

Sydney Water Inquiry

Fourth Report
Prospect Water Filtration Plant
tender process
and contract arrangements

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Fourth Report

Prospect Water Filtration Plant tender process and contract arrangements

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Chapter 1: Executive summary

This report is prepared using my powers as a Royal Commissioner. On 21 October 1998 the original Sydney Water Inquiry was constituted as a Royal Commission under the *Royal Commissions Act 1923* to investigate:

"(1) the process of calling and evaluating tenders and awarding the contract for the construction of Prospect Water Filtration Plant; and
(2) the preparation and terms of that contract".

The Letters Patent required these matters to be examined to the extent relevant to the following Terms of Reference of the original Inquiry, which required me to:

"(v) determine whether the current arrangements for water treatment are appropriate; and
(vi) determine who is responsible for the current arrangements and whether their actions were appropriate".

A copy of the Letters Patent is included in the Appendices.
Concern about the contamination of the water supply occurred first in the system which is sourced through the Prospect Water Filtration Plant. Accordingly, my original Terms of Reference required me to investigate the contract for that plant.

Since that time the Terms of Reference have been widened, but I have not examined the contracts for the other plants. This would have required major inquiries beyond the scope of this report. However, the general selection process for each contract is examined.

As required by the Terms of Reference, this Inquiry has identified the persons responsible for the current arrangements for the Prospect plant and examines whether their actions were appropriate. I have discussed the question of the suitability of the current water treatment arrangements in this report and the matter will be further considered in my Final Report, which will provide recommendations on the future treatment of the water supply. The present state of scientific knowledge in relation to *Cryptosporidium* and *Giardia* makes this issue complex and difficult.

The Water Board contemplated water filtration as far back as the 1960s. In fact, provision was made for water filtration when Warragamba Dam was built. However, there was no capital available to construct the facility and Prospect Reservoir was believed to be doing an appropriate job as a settlement basin.

By the late 1980s, Prospect Reservoir's effectiveness was seriously compromised. Massive doses of alum were required to be added to the water to reduce turbidity, especially during storm events. The system was beginning to feel the strain, and complaints about drinking water quality were emerging.

There were also increasing indications from publications by the National Health and Medical Research Council (NHMRC) and Australian Water Resources Council (AWRC) that desirable water quality would require stricter standards. The 1987 NHMRC/AWRC guidelines confirmed the need to address the quality of Sydney's water. Further guidelines that would impose a stricter regime were expected in 1993. In fact, these guidelines were not published until 1996.

My inquiries reveal that the Water Board began to consider *Cryptosporidium* and *Giardia* in about 1986. The matter was not considered particularly significant in the Sydney context, although it was believed that a general improvement in water quality was necessary. To advance this improvement, a Drinking Water Program (DWP) was developed in the late 1980s. This was one of a number of programs setting out the long term objectives of the Water Board. The other programs were the Clean Waterways Program, the Water Resources Program and the Urban Development Program. The DWP was designed to ensure that the Water Board improved Sydney's drinking water by meeting the relevant NHMRC/AWRC water quality guidelines. One of the strategies to be used to achieve this was the development of four new water filtration plants to be known as Prospect, Macarthur, Woronora and Illawarra.

The difficulty for the Board was finding ways to finance the necessary capital works. There was insufficient capital to finance all of the identified programs. This problem was solved when policies were developed within government to make greater use of private sector funds for building and operating public infrastructure. The filtration plants were originally intended to be provided under the Build Own Operate Transfer (BOOT) policy but this ultimately changed to Build Own Operate (BOO) due to taxation and financial considerations. The development of the facilities by the private sector was not without controversy within the Board.

The Board called for Expressions of Interest for the four plants in April 1991. The Expressions of Interest were evaluated and Invitations to Tender were issued to five pre-qualified parties. This resulted in three tenders for Prospect.

The process of inviting Expressions of Interest and evaluation of the tenders was scrutinised rigorously. I am satisfied that the process was undertaken with integrity.

The rigour of the early stages of the tendering process continued through to the selection of the preferred tenderers. I am satisfied that this was done with honesty and without influence from any inappropriate source.

Some aspects of the selection process require comment. The Board sought tenders for the four filtration plants, which were to be constructed at the same time. Prospect was by far the largest and it was decided that the projects would be packaged so that whoever succeeded in the Prospect tender would not be able to contract for any of the others. This decision was made known to the tenderers with the tender documentation. It had the potential to inhibit the Board from achieving a fully competitive tender process. In fact, NSW Water Services Pty Ltd shrewdly assessed the position and determined to tender only for Prospect, thereby enhancing its chances of success. (NSW Water Services Pty Ltd was a subsidiary of Australian Water Services Pty Ltd, which ultimately negotiated the contract for the Prospect plant. I have referred to both NSW Water Services Pty Ltd and Australian Water Services Pty Ltd as AWS throughout this report.)

As it happened, AWS offered the lowest price for the Prospect plant. When analysed appropriately, it offered a price which, over the 25-year term of the contract, had a net present value that was \$40 million less than the nearest tender price, which was offered by the Wyuna consortium. At the time AWS was selected as the preferred tenderer, it had not proved its treatment process to the satisfaction of the Board's technical assessment team. This problem was dealt with by AWS offering a guarantee to provide an alternative filter medium if its proposed sand medium could not meet the Board's specified filter run times. In adopting this approach, the Board took a significant risk but, as it happens, no problems emerged. AWS was ultimately able to prove its technology. However, the process of selection was concerned more with obtaining the lowest price rather than ensuring the highest quality technology.

During the time the filtration plant proposals were being developed, the Board again considered the issue of *Cryptosporidium* and *Giardia*. It was decided that the Scientific Services Unit of the Water Board would commission work in the catchment to determine whether *Cryptosporidium* and *Giardia* were a problem. This work was undertaken by Dr Primrose Hutton and revealed levels of *Cryptosporidium* which were considered to be of health concern, and some evidence of *Giardia*. The work, which identified the need for further study, was available by October 1992.

In March 1992 the Board also commissioned a report from Aquatech Pty Ltd, a firm of environmental and water management consultants, which reviewed the existing published information on *Cryptosporidium* and *Giardia*. This was an important document.

These reports were obviously known to the scientific group within the Water Board and to the engineers responsible for the DWP. However, the Hutton report of October 1992 was not given to the Board's Environmental Management Unit (EMU), which was responsible for preparing the environmental evaluation of the projects, until March 1993.

The relevant provisions of the *Environmental Planning and Assessment Act 1979* required the Water Board to prepare Environmental Impact Statements and consider the environmental consequences of the proposals before deciding whether or not to proceed with the plants. For this purpose the Board relied upon consultants who were overseen by the EMU. Although I am satisfied the EMU carried out its task with rigour, some of the engineers of the DWP did not always appreciate the obligations the *Environmental Planning and Assessment Act* imposed on the Board.

The issue should be seen in context. The Board undertook the design and tender stage of the project before publishing an Environmental Impact Statement. It chose a preferred tenderer with whom it proceeded to negotiate a final contract before a Determination had been made that the project could proceed under the *Environmental Planning and Assessment Act*. It was most unlikely that a decision would have been made that the project should not proceed after a preferred tenderer had been chosen. By the time the environmental process was finalised, the Board was under time cost pressures imposed by the preliminary contractual arrangements.

The antipathy of some of the engineers to the environmental assessment process is evidenced by their dealings with the environmental scientists and is particularly emphasised by the fact that the Hutton report on *Cryptosporidium* and *Giardia* was not given to the EMU as soon as it became available. This conduct was inappropriate considering the potential importance of these organisms to the safety of drinking water.

It is clear that the Board's engineers in 1993 had an incomplete understanding of *Cryptosporidium* and *Giardia*, their consequences for human health and the effectiveness of the filtration plants in dealing with them. The engineers were concerned that, as information about *Cryptosporidium* and *Giardia* became available, this did not delay the development of the filtration plants because of the general deterioration in the quality of the water. This was a legitimate concern. The early release of the information may not have altered the course of subsequent events but would have allowed better informed decisions.

When the Hutton report was made available, the EMU expressed concern about whether or not the filtration plants were appropriate for the treatment of *Cryptosporidium* and *Giardia*. It was also concerned that the backwash supernatant (the water produced by backwashing the filter beds) could accumulate organisms which could break through the plants. The matter became a significant issue.

The answer given to the problem by Mr David Manzi, the Manager of the DWP, was that the plants were appropriate as the engineers believed overseas experience had shown that the filtration plants would remove or inactivate 99.9% (3 log) of pathogens, including *Cryptosporidium* and *Giardia*. Although there was some evidence to support the view that (by a combination of removal and disinfection) the proposed filtration plants would deal effectively with *Giardia*, having regard to the information which was then available, the same conclusion was not appropriate with respect to the removal or inactivation of *Cryptosporidium*.

The EMU accepted the advice from Manzi. A discussion of this matter was included in the Prospect plant clause 64 report which incorporates the Water Board's Determination of the matter under the *Environmental Planning and Assessment Act*, and provides conditions for its implementation. The language of the clause 64 report is unclear. However, I am satisfied that it was the intention of the draftsman of the report that a performance standard requiring the removal or inactivation of 99.9% (3 log) of *Cryptosporidium* and *Giardia* would be imposed on the plant. The report required the backwash supernatant to be disinfected unless it could be shown that recycling this water to the plant inlet would not affect the attainment of 99.9% (3 log) overall removal or inactivation by the plant.

Clause 2.2.4.4 of the report provides as follows:

"(a) The Water Board will require the water treatment company to return the filter backwash supernatant to the head of works after being treated by disinfection, unless disinfection can be shown to not be required to the satisfaction of the Water Board's Manager Bulk Water, to ensure removal of pathogens so that the overall treatment process ensures a minimum 3 log removal or inactivation (99.9%) of pathogens (7.7.3).

(b) The Water Board will continually review the management of filter backwash supernatant and ensure that best available technology economically achievable is adopted at the Prospect WTP as better information becomes available on pathogens in drinking water (7.7.3)."

I am satisfied that the Managing Director, Mr Bob Wilson, made plain to Manzi and the environmental scientists of the EMU that he required the treatment process to effectively remove all *Cryptosporidium* and *Giardia*. He also contemplated some future modification of the plant, if necessary, to achieve this. Whether he directed that the contract for the Prospect plant should contain an obligation for AWS to remove or inactivate 99.9% (3 log) of pathogens is unclear. The clause 64 report was determined by his successor, Mr Paul Broad, who does not appear to have been aware of the previous consideration of the issue.

Clause 2.2.4.4 (a) is expressed as a modification related to the backwash waters but describes the required overall efficiency of the plant. In my view the draftsman intended to include a requirement for 99.9% (3 log) removal or inactivation on the plant. However, I doubt whether the wording chosen was effective to impose this obligation.

AWS was advised of the clause 64 report. The draft contract provided for the requirements of the clause 64 report to become contractual obligations and AWS became concerned that clause 2.2.4.4 may impose a performance standard on the plant. It responded by confirming that the plant had not been designed to "ensure minimum 3 log removal or inactivation (99.9%) of pathogens." This was correct, for the plant had been designed at a time before *Cryptosporidium* and *Giardia* were believed to be a problem in Sydney's catchments. The negotiations concentrated on who was to pay for any disinfection of the backwash water should this be required. I am satisfied that it was never intended by the engineers of the DWP who were responsible for the negotiations that AWS would be obliged by contract to remove or inactivate 99.9% (3 log) of *Cryptosporidium* and *Giardia*. The engineers assumed that the contractual requirements for turbidity would adequately deal with the removal of pathogens.

Recent information indicates that it is likely that the plant is removing or inactivating 99.9% (3 log) of *Cryptosporidium* and *Giardia* in most circumstances. Work is being undertaken with the prototype plant to confirm whether or not this is so. There are indications that on occasions the plant will not achieve this level. However, it will achieve 99.9% (3 log) at most times, in particular when the water is dirty and likely to contain higher levels of *Cryptosporidium* and *Giardia*.

An examination of the events reveals some problems with the assessment of the project under the *Environmental Planning and Assessment Act*. The provisions of Part 5 of that Act are designed to ensure that decisions on major government projects are taken after consideration of all relevant environmental matters. The environmental assessment process is intended to assist the decision making process of the Board, including the choice of appropriate technology. This is made difficult when the project itself will be defined by the tenderer who wins the contract. However, I doubt

whether there is any practical alternative. Obviously the project which the Board would prefer to implement must be the subject of an environmental evaluation. In this case, because the parameters for efficiency of the plant had been defined at the tender stage, the desire of the EMU to include a performance standard in relation to *Cryptosporidium* and *Giardia* in the environmental determination caused difficulties and could not have been carried through to the contract.

A great deal has been learnt about *Cryptosporidium*, *Giardia* and water treatment since 1993, particularly during the recent events. If 99.9% (3 log) removal or inactivation of pathogens had been imposed as a requirement under the contract, it would have been difficult to audit compliance. It would not have been effective as a contractual term. Accordingly, the fact that 99.9% (3 log) removal or inactivation was not imposed as a contractual term is of no practical consequence. If the Water Board had required AWS to achieve 99.9% (3 log) removal or inactivation, this would have led to a far more expensive plant. It was appropriate for the Board to require the turbidity levels indicated in the contract but, on the evidence available at the time, additional expenditure on water treatment would not have been appropriate.

The Water Board did impose obligations on AWS to achieve defined maximum levels of turbidity and other potential contaminants in filtered water. These levels were assumed to be an adequate means of defining water quality. The levels chosen were appropriate having regard to the contemporary circumstances.

Chapter 2: Introduction

This report is in two parts. The first deals with the processes which concluded when AWS was chosen as the preferred tenderer for the Prospect Water Filtration Plant. This was part of the Water Board's Drinking Water Program which also included the establishment of the Macarthur, Illawarra and Woronora plants.

A team headed by Manzi, Manager of the DWP, was established to conduct the Board's tender process. The team also included Messrs Graham Trickett, Colin Nicholson, Richard Browning, Bruce Murray, Keith Craig and Stephen Roddy, who are engineers, and Ms Raj Goyal and Mr Denis Pidcock who provided financial expertise.

A concept design for the plant was prepared in the early 1990s identifying possible treatment processes.

Expressions of Interest for the four filtration plants were called in 1991. Tenders were then sought from five pre-qualified proponents. In November 1992 the preferred tenderers were selected for the design, construction and operation of the water filtration plants. AWS, which represented a consortium comprised of Lend Lease Corporation Ltd, P&O Australia Ltd and Lyonnaise des Eaux-Dumez SA, was selected for the Prospect plant.

In considering the tender process I have interviewed many staff from the Water Board who were directly involved in the evaluation process and the subsequent selection of

preferred tenderers. This included the executive, staff from the DWP and members of the various evaluation teams who considered the operational, project development and commercial/legal aspects of the proposals.

The second part of the report deals with the environmental assessment process leading to the establishment of the Prospect plant.

The environmental assessment process followed the selection of the preferred tenderers. The assessment was undertaken by a unit within the Water Board known as the Environmental Management Unit (EMU).

This unit was headed by Dr Lorraine Cairnes, although the Prospect environmental assessment was under the control of Dr Ross Woodward.

I have interviewed the relevant staff from the EMU, the DWP, Scientific Services and the executive.

The second part of the report also examines the contract between the Water Board and AWS. For this purpose I have examined all documents relating to the relevant contract. The Water Board and AWS have, for appropriate commercial reasons, claimed legal professional privilege for certain documents. The privileged documents were obtained utilising my powers as a Royal Commissioner under section 17 of the *Royal Commissions Act 1923*. Certain of the evidence given to me, particularly that of the lawyers involved, was also given pursuant to those compulsory powers without waiver of claim of privilege.

The Water Board and individuals employed by the Board were represented by Clayton Utz, solicitors. Mr John Shirbin, a solicitor of that firm who advised the Board during the contract negotiations, gave evidence before me. He was represented by Mr R Ellicott QC. I also interviewed relevant individuals associated with AWS, including Mr Bryan Weir who acted for AWS during the contract negotiations. He was then a partner of Freehill Hollingdale & Page, Solicitors. AWS was represented at the Inquiry by Freehill Hollingdale & Page and Mr R V Gyles QC appeared before me to make submissions on behalf of the company. A number of submissions were received from the public in relation to matters concerning the Prospect Water Filtration Plant. A complete list of submissions received by the Inquiry will be included in the Final Report.

The report quotes from the transcripts of evidence given by a number of the people. For uniformity of terminology throughout the report, references in quoted material to NSW Water Services and Sydney Water have been standardised to AWS and the Water Board respectively. The Water Board was corporatised in January 1995 and its name was changed to Sydney Water Corporation. For clarity I have used the Water Board when referring to the organisation either before or after it was corporatised.

In accordance with the procedures I have adopted throughout the conduct of the Inquiry, all parties involved who may have been subject to adverse findings or inferences were offered the opportunity to provide further information or cross examine any person who made a statement or was interviewed.

I express my appreciation for the co-operation I have received from all involved in this Inquiry. The difficulties of continuing to manage the filtration plants, the catchment and the distribution system while the Inquiry process was undertaken imposed stress on all involved. The nature of the problem and the need for a timely investigation have imposed great burdens on the Inquiry staff. I am grateful to all who have worked with immense dedication to assist in the preparation of this report. They are acknowledged individually in the Final Report.

PART I

The process leading to the establishment of the Prospect Water Filtration Plant

Chapter 3: The quality of Sydney's water supply before the Prospect Water Filtration Plant

The significance of Prospect to Sydney's water supply

The Water Board provides approximately 1,500 megalitres (1,500 million litres) of water each day to more than 3.8 million people in the Sydney, Blue Mountains and Illawarra regions. Since late 1996, 11 plants have treated all of the water supplied to these regions.

Seven water filtration facilities are owned and operated by the Water Board. They are located at Orchard Hills, Cascade, North Richmond, Nepean, Warragamba, Linden and Greaves Creek.

The remaining four plants provide more than 90% of Sydney's water. They are at Prospect, Macarthur, Illawarra and Woronora. These facilities were constructed during the last eight years and are operated under Build Own Operate (BOO) contracts between the Water Board and three private sector companies. The construction and operation of these facilities is an essential element in the Water Board's current DWP.

The Prospect plant is the largest of the Board's drinking water filtration facilities. It filters about 85% of Sydney's drinking water. It has the capacity to process 3,000 megalitres of water per day, with provision to increase to 4,200 megalitres per day. This makes it one of the largest of its type in the world.

The water supply for Sydney, the Blue Mountains and Illawarra is primarily drawn from catchments on four main river systems the Upper Nepean, the Warragamba, the Shoalhaven and the Woronora.

The Upper Nepean Scheme commenced in 1880. It consisted of diversion weirs and, later, dams on the upper tributaries of the Nepean River. The growth of Sydney's

population and the increasing knowledge of the incidence of drought led to construction of Warragamba Dam and the Upper Shoalhaven Scheme. By the late 1980s the Upper Nepean system was based on nine major storage reservoirs and six small storage dams. Together these harnessed water from 16,780 square kilometres of catchments. They could store approximately 2,400,000 megalitres of water or almost five times the capacity of Sydney Harbour. This was the equivalent of 667,000 litres for every one of the 3.6 million people the Water Board supplied at that time.

