CHAPTER 7

INDUSTRIAL WASTES IN THE OCEAN - ENVIRONMENTAL HAZARD OR ECONOMIC BENEFIT?

The compromise between environmental protection and the promotion of economic growth that was revealed in the legislation of pollution in the previous chapter was even more evident in the Water Board's policies towards industrial waste. Until the 1970s the environmental damage caused by industrial waste discharged through the sewers did not even figure in the formation of Board policy. The legislative moves of the early seventies caused environmental concerns to be part of the Board's rhetoric. The actual extent to which these concerns have affected policy has still been severely limited.

The reason that wastes have been accepted into the sewers despite their environmental consequences has been in large part based on the assumption that if industry was not provided with a cheap disposal system this would adversely affect economic and industrial growth and would pose a threat to the living standards of Sydney residents. This assumption can easily be challenged both in narrow economic terms and also in terms of the loss to the community of environmental amenity.

Industrial waste management can be approached in two different ways. One way is to concentrate on reducing the production of wastes and restricting their discharge, the other is to provide facilities for the treatment and disposal of those wastes. The emphasis in Sydney has always been towards providing disposal facilities rather than on preventing pollution at its source, for example, by changing production processes and encouraging recycling of waste materials.[1] Seen as an add on after production, pollution control is a cost that must be added to each industrial process. However, pollution controls which cause changes in the production process and increase efficiency and resource conservation can be cost-saving to industry in the long run.

The long term environmental costs of unhindered industrial discharges, via the sewers, into the sea have not figured in the cost-benefit assessments and yet there is growing evidence that toxic industrial waste is accumulating in the marine life off Sydney. This, together with the impact of pollution on bathing, surfing and fishing activities, mean that the supposed cheaper goods that arise from allowing cheap disposal methods are counterbalanced by losses in other areas.

CATERING TO INDUSTRY BEFORE THE CLEAN WATERS ACT

Having settled on water carriage as the best means of disposing of domestic waste in the nineteenth century, water carriage seemed the obvious way to dispose of industrial wastes which at the time were similar in nature to domestic wastes. Industrial wastes before the second world war were almost totally organic and biodegradable. The strength and volume of these wastes were the major problems. Nevertheless it was agreed by all Australian sewerage

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[1] W.J.Hickson, `Service and Capital Charges for Sydney's Sewer Wastes', in C.Joy et al, Liquid Waste Management, Botany Bay Project, Canberra, 1978, pp116-7.

authorities that the sewers were a proper means of disposing of industrial waste.[2]

Despite the changing composition of industrial waste because of an increasingly non-organic component, the Sydney Water Board, in 1957, affirmed the principle that the sewerage system was the "logical" means of disposal for water-borne wastes which were no longer of any value and which could not be handled by industry in an economical, convenient or inoffensive manner.[3]

The two main arguments for the use of the sewers to dispose of liquid industrial wastes centred around the provision of a service to industry and the protection of the environment from the possible irresponsibility of individual firms. It was argued that if the sewers were not available as a cheap and easy disposal method then the waste would be dumped irresponsibly in a way that would endanger waterways and natural bushland.

Although the Sydney Water Board does not legally have to accept industrial waste into its sewers, the provision of a service to industry was justified because the existing centralised public system, it was argued, could treat the wastes more cheaply than individual industries. It was also argued that industrial wastes could be "more easily treated when mixed with large volumes of domestic sewage"[4] because the domestic sewage diluted the industrial wastes and thereby reduced their toxicity, equalised the sporadic industrial flow and provided biological seeding for the decomposition of organic industrial waste.[5]

Such a system seemed to suit everyone. The government authorities would gain from having control over treatment facilities. Industry would save money. They would be able to concentrate on production whilst the specialists looked after their waste and they would be able to use their property to the full without having a treatment plant taking up room and causing complaints from neighbours.[6]

Restrictions on industrial waste going into the sewers were originally only imposed to protect the sewer system and sewerage workers. Most states were also concerned about the effect of the industrial wastes on their treatment plants in terms of the plant capacity and ability to deal with wastes which might interfere with the biological processes.[7] Sydney did not, at first, have this

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[2] Conference of Professional Officers Representing the Authorities Controlling Water Supply and Sewerage Undertakings Serving the Cities and Towns of Australia, Report of the Proceedings of the Third Conference, 1947.

[3] M.W.S.&D.B., 'Policies Respecting Trade Waste Discharges and Pre-treatment Before Discharge to Sewers', Conference of Professional Officers Representing the Authorities Controlling Water Supply and Sewerage Undertakings Serving the Cities and Towns of Australia, Report of the Proceedings of the Eighth Conference, 1957, p146.

[4] Engineering and Water Supply Department, South Australia, 'Trade Wastes Discharge to Sewers-Policy, Legislation, Pretreatment, Inspection and Charges' in Conference of Engineers Representing the Authorities Controlling Water Supply and Sewerage Undertakings Serving the Cities and Towns of Australia, Report of the Proceedings of the Fourteenth Conference, Brisbane 1969, p49.

[5] R.D.King-Scott, discussion, in Conference of Engineers, Fourteenth Conference, p83.

[6] ibid.

[7] Conference of Professional Officers, Third Conference

concern because Sydney's sewage was discharged directly into the sea without treatment. Mr Farnsworth, Chief Engineer of the Board, and a colleague told a conference of sewerage representatives in 1947 that the strength and quality of discharge was not "of immediate importance" and that they were only concerned about wastes which might damage the actual sewers.[8]

Sydney authorities had first given attention to industrial waste discharges after problems were experienced with the effluent from the NSW State Abattoirs, the CSR, pickling wastes from Lysaght's Ltd, wastes from Davis Gelatine Company, various gas works and other minor sources. Maintenance work costing thousands of pounds had been required for damage to, and blockages of, the sewers.[9]

The priority given to protecting the sewers rather than the environment was evident when the Sydney Water Board entertained the idea of reducing charges for industrial wastes going into stormwater drains. Farnsworth suggested that the discharge of industrial wastes into stormwater drains was "beneficial". The Board was only responsible for drains that passed through more than one municipality. Stormwater effluents were not treated before entering the nearest waterway so that discharge to stormwater got around the problem of damaging the sewers, sewerage workers and treatment processes. The charge for discharge of effluents into sewers and stormwater drains in 1947 was 6d per thousand gallons and the Board proposed to drop the charge for stormwater drains to 3d per thousand gallons "as an inducement to manufacturers to spend the other 3d in treatment". There were no set limits on what could be put into the stormwater drains, however, although Farnsworth said that it was hoped in the future to set standards for stormwater drains.[10]

Since most industrial waste at this time was organic, Sydney sewerage authorities were concerned with limiting the solid and fat content and the biological oxygen demand of these wastes as well as temperature and acidity in some cases.[11] Standards were set for industrial waste discharges allowed into the sewers in 1940 according to the advice of the Board's Medical Officer. These standards were based on the average composition of sewage at that time. The standards could be changed at any time by the Engineer-in-Chief but were still being used as a guide in 1957 although they were never rigidly enforced.[12]

The desire to service industry was the same in every Australian state. The Adelaide authorities, who wanted to allow as much industrial waste through the sewers as possible, lined the main sewer running through their heavy industrial district with plastic in the 1960s so that it would not be corroded by strong wastes and the treatment plant to which this sewer carried the waste was also designed to handle "strong sewage with a heavy trade component".[13]

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8 Mr Fansworth, coment in ibid., p116.

9 M.W.S.&D.B., 'Policies Respecting Trade Waste Discharges and Pre-treatment, p145.

10 Mr Fansworth, coment in Conference of Professional Officers, Third Conference, p120.

11 ibid.

12 M.W.S.&D.B., 'Policies Respecting Trade Waste Discharges and Pre-treatment, p145.

13 Engineering and Water Supply Department, South Australia, 'Trade Wastes Discharge to Sewers, p48.

There was also a reluctance amongst Australian sewerage authorities to have hard and fast regulations about what would and would not be accepted into the sewers. One reason for this was that some parts of the sewerage systems were more able to deal with more concentrated wastes than others depending on how much treatment the sewage would be getting at the outfall and how far from the outfall the company's discharge was.[14]

Some of the authorities actually encouraged industries to be sited at certain parts of the sewerage system.[15] For example, the Sydney Water Board encouraged industries likely to have "bad wastes" to be established in areas draining to the ocean outfalls rather than to inland treatment plants.[16] Also acid waste from one company might be balanced out by the alkaline waste from another. At the 1947 conference it was suggested that it might be expedient to accept a strong waste without pretreatment.[17] A Melbourne delegate said of one set of suggested standards

> to adopt them as a definite standard for all cases would tend to make conditions too rigid and might hence impose an unnecessary burden on industry.[18]

The decision to install primary treatment facilities at the ocean outfalls in Sydney forced the Board to tighten up somewhat on even those firms discharging to the ocean outfall systems. Previously only floating grease had been a problem in these systems because of the nuisance it caused on nearby beaches and bathing waters.[19]

A 1970 Water Board Trade Waste Committee report described how the volume and significance of industrial wastes had increased over the years till industrial wastes in 1970 "largely determined" the characteristics of the raw sewage at the main outfalls. Several times industrial wastes had "caused noxious and noisome conditions" at the Malabar treatment works and severe pollution of beaches and bathing waters.[20] The Committee also found that there were "a substantial number" of industries discharging wastes which did not comply with the standards set by the Board. This caused increased costs to the Board because of damage to sewerage structures and treatment.[21]

The Sydney Water Board had been the first Australian authority to introduce industrial waste charges in 1942 following investigations in 1940 which had revealed that industrial wastes made up about 17% of Sydney's sewage flow and yet this was not being paid for, despite the fact that this addition to the flow

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[14] Melbourne and Metropolitan Board of Works, 'Special Charges for Discharge into Sewers' in Conference of Professional Officers, Third Conference, p109.

[15] ibid.

[16] M.W.S.&D.B., comment, in Conference of Engineers, Fourteenth Conference, p68.

[17] Metropolitan Water Supply, Sewerage, and Drainage Deapartment, Perth, 'Paper No.3', in Conference of Professional Officers, Third Conference, p104.

[18] Mr Borrie, comment in Conference of Professional Officers, Third Conference, p114.

[19] M.W.S.&D.B., comment, Conference of Engineers, Fourteenth Conference, p69.

[20] A.N.Killmier, 'Charging for Trade Waste Disposal', Thirteenth Conference of Administrative Officers of Water Supply and Sewerage Authorities of Australia, 1972, p24.

[21] ibid., p25.

necessitated larger disposal facilities. Industries at that time were only paying normal sewage rates based on the value of their property.[22]

Although it was estimated that it cost 1 shilling per 1,000 gallons to dispose of sewage this was considered to be too harsh a levy on industry and the industrial waste was established at a level of 6d per 1,000 gallons.[23] Calculation of the volume of industrial waste being discharged by an individual industry was difficult to measure and gauging equipment was considered expensive so the volume charged for "became a matter for negotiation between the discharger and the board".[24]

The reasons given for imposing a charge varied. Aird, the Sydney delegate at the 1948 conference, said that in 1942 the Board needed extra revenue and had the choice of raising the sewerage rate or finding the money some other way. The industrial wastes charge would therefore cover the cost of larger sewers and additional maintenance, encourage economical use of water (there was a drought at the time) and produce extra revenue.[25] In a 1940 report Aird had said that the industrial waste charge was not to raise revenue but to "provide a more equitable distribution of the cost of the sewerage service between domestic users and manufacturers."[26]

The Board charged for industrial wastes according to volume after a certain threshold allowance. They claimed that charges that were also based on composition would be too complicated and not justified since the cost of treatment (i.e. discharge to ocean of raw sewage) was not affected by composition. It also had the advantage of not discriminating against industries which discharged into its inland secondary treatment works which were far more sensitive to strong and toxic wastes and would therefore be required to pay more for the disruption caused by high strength wastes.[27]

LEGISLATIVE REFORMS & STRENGTH CHARGES

The legislative reforms of the early 1970s did not change the basic philosophy that the sewers were, in most cases, the best means of disposal, for liquid industrial waste. In 1970 a Trade Waste Committee, under the Chairmanship of the Deputy Principle Chemist of the Sydney Water Board reaffirmed that the Board was following a world-wide practice in allowing industrial wastes into the sewers when there was adequate capacity available.[28]

In fact the efforts to clean up the environment in the 1970s directed more waste into the sewers because of the emphasis on waste removal, transfer and treatment rather than on pollution prevention and control. Not only was liquid industrial waste diverted to the sewers but air-borne wastes were converted to

22 ibid., p4.
23 ibid.
24 ibid.
25 ibid., p7.
26 ibid., p8.
27 M.W.S.&D.B., comment in Conference of Engineers, Fourteenth Conference, p68.
28 Killmier, 'Charging for Trade Waste Disposal', p24.

liquid form for disposal to sewer. For example, in the newspaper industry, vapours are drawn off the printing machines and condensed into a liquid which is treated before going to sewer.[29] At a 1978 conference, a Sydney Water Board engineer explained that the Board had accepted "progressively heavier industrial wastes" into its system to assist the government cope with the requirements of the Clean Waters Act.[30]

A consequence of the Clean Water Act on the Board's industrial waste policy was that in 1972 stormwater drains were no longer available for industrial discharge and so standards were set for discharges going into stormwater drains and the standards for the acceptance of industrial wastes into sewers were revised. Although the costs of dealing with wastes going into stormwater channels were far less than those going to sewer because of the shorter lengths of pipe and absence of treatment, the Sydney Water Board imposed the same volumetric charge on waste going into stormwater drains as into sewers so that there would be no financial incentive for firms to use the stormwater system.

The new standards for acceptance of industrial waste into sewers covered parameters such as temperature, acidity, grease content, biochemical oxygen demand, suspended solids, sulphides and maximum concentrations for various toxic metals and compounds, including arsenic, cadmium and insecticides.[31] (see table 7.1) Despite these new restrictions the Water Board was careful to assure a meeting of the Royal Australian Chemical Institute that this did not mean the Board was reluctant to accept industrial wastes.

> Nothing is further from the truth. No enterprise, whether public or private, can operate successfully by turning away business that it might reasonably accept.[32]

The board would in fact do its utmost, the Chemical Institute was told, to find ways of placing minimum restrictions whilst protecting the sewerage system.[33]

The Water Board spokesmen did point out however, that although the Board's total policy was "aimed at providing industry with the opportunity to discharge to sewer those wastes which the Board can handle more efficiently than the owner"[34] certain wastes could be more easily and economically removed or treated at their source.[35] (After entry into the sewers the wastes became highly diluted by domestic and other industrial sewage.) Also discharges could be reduced by more efficient use of materials, recovery of by-products, better

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29 Hickson, 'Service and Capital Charges for Sydney's Sewer Wastes', p118.

30 M.W.S.&D.B., Comment in Conference of Engineers Representing the Authorities Controlling Water Supply and Sewerage Undertakings Serving the Cities and Towns of Australia, Report of the Proceedings of the Eighteenth Conference, 1977, pp76-7.

31 E.W.T.Pierce and C.S.Ralph, `Principles and Practices Relating to the Acceptance of Trade Wastes into the Sydney Water Board's Systems', in Royal Australian Chemical Institute, Process Chemistry Group, Industrial Waste Water, 1972, pp10-12.

32 ibid., p18.

33 ibid.

34 ibid., p12.

35 ibid.

Table 7.1

METROPOLITAN WATER SEWERAGE AND DRAINAGE BOARD

STANDARDS FOR ACCEPTANCE OF LIQUID TRADE WASTE TO SEWERS

Temperature	Not to exceed 37°C if the waste contains grease or fats. Otherwise not to exceed 50°C.
pH	To be in the range 6.8 to 10.
Grease	Not to exceed 200 mg/L.
Bio-chemical Oxygen Demand (5 days)	Not to exceed 600 mg/L.
Suspended Solids	Not to exceed 600 mg/L.
Sulphides	Not to exceed 10 mg/L.

Toxic Metal or Compounds (the discharge to be subject to prior approval in each case) – not to exceed:

Arsenic	100 mg/L
Cadmium	30 mg/l
Chromium	100 mg/L
Cobalt	200 mg/L
Copper	5 mg/L
Cyanide	7 mg/L
Lead	10 mg/L
Nickel	100 mg/L
Zinc	30 mg/L
Organic Herbicides	5 mg/L
Organic Insecticides	5 mg/L

Notes:

1. No discrete oil may be discharged.
2. No mercury may be discharged.
3. When two or more metals or salts of metals are discharged concurrently to the sewer in a waste, the sum of all the proportions which the concentration of each camponent metal or ion bears to the Board's limit for that metal or ion shall not exceed unity.
4. Cyanide baths are only accepted after detoxification. (The acceptable level of 7 mg/L in the table above refers to rinses only).
5. Volatile solvents shall not be discharged unless miscible with water and then only with special approval. The use of solvents in discharging the contents of grease traps to the sewer is prohibited.
6. Ferruginous pickling wastes will be accepted with pH not less than 5.5 in certain cases.

