in relation to other pollutants—

(a) the criteria for faecal coliform bacteria are based on statistical descriptions of data from several samples;

(b) the criteria for dissolved oxygen and light penetration are minima;

(c) the criteria for pH are stated as ranges, the limits of which must not be exceeded at any time.

(4) Toxicant concentrations must be measured in unfiltered samples.

(5) Numerical water quality criteria were derived from data on toxic effects on a wide variety of organisms. Where there were insufficient data to derive a numerical criterion, Table 1 lists "lowest observed effect levels" which are concentrations at which some effects were observed in aquatic organisms. The LOELs convey an estimate of toxicity of the pollutant in the absence of a recommended criterion.

(6) For the protection of aquatic species, a safety factor of 0.02 has been applied to each of the acute LOEL concentrations in Table 1 to produce figures for acute criteria. The same safety factor may be applied to chronic LOEL concentrations to produce an equivalent chronic criterion. The values derived through that safety factor are to be applied as acute or chronic criteria, not to be exceeded for more than 1 hour per 3 years in the case of acute criteria, and not to be exceeded more than 4 days every 3 years in the case of chronic criteria.

Acceptable concentrations of nutrients

7. (1) Where toxicants at sufficient concentration suppress growth, nutrients stimulate growth and may produce the effects listed in the Action Priority Table 5. The National Guidelines list "Indicative values" - concentrations at or above which problems have been known to occur in Australian coastal waters (see Table 4). These indicative values are a guide only to show the order of concentration the Authority and licensees should aim for in discharges. It is possible that discharges at less than these values could still produce some of the forms of environmental harm listed in this policy beyond the limits of a point of discharge as defined in this policy.

(2) Operators who propose to discharge significant quantities of nutrients should consider alternatives to marine disposal and undertake studies to model the impact of marine disposal.

Guidelines for licensing activities lawfully carried on on a continuous or regular basis during any period up to 25 October 1990

8. (1) Schedule 1 of the *Marine Environment Protection Act 1990* contained transitional provisions allowing an activity lawfully carried on on a continuous or regular basis during any period up to 25 October 1990 (the date that Act was assented to) to be licensed subject to conditions requiring the licensee to bring the activity licensed into conformity with the requirements applying to an activity of the same kind that commenced after commencement of the *Marine Environment Protection Act*. Full compliance is to be achieved in not more than eight years from commencement of the *Marine Environment Protection Act 1990* or such shorter period as is specified in the licence. The relevant parts of the *Marine Environment Protection Act 1990* commenced on 25 March 1993. Hence all licensees will be required to comply with criteria for beneficial uses of local receiving waters before 25 March 2001. The waters of South Australia are classified by apparent beneficial use in Appendix 1.

For the first two years of licensing, the principle objective was to identify and confirm what pollutants were contained in each licensed discharge, and the mass load discharged. Based on this mass load, independently verified, and before issue of a licence for the third year, the licensee was required to submit an environment improvement program showing how they would comply with the relevant guidelines before 25 March 2001. Compliance with this environment improvement program was to become a condition of licence and reissue of the licence would depend on the licensee meeting the targets set out in the environment improvement program. Provision was made for monitoring to be carried out by licensees with independent verification of the results.

(2) Licences for such activities will be issued under the new Act with conditions imposed by the Authority to maintain the objectives and carry out programs previously established. Conditions are to be imposed—

(a) to improve identification of matter discharged, and the operational conditions that control those discharges; and

(b) to obtain independent verification of monitoring of those discharges and use the data obtained to establish a baseline to measure change in water conditions; and

(c) to ensure that licensees, where they have not already done so, quantify the major pollutants contained in licensed discharges and their pattern of variation as soon as possible; and

(d) to encourage introduction of best available technology economically achievable. Application of such technology to any licensed discharge must be based on an environment improvement program submitted by the licensee and incorporated as a condition of the licence; and

(e) to ensure that each licensee negotiates an environment improvement program with the Authority by 25 March 1995. Such a program may include the following matters:

(i) application of best available technology economically achievable; and

(ii) integration of waste minimisation projects with business plan; and

(iii) waste minimisation and monitoring of constituents in the discharge; and

(iv) use of process information as part of the approved monitoring program. Process information may be used as a substitute for other monitoring, or it may be used to verify other monitoring where that is acceptable to the person giving independent verification of the program; and

(v) calculation of the initial mass loading as the product of average flow rate and average concentration of pollutants in the discharge; and

(vi) allowance for concentrations at the point of discharge after 25 March 2001 to exceed chronic criteria in these guidelines provided that—

(A) the mass load is less than that which would be calculated from the flow rates that were measured in the first two years of licensing and the concentrations listed for chronic criteria; and

(B) the allowed concentrations at the point of discharge did not produce concentrations that exceeded acute criterion values beyond any mixing zone;

(f) to provide that final target concentrations and mass loads will be derived after consideration of National Guidelines; and

(g) to review environment improvement programs in sufficient time to introduce any necessary changes before 25 March 2001 or the date for compliance fixed by the Authority.

Guidelines for licensing activities which were not lawfully carried on on a continuous or regular basis during any period up to 25 October 1990

9. (1) Where a person applies for a new environmental authorisation, the Authority must impose conditions that ensure compliance with this policy, and relevant national discharge standards set under the National Water Quality Management Strategy.

(2) Discharges must not exceed criterion values in Table 1 if the discharge is made to waters identified as Class I or II on the map in Appendix 1 and must not exceed the criterion values in Schedule 1 if the discharge is to waters identified as Class III in Appendix 1. Refer to the explanation under 6—Acceptable Concentrations of Toxicants—for specifications of the exceedences which are allowed for particular criteria and substances. Other limits will be set according to the schedules that apply to other beneficial uses of the receiving waters.