In comparative terms, that was the equivalent to about five times as much water per capita stored for Los Angeles or New York.

The Prospect Reservoir was used as a settling and storage basin. It was a vital part of the system. For many years Prospect's size proved effective. Water flowed into the Reservoir where settlement occurred. It was originally designed to retain water for 180 days which was thought to be sufficient for natural settlement.

Tell-tale signs of stress

As Sydney's demand for water grew, the average time water was held in the Prospect Reservoir reduced. By the 1980s water remained in the Reservoir for only two or three days, depending upon demand. This reduced Prospect's value as a sediment settling basin. Wilson, Managing Director of the Water Board between October 1987 and April 1993, says that during his time "massive doses of alum were being used through a makeshift injection system to reduce turbidity, especially during storm events".

The addition of alum assisted in the flocculation of the sediments, causing them to drop to the bottom more quickly. However this could never be a long term solution. Wilson tells me that by the late 1980s the Reservoir was filling up with alum to such an extent that "the amount of alum accumulating on the bed of Lake Prospect was threatening to create visible islands. It was clear that something had to be done to reduce the amount of chemical treatment and build a more reliable method of treatment."

There were also increasing health concerns about the use of alum and its possible links to Alzheimer's disease. In addition, it was becoming apparent that reliance on screening to remove leaves and other large organic matter together with disinfection was no longer sufficient to ensure satisfactory water quality for Sydney. This was reflected in the increasing number of "dirty water" complaints by customers who objected to the taste, washing stains and discolouration of Sydney's water.

In the words of Wilson there were "tell-tale signs emerging" which indicated that the water supply system was "beginning to feel the strain".

Increasingly the water out of Prospect was failing to meet community expectations and official guidelines for water quality.

Australian water quality guidelines

In 1980 the National Health and Medical Research Council (NHMRC) and the Australian Water Resources Council (AWRC) jointly produced a document, *Desirable Quality for Drinking Water in Australia*. These guidelines were intended to assist water authorities in determining standards for appropriate drinking water quality.

In 1987 the NHMRC and AWRC published *Guidelines for Drinking Water Quality in Australia 1987*. This took into account developments in the area of water quality criteria since 1980 and was largely consistent with the World Health Organisation's publication *Guidelines for Drinking Water Quality* (1984).

The NHMRC/AWRC Guidelines stated that they are intended to provide:

● day-to-day operational values generally consistent with those adopted by the World Health Organisation, which ensure that water supplied does not carry any significant risk to the consumer;

- a basis for the design and planning of water supply augmentation and water quality improvement works; and
- a benchmark for assessing long term trends in the performance of the system.

The Guidelines also stated that they were not developed "for regulatory purposes and the values should not be construed as standards. However, achievement of these values will ensure generally aesthetically acceptable water which does not carry any significant risk to the health of the consumer".

There was also an expectation that the NHMRC and AWRC would publish new guidelines in 1992/3. This did not occur until 1996.

What was known of *Cryptosporidium* and *Giardia*?

In 1986 Dr David Wilcox, Chief Medical Officer for the Water Board, worked with officers from the Water Board's Headworks Branch and Scientific Services Branch, to produce a report entitled *Water Quality Strategy*. This report reviewed water quality issues associated with the Water Board's supply system. The report did not refer to *Cryptosporidium*, but in relation to *Giardia*, it said:

"Giardiasis is increasingly being recognised as a common disease within society (about 2% of the population harbour the organism). The parasitic protozoa can give rise, if ingested, to acute or chronic diarrhoea, fever, anaemia, weight loss and chronic gall bladder diseases. It is hardly ever fatal but may produce prolonged ill health.

Indeed there is evidence to suggest that *Giardia* cysts within water supplies is the largest single cause of water borne disease outbreaks in developed countries. *Giardia* cysts, particularly when developed to the stage of having a hard shell are not destroyed by normal chlorination and can only be satisfactorily eliminated from water by filtration. Testing for *Giardia* cysts is technically difficult and up until now could

not be undertaken by the Board. However, limited tests to date have not revealed any cysts in the supply system. No technique currently exists for continuous monitoring for *Giardia*. From overseas experiences it would have to be assumed that *Giardia* would be present in our water from time to time. It is understood that it is because of *Giardia* that the American EPA will soon be making it compulsory for all water to be filtered.

It is recommended that a comprehensive study be made of this aspect of water quality, including experience world wide to determine what actions should be taken by the Board."

(I note that Wilcox was not correct in his understanding of the effect of chlorine on *Giardia*. In appropriate doses chlorine will inactivate *Giardia*.)

Wilcox says that he undertook a study in 1986/87 and found a background level but no focal point of *Giardia* in Sydney.

The first Australian conference on *Giardia* in the water supply was held in Canberra in 1989. Wilcox advises me that the conference concluded that *Giardia* did not pose a big problem in Australia due to climatic conditions.

In the United States, however, there had been a number of outbreaks of waterborne giardiasis, the first recorded in Aspen, Colorado in 1965 (Hibler and Hancock, 1990). Waterborne outbreaks of cryptosporidiosis had been less common, the first instance recorded in San Antonio, Texas, in 1984 (D'Antonio, 1985).

In 1989 concern about *Giardia* in the United States led to the introduction of the *Surface Water Treatment Rule* which required that water supplies be treated in order to achieve 99.9% (3 log) removal or inactivation of *Giardia*. There was no prescribed requirement for *Cryptosporidium*.

No outbreaks of waterborne cryptosporidiosis or giardiasis through public water supply had been documented in Australia. An incidence of giardiasis at Mt Isa in 1984 was suspected by the community to have been caused by the water supply. However, later this was shown to have been transmitted by person to person contact (Boreham & Phillips, 1986). Accordingly there remained little concern in Australia about a threat from *Cryptosporidium* or *Giardia*.

During the 1980s the Water Board's scientists recognised *Cryptosporidium* and *Giardia* as potential problems. However, by the end of the 1980s they were not considered to be significant water quality issues in themselves. Instead, the more general deterioration in the quality of Sydney's drinking water, the declining effectiveness of the Prospect Reservoir as a quality barrier, increasing public complaints and the publication of drinking water quality guidelines were the factors which culminated in the Water Board developing the DWP.

Drinking Water Program

The Drinking Water Quality Program was developed by the Water Board in the late 1980s. Its name later changed to Drinking Water Program and is referred to throughout this report as the DWP. It was one of a number of programs which set out the long term objectives of the organisation. The other three programs were the Clean Waterways Program (which dealt with the issues associated with Sydney's sewerage and waste water treatment), the Water Resources Program (which dealt with dam capacity issues) and the Urban Development Program (which dealt with the provision of water related services to large scale urban developments).

By 1990 the Water Board was only meeting the 1980 NHMRC/AWRC health guidelines 91% of the time and the aesthetic guidelines 95% of the time. The DWP was designed to ensure that the Water Board improved Sydney's drinking water quality by progressively meeting the 1980 and 1987 guidelines.

The principal objectives of the program were to:

- meet the 1980 national guidelines on a continuous basis in all parts of the system by 1991;
- ● meet 1987 health related guidelines by 1994 and other aspects of the guidelines by 1998 through the provision of major treatment facilities;
- involve the community in an informed decision making process that uses the guidelines to set standards of service relating to community needs and wants, and costs; and
- advance the long term targets to 1993 if possible, through the application of research and implementation of new technologies.
- There were three main strategies for achieving these objectives.

1. Improved operations overhauling the monitoring and reporting systems, increasing the skill, expertise and accountability of the Board's operators and investigating and researching new technologies to maintain drinking water quality standards.

2. System upgrade and treatment upgrading water treatment from screening and disinfection to at least filter all the Board's supply systems through the construction of four water filtration plants; and continuing to improve the design, layout and operation of all supply systems of the Board's operations including the roofing of all reservoirs and the lining, flushing and swabbing of water mains.

3. Community involvement raising the awareness of the community about aesthetic and quality issues, by involving the community in setting future water quality standards and providing input into the environmental impact assessments of the water filtration plants.

The Board approved the DWP in January 1990 and the strategy was announced by the Minister the following April.

It was estimated that the implementation of the DWP would cost \$1 billion over 10 years. More than half this amount was to be spent on the design, construction and

operation of the proposed water filtration plants at Prospect, Macarthur, Woronora and Illawarra.

Chapter 4: A water filtration plant at Prospect?

A water filtration plant at Prospect had been considered as far back as the late 1950s. It was included in the plans for Warragamba Dam.

Between 1965 and 1989 there were at least nine reports commissioned by the Board which considered aspects of establishing a water filtration plant at Prospect.

Wilson tells me the Water Board engineers saw the inclusion in the DWP of a water filtration plant at Prospect as the signal for "their resurrection". He adds that it had been on the engineers' "books for a long, long time and it had been knocked back by previous Boards".

The 1986 Water Quality Strategy prepared by Wilcox observed that previously identified management options for improving the quality of water leaving Prospect had been implemented. While water quality had been maintained at a generally satisfactory level, the raw water quality was deteriorating. Turbidity of the raw water had risen on many occasions to levels that rendered disinfection less effective. In addition, pathogens such as *Salmonella* and *Giardia* had been found in the raw water. Wilcox observed that the Water Board, was now "at the crossroads having exhausted most of the easy options open to it". Wilcox's report therefore defined other options and actions necessary to enable the Water Board to continue to supply water of adequate quality.

The report predicted that a water filtration plant would ultimately be necessary at Prospect and that the required studies, "including those associated with Giardiasis", should be completed in two years. The report also recommended a review of the most appropriate treatment process for the Prospect plant having regard to possible variations to the management of the catchment areas.

Resistance to water filtration plants

Wilcox advises me that, after the 1986 Water Quality Strategy report was completed, there was considerable resistance to its circulation. In fact, he tells me that the report was "banned". Wilcox indicates that he was advised by the then Managing Director, Wilson, that "full filtration, full treatment" should not be pursued until about 2000, if possible. This reflected concerns about the availability of capital to meet the cost of treatment, considering the other significant demands on the Board's resources associated with sewage treatment.

The Government had to be persuaded of the need for the DWP. Wilson notes that there was resistance within the Cabinet to the program. The view was "why did we

need to fix something that wasn't broken". The program was not supported by the Treasury which, Wilson tells me, said "wait for it to crash, you only get money in a crisis".

Eventually, Premier Greiner approved the program. He placed an important condition on the approval. He required the Board to show due cause why the water filtration plants should not be financed, owned and operated by the private sector. This meant that, unless good reasons could be demonstrated, the water filtration plants would proceed as Build, Own, Operate and Transfer (BOOT) contracts with the private sector.

Chapter 5: Concept Design Report and the prototype plant

In December 1990 the Water Board engaged the Prospect Water Group, a joint venture of engineering firms Camp Scott Furphy Pty Ltd and Sinclair Knight & Partners Pty Ltd, to undertake a concept design study for the proposed Prospect plant. The purpose of the study was to:

- assess the implications of integrating the new water filtration works within the existing distribution system; and
- develop and conduct a program of pilot testing of different treatment processes as the basis for the concept design for the plant.

The Concept Design Report resulting from this study was completed in February 1992.

Water treatment options

An important aspect of the concept design process was the design and construction of a pilot plant. This plant allowed evaluation of various filter processes and individual quality parameters. The pilot plant was used between March and November 1991 to assist in the selection of the recommended water treatment process and development of the concept design.

As a result of the pilot plant testing program, three possible water treatment processes were considered. All of these involved contact filtration but with differing filtration rates. Contact filtration involves the use of coagulant immediately ahead of the filters. This causes the particles to form flocs that are then trapped by the filter. This process is different from conventional filtration as it eliminates the settling stage. The pilot plant testing also examined the use of chlorination and ozonation before filtration.

The Concept Design Report recommended that the Prospect plant be designed for pre-chlorination followed by contact filtration with a filtration rate of 25 megalitres per hour. The report also noted that pre-ozonation may be substituted for pre-chlorination

in the future, should more stringent water quality standards be introduced, particularly for disinfection.

The contact filtration and pre-chlorination process was found to offer "significant" benefit in terms of capital and operating costs. The report estimated that the preferred process would have a total project cost of \$268 million and an annual operating cost of \$24 million, based on an average daily demand of 1,760 megalitres per day.

In relation to the filter media to be used, the design criteria for the plant specified dual media filtration comprising 1,700 millimetres of 1.7 millimetres effective size Australian filter coal, over 150 millimetres of 0.7 millimetres effective size sand, supported on 150 millimetres of gravel.

In terms of backwash requirements the Report recommended that the backwash water supply system and reclamation facilities should be sized for a maximum daily backwash volume which could be utilised three times per day (that is, on average, every eight hours).

Treated water quality goals

The Concept Design Report used water quality goals based on the 1987 NHMRC/AWRC Guidelines with allowance for anticipated future variations. Water quality goals were also included in the subsequent Brief for Expressions of Interest and Invitation to Tender.

Schedule 10 of the draft contract for the design, construction and operation of the Prospect plant which was provided with the Invitation to Tender, set out the treated water quality objectives and criteria which the successful tenderer would be required to meet. The draft contract provided that, if the plant operator failed to meet the water quality criteria, then financial penalties would be incurred by a reduction in the tariff payable by the Water Board. By comparison, although the water quality objectives set higher standards for treated water quality, the operator had only to "endeavour" to meet these objectives. Failure to do so would not incur a financial penalty.

The water quality requirements for the Prospect plant as they finally appeared in the contract between the Water Board and AWS are included in the Appendices to this report. However, for present purposes the turbidity measures in the draft contract should be noted.

Turbidity is the measure of the presence of suspended particles in water and the unit of measurement is NTU (Nephelometric Turbidity Units). Turbidity is important in the present context because the Water Board ultimately used it as a surrogate for assessing the likely effectiveness of pathogen removal. The draft contract provided that the water quality criteria for turbidity was to be not more than 0.5 NTU and the water quality objective was to be less than 0.3 NTU. The 1987 NHMRC/AWRC guidelines provided for 5 NTU, with less than 1 NTU being desirable for effective disinfection. Thus, in the case of turbidity, the Prospect plant was required to achieve a higher standard than the then current NHMRC/AWRC guidelines. These turbidity levels were appropriate at the time, especially as they were defined before

Cryptosporidium and *Giardia* were considered to be a problem. They reflected levels specified by the US Environmental Protection Agency (US EPA) *Surface Water Treatment Rule*.

Cryptosporidium* and *Giardia

With regard to *Cryptosporidium* and *Giardia*, the Concept Design Report refers to the fact that the Board's Medical Officer had revealed "some concern within the Water Board at the potential for the parasites *Giardia Lamblia* and *Cryptosporidium* to be present in the supply system". The Report also noted that at that stage (February 1992) there was no data available to confirm this. However, an improved method of detection had been developed by Scientific Services which was to be applied in monitoring for *Cryptosporidium* and *Giardia* in the Upper Nepean storages. The Report also stated that it was likely that specific requirements for cyst and virus inactivation may be introduced in the future as a result of continuing investigations into the risk of microbiological contamination under Australian conditions.

At the time the Invitation to Tender was sent to the pre-qualified tenderers, there were no specific water quality objectives or criteria set for the removal of pathogens such as *Cryptosporidium* or *Giardia*. Instead, turbidity levels were provided and the assumption was made that if these levels were met pathogens would be removed to an appropriate level.

Prospect prototype research plant

The Concept Design Report led to the design and construction of the Prospect prototype plant, which was built in 1992. It is significantly larger than the pilot plant, with the capacity to treat far greater raw water flows. It has a filter area 57 times greater than the pilot plant. The prototype plant includes many of the features of a full-scale water filtration plant that could not be provided at the pilot plant scale. For instance, it includes a variety of scaled-down mixing systems, contact channels and a large filter with most of the features of a full-scale filter backwashing system.

The larger size and complexity of the prototype plant enabled the Water Board to more accurately compare and fine tune alternative filtration processes. This led to the selection of the preferred tenderers and ultimately the construction and operation of the Prospect plant.

Chapter 6: To BOOT or not to BOOT private sector participation?

What is a BOOT contract?

A key policy of the Greiner Government was to actively encourage and assist private sector involvement in government infrastructure projects. Under a BOOT contract, a private sector company or organisation agrees with a government agency to build, own and operate a piece of infrastructure, for example, a road, hospital, prison or water filtration plant. After a defined period of time the asset is transferred to the government agency.

One important advantage of these arrangements is that the government agency does not have to fund the initial capital cost of the asset or facility. Instead, the private sector company agrees to build, own and operate the infrastructure for which it earns a commercial rate of return that includes recovering the capital and operating costs over the period of the contract. In the case of the Prospect plant, this return is recovered through the tariff which AWS charges the Water Board to supply treated water. In this way BOOT arrangements enable governments to accelerate the provision of new infrastructure facilities, which could not otherwise be funded.

BOOT and the Water Board

There was initial reluctance within the Water Board to a BOOT scheme for the Prospect plant. In November 1990, Manzi, the Manager of the DWP, recommended in a memorandum to the Deputy Managing Director, Mr Tony Wright, that the Prospect plant was unsuitable for consideration as a private sector BOOT project. His reasons included the fact that Prospect was a "very large" and "critical part of the water supply system" and it would require "a very strong presence by the Board to manage the many elements of the Prospect complex". The other three water filtration plants at Macarthur, Illawarra and Woronora were identified as suitable for BOOT projects.

Further concerns within the Board about adopting BOOT principles for the Prospect Water Filtration Plant prompted Wright to issue a memorandum to the Headworks Manager, Mr Ron Quill, in December 1990. In this, Wright sought an assurance that "a private sector arrangement ... will include flexibility in relation to treatment processes".

Following further internal consultation, the drinking water treatment projects were found to meet the criteria set out in the guidelines for private sector participation, prepared by the Water Board. It was agreed that the water filtration projects were suitable for consideration as BOOT projects.

On 30 January 1991 the Water Board publicly advertised that it was proposing to invite private sector participation in four water filtration plants. This was to assess the level of interest in the private sector and to ensure that the industry had sufficient time to gear up for preparation of expression of interest documentation.

In February 1991 the BOOT Tender Management Team was set up within the Water Board. Its purpose was to provide strategic direction and to establish working groups to set up the tender processes and prepare the documentation. The objectives of the BOOT process applied by this team were to:

- reduce the Water Board's capital expenditure by repayments over the life of the project;
- provide opportunities for a comparative / competitive climate;
- introduce innovative and alternative technology;
- provide a favourable cost benefit to the Water Board; and
- retain the Water Board's accountability to its customers for a reliable and appropriate quality water supply.

Manzi reported that the level of private sector interest following the advertisement was "extremely high and most encouraging". Accordingly, the Water Board sought the Premier's approval to proceed with a full Expression of Interest for pre-qualification of tenderers. This was obtained on 22 March 1991.