C. S. Keith
Secretary.

'housekeeping' and alternative manufacturing processes and materials as well as by pretreatment.[36]

A basic strategy that encourages the use of the 'best practicable means' available to industry to treat their waste has been preferred over any attempt to enforce general environmental standards. This has allowed the application of standards of acceptance to sewer to be flexibly applied.[37] If a waste stream was causing the Board some trouble in terms of its operations and a technology was available that the industry could install cheaply or that enabled some cost savings to the industry through recycling or added efficiency, then the Board might insist that such a technology be installed. The limits set in 1972, which were partially based on the technology available at that time, have remained the same until 1988 except for sulphide which has had its limit reduced.[38]

Despite the provisions of the Clean Waters Act the Water Board did not put environmental protection high on its agenda of priorities and was not a key factor in setting restrictions on what could go in the sewers. The four stated objectives of placing conditions on acceptance of industrial waste into the sewers were a) safety of Board's workmen and the public, b) protection and proper operation of the sewerage structures, c) proper functioning of the sewage treatment processes and d) recovery of reasonable costs for the service rendered. Increasing public concern for the environment had an indirect affect in that it influenced the criteria for the satisfactory operation of the sewers and treatment works.[39]

The standards of acceptance for industrial waste to sewer that were developed by the Board therefore represented a balance between the requirements of the Board's sewerage collection and treatment operation and the need to minimise costs to industry. A paper written in 1975 as part of the Botany Bay project concluded that effluent controls in Sydney were still oriented towards protecting Water Board facilities and workers rather than towards protecting the environment despite the 1972 anti-pollution legislation which was a response to perceived environmental threats.[40] In fact, although these standards were introduced at the time of legislative reform, the legislation seems to have had little impact on the actual content of these standards.

Another change in Board policy which followed the new NSW legislation was the introduction of strength charges but these had been foreshadowed a few years earlier. By 1969 the Sydney Water Board was becoming more amenable to what they saw as an overseas trend to charge on the basis of strength as well as quantity of industrial waste discharge "where subsequent treatment of the sewage is involved". They argued that such a charging system would allow individual industries to pay the Board to discharge high strength wastes and

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36 Melbourne and Metropolitan Board of Works, 'Quantity and Quality Charging for Acceptance of Discharge into Sewers' in Conference of Engineers, Eighteenth Conference.

37 Hickson, 'Service and Capital Charges for Sydney's Sewer Wastes', p118.

38 John Hitchen & Greg Klamus, `Trade Waste Discharge Limits; Current Status and Likely Trends', 1987, pp2-3.

39 Pierce & Ralph, `Principles and Practices Relating to the Acceptance of Trade Wastes into the Sydney Water Board's Systems', p1.

40 Hickson, 'Service and Capital Charges for Sydney's Sewer Wastes', p140.

thereby avoid "possibly expensive treatment facilities."[41] It would also have the advantage of inducing industries to try and recover their by-products where this was economical which would keep the "pollutional load" out of the sewers.[42]

In 1970 a Sydney Trade Waste Committee, set up partly in anticipation of the introduction of anti-pollution legislation[43], recommended that the basis for charging be changed so that it would be more related to costs. Strong wastes should be subject to extra charges with the maximum penalty for breach of the by-laws increasing and a bond being a condition for reconnection if a firm was ever disconnected.[44]

Two Water Board employees, an engineer and a chemist, sent on an overseas fact finding trip, also recommended that strength charges be established. The two objectives of these charges, they said, would be firstly that the discharge of strong wastes which might cause the sewerage system problems would be expensive to industry and their discharge would be discouraged. Secondly, the industry would bear the cost of treating and disposing of that waste and this was a principle accepted in Europe and the United Kingdom.[45]

That year, 1972, the Sydney Water Board established the concepts of "Basic Strength" and "Established Strength" for industrial wastes that were above limit in concentrations of grease, suspended solids and biochemical oxygen demand. Basic Strength applied to effluents assumed to comply with basic standards. These effluents would not be examined too closely and would be charged at the basic rate. For effluents that did not comply with the basic standards in one or more aspects an "agreed strength" might be established for these effluents which would be the basis of charging or, where information was lacking or in dispute, an "established strength" would be determined by sampling and testing.[46]

As in the case of the new standards for acceptance of industrial waste to sewer it seems that although the strength charges coincided with new pollution legislation, they were not brought in specifically to clean up the environment. The reason that these changes in Water Board policy were brought in had more to do with the consequences of the Clean Waters Act than the spirit or intention of the Act, that is, these changes were in response to the added load of industrial waste diverted to the sewers from the rivers because of the Act.

The fact the strength charges were not aimed at keeping high strength wastes out of the sewers but rather were part of decision to allow relatively high strength wastes into the sewers subject to charges being made for this[47] can be

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41 M.W.S.&D.B., comment in Conference of Engineers, Fourteenth Conference, p69.

42 ibid., p82.

43 Hickson, 'Service and Capital Charges for Sydney's Sewer Wastes', p123.

44 Killmier, 'Charging for Trade Waste Disposal', pp29-30.

45 E.W.T.Pierce & B. Parkes, The Control and Treatment of Trade Wastes in Sewerage Systems, Report on Visit to Europe, South Africa and Singapore, MWS&DB, 1970, p7.

46 M.W.S.&D.B., 'Pollution Control Legislation Effect on Water Supply and Sewerage Authorities' in Conference of Engineers Representing Authorities Controlling Water Suply & Sewerage Undertakings Serving Cities & Towns of Australia, Proceedings of the Fifteenth Conference, 1971, pp388-9.

47 Hickson, 'Service and Capital Charges for Sydney's Sewer Wastes', p123.

seen by the way the by-law was amended so that the Board would be able to accept any over-strength waste if the appropriate strength charge was paid. It was stated, however, that this concession was only available for wastes that were over the limits in Biochemical Oxygen Demand, grease content or suspended solids content. Wastes over the standards in temperature, pH, sulphides or toxic substances would not be accepted because of the threat they posed to workers, sewers and treatment processes.[48] Moreover there were compensations for large volume industrial dischargers because the strength charges were accompanied by a decrease in volumetric charges as quantity increased.[49]

One consequence of the strength charges in conjunction with low charges for water has been the encouragement of a heavy use of water for dilution and carriage of wastes. This has led to a situation where the proper treatment of industrial wastes in the sewage before the discharge of sewage into waterways would be extremely costly because of the additional volumes that had to be dealt with.[50]

SUBSIDIES FOR INDUSTRY - THE VELVET GLOVE APPOACH

The decision to charge industry for disposing of its wastes was not an easy one and other Australian sewerage authorities were much slower to do so. The Perth authority was not a statutory board and had a more direct relationship with government. They feared that the institution of industrial waste charges would have to be approved by the parliament where objections from the Chamber of Manufacturers and other like bodies was bound to have an influence. In addition their Department of Industrial Development, which was trying to encourage industries to establish in Western Australia, would probably oppose such a move.[51] All sewerage authorities looked at charges on industry "with a certain amount of fear and trepidation."[52]

Adelaide made no industrial waste charges for many years because special charges were a means of repressing industry[53] and because their policy of not charging industry had "considerable impact on the economic development of the city by attracting industry."[54] The Adelaide Sewerage authority still did not make any charge for industrial waste in 1972 and justified this policy in terms of the impact on industry and the environment. Some industries, which had strong and difficult wastes, Adelaide's engineer argued, would not be economically viable if they had to pay their true sewerage costs and these difficult wastes "frequently become quite amenable to treatment when mixed with large volumes of domestic sewage and other wastes."[55]

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48 Pierce & Ralph, `Principles and Practices Relating to the Acceptance of Trade Wastes into the Sydney Water Board's Systems', p13.

49 Killmier, 'Charging for Trade Waste Disposal', pp29-30.

50 Hickson, 'Service and Capital Charges for Sydney's Sewer Wastes', p115.

51 Killmier, 'Charging for Trade Waste Disposal', pp9-10.

52 ibid., p11.

53 Mr Murrell, comment in Conference of Professional Officers, Third Conference, p117.

54 Mr Hodgson, 'Policies Respecting Trade Waste Discharges and Pre-treatment Before Discharge t Sewers', in Conference of Professional Officers, Eighth Conference, p149.

55 Killmier, 'Charging for Trade Waste Disposal', p36.

The Adelaide engineer said that the absence of industrial waste charges had not led to the preponderance of 'dirty' industries in South Australia. On the contrary, the environment benefited because all wastes were discharged to the sewers since industry did not seek to avoid industrial waste charges. Also individual industry pretreatment plants, which might otherwise produce sludges and concentrated wastes that could be irresponsibly disposed of, were discouraged. Pre-treatment tended only to remove the easily treated part of waste anyway leaving the "more stable and difficult-to-treat wastes" for the city's treatment plants.[56]

In 1970 the Senate Select Committee on Water Pollution (discussed in previous chapter) raised questions about who should pay for pollution.

> The question to be answered is whether a community in which aesthetic, health and recreation expectations are rising, as its affluence, mobility and leisure opportunities increase, can afford to provide industrial waste treatment facilities free, or even to provide them at all.[57]

The Select Committee report pointed out that the community ended up paying for the pollution either indirectly through higher prices for products or directly through loss of amenity or clean up costs.[58]

Whilst taking evidence the Select committee found that industrialists assumed that "in treating their effluent they were performing an unrewarded community service." Companies felt they should be reinbursed for their efforts which had no direct financial return for the capital expended.[59]

> Treatment plants were installed to pay token respect to a by-law but in the knowledge that they would be ineffectual within a short time [because of a lack of maintenance and supervision] .[60]

(This was still happening recently in Sydney, according to an industrial waste inspector who found that firms would not maintain nor repair their pretreatment plants until a industrial waste inspector visited and directed them to do so.[61])

The Senate Committee observed that those companies that did the right thing were discouraged by seeing that other companies were not penalised for not doing it.[62] Waste-treatment obviously raised costs and situations could arise where competing firms were able to avoid these costs because of their location, their lesser degree of responsibility or variations in enforcement policies and

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56 ibid., pp36-7.

57 Senate Select Committtee on Water Pollution, Water Pollution in Australia, Canberra, 1970, p80.

58 ibid., p104.

59 ibid., p81.

60 ibid.

61 interview with Nick Kenny, Trade Waste Inspector, M.W.S.&D.B., 10th March 1987.

62 Senate Select Committtee on Water Pollution, Water Pollution in Australia, p81.

supervision exercised by public authorities. Such firms would then be able to undersell a firm forced to install treatment facilities.[63]

For all these reasons, the Sydney Water Board was loath to charge industry the full cost of treatment all at once. The strength charges were introduced progressively over 5 years so as to assist industry. In the 1972/73 financial year it was estimated that Sydney industry would pay 8% of its share of the cost of treatment. It was intended that this proportion would be raised slowly until 100% was being paid by 1976/77. This would not include the costs relating to capital (including the cost of "interest, redemption and sinking fund") which the Board considered should be covered by the sewerage rates.[64] The anticipated 1976/77 charges were still well below equivalent charges for industrial wastes in Britain at the time.[65]

Grease was, however, fully charged for from the beginning because of the problems grease had caused on the beaches and it was hoped the sudden imposition of the full grease charge would induce industry to reduce that component of their wastes.[66] Clearly, the Board was prepared to be tough when the industrial waste was highly visible, even if it was less toxic than other components of industrial waste streams.

CONCESSIONS TO INDUSTRY - FAVOUR OR DISSERVICE?

Although the Sydney Water Board tried to achieve some sort of balance between industrial interests in general and its own requirements in setting standards for acceptance of waste and charges, it still retained the right to relax these in individual cases to suit particular firms. The standards were not rigidly enforced and the Board adopted a discretionary approach which involved negotiation with business interests.

Water Board officers reported that overseas authorities felt that the maintenance of good relations with industry kept illegal discharging to a minimum and ensured accidental discharges were reported. Those who reported such accidents were not prosecuted. The Water Board also fostered a close liaison with industry "at all stages of the planning construction and operation of factories and processes." Negotiation rather than prosecution was the preferred means of controlling illegal discharges in Sydney.[67]

The 1970 Sydney Trade Waste Committee report recommended that the Board be able to exercise discretion in authorising departures from standards of acceptance to the sewers.[68] The reasoning behind this was that some industries,

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63 ibid., p107.

64 Killmier, 'Charging for Trade Waste Disposal', p21.

65 Pierce & Ralph, `Principles and Practices Relating to the Acceptance of Trade Wastes into the Sydney Water Board's Systems', p15.

66 Hitchen & Klamus, `Trade Waste Discharge Limits', p2; Pierce & Ralph, `Principles and Practices Relating to the Acceptance of Trade Wastes into the Sydney Water Board's Systems', p14.

67 Pierce & Parkes, The Control and Treatment of Trade Wastes in Sewerage Systems, pp2, 18-19.

68 Killmier, 'Charging for Trade Waste Disposal', pp29-30.

having "intractable wastes" would have trouble meeting the set standards and so provision was made in the legislation to allow wastes which were stronger than the prescribed standards to be accepted if the local sewerage conditions were favourable (this would depend on the flow at that point, the ventilation and the treatment works).

> where unfavourable reaction in the sewer can be kept within acceptable limits it is clearly in the community interests that a partial relaxation of the standards be granted.[69]

After strength charges were introduced in Sydney the problem of determining the strength of a companies discharge was usually resolved by negotiation. If that failed then it was measured. Generally the company in question submitted an estimate of the strength of its wastes for the next 6 months and, if the Board considered the estimate to be reasonable, it would be the basis for charging.[70]

The negotiation approach was said to be necessary because for many firms it was most economical to treat their effluent to a certain point after which further treatment would be more expensive than putting the partly treated effluent down the sewers and paying industrial waste charges. It was therefore best not to impose arbitrary and rigid standards of acceptance since such standards might be lower than the optimum economic cutoff point for the firm.[71]

Another problem observed by the Senate Committee was that uniform standards and charges could be seen as unfair to older areas where equipment was less efficient and produced more waste and unfair to low-income areas by "forbidding them from making productive use of the very resources [e.g. a nearby river] which gave them a basis for competing with more developed areas." [72]

If an industrial waste was unacceptable for sewer disposal, the firm could be required to install treatment facilities so that the waste stream was either reduced or less concentrated before it was discharged. Most Australian authorities tried to keep these pretreatment requirements to a minimum because of complaints from industry and others who accused the authorities of "impeding or harassing industry".[73] Pretreatment was a cost to individual industries whereas treatment of the sewage as a whole was paid for by the community. It was argued that industry provided employment and therefore should be supported by the community.[74] This attitude was summed up by a delegate to the 1947 conference of professional sewerage authority officers.

> It must be realized that any costs put on to industry will be spread over the community and that it is in the interests of the community that the cheapest overall method of handling wastes should be

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69 Pierce & Ralph, `Principles and Practices Relating to the Acceptance of Trade Wastes into the Sydney Water Board's Systems', p12.

70 M.W.S.&D.B., comment in Conference of Engineers, Eighteenth Conference, p75.

71 ibid.

72 Senate Select Committtee on Water Pollution, Water Pollution in Australia, p111.

73 Engineering and Water Supply Department, Adelaide, 'Paper No.2' in Conference of Professional Officers, Third Conference, p100.

74 ibid., p102.

> adopted. It is probably more economical to treat industrial wastes with the domestic sewage than to have a lot of small plants distributed throughout industry. Some pre-treatment is necessary, but this should be kept to a minimum.[75]

In the early days the Perth sewerage authority even considered that pretreatment, where it was absolutely necessary, should be paid for, installed and operated by the sewerage authority. In this way the costs would be minimised and efficacy of the pre-treatment ensured.[76] The other sewerage authorities were not so keen on this idea. They preferred to be in a position to advise companies on what pretreatment they should install, approve their plans and inspect the pretreatment plants in operation.[77]

By 1957 the Sydney Water Board was insisting on pretreatment when it felt it was necessary to remove coarse particulate matter or oils, to neutralise acids, to reduce temperatures or to protect the sewers and sewage workers from toxic materials.[78] A spokesman told a conference that stormwater discharge was allowed if it met with Maritime Services Board requirements respecting discharge into tidal estuaries. These requirements limited toxic materials such as zinc, arsenic, and cyanides. These substances were allowed into the Board's sewers provided they were discharged at night and the Maintenance staff were previously notified.[79]

The Melbourne delegate was quite shocked that Sydney allowed toxic materials into their sewers at specified times at night. He explained that this would not be allowed in Melbourne because flows were lower at night meaning that the resulting concentration would be higher and this would be dangerous to workers. The Sydney delegate reassured him that it was only a matter of a few hundred gallons of cyanide waste every two or three months.[80] The Adelaide delegate pointed out that they had to be particularly rigid about excluding acids, heavy metals and cyanides from the sewers since their biological treatment would be destroyed.[81]

The Sydney Board was careful not to require anything of companies that they might not be able to meet.

> The levels that we put on had to be such that industry could adjust without going broke. Some industries were producing very high BOD wastes and. our levels that we intended to apply, there was just no way in the world that they could put any form of treatment plant at the site that they were at to get it down to under those levels so they

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75 Mr. Borrie, comment in Conference of Professional Officers, Third Conference, pp115-6.

76 Metropolitan Water Supply, Sewerage, and Drainage Department, Perth, 'Paper No. 3', in Conference of Professional Officers, Third Conference, p105.

77 ibid., p105.

78 M.W.S.&D.B., 'Policies Respecting Trade Waste Discharges and Pre-Treatment', p145.

79 ibid., p146.