(3) If a discharge includes a substance which is not listed in Table 1 or Schedule 1 but is listed in Appendix II of Schedule 4 (updated to 5 December 1985) of the *Pollution of Waters by Oil and Noxious Substances Act 1987*, the Authority may impose conditions based on criteria from that Appendix provided that criterion values for the categories of substances listed in Table 2 at the point of discharge do not exceed the values set out opposite those categories.

Monitoring conditions in environmental authorisations

10. (1) The *Environment Protection Act 1993* empowers the Authority to impose conditions in an environmental authorisation in relation to an environment protection policy and to require the holder of an authorisation to test or monitor the environmental effects of an activity.

(2) The Authority should impose conditions for monitoring by the holder of an authorisation and to require the holder to correlate information from normal process control within the authorised activity with the monitoring information.

(3) The Authority may require independent verification of monitoring carried out by the holder of an authorisation to ensure that the results of such monitoring can be used confidently as a measure of improvement in discharge quality.

(4) Verification of results of monitoring should normally be required to be undertaken by a specialist who is able to make an independent professional examination of records, procedures and transactions of the authorisation holder and to give an opinion as to whether the holder of the authorisation's report is accurate, and whether appropriate controls and procedures have been followed.

(5) The verification report—

(a) should name the person undertaking the verification, and give that person's qualifications, experience and professional affiliation; and

(b) should establish the independence of the person and firm from the holder of the authorisation; and

(c) should verify that—

(i) samples for monitoring were taken from required or identified sampling points, by persons who can be identified for each sample; and

(ii) those samples were taken on a schedule that is statistically valid; and

(iii) those samples were secure at all stages; and

(iv) all sampling equipment was in good working order; and

(v) sampling followed appropriate industry practice, and analysis was consistent with professional standards; and

(vi) data and any logging apparatus were secure from interference; and

(d) should compare findings of verification studies (and, where appropriate, samples) with monitoring results; and

(e) should comment on compliance with targets. For activities commenced after 25 October 1990, it should comment on compliance at the point of discharge (as defined in these guidelines) with criterion values contained in relevant schedules of this policy; and

(f) should comment on apparent impacts of the licensed discharge, in comparison with any statements of expected impacts in the application for the authorisation; and

(g) should qualify statements where there is reason to believe that monitoring was inconsistent with requirements of the authorisation (including gaps in monitoring data series); and

(h) should state if there is reason to expect that there may be problems with compliance in coming years (for example, where there is to be installation of new plant or process, or where inputs to the process are to be revised); and

(i) may suggest better ways of monitoring, particularly where monitoring could be tied to process control. Such comments should be separate from the main report.

(6) Where standards do exist for a particular procedure or where the authorisation holder has current professional certification (such as NATA) a report need not describe that procedure if the report cites the standard or certification.

Screening for likely pollutants

(7) Monitoring programs will include identification of pollutants. Licensees will not be required to test exhaustively for all pollutants but may use targeted monitoring based on, for example—

(a) knowledge of the licensed activity;

(b) testing for the indicators used in designated beneficial uses;

(c) testing for pollutants which represent broader categories;

(d) use of broadscan techniques such as chromatography.

(8) Where the pollutants consist of a wide mixture of organic matter - as in pulp mill waste—a general indicator such as "Microtox" may be used. "Microtox" (trade name registered to Beckman Instruments) is a process using the rate of decay in luminescence of standard preparations of bacteria exposed to mixtures of compounds to assess the overall toxicity of the mixture. This method may be especially useful when environmental impacts are expected from the collective impact of several related pollutants.

Dredging guidelines

11. (1) It is not appropriate to require strict compliance with water quality guidelines at a dredge site. Rather, the objective is to minimise environmental impact over the entire operation.

(2) The environmental impact of dredging is a function of—

(a) condition of the affected waters. Most dredging occurs in ports, where ambient water quality may be less than in immediate surrounding waters; and

(b) physical type of substrate. Chemical processes and their rate usually are a function of particle size. Most maintenance dredging for existing channels removes relatively fine sediment, usually with high organic content, that had drifted into the previous cut; and

(c) temperature of water and of sediment. The processes that release pollutants are chemical reactions, and follow the thermodynamic rules of such reactions; and

(d) contamination of the substrate. For chemical pollutants this is a function of the physical form of that substrate (for example, fine organic-rich sediments tend to retain metals as relatively insoluble sulphides). Some ports (*e.g.*, Adelaide, Port Pirie and Wallaroo) have a long history of heavy metal contamination.

Living pollutants (pests parasites and diseases) are the one form of pollution that can multiply, so (unlike most metals and many organics) there is no release that presents an "acceptable" level of contamination. There is a known problem with cysts of dinoflagellates and other algae that can proliferate as "blooms" or "red tides" and either release toxins or cause fish deaths as the oxygen in water is used up. Licenses should include conditions to deal with spoil taken from known algal bloom areas; and

(e) method of dredging. Methods that send spoil to land are practicable only within a few hundred metres of that land. The final impact is a function of the period in which the spoil can oxidise or reduce (a function of the temperature of the spoil) and how the supernatant water is treated to remove particulates or re-deposit pollutants;

In most inshore areas (rivers and ports) licensees should be required to bring material ashore to be de-watered, and treat the supernatant water to bring suspended solids and dissolved pollutants below guideline values at the point of discharge; and

(f) amount of spoil to be moved. Biological/chemical processes that release NH_3 or control metal mobilisation through changes to redox state depend in part on the extent to which the mass of spoil is open to oxidation.

(3) The best environmental outcome depends on appropriate consideration of all of these factors, related to the expected beneficial uses of the relevant waters. For example, a method that turns sediment over quickly, and deposits it near the cut, could be quite appropriate for a navigation channel 3 km away from a swimming beach, but may not be appropriate if the area were a favoured fishing ground.