From BOOT to BOO

During the water filtration plant tender process, the Water Board came to the view that the transfer of the plants to the Water Board was only one option available for dealing with the facilities at the end of the 25-year contract. Other options included extending the arrangements for a further term, purchasing the plants from the contract operators, or declaring the plants obsolete and requiring the operators to demolish and remove them.

It also became apparent that there may be tax consequences for the operators if the facilities were to be transferred to the Water Board at the end of the contracts. This in turn could have had an impact on the cost of the projects and consequently increased the amount of the tariff charged to the Water Board by the operators over the term of the contracts.

As a result, the Water Board changed the projects from BOOT (Build Own Operate Transfer) to BOO (Build Own Operate) projects and left open, until towards the end of the contracts, the decision on what would happen to the facilities at the end of 25 years.

Chapter 7: Expressions of Interest for the water filtration plants

The call for Expressions of Interest

On 10 April 1991 the Water Board advertised for Expressions of Interest (EOI) for each of the Prospect, Macarthur, Woronora and Illawarra water filtration plant projects.

Interested parties were provided with a detailed brief outlining the process and the assessment criteria to be used. The brief stated that the Water Board was seeking "innovative solutions based on proven technology for design, construction, finance,

operation and ownership" of the projects. Proponents were permitted to register their interest in one or more of the projects.

The brief set out the water quality goals that the Board proposed were to be achieved by the water filtration plants. These included parameters for turbidity, colour, iron, aluminium, total coliforms, taste and odour. There were no water quality goals for either *Cryptosporidium* or *Giardia* as there were no drinking water quality standards for these pathogens. The drinking water quality goals were intended to enable the Board to meet the 1987 NHMRC/AWRC Guidelines at the customers' taps and to make allowance for anticipated future variations in the Guidelines.

The following evaluation criteria to assess the EOIs were set out in the brief:

- managerial, commercial and technical capability appropriate to a water supply project as demonstrated by past experience and current resources;
- extent of involvement in water treatment and supply as an on-going area of operation;
- specific skills appropriate for various project phases including evidence of the ability to manage time, cost and quality objectives;
- financial soundness and long term viability of the consortium and its members;
- quality of the outline proposal in terms of conceptual approach and methodology;
- and

- operating experience and skill in the Australian industrial environment relevant to these projects.

Seventeen proposals were received in response to the request for EOIs.

There was an initial review of the 17 EOIs received. Four were ruled out of contention as "non conforming" on the grounds that they did not provide effective operating proposals.

The remaining 13 EOIs were then evaluated by a two stage process which is illustrated in Figure 1: Expression of Interest Evaluation Process.

EOI evaluation process stage 1

The first stage of the EOI evaluation process consisted of an assessment by three teams from within the Water Board. Each team assessed one of the following areas:

- - operations;
- - project delivery; and
- - commercial/financial and legal aspects of the proposals.

There was no uniform methodology used by all the teams for assessing the EOIs, instead the teams used both numbered scoring and ratings expressed as poor, fair, satisfactory, good and very good.

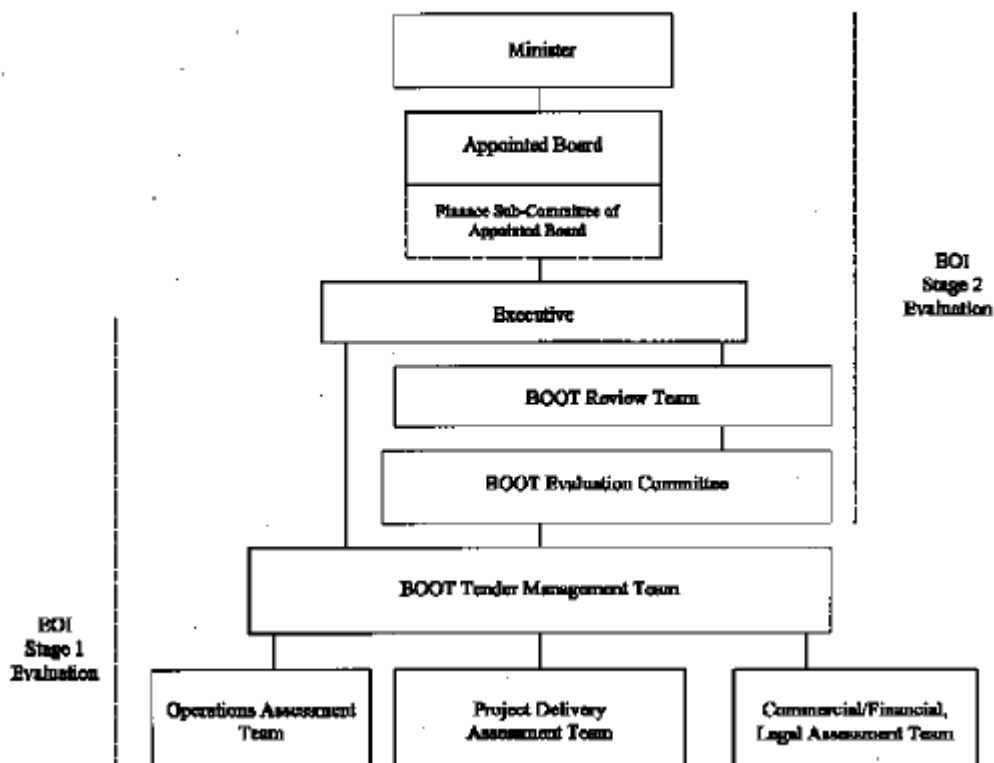
Operations Team assessment

The Operations Team recommended ranking eight of the consortia that submitted EOIs as follows:

1. Compagnie Generale des Eaux (CGE)
2. AWS
3. North West Water Transfield
4. Metal Manufacturers
5. The Australian Water Supply Company (Welsh Water)
6. Theiss
7. The Australian Water Treatment Company (Thames Water)
8. CRI Bechtel.

The remaining five consortia were assessed as lacking sufficient experience and so were not ranked.

FIGURE 1: EXPRESSION OF INTEREST EVALUATION PROCESS



During the EOI and tender processes AWS was called NSW Water Services, a consortium comprising Lend Lease Corporation Ltd, P&O Australia Ltd and Lyonnaise des Eaux-Dumez SA.

The Operations Team's recommendation also stated that only the first three consortia were "considered suitable for the Prospect project". Therefore, from the technical point of view, only three consortia were identified as having sufficient technical expertise to be capable of tendering for the Prospect plant.

Project Delivery Team assessment

The overall result of the Project Delivery Team's assessment, although not unanimous, was similar to that of the Operations Team. The Project Delivery Team's report also stated that if a smaller group of tenderers was required then Metal Manufacturers followed by CRI Bechtel could be culled.

Commercial /Financial and Legal Team assessment

The Commercial/Financial and Legal Team ranked 10 of the consortia as follows:

- Equal first CGE; Metal Manufacturers; AWS
- Equal fourth Australian Water Management & Technology; The Australian Water Supply Company (Welsh Water); The Pacific Water Systems
- Equal seventh The Australian Water Treatment Company (Thames Water); CRI
- Bechtel
- Ninth Theiss
- Tenth North West Water Transfield.

Result of stage 1

On 14 June 1991 the three assessment teams presented their findings to the BOOT Tender Management Team, which decided that the following seven consortia should be interviewed:

- The Australian Water Treatment Company (Thames Water)
- CRI Bechtel
- CGE
- Metal Manufacturers
- AWS
- North West Water Transfield
- Theiss.

On 8 July 1991 the Water Board's senior executive group endorsed the BOOT Tender Management Team's recommendation to interview these seven consortia.

The BOOT Tender Management Team did not rank the proponents when putting its recommendation to the senior executive. However, it is clear by the end of stage 1 there was a general consensus among the assessment teams, that CGE and AWS were at or near the top of the evaluation list. All three teams assessed them favourably with two of the teams ranking them either equal first or first and second respectively.

Furthermore, the Operations Team's report specifically stated that CGE, AWS and the North West Water Transfield consortium were the only three consortia "considered suitable for the Prospect project".

Manzi, as chairman of the BOOT Tender Management Team, commented in his report to the senior executive that the decision as to whether the CRI Bechtel consortium should be interviewed was "on the fringe". He noted that the operating and maintenance aspects of its proposal were not as well covered as the project delivery aspects. However, the financial situation of CRI Bechtel was found to be "good" and on balance Manzi recommended that this consortium should be interviewed.

Chapter 8: Probity audit of stage 1 of the EOI evaluation process

Concerns about the evaluation process

In early June 1991 the Deputy Managing Director of the Water Board, Wright, sought advice from the Audit and Review Unit within the Water Board on the evaluation process for the water filtration plant proposals. This was done in the broader context of the Board having been criticised previously by the Independent Commission Against Corruption about other tenders. Wright records that his purpose "was to ensure that the evaluation team was appropriate, and that confidentiality and objectivity were employed, and that the further development of the process was satisfactory".

Andersen Consulting was engaged by the Audit and Review Unit to carry out the review.

Audit findings

Andersen Consulting's report dated 24 July 1991 notes that the water treatment plant project team wanted to progress to stage 2 of the EOI evaluation process immediately. However, before proceeding to stage 2, the Deputy Managing Director "requires assurance" that stage 1 has ensured "the best possible consortia are selected to undertake a competitive bid process" and the evaluation has been undertaken "in a fair and equitable manner".

Andersen Consulting observed that:

"The individuals involved in the evaluation appear to be conscientious and highly capable. Whilst there is not a great deal of experience within the Board in evaluating projects of this size or nature, the specific skills and experience of the individuals involved seems appropriate. The attitudes, efforts, skills and experience of the team members should contribute to the overall confidence in the evaluation results."

Notwithstanding this assessment, Andersen Consulting was critical of the Water Board. The overall conclusion was that "the Board has failed to adequately justify its decision to exclude six of the proponents from further participation in this project". Furthermore, Andersen Consulting found that there was a risk that the underlying logic and decision making processes may have been flawed.

Andersen Consulting found that, although the evaluation process may have resulted in the most appropriate short list of proponents, the approach and outputs of the evaluation process did not provide sufficient evidence to conclude with assurance that the correct selection was made.

Particular problems with the evaluation process which were identified included inadequate definition of the evaluation criteria, inconsistent analysis between and among teams, evaluation memoranda not providing sufficient support for the Board's conclusions and communications with proponents not being recorded sufficiently.

The report recommended producing a more comprehensive evaluation report to support the first stage of the evaluation process. It also sought a retrospective record of all communication between proponents and Board officers and required a more comprehensive and disciplined approach to all subsequent stages of the evaluation process.

Water Board's response to the audit

Manzi did not accept the report. He wrote to Wright saying:

"The consultants in my view do not understand and were not qualified to comment on the actual evaluation for pre-qualification of consortia to build own operate water treatment plants. They have expected fully documented justification for decisions that appeared to them to be subjective but were actually objective when the professionalism and skills of the person making the judgment are taken into account. This was the basis for breaking the evaluation up into functions and using a relatively large number of people with specialist skills to make the evaluation.

The consultant's report reaches conclusions that are not substantiated by the depth of the investigation for example the evaluation sheets of the project development evaluation team and operational evaluation team were not viewed and comments by the leaders of both these teams have been taken out of context."

Manzi says that he accepts "the essence of the final recommendations of the report although not the actual words". He advised Wright that he would prepare and submit a more detailed report of the evaluation teams' findings and their reasons. Attempts would also be made to retrospectively detail contact with consortia and record all

future contacts. He also assured Wright that the process for further evaluation would be fully documented.

Despite Manzi's criticisms of the audit, Wright was satisfied that it was useful. He informed the Managing Director that the review had "served its purpose of tightening the objectivity and confidentiality aspects of the evaluation teams' work, and ensuring the objectivity and documentation of criteria and reasons for decisions will henceforth take place". He also stated that "given the information we have, and the further stages of ... [the] tender evaluation, I believe it would be inappropriate to further review the remaining six excluded consortia. I therefore propose to proceed with the further steps of the pre-qualification process".

Wright also advised the Managing Director that he would ensure that there was "a more comprehensive and disciplined approach to all subsequent stages of the evaluation process". He also foreshadowed the establishment of a BOOT Review Team, as proposed by Andersen Consulting. The purpose of this team was to review the findings and recommendations of the Evaluation Committee to ensure the "objectivity, equity and fairness" of the tender process. The Review Team was also to scrutinise the "quality of the analysis and soundness and consistency of the judgments" made by the evaluation teams. The BOOT Review Team was chaired by Wright and comprised the managers of a number of the Board's divisions associated with the development of the water filtration plants, including Manzi.

Although, when the final recommendation for the selection of the preferred tenderers was made in November 1992, it was not supported by a detailed report, I am satisfied that in other respects the Board's response to Andersen Consulting's review was appropriate. I am in no doubt that the review process throughout the tender period following the audit was both rigorous and honest.

Chapter 9: Selection of pre-qualified tenderers

EOI evaluation process stage 2

During August 1991 the seven shortlisted consortia were each interviewed by the Evaluation Committee. This Committee included representatives from each of the assessment teams as well as other managers of the Water Board and was chaired by Manzi.

Each consortium was allocated a total of 6P hours over one day to present its offer for consideration. They were each given an opportunity to make a presentation to the Board's executive management, including the Managing Director. Time was set aside for formulating and responding to detailed questions.

The process for the ultimate ranking of the consortia and selection of the pre-qualified tenderers was developed prior to the interview process. A pre-determined list of

attributes, based on the criteria published in the EOI brief, was developed to establish a clear perception of the relative strengths and weaknesses of each consortium.

Each member of the Evaluation Committee assessed each consortium. All these assessments were then collated. A process of ranking and cross checking average and total scores was then applied to ensure that all members' inputs were reasonably distributed and that no group or individual within the Committee dominated the output.

The result of this process is summarised in the following table extracted from the Evaluation Committee's report:

Table 1

Rank	Consortium Principal	Operator	Points	Comments
1	AWS	Lyonnaise des Eaux-Dumez	68.59	Capable of operating and delivering all plants.
2	CGE	Compagnie Generale des Eaux	67.43	Capable of operating and delivering all plants.
3	Thiess	OMI-USA	59.90	Capable of smaller plants.
4	NW Water Transfield	NW Water UK	59.67	Capable of smaller plants.
5	CRI Bechtel	American Water Works Co	58.32	Capable of all plants.
6	AWEM [Metal Manufacturers]	Yorkshire Water	49.45	Not considered relatively capable.
7	AWTC	Thames Water	48.65	Not considered relatively capable.

Evaluation Committee recommends the pre-qualified tenderers

The Evaluation Committee recommended to the BOOT Review Team that the first five consortia in the table be pre-qualified and that the last two be eliminated from the list.

It is clear that AWS and CGE were well ahead of the field. A clear difference between these two and the next three consortia was their experience with large plants. With respect to CGE, the Committee's report said that it "currently operates more than 1,000 water treatment works throughout the world and may be argued as pre-eminent in this aspect". As for AWS, the report states that "the operating partner can point to current involvement with over 2,000 water treatment plants throughout the world and can only be regarded as highly experienced in this field".

By contrast, the Thiess and North West Water Transfield consortia were assessed to be significantly less experienced. The report states that Transfield's "available experience relates to small plants only". The Thiess consortium was described as having "only six small plants being the current level of experience of the operating company OMI". Thus the Evaluation Committee came to a different view from the Operations Team about North West Water Transfield's ability to deliver on the Prospect contract.

Similarly the Committee took a different view on CRI Bechtel's ability. It was now ranked fifth (up two places from stage 1) coming in ahead of the Metal Manufacturers consortium and AWTC (Thames Water). The Committee also reported that "the operator can point to relevant experience with large WT [water treatment] plants and demonstrated clear understanding of the commissioning phase of the project". While CRI Bechtel was seen as being "capable of all plants", its capability was regarded as significantly less than the "pre-eminence" of CGE and the "highly experienced" AWS consortium.

Even though Bechtel had moved up two places from the stage 1 assessment, its relevant experience with large plants was still not sufficient to outrank Thiess or North West Water Transfield.

By the end of the EOI evaluation process, of the 17 consortia that had submitted EOIs, five were selected as preferred tenderers. They were AWS, CGE, Thiess, North West Water Transfield and CRI Bechtel.

Chapter 10: The packaging decision and approval of the pre-qualified tenderers

The packaging concept

During stage 2 of the EOI evaluation process a number of issues arose. There was concern about the cost to the tenderers of preparing their bids, and the differences between the relative sizes of the proposed water filtration plants. As a result the BOOT Tender Management Team believed it should "package" the various projects. It identified a number of objectives. These were that:

- two or three operators from different continents is the preferred number as this will preserve competition throughout the process and reduce the Board's vulnerability to being supplied by one organisation;
- the Board's customers must have reliability of supply and receive the best water quality for the duration of the contracts and at the most attractive price; and
- the smaller less lucrative water filtration works (such as Woronora) should be addressed as well as the more lucrative plants.

In response to these objectives, the BOOT Tender Management Team recommended that the tender process should result in two or three operators. It also stated that the four projects should be reduced to two or three packages and that Woronora, because of its small size, should be combined with one or more of the other projects. It also recommended there should be smaller shortlists chosen for each package to reduce the number of possible tender combinations. It recommended that:

- Prospect should be offered to the AWS, CGE and CRI Bechtel consortia;
- Macarthur should be offered to the AWS, Thiess and North West Water Transfield consortia; and
- Illawarra/Woronora should be offered to the CGE, Thiess and North West Water Transfield consortia.

On 25 September 1991 Wright sent to Manzi a memorandum on these packages. Wright proposed the same package for Prospect as proposed by the BOOT Tender Management Team but he recommended that all the pre-qualified tenderers be permitted to tender for the Macarthur and Illawarra/Woronora packages. This was clearly appropriate and it had greater potential to maximise competition, compared to the proposal put by the BOOT Tender Management Team.

BOOT Review Team recommendations

The BOOT Review Team, chaired by Wright, met on 25 September 1991 and endorsed the Evaluation Committee's recommendation of five short listed tenderers, ranked as follows: AWS, CGE, Thiess, North West Water Transfield and CRI Bechtel.

In relation to the packaging of the contracts, the majority of the meeting agreed that:

- all five remaining proponents be permitted to tender for all packages and there should be three packages and at least two final contractors;
- the successful bidder for Prospect will NOT be considered for any other package; and
- all tenders must be issued and closed at the same time.

Pre-qualified tenderers approved

On 30 September 1991 the Water Board executive endorsed the selection of the five pre-qualified consortia and the packaging proposal put forward by the BOOT Review Team.

On 22 October 1991 the Finance Sub-Committee of the Appointed Board, comprising Professor Brian Brooks, Mr Ken McDonell and Wright agreed to the adoption of the three separate BOOT contract packages and approved the selection of the five pre-qualified tenders. The Sub-Committee also agreed to report its decision to the next meeting of the Appointed Board to be held on 5 November 1991.

On 28 October 1991, the Minister for Housing, the Hon Joe Schipp MP who was responsible for the affairs of the Water Board at that time, issued a press release concerning the selection of the five pre-qualified consortia.