80 Mr. Sweet, comment in Conference of Professional Officers, Eighth Conference, p151.

81 Mr. Hodgson, comment in Conference of Professional Officers, Eighth Conference, p149.

> were given more or less an open cheque book to discharge the stuff providing they paid.[82]

The argument that a business might have to close down because of the cost of treatment was answered by Stepp and Macaulay giving evidence to the 1970 Senate Committee. They pointed out that companies have to face increased costs all the time as the price of labour, materials and land rents go up and as they are forced to update their processes and equipment in the face of competition. "These are generally recognised as conditions that a firm must face and overcome". In all these cases firms which are unable to adjust go out of business. Pollution control costs may be non-productive but so, argued Stepp and Macaulay, are telephones, air conditioners, typewriters etc. [83]

The assumptions about the costs to industry and impact on economic growth inherent in all these arguments about industrial waste policy were occasionally questioned. At the end of 1970 two representatives of the Sydney Water Board travelled overseas to find out about overseas practice with regard to the control and treatment of industrial wastes in sewerage systems. In their report, they concluded that although the installation of pretreatment equipment by individual factories often involved a large capital outlay, this money was sometimes recovered very quickly by the reclamation of valuable materials from the waste. Businesses had generally been unaware of the amount of saleable product being lost to the sewer.[84] Additionally, they found experts stressing that pollution was "best and most economically dealt with at the process producing the waste, not at the final effluent from the factory."[85] At the opening address to the International Congress on Industrial Waste Water the President of the Federation of Swedish Industries, Mr Eidem, had pointed to the fact that pollution could be reduced by actually changing the industrial processes. Recovery of waste materials and production processes that created less waste were more likely to happen if industry was paying for the treatment of its own wastes to a satisfactory standard.[86]

The report of the Board representatives also concluded that the technology for adequately treating "all but the most uncommon industrial waste waters" was already existing and available.[87]

The usual argument against rigidly enforced absolute standards are that they destroy the competitiveness of industry and thereby harm the economy. This is partly because compliance costs are often exaggerated. The experience of the U.S. Environment Protection Agency (EPA) offers many examples of this. It was found that both the EPA and the industry concerned tended to overestimate compliance costs. Between 1974 and 1977 it was estimated by the EPA and the petroleum refining industry that pollution control would cost $1.4 billion. The actual cost was between $550 and $750 million. For iron and steel plants the EPA estimated they would have to spend $830 million during the same three

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82 interview with Greg Klamus, Trade Waste Manager, M.W.S.&D.B., 2nd March 1987.

83 Senate Select Committtee on Water Pollution, Water Pollution in Australia, pp113-4.

84 Pierce & Parkes, The Control and Treatment of Trade Wastes in Sewerage Systems, pp2,6.

85 ibid., p6.

86 ibid., p5.

87 ibid., p2.

years, and the industry estimated $1.6 billion. The actual cost was between $470 and $630 million.[88]

In 1978 the U.S. Occupational Safety and Health Administration proposed a standard to control carcinogenic beryllium dust and fumes. The industry estimated that it would cost $150 million and would close down plant vital to national security. It was later conceded by the Department of Energy that the cost was more likely to be $4.6 million. Similarly a chemical industry estimate of the cost of complying with a proposed vinyl-chloride standard turned out to be inflated by 200 times.[89]

In fact in many cases the innovations forced upon industries by legislation have benefited those industries. M.G. Royston argues that old fashioned technology leads to both low profitability and low resource utilisation efficiency. He contends that investment in low pollution technology is likely to encourage "higher technology, high skill development, lower energy and resource usage, and hence, high value added, specialization and profitability."[90]

Royston points to a French survey that showed that 70 out of 100 companies invested less in their 'clean' technology than they would have had to if the pollution had been solved by adding on pollution control equipment and in 69 cases the running costs were less than with the original "dirty plants".[91] Royston sees clean operation as being as much an indication of good management as profitability. He says

> All around the world it is being realized that pollution is a sign of wasteful inefficiency and represents a potentially valuable resource in the wrong place.[92]

And obviously the requirement for firms to install pollution control equipment benefits the companies that produce that equipment and encourage their research and development efforts. In the United States, Union Carbide told its shareholders that the tighter government standards had "significantly increased air pollution control markets".[93]

In the United States stricter standards, not based on available technologies, have resulted in new technologies. Lawsuits, regulations and the threatened ban on PCB's forced PCB users to develop product alternatives. Most of these substitutes were cheaper than the PCB's they replace.[94] Bans on CFC's in aerosols have resulted in two innovations; a non-fluorocarbon propellent was developed using carbon-dioxide and a new pumping system was introduced that

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88 Douglas Costle, 'The Decision-Makers Dilemma', Technology Review, July 1981, pp10-11.

89 ibid.

90 M.G.Royston, 'Making Pollution Prevention Pay', in Donald Huisingh & Vicki Bailey, eds, Making Pollution Prevention Pay: Ecology with Economy as Policy, Pergamon Press, 1982, p2.

91 ibid., p2.

92 ibid.

93 Dickson, The New Politics of Science, Pantheon, New York, 1984, p278.

94 Nicholas Ashford et al, 'Using Regulation to Change the Market for Innovation', Harvard Environmental Law Review 9, 1985, pp432-433; Charles Caldart & William Ryan,'Waste Generation Reduction', Hazardous Waste and Hazardous Materials 2(3), 1985, p315.

did not depend on propellents and actually turned out to be cheaper than CFC propellents.[95]

Wastewater pretreatment standards proposed for effluent from the electroplating industry were predicted to force a closure of 20% of electroplating job shops. A research and development project following this announcement produced a new rinsing method, the "Providence method" which reduced water consumption by one third and cut hazardous waste production by 50-70%.[96]

All of these cases show that constraints on industry are not necessarily detrimental to their viability. Charles Caldart, of the Centre for Technology and Industrial Development, M.I.T. and William Ryan of the Massachusetts Public Interest Research Group have expressed the conviction that regulatory approaches

> must not be bound by existing technologies and existing economic conditions. Rather, public policy must encourage the type of innovation that can spur technological breakthroughs and alter economic circumstances. In short, we believe it is possible to change production technologies. [97]

The economist, Nathan Rosenberg, suggests that most firms will direct their research efforts towards parts of their operations which seem to pose the heaviest constraints. These constraints may be created by a technical imbalance between interdependent processes so that an improvement in one part of a production line causes problems or bottle necks in other parts of the line or operation. Imbalances between rival firms is also a cause of innovation. Technical disequilibria can also be caused by the threatened withdrawal of labour which provides an impetus for research into labour replacing technology.[98]

The category of situations which may encourage innovation, which is of interest here, is the "imposition of a previously nonexistent constraint". For example, legislation can impose constraints in this way and force a search for innovations in order to comply with the legislation. Such exploratory activities, Rosenberg points out, can confer advantage on those who were constrained by the legislation. He gives the example of Swedish chemical pulp producers who were forced by a Swedish law against stream pollution to work out new ways of utilizing their waste liquors. In doing this Swedish sulphate producers gained an advantage over their Canadian and American competitors when they developed a recovery process for waste sulphite liquor. [99]

Rosenberg refers to constraints which led to innovation as inducement mechanisms or focusing devices,

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95 Ashford, 'Using Regulation to Change the Market for Innovation', pp433-4.

96 Caldart & Ryan, 'Waste Generation Reduction', p315.

97 ibid., p310.

98 Nathan Rosenberg, Perspectives on Technology, Cambridge University Press, 1976.

99 ibid., p122.

> The mechanisms examined here share the property of forcefully focusing attention in specific directions. They called attention decisively to the existence of problems the solutions to which were within the capacity of society at the time, and which had the effect of either increasing profits or preventing a decline that was anticipated with a high degree of probability.[100]

Legislation and regulation is most effective where it acts as an inducement for technological change. Environmental legislation and standards which are based on existing technologies and the economic circumstances of individual firms may impede technological advance in directions which can be both environmentally and economically beneficial. Certainly the retention of standards set in 1972 has done nothing to encourage the development of new industrial processes that produce less pollution since that time.

THE NEW TRADE WASTE POLICY - REVAMPING AN OLD APPROACH

The crisis at the end of the 1960s that followed from the closing of council tips to industrial waste caused an increasingly toxic load on the sewers. The crisis was solved in part by the opening of a landfill dump at Castlereagh for industrial waste. However this dump did not accept strong acids, cyanides, trace-metal residues nor organochlorines.[101] Sydney has not provided any disposal service for many of these wastes since then and although some intractable organochlorines are stored, little is known about the fate of the trace-metal residues and chemicals that do not find their way down the sewers. In 1988 an aqueous waste treatment plant was established to take the wastes previously going to Castlereagh but there are still various toxic wastes which will not be accepted at this facility including organochlorines, mercury and arsenic wastes and organometallics.[102] It is not expected that this facility will relieve the sewers of any of their toxic load but may in fact add to it because liquid residues from the treatment processes will be put into the sewers.[103]

Because the Water Board provides a cheap disposal service and because, in many cases, there are no alternatives to that disposal service for various waste types, most industrial liquid waste, over 99%, goes to the sewers. In 1983 153,000 million litres was estimated to be going to the sewers annually whilst only 53.5 million litres was marked down for the aqueous waste treatment plant.[104] (see figure 7.1) By July 1988 when the new Trade Waste Policy was brought in, industrial waste made up a significant proportion of the sewage flow at the three main ocean outfalls, particularly at Malabar where about 50% of the flow was industrial waste.[105]

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100 ibid., p123.

101 SPCC, Future Disposal of Industrial Liquid Wastes in Sydney, March 1983, p15.

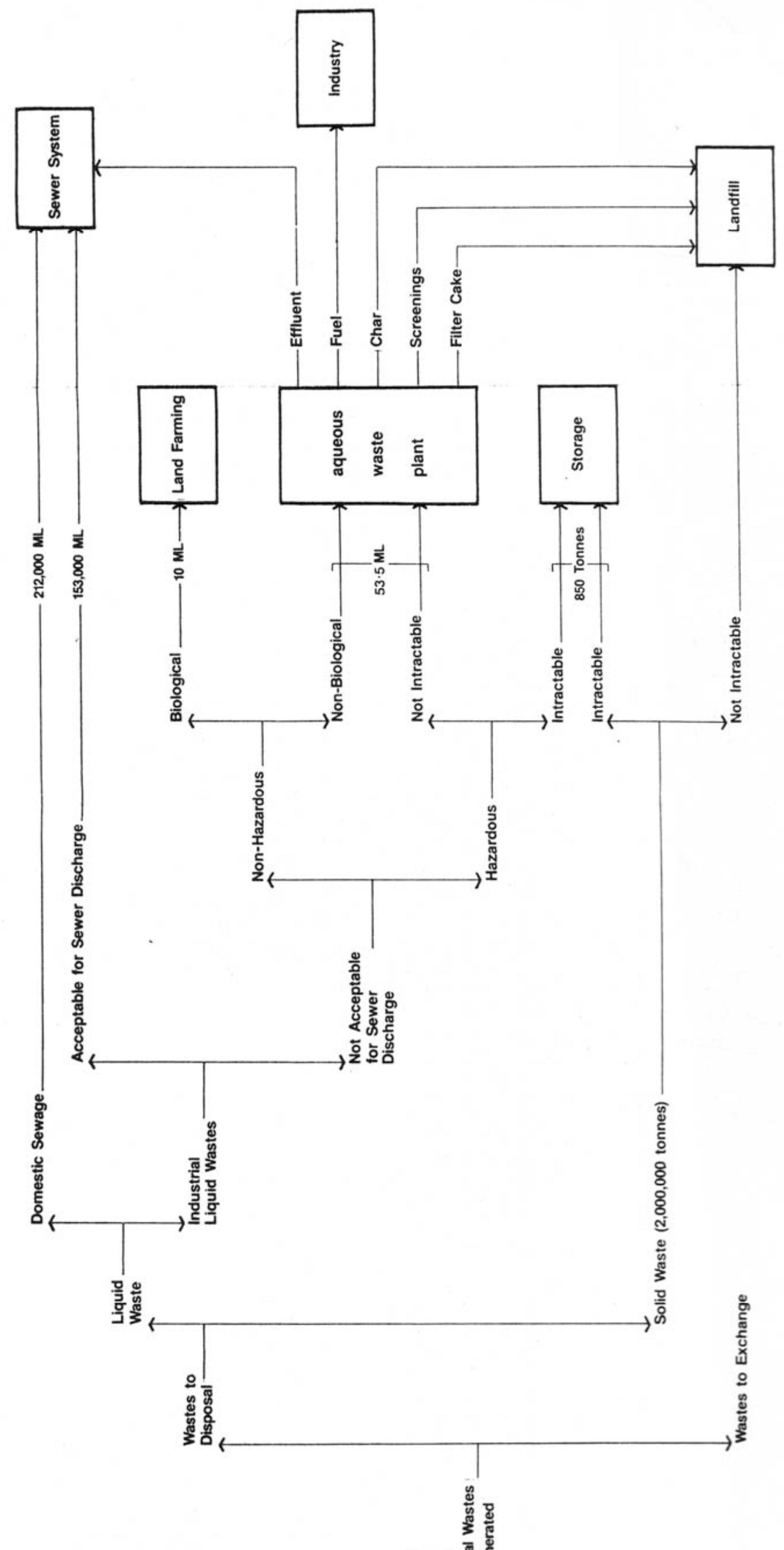
102 John Woodward & Dr Alan Gilpin, Proposed Aqueous Waste Treatment Plant, McPherson St, Banksmeadow, Municipality of Botany, Report ot Hon R.J.Carr, Minister for Planning & Environment, 1984, p23.

103 see for example, Maunsell & Partners, Submission to Public Inquiry, Banksmeadow Aqueous Waste Treatment Plant, Randwick Municipal Council, November 1984, p7.

104 Gutteridge Haskins & Davies, Environmental Impact Statement: Aqueous Waste Treatment Plant Banksmeadow, MWDA, December 1983.

105 interview with Greg Klamus, Trade Waste Manager, M.W.S.&D.B., 2nd March 1987.

Figure 7.1 Sydney's Waste Flow (Annual Quantities)



Source: Gutteridge Haskins & Davies, Environmental Impact Statement: Aqueous Waste Treatment Plant Banksmeadow, MWDA, December 1983.

Annual Quantities are shown

The Trade Waste Manager, Greg Klamus, had consulted with various people within the Board, from the State Pollution Control Commission and from industry in putting together the new Trade Waste Policy. A draft policy had been drawn up which was be circulated for comment within the board, modified, discussed with industry and other government authorities, approved by the General Manager of the Water Board and finally sent to State Cabinet for approval. The reason for consulting industry was to ensure that the standards for acceptance to sewer were not unreasonable and therefore likely to put firms out of business. The SPCC was consulted to ensure they were happy that the new policy would conform to legislative requirements.[106]

The Board claim the new policy represents a radical change in approach. However it is based on a similar philosophy. It attempts to provide a service to industry whilst limiting the contamination of discharges through strength charges rather than through absolute limits or effluent standards.

> The Policy aims to encourage industry to improve pretreatment of wastes, towards 'domestic' quality. At the same time, the Board will be providing a commercially oriented liquid waste disposal service to industry, and recovering some of the special treatment costs that the discharge of pollutants impose on the whole community.[107]

Klamus stated, in a joint paper the year before, that the sewerage system was the most appropriate method of disposing of many industrial liquid wastes. This was because the sewers offered the community an acceptable method of controlling environmental pollution from industrial waste and because disposal was cheaper than a system requiring individual industries to treat their own wastes.[108]

The new trade waste policy aims to replace the emphasis on 'control' with one of 'commitment'.[109] The monitoring and policing of industrial discharges has always been difficult. Huge variations in strength and volume of effluent are typical of industries which have certain cycles and seasonal variations. The installation of measuring apparatus could also be expensive as well as technically difficult. Understaffing has also been a problem according to Water Board inspectors, who are unable to visit firms as often as they would like.[110] In 1987 there were 34 trade waste inspectors to monitor some ten thousand properties 24 hours a day.[111] Obviously, random illegal discharges could not possibly be controlled in this way.

Inspectors were equipped with pH indicator paper and meters and field test kits to measure for concentrations of certain metals. If they discovered a breach of the standards they were expected to discuss it with the management of the company first. If the company failed to make the required permanent change then a

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106 ibid.

107 M.W.S.& D.B., Trade Waste Policy 1988, March 1988, p1.

108 John Hitchen & Greg Klamus, `Trade Waste Discharge Limits; Current Status and Likely Trends', 1987, p1.

109 Hitchen and Klamus, `Trade Waste Discharge Limits', p7.

110 interview with Nick Kenny, Trade Waste Inspector, M.W.S.& D.B., 10th March 1987.

111 interview with Greg Klamus, Trade Waste Manager, M.W.S.& D.B., 2nd March 1987.

sample of effluent would be analysed and a warning letter sent. Further breaches which were confirmed by laboratory analysis would result in prosecution. But prosecution was a long, expensive business and in the end the fines meted out could be quite trivial because judges would consider factors such as the firm's financial position.[112]

The new policy aims to achieve its ends by encouraging the cooperation of industry rather than through policing. It is hoped that businesses can be encouraged, through financial incentives, to manage their wastes as carefully as they do their production processes.[113] Each company will be required to institute its own monitoring programme of sampling and testing which will be audited by the Board or the company will be able to pay the Board to do it for them.[114] Fines for discharge over the negotiated limits will be raised and disconnection will be "seriously considered".[115]

Waste quality targets will be negotiated with each firm. Under this system, if the polluter is able to install treatment equipment for a lower cost than they would otherwise have to pay to the Water Board to discharge their untreated wastes then there is a financial incentive to do so. The question is, are financial incentives and negotiated standards as effective at inducing innovation as absolute standards?