(4) The Authority should impose conditions requiring persons with authorisations to dredge to apply exposure and elutriation tests (that is, exposing a sample, then washing it with seawater and testing the seawater for pollutants) as part of their planning for the best time and method of dredging. The Authority must also impose conditions relating to how long the supernatant water is to be retained (*e.g.* by ponding) to bring levels of suspended solids within guideline values.

Waters of the State are classified broadly in Appendix 1. Discharge in the waters shown as Class I adjacent to metropolitan Adelaide, Port Pirie, Whyalla and Port Lincoln should be required to meet values for criteria in Schedule 7, and in Table 1.

TABLE 1
Acceptable concentrations of toxicants for marine and estuarine waters

TOXICANT	acute criterion µg/L	chronic criterion µg/L	National Guideline 1992 µg/L
A METALS			
arsenic III arsenic V	69	36.0	50.0 (all arsenic)
cadmium	43	9.3	2.0
chromium VI	1100	50.0	50.0
copper (total)		2.9	5.0
lead	140	5.6	5.0
manganese		100.0 (see notes below)	
mercury	2.1	0.025 (methyl mercury)	0.1 (total; assumes <10% methyl)
nickel	75	8.3	15.0
selenate inorganic selenite inorganic	410	54.0	70.0 (all selenium)
silver	2.3		1.0
thallium			20.0
zinc	95	86.0	50.0

	acute criterion	chronic criterion	National Guideline 1992
B PESTICIDES	µg/L	all µg/L x 10^{-3}	all µg/L x 10^{-3}
acrolein			200
aldrin	1.3		10
chlordane	90 x 10^{-3}	4.0	4
chlorpyrifos	11 x 10^{-3}	5.6	1
DDE			14
DDT	0.13	1.0	1
demeton		0.1	
dieldrin	0.71	1.9	2
endosulfan	34.0 x 10^{-3}	8.7	10
endrin	37.0 x 10^{-3}	2.3	3
guthion		10.0	10
heptachlor	53.0 x 10^{-3}	3.6	10

lindane	0.16×10^{-3}		3
malathion		100.0	100
methoxychlor		30.0	40
mirex		1.0	1
toxaphene	0.21	0.2	8

TOXICANT	acute criterion (calculated as 0.02 of LOEL) µg/L	acute LOEL µg/L	chronic LOEL µg/L	National **Guideline** or LOEL µg/L
C OTHER ORGANIC				
acenaphthene	20	970	710	
benzene	100	5100	700	**300**
carbon tetrachloride	1000	50000		LOEL 50000
chlorinated benzenes	3	160	129	
Cl-naphthalenes	0.15	7.5		
chlorinated phenols	9	440		
4-chlorophenol	600	29700		
dichlorobenzenes	40	1970		
1,2-dichloroethane	2260	113000		LOEL 113000
dichloroethylenes	4480	224000		LOEL 224000
dichloropropanes	206	10300	3040	LOEL 3040
dichloropropene	16	790		LOEL 790
dinitrotoluene	12	590	370	
ethylbenzene	9	430		
fluoranthene	0.8	40	16	
halomethanes	224	12200	6400	LOEL 6400
hexachlorobutadiene	6	32		**0.3**
hexachlorocyclo-pentadiene	0.14	7		
hexachloroethane	19	940		LOEL 940
isophorone	258	12900		
naphthalene	47	2350		
nitrobenzene	134	6680		
nitrophenols	97	4850		
nitrosamines	66	3300		
PCBs	10			**0.004**

pentachloroethane	8	390	281	LOEL 281
pentachlorophenol	13		7.9	**0.2**
phenol	116	5800		**50**
phthalate esters	59	2944	3.4	
polycyclic aromatic hydrocarbons	6	300		**3.0**
tetrachloro ethane	180	9020		LOEL 9020
tetrachloroethylene	204	10200	450	LOEL 450
tetrachlorophenol			440	
toluene	126	6300	5000	
trichloroethane	624	31200		LOEL 31200
trichloroethylene	40	2000		LOEL 2000

D MISCELLANEOUS	acute criterion (calculated as 0.02 of LOEL) µg/L	chronic criterion µg/L	National Guideline µg/L
chlorine (total residue)	13	7.5	
cyanide (free ion)		10.0	**5.0**
phosphorus (elemental)		0.1	
sulphides (H_2S)		2.0	**2.0**

Source National Guidelines from ANZECC "Australian Water Quality Guidelines for Fresh and Marine Waters" November 1992.

Others from USEPA "Quality Criteria for Water" 1986, except for zinc and nickel, 1987 (update) of USEPA, pentachlorophenol, 1987 (update) of USEPA, chlorpyrifos and toxaphene, 1987 (update) of USEPA.

Notes

— **barium** is not considered a problem in marine waters

— **chromium III** is not listed because there are insufficient data in relation to its effects

— **manganese** is listed to protect against a possible human health hazard through accumulation of manganese in shellfish

— **oil & grease** are not listed. Discharge standards adapted from the *Pollution of Waters by Oil and Noxious Substances Act 1987* appear under 6—Acceptable Concentrations of Toxicants

— **pH** should be within the range 6.5-8.5, but not more than 0.2 units outside of normally occurring range

— The following substances have received preliminary assessment, but are excluded from this listing because there are insufficient data in relation to their effects:

• acrylonitrile • benzidine • dichlorobenzidine • chloroalkyl ethers • chloroform • 2-chlorophenol • 2, 4-dichlorophenol	• dioxin (2, 3, 7, 8-tetrachlorodibenzo-dioxin) • 1,2-diphenylhydrazine • haloethers • hexachlorobenzene • parathion • vinyl chloride and • asbestos;

Compounds not listed in this table may be listed in Appendix II of Schedule 4 (updated to 5 December 1985) of the *Pollution of Waters by Oil and Noxious Substances Act 1987*—"List of noxious liquid substances carried in bulk". Criterion values for each category are shown in Table 2. Criterion values for the high risk compounds appear in Table 3. There are about 500 compounds in Category B and C of Appendix II to the *Pollution of Waters by Oil and Noxious Substances Act 1987*.