Soon after, the Board wrote to each of the shortlisted consortia requesting them to nominate the projects for which they would be tendering. The shortlisted parties were also advised of the condition for the Prospect tender.

Three of the five shortlisted consortia advised that they would be tendering for Prospect, namely AWS, CGE and CRI Bechtel. These were listed in the Invitation to Tender issued in February 1992.

Prospect or nothing

The decision that the successful bidder for Prospect was not to be considered for any other package was very significant. However, I doubt that its significance was understood by the Water Board at the time.

The decision had the potential to inhibit the Board from achieving a fully competitive tender process.

Manzi tells me there were a number of reasons for this decision. Firstly, given the "enormous amounts of resources" which the Prospect project required, the decision avoided the possibility of one contractor putting all its effort into Prospect at the expense of any of the other contracts it might also win. Secondly, the Board did not want one company winning all the projects thereby placing the Board in the "grips of one company". Thirdly, the Board wished to avoid the possibility of collusion between tenderers by ensuring there were a number of different tenderers from different continents.

Although these reasons are understandable, the decision also had a number of drawbacks from the Water Board's point of view. As in fact happened, if one consortium decided to bid only for Prospect, provided it was at least competitive on price, it increased its chance of winning the Prospect contract. By singling out the Prospect project for this special requirement, the Board ran the risk of having to choose the second best bid for Prospect either in terms of price or technology to ensure it had a suitable contractor for the other plants.

Impact of the decision

Although the significance of this decision was not appreciated by the Water Board, it certainly was by AWS. Mr Philip Garling was AWS' bid manager. He tells me that AWS considered bidding for Macarthur as well as Prospect, however, in the end it decided to only bid for Prospect. There were a number of reasons for this.

Garling was asked:

QUESTION: "Did it occur to you that, if you took yourself out of the race for the others, that might give you a better chance, if this was a precondition, to picking up Prospect?"

GARLING: "I think that occurred to us more than other things ... I guess, looking at this strategically, we went through a lot of permutations in our mind. One of them was that we were the best bid on both, and we didn't want them deciding to give us Macarthur in lieu of Prospect, without any reference to us. So we took that option away ... we increased our risk of getting nothing, of course, but Prospect, from our point of view, was a much more desirable contract, because of its scale, than Macarthur, and we didn't want to be in the position of having won Macarthur even if we were actually the best offer on Prospect."

QUESTION: "Did you realise that, if you've confined yourself to Prospect, that may increase your chances because, in taking someone for Prospect, they couldn't take someone who they wished to give the other projects to?"

GARLING: "That was the point I was trying to make a second ago, yes. That was part of their strategic analysis, sort of thing."

I accept that the Board's reasoning in the matter was well intended. However, it does not seem to have been apparent to the Board that it may not have yielded the best outcome. It would have been preferable if the Board had kept a discretion to award a consortium only one contract, rather than close this option at the outset.

Chapter 11: Evaluation of tenders

The call for tenders

In February 1992 Invitations to Tender for the four water filtration plants were issued to the shortlisted parties. The Invitation to Tender for Prospect was provided to the three shortlisted consortia: AWS, CGE and CRI Bechtel. CGE submitted its tender as Wyuna and from now on this is how I shall refer to this tenderer.

Several supporting documents were also provided with the Invitation. These included the Concept Design Report, a commercial principles document and a draft contract.

Tenders closed on 17 July 1992. As anticipated AWS, Wyuna and CRI Bechtel all tendered for the Prospect Water Filtration Plant. Four tenders were received for the other three plants: Wyuna, CRI Bechtel, North West Water Transfield and Thiess all bid for both the Macarthur and Illawarra/Woronora projects.

The Invitation to Tender provided that tenders were to remain valid until 16 July 1993. Initially it was anticipated that the contract would be signed on 28 February 1993. However, if the contract was signed after that date (which was the case) the

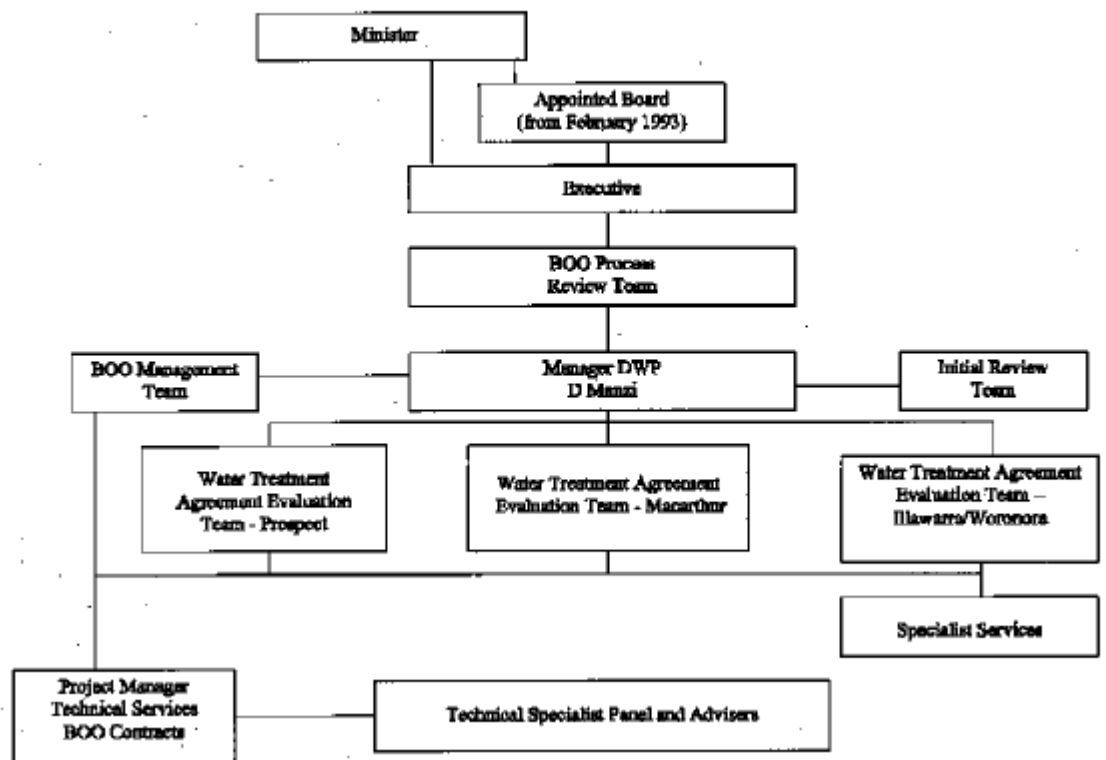
tendered prices could be adjusted from 28 February up to the date of signing. Increases in operating costs were to be indexed to the Consumer Price Index. Financing costs were not to be indexed, which meant that the Board took this risk. As it turned out, interest rates declined during the tender process, thereby reducing this cost to the Board.

It was during the time when tenders were being called that the name of the tender process changed from BOOT to BOO (Build Own Operate).

The evaluation process

The Water Board prepared A Strategic Plan for Managing the BOO Tender Evaluation Process in July 1992, prior to the close of tenders. This detailed document identified risks that may emerge in the tendering and evaluation processes and strategies to mitigate them. It set out the criteria and factors to take into account in assessing the tenders and the arrangements for conducting the assessment process. Figure 2 sets out the tender evaluation and selection process.

FIGURE 2: TENDER EVALUATION AND SELECTION PROCESS



An Initial Review Team was established to undertake a preliminary review of tenders. This review considered the broad commercial implications of the tenders and the adequacy of the tender responses. In the words of the Strategic Plan, it provided a "coarse filtering of tender options".

Water Treatment Agreement Teams were also established. These were responsible for the detailed evaluation of tenders and considered both technical and commercial implications. One was established for each water filtration plant project. Trickett, Technical Manager DWP, headed the Prospect Team. Operational and technical people from these teams worked on all the projects.

The BOO Management Team which established the tender evaluation process was responsible for considering the tender packages. The team was chaired by Manzi.

The BOO Management Team reported to the Operating Executive of the Water Board. The Operating Executive comprised Wilson, the Managing Director, Mr Arthur Butler (Director, Corporate Finance), Mr Warren Hart (Director, Human Resources), Ms Pamela Pearce (Director, Operations), Mr Paul Forward (Director, Planning & Marketing), Mr Jeff Cameron (Director, Contracting and Supply), Mr Ron Quill (Senior Engineering Adviser on Operations & Manager, Headworks) and Mr Neville Green (Manager, Corporatisation Unit).

The initial review of tenders was an intensive period for those involved. It was conducted in isolated conditions over a number of days.

On 27 July Manzi reported to the Operating Executive on the tenders received and the issues which had been identified as a result of the initial review "lock up". Manzi is recorded as expressing concern at this stage that the Environmental Impact Statements (EIS) had been delayed and questioned whether the resources in the Environmental Management Unit were sufficient to complete the EISs on time. There is an indication of emerging tensions between some of the engineers of the DWP and the environmental scientists.

After the initial overall review of the tenders, the detailed assessment of the technical and financial aspects was undertaken. The technical assessors were not told the prices offered by the tenderers for the various projects.

Technical assessment

Technical assessment involved examining the following aspects of the tenders:

- environmental aspects;
- project delivery;
- water treatment process; and
- future plant operation.

A vital part of the technical assessment was the testing of the filtration processes proposed by the tenderers. This was done using the pilot and prototype plants, developed as part of the concept design study.

Between December 1991 and June 1993 Mr Bruce Murray was contracted to the Water Board as pilot and prototype plant engineer for investigations into the proposed Prospect plant process and the evaluation of the tendered processes.

Different filtration processes

A key difference between the filtration process tendered by AWS and that of Wyuna, was that AWS proposed the use of a single medium sand filtration process. Wyuna and CRI Bechtel proposed a dual filter using anthracite and sand media as recommended in the Concept Design Report.

I am advised that the main benefit of the water treatment process proposed by AWS was its greater backwashing efficiency. As sand is of a higher density than filter anthracite, the filters can be washed with air and water together. This means that less water is used during the backwashing process, smaller backwash pumps are required and less backwash water needs to be treated. In a plant the size of Prospect, this resulted in a considerable saving in the capital cost of the plant.

The Water Board tested the tenderers' treatment processes between August and October 1992. Wyuna and CRI Bechtel's processes proved satisfactory. A second series of test runs was also conducted for AWS between 19 October and 11 November 1992, to provide further opportunity for AWS to prove its technology.

Murray prepared a report to Trickett on the Wyuna and AWS processes.

Wyuna

The success of Wyuna's water treatment process was proved quite quickly. Two runs of chemical optimisation were required on the prototype plant to achieve the 24 hour normal water quality run target and two runs were required to achieve the eight hour dirty water target. In fact, the results were sufficiently successful to lead Murray to observe that "the process may be able to meet eight hour run times with poorer quality water" than was provided in the test. He also observed that the filtered water quality was better than the water quality objectives in all cases when alum/cationic polymer coagulation was used.

AWS

In contrast, Murray reported that AWS' tendered process "did not achieve the run time targets for either normal or dirty water". Use of a modified mixing system improved the results of AWS' tendered process so that by the end of the test runs it was "able to achieve the normal water run time target". In the case of dirty water, the run time target was almost met with a modified mixing system but with AWS' "full, tendered process ... the run time was still well short of this [eight hour] target, with no runs exceeding 6 hours". However, Murray did find that the filtered water quality was satisfactory with both clean and dirty water.

Murray describes the extent of testing and modifications to AWS' process in the following terms.

"While examining AWS' tendered process the media was changed three times, the filter floor and filter nozzles were changed once and the backwashing system was continually modified under the direction of AWS through the Drinking Water Program. Tests were also carried out with both the tendered coagulant mixing system

and a high energy turbine mixing system that allowed the performance of the tendered media to be evaluated independently of the tendered mixing process. A total of 25 tests were carried out on the prototype plant in evaluating AWS' process with normal raw water and 25 with dirty raw water."

Murray concluded that Wyuna's tendered process should be recommended above that of AWS, as the run times achieved were less for AWS, particularly for highly turbid water. This view was reflected in the Board's technical evaluation assessment.

Technical evaluation tables

On 16 September 1992 a technical evaluation table was produced. This is included in the Appendices. The table summarises the assessment of the tenders in relation to environmental matters, project delivery, treatment process and plant operation.

The initial overall rankings given to the three tenders were:

1. Wyuna Water
2. AWS
3. CRI Bechtel.

Wyuna's tender at this stage was clearly ahead in all categories of assessment. It was considered "GOOD" in relation to plant operation and "ACCEPTABLE" in relation to the treatment process. However, it was considered "NOT ACCEPTABLE" in relation to project delivery aspects. On environmental matters the tender was considered "NOT ACCEPTABLE ranking 1" but with minor earthwork modifications it would be considered "GOOD".

By comparison AWS was ranked "NOT ACCEPTABLE" in all the assessed categories with the exception of environmental assessment which was seen as being "good" if the clear water tank was moved 30 metres.

CRI Bechtel was assessed "ACCEPTABLE" in terms of future plant operation but "NOT ACCEPTABLE" in terms of project delivery. In relation to environmental and treatment process it was assessed as being "NOT ACCEPTABLE". However, the environmental assessment would be considered "ACCEPTABLE" if certain acacia trees (which were endangered species) on the site of the plant could be preserved. In terms of the treatment process it would also be considered "ACCEPTABLE" if the further details required on such matters as chemical storage and dosing were satisfactory.

AWS was ranked second, behind Wyuna and ahead of CRI Bechtel, in terms of its overall process.

Following further tender assessment work a revised summary table was prepared on 24 September 1992. This is included in the Appendices. This table shows that in all categories of assessment, all the tenders were assessed as either "GOOD" or "ACCEPTABLE" subject to the resolution of certain matters. For the treatment

process AWS was ranked third. Although it was seen as "ACCEPTABLE" this was subject to resolution of two matters. Firstly, the filter media's performance at the prototype and pilot plants during the filter run and backwashing was poor. Secondly, the assessment stated that the residuals handling system design was "inadequate". The assessment also noted that the clear water tank was too small.

This summary table was submitted to the meeting of the Operating Executive on 28 September 1992, when Manzi gave a progress report on the water treatment plant tenders. The minutes of the meeting record that the relative merits of individual and combined tenders for the Macarthur, Illawarra and Woronora plants were considered. The minutes of the meeting do not record any specific discussion of the Prospect plant or the tenders for it.

The next and final assessment was prepared on 13 November 1992. This is reproduced as Table 2: Prospect WTW Contract No.8193 Summary Table of Evaluation (as at 13/11/92). This assessment was used as part of the basis for the decision to appoint the preferred tenderers.

This assessment shows again that for Prospect, Wyuna was assessed as "GOOD ranking 1" in all four assessment categories and "GOOD 1" overall. The overall ranking of AWS was "ACCEPTABLE 2" and CRI Bechtel was ranked "ACCEPTABLE 3".

Manzi explains that the ranking which the technical assessors gave the tenders was not required by the evaluation process. All that was required was to assess whether the tenderers had submitted proposals that would meet the Board's requirements. Accordingly, "acceptability" was the only rating that needed to be determined by the technical assessment.

On thin ice AWS' guarantee

The other important aspect about the summary evaluation table dated 13 November 1992 is that it refers to a guarantee given by AWS for its water treatment process. In fact, but for this guarantee, AWS' treatment process would not have been acceptable.

PROSPECT WIW - CONTRACT No. 8193

SUMMARY TABLE OF EVALUATION (AS AT 13/11/92)

CONSORTIUM	NSW WATER SERVICES	WYUNA WATER	CRIBBECHTER AMERICAN
1. Environmental	1. Commitment given to preserve rare Assets 2. Very little surplus construction spoil +	1. Commitment given to preserve rare Assets 2. Pumping residuals minimises impacts +	1. Rare Assets of Ash - 2. Residuals lagoons tied to reservoir - 3. No construction safeguard details -
Assessment	GOOD - ranking 2	GOOD - ranking 1	ACCEPTABLE if Assets can be preserved - ranking 3
2. Project Delivery	1. Surface drainage problems - 2. Coffin dam design problems - 3. P&PS needs proving -	1. Good earlier dam proposal +	1. Licences/Approvals not addressed - 2. No details of water dam - 3. Early construction access not addressed - 4. No construction management plan - 5. Residuals yards detail poor -
Assessment	ACCEPTABLE subject to resolution of the above - ranking 2	GOOD - ranking 1	ACCEPTABLE subject to resolution of the above - ranking 3
3. Process	1. Multiple flow paths + 2. Filter media performance at prototype/pilot plant not proven, but guarantee given - 3. Chemical storage minimal - 4. Residuals handling system design minimal - 5. Low channel velocities -	1. Process tested successfully + 2. Buffered land/chemical loading + 3. Conservative residuals treatment + 4. Multiple flow paths + 5. Flammable Ash proposed - 6. Flammable not defined -	1. Media tested successfully + 2. Technical details provided inadequate - 3. No on-site residual storage - 4. Lack of multiple flow paths -
Assessment	ACCEPTABLE subject to acceptance of guarantee - ranking 3	GOOD - ranking 1	ACCEPTABLE if details provided are satisfactory - ranking 2
4. Operation	1. Reservoir bypass - out of service long time - 2. Chemical storage on reservoir side channel -	1. Minimal downtime of bypass channel + 2. Residuals pumped to quarry + 3. Redundancy built into all plant design +	1. Corrosion/interference program good + 2. Maintenance strategy acceptable + 3. Dual commissioning strategy irrelevant - 4. Breakdown/maintenance details not addressed -
Assessment	ACCEPTABLE - ranking 2	GOOD - ranking 1	ACCEPTABLE - ranking 2
	ACCEPTABLE 2	GOOD 1	ACCEPTABLE 3

By the middle of September 1992 AWS' tender was in trouble from the technical point of view. Trickett describes the situation that had developed by this stage in the following terms:

TRICKETT: "... we came very, very close to knocking out AWS and I think they realised that at some of the meetings we were having and that's when they offered the guarantee and said that they would immediately do some more pilot plant work, or actually prototype work. They were aware that they were on thin ice, so to speak."

On 21 September 1992 Trickett wrote to Mr Pierre Alla, Managing Director of AWS, advising him that:

"your nominated process using both clean water and artificially dirty water has not convinced us that your process is viable with the media you provided. ... It is fundamental to the Board that the viability of the accepted process has been clearly demonstrated. We are prepared to carry out further tests but in order for such tests to be meaningful, it will be necessary for these tests to be carried out with the filter media which you intend to use in the full scale plant. ... we will require to test several filter runs with your nominated backwash sequence in order to assure ourselves that backwashing is effective."

It was subsequently agreed that further testing of AWS' sand filter media should occur once further media tests had been completed in Paris by Lyonnaise des Eaux-Dumez. In addition, AWS offered to give the Water Board a guarantee in respect of its filters.

This was subsequently confirmed by AWS in a letter from Alla to Trickett which says:

"In addition to further testing of our current media selection being undertaken, prior to the preferred tenderer period, we would be prepared to offer you a warranty on the performance of the media we will put in the filters. This warranty would be in the form of an undertaking from us, that in the event that our proposed media did not meet the pre-agreed performance criteria then we would replace it with anthracite, with no resultant change to our tendered tariff."