Rosenberg notes that in a production process any change which reduces costs would be welcome, not just those changes that are associated with rising costs. One could concentrate on reducing labour costs, reducing material costs or reducing processing costs.[116] Rising waste disposal costs may be counteracted with the installation of treatment equipment if this is easy to do otherwise profits could be maintained by making savings elsewhere in the plant. For some firms profit levels may be maintained by passing the cost on to the consumer, especially where a whole industry is hit with the new charges. If a firm is going to invest $X,000 they will consider the best part of the production process to spend it in. This may be in pre-treating their waste which will save on disposal costs, or it may be in some other part of the plant where savings might be more. It may even be spent on marketing the final product with the costs of disposal being passed on to the consumer.

Moreover, such a financial incentive may act as an incentive to bypass the charges through cheating in the self-monitoring process or to do some illegal dumping or to persuade the Board that they cannot afford the charges. Whilst the extra revenue may be of use to the Water Board the financial incentive approach is not one that will force technological changes that will reduce waste generation. The charging mechanism is not specific enough. It still leaves a substantial amount of choice in the hands of individual firms who have no special interest in protecting the environment. Standards of effluent are specific and if rigidly enforced are more likely to force technological change in the right directions.

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112 ibid.

113 Hitchen and Klamus, `Trade Waste Discharge Limits', p7.

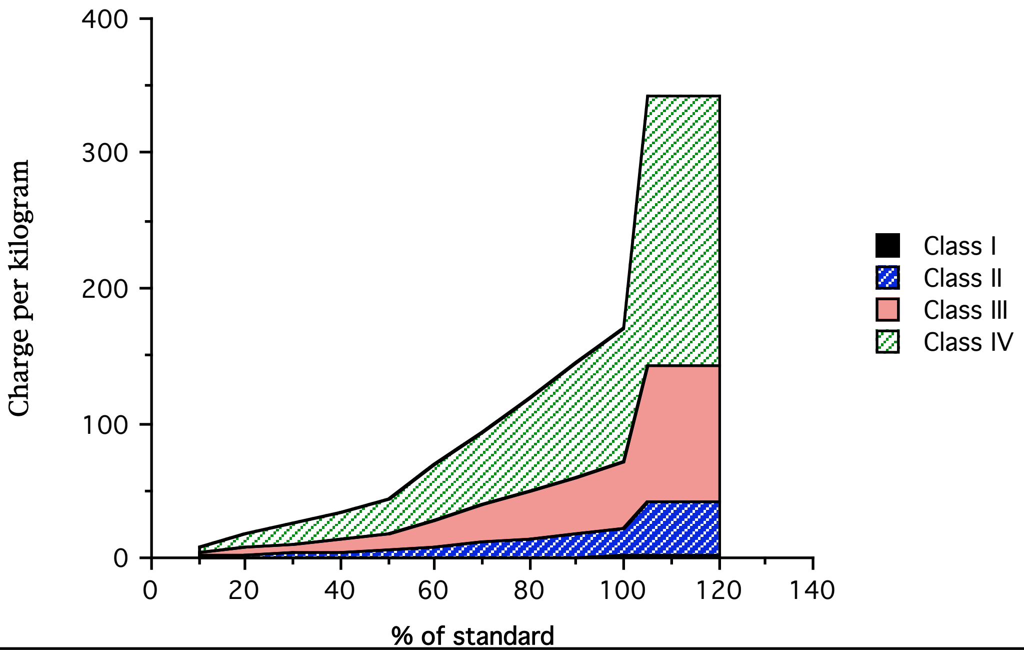
114 Draft Policy, Trade Waste Section, MWS&DB, Jan 1987, p8.

115 Draft Policy, Trade Waste Section, MWS&DB, Jan 1987, p10.

116 Rosenberg, Perspectives on Technology, p109.

Charges will still be based on concentrations of contaminants in the effluent entering the sewerage system. The more concentrated the pollutants in a firm's discharge, the more it will be charged. Strength charges will go up more steeply for higher strength waste.(see figure 7.2)

figure 7.2 CHARGES FOR NON-DOMESTIC POLLUTANTS



INFO FROM: MWS&DB, "Trade Waste Policy 1988"

As can be seen in the above figure, charges will be related to standards, set for various effluent contaminants including toxic metals and chemicals as well as biochemical oxygen demand, suspended solids and grease. (see table 7.2)

Standards, as shown table 7.2, again represent a compromise between requirements of the sewerage system (including protection of sewers, workers and treatment plants), the requirements of the SPCC and perceptions of what industry can cope with. A comparison of these standards with those elsewhere are shown in table 7.3. As Klamus said, "It is no good us setting some fancy limit that industry can't comply to."[117] Standards will be more stringent for effluents going to inland secondary treatment plants because the biological processes that treatment in those plants depends on would be disrupted by the types of waste that can go out the sewers.

As can be seen in table 7.2, many more substances are included, and the standards, in most cases, seem to have been tightened up. Nevertheless, these standards do not represent the limits in any real sense for what will be allowed into the sewers, since, as can be seen in the above figure, there is provision for charges for concentrations above the standards. These standards are little more than a pricing mechanism and whether the Board uses them as upper limits for discharge is up to their discretion at the time, presumably after negotiation with businesses concerned.

117 interview with Greg Klamus, Trade Waste Manager, M.W.S.& D.B., 2nd March 1987.

TABLE 7.2

STANDARDS FOR ACCEPTANCE OF LIQUID TRADE WASTE TO SEWER

POLLUTANT	1972-88	POLICY EFFECTIVE 1/7/88	
		discharge to primary plant	discharge to secondary or tertiary plant
Aluminium		200 mg/l	100 mg/l
Ammonia (as N)		200 mg/l	50 mg/l
Arsenic	100 mg/l	100 mg/l	1 mg/l
Barium		20 mg/l	20 mg/l
Boron		25 mg/l	25 mg/l
Bromine		50 mg/l	5 mg/l
Cadmium	30 mg/l	10 mg/l	5 mg/l
Chlorine (as Cl)$^-$		50 mg/l	50 mg/l
Chromium	100 mg/l	10 mg/l	10 mg/l
Chlorinated Hydrocarbons		10 mg/l	5 mg/l
Cobalt	200 mg/l	50 mg/l	10 mg/l
Copper	5 mg/l	10 mg/l	5 mg/l
Cyanide	7 mg/l	10 mg/l	10 mg/l
Formaldehyde		50 mg/l	50 mg/l
Herbicides	5 mg/l	0.1 mg/l	0.1 mg/l
Iron		100 mg/l	100 mg/l
Lead	10 mg/l	10 mg/l	10 mg/l
Manganese		300 mg/l	10 mg/l
Mercaptans		1 mg/l	1 mg/l
Mercury	none	0.1 mg/l	0.05 mg/l
Nickel	100 mg/l	30 mg/l	10 mg/l
Pesticides (organic)	5 mg/l	0.1 mg/l	0.1 mg/l
Phenolic compounds		100 mg/l	10 mg/l
Silver		10 mg/l	2 mg/l
Sulphide	10 mg/l	5 mg/l	5 mg/l
Sulphite		50 mg/l	10 mg/l
Tin		50 mg/l	50 mg/l
Zinc	30 mg/l	10 mg/l	5 mg/l
PARAMETERS			
Temperature	50 degrees 37 degrees with grease	38 degrees	38 degrees
pH	6.8-10	7-9	7-9
grease	200 mg/l	100 mg/l "beach grease"	n.a.
Biochemical Oxygen Dem	600 mg/l	to be determined	to be determined
Suspended Solids	600 mg/l	"	"

Source: MWS&DB, "Standards for Acceptance of Liquid Trades Waste to Sewers" & MWS&DB, "Trade Waste Policy 1988", March 1988.

TABLE 7.3

COMPARISON OF STANDARDS FOR ACCEPTANCE OF WASTES TO SEWER

Element	Sydney 1984	Brisbane 1984	Melbourne 1984	France 1984	England 1984	Sydney 1988 *
Arsenic	100	10	1			100
Cadmium	30	4	10	3		10
Chromium	100	20	10	15	10	10
Cobalt	200		10			50
Copper	5	20	10	15	10	10
Cyanide	7	3	10	1	5	10
Lead	10	20	10		10	10
Nickel	100	20	10	15	10	30
Zinc	30	20	10	15	10	10
Herbicides	5	1				0.1
Insecticide	5	0.001				0.1
Sulphides	10	1			1	5

* for sewers connected to primary treatment plants

FROM Info in: Maunsell & Partners, Submission to Public Inquiry, Banksmeadow Aqueous Waste Treatment Plant, Randwick Municipal Council, November 1984 & MWS&DB, Trade Waste Policy 1988, March 1988.

Moreover, the pricing mechanism works in such a way that industries are charged less for putting a certain volume of restricted substances down the sewer if that volume is more dilute. Mercury, for example, would cost $100 to discharge 1 kg in 0.1 mg/l concentration but it would only cost $10 to discharge the same 1 kg of mercury in the more dilute form of 0.01 mg/l although there might be a small additional volumetric cost. Moreover, charges are based on 90 percentile concentrations[118] so that 10% of the time discharges can be extremely concentrated without attracting further charges. This would conveniently allow for occasional discharges that may occur, for example, when vats or rinsing tanks are washed out.

The emphasis in the Board's trade waste policy on levels of dilution can be traced back to the SPCC guidelines which are in terms of dilution. The SPCC regulates restricted substances by stating maximum concentrations. (see figure 8.1, next chapter) Similarly, the harm posed to sewers, workers and equipment can be minimised by ensuring high levels of dilution. For these reasons the Board is more concerned about concentrations of toxic substances being discharged than total quantities.

It is interesting to note the changes between the draft trade waste policy drawn up at the end of 1986 as compared with the final policy that emerged from the consultation process with government and industry. In the draft the table of standards was in terms of "maximum allowable concentrations" and charges for discharges above these maximums were termed penalties. This terminology was dropped in the final policy document and the charges for above standard wastes was also considerably reduced in some cases.(see table 7.4)

118 Sydney Water Board, Trade Waste Policy and Management Plan 1988, M.W.S.&D.B., November 1988.

Table 7.4

STANDARDS & CHARGES FOR W ASTES GOING TO OCEAN OUTFALLS				
ELEMENT	draft maximum allowable mg/l	final standard mg/l	draft basic penalty above limits $/kg	final charges for >100% standard $/kg
Aluminium	50	200	50	2
Arsenic	10	100	100	100
Bromine	50	50	100	2
Cadmium	10	10	100	40
Chl Hydrocarbons	5	10	200	100
Chlorine	50	50	100	2
Chromium	30	10	200	40
Cobalt	50	50	100	40
Copper	10	10	200	40
Cyanide	10	10	200	100
Lead	10	10	200	40
Mercaptans	1	1	200	100
Mercury	0.1	0.1	100C	200
Nickel	30	30	100	40
Phenolic cmpds	100	100	100	100
Silver	10	10	500	100
Tin	50	50	10	2
Zinc	10	10	100	40

source: MWS&DB, Draft Trade Waste Service Policy,23rd December, 1986, pp6- 7 & MWS&DB, Trad e Waste Policy 1988, pp 9 &11.

Moreover the whole thrust of the charging system has been changed as can be seen in figures 7.3 & 7.4 which typify the new charging systems. Under the draft policy, no charge was to be made for concentrations of restricted substances below the allowable limits but heavy penalties would be imposed once those limits were breached. Under the final policy guidelines there are charges for discharges of restricted substances at all levels and the difference between charges below and above the standards are not as marked. These changes obviously offer much less incentive to industry to stay under the standards in their discharge and virtually defeats the aims of the Trade Waste Manager to establish effective financial incentives to industry to keep restricted substances out of their waste.

The Board is fairly secretive about the amount of restricted substances that enter the ocean through their ocean outfalls. Virtually the only published figures on this were given in the Caldwell Connell report in 1976 and repeated in the Environmental Impact Studies in 1979. They are shown in table 7.5. More up to date figures are difficult to find because the Water Board no longer includes the sludge in their published figures of concentrations of restricted substances in effluent.[119]

Figure 7.3

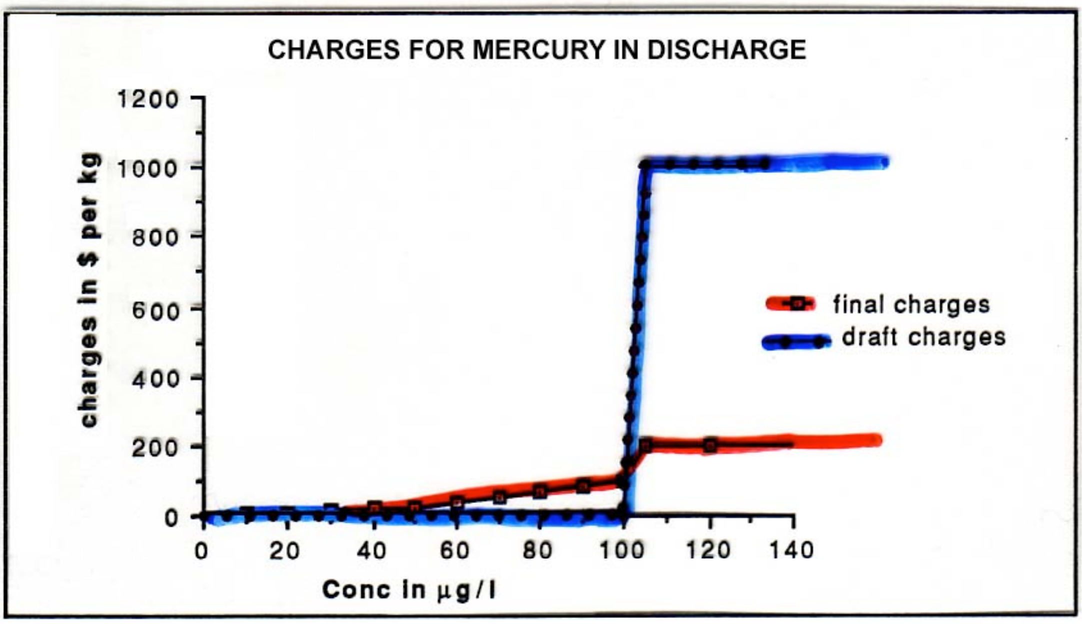
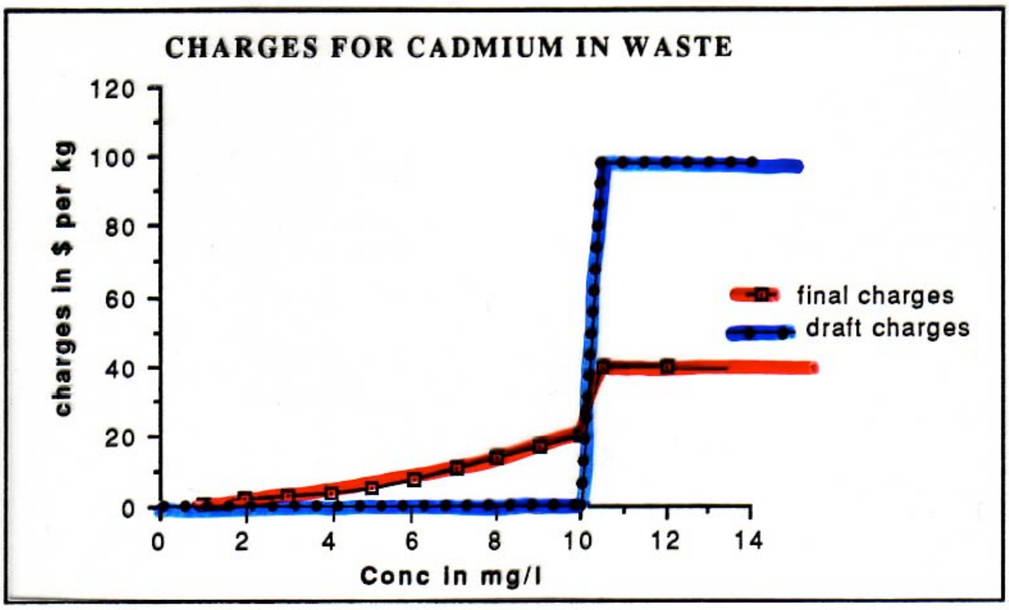


Figure 7.4



119 for example see Sydney Water Board, Sydney Deepwater Outfalls Environmental Monitoring Programme Pilot Study, vol 11 - Restricted Substances, March 1988.

TABLE 7.5

RESTRICTED SUBSTANCES IN SEWAGE EFFLUENT AT THE OUTFALLS						
SUBSTANCE	NORTH HEAD		BONDI		MALABAR	
	Effluent[a] Concent. mg/l	Total[b] Quantity t/yr	Effluent[a] Concent. mg/l	Total[b] Quantity t/yr	Effluent[a] Concent. mg/l	Total[b] Quantity t/yr
Arsenic	< 0.1	< 12.4	< 0.1	< 6.2	< 0.1	< 15.7
Cadmium	< 0.01	< 1.2	< 0.01	< 0.6	0.1	15.7
Total Chromium	0.05	6.2	0.1	6.2	0.7	109.9
Copper	0.15	18.6	0.23	14.3	0.4	62.8
Lead	0.07	8.7	0.25	15.5	0.3	47.1
Mercury	0.003	0.4	0.015	0.9	0.020	3.1
Nickel	0.05	6.2	0.05	3.1	0.2	31.4
Silver	0.02	2.5	< 0.02	< 1.2	< 0.02	< 3.1
Zinc	0.70	86.8	1.07	66.3	2.0	314
Cyanide	< 1.0	< 124	< 1.0	< 62	< 1.0	< 157
Phenolic cmpds	0.4	49.6	0.2	12.4	1.0	157
Total Chlorine	0	0	0	0	0	0
Ammonia-N	30	3720	22	1364	28	4396
Chlorinated Hydrocarbons	0.064	7.9	0.10	6.2	0.25	39.2

[a] Mean Value [b] Concentration x Aver Annual Flow

source: Caldwell Connell, Sydney Submarine Outfall Studies, 1976.