TABLE 2

Licensing criterion value: **chronic criteria**	**Appendix II categories of substances:**
not to exceed 10 µg/L	for which the residual concentration is 0.005 percent by weight
not to exceed 100 µg/L	for which the residual concentration is 0.05 percent by weight
not to exceed 1.0 mg/L	of Category B
not to exceed 1.0 mg/L	of Category C
not to exceed 10.0 mg/L	of Category D

A category includes any provisional classification, shown in brackets in Appendix II of the *Pollution of Waters by Oil and Noxious Substances Act 1987*.

If a compound appears in Table 1 and in Table 2 or 3, a holder of an authorisation to discharge from land to marine waters must comply with the more stringent criterion shown in the tables.

TABLE 3
Criterion values for high risk compounds under Pollution of Waters by Oil and Noxious Substances Act 1987

no more than 10 µg/L
carbon disulphide
no more than 100 µg/L
acetone cyanohydrin
butyl benzyl phthalate
Ca naphthenate in mineral oil
carbolic oil
1-chloroheptane
o-chlorotoluene
chlorotoluene (mixed isomers)
cobalt naphthenate in solvent naphtha
creosote (wood)
cresol (mixed isomers)
cresyl diphenyl phosphate
cresylic acid
decyl acrylate
dibutyl phthalate
2,4-dichlorophenol
2,4-dichlorophenoxyacetic acid, and as diethanolamine salt or dimethylamine salt or triiso-propanolamine salt solution
diisopropylbenzene (all isomers)
diphenyl, and its oxide or ether
dodecylphenol
o-ethylphenol
iron chloride, copper chloride mixtures
isodecyl acrylate
methanethiol
α, β, methylnaphthalene
α, methylstyrene
motor fuel anti-knock cpds
naphthenic acids

nonylphenol
pinene
rosin
tall oil, crude & distilled
tricresyl phosphate
triethylbenzene
trixylyl phosphate
vinyl toluene

TABLE 4
Indicative values or indicators for nutrients in the National Guidelines

Nutrient or indicator	**estuaries** all µg/l	**coastal waters** all µg/l
PO_4-P	5-15	1-10
NO_3-N	10-100	10-60
NH_3-N	<5	<5
Chlorophyll-a	1-10	<1

TABLE 5
Action Priority Table

The table is not intended to establish a rigid set of priorities by impact, but it does indicate implicit action priorities which should be followed by the Authority in managing both point- and diffuse-source pollution from land.

The table deals only with water-borne pollutants of estuarine and marine waters.

Pollutant	**Human impact**	**Ecological impact**	**Source**	**Areas most affected**	**Probable spread or increase**	**Scope to prevent or ameliorate**	**Action priority**
nutrients and other organic wastes	boost algal growth: create nuisance special case is Red Tides combination of nutrient buildup and pest species	algal growth reduces light penetration, killing seagrasses, change in nutrient ratios can alter makeup of plant & animal communities; organic wastes deplete oxygen	point - sewers diffuse - drains, stormwater	Metropolitan Adelaide Port Lincoln	moderate - through fish farming	moderate	**High**
	Red Tides restrict recreation, and consumption of seafoods	Red Tides deplete oxygen during and after "bloom" & introduce toxins		Red Tides also off metropolitan Adelaide & Port Lincoln	Red Tides likely to increase with development of fish farming	moderate - but expensive	
faecal waste	restricts recreation and consumption of seafoods	may promote filter feeders	point - sewage diffuse - other human and animal sources	Adelaide - West Lakes/Port R. River Torrens Patawalonga Onkaparinga R: Port Lincoln	low for human, high for other animals (pets)	moderate - but expensive	**High**
particulates & turbidity	aesthetic, swimming accidents	smothers substrate and changes species mix - (*e.g.* Aldinga)	stormwater; industrial discharge; dredging	all larger towns and ports	high - with further residential demands	good, but lies with Local Government	**High**
exotic pests and diseases	foul hulls free living algae may "bloom"	complete directly, or reduce advantages of local species	point - ships and boats fish farming	statewide and continuous	high	high to exclude, nil to eradicate	**High**

heavy metals	contaminates seafoods reduce number of fish that may be taken or consumed by humans	reduce numbers of marine organisms	point (municipal and industrial process) diffuse (agriculture and cars)	Upper Spencer Gulf Adelaide - Port River/West Lakes, Patawalonga	low falling	Pirie - good Whyalla - fair diffuse - poor	**Medium**
litter	restricts recreation accidents (needles stick)	kill birds, mammals:	diffuse (drains, stormwater, boating)	statewide	moderate	high	**Medium**
other chemicals **(pesticides, consumer & household products)**	contaminate seafoods recreational exposure	kill marine organisms	household & agriculture	statewide	low - many problem chemicals no longer registered (hence unavailable)	moderate	**Medium**
(process waste)	perceived effects often aesthetic: contaminate seafoods; recreational exposure	may affect behaviour of organisms	industry	Adelaide Regional centres Lake Bonney (SE)	low	high	
chemical spill /overspray (from pest control)	kill fish that may be taken/ consumed by humans	kill marine organisms	point	statewide sporadic	low	high	**Low**
hydro-carbons **(oil)**	foul structures and beaches - may taint seafoods	probable metabolic effects on organisms; kill birds	point - tankers and pipelines, industrial (solvents, etc.) diffuse - road runoff	statewide but sporadic regular at Adelaide & Port Augusta	low	high for point sources, moderate for diffuse	**Low**
bitterns (salt field)	aesthetic	probably affects organisms	point (saltfields)	Adelaide Price (at intervals)	low	moderate	**Low**
thermal	restricts recreation (but boosts fish growth)	excludes some organisms - facilitates exotic species	point - power stations	metropolitan and Upper Spencer Gulf	low	low	**Low**

Explanation of schedules

12. Each explanation lists the main beneficial uses which can be supported by waters of that quality.

Schedule 1

Passive Recreation—Pristine Environment—National Parks and similar reserves—Areas shown as Class III waters in the Appendix.