Subsequently, Trickett advised AWS that, despite further testing, the Water Board was still "not entirely satisfied" that AWS' tendered treatment process could meet the eight hour dirty water run time required by the Board. However, it was prepared to accept AWS' process supported by the guarantee that AWS would install anthracite media filters if, after further testing, it could not meet the Board's eight hour filter run requirement.

Manzi saw this guarantee as sufficient to make AWS' process "acceptable". He tells me:

MANZI: "we were confident that they could meet the requirements, and that's why they gave the guarantee. The guarantee was a substantial amount of money, because the additional cost of putting anthracite in those [filters] is very much more; and, so, they just would not have given that guarantee if they hadn't been confident. The only last thing that was missing was filter runs with very high turbidity water, when they got 7.9 hours when we were looking for eight hours; that was the very last thing to be proven.

Since that time they have been running the plant at 70 hours and more, filter runs, with low turbidity water. That was the final test that we needed to be clarified and eventually we got it clarified, yes, just after this, finally clarified. It certainly wasn't a position where we could exclude them."

AWS makes the grade

Accordingly, when the next technical summary evaluation table was prepared on 13 November 1992 AWS' process was regarded as "ACCEPTABLE subject to acceptance of guarantee ranking 3".

The guarantee was subsequently given in a letter from Alla to Manzi dated 10 December 1992. This was after AWS had been selected as the preferred tenderer for Prospect. This letter is reproduced in the Appendices.

Some technical assessors push for Wyuna

My inquiries have revealed that not all of those involved in the technical assessment agreed with the decision to select AWS for Prospect.

Some of the technical assessors were of the view that AWS had not "crossed the line" in relation to dirty water performance and there were also concerns about the size of the plant and the clear water tank. However, there was a conflicting view in the Board that, if AWS was appointed as the preferred tenderer for Prospect, the contract costs would be lower and Wyuna would be free to get some of the other projects.

I have been advised that on Monday 16 November 1992, there was a meeting of the technical assessors to discuss these concerns. Browning, one of the technical assessors, says that at this meeting he "led a push" to revisit the recommendation to select AWS as the preferred tenderer for Prospect. Craig, another assessor, also recalls this meeting and tells me that, as a result it was agreed with Trickett, Nicholson and Roddy, that a report would be prepared for senior management setting out their technical concerns. Recollections about this meeting vary between participants. However, it is clear that at the same time the assessors met to discuss these matters the Operating Executive was also meeting and approved the selection of AWS as the preferred tenderer for the Prospect Water Filtration Plant.

Final position on technical assessment

There was some disquiet among the technical assessors about the selection of AWS for the Prospect contract. Although the testing of different sand media and different backwash techniques in the pilot and prototype plants had produced improving results, AWS had still not proved its technology to the satisfaction of a number of the technical assessors. Notwithstanding this, the improving test results and the "guarantee" were considered sufficient to make AWS' process acceptable.

It is clear that on technical grounds alone, AWS was not the most attractive tenderer, particularly in view of the difficulties it experienced in meeting the Board's filter run rate for highly turbid waters. However, while AWS was clearly behind Wyuna on technical aspects, AWS' proposal was significantly cheaper than the other tenders, and it was this which proved decisive in it winning the Prospect contract.

Financial assessment

The financial assessment was undertaken by Goyal, the Water Board's Manager Commercial and Financial Services, and a representative of the NSW Treasury Corporation, Mr Denis Pidcock.

The tenderers were requested to submit benchmark tenders. The benchmark was based on the concept design and the commercial processes included in the draft contract. In the words of Pidcock this was done to ensure that when comparing the bids the Water Board compared "apples with apples". It also meant that when a tenderer made a variation or an addition to the benchmark this could be related back to the benchmark tender price and to all the other tenders.

The tenders were also required to address different average demand flows so that the cost of upgrading the plants could be calculated over the life of the contract. This was important in determining the cost of the contract to the Water Board. In fact, the accurate estimation of future demand for water was critical in determining the competitiveness of the various bids.

The tenderers were required to tender their prices based on a two-tiered tariff. This consisted of an availability charge, that is an amount payable per day irrespective of the volume of water that flows through the plant. Penalties apply if the plant is not available. The other tariff is a usage charge, payable per megalitre of water treated. This second tariff varies in response to demand and there are penalties if the water quality parameters are not met. Determining the future demand for water was critical to calculating this second tariff. AWS devoted significant resources to estimating Sydney's future water demand. The predictions were apparently correct. They were significantly below the demand levels estimated by Wyuna and CRI Bechtel with the result that AWS' tender was significantly cheaper than the other two.

Pidcock describes the strength of AWS' tender in the following terms:

PIDCOCK: "I personally thought it was a one-horse race when the bids came in. On the pricing there were other elements, apart from just the dollars ... There is the revenue, what was called the tariff. The tariff was devised in a two-tiered tariff for the purposes of conforming with Loan Council requirements and the Taxation Act. We had to build into the tariff a possibility of the consortium making a loss and actually carrying what we call market risk or the risk of usage, etcetera, and in addition to the dollars I considered the approach taken by AWS as being a far superior approach to anything else. They actually built in a floating adjustment to the tariff curve which genuinely shared the risk. It was a very innovative approach."

Financial evaluation tables

The financial assessment for Prospect is reproduced as Table 3: Prospect WTP-Comparison of NPV Results. This sets out the net present value of each of the tenders under a range of scenarios.

Analysed by the benchmark tender, AWS was, in net present terms, \$26.4 million cheaper than Wyuna and \$210 million cheaper than CRI Bechtel. However, AWS tendered an alternative which involved using lime to adjust the pH of the untreated raw water which gave overall savings in the operation. The Board accepted this alternative, making AWS' tender approximately \$40 million less than Wyuna's benchmark tender.

The sensitivity of price to the water demand projections used is demonstrated by comparing the prices at 120% of Average Demand Forecast. In this case the tenders were much closer with the difference, in net present value, between AWS and Wyuna's benchmark tenders being \$19 million. Clearly, the AWS tender was significantly cheaper than the other two tenders.

Once the various tenders had been costed and compared a range of options was prepared. See Table 4: N.P.V. Total Cost of Water Treatment Plants Various Options.

Five options were presented to the Operating Executive.

Options 1 and 2 were the lowest in price. They involved selecting AWS for Prospect and either Wyuna or North West Water Transfield for the remaining projects. The net present values of these options were \$686 million and \$708 million respectively.

Prospect WTP – Comparison of NPV results (\$M)

Options-	NPV Without Upgrading & ADF Projection to 2021	NPV Without Upgrading & Constant ADF All Yr 2021	NPV With Upgrade & ADF Projection to year 2021	NPV Without Upgrading & ADF Projection to 2021 At ADF's Op-	
				80%	100%
ASW/YS-					
Benchmark Tender	\$298.0M	\$290.2M	\$306.3M	\$268.7M	\$294.6M
CPI based estimate (2) (20% equity)	\$285.2M	\$275.8M	\$297.1M	\$254.6M	\$275.0M
CPI based estimate (2) (10% equity)	\$277.8M	\$269.6M	\$288.8M	\$251.0M	\$264.2M
Preferred Technical (Line Water)	\$285.1M	\$277.4M	\$281.9M	\$258.3M	\$271.5M
WYUNA-					
Benchmark Tender	\$525.4M	\$518.0M	\$535.6M	\$502.8M	\$548.6M
Indexed Bids (3)	\$306.9M	\$301.7M	\$322.4	\$285.9M	\$332.1M
CRI - BECHTEL- (4)					
Benchmark Tender	\$808.1M	\$500.4M	N/A	\$481.1M	\$537.0M
Low Cost Option	\$334.5M	\$347.9M	N/A	\$373.9M	\$415.0M
Water 2040 Base Case	\$248.3M	\$282.1M	\$251.2M	\$224.7M	\$247.7M

POINTS TO NOTE:

- (1) Includes Water Board project Management costs of \$700,000 per station, during project delivery and operational phases. This is equivalent to a NPV of \$9,000M.
- (2) This option does not include a 140ML Clearwater Tank.
- (3) This option does not include a 200ML Clearwater Tank.
- (4) CRI - Bechtel uses an inflation rate of 3% and a discount factor of 10.21%.

N.P.V.

Total Cost of Water Treatment Plants Various Options

Consortium	Prospect	Macarthur	Illawarra/ Woronora	Combined	Total	Extra Cost
Option 1:						
NSWWS	\$285M				\$285M	
Wyuna Water				\$400M	\$400M	
Total	\$285M			\$400M	\$685M	
Option 2:						
NSWWS	\$285M				\$285M	
North West				\$422M	\$422M	
Total	\$285M			\$422M	\$707M	\$22M
Option 3:						
NSWWS	\$285M				\$285M	
North West		\$195M			\$195M	
Wyuna Water			\$234M		\$234M	
Total	\$285M	\$195M	\$234M		\$714M	\$26M
Option 4:						
NSWWS	\$285M				\$285M	
North West			\$254M		\$254M	
Wyuna Water		\$190M			\$190M	
Total	\$285M	\$190M	\$254M		\$729M	\$44M
Option 5:						
Wyuna Water	\$328M				\$328M	
North West				\$423M	\$423M	
Total	\$328M			\$423M	\$751M	\$23M

Footnote:

- (1) The combined option includes Macarthur, Illawarra/Woronora WTP's.
- (2) NSWWS's bid represents the preferred technical lime water option and 140ML clear water tank.
- (3) Wyuna Water includes the saving of a 200ML capacity clear water tank.

Options 3 to 4 were more expensive and involved selecting three preferred tenderers. Under either option AWS would get Prospect. Option 3 gave Macarthur to North West Water Transfield and Illawarra / Woronora to Wyuna. The combined net present value of this option was \$714 million.

Option 4 gave Macarthur to Wyuna and Illawarra / Woronora to North West Water Transfield and was assessed to cost \$729 million.

Option 5 was the most expensive, \$749 million, and involved Wyuna getting Prospect and North West Water Transfield getting the other two projects.

Manzi describes this table in the following terms:

MANZI: "What that's saying to you is that you can look at each plant and what the prices were but then we ought to look at making a decision overall because we have got three packages at work. So this tells us that option 1 is AWS winning Prospect, Wyuna Water picking up Macarthur and Illawarra/Woronora, with their combined bid. That was the lowest cost, overall, to the Water Board, if we chose that arrangement."

QUESTION: "\$686 million?"

MANZI: "That's it yes. The next option was for AWS and North West, with their combined bid, and that gave us it was a \$22 million increase in cost. The third option was AWS, North West and Wyuna Water ... that ... was \$29 million more, the executive decided that that was the best option for the Water Board to go with."

These options, together with the technical and financial evaluation tables, formed an important part of the material considered by the Operating Executive when making its decision on the selection of the preferred tenderers.

Chapter 12: The preferred tenderer decision

The decision to appoint AWS as the preferred tenderer for Prospect was taken by the Operating Executive of the Water Board on Monday 16 November 1992.

The role of the Appointed Board

The appointment of preferred tenderers would normally have been made by the Appointed Board or a sub-committee, just as the Finance Sub-Committee had approved the selection of the pre-qualified tenderers and the packaging proposal in October 1991.

However, the term of the Appointed Board (except for the Managing Director and the employee elected representative) expired on 19 October 1992. The Chairman, Mr David Harley, had resigned on 15 September 1992. The new Board was not appointed until February 1993.

Accordingly, at a meeting of the Appointed Board on 29 September 1992, the Board passed a resolution delegating its powers and functions to the Managing Director or in his absence to other members of the Water Board executive.

The Operating Executive's decision

On 16 November 1992 the Operating Executive met at the North Western Regional Office at Blacktown.

The meeting commenced at 9.00am. Wilson chaired the meeting initially. Manzi and Goyal presented the final tender evaluation assessment and sought the Operating Executive's approval to the preferred tender package.

The minutes of the meeting record that several documents were distributed, including a technical appraisal of the tenders, and these were returned at the end of the presentation. Manzi led the meeting through the results of the tender evaluation and Goyal discussed the financial aspects of the tenders.

In terms of the preferred option for awarding contracts, Manzi recommended to the meeting the award of the following contracts:

Prospect	AWS	\$285 million
Macarthur	North West Water Transfield	\$195 million
Illawarra/Woronora	Wyuna	\$234 million

The net present value of the total cost of these three contracts to the Water Board was assessed to be \$714 million. This represented an overall saving of nearly \$100 million, based on the net present value of the Water Board's base case of \$807 million prepared by quantity surveyors as a best market estimate.

Goyal also advised the Board that the NSW Treasury Corporation had examined the evaluation process and found it "sound". It was agreed that no further review of the probity of the process would be needed.

Significantly, the minutes do not record that AWS had not proved its treatment process or provided a guarantee. However, I note that the technical evaluation summary of the tenders dated 13 November 1992 was distributed to the meeting and this, of course, stated that AWS' media process was "not proven, but guarantee given". It is also recorded that the overall assessment of the process criteria for AWS' tender was "ACCEPTABLE subject to acceptance of guarantee ranking 3".

The next day, 17 November 1992, Manzi sent a memorandum to Wilson summarising the outcome of the meeting of the Operating Executive. The memorandum sought Wilson's approval that it is a correct account of that meeting.

Manzi states that "from a technical perspective three of the consortia were rated as good or acceptable in all areas and were most preferred. These consortia were Wyuna, AWS and North West Transfield. The net present value analysis of each package indicated that the above three were either the most cost effective or very close, the other bidders were substantially more costly and above the Board's base case".

Manzi then records the detail of the executive's decision by stating that "following discussion of a number of options and combinations of bidders it was agreed that the following arrangement of preferred tenderers was the most long term, cost effective." Manzi then sets out the decision on the preferred tenderers.

Manzi's memorandum notes that although the preferred tender list as approved had a net present value "slightly above the lowest combination", it did have the following advantages:

- strategic competitive benefits of a separate tender for each package;
- technology benefits of including both French and UK operators;
- project specific benefits of choosing the most effective project solution and project capability of consortia for the Macarthur and Illawarra water filtration plants; and
- better options in the event that the Board is unable to finalise a deal.

In further explanation of these points Manzi tells me:

MANZI: "since we had to negotiate these contracts further, there were benefits in having three separate companies, rather than only having the two French as the top option. We would have then been you know, had a much lesser position in regards to negotiating the final contracts. We would have had two French companies, with the fear that they might collude in future negotiations ... there's no way the Brits and the French are going to get together and collude well, that was our belief, anyway.

That meeting with the executive, we discussed this issue for quite some time."

Manzi's memorandum of 17 November 1992 also records that a presentation would be provided to the Minister before establishing a strategy for the announcement of preferred tenderers and managing the unsuccessful bidders.

Wilson's endorsement at the end of the memorandum is dated 17 November 1992 and states:

"Approved. Subsequent to the Executive Meeting Messrs Wilson, Manzi & Forward and Ms Jones briefed the Minister on the process and the outcome. The Minister expressed his satisfaction with the process."

Consequently, by 17 November 1992 the Water Board had selected the preferred tenderers for the four water filtration plants and this decision had been approved by the Minister.

The Government announced the preferred tenderers on 18 November 1992.

Chapter 13: Proving AWS' filtration process: did it work?

Testing the filtration process

At the time AWS was selected as preferred tenderer for Prospect, it had yet to demonstrate to the Water Board's satisfaction that its tendered filtration process was adequate. Testing continued on the filtration process after selection. The tests were undertaken at a number of the Water Board's facilities, including the pilot and prototype plants between 15 January and 30 April 1993. The sand filtration media was tested as well as other aspects such as the chemical mixing systems and chemical lag times and backwashing efficiency and volumes.

AWS' report dated 16 June 1993 detailing the results of these tests was provided to the Water Board. The report stated that the crushed sands used by AWS "exhibit bed capacities slightly higher than the dual media over the full range of expected raw water quality" proposed in the Concept Design Report. This meant that AWS believed they could meet the Water Board's filtration targets.

The Water Board accepted the results in the report. It did not have them independently verified. When Trickett is asked why this was not done he replies:

TRICKETT: "What we were looking for was not the water quality, treated water quality criteria, but a run time. The early testing had been very close when they developed their final media. We accepted their results because the people that they were using in the pilot plant had been working for us as casuals and then they took them over so we knew the people that were doing the work."

In my view it would have been prudent for the Board to have independently verified the results. Prior to AWS being selected as the preferred tenderer for Prospect, AWS had asserted to the Water Board that it had "proved" its process. However the Water Board had not been satisfied and refused to accept the results. Accordingly, in my view it was not appropriate for the Water Board to leave the further process testing entirely to its preferred tenderer, AWS, without having the results independently verified.

On 26 July 1993 Murray wrote to Trickett to remind him of the outstanding issues in relation to AWS' process. These included filter run time targets, hydraulic mixing, backwashing capacity, the effects of temperature on the overall effectiveness of the filtration process and disinfection byproduct formation from chlorination.

Trickett says that although he does not specifically recall checking that each of these issues was satisfactorily dealt with, he "would have been very familiar with these issues at that time" and he would have "handled them appropriately".

I am satisfied that AWS' report adequately addresses most of the issues raised in Murray's letter, including run time targets, hydraulic mixing and filter backwashing. A suggestion by Murray that tests be carried out in winter to check for temperature effects was not followed as AWS' testing program was completed in April 1993. Further, issues in relation to chlorination raised in the letter are not referred to in the report, though chlorine levels were intended to remain a matter under the Water Board's control.

Reporting the outcome of the testing to the Operating Executive

The final reporting of the AWS test results to the Operating Executive remains a mystery. I can find no report and Trickett says he cannot recall and could not produce to me a written report to the Operating Executive on the outcome of the testing of AWS' filtration process. Perhaps it was done orally, which is Trickett's suggestion. This would hardly be sufficient, given the importance of these matters and the obligation on AWS to provide a guarantee if its filtration media failed to meet the Board's requirements.

The apparent lack of any formal process within the Water Board to confirm that AWS had proved its technology is a significant deficiency. It is of particular concern, in view of the audit findings of Andersen Consulting, that the Board had not adequately documented its earlier decision making processes.

PART II

The environmental assessment and the Prospect contract

Chapter 14: The awareness of *Cryptosporidium* and *Giardia* in the catchment

At the same time as the selection of the preferred tenderer for the Prospect plant was proceeding, the Scientific Services staff of the Water Board (later Australian Water Technologies Science and Environment Division) were developing a greater knowledge about the presence of *Cryptosporidium* and *Giardia* in Sydney's water supplies.

In September 1991 the increasing detection of pathogens in overseas water supplies, and particularly the outbreaks of waterborne cryptosporidiosis in the United Kingdom and United States of America, caused the DWP to write to Scientific Services:

"With growing public concern overseas about *Giardia* and *Cryptosporidium* it is likely that public perception of the issue will increase in Australia. It is therefore essential that the Board be capable of a ready response to any public concerns. We are endeavouring on the Prospect WTW [water treatment works] project to ensure that

cyst removal would be effective by checking that particle removal is effective within the ranges of *Cryptosporidium*/*Giardia* size.