TABLE 7.6

CHANGES IN HEAVY METAL LEVELS IN MALABAR SEWAGE							
METAL	EIS RAW SEWAGE mg/l	EIS estimate[a]	1979 1 sample	1982 estimate[b]	estimated change	EIS estimate[c]	1982 estimate[d]
		SLUDGE mg/kg dry solids			EIS-1982	TOTAL tonnes/year	
Cadmium	0.1	20	40	<100	+400%	16	< 80
Copper	0.4	660	942	1000	+52%	63	95
Mercury	0.02	1.6	2	<10	+525%	3	< 19
Lead	0.3	410	412	400	-2%	47	46
Zinc	2.0	1410	1316	1400	-1%	314	312
Chromium	0.7	790	1086	--	--	110	--
Nickel	0.2	160	158	--	--	31	--

a = estimate by Caldwell Connell Engineers, b = estimate by Caldwell Connell Engineers, c = raw sewage conc given in EIS x annual flow at Malabar, d = c x % change

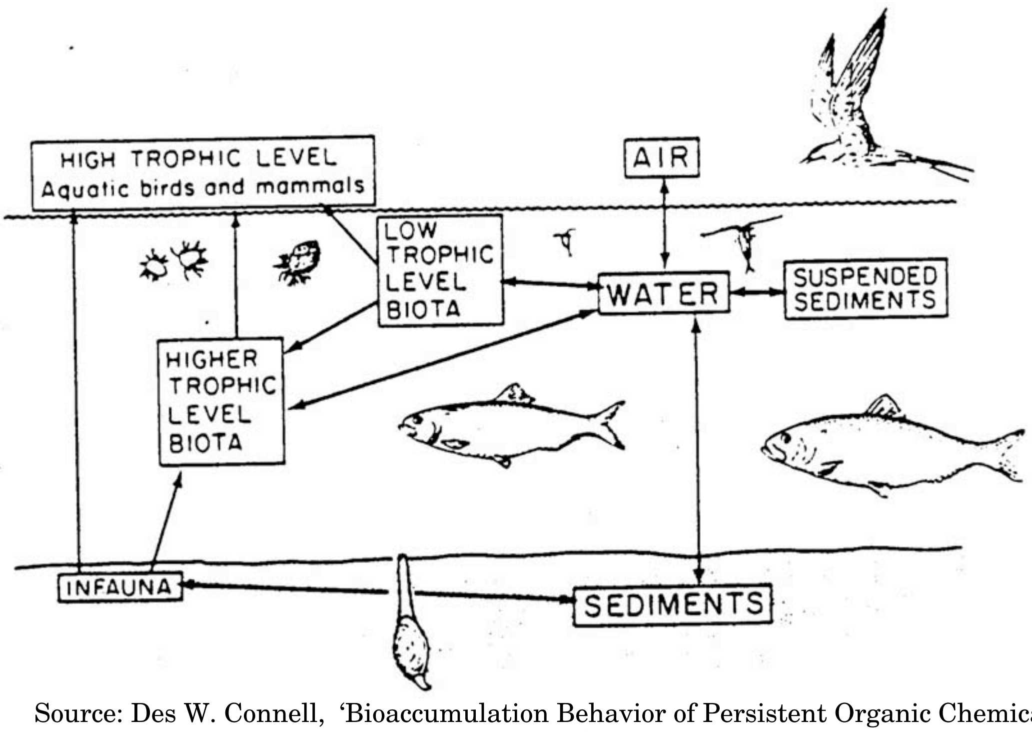
FROM: Caldwell Connell, Environmental Impact Statement North Head WPCP, MSW&DB, 1979, p47
Technical Support Paper - Sludge Disposal Policy, Clean Waters Advisory Committee, 10th September 1987, Appendix.

Table 7.6 shows estimates of more recent figures using estimates by Caldwell Connell of restricted substances in sludge and the percentage change since the first figures given in the 1976 and 1979 Caldwell Connell reports. These show a marked increase in restricted substances being discharged into Sydney waters in the years up to 1982. However figures given to the Clean Waters Advisory Committee by the Board in 1983 and 1984 claim that the restricted substances in the effluent will be slightly lower than the 1976 estimates at Commissioning and ultimately at Malabar and slightly higher at North Head.[120] Just where the truth lies is a matter of conjecture.

TOXIC FISH & EMBARRASSING SURVEYS

Industrial waste poses a threat both to the marine environment and also to human health. In particular, toxic waste can be taken up by marine vegetation and organisms and accumulated. Organic chemicals such as those in the organochlorine group are very stable and often persist in the environment for long periods. Biota can accumulate these compounds even when there are very low concentrations of the compounds in the water around them. The compounds can be transferred directly from the water to the biota, for example through the gills, (bioconcentration) or they can be consumed with food and accumulate in the tissues of the fish or other organism. The concentration of the compound up the food chain as each organism is in turn eaten by another is referred to as biomagnification or bioaccumulation in the food chain. Often there is a combination of the two processes.[121] (see figure 7.5)

Figure 7.5 Environmental Distribution of Persistent Organic Chemicals



Source: Des W. Connell, 'Bioaccumulation Behavior of Persistent Organic Chemicals with Aquatic Organisms', *Reviews of Environmental Contamination and Toxicology*, vol 102, 1988, p122.

[120] Technical Report on Malabar Deepwater Submarine Outfall, Clean Waters Advisory Committee Meeting, 8th September 1983, p12; Technical Report on North Head Deepwater Submarine Outfall, Clean Waters Advisory Committee Meeting, 14th June 1984.

[121] Des W Connell, 'Bioaccumulation Behavior of Persistent Organic Chemicals with Aquatic Organisms', Reviews of Environmental Contamination and Toxicology 102, 1988, pp118-125.

Similarly other toxic materials, in particular, trace metals, can be taken up by aquatic organisms by direct absorption from the water or by ingestion of contaminated food or polluted particulate matter or via aquatic plants. These metals can be present in the water either as colloids and as free or complex ions; they can be absorbed on the surface of particles and they can form part of waterway sediments "where conditions favour the formation of insoluble compounds or where suspended materials settle."[122]

Of the heavy metals that are discharged in industrial waste, mercury and cadmium are of particular concern because of well documented acute health effects. In Minamata, Japan more than 100 people died and 700 suffered "severe, permanent neurological damage" after consuming seafood that had been contaminated by industrial waste containing mercury. Similarly, 60 people died in Japan when rice paddies were contaminated with industrial waste containing Cadmium.[123] Nonetheless it is recognised that other heavy metals and the organic chemicals also pose a health threat if they are present in human food. Tables 7.7 and 7.8 show the properties and health effects of heavy metals and organic chemicals in the marine environment.

Table 7.7 Properties and Effects of Metals in Marine Environments

	Arsenic	Cadmium	Lead	Mercury
Bioaccumulation	Low except in some fish species	Moderate	Low or none	Significant (methylated form)
Biomagnification	Low or none	Low or none	Low or none	Significant (methylated form)
Properties	Metallic form: insoluble Readily methylated by sediment bacteria to become highly soluble, but low in toxicity	Metallic form: relatively soluble Not subject to biomethylation Less bioavailable in marine than in fresh water Long biological residence time Synergistic effects with lead	Generally insoluble Adsorption rate age-dependent, 4 to 5 times higher in children than adults Synergistic effects with cadmium	Metallic form: relatively insoluble Readily methylated by sediment bacteria to become more soluble, bioavailable, persistent, and highly toxic
Major environmental sink	Sediments	Sediments	Sediments	Sediments
Major routes of human exposure:				
Marine environments	Seafood: very minor route, except for some fish species	Seafood contributes ≈ 10% of total for general population	Seafood comparable to other food sources	Seafood is primary source of human exposure
Other environments	Inhalation: the major route	Food, primarily grains	Diet and drinking water	Terrestrial pathways are minor sources in comparison
Health effects	Acute: gastrointestinal hemorrhage; loss of blood pressure; coma and death in extreme cases Chronic: liver and peripheral nerve damage; possibly skin and lung cancer	Emphysema and other lung damage; anemia; kidney, pancreatic, and liver impairment; bone damage; animal (and suspected human) carcinogen and mutagen	Acute: gastrointestinal disorders Chronic: anemia; neurological and blood disorders; kidney dysfunction; joint impairments; male/female reproductive effects; teratogenic	Kidney dysfunction; neurological disease; skin lesions; respiratory impairment; eye damage; animal teratogen and carcinogen
References[a]	Doull, et al., 1980 Harrington, et al., 1978 O'Connor and Kneip, 1986 Woolson, 1983	Chapman, et al., 1968 Nriagu, 1981 O'Connor and Kneip, 1986 Wiedow, et al., 1982	Callahan, et al., 1979 Heltz, et al., 1975 Kneip, 1983 NAS, 1980 O'Connor and Kneip, 1986 O'Connor and Rachlin, 1982	Grieg, et al., 1979 Kay, 1984 Nriagu, 1979 Windom and Kendall, 1979

Source: US Office of Technology Assessment, Wastes in Marine Environments, 1987, p. 126.

122 S.P.C.C., Toxic Chemicals, Environmental Control Study of Botany Bay, Sydney, 1979, p6.

123 US Office of Technology Assessment, Wastes in Marine Environmnents, National Technical Information Service, 1987, pp125-6.

Table 7.8

Properties and Effects of Major Classes of Organic Chemicals in Wastes Disposed of in Marine Environments

Chemical class	Major examples	Properties	Primary routes to humans	Health effects	References[a]
Low molecular weight hydrocarbons	Benzene Toluene Xylene	Volatile Biodegradable Low bioaccumulation potential	Inhalation Drinking water	Benzene: central nervous system (CNS) effects, blood disease, leukemia Toluene: possible CNS effects, low toxicity Xylene: irritant; teratogen	Callahan, et al., 1979 Doull, et al., 1980 NAS, 1977 O'Connor and Kneip, 1986 Snyder, et al., 1984
Low molecular weight chlorinated hydrocarbons	Chloromethanes: carbon tetrachloride (CTET) chloroform methylene chloride	Volatile Lipid-insoluble Low bioaccumulation potential Some (e.g., CTET and chloroform) are persistent; others (e.g., methylene chloride) are readily biodegraded	Inhalation Drinking water	CTET and chloroform: liver, kidney, blood, and gastrointestinal disorders; liver and kidney cancer Methylene chloride: possible CNS effects	Callahan, et al., 1979 Doull, et al., 1980 O'Connor and Kneip, 1986 Thom and Agg, 1975
	Trichloroethylene, tetrachloroethylene, tetrachloroethane	Volatile Lipid-insoluble Low bioaccumulation potential	Inhalation Drinking water	All: CNS effects, liver toxicity Tri- and tetrachloroethylene: liver cancer	Callahan, et al., 1979 Doull, et al., 1980 Sittig, 1985
	Vinyl chloride	Volatile Low bioaccumulation potential	Inhalation	Animal and human carcinogen; liver toxicity	Doull, et al., 1980
	Chlorobenzenes	Range of volatilities Lipid-soluble Significant bioaccumulation potential	Food (including seafood)	Hexachlorobenzene: carcinogen	Doull, et al., 1980 O'Connor and Kneip, 1986
Chlorinated pesticides	Cyclodiene pesticides: aldrin, dieldrin, heptachlor, chlordane DDT and metabolites Chlorinated phenoxyacetic compounds (2,4,5-T; 2,4-D) Hexachlorocyclohexanes: lindane, BHC	Nonvolatile High bioaccumulation potential Moderate to high toxicity Most are highly persistent	Food (including seafood)	Known or suspected human carcinogens; neurotoxic effects; chloracne and other skin diseases	Doull, et al., 1980 Mrak, 1969 NAS, 1977 Sittig, 1985 Walker, et al., 1969
High molecular weight chlorinated hydrocarbons	Polychlorinated biphenyls (PCBs) Chlorinated dioxins (TCDD) Chlorinated dibenzofurans	Nonvolatile High bioaccumulation potential Moderate to high toxicity Highly persistent	Food (including seafood)	All: neurological, liver, and skin disorders PCBs: tumor promoters or carcinogens TCDD: highly carcinogenic	Kimbrough, et al., 1975 Kolbye and Carr, 1984 Murai and Juroiwa, 1971 Polger and Schlatter, 1983
Aromatic hydrocarbons	Phthalate esters (e.g., DEHP) Polycyclic aromatic hydrocarbons (PAHs)	Low to moderate volatility Highly insoluble Range of bioaccumulation potential Low to moderate toxicity	Food (including seafood)	Phthalates: many are teratogens DEHP: possible carcinogen PAHs: many (e.g., benzo(a)pyrene) are carcinogens; some are teratogens	FDA, 1974 Glam, et al., 1978 MacLeod, et al., 1981 NAS, 1977

[a]See list of references at end of report

Source: US Office of Technology Assessment, Wastes in Marine Environments, 1987, p.130

Sydney's coastal waters, into which the three main ocean outfalls discharge, support fish and other marine life that are fished both commercially and for recreation. Rock fishing is a popular sport and fishing directly adjacent to the sewage field is common. The area around the outfalls also provides a feeding ground for seabirds.[124] Figures 7.6 & 7.7 show the key fishing spots as identified in publications for fishermen.

Very few surveys of the affect of industrial waste discharge on marine life have been carried out in Sydney and those that have tended to concentrate on the existence and numbers of species rather than on fish disease and bioaccumulation of heavy metals and organochlorines. No comprehensive studies have been done on the latter.

When Caldwell Connell did the five year feasibility study for the submarine outfalls for example, their biological studies "concentrated on a broad community approach rather than a study of arbitrarily chosen species".[125] They described and quantified existing marine life and although they collected new organisms that had not been described before they assumed, without further investigation, that these were not unique to the area and that the outfalls therefore did not threaten marine species endemic to the mid-NSW coast.[126]

The question of fish contamination was more fully addressed in the Environmental Impact Statements for the submarine ocean outfalls. Data for concentration of restricted substances in biota came from "a brief reconnaissance study" undertaken by the Water Board in 1973 under the direction of Caldwell Connell. In this study fish were collected near the North Head and Malabar outfalls and at Marley Head which was to act as a control area. The results are shown in table 7.9.

Only one sample of each species was taken and for this reason Caldwell Connell argued that no statistical significance can be assigned to the study.[127] It is unclear what Caldwell Connell mean by this. Do they mean that no significance should be attached to the results of their survey? If so, why did they bother with the survey, or why didn't they do it properly? It would seem from the table, however, that heavy metals and/or pesticides were accumulating in nearly every species sampled and the fact that some accumulation was also taking place in the samples from the control area (Marley Head) means only that the control area was not unaffected by pollution, especially given the accumulation of DDT & DDE (which do not occur naturally) in some Marley Head fish samples.

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124 M.W.S.& D.B., Environmental Impact Statement Bondi Pollution Control Plant, M.W.S.& D.B., 1979, p17; Caldwell Connell, Environmental Impact Statement North Head Pollution Control Plant, M.W.S.& D.B., 1979, pp15-6.

125 Caldwell Connell, Sydney Submarine Ocean Outfall Studies, 1976, p93.

126 ibid., p129.

127 Caldwell Connell, Environmental Impact Statement North Head, p33.

SYDNEY'S TOP 20 TROLLING GROUNDS

FIGURE 7.6

To many bluewater anglers the idea of trolling is simply dragging a lure behind the boat in the hope that something will latch onto it.

But trolling can be more than this, it can be a carefully planned, aggressive and exciting form of productive fishing.

Even when the whole day's fishing is not to be spent trolling, results from a couple of hours with the lures can provide bait and table fish as well as some very enjoyable action.

The gear needed does not have to be fancy, any good quality geared reel or heavy threadline, combined with a good boat rod will get you involved with the fish.

If you want to do a lot of trolling, then buy a rod that will stand up to the searing runs that the hard hitting pelagics can dish out.

Any of the good 4/0 type game reels are perfect for the job especially when combined with a good jig or game rod.

The lures are simple and the techniques in using them are also easy. Basically any lure that comes through the water without spinning can be with success.

Naturally some lures are better than others and I tend to base the range I use around 3 or 4 different patterns.

For the small tuna I use ¼oz and ½oz feathers as well as small squids and pearlheads.

The colours I find best are red and white in the feathers and pink, red or white in the squids and pearlheads.

To catch the larger types of fish found off Sydney, I use a couple of small to medium sized Kona Heads and big green squids.

In this map I have attempted to show some of the main areas around Sydney where surface fish can be found in good numbers.

Naturally all areas are subject to the movement of currents and baitfish and some searching may be necessary.

This map is the first of its type and hopefully it will lead anglers to catch more and better fish.

Quality kingfish, yellowfin, wahoo, dolphin fish and marlin can be taken by trolling the bigger lures.

The Kona Heads that seem to produce best are the 350V in red or yellow with green. The big green squid is a favourite with yellowfin and marlin.