Water quality criteria are the most stringent proposed in the National Guidelines.

Schedule 2

Primary Contact Recreation

This is characterised by bodily immersion or submersion where there is direct contact with the water. It includes swimming, diving, water skiing and surfing.

Water quality criteria to protect these uses relate to human health and safety, and aesthetic considerations.

Schedule 3

Secondary Contact Recreation

This includes those activities such as wading, boating and fishing, in which some contact with the water may occur but in which the probability of bodily immersion or the intake of significant amounts of water is minimal. The following matters should be considered:

(i) human health;
(ii) safety, including protection of vessels;
(iii) aesthetics; and
(iv) effects on recreational fisheries.

Schedule 4

Passive Recreation—Non Pristine Environment

This schedule deals with waters used for scenic or aesthetic purposes by picnickers, etc.

Water should be pleasing to the senses and not objectionable and water quality should be consistent with the preservation of flora and fauna that require the water for their habitat and watering needs.

Schedule 5

Maintenance of water-associated wildlife

Water-associated wildlife means all indigenous species of vertebrates other than fish and man that depend on aquatic environments for drinking water, food and other habitat requirements.

Bioaccumulation

Many wildlife species, especially birds, are high in the food chain and thus are extremely vulnerable to the effects of toxic materials, such as chlorinated hydrocarbons and some heavy metals which are biologically concentrated up food chains. For these classes of pollutants, criteria are more stringent than those recommended in other schedules.

Habitat requirements

For the protection of wildlife, water quality should be consistent with the maintenance of the appropriate physico-chemical and biological constitution of wildlife habitats, particularly for vegetation. Thus, where wildlife depend on aquatic organisms for food or on aquatic plants for shelter, protection of wildlife requires protection of the aquatic ecosystem.

Protection of aquatic ecosystems

Schedule 6—Level I Protection

A maximum level of protection for ecosystems corresponding to water quality of near-natural state. Waters subject to this level of protection should not receive any waste discharges.

Schedule 7—Level II Protection

Areas shown as Class I or Class II waters in the Appendix.
A practical level of protection for modified aquatic ecosystems, recognising that since European settlement, the greater part of the nation's aquatic ecosystems have been degraded and modified so that their natural state is of limited relevance. The degradation may have arisen from changes in land-use and habitat and the introduction of exotic species. These impacts are generally irreversible.

Schedules 8, 9 & 10

Production of Edible Fish and Crustacea

The commercial and sporting use of fisheries represents an important use of waters. Water quality criteria for the protection of this use should provide the physical conditions to maintain the stock but not put human consumers at risk from pollutants that may accumulate in otherwise healthy fish.

Criteria for the Protection of Fisheries

Water quality should be consistent with the maintenance of the densities and distribution of the important species. In general this will mean that the water quality will need to be suitable for the physiological tolerances of individual species, and will ensure the preservation of food species and habitat. The criteria must also address the problems of bioaccumulation and biomagnification of persistent toxicants in food chains including the commercially important species. For the beneficial uses listed for Schedule 1, if one species or general biodiversity have been reduced in a body of water—even if the water quality is high—then that body of water does not provide best environmental value. The criteria for the protection of commercially and recreationally important species of fish and crustacea are generally those discussed in **Maintenance of Marine Aquatic Ecosystems—Schedules 6 & 7**

Shellfish culture and harvesting

The term shellfish is confined to edible oysters, abalone, scallops cockles and mussels. Shellfishing may be a commercial industry, or a recreational activity. Water quality criteria for the protection of shellfish culture and harvest may be divided into two groups: Schedule 8 and Schedule 9

Schedule 8

Criteria for protection of the organism

Schedule 9

Criteria for the Protection of the Human Consumer

Shellfish from polluted waters generally pose a greater threat to human consumers than do other forms of edible aquatic life. Eating of raw shellfish has been positively implicated in the transmission of infectious hepatitis in humans.

Consumption of shellfish may result in paralytic shellfish poisoning due to concentration by shellfish of the toxic dinoflagellates. In South Australia this is most likely to be *Alexandrium minutum*, see Hallegraeff, Steffensen & Wetherbee, Journal of Plankton Research, V.10 pp. 533-541, (1988)

Other forms of shellfish toxins likely to occur in South Australia are listed in Schedule 9.

Consumers are unlikely to detect substances at the concentrations indicated in Table 2, in seafoods they are eating. Some compounds taint seafoods to the point where they are readily detected. The concentrations at which they taint the food may not present any other hazard to the consumer, particularly as their presence minimizes consumption. These compounds are listed in Table 2.12 of the ANZECC National Guidelines, which could be used as a guide to identification where a tainting problem had appeared.

Other substances may be taken up by fish to levels (in edible parts) approaching or exceeding the NHMRC recommendations for human consumption. Table 2.11 of the National Guidelines offers concentrations in waters that may produce problems for human consumers of fish which live in those waters.

Schedule 10 proposes criteria to contain effects of oyster farms on the surrounding environment. More intensive culture with supplementary feeding would require more stringent controls.