We also need to assure the public that we are using best available technology to try to identify whether or not our water supplies contain cysts."

In response to this memorandum, Scientific Services commenced an investigation of the presence of *Cryptosporidium* and *Giardia* in Sydney water. Work continued for the design and tender for the filtration plants.

Studies of *Cryptosporidium* and *Giardia* in the catchment

The Hutton report

Hutton, a microbiologist, was engaged by Scientific Services to do the primary investigative work. In October 1992, she reported her findings in the catchments. She found *Cryptosporidium* at levels of up to 143 oocysts /10 litres of water, though there was only one positive result for *Giardia*. Her conclusions included:

- "1. *Cryptosporidium* is present in the major water storages at levels that have been associated with disease overseas. Acceptable risk level has been reported as 0.00007 oocysts/10L. This could only be achieved by >99.9% removal at a treatment plant.
2. *Giardia*, while less of a problem in more protected raw waters, is likely to be a problem in sewage impacted waters.
3. The incidence of these organisms in other storages should be examined to determine the extent of parasitic protozoa entering the Water Board's supplies.
4. Further work is necessary on the viability of these organisms, to help ascertain their potential health risk to consumers...."

It must be understood that this was a preliminary report, which anticipated further work being undertaken. However, the report was important because it identified significant levels of *Cryptosporidium* in the Water Board's catchments. It also attempted to identify an appropriate efficiency standard for the removal of pathogens. In fact to attain a constant level of <0.00007 oocysts/10L would require greater than 99.99999% (7 log) reduction. These findings demanded urgent consideration as part of the water treatment proposals.

Dwyer Leslie Report

Other reports commissioned by the DWP during this period had drawn attention to the possible risk of *Cryptosporidium* and *Giardia*. A report, Risk Analysis of the Drinking Water Quality Program, was completed by Dwyer Leslie Pty Limited in February 1992. In dealing with possible microbiological events, the report stated:

"Protozoa such as *Cryptosporidium*/*Giardia*: There is a possibility of cysts from animals, which cause various forms of gastroenteritis. The occurrence of these in water supply systems has been demonstrated in the USA and Europe. It has not, thus far, been demonstrated in Australia, but it would have to be assumed that such demonstration is only a matter of time."

Studies on the removal or inactivation of *Cryptosporidium* and *Giardia*

Aquatech report

In March 1992 the Health Services Unit of the Water Board commissioned a report from Aquatech Pty Ltd. The report, Review of *Cryptosporidium* and *Giardia* Water Treatment and Catchment Management Implications, was completed in August 1992.

The report noted the proposal to construct direct filtration plants. Following an extensive review of the literature, the report recommended that, until proven otherwise, the Water Board should consider all raw water sources to be potentially contaminated with *Cryptosporidium* and *Giardia* and take appropriate decisions on treatment protocols.

Its recommendations included:

- "pilot scale field trials should be undertaken by the Board to investigate the efficacy of various disinfection options available in light of the proposed WTWs;
- all water treatment facilities should install laser particle sizing instrumentation on effluent lines from each filter to forewarn of possible filter breakthrough;
- the Board should not rely on compliance with turbidity requirements for treatment plants, but should place emphasis on continuous monitoring of filter effluents to detect sudden changes in turbidity and particle counts."

This report has been described by some of the Water Board's engineers as a mere "desktop review" and accordingly of lesser significance than original scientific research. Although it is a review of the work of others, it is significant.

Results of seeding test

In December 1992, Hutton carried out a test in the pilot plant at Prospect in an attempt to gauge the efficiency of treatment processes to remove *Cryptosporidium*. The test indicated a removal capacity of 99.99% (4 log).

However, the test was conducted in only one run using a single large "spike" of oocysts through a dual media filter (unlike the single media filter to be used at Prospect). The finding was heavily qualified, but it was a report to which the engineers of the DWP attached a great deal of significance in assessing the proposed

plant's capacity to remove *Cryptosporidium* and *Giardia*. These results are discussed in detail in chapter 20.

Report on supernatant recycling Gutteridge Haskins and Davey Pty Ltd

In February 1993 Gutteridge Haskins & Davey Pty Ltd, which had been retained by the Water Board to prepare the EIS Determination report, was also requested to prepare a report on handling the backwash supernatant (the water produced by backwashing the filter beds). This was important because there were concerns that returning the backwash to the plant inlet may cause problems to the plant's efficiency in removing pathogens from the water during treatment.

The report indicated that, while returning the settled backwash water to the plant inlet would increase the load on the plant, the overall removal efficiency would be similar. However, the report made assumptions about the levels of organisms in the raw water and the removal of the oocysts from the backwash water during settling. These assumptions may not be correct and accurate figures still need to be established, particularly for removal of pathogens from the backwash water.

Was the Water Board management advised of the Hutton report?

Manzi took steps to inform the Managing Director of the Water Board of Hutton's findings.

He wrote to Forward, Director Planning and Marketing, on 29 October 1992 and recommended that the Managing Director be informed.

Were the tenderers given these reports?

While these reports were being gathered and considered in various sections of the Water Board, the process of contracting for the water filtration plants and their environmental assessment was continuing. I have been told that at least the Hutton report was not made available to AWS.

Garling was the bid manager for AWS. As to the Hutton and Aquatech reports, he tells me:

GARLING: "Frankly, I'm surprised and disappointed by the presence of those reports, the two reports on it, that we weren't made aware of those, because we were proceeding at that time. Might I say, we were proceeding at that time technically on the basis that ... they had found one *Giardia* or something and no *Crypto*, and that's all that had ever been found in the catchment in the past. While I think Lyonnaise might have, sort of, had a subconscious expectation, 'Well, that won't continue forever because that's not what has happened,' it hadn't been their experience. This was an upcoming issue in the water industry ... and I guess their expectation was that it would

happen gradually and you would have time to address it through the R&D program and then decide on an upgrade. That has proved to be a false assumption."

As *Cryptosporidium* and *Giardia* now appeared significant, if not central, to the objective of acquiring the plants, it should have been obvious that any information on the state of the catchment should have been shared with the tenderers. I am sure this was not done.

Manzi tells me that he would be "incredibly surprised" if he had not told the tenderers about the investigations described in the Hutton report, but has no "absolute recollection" of having done so.

His evidence on the relevance of the report confirms that he had the view it should not have been given to AWS when it became available. As to whether it should have been given to AWS, he says:

MANZI: "Not necessarily before we signed a contract."

QUESTION: "Why not?"

MANZI: "Because they didn't need it. It didn't make any difference to them."

In a written statement provided to me he says:

"AWS were not provided with the Primrose Hutton report itself. No decision was made to withhold this information from them. When the Primrose Hutton report was received it was furnished to those who, in my opinion, required it, namely Paul Forward, my immediate superior, and those people involved in further research work. I gave it to Paul Forward on the understanding that he would inform the Managing Director of its contents.

AWS became aware of the *Cryptosporidium* and *Giardia* results and the Primrose Hutton report when the EIS Determination was published."

Trickett does not recall any consideration being given to release of the reports to the preferred tenderers. His answers are revealing.

TRICKETT: "...it was a difficult situation for the Water Board, were we to release the reports or were we to try and determine a course of action first, so that we could manage the situation?"

There were also problems in the exchange of information about filtration efficiency in removing *Cryptosporidium* and *Giardia*. AWS had obtained a copy of a report published in April 1993 on the Board's tests in the Prospect pilot and prototype plants. The report, prepared by Murray and Roddy, made brief reference to the seeding test having achieved 99.99% (4 log) removal of *Cryptosporidium*. However, with respect to those tests, Alla says that AWS was only informed of the results in a report in 1994:

ALLA: "In this report they said they have conducted trials on processes which gave them satisfaction, that the process at Prospect would achieve not 3 log but 4 log removal, which would have meant 99.99. The first time we saw this report was in 1994, in November 1994, a year after the contract was signed ... we never got the detail of the trials they made. We asked them several times."

Obviously, AWS was not provided with all relevant reports. Although AWS learnt from the Environmental Impact Statement (EIS) Determination report that *Cryptosporidium* was present in the storages and the reticulation system, all reports should have been provided to the preferred tenderers as soon as they became available. As it was, the EIS Determination report was not completed until 11 June 1993.

Cryptosporidium and *Giardia* had not been identified in the tender documents as a matter to be addressed by the filtration plants, although I understand they were referred to in discussions between the Water Board and AWS prior to the close of tenders. Once their presence in the catchments was confirmed, questions about the suitability of the design of the plants should have been considered. This would have allowed AWS to indicate whether a more sophisticated filtration process would be required.

It is clear that the Board's engineers in 1993 had an incomplete understanding of *Cryptosporidium* and *Giardia*, their consequences for human health and the effectiveness of the filtration plants in dealing with them. They were concerned that, as information about *Cryptosporidium* and *Giardia* became available, this did not delay the development of the filtration plants within the previously identified timeframe. This was a legitimate concern. The early release of the information may not have altered the course of subsequent events but would have allowed better informed decisions.

Chapter 15: Environmental assessment process

The Environmental Management Unit

The Environmental Management Unit (EMU) of the Water Board was established in 1990. It had responsibility for the development of corporate policy and strategy in relation to environmental matters. Its functions included environmental investigations and audits of the Board's operations, such as ocean outfalls. It established procedures for environmental assessment processes and advised the Board on the adequacy of EISs and had responsibility for the preparation of EIS Determination reports for major Water Board projects. The process of assessing the Prospect plant was primarily managed by Woodward of the EMU.

The Unit was created by the Board at a time when there was increasing community awareness of environmental issues. At the same time environmental legislation was having a more significant impact. Contemporary approaches to environmental problems have not always been sympathetically received by those who traditionally manage the development of major infrastructure.

The statutory process

The *Environmental Planning and Assessment Act 1979 (EP&A Act)* provides the statutory process for the consideration and approval of all development. Part 4 controls development that requires a consent. Part 5 provides the environmental assessment process for development, usually by government, that does not require development consent.

There has been considerable misunderstanding about the role of Part 5. It does not provide a "consent" process, at least in the terms that were applicable in 1993. Rather it provides a mechanism to ensure decisions to undertake major projects, mainly by government, are made only after consideration of all relevant environmental matters. The Act provides for the preparation of EISs for projects which could have significant impact on the environment. The regulations provide that before the project can proceed a detailed report, known as a clause 64 report, must be prepared and considered by the body proposing to undertake the project.

How the process applied to Prospect

The planning controls for Prospect were complex. The site of the proposed filtration plant straddled three local government areas. It was to be located predominantly in the Fairfield City Council area, although the site of the clear water tanks extended into the City of Blacktown. The site to dispose of excess spoil was in the Holroyd City Council area.

The planning approval for the filtration plant did not neatly fit under Part 4 or Part 5. The raw water pumping stations, the water filtration plant below ground, and below ground residual and spoil disposal sites were activities which required independent consideration under Part 5. The Board took the view that the proposed plant was "likely to significantly affect the environment" and accordingly an EIS was required and a clause 64 report had to be prepared, considered and determined by the Water Board's Managing Director.

Throughout the Board's consideration of this project, it gave great significance to the clause 64 report. It was effectively treated as a grant of development consent under Part 4. This approach, and its implementation by the EMU, which was given the task of its preparation, ensured a rigorous examination of the environmental aspects of the project.

What did the EIS have to say about *Cryptosporidium* and *Giardia*?

The Prospect EIS was published in November 1992. The presence of *Cryptosporidium* and *Giardia* in the catchment waters had been reported by Hutton in October 1992.

The EIS noted the Water Board's goal of compliance with the 1987 NHMRC/AWRC guidelines and possible future guidelines. The discussion of *Cryptosporidium* and *Giardia* is both brief and obscure.

It said:

"There are some issues of concern not covered in current Water Quality Guidelines. With our current systems, two areas of concern are cysts (*Giardia* and *Cryptosporidium*) and viruses. The Board is keeping abreast of 'Best International Practices' and is using overseas research to meet these concerns. The proposed WTPs [water treatment plants] will be capable of removing cyst size particles by filtration."

There can be little doubt that a filtration plant would remove some particles, but the likely efficiency of removal is not indicated. Without comment on efficiency, the statement has little meaning.

The EIS also included extracts from the Concept Design Report for the plant. These include reference to *Cryptosporidium* and *Giardia*:

"Discussions with the Water Board's Medical Officer have also revealed some concern within the Water Board at the potential for the parasites *Giardia lamblia* and *Cryptosporidium* to be present in the supply system. No data are yet available to confirm this. An improved method of detection has been developed recently by Scientific Services which will be applied to sources including Lake Burragorang."

It is apparent from these statements that the EIS referred to *Cryptosporidium* and *Giardia*. However, it provided little meaningful detail and, although identifying that pathogens would be removed, provided no indication of the likely efficiency of removal. The suggestion that the Board was using "overseas research" to meet the concerns, was no doubt intended to give comfort but offered no detail. I discuss the nature of the overseas information later in this report.

Chapter 16: The preparation of the clause 64 report

Tensions in the Water Board conflict between the environmental scientists and the engineers

The process of preparing the clause 64 report was rigorous, although subject to time pressures. The Board assigned its preparation to the EMU which consulted with, but remained separate from, the engineers forming the DWP. This was appropriate. However, considerable and unproductive tensions emerged between the two groups. Manzi describes them, and his relationship with Woodward:

MANZI: "If I describe it in simple terms, he put blockages in front of us every step we were going, in going through this process, legal opinions and a whole host of things, that we had to go this way instead of that way; and many of those things were his opinion, rather than a reality. I believe he had a view that we shouldn't build the water filtration plants, he was actually working against them..."

Trickett says of the difficulties:

TRICKETT: "They had their agenda and we had ours and they didn't quite match.

...

We were trying to work to a timetable to get treated water for Sydney as soon as we could and the environmental unit didn't seem to have the same enthusiasm to get on with the job that our team had.

They were very tardy in asking for information or providing stuff to us. We tried to respond fairly quickly when they asked us for information, to try and keep the process running."

For his part, Woodward acknowledges the tension, saying:

WOODWARD: "I would say they [the DWP] were driven by the engineering aspects of the project and the desire to get the project delivered on time in the shortest possible time, whereas I would say that the environmental people were concerned that the social, environmental and health issues were being properly canvassed in this documentation. We were, I guess you could say, continually frustrated by the process."

The EMU was headed by Cairnes. She describes pressure from the engineers who "wanted to get everything finished so that the project could start". She understood correctly that there were cost penalties if the water filtration plants were delayed but says the EMU worked extremely hard under difficult conditions and immense pressure. Cairnes says they were "wise not to take short cuts".

Wilson describes the relationship between the DWP engineers and Woodward as a "healthy tension". He points out that it was appropriate for them to be apart because of Woodward's role in the determination of the EIS. He observes:

WILSON: "...there was certainly tension there and at times people would go a bit overboard."

Broad was appointed Managing Director of the Water Board in April 1993. He says that it was at about the end of April that he became aware of the "debate" going on between the EMU and the DWP. He observes:

BROAD: "... the place is a traditional engineering place, that's what it grew up from. When I arrived ...there was this warring faction going on between a whole variety of places, the environmental scientists seemed to have their own agendas. Everyone seemed to have their own agendas."

Information is not provided to the EMU

As consideration of the project continued, a number of significant issues emerged. The most significant appears to have been the disposal of the backwash waters from the treatment process. The original intention proposed by the Concept Design Report, and identified in the EIS, was to dispose of these to Prospect Reservoir. This was denied, quite properly, by the Environment Protection Authority (EPA). Prospect is categorised as "Class S Specially Protected Waters" under the *Clean Waters Regulations 1972* and could not receive backwash from the plant. The Board decided

that the backwash should be treated and then returned to the head of the works (plant inlet).

The disposal of the backwash came to be linked with the possible problem of *Cryptosporidium* and *Giardia*. If particles could build up in the backwash water, they may accumulate and ultimately break through the plant.

Regular meetings were held to carry the determination process forward. These were attended by the Managing Director, then Wilson, and by representatives of the EMU and the DWP. *Cryptosporidium* and *Giardia* were discussed at a number of meetings in March and April 1993.

The minutes of the meeting on 11 March 1993 record:

"It was apparent that the management of backwash supernatant was still the biggest problem from the global issues yet to be solved. The biggest concern remained the recycling of pathogens should the supernatant be returned to the head of works, especially *Cryptosporidium* and *Giardia*."

I have already identified that the Water Board had obtained the Hutton report on *Cryptosporidium* and *Giardia* in October 1992. It was only by accident that Woodward learnt of the existence of this report. The correspondence is a comprehensive account of events.

Woodward's evidence

On 16 March 1993, Woodward sent a memorandum to Manzi. He said:

"As you are aware, the presence of pathogens, especially *Cryptosporidium* in the drinking water supply has been an issue during the Determination of the water treatment plant proposals. This issue has been discussed at a number of meetings and several people within the Board are investigating various options and system management proposals to safeguard against *Cryptosporidium* levels becoming high in the supply system.

As discussed with you today, I was somewhat concerned to learn yesterday that Science & Environment has prepared a report on the incidence of *Cryptosporidium* in Sydney's water storages and at no stage has this information been offered by the Drinking Water Program to the officers doing the Determinations. I was even more concerned to learn that when a request was made for a copy of this report by one of these officers to the Drinking Water Program, it was refused pending clearance with yourself.

...It is not acceptable that we have to 'discover' documents that have an important bearing on the Determinations

...It is essential that there be a full and open exchange of information between the Drinking Water Program and the Determination team if the health of the public is to be protected, the Board's interest and responsibilities accounted for and proper environmental safeguards built into the Project. Further, if the Science &

Environment report was made public and the Determinations failed to give due weight to its contents, the potential for embarrassment to the Board and Government is significant.

You have my full co-operation in these matters and I would hope that we also have your full cooperation."

The matter was not resolved between Woodward and Manzi.

On 1 April, Woodward and other members of the EMU wrote to Wilson:

"The withholding of reports from the Determination Team on the research done to date on *Cryptosporidium* and *Giardia* by the Drinking Water Program is of great concern. This is a serious public health matter and yet the results and the recommendations of investigations into the occurrence of these pathogens in the Board's storages and distribution system have been withheld from the people preparing the Determination Reports."

Manzi's evidence

Manzi gave evidence about these matters describing how he attempted to manage the information going to the EMU. His evidence reflects uncertainties and contradiction about the issue of when the Hutton report was made available:

MANZI: "The stage that the EIS was at that information was provided to the EIS at certain stages. It wouldn't have been the Environmental Management Unit's role to receive that information in an operational sense but they received it in developing when they needed it in developing their EIS sorry, the consultants, in developing the EIS."

QUESTION: "I'm sorry, when they needed it? How would they know that they needed it if they didn't know it existed?"

MANZI: "They needed it for the EIS so we gave it to them for the EIS, but we didn't give it to them from an operational perspective."

QUESTION: "Why didn't you just give it to them straight away when you got it?"