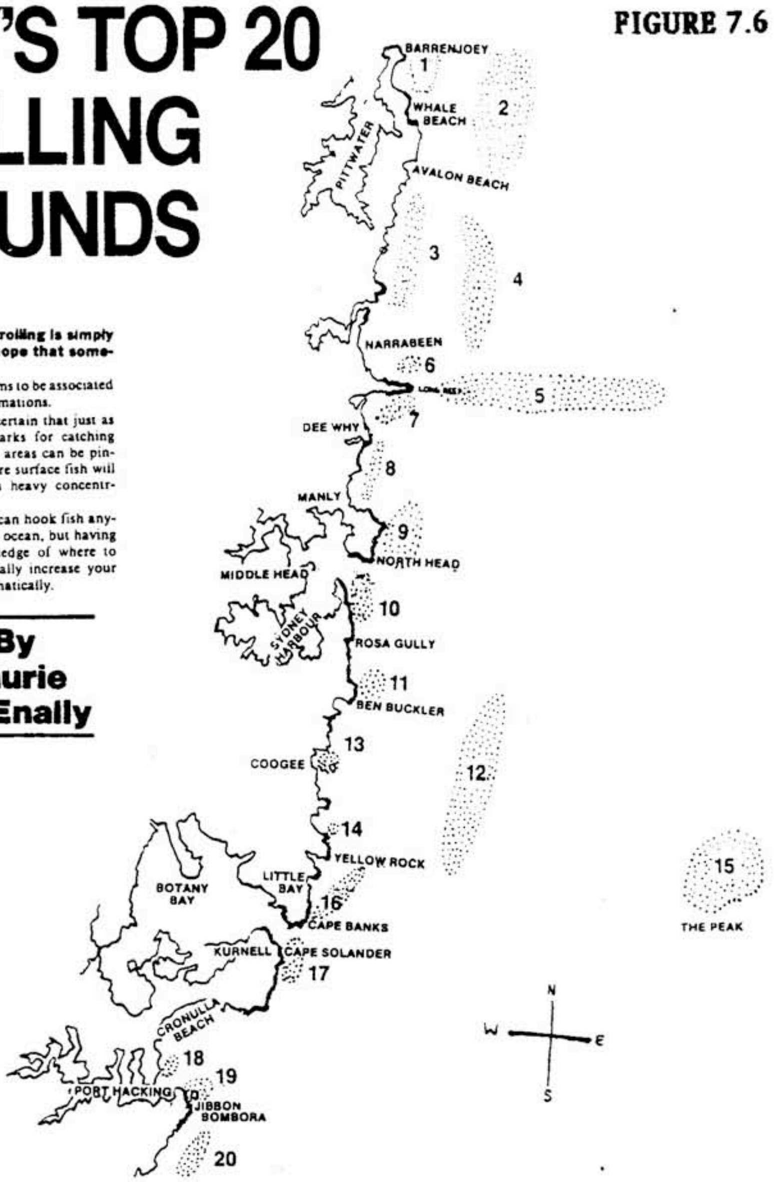
The pelagics can be found anywhere there is good bluewater, but to really score you should know where good numbers of surface fish can be located.

The reason why these fish congregate in certain areas is open to conjecture, but it certainly seems to be associated with reef formations.

It is also certain that just as there are marks for catching bottom fish, areas can be pinpointed where surface fish will be found in heavy concentrations.

Sure you can hook fish anywhere in the ocean, but having some knowledge of where to look will really increase your catches dramatically.

By Laurie McEnally

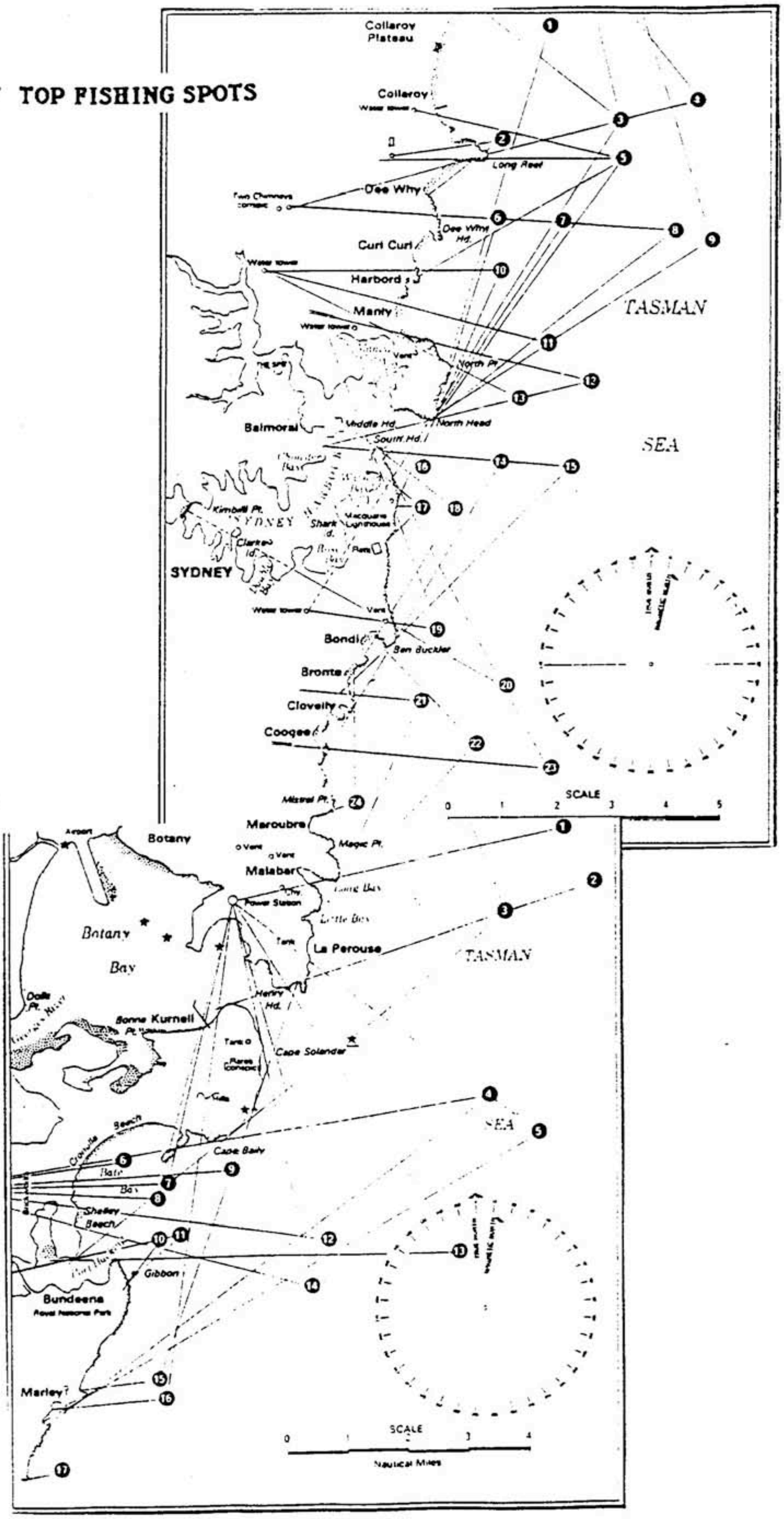


HOW YOU FIND THEM

1. Barrenjoey to Palm Beach holds a lot of mixed small fish, tailer, salmon, bonito, stripies and kingfish.
2. Top area on a run out tide. Strong current line forms, forcing bait fish to bunch up and mixed tuna as well as a lot of marlin are caught here.
3. Southwards from Whale Beach to Newport Reef is often a good pit-stop to get some gamefishing baits. Small tuna, tailer, salmon and kings can be trolled up on the drop-offs, with minnow lures.
4. Trolling along the 20 fathom line in this area is very productive for striped tuna.
5. Long Reef can produce anything at the right time; marlin, dolphin fish, wahoo, kingfish, yellowfin and stripies are all on the cards. Troll from the area known as Reef Wide to about the 12 fathom line.
6. White Rock: Top spot for kingfish. Also tailer, salmon and bonito at times.
7. Mixed light gamefish. Small kingfish, stripies, bonito, salmon and tailer.
8. The stretch of water between Queencliff Point and South Curl Curl often has visual schools of surface fish feeding. Troll around patches of birds no further out than moored ships.
9. North head seems to be extremely good at times for big fish. Yellowfin and marlin are often taken in this area. School yellowfin from 5 to 18kg are a good bet in this area.
10. South Head is good for mixed small tuna, kingfish, bonito, tailer and salmon.
11. Ben Buckler: Trolling along the murk line is tops for stripies.
12. The Four Mile is a good area for stripies and small yellowfin.
13. Wedding Cake Island: Small kingfish school in big numbers around the island, especially in summer. Bonito also move around the island in good sized schools.
14. South Maroubra is a very productive little spot, particularly for tailer, salmon, bonito and small kingies.
15. Trolling around the Peak can produce anything that takes lures. Kingfish, tuna, marlin, wahoo and dolphin fish can all be taken here. It is one spot that can produce fish in both winter and summer.
16. & 17. North and South of Botany Bay are good for most small light gamefish as well as the odd yellowfin and marlin.
18. The area around Bate Bay and Shelley Beach is a top area for small kings, salmon and tailer.
19. Jibbon: This area is famous for the huge numbers of kingfish.
20. South of Port Hacking and down to Marley is a good area for stripies and small yellowfin.

SOURCE: <u>Fishing Giant Map Book</u>, Neptune Press, p62.

FIGURE 7.7 TOP FISHING SPOTS



SOURCE: Harold Vaughan, The Australian Fisherman, Landsdown Press, 1985, pp86–87.

Table 7.9

CONCENTRATIONS OF RESTRICTED SUBSTANCES IN MARINE LIFE 1973										
SAMPLE		HEAVY METALS mg/l or parts/million					PESICIDES parts/billion			
SPECIES	LOCATION	Mer-cury	Cad-mium	Copper	Lead	Zinc	DDT & DDE	Lindane	Aldrin	Di-eldrin
Yellow Tail	Malabar	0.04	0.05	1.4	1.1	26	5.6	0.9	0.3	0.9
	Marley	0.04	0	0.8	0.22	3.4	4	0	0	0
Flat Head	Malabar	0.3	0	1.1	0	3.0	2	0.6	0	0
	Marley	0.11	0	0.2	0	0.3	0	0.9	0.4	0
Crested	Malabar	0.12	0.02	0.43	1.1	4.3	14	1.0	0.4	0
Flounder	Marley	0.22	0.05	0.49	0.79	3.4	13	0.6	0.2	0
	Malabar	0.34	0.02	1.9	0.22	4.5	15	4	0.09	0
John Dory	North Head	0.21	0.2	1.24	0.46	3.0	102	0	0.08	0
	Marley	0.40	0	0.79	0.11	2.1	1.6	0.2	0	0
Blue Groper	North Head	0.43	0	0.32	0	3.0	430	30	0.8	80
	Marley	0.53	0	0.14	0.19	5.8	150	1	0	0
Brown Groper	North Head	0.54	0	1.44	0.33	3.5	102	0	100	9
	Marley	0.31	0	0.14	0	1.8	120	2.5	0	0
Black Drummer	Malabar	0.14	0.02	2.54	0.38	9.6	70	10	0	30
Black Fish	Malabar	2.64	0.02	0.34	0.22	4.8	200	20	0	30
Tuna	Malabar	0.4	0	0.86	2.4	7.1	5	0	0	0
Bream	Malabar	0.43	0	0.28	0.19	2.8	620	30	0	0
Tailor	Malabar	0.16	0.06	0.27	0.22	6.2	300	6	0	20
Trevally	Malabar	0.08	0.07	0.42	0.19	4.45	280	20	0	20
Worm	Malabar	0.12	0.38	4.8	3.5	98	220	50	0	30
mussel	North Head	0.30	0.36	6.6	3.0	75	17	0	0	0
ascidian 1	North Head	0.26	0	2.5	2.5	10.4	250	0	20	0
	Marley	0.17	0.02	1.6	0	8.8	-	-	-	-
ascidian 2	North Head	0.15	0.03	1.9	0.25	25.2	100	0	0	0
mollusc 1	North Head	0.08	0.92	33	1.48	310	-	-	-	-
mollusc 2	North Head	0.28	0.27	2.2	0.22	13.7	220	0	0	5
NH&MRC max levels	1972	0.5	5.5	30	2	40	1000	1000	200	200
	1987 fish	0.5	0.2	10	1.5	150	1000	1000	200	100
	" shellfish	0.5	0.2	70	2.5	1000	1000	1000	200	100

worm - Torebellidae
ascidian 1 - Pyura pachyddermatins
acidian 2 - Pyura Praeputiallis
mollusc 1 - Agnewia tritoniforis
mollusc 2 - Cebastans spengleri

information compiles from:
Caldwell Connell Engineers, Environmental Impact Statement: North Head WPCP, MWS&DB, Dec 1979, pp32 -33 & Caldwell Connell Engineers, Environmental Impact Statement: Malabar WPCP, MWS&DB, Dec 1979, p42.

In Australia the NH&MRC recommends maximum levels of various toxic substances for food stuffs, including fish. These figures are based on Australian dietary habits and what little is known about the toxicology of the substances in question. For example, for mercury, it has been estimated that an "average" human of 70 kg (which seems to imply an average adult male more than an average human) can consume 0.3 mg of mercury each day and just be on the borderline of showing clinical symptoms of toxicity. It is assumed that such a person would eat no more than 59 g of fish a day or 410 g per week and the theoretical blood levels are calculated. A safety factor of ten is applied (and these safety factors vary for each toxic substance) and the maximum concentration of mercury in fish is thereby worked out.[128]

The guidelines put out by the NH&MRC are therefore based on assumptions that may be wrong, particularly for the children of amateur rock fishermen. Moreover the maximum levels are based on partial ignorance and a good deal of uncertainty and they are frequently changed as new information comes to hand. Nevertheless they are the only Australian standards available. In the 1973 study, 16 species caught at Malabar, 5 (that is 33%) were above the NH&MRC maximum allowable levels set in 1972 for one or more of heavy metals and seven (that is 47%-almost half) were at or above the 1987 NH&MRC levels for heavy metals. Moreover these levels recommended by the NH&MRC do not seem to take account of the possible synergistic effects of more than one heavy metal or organochlorine being present in seafood.

Despite these astounding results Caldwell Connell argued that the findings should cause no concern and say that although a blackfish had more than five times the level of mercury allowed for food by the NH&MRC guidelines, they subsequently caught six more to check them and found that they had mercury levels below the guidelines and so they assumed the first blackfish (which by this time still represented 14% of the blackfish samples) was of dubious validity. The Water Board cheerily accepted Caldwell Connell's interpretation of the results of the survey. In what some might see as an unduly optimistic conclusion the Board stated

> Whilst the statistical significance of the 1973 survey is not able to be clearly established the results are encouraging in that they indicate that no serious environmental problem existed even prior to the full implementation of source control of restricted substances... [129]

A later SPCC report argued that the Board's conclusions were open to question because very few samples were collected and because the validity of the species selected as indicators of pollutants have not been established. They point out that only muscle tissue was analysed although many metals accumulate in the liver and other organs and that microanalytical techniques for metals were not well developed at the time the study was done.[130]

Recently an ex-Water Board employee, Ron Snape, a marine biologist, has told the press that whilst he was conducting a survey of marine life off Sydney's outfalls for the Board, he carried out tests for concentrations of heavy metals and organochlorines although this was not part of his brief. He claims that he found concentrations of mercury, zinc, cadmium and dieldrin in the samples found near the Malabar outfall and the Blackfish had concentrations of mercury up to six times the NH&MRC maximum levels. He says the Water Board did not want to know and he was forced to resign over it. He was coaxed back into their

128 S.P.C.C., Toxic Chemicals, p10.

129 M.W.S.& D.B., Environmental Impact Statement Bondi, pp30-321.

130 Ralph Kaye, 'Technical Support Paper - Sludge Disposal Policy', Clean Waters Advisory Committee, 10th September 1987, p14.

employment and completed the report in 1975 but claims that the report was heavily rewritten and distorted. He again resigned from the Board.[131]

Another study undertaken by the Fisheries Research Institute of fish in the vicinity of the ocean outfall sites was not mentioned in the environmental impact statements. The results were not published because it was argued they were not scientifically significant.[132] It was a study of heavy metal content of fish in 1974 and 1979. The results of this very small survey are shown in table 7.10. In this study all eight Blue Groper sampled from Manly waters were above the NH&MRC maximum allowable levels for mercury and one Red Morwong out of eight was also over.[133]

Table 7.10

HEAVY METAL CONTENT OF FISH 1974/78
mg/l or parts/million

SPECIES	location		Cadmium	Copper	Lead	Zinc	Mercury
Bream	Malabar	one only	0.07			27.5	0.36
	Manly	mean	0.10			12.6	0.10
		range	0.05-0.15			4.0-41.0	0.06-0.18
Black drummer	Malabar	one only	0.07			24.5	0.09
Luderick	Malabar	mean	0.07			22.4	0.33
		range	0.07-0.07			13.5-30	0.29-0.37
	Bondi	mean	0.10			31.4	0.04
		range	0.05-0.20			4.0-180.0	0.03-0.07
Trevally	Manly	one only	0.10			9.0	0.06
Sweep	Manly	mean	0.08			65.3	0.05
		range	0.05-0.10			15.0-144.0	0.04-0.05
	Bondi	mean	0.10			46.3	0.05
		range	0.10-0.15			9.0-130.0	0.04-0.06
Tarwhine	Bondi	one only	0.10			59.0	0.06
Blue Groper	Malabar	one only	0.01	0.59	0.4	1.9	0.46
	Manly	mean	0.01	0.55	0.15	2.4	0.67
		range	0.01-0.01	0.31-0.71	0.1-0.2	1.6-5.0	0.51-1.06
Red Morwong	Manly	mean	0.01	0.57	0.2	2.9	0.35
		range	0.01-0.01	0.35-0.85	0.1-0.5	2.2-3.9	0.21-0.54
NH&MRC maximum levels		1972	5.5	30	2	40	0.5
		1987	0.2	10	1.5	150	0.5

FROM: correspondence between R.Chvojka, Fisheries Research Institute to Ralph Kaye, SPCC, 16th December 1985.