Water quality criteria for the protection of shellfish species are generally those discussed in **Maintenance of Aquatic Ecosystems.**

Scientific and educational uses

Scientific and educational uses refer to the investigation and study of the physical, chemical and biological characteristics of the aquatic environment under natural conditions, or using such habitats as reference sites in comparative studies with sites showing impacts. There should be no evidence of human modification of the aquatic habitats reserved for scientific uses.

Marine Parks and Reserves, and waters within the boundaries of National and State Parks should be protected from human impact.

The quality of waters used for scientific and educational uses should be compatible with the criteria set out for **Protection of Aquatic Ecosystems—Level 1; Recreation—Level 1 and Maintenance of Water—Associated Wildlife**.

SCHEDULE 1

Water quality criteria for recreational or scientific uses, including national parks and similar aquatic reserves

Level 1—pristine waters and Class III waters

INDICATOR	CRITERION
Physico-chemical	
Colour & clarity	<10% change in euphotic depth
Dissolved oxygen	>6 mg/L
pH (change)	no change > 0.2 units
suspended particulate matter	change to be less than 10 mg/L or less than 10% of mean concentration
temperature (change)	< 2°C from natural range

Toxicants	µg/L		µg/L
antimony	500	hexachlorobutadiene	0.3
arsenic	50	acrolein	0.2
cadmium	2.0	benzene	300
chromium	50	phenol	50
copper	5.0	sulphide	2.0
lead	5.0	polychlorinated biphenyls	0.004
mercury	0.1		
nickel	15	polycyclic aromatic hydrocarbons	3.0
selenium	70	2,4,5 trichlorophenol	8.0
silver	1.0	pentachlorophenol	0.2
thallium	20		
tin	0.002		
zinc	50		

For toxicants not listed above, requirements of Schedules 2, 7 and 8 apply

SCHEDULE 2

Water quality criteria for recreational waters
Level 2—primary contact

INDICATOR	CRITERION
Biological	
(a) faecal coliform	Median value must not exceed 150 faecal coliforms per 100 mL for a minimum of 5 samples taken at regular intervals not exceeding 1 month with 4 out of 5 samples containing less than 600 organisms per 100 mL.
(b) blue-green algae	Action level for further testing for toxic products is 1000 cells per millilitre
(c) pathogenic protozoans	Waters should be free of pathogenic free-living protozoans (waters of salinity greater than 20%*o* normally are free of *Naegleria fowleri*,)
pH	Should be in the range 6.5-8.5
light penetration	A Secchi disc should be visible at a minimum depth of 1.2 m. and on the bottom in "Learn to Swim" areas
aesthetic quality	There should be no visible floating foam* debris, oil, scum, or objectionable matter or odour.
dangerous objects	The waters should not contain floating or submerged objects which might injure tangle or obstruct users. Bottom should be safe to walk on.
temperature	Not to exceed 35°C.
toxic substances	Should not contain substances at levels which are either toxic or irritating to the skin or mucous membranes

* This does not include persistent foam produced by natural surfactants released mainly by algae.

SCHEDULE 3

Water quality criteria for recreational waters
Level 3—secondary contact

INDICATOR	CRITERION
Biological faecal coliform	Median value shall not exceed 1000 faecal coliform organisms per 100 mL of 5 samples taken at regular intervals not exceeding 1 month with 4 out of 5 samples containing less than 4000 organisms per 100 mL.
pH	The pH should be in the range 6.5-8.5—pH. Values in the range 5.0-9.0 may be acceptable in waters of low buffering capacity

Where there is likely to be actual primary contact, other indicators in Schedule 2 should apply.

Values for faecal coliform indicator bacteria arise from assessments of risks **to** humans **from** human contamination. In South Australia, high coliform indicator levels in many recreational waters are of animal origin. In the absence of human enteric viruses, they do not offer the same level of risk to humans. When high levels are found, a sanitary survey should be conducted to determine the contribution of human faecal contamination. Where pollution is suspected, but only low numbers of faecal coliforms are detected, a geometric mean not exceeding 33 enterococci per 100mL should be used as a secondary guideline, applied as for the faecal coliform criterion.

SCHEDULE 4

Water quality criteria for recreational waters
Level 4—Passive recreation in non-pristine waters
(e.g. aquatic scenery)

INDICATOR	CRITERION
I Abiotic considerations	
odours, taints and colours	The water should be free of objectionable odours and taints, and colour should not exceed 100 Pt-Co (platinum-cobalt) units
floatable matter	There should be no visible floating debris, oil, scum, foam or other objectionable matter. See also note to Schedule 2
settleable matter	The water should be free of all materials which settle to form objectionable deposits in areas where they would not occur naturally
II Biotic considerations	
plant growth—nutrients	Levels of nutrients should not promote "environmental harm" as defined in this policy
wildlife	Water quality criteria necessary to protect animal life with respect to watering and habitat requirements are in Schedule 5.