MANZI: "I didn't say I didn't. I don't know when I gave it to them."

In fact the report was not given to the EMU until after the EIS had been completed.

Manzi says that it would be incorrect to say that the Hutton report was "withheld" from the EMU; the failure to provide it would only have been an "oversight". He submits to me that:

"(a) I deny that I or others in the Drinking Water Program 'withheld' the Primrose [Hutton] Report from EMU. The Primrose Report was furnished to EMU at the appropriate time, after the further testing and research that it called for had begun;

(b) even though EMU officially received the Primrose Report in April 1993 they knew of its existence and import by no later than February 1993;

(c) In the normal course the Primrose Report would have been officially furnished to EMU shortly after it had been received by DWP. I believe it was an oversight on the part of DWP that it was not furnished to EMU immediately. When Ross Woodward raised the issue, I realised that an oversight had occurred."

Conclusions

In my opinion, the report should have been provided to the EMU as soon as it was available. It was important to the evaluation of the projects. I am satisfied that the report was only provided after complaint was made by Woodward. I am left with the strong impression that the some of the engineers of the DWP saw the EMU as antipathetic to the task of completing the water filtration plant projects. They wrongly believed they should control the flow of information relevant to the projects rather than share it freely with the environmental scientists. Although there was a legitimate concern that the plants not be delayed, this conduct was inappropriate considering the importance of *Cryptosporidium* and *Giardia* to the safety of drinking water.

In part these problems were created by the decision to implement the contractual process before undertaking the evaluation required by the *EP&A Act*. I accept that, for practical reasons, it is difficult to do otherwise. However, in this case it had the consequence that the parameters for the quality of treated water were defined at the tender stage and before the environmental evaluation had been undertaken. It also meant that the environmental evaluation was conducted when preliminary contractual arrangements were in place which imposed deadlines and cost penalties for the Board if the contract was not concluded by the identified dates.

The resolution of the issue of *Cryptosporidium* and *Giardia*

The EMU was reluctant to complete the clause 64 report until all issues, particularly the impact of backwash waters on the efficiency of the plant, were resolved. Wilson had originally hoped to have the clause 64 report completed by the time he ceased to be Managing Director on 2 April 1993. However, this could not be achieved. Instead, on that day he chaired a meeting attended by members of the EMU and the DWP with the intention of resolving the issue of *Cryptosporidium* and *Giardia* and the backwash waters.

Many of the tensions between the DWP and the EMU were aired at this meeting. Those tensions are reflected in attempts to settle an agreed account of the meeting. This proved difficult and generated acrimonious correspondence. Manzi wrote by hand on Woodward's first copy of his notes of the meeting in the following terms:

"How come only myself and the MD are quoted in this respect. I am disappointed that I have been misquoted and quoted out of context and question your honesty in preparing these minutes [Woodward's notes]. If this is receiving your full support I would prefer not to have your support. Thank you."

The process for preparation of these notes is important. Woodward prepared a draft of the notes which was reviewed by Manzi. He made detailed changes by hand and returned them to Woodward. A final typed version was then created. Manzi's changes generally related to matters where he was integral to the discussions. He obviously read Woodward's notes carefully. Although Manzi suggests otherwise, it is difficult to believe that if he disputed other matters, he would not have identified them.

Because of his concern that the outcome of the meeting should be accurately documented, Manzi also prepared an addendum to the notes. In his memorandum he does not question the accuracy of Woodward's document but does provide his own account of the relevant matters and his understanding of the relevant context.

The meeting of 2 April 1993

Because of the importance of Woodward's notes of the meeting of 2 April 1993, I have reproduced them in full. They include the changes suggested by Manzi. Some matters have been emphasised by me.

NOTES of MEETING to DISCUSS PROGRESS of
DETERMINATIONS for

DRINKING WATER QUALITY PROJECTS

At

PROSPECT, WORONORA, MACARTHUR & ILLAWARRA

Held 12 Noon, Friday 2 April 1993

PRESENT: Managing Director Paul Forward
David Manzi Lorraine Cairnes
Martin Bowles Mick DeGiorgio
Rob Salisbury Amanda Jones
Karen Kaufman Ross Woodward

The draft letter to ACF responding to their letter of 30 March was endorsed by the Managing Director who asked that it be further reviewed by Lorraine Cairnes and Dave Manzi.

The incidence of *Cryptosporidium* and the way it was dealt with in the Determinations was discussed at length. It was acknowledged the study carried out in October 1992 was an initial one and had discovered *Cryptosporidium* in all storages and further studies were recommended and under way. The trials carried out on the prototype plant at Prospect have given a five log removal. The Managing Director thought WHO has new guidelines on *Cryptosporidium* and requires a two stage

filtration system when it was present. The Managing Director asked if the water treatment plants will remove *Cryptosporidium*. Dave Manzi responded that we need to carry out further trials to assess the effectiveness of the process. The Managing Director stated he doesn't want to wait for the real science to provide results he wants the Board to do something about it now.

It was suggested that water treatment plant efficiency criteria should be based on the degree of *Cryptosporidium* removal; the Managing Director agreed and wanted words to that effect put in the Determination reports. He requested that the reports indicate that the Board will look for it, measure its incidence and ensure satisfactory removal or inactivation; and as we learn more about the pathogen, the Board will ensure that treatment processes are upgraded to remove or inactivate it to acceptable levels. A clause was already in the Contract to enable such upgrades, but *Cryptosporidium* was not part of the current performance agreement in the Contract.

The Managing Director requested that the incidence of *Cryptosporidium* be described in the preamble (to the Determination Reports) together with the statement on the importance of the treatment plants with regard to its removal.

The Managing Director indicated he was happy with the draft Prospect and Macarthur Determination Reports except for the large number of typographical and grammatical errors. It was explained the reports were really the first complete drafts received and had not been reviewed adequately.

The meeting then discussed the memo from the Determination Team to the Managing Director dated 1 April 1993.

The question of supernatant management was discussed at length; it was suggested that if ozone was used as a disinfectant it could require activated carbon for further treatment. The Determination Team said there was doubt as to the effectiveness of the proposed management system because the information simply was not available to show the proposed supernatant treatment was effective. Manzi stated that a well run backwash treatment will remove pathogens and other matter with the residuals and further studies would be carried out to assess the effectiveness and possible need for disinfection.

The Managing Director said that the water treatment plant operator should ensure 3 log removal of pathogens. The concentration levels of pathogens was discussed at length and it was suggested that the Determination condition should be re-written to include different levels of removal or inactivation for different levels of incidences to keep absolute numbers as low as possible in the treated water. **The Managing Director suggested that the required performance removal or inactivation of *Cryptosporidium* should be specified for the catchments and the treatment plants. It was agreed that 3 log removal and the US EPA criteria should be used as desirable outcomes; if pathogen levels are actually higher than expected then the Determination should say that catchment management and plant performance will be improved.**

The Managing Director required a letter to go to the Department of Health the same day notifying them of the presence of *Cryptosporidium* in the raw water supply; Amanda Jones was to arrange this.

Residual disposal was then discussed since the Determination Team had pointed out that there was no guaranteed solution that the Board could rely on fully. Manzi listed the range of options available:

- disposal at council tips;
- disposal to BHP from Macarthur;
- disposal at Prospect Quarry;
- disposal at Wilton Grasslands, which was the only "viable" option at present;
- disposal to various brick works; and
- mixing with sewage sludge and subsequent recycling; and
- disposal to sewer.

Dave Manzi indicated that a full study had been carried out into options for residual treatment and that the Wilton Grasslands and Prospect Quarry were considered as interim solutions and that further studies would be made into beneficial options.

The Determination Team pointed out that disposal to Wilton Grasslands was not guaranteed as rezoning of the site had yet to be done by local council.

The Managing Director suggested the residuals could also go to the Board's sludge landfill site; this was currently undergoing a three months trial to ensure there were no odour problems, subsequently a two year contract with a two year option was in place.

The Managing Director indicated that he only wanted the viable or preferred options to be placed in the Determination Reports. He requested Manzi to prepare a complete list of options and the approvals required in a decision tree which would guarantee a fail-safe solution for the management of residuals.

The issue of *Cryptosporidium* had been discussed extensively earlier in the meeting and Manzi provided the Determination Team with a copy of the scientific report on *Cryptosporidium* prepared by Science & Environment.

The contractual relationships between the Board and the water treatment plant operators were then discussed. It was explained that the contracts were only in draft form and that the Determinations would influence, to some extent, the content of the contracts. The details of the contracts would not be released for commercial reasons although some aspects of them could be made public.

The pricing and capital works program issues were then discussed. Further text was to be added to the Determination Reports to say that the water treatment plants were a high priority of the capital works program and part of the Board's commitment to ensuring service to customers. It was suggested that the criteria for supporting the status of high priority were:

- commitment to meet 1987 water quality guidelines;

- providing efficient customer services; and
- to comply with key result areas of the corporate plan.

Manzi assured the meeting that value management studies had been carried out on all the projects and the methods used would meet Treasury guidelines.

The Preliminary Hazard Analyses were then discussed; it was indicated that agreement in principle had been given by the Department of Planning for both Woronora and Macarthur PHAs. The Department of Planning was expected to respond to BHP's revised PHA for Prospect on Monday, 5 April 1993; it was also decided that unless BHP could substantially meet the concerns of the Department of Planning, then consideration would be given to terminating their consultancy. Should the revised PHA indicate that only one house may lie within the Department of Planning risk criteria for the Prospect project, then it should be purchased after negotiations with the owners.

It was agreed that all the points raised in the memo to the Managing Director had been discussed.

The Determination Team explained the heavy workload and high stress levels they have been working under for the last four weeks and canvassed the opportunity of having at least one or two additional staff working on the Project. Forward suggested that Ms Maria Zannetides could possibly provide a person for two weeks and Manzi would consult with Ron Quill to see if Shanahan could be made available for two weeks.

The next meeting would be held on Wednesday, 7 April 1993 at 4pm on 23rd Floor.



MEMORANDUM

To: R. Woodward
Senior Environmental Scientist

From: David Manz
Manager, Drinking Water Programme

Subject: EIS Determinants Meeting on 2/4/93

I have read your notes from the above meeting and had some concerns that they accurately reflected the meeting. I cannot understand why only the Managing Director and myself are quoted and I was concerned that I had been quoted out of context and I believe misquoted in some cases. I have made amendments to the draft which I believe reflect my comments. In addition, I would like you to add the following note to the minutes which better places the notes of the meeting in context.

NOTE

The water filtration plants proposed for Woonona Ilawarra and Macarthur are anticipated to be commissioned by the middle of 1995 and the plant at Prospect by the middle of 1996 which provides an opportunity to seek beneficial use options for the residual management before the plant is commissioned. The EIS has been prepared on the basis of a defined solution following a thorough study of options by the Board and consultants PPK in December 1991. The option to seek beneficial use remains for both the Board and the successful water treatment company to pursue. A Co-operative Research Centre (CRC) project to which the Board is party too is being carried out over a 3 year period at an estimated value of \$1.5m to further investigate beneficial uses. It should also be noted that the quantities of residual are approximate 10 tonnes of dry solids per week for the smaller plants and 100 tonnes of dry solids per week for the Prospect plant.

The design of the plants and the EIS had been prepared on the basis that pathogens including cryptosporidium and giardia were not present in the raw water as they had not previously been detected, however flexibility in the design to treat these was a major consideration. In October 1992 an initial report was prepared by Science & Environment following intensive research into detection methods that detected cryptosporidium in all the Board's stored waters at levels indicating some concern. A workshop to review this report between the Operators, Drinking Water Programme and Science and Environment agreed that further studies were required to assess the true extent of cryptosporidium and other pathogens in relation to overseas data and the

level of treatment required. At this time with only disinfection and screening on the four water supply systems to be provided with filtration plants we have no protection against these pathogens which are resistant to chlorine disinfection and therefore the plants as they are proposed should not be delayed awaiting further information. The proposed filtration plants on overseas experience are capable of log. (99.9%) removal of these pathogens when properly managed and with this in mind it was resolved to carry out further studies to assess the extent of *Cryptosporidium* and other pathogens in the system and the capability of the plants to remove these to a satisfactory level and that modification (such as ozone or activated carbon) to the plants would be carried out if found to be necessary. This issue also has an impact on the management and treatment of backwash water which will be included in the studies. It is anticipated that sufficient information will be available to modify the plants if considered necessary before or very soon after they are commissioned.

On the basis of the health issues outlined in the EIS's relating to the Sydney Region's water supply and the above health issue, it is incumbent on the Board to proceed with these water filtration plants as soon as possible."

I would appreciate if you would include the above note and my notations on the draft notes of meeting. Thank you.


D. MANZI
8th April, 1993

cc. P. Forward
cc. P. Fagan

As I have indicated, Manzi did not accept that Woodward's notes fully recorded the relevant matters. He prepared an addendum which dealt in particular with *Cryptosporidium* and *Giardia*. He confirmed his claim as to the likely efficiency of the plant, which was presumably advanced to meet the EMU's concern about the findings of *Cryptosporidium* and *Giardia*. Manzi's addendum follows.

I interpret this memorandum as indicating confidence that 99.9% (3 log) of pathogens would be removed or inactivated by the plant. Based on current knowledge, this was assumed to be satisfactory. However, if research revealed a greater concentration of pathogens than had presently been identified or if the plant could not achieve 99.9% (3 log) removal or inactivation, then augmentation by ozone and activated carbon may be required. Fundamental to Manzi's view is that 99.9% (3 log) removal or inactivation was satisfactory and his belief that the plant would achieve it. If he offered these views to the meeting, it would not be surprising if both the EMU personnel and Wilson accepted that the performance standard for the plant should require 99.9% (3 log) removal or inactivation.

Wilson's evidence

Wilson does not have a clear recollection of everything said at the meeting. It was held on his last day as Managing Director and he did not see Woodward's notes until recently. I have formed the view that it would be preferable to rely on contemporaneous notes made by others than on his incomplete recollections. He believes the following words accurately record his view:

"It was suggested that water treatment plant efficiency criteria should be based on the degree of *Cryptosporidium* removal; the Managing Director agreed and wanted words to that effect put in the Determination reports."

Wilson remembers requesting that the incidence of *Cryptosporidium* be described in the preamble to the Determination reports, as recorded in Woodward's notes. However, he does not believe it is accurate to record the following:

"The Managing Director said the water treatment plant operator should ensure 3 log removal of pathogens."

He says that he did not have an understanding, at the time of the meeting, of the technical term "3 log removal" and therefore would not have used it. However, he says that there "could have been" reference to "99.9%".

Wilson believes that there was probably a reference to US EPA criteria, that he would have been looking towards US EPA standards and that he would have gone along with the US EPA criteria as a basis for determining efficiency.

Wilson emphasises that the message he wanted to convey to the meeting was: "I wanted the drinking water to be safe and I wanted *Cryptosporidium* and *Giardia* out".

He believed the EIS Determination would be reflected in the obligations provided by the contract.

Manzi's evidence

Manzi's evidence about the meeting of 2 April 1993 was given on more than one occasion. His evidence is not always clear and on some occasions is conflicting.

On 22 October 1998 he gave the following evidence to me:

QUESTION: "... the Managing Director was recorded in this minute as saying that he wanted *Cryptosporidium* removal to be the criteria ... Do you remember that?"

MANZI: "Yes. I believe this is correct but I don't actually remember him saying this, but I have thought about it a lot."

In responding to questions by his solicitor, he said:

QUESTION: "If you go to paragraph 3 ... [of Woodward's notes], it says, 'It was suggested that the water treatment plant efficiency criteria should be based on the degree of Crypto removal.' Was that the subject matter of a discussion at the time?"

MANZI: "I'd have to assume so, yes."

QUESTION: "If I could read the last sentence of that paragraph, we now know that there was a suggestion, the Managing Director agreed with that suggestion and made a recommendation as to what should be put in the determination reports. Do you follow that?"

MANZI: "Yes."

QUESTION: "And then it says, 'He requested the reports indicate that the Board would look for it, measure its incidence and ensure satisfactory removal or inactivation.' The reports there deal with the EIS Determination report. Is that correct?"

MANZI: "Yes"

Manzi was also asked about the record of the Managing Director stating that the water treatment plant operator should ensure 99.9% (3 log) removal of pathogens. His answer is informative.

MANZI: "...we had a view that the treatment technique proposed, and good operating practice would deliver 99.9%, so therefore we had a view that we could meet the Managing Director's requirement at that time."

He also said:

MANZI: "He said the operator must operate it in that way, and the way I interpreted that is that, on the treatment technique we had and good operating practice, that could be achieved; therefore, the Managing Director's requirement could be achieved."

When asked whether, having regard to the Managing Director's requirement for 99.9% (3 log) removal of pathogens, he should have informed the Managing Director of a later statement by AWS that the plant was not designed for 3 log removal of pathogens, Manzi appears to be in no doubt that such an obligation had been imposed.

MANZI: "I have trouble with clearly stating whether I had any obligation because I believe I met his obligation by the process which we set up. So I believed I'd met his obligation. I didn't go back to present the process in which I believed I'd met his obligation, mainly because he wasn't there any more. You use the term 'Managing Director'; then we had a different Managing Director."

There was a discussion in the evidence about whether Manzi understood Wilson was defining a requirement for inclusion in the clause 64 report alone or whether it applied to the contract. Because the contract had to be consistent with the Determination, in fact it made no difference. However, his evidence in answer to a question asked by his solicitor was:

QUESTION: "[Woodward's note] says, 'The Managing Director said the water treatment plant operator should ensure 3 log removal of pathogens.' In the context of the meeting you were at the meeting... was that, to your recollection, a direction to

yourself to include it in the contract or discussion as to what should go in the Determination report?"

MANZI: "We were discussing the Determination report. It was not, from my recollection, a direction to put it in the contract."

Any doubt about Manzi's understanding of the requirement of Wilson was resolved with the following exchange:

QUESTION: "One other question there: did you understand the Managing Director to have made plain that the EIS Determination would require 99.9% removal?"

MANZI: "Yes, I did, because I told him it would do it."

Manzi was also asked:

QUESTION: "... but did you go away from the meeting understanding that the Managing Director had required 99.9% removal to be reflected in the Determination?"

MANZI: "I have difficulty answering that with yes/no type answers because I went away from that meeting with the expectation that the Managing Director expected the plant to remove 99.9%."

It was suggested that the second answer in some manner qualified the preceding answer. Having regard to the manner of Manzi's response I believe the first answer is an accurate account of his understanding.

Manzi gave further evidence to me on 13 November 1998 after a request from his solicitor that he be given the opportunity to explain some matters. By this stage, the issues of concern to me would have been apparent to Manzi and his advisers. On this occasion his evidence is different in a number of significant respects to that given on the earlier occasion. Having observed him giving his evidence and after deliberation I believe the earlier account is more accurate.

His later evidence was:

QUESTION: "Put simply, did the Managing Director at that meeting state that treatment efficiency criteria should be based on the degree of *Cryptosporidium* removal?"

MANZI: "No."