A further study by the Fisheries Research Institute has been kept secret for years. Attempts by Stop the Ocean Pollution, the Australian Conservation

[131] Sydney Morning Herald, 4th February 1989; Daily Telegraph, 4th February 1989.

[132] interview with R.Chvojka, Senior Technical Officer, Fisheries Research Institute, 16th December 1988.

[133] correspondence, R Chvojka, Fisheries Research Institute, to Ralph Kaye, SPCC, 16th December 1985.

Foundation[134] and by the then shadow minister for environment, Tim Moore, to find out the results of the study were unsuccessful.[135] The Senior Technical Officer of the Fisheries Research Institute now has no memory of the survey.[136] However the results are mentioned in an SPCC report. In the study Blue Groper and Red Morwong were collected between 1977 and 1979 near the ocean outfalls and tested for pesticides. Three of forty blue groper specimens exceeded NH&MRC maximum levels (0.1 mg/kg) for Dieldrin. Ten of 58 Red Morwong exceeded the same levels for Dieldrin and five had DDT body burdens in excess of NH&MRC maximum levels (1 mg/l) for total DDT. PCB's were also detected.[137]

A study by the NSW Health Commission of PCB's (Polychlorinated Biphenyls) in fish in Sydney waters, including Malabar sewage outfall waters, was done for the Australian Environment Council in the early 1970s but even experts in the field found interpretation of the results difficult because of the way the data were presented. It was possible to say, however, that large quantities of PCB's had been detected in Bream and Mullet and smaller amounts in Blackfish and oysters.[138]

The comments made in 1982 on how little work had been done on the amounts of PCBs in the Australian marine environment could be equally well applied to other toxic material.

> Most surveys seem to have been the result of sporadic, poorly planned and documented spot tests on the various localities thought to have been contaminated as a result of local industrial activity. At present it would seem that a pattern of PCB contamination similar to that of the Northern Hemisphere is occurring in Australia, in that the aquatic environment, particularly in the vicinity of industrial centres, is at greatest risk.[139]

Two recent studies of both pesticides and heavy metals in fish in the vicinity of the ocean outfalls have been done recently. One was published by the Water Board as part of a pilot study for an ongoing monitoring program. Organochlorines were found in all the fish species and the mean levels for the livers of the Stingray and of the Wobbegong shark were above the NH&MRC guidelines. Cadmium levels were also above NH&MRC guidelines in Balmain Bug and the Giant Hermit Crab.[140]

The other study, "The Malabar Bioaccumulation Study", came up with much more serious levels of both organochlorines and heavy metals (results shown in

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134 correspondence, Jane Elix, NSW Campaign Officer, ACF, to Richard Gosden, undated.

135 correspondence, Alderman Ray Collins, Waverley Council to Richard Gosden, STOP, 9th September 1986.

136 interview with R.Chvojka, Senior Technical Officer, Fisheries Research Institute, 16th December 1988.

137 Kaye, 'Sludge Disposal Policy', p15.

138 B.J. Richardson & J.S. Waid, 'Polychlorinated Biphenyls (PCBs): An Australian Viewpoint on a Global Problem', Search 13(1-2), Feb/March 1982, p22.

139 ibid., p24,

140 Sydney Water Board, Sydney Deepwater Outfalls, Environmental Monitoring Programme Pilot Study, vol 11, March 1988, pp6-10.

table 7.11 & 7.12) but the results were not published. In that study all three fish species (the Red Morwong, the Blue Groper and the Rock Cale) sampled had average levels above the NH&MRC guidelines for several heavy metals in the livers of the fish and arsenic seemed to have been at high levels throughout the fish and invertebrates sampled. The Red Morwong and the Blue Groper also had average levels of organochlorines above NH&MRC guidelines. The eight Red Morwong taken at Malabar, in fact, had average levels of Benzene Hexachloride over 120 times the NH&MRC maximum levels, Heptachlor Epoxide over 50 times the levels as well as Dieldrin and arsenic in the muscle tissue that was above NH&MRC levels and above guideline levels of Lead, Cadmium, Arsenic, Selenium and Mercury in their livers.[141]

When part of this report was first leaked to the media[142], the SPCC, which had carried out the study on the Water Board's behalf, responded that the results were not significant because it was merely a preliminary study and a further broader study was to take place. The study had consisted of 8 samples of three fish species (24 samples) and 3 species of invertebrates (24 samples) taken off Malabar. The broader study was to consist of eight samples of 1 species, the Red Morwong, to be taken at various studies up and down the coast.[143] In effect the second more extensive study would be less extensive as far as fish off Malabar were concerned.

When more specific results from the first study were leaked to the Herald a few months later the official response was that a second set of tests had been conducted and the results would be due in another month. It was argued that the second set of tests had been conducted to test the results of the first survey. The Board stated that the original survey was considered too limited and "never intended to be used as a basis for public discussion."[144]

The extent to which organisms will accumulate toxic materials of various kinds depends on a number of factors including the species, the age of the organism, the season, the feeding habits and even the presence or absence of other toxic chemicals in the organism.[145] The purpose of the Malabar Bioaccumulation study was to provide data that would assist the Board in selecting organisms as part of their ocean outfall monitoring study.[146] From the studies which have been done in Sydney it is clear that of the fish species which have been sampled, those which accumulate toxic substances the most include the Blackfish, the Red Morwong, the Blue Groper and the Wobbegong Shark. The principle species of game and commercial fish taken in Sydney ocean waters are the Mullet, Tuna, Morwong, Flat-Head, Australian Salmon and Snapper.[147]

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141 'Malabar Bioaccumulation Study', Business Papers, Clean Waters Advisory Committee Meeting, 10th December, 1987.

142 Sydney Morning Herald, 27th September 1988.

143 interview with Bob Rothwell, S.P.C.C., Lidcombe, 27th September 1988.

144 Sydney Morning Herald, 7th January 1989.

145 S.P.C.C., Toxic Chemicals, p1.

146 ibid.

147 Caldwell Connell, Environmental Impact Statement North Head, p15.

TABLE 7.11

HEAVY METALS IN MARINE LIFE 1987
mg/l or parts per million

SPECIES	LOCATION	Copper	Zinc	Lead	Cadmium	Arsenic	Selenium	Mercury
RED MORWONG muscle	Malabar	0.28	4.6	0.26	--	2.0	0.10	0.36
	Pt Hacking	0.26	4.0	0.18	--	2.0	0.18	0.28
	Terrigal	0.62	4.6	0.07	--	3.0	0.18	0.31
liver	Malabar	6	32	8.4	1.3	3.2	3.0	1.1
	Pt Hacking	17	46	3.8	5.0	4.2	2.8	0.84
	Terrigal	17	54	2.2	8.2	7	4.1	1.0
BLUE GROPER muscle	Malabar	0.29	4.1	0.04	0.01	0.8	0.23	0.55
	Pt Hacking	0.22	4.6	--	--	0.8	0.03	0.26
	Terrigal	0.54	6.4	0.15	--	1.3	0.25	0.30
liver	Malabar	3	34	2.8	1.4	1.8	1.0	1.45
	Pt Hacking	6	38	2.8	3.2	3.0	1.4	0.46
	Terrigal	6	44	1.8	4.4	3.8	2.2	0.54
ROCK CALE muscle	Malabar	0.27	8.4	0.04	--	0.5	0.05	0.04
	Pt Hacking	0.58	8.4	0.04	--	0.4	--	0.03
	Terrigal	0.55	12	0.10	--	1.0	--	0.06
liver	Malabar	520	60	0.5	1.0	1.7	5.4	0.32
	Pt Hacking	620	104	0.2	2.2	2.7	11.4	0.12
	Terrigal	600	98	0.1	3.2	6.2	11.4	0.24
RED BAIT CRAB	Malabar	32	25	0.38	0.04	6.1	0.84	0.065
	Pt Hacking	23	26	0.45	0.06	13	0.78	0.070
	Terrigal	26	28	0.02	0.08	8.1	0.68	0.054
ABALONE	Malabar	7	17	0.29	0.02	4.1	0.08	0.04
	Pt Hacking	7	15	0.02	--	12	0.20	0.058
	Terrigal	5	15	0.06	--	5.0	0.02	0.035
CUNJEVOI	Malabar	2	7	0.39	0.03	0.8	0.42	0.018
	Pt Hacking	3	6	0.28	0.01	0.6	0.42	0.038
	Terrigal	3	6	0.29	0.15	0.6	0.32	0.034
NH&MRC GUIDELINES	FISH	10	150	1.5	0.2	1.0	1.0	0.5
	SHELLFISH	70	1000	2.5	0.2	1.0	1.0	0.5

FROM: information supplied in business papers, Clean Waters Advisory Committee Meeting, 10th December 1987.

The Board has subsequently decided not to monitor any of the species that have gone above NH&MRC recommended levels in the past. Rather they are going to concentrate on the Snapper, with some monitoring of the Stingray, the Nannygai, the Tarwhine and the Leatherjacket.[148] The invertebrates that they have chosen to monitor are not the mussel or the ascidian or the mollusc that went over NH&MRC levels in 1973, nor the Red Bait Crab or Abalone that had elevated levels of copper and arsenic in the 1987 SPCC study but the Balmain Bug, the prawn and the squid. The Snapper has been chosen as the main focus of the monitoring study because it is a valuable commercial and recreational species, whose biology is well known, that accumulates a range of restricted

148 Sydney Water Board, Pilot Study, vol 11, pp15-6.

substances, occurs at all depths over soft and hard substrates and which can be easily caught. [149]

TABLE 7.12

ORGANOCHLORINES IN FISH 1987 parts per billion							
SPECIES	LOCATION	TISSUE	BHC	HPTE	DDT (total)	Dieldrin	TOTAL OC'S
Red Morwong	Malabar	muscle	1220	2600	300	105	4230
		liver	160	320	--	--	480
	Pt Hacking	muscle	10	60	20	--	100
		liver	--	30	--	--	30
Blue Groper	Malabar	muscle	200	250	20	20	500
		liver	80	100	--	--	220
	Pt Hacking	muscle	--	--	--	--	--
		liver	--	--	--	--	--
Rock Cale	Malabar	muscle	--	20	--	5	50
		liver	--	30	--	--	30
	Pt Hacking	muscle	--	10	--	--	10
		liver	--	10	--	--	10
NH&MRC maximum levels			10	50	1000	100	

BHC - Benzene Hezachloride
HPTE - Heptachlor Epoxide
TOTAL OC'S - sum of all organochlorines detected.

FROM: Information supplied in business papers, Clean Waters Advisory Committee Meeting, 10th December 1987.

There is a tendency in NSW to limit discussion of industrial waste impacts on marine life to the possible health effects that may accrue to humans through consumption of seafood rather than considering effects on the marine life itself.[150] In 1976 Caldwell Connell argued that a detailed investigation of levels of pesticides and heavy metals in the marine environment was beyond the scope of the study. They assumed that as long as they met the SPCC guidelines for concentrations of restricted substances in ocean waters it would be okay.[151] (These guidelines are discussed further in chapter 8)

Caldwell Connell were unable to dismiss the problem of fish contamination so easily in the Environmental Impact Statements although they did allow themselves such statements as "The abundance of fish observed near the outfall discharge indicates that the discharge does not have an adverse impact on fish."[152] Moreover, they judged the obvious accumulation of restricted substances in the marine biota as acceptable, partly because the criterion they used were NH&MRC guidelines for food.

149 ibid.

150 for example, S.P.C.C., Toxic Chemicals, pp1-2.

151 Caldwell Connell, Sydney Submarine Outfall Studies, p129.

152 Caldwell Connell, Environmental Impact Statement North Head, p32.

There are no Australian standards for what levels of bioaccumulation of restricted substances will not cause an adverse impact on fish. Often the level which is considered safe for human consumption purposes is higher than the level considered safe for protection of fish eating mammals and birds. For example the US Food and Drug Administration recommends a maximum level of 2 mg/l of PCB's for fish for consumption whereas the US Fish and Wildlife Service recommends a limit of 0.5 mg/kg.[153]

In 1987 a U.S. Office of Technology Assessment Report argued that despite the problems of documenting a relationship between waste disposal and marine impacts, "a strong overall case can be established that waste disposal activities are contributing significantly to substantial declines in the quality of marine waters and harming marine organisms."[154] The report noted that some organisms are more vulnerable than others, especially bottom-dwelling (benthic) organisms and those which spend all or part of their lives in coastal waters, as well as those that inhabit polluted waters during sensitive parts of their life cycles. Also marine birds and mammals which are at the top of the food chain can suffer because of biomagnification of pollutants. Such biomagnification has led to impaired reproduction in the animals. For example. in California, the decline of the brown pelican population and that of several other bird species has been directly linked to DDT-contaminated fish.[155]

Actual deaths of organisms due to pollution are difficult to detect, unless there is a mass killing that cause fish to be washed up in numbers on a beach or shore, because very sick or dead organisms don't last very long. Nevertheless other symptoms such as behavioural and physiological effects, as well as changes in abundance and distribution of organisms and fish have been detected in various polluted coastal waters in the United States and the US Office of Technology Assessment report states that

> a growing body of evidence links these effects to exposure to pollutants that sometimes are present at very low concentrations or to environmental changes induced by pollutants... The effects are concentrated in estuaries and coastal waters, but detectable effects also have been found in fish far from shore in the open ocean. . .
> considerable circumstantial evidence indicates that pollutants from waste disposal activities have contributed to declines of major fish populations in the United States.[156]

Noticeable physiological effects include fin erosion (fin rot), ulcers, shell disease or erosion, tumors and skeletal anomalies. Resistance to infection, growth and reproductive ability can also be affected and although these effects may not be immediately fatal they can lead to a premature death. Moreover submerged aquatic vegetation, which is an important part of the ecosystem that not only provides shelter and food but also sediment stabilising functions, seems to have been generally decreasing in the United States coastal areas and benthic

153 S.P.C.C., Toxic Chemicals, p10.
154 US Office of Technology Assessment, Wastes in Marine Environmnents, p99.
155 ibid., p104.
156 ibid., pp110-2.

communities "have been affected by waste disposal in every region of the country"[157]

THE INTERNATIONAL DIMENSIONS OF SLUDGE

When sewage is primary treated it is the sludge which contains the highest proportion of toxic substances. At present, at the North Head outfall very little sludge is produced because there is only a minimal sedimentation process, therefore any toxic substances are retained in the effluent and enter the sea with the effluent. At both Bondi and Malabar, where some sedimentation takes place, sludge is collected and digested to allow some break down of organic matter. The sludge is then sent out the outfalls after dark. The sludge creates a dark slick and is discharged at night so it won't be observed.[158] Any resulting deposits on the beaches can be cleaned up early the next morning before most beachgoers arrive. (Randwick Council estimated that it cost them $23,000 during the 1983/84 year to clean up the sewage debris from the beaches in their municipality.[159]) The routine sampling that is done during the day time as part of the licence conditions misses the bulk of the sludge as well.

This practice of adding the sludge back into the effluent defeats much of the effect of primary treatment. An internal Water Board report stated that the advantages of treating sewage with primary treatment as compared to merely screening it and removing the grit and some of the grease disappeared to a large extent when the digested sludge extracted by primary treatment was added back into the effluent before discharge.[160]

Even digested sludge can cause problems in the marine environment. An SPCC report noted that digested sludge still contained significant amounts of grease and oil as well as other organic matter, trace metals synthetic organic compounds such as organochlorines and pathogenic organisms.[161] Table 7.6 gives an indication of the concentrations of metals in sludge as compared to raw sewage and shows that many of these substances aggregate in the sludge after treatment. The Board has not published any figures about concentrations of organochlorine pesticides and PCBs in sludge but the SPCC estimates that the .002 mg/litre in the raw sewage translates to about 6700 parts per billion in the sludge which would give about 3000-4000 milligrams per litre (wet basis) with higher values occasionally recorded.[162]

The SPCC report notes that the grease in the sludge creates an aesthetic problem but that problems are created for the marine life because of its nature and toxic content. The SPCC has observed changes to ecosystems in the immediate vicinity of the existing outfalls but argue that whether such changes are undesirable is really a value judgement. WP-1 guidelines in fact state that

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157 ibid., p112.

158 Sun-Herald, 18th December 1988.

159 Randwick Municipal Council, Minutes, date unknown.

160 M.W.S.&D.B., North Head and Ocean Outfall Re-evaluation of Treatment and Disposal Options, Sept 1977, p2-7.

161 Kaye, 'Sludge Disposal Policy', p3.

162 ibid., p3.

the ocean waters should be protected "to retain a natural and diverse, but not necessarily unchanged, variety of marine life."[163]

Changes can occur because of the smothering of benthic organisms, alteration of sediment type from silty/sand or rock-reef to organically rich silt.[164] Sludge may contaminate the sediments with metals and organic chemicals as well as pathogens.[165] These sediments form part of the food chain and provide a pathway for these toxic substances into the food chain.