SCHEDULE 5

Water quality criteria for the maintenance of water-associated wildlife

INDICATOR	CRITERIA
dissolved oxygen	Bottom waters should remain aerobic in waterbird habitats in order to prevent outbreaks of *Clostridium botulinum*
pH	Water pH should be in the range 6.5-9.2
buffering capacity	Bicarbonate alkalinity should be in the range 30-130 mg/L for waterbird habitats. Fluctuations from background levels should not exceed 50 mg/L
salinity	The weekly average should not exceed background variation by more than the values shown. Background Permitted variation 0.0— 3.5 ‰ 1.0 ‰ 3.5—13.5 ‰ 2.0 ‰ > 13.5 ‰ 4.0 ‰ natural seasonal extremes are not to be exceeded
light penetration	The combined effects of colour and turbidity should not reduce the depth of the compensation for photosynthetic activity by more than 10% from the natural seasonal background value
settleable substances	Any extra deposition should not exceed 10% of the normal rate, over a year.
plant growth—nutrients	Levels of nutrients should not promote "environmental harm" as defined in this policy
oil	There should be no visible floating oil; and concentrations of hexane-extractables should not exceed 1 000 mg/g in air dried sediments.
chlorinated hydrocarbons	Total DDT concentrations in any aquatic plants and animals should not exceed 1 µg/g wet weight (see also criteria for pesticides in other schedules) levels in water should not exceed 0.005 µg/L
polychlorinated biphenyls	PCB concentrations in food organisms should not exceed 0.5 µg/g wet weight. 24 hour concentrations in water should not exceed 0.03 µg/L*
mercury	For the protection of wildlife which consume fish and other aquatic organisms, a concentration of mercury in edible tissue of 1.0 µg/g wet weight should not be exceeded If 4 day average concentrations in water exceed 0.25 µg/L more than once in 3 years, the edible portion of consumed species should be analysed to determine methylmercury levels.
other toxicants	The chronic criteria in Table 2 for heavy metals must be met, and criteria for other relevant toxicants may be applied.
*	The criterion specified in USEPA 1986 (p 246—see references) adds the qualification The concentration of 0.030 µg/L is probably too high, because it is based on bioconcentration factors measured in laboratory studies, but field studies apparently produce factors at least 10 times higher for fishes.

SCHEDULE 6

Water quality criteria for the maintenance of marine aquatic ecosystems—Level I protection

INDICATOR	CRITERION
dissolved oxygen (mg/L)	The dissolved oxygen concentration should not fall below 6 mg/L unless as a result of temporary natural variations.
pH	pH should not be outside the range 6.5 - 9.2
salinity—marine	Salinity should not vary by more than 2% from the background limits of natural variation
salinity—estuarine	No change in the hydrography of stream flow should be allowed which causes a permanent change in isohaline patterns by more than 2% of the natural background variation
suspended solids (mg/L)	The suspended solids should not exceed a level given by the formula: SS = 10 + 0.6N (where N is the background seasonal maximum in milligrams per litre, or 25 mg/L, whichever is lower—see also criterion for turbidity below)
turbidity and colour	The combined effects of turbidity and colour should not reduce the depth of compensation point for photosynthetic activity by more than 10% from the seasonal natural background value
settleable solids (including particulate organic matter)	Settleable solids should not be in excess of natural background levels
temperature	The maximum weekly average temperature should not exceed the natural background level by more than 0.5°C during all seasons of the year. In addition, seasonal maxima should not be exceeded;
nutrients	Nutrient levels should not promote "environmental harm" as defined in this policy
toxicants	The levels of toxicants should not exceed a value given by the formula: N + 0.2 (T-N) where T is the *chronic criterion* in Table 1 and N is the natural background level.
toxicant mixture	The following relationship should apply for combinations of toxic materials: $\frac{C_1}{L_1} + \frac{C_2}{L_2} + ... + \frac{C_n}{L_n} < 1.0$ where C_1, C_2 *etc.* are the measured concentrations of the toxicants, and L_1, L_2 etc. are the appropriate criteria recommended for individual toxicants. Individual fractions less than 0.2 should not be included in the calculation

SCHEDULE 7

Water quality criteria for the maintenance of marine aquatic ecosystems—Level II protection

INDICATOR	CRITERION
dissolved oxygen (mg/L)	At no time should levels fall below 4 mg/L unless as a result of temporary natural variations.
pH	pH should not be outside the range 6.5 - 9.2
salinity—marine	Salinity should not vary by more than 10% from the natural background limits of variation
salinity—esturine	No change in the hydrography of stream flow should be allowed which causes a permanent change in isohaline patterns by more than 10% of the background variation
suspended solids (mg/L)	The suspended solids should not exceed a level given by the formula: SS = 80 + 0.8N (where N is the background seasonal maximum in milligrams per litre, or 400 mg/L, whichever is lower—see also criterion for turbidity below)
turbidity and colour	The combined effects of turbidity and colour should not reduce the depth of compensation point for photosynthetic activity by more than 50% from the seasonal natural background value
settleable solids (including particulate organic matter)	Settleable solids should not be in excess of natural background levels
temperature	The maximum weekly average temperature should not exceed the natural background level by more than 2.0ºC during all seasons of the year. In addition, seasonal maxima should not be exceeded;
nutrients	Levels of nutrients should not cause "environmental harm" as defined in this policy
toxicants	The levels of toxicants should not exceed the *chronic criteria* in Table 1
toxicant mixture	The following relationship should apply for combinations of toxic materials: $\frac{C_1}{L_1} + \frac{C_2}{L_2} + ... + \frac{C_n}{L_n} < 1.0$ where C_1, C_2 *etc.* are the measured concentrations of the toxicants, and L_1, L_2 etc. are the appropriate criteria recommended for individual toxicants. Individual fractions less than 0.2 should not be included in the calculation

SCHEDULE 8

Water quality criteria for shellfish culture and harvesting

I Criteria for the protection of shellfish growing areas

The criterion for organic tin is to protect molluscs primarily from tributyltin (TBT) Criteria for other indicators should be taken from **Schedule 6—Maintenance of Aquatic Ecosystems—Level 1 protection**

Shellfish growing areas generally should approach or meet this level of water quality. Refer also to Table 1, for particular pollutants, with values applied through the formula given in Schedule 6

INDICATOR	**CRITERION**
tin (organic)	Antifoulants should not release more than 5 µg tributyltin per cm^2 per day*
	From 1995, this rate may be reduced to 1 µg tributyltin per cm^2 per day
	Residual concentrations of organic tin should not exceed 0.002 µg/L in relevant growing areas
*	measured from a continuously rotating cylinder, by the method used by Materials Research Laboratories of the Australian Defence Science and Technology Organisation.