QUESTION: "Secondly, did the Managing Director, Mr Bob Wilson, state that the plant operator should ensure 3 log removal of pathogens?"

MANZI: "No."

Later he was asked:

QUESTION: "... 'The water treatment plant efficiency criteria should be based on the degree of *Cryptosporidium* removal.' Now, is that an accurate record?"

MANZI: "No, it's not."

QUESTION: "Is it anything like that?"

MANZI: "There were a lot of discussions at that meeting with regards to *Cryptosporidium* removal. The main item at that meeting was that ... the plant had a capability and that we found *Cryptosporidium*, but the Managing Director never directed either the Determination report or myself that efficiency criteria should be included in the contracts, because he knew and understood the process of what we understood and the fact that the plant had a capability but we couldn't specify it."

QUESTION: "Did the Managing Director say words to the effect, 'I want you to get rid of all the *Cryptosporidium*'?"

MANZI: "I don't have any recollection of him saying that. I don't think he would have said that because it's not possible."

QUESTION: "Did he say anything about removing *Cryptosporidium* to your recollection, at all?"

MANZI: "There were a lot of people there and we were discussing *Cryptosporidium* and its removal ..."

QUESTION: "Did the Managing Director say anything about removing *Cryptosporidium*?"

MANZI: "I don't actually recall those words or him actually saying anything."

QUESTION: "The words, 'He requested that the reports indicate that the Board will look for it, measure its incidence and ensure satisfactory removal or inactivation'. Were those words said by the Managing Director?"

MANZI: "That falls into line with the sort of thing he would have said but I can't guarantee any of the words in this minute because, on reflection, I was so badly misquoted myself that I don't think that any of this truly reflects the meeting."

QUESTION: "...did the Managing Director ... say that the treatment plant operator should ensure 3 log removal of pathogens?"

MANZI: "No."

QUESTION: "Did he say anything like that?"

MANZI: "He might have said that the treatment plant technique had a capability of 3 log removal."

QUESTION: "As I understand it, you said that, didn't you?"

MANZI: "That's why I believe he might have said it too, because he took my guidance on this issue."

Conclusions

I accept the recollections of those who gave evidence about this meeting may be flawed after the lapse of time. Accordingly, it is difficult to prefer that evidence to the contemporaneous notes made by Woodward. Given the circumstances of its creation and the intensity of the difference between the two groups, if the notes were not accurate, I believe this would have been raised by Manzi at the time.

I am satisfied that Wilson intended that the Prospect plant should deal with all pathogens. He contemplated that the ultimate level of treatment necessary to achieve this outcome would have to be further investigated and that additions to the proposed plant may be required. In the meantime he wanted the project to proceed and achieve the best outcome possible having regard to the available knowledge. Whether he used the term "3 log" is of little consequence; he tells me he said he wanted pathogens removed. It is clear that Manzi believed the plant would achieve 99.9% (3 log) removal or inactivation and offered this view to the meeting. This was done to persuade the EMU and Wilson that, having regard to current knowledge, the plants would adequately deal with *Cryptosporidium* and *Giardia* and should proceed.

Broad was appointed Managing Director on 5 April 1993. Broad does not recall Woodward's notes of the 2 April 1993 meeting. However, he never varied the direction given by Wilson on the required efficiency of the plant.

Was the claim for 99.9% (3 log) removal or inactivation justified?

The claim of Manzi that the plant would achieve 99.9% (3 log) removal or inactivation of both *Cryptosporidium* and *Giardia* could not be justified having regard to the evidence available to him. I asked, on a number of occasions, for the material that was relied on for this statement to be identified. Manzi tells me that the reference to "overseas experience" in his addendum to Woodward's notes of the 2 April 1993 meeting is a reference to the US EPA *Surface Water Treatment Rule (SWTR)* and to information set out in the Aquatech report.

At the time the *SWTR* Guidance Manual reflected a belief on the part of the US EPA that direct filtration, also known as contact filtration, would effect 99% (2 log) removal of *Giardia*. The US EPA also believed that if adequate chlorination was provided, a total of 99.9% (3 log) of *Giardia* would be removed or inactivated. There was also a study available at the time which suggested that well operated plants could achieve up to 99.9% (3 log) removal of *Giardia*, although this was not confirmed by other work. However, at the time the level of protection against *Cryptosporidium* was unknown. *Cryptosporidium* is not inactivated by chlorine at doses appropriate for a water supply and accordingly, even if it could be removed with the same efficiency as *Giardia*, this would only have justified an assumption of 99% (2 log) reduction.

I can find no foundation in the Aquatech report for a conclusion that the proposed plant would achieve 99.9% (3 log) removal or inactivation of *Cryptosporidium*. It does refer to a study of the effectiveness of contact filtration plants in removing *Giardia* which suggested a possibility of 3 log removal on some occasions (De Walle

et al, 1984). However, the Aquatech report also referred to the more recent work of Le Chavellier (1991) who looked at conventional filtration, a more efficient process, which showed only 99% to 99.68% (2 log to 2.5 log) removal of *Cryptosporidium* and *Giardia*. In any case the former study, which provided no information on *Cryptosporidium*, could not have been relied upon to support an expectation of 99.9% (3 log) removal or inactivation of that organism.

At the time the Water Board had available a pilot plant seeding trial which had given 99.99% (4 log) removal of *Cryptosporidium*. Manzi claims that the data from this trial supported his view that the plant would achieve 99.9% (3 log) removal. However, this trial was conducted with only one run using a single large "spike" of oocysts. The finding was heavily qualified by Hutton, who conducted it. She noted that the results had to be interpreted cautiously because:

- the number of oocysts coming through the filter may have reached peak levels higher than those detected;
- removal efficiencies had exceeded those achieved in most US plants investigated which used clarification and filtration; and
- a filter cycle includes periods of lower efficiency. These had not been fully tested, with the result that the removal efficiencies for an entire filter cycle were likely to be lower than the experiment indicated.

Unlike the proposed Prospect plant, the test used a dual media filter. The Prospect plant was to use a single media filter. It is inappropriate to extrapolate data from one medium to another. In relation to this test, Manzi says in a statement provided to me:

"Although this result was based on only one test, at the time I was of the view that the method of detection developed by EnSight [Australian Water Technologies Science and Environment Division] was both accurate and reliable.

The testing was carried out with a dual media filter. Testing of mono media filter produced treated water of similar quality when the processes were optimised, and it was therefore considered unnecessary to test other media."

In my view, this test provides no real support for a conclusion that the Prospect plant would achieve 99.9% (3 log) removal or inactivation of *Cryptosporidium*.

Manzi tells me that he also relied upon the results of testing at Orchard Hills Water Filtration Plant, which indicated a removal efficiency of 99.77% (2.88 log-sic). In this respect Manzi is in error. The relevant tests were not conducted until May and June 1993.

In these circumstances I doubt that an assumption that the plant would remove or inactivate 99.9% (3 log) of both *Cryptosporidium* and *Giardia* was justified. It may have been appropriate to assume that with chlorination the plant would remove or inactivate 99.9% (3 log) *Giardia*. At best it could have been assumed from the available literature that the plant under all conditions might remove 99% to 99.68% (2 to 2.5 log) of *Cryptosporidium*.

Chapter 17: The final form of the clause 64 report

The clause 64 report was accepted by Broad on 11 June 1993. His Determination was as follows:

"As a result of an examination and consideration of the Environmental Impact Statement for the proposed Prospect Water Treatment Plant, November 1992, and as a result of an examination and consideration of all representations received concerning the proposal pursuant to Section 112 of the *Environmental Planning and Assessment Act*, and after examination and consideration of other information and reports available, I hereby determine that the proposal should proceed generally as described in the Environmental Impact Statement and with the modifications described in this report (prepared in pursuance of clause 64 of the *Environmental Planning and Assessment Regulation*) to reduce any adverse impact on the environment and subject to and conditional upon the necessary consents being received under Part IV of the *Environmental Planning and Assessment Act*."

The clause 64 report is comprised of nine sections. Section 1 is an introduction. Sections 3-9 inclusive contain a general discussion of various issues. Section 9 records the Board's conclusion that the project should proceed with the modifications identified in the report. It is section 2 which contains the operative provisions. They were intended to provide obligations binding the Water Board and, where relevant, were intended to be reflected in obligations on the Prospect Water Filtration Plant.

The preamble to the report identifies the problem of *Cryptosporidium* and the approach for its resolution. It states:

"While catchment and storage management are the preferred, most cost effective and least chemically dependent strategies, water treatment plants nevertheless are needed to deal with problems of water quality. These problems are occurring because of the demands on the system, the consequent need to improve the efficiency of disinfection and the need to meet increasingly stringent health and aesthetic requirements. The proposed water treatment plant is an effective means of removing pollutants and pathogens from Sydney's raw water supply. In late 1992, *Cryptosporidium*, a human pathogen, was detected in all the Water Board's storages at levels comparable to those reported overseas in similar water bodies. These were preliminary investigations. A more comprehensive investigation program is under way to determine the characteristics of this occurrence and to ensure the proposed treatment plant can effectively remove or inactivate it."

The discussion in the report anticipated NHMRC/AWRC guidelines which would include standards for *Cryptosporidium* and *Giardia*. It stated:

"The 1993 NHMRC Guidelines are likely to include *Giardia* and *Cryptosporidium*, two protozoa with the potential to affect the health of the community. Both protozoa may cause gastroenteritis if cysts are present in drinking water. Infection of immunocompromised people may be fatal.

...

Both *Giardia* and *Cryptosporidium* are resistant to disinfection by chlorination. However, the filters of the proposed water treatment plant should remove or inactivate 99.9% of the cysts of *Giardia* and *Cryptosporidium*. The backwash water and the residuals will contain the cysts removed by the filters. It is proposed to return the backwash supernatant to the head of the plant. If necessary this supernatant will be disinfected (probably by ozonation) to achieve 99.9% overall removal or inactivation of cysts by the water treatment plant."

It is plain from this statement that the authors of the clause 64 report had accepted the assumption of 99.9% (3 log) removal or inactivation put to them by Manzi. They believed that the only impediment to achieving this outcome may be the backwash supernatant. Provided this problem was dealt with they understood the plant would meet a performance standard of 99.9% (3 log) removal or inactivation of pathogens.

Because the supernatant could not be disposed of in Prospect Reservoir nor, without treatment, in the sewer system, the clause 64 report concluded that the most appropriate option was to return it to the plant inlet. The report states:

"The percentage removal (raw water versus finished water) of parasitic cysts drops slightly if the washwater supernatant is returned to the plant inlet.

Giardia has only been detected once in water in a Water Board's storage dam. In late 1992, *Cryptosporidium* was found in all the Water Board's storage dams and at the four locations tested in the reticulation system. The Water Board has commenced an investigation program to determine its distribution, concentration, temporal variation, viability, source and health risks, using the latest techniques and information from overseas.

Treatment of the supernatant to reduce or inactivate such pathogens will be required by the Water Board unless it can be shown that this disinfection is not required and there is no risk to human health.

The Water Board will consider a number of methods of disinfection, such as superchlorination, UV, ozonation, ultrafiltration and will require the most appropriate method to be installed at all four water treatment plants."

The operative clause

As I have indicated, section 2 of the clause 64 report provides its operative provisions. The decision was expressed as a determination that the project can proceed subject to the modifications set out in section 2. The problem of the backwash waters and the

performance standard required of the plant are referred to in clause 2.2.4.4 which states:

"(a) The Water Board will require the water treatment company to return the filter backwash supernatant to the head of works after being treated by disinfection, unless disinfection can be shown to not be required to the satisfaction of the Water Board's Manager Bulk Water, to ensure removal of pathogens so that the overall treatment process ensures a minimum 3 log removal or inactivation (99.9%) of pathogens (7.7.3).

(b) The Water Board will continually review the management of filter backwash supernatant and ensure that best available technology economically achievable is adopted at the Prospect WTP as better information becomes available on pathogens in drinking water (7.7.3)."

This clause presents difficulties of interpretation. It was written by environmental scientists, and can be assumed to have expressed the understanding given to the scientists by the engineers. It was intended to bind the Water Board and where relevant, the filtration plant operator. The reference to clause 7.7.3 in clause 2.2.4.4 indicates that the clause is the product of a discussion at clause 7.7.3 of the clause 64 report.

Clause 7.7.3 of the clause 64 report is an appendix to my report.

Was there a performance standard for the plant?

The Water Board submits that clause 2.2.4.4 is only concerned with the treatment of the backwash supernatant and does not seek to impose any general requirement for the quality of all treated water processed by the plant. I have received an opinion by Mr T Bathurst QC, retained by Clayton Utz solicitors, who acted for the Water Board in the transaction. He expresses the view that the provision imposes only two primary obligations, which are:

1. To return the filter backwash supernatant to the head of works.
2. To disinfect the supernatant, unless the Manager Bulk Water is satisfied that disinfection is not necessary for an overall 99.9% (3 log) removal or inactivation of pathogens.

He argues that the words "to ensure removal of pathogens so that the overall treatment process ensures a minimum 3 log removal or inactivation (99.9%) of pathogens" qualify the discretion to be exercised by the Manager Bulk Water. They do not impose a primary obligation on the Water Board to require the operator of the plant to achieve an overall 99.9% (3 log) removal or inactivation. If this had been intended, he suggests, it would have been specified in plain terms.

When Manzi first appeared before me he offered the view that clause 2.2.4.4 imposed a performance standard which required the plant to achieve 99.9% (3 log) removal or inactivation. He later expressed doubt about the matter, telling me:

MANZI: "I have a problem with the way ... [it] reads; of whether that's a clear cut case. It may or may not be."

He gave further evidence:

QUESTION: "...but the Managing Director says that he wants words in the Determination report which require the efficiency criteria for the plant to be based on the degree of *Cryptosporidium* removal. Right?"

MANZI: "Yes."

QUESTION: "If that's the criteria, then the obligation to achieve that criteria has to ultimately pass to the operator, doesn't it?"

MANZI: "Through the Determination report."

QUESTION: "Yes, by requiring the operator in the contract to comply with that requirement in the Determination report. It has to be that way, doesn't it?"

MANZI: "Yes, and the bottom line is that the Determination report does not clearly state that. The Determination report says that you mustn't manage the supernatant in such a way as it impacts on the capability of the plant to remove 3 log removal. That's the way we read it at the time because we believed the plant has that capability."

QUESTION: "Even if that's the way you read it, you had an obligation, didn't you, to honour what the Managing Director had expressly said at that meeting?"

MANZI: "And we managed that obligation by knowing that the plant could remove that amount, on the information we had at that time."

I also received a submission by Mr R V Gyles QC, on behalf of AWS. He notes that clause 2.2.4.9 of the clause 64 report imposes a specific performance standard for drinking water, namely adoption of the 1987 NHMRC/AWRC Guidelines (which did not refer to *Cryptosporidium* or *Giardia*). He also notes that the discussion in clause 7.2.2 which led to this modification foreshadowed the inclusion of *Cryptosporidium* and *Giardia* in the proposed 1993 NHMRC/AWRC Guidelines and that the report indicated that there would be community consultation before effecting any upgrades of the plant required to comply with the new Guidelines. He submits that the adoption of the 1987 NHMRC/AWRC standard indicated that there was a deliberate decision not to require pathogen removal as a performance standard.

He also notes that clause 7.6.5 of the report states:

"The need for the WTP and efficient operation of the plant will be even more important if further research work shows that pathogens such as *Cryptosporidium* are at levels which constitute a health risk to consumers. The efficiency of the treatment process and the filters to remove or inactivate cysts of such pathogens will have to be very high, exceeding 99.9%."

He observes that this concern led to further modifications on monitoring the quality of water produced by the plant. He submits that anticipation of the need for monitoring and research confirms that the reference to 99.9% (3 log) removal or inactivation in clause 2.2.4.4(a) was not intended as a performance standard. He maintains the effect of clause 2.2.4.4(a) is only to require disinfection of the backwash supernatant if the Manager Bulk Water is not satisfied that 99.9% (3 log) removal or inactivation can be achieved. He contends that this provision merely reflects the Water Board's assessment that the plant would achieve 99.9% (3 log) removal or inactivation.

A construction which identifies an overall performance standard for the plant accords with the view of Woodward who was involved in the drafting:

WOODWARD: "Yes, I remember that. There was a big fight. We fought all the way to get this 99.9% removal of pathogens ...

This paragraph was written without this 'unless it can be required by the satisfaction of the Water Board's Manager, Bulk Water', and it remained that way for quite some time. I remember the water filtration managers continually came back to us and said, 'It's just unacceptable. We may not need this, you're just wasting money, and you're wasting everybody's time by putting it in the way you have. We don't know enough about the problem at the moment.'

So they kept on insisting that we have this sort of fall-back clause where it's left to a further decision or satisfaction of the Manager Bulk Water about whether that backwash water is treated."

Woodward indicates that the reference to the Manager Bulk Water was inserted in response to these objections. However, he says:

WOODWARD: "...the intent of that clause always was, and in the early drafts of this document, that inserted phrase was never in the middle of that clause in our mind, there was never any doubt that there was *Crypto* and *Giardia* in the catchments once they detected it and that it would always be there and probably always had been there. Therefore, in our mind, that plant had to address that as an issue and the intention was that we had to achieve 99.9% removal of pathogens."

In my view the draftsman of the clause was attempting to impose a performance standard on the plant of 99.9% (3 log) removal or inactivation of pathogens. It must be remembered that the EMU was aware that the clause 64 process provided only limited opportunities to impose conditions on the operation of the plant. Any condition had to be expressed as modifications to the project. Accordingly, the clause is expressed as a modification related to the backwash but was intended to describe the overall removal efficiency of the plant. It is for this reason that the words "so that the overall treatment process ensures a minimum 3 log removal or inactivation (99.9%) of pathogens" were included.

However, it is clear that the clause is difficult to construe and I accept that before a binding obligation could be created, clearer language would be necessary. The clause was included following a discussion about the appropriate treatment of the backwash to ensure the assumed efficiency of 99.9% (3 log) removal or inactivation was not impaired. In these circumstances, although I believe the effect of the clause is unclear,

it is appropriate to conclude that the clause does not impose an overall performance standard on the plant.

Of course, if the obligation had been imposed, the cost of the plant to the Board may have increased significantly.

Chapter 18: The basic provisions of the contract

The contract for the Prospect Water Filtration Plant was made between the Water Board and a partnership, which comprised Lyonnaise (Prospect) Pty Limited, P & O (Prospect) Pty Limited and Lend Lease Water Services Pty Limited.

At the time of the contract AWS had entered into a separate agreement with the partnership companies to manage the design, construction and operation of the plant on behalf of the partnership. I have referred in this report to the partnership and AWS, collectively as AWS.

The contract contains various provisions detailing the requirements of the plant.

Term of the contract

The initial term of the contract commenced on the date it was signed, that is 10 September 1993, and continues for a period of 25 years from the date the plant was commissioned, 11 September 1996. Accordingly, the initial term expires on 12 September 2021.

The contract provides for the parties to negotiate an extension of the initial term. If no extension of time is negotiated