The ocean disposal of sewage sludge is controversial in many parts of the world. Two Water Board engineers noted after an overseas study tour

> Some countries regard all forms of sea dumping as reflecting the practices of an unsavoury past or as a last resort if no alternative land disposal options can be found; other countries regard it as an option, the merits of which should be considered alongside those of alternative options on the basis of science and of economics.[166]

In Europe only 7% of all sludge generated is disposed of in the sea and only the United Kingdom, Ireland, Netherlands and Spain use the ocean for sludge disposal with the UK contributing 90% of the sludge going to sea.(see table 7.13) In the U.K. 95% of sludge disposed of to sea was deposited from vessels and ocean disposal represented 29% of all sludge disposal there whilst in the U.S. it represented only 15%. In Japan, all sludge is either incinerated or composted and ocean disposal is prohibited because of public pressure. All over the world the trend is towards increased restriction of sludge being discharged into the sea.[167]

The global nature of marine environmental problems associated with sludge dumping was recognised in the early 1970s when a number of countries got together to negotiate terms of a global dumping convention in London. The London Convention on Dumping necessarily represented political compromises amongst the various interests and was not very rigorous, but this was necessary to maximise the number of countries that would be a party to it. Like NSW environmental law it allows for a certain amount of flexibility and discretion in its implementation and does not establish rigid standards. "The agreement implicitly recognizes that economic or policy considerations should be allowed to influence national decisions."[168]

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163 ibid., p6.

164 ibid.

165 US Office of Technology Assessment, Wastes in Marine Environmnents, p103.

166 W.R.Hazell & J.H.Browne, Report on IAWPR London Conference on Disposal of Sewage Sludge to Sea and Study Tour in U.K. and U.S.A., M.W.S.&D.B., 1981, p3 & p8.

167 ibid., p6; Kaye, 'Sludge Disposal Policy', p17; Clean Waters Advisory Committee Meeting 10th December 1987.

168 Marc Zeppetello, 'National and International Regulation of Ocean Dumping: The Mandate to Terminate Marine Disposal of Contaminated Sewage Sludge', Ecology Law Quarterly 12(3), 1985, p647.

Table 7.13

European Sludge Disposal Practices

Country	Sludge Prodn (1000 tds/yr)	Ag Land	Other Land	Incin	Sea	Unspec
			Disposal Method (%)			
Austria	140	small	large	30	0	0
Belgium	70	15	83	2	0	0
Denmark	130	45	45	10	0	0
Finland	130	40	45	0	0	15
France	840	30	50	20	0	0
Germany	2200	39	49	8	2	2
Greece	3	0	100	0	0	0
Holland	230	60	27	2	11	0
Ireland	20	4	51	0	45	0
Italy*	1200	20	55	0	0	20
Luxem.*	11	90	10	10	0	0
Norway	55	18	82	0	0	0
Spain	45	60	......20......		20	0
Sweden	210	60	......30......		0	10
Switz.	50	80	10	10	0	0
UK	1200	39	27	4	30	0
Europe	6934	37	43	8	7	5

* Indicates percentages do not total 100

Source: Ralph Kaye, Technical Support Paper – Sludge Disposal Policy, CWAC, 10th September 1987, p. 73.

What the London Convention did recognise was the desire for many nations to control marine pollution. The Convention states

> Contracting Parties shall individually and collectively promote the effective control of all sources of pollution of the marine environment, and pledge themselves especially to take all practicable steps to prevent the pollution of the sea by the dumping of waste and other matter that is liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.[169]

The Convention prohibits the dumping of substances such as organohalogen compounds (which include organochlorine pesticides), mercury and mercury compounds, cadmium and cadmium compounds and requires special permits for wastes containing substances such as arsenic, lead, copper, zinc, cyanides, fluorides, nickel and chromium and their compounds. Other wastes require general permits. Permits must consider the impact the wastes will have and the aspects which must be considered are specified.[170]

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169 Environmental Protection (Sea Dumping) Act 1981, Commonwealth of Australia, Schedule 1.

170 ibid.

The prohibition of dumping of wastes such as mercury is regardless of the need for a disposal method or the cost of alternative disposal methods. These prohibited substances are only allowed to be dumped as trace contaminants or if they were rapidly rendered harmless. At the time the term "trace contaminants" was not defined. Interim guidelines were therefore adopted in 1978 which stated that material could not be defined as "trace contaminants" if it had been added to otherwise acceptable wastes for dumping, if it occurred in such amounts as could cause undesirable effects on marine organisms or human health, or if it was practical to reduce the concentration further by technical means.[171]

Australia was a signatory to the London Convention in 1972 but did not ratify it till 1985. The Environmental Protection (Sea Dumping) Act 1981 represents the conventions provisions in Australian law. Although the Convention was clearly aimed at all sludge dumping in the ocean the Australian Act has changed the wording slightly in a way which makes it inapplicable to the disposal of sludge from outfalls and pipelines despite the noting of outfalls and pipelines as a source of marine pollution in the Convention's preamble.[172]

Whether or not the Act applies to sewage sludge discharged through pipes or only that which is barged out to sea, the discharge of sludge through pipes close to shore is obviously no better than dumping from vessels. The U.S. Environmental Protection Agency noted in 1979 with respect to its own laws

> It would be incongruous for Congress to ban dumping of such sewage sludge at dumpsites anywhere from twelve to more than one hundred miles from shore, while, at the same time, to allow it to be discharged through outfalls in nearshore coastal waters. [173]

Nevertheless the Water Board is able to legally discharge organochlorines, mercury and cadmium through its outfall in quantities large enough to show accumulation in marine life and to accumulate to the extent that some fish species have shown levels above health guidelines for consumption. This clearly breaches the intention of the London Convention for these substances do not meet the definition of "trace contaminants" given above and are obviously not "rapidly rendered harmless".

The problems in meeting the provisions of the London Dumping Convention have been felt in other countries too. In the United States, which drafted the original document that formed a basis for negotiation for the Convention, attempts by the Environmental Protection Agency to phase out sludge dumping have not been very successful. The EPA introduced revised regulations in 1977 which were aimed at incorporating the requirements of the London Convention. Special permits were issued for some sludges whilst others received interim permits for limited periods. The EPA set a 1981 deadline for full compliance with the provisions of the Convention.[174]

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171 Zeppetello, 'National and International Regulation of Ocean Dumping', p640.

172 Environmental Protection (Sea Dumping) Act 1981, Commonwealth of Australia.

173 Environmental Protection Agency, 'Modification of Secondary Treatment Requirements for Discharges into Marine Waters', Federal Register 44(11), June 15 1979, p34797.

174 Zeppetello, 'National and International Regulation of Ocean Dumping', p629.

These interim permits could only be issued if there was sufficient need or if the denial of such a permit would cause worse environmental affects because of alternatives that would be used. Concerned that the EPA was issuing these interim permits too liberally without determining need but rather in response to pleas of economic hardship from municipalities, the US Congress directed the EPA to end sewage sludge dumping by the end of 1981. Sewage sludge was defined as waste generated by a municipal sewerage treatment plant which might "unreasonably degrade or endanger human health, welfare, or amenities or the marine environment, ecological systems, and economic potentialities" if it was dumped in the ocean.[175]

Some States willingly acquiesced to the Federal restrictions on sludge dumping. In California the impact of sludge dumping had been extensively monitored and the marine environment had been "significantly degraded" at two sites where they had been dumping sewage sludge. The Californian government therefore explicitly banned sewage sludge discharges in ocean waters.[176]

When the 1981 deadline came up, both New Jersey and New York municipal authorities challenged the EPA in the court. The New Jersey authority lost in a New Jersey district court but the New York authority won in a New York district court. New York city argued that the environmental consequences of land disposal outweighed the environmental consequences of ocean dumping 12 miles out in the New York Bight.[177] The ruling which the EPA did not appeal against weakened the EPA resolve and it decided to "be more flexible".[178] The EPA was successful however in getting the sludge dumping site shifted from 12 miles out to sea to 106 miles out.

Another attempt by the EPA to formulate a policy which stated that ocean dumping should only be allowed if it was considered "environmentally preferable" to other alternatives was squashed by the Office of Management and Budget (OMB) which ordered the EPA to abandon efforts to issue the policy because it wanted the EPA to consider all disposal media to be equally appropriate.[179]

Even the US House of Representatives which has been strongly opposed to ocean dumping has been unsuccessful at getting laws implemented to restrict ocean dumping. A 1984 bill (H.R.4829) for example which contained no deadline for stopping ocean disposal of sewage sludge but rather sought a reduction in contaminant levels after 1986 was not passed by the Senate. If these bills had been passed by the Senate they would probably not have been passed by the Reagan Administration.[180]

More recently the 1988 summer in New York has brought huge publicity about beach pollution and closures and rumours that sludge from the old 12 mile dump

[175] ibid., p630.

[176] Environmental Protection Agency, 'Modification of Secondary Treatment Requirements', p34797.

[177] Zeppetello, 'National and International Regulation of Ocean Dumping', p631-4.

[178] ibid., p650.

[179] ibid., p651.

[180] ibid., pp656-8

is breaking away and coming on shore.[181] As the Congress was debating a bill to end sludge dumping within four years, New York promised it would stop dumping within a decade.[182]

Ocean disposal is more attractive to the municipal authorities than land disposal because it is cheaper and because available land is becoming scarce. At the same time the amount of sewage sludge being generated is increasing. Moreover, no option is environmentally beneficial whilst sewage sludge is contaminated with toxic substances and pathogens. Sewage sludge will remain a problem whilst the authorities are unwilling to enforce strict controls on what industries are allowed to put down the sewers and thereby ensure that measures such as waste minimisation, process changes, recycling and pretreatment are encouraged.

In Australia where the Federal Government has chosen to interpret the London Dumping Convention as applying to sludge dumped through pipes and where environmental regulation is left to a state level, there is no body such as the EPA pushing to stop sludge dumping. In NSW the SPCC decided in the 1980s that it had better put together a sludge policy. An attempt in 1985 to get a draft sludge policy approved by the Clean Waters Advisory Committee met with opposition from the Water Board's representative despite the fact that the policy was careful to make provision for the Board to continue to discharge sludge through its three main shoreline outfalls and to dispose of sludge through the extended ocean outfalls when they were built.[183]

The Board's representative, John Browne, argued that the Board's research had not shown any detrimental effects accrued from dumping sludge in the ocean. He suggested that the SPCC had no scientific basis for rejecting ocean sludge disposal as a legitimate option. The Draft Policy was not approved by the Committee and sent away to have more work done on it.[184] The SPCC subsequently consulted with the Sydney Water Board, as well as the Hunter District Water Board and the Fisheries Research Institute on its draft sludge policy which became a draft "interim policy."[185]

The Board refused to acknowledge that adverse environmental impacts made sludge disposal undesirable and adopted its own policy that it would only select land treatment where "present worth cost difference" was equivalent to ocean disposal or where the cost of land utilisation was only marginally greater.[186] Costs for sludge disposal at Bondi and Malabar are shown in table 7.14. The negligible cost of ocean disposal is hard to beat.

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[181] see for example, New York Times throughout July/August 1988.

[182] New York Times, 4th August 1988.

[183] Clean Waters Advisory Committee Meeting Minutes, 14th November 1985.

[184] Clean Waters Advisory Committee Meeting Minutes, 14th November 1985.

[185] Clean Waters Advisory Committee Meeting Business Papers, Agenda Item 5, 10th September 1987,p36.

[186] Clean Waters Advisory Committee Meeting Minutes, 11th June 1986.

TABLE 7.14

COMPARATIVE COST OF SLUDGE DISPOSAL OPTIONS				
Sludge Disposal Option	location	Capital Cost $M	Operating Cost $M	Total Capitalised Cost $M @ 10% p..a.
ocean via outfall	Malabar Bondi	negligible negligible	negligible negligible	negligible negligible
Incineration	Malabar Bondi	19 8	2.4 1.0	43 18
Landfill	Malabar Bondi	28 14	2.3 1.3	51 27

Source: Disposal of Digested Sludge to the Ocean: Malabar & Bondi Water Pollution Control Plants, MWS&DB, December 1982.

The SPCC interim policy on sewage sludge disposal was presented to the Clean Waters Advisory Committee towards the end of 1987. It emphasised that its objective was not to prohibit existing discharges of sludge to the ocean but only to restrict the growth of quantity of sludge being discharged till the results of environmental studies could be evaluated, particularly in other parts of NSW. The policy stated that ocean discharge would normally only be approved if the sludge was digested and discharged through approved submarine outfalls and then only if no significant environmental effects were detected and that land treatment of sludge would be encouraged because it was generally beneficial.[187]

A SPCC representative at the meeting noted that a visitor from the "influential US Congress Appropriations Committee" thought that the US EPA was unlikely to relax its policy of prohibiting new sludge discharges to the ocean. He also pointed out that Japan had to abandon plans to dump sludge at sea because "popular and political pressure against the move was so strong that it has been abandoned as an option" and a similar trend could be observed amongst the Scandinavian countries with respect to the Baltic Sea.[188]

The Water Board and the Public Works Department opposed the policy although the Public Works Department, which was responsible for all treatment works in NSW aside from those operated by the Hunter District and Sydney Water Boards, in fact, did not use the ocean for disposal at any of its treatment plants but rather used land treatment already and although the Sydney Water Board's three main ocean outfalls were exempted whilst the submarine ocean outfalls were built. The interim sludge policy was therefore not approved by the Clean Waters Advisory Committee. Rather they recommended that a Sludge Sub-Committee consisting of representatives from the SPCC, the Sydney Water Board, the Hunter District Water Board, the Public Works Department, the

187 Clean Waters Advisory Committee Meeting Business Papers, Agenda Item 5, 10th September 1987, pp36-38.

188 Clean Waters Advisory Committee Meeting Minutes, 10th December 1987.

Health Department, the Department of Agriculture and the Metropolitan Waste Disposal Authority, be formed to investigate and report.[189]

CONCLUSION - THE HIDDEN COSTS OF INDUSTRIAL POLLUTION

The responsibility for disposing of industrial wastes has become a public one because of the desire to encourage industrial growth and also because of the lack of responsibility shown by industries when left to their own devices in this respect. The use of the sewers for this purpose seemed a logical idea at a time when the composition, and therefore the treatment, of domestic and industrial liquid wastes was basically similar. The changing composition of liquid industrial wastes brought that logic into doubt and has given rise to the need for restrictions, pricing mechanisms, inspections and prosecutions just to ensure that the sewerage system can continue to function as it was originally designed to.

The growing environmental awareness of the late 1960s and 1970s forced a crisis during which the environmental consequences of the use of water carriage for industrial waste disposal and especially the use of stormwater drains, canal, creeks and rivers for this purpose became unacceptable. The response was to divert most of Sydney's liquid wastes east of Prospect into the sewer system. Consequently, the Water Board, rather than changing its criteria for acceptance of industrial waste into the sewers to cover environmental damage that might occur at the ocean outfalls, was forced to accept a heavier industrial waste load to cater for the political desire to clean up the rivers.

Strength charges allowed a degree of flexibility in applying acceptance to sewer standards and were supposed to act as a financial incentive to industries to install on-site treatment facilities. Standards had been enforced where these facilities could be economically installed. The term "economically" seems to be a negotiated one with the result that most pre-treatment, today, is very rudimentary and is limited to dilution, neutralisation, settlement and precipitation. The philosophy of 'Best practicable technology' overrides environmental standards in control of industrial waste.

The desire to maintain good relations with industry together with staff cutbacks has led to a situation where these standards are increasingly self-monitored and self-policed. It seems that industry can be trusted to do this although they would not be trusted to completely deal with the waste themselves. Moreover, the encouragement of industrial waste into a system that was never designed for it has not only diminished the effectiveness of the treatment of domestic sewage but acted as a disincentive for the development of any form of waste management that reduces the generation of waste during production or recovers or recycles waste products. It has literally inhibited the development of waste treatment and disposal technology.

Experience overseas has shown that the assumption that regulation inhibits industrial growth and that tight pollution control in particular makes an

189 Clean Waters Advisory Committee Meeting Business Papers, Agenda Item 5, 10th September 1987, p37; Clean Waters Advisory Committee Meeting Minutes, 10th December 1987.

industry less profitable cannot be maintained. Dirty industries are often inefficient and badly managed and process changes and innovations forced by regulation can in fact reduce costs and help industries to be more productive and more profitable.

Moreover, the costs to the environment of allowing the sewers to be a cheap disposal system for industry are unknown. Despite the assurances by the Water Board and their consultants, there is growing evidence that benthic life is disturbed and that heavy metals and organochlorines are accumulating in the marine life, posing a threat to both humans and the ecosystem. This situation is exacerbated by the continued insistence that sludge be disposed of to sea despite international law and trends to the contrary and despite some attempts by the SPCC to curb this practice.

The growing body of evidence in Sydney and abroad that the use of sewers for the disposal of toxic industrial waste is having a detrimental effect on the marine ecosystem is studiously ignored by the Water Board. The presence of this toxic industrial waste in the sewage means that sewage sludge cannot be safely incinerated nor treated on land, and that more advanced, biological treatment is not possible. The choice of submarine ocean outfalls reflects a decision made given these constraints. This decision and its defence will be discussed further in the next two chapters.