SCHEDULE 9

Water quality criteria for shellfish culture and harvesting
II Criteria for the protection of human consumers

INDICATOR	CRITERION
approved growing area	
(a) total coliforms (oysters and mussels only)	The total coliform median MPN (most probable number) in the water should not exceed 70 organisms per 100 mL based on at least 5 water samples taken within a 42 day period. No more than 10% of those samples is allowed to exceed a total coliform median MPN of 230 organisms per 100mL for a 5 tube decimal dilution test
(b) faecal coliforms (oysters and mussels only)	The faecal coliform median MPN in water should not exceed 14 organisms per 100mL based on at least 5 water samples taken within a 42-day period. No more than 10% of those samples is allowed to exceed a median MPN of 43 organisms per 100mL
There may be restricted growing areas, subject to these criteria and to further treatment after harvest	
(a) total coliforms (oysters and mussels only)	The total coliform median MPN (most probable number) in the water should not exceed 700 organisms per 100 mL Nor shall more than 10% of those samples exceed a total coliform median MPN of 2300 organisms per 100mL
(b) faecal coliforms (oysters and mussels only)	The faecal coliform median MPN in water should not exceed 88 organisms per 100mL Nor shall more than 10% of those samples exceed a median MPN of 260 organisms per 100mL
biotoxins	Shellfish should not be harvested when concentrations of shellfish poisons exceed: PSP (paralytic shellfish poison)—saxitoxin equivalent of 0.8 µgm/gm of shellfish meat [International Standard see Williams in refs]. - or DSP (diarrhetic SP)—2.0 µgm of okadaic acid per gram of shellfish hepatopancreas - or 1.8 µm of dinophysis toxin per gram of shellfish hepatopancreas [proposed Japanese standard—which may be revised depending on carcinogenicity tests; see Lee in refs.} -or ASP (amnesic SP)—20 µgm of domoic acid per gram of shellfish meat [Canadian action level—see Subba Rao in refs.]
algae	Excessive algal growth may include species toxic to shellfish or which generate toxins which are stored in the shellfish. These may affect secondary consumers.

nutrients	Levels of nutrients should not promote "environmental harm" of the kinds defined in this policy
tainting substances	Compounds should not be present in water at concentrations that individually or in combination produce undesirable flavours or odours in the edible portions of shellfish.

SCHEDULE 10

Water quality criteria to minimise effects of fish farming on the surrounding environment

All requirements of the *Fisheries (Exotic Fish, Fish Farming and Fish Diseases) Regulations* should be met.

The Aquaculture Committee, which was set up under the *Planning Act*, recommended the following criteria

pH	not to be less than 6.5
oxygen	not to be less than 4.0 mg/L
sediment	not to exceed 3 cm/year average buildup over the lease

The SA Health Commission monitors chemical residues and bacterial levels within the oysters, primarily for the benefit of human consumers, but this would also indicate what chemicals (such as heavy metals, or the pesticide "Dichlorvos"—which may be used on oyster farms to control predators) may be available in the area. Lease areas would also be photographed, and biological indicators identified.

Waters contiguous with leases should better criteria in Schedule 7 and approach Schedule 6.

References for the water quality guidelines

A full set of references appears in the "Guidelines for Licensing Discharges to the Marine Environment" dated November 1993.

Lee *et al* (1987) *Fluorometric determination of diarrhetic shellfish toxins by HPLC* Agric. Biol. Chem; **51,** 877-881.

Subba Rao *et al* (1988) *Domoic acid—a neurotoxic amino acid produced by the marine diatom Nitzschia pungens in culture.* Can. J. fish Aquatic Sci; **45**, 2076-2079

USEPA 1986 Quality Criteria for Water—US Environmental Protection Agency Washington DC [EPA/440/5-86/001]

Williams S 1987 *Paralytic shellfish poison*. in: Official methods of analysis, p. 344. Association of Official Analytical Chemists, Arlington VA

APPENDIX

Classification of waters according to beneficial uses

Definition of waters of South Australia likely to suffer continuing diffuse impacts (Class I waters)

Port Lincoln

The waters of Boston Bay and Proper Bay west of a line joining Point Boston to Maria Point (Boston Island) and Point Fanny (Boston Island) to the Flinders Monument on the summit of Stamford Hill.

Port Pirie

The waters of Germein Bay commencing at Ward Point thence generally WSW along Ward Spit to Ward Spit Beacon (E 137° 49.4′; S 33° 02.75′). Thence SSW to the beacon on the northern end of Eastern Shoal (E 137° 47.9′; S 33° 04.5′). Thence SW generally along Eastern Shoal to the beacon at the southern end of Eastern Shoal (E 137° 43.55′; S 33° 10′). Thence south easterly to the NE bank of Port Davis Creek.

Whyalla

The waters of False Bay NW of a line commencing at Black Point, thence generally south westerly to a point on the SSE corner of the "Spoil Ground" for Port Whyalla (E 137° 41.9′; S 33° 01.1′) thence in a generally WSW direction to pass through the Port Whyalla outer beacon (E 137° 37.65′; S 33° 02.45′), and continuing, to intersect the coast at HWM.

Adelaide metropolitan

Waters east of a line commencing at a point on the southern bank of the Light River (the SW corner of Section 732 Hundred of Port Gawler)—point (1). Thence southerly to a point on the northern bank of the Myponga River mouth—point (2)

AMG co-ordinates—Zone 54

point (1)	258 460 E	6 170 500 N
point (2)	262 300 E	6 082 300 N

37.

Classification of Waters According to Beneficial Use

[Map appears in *Gaz*. 27 October 1994, p. 1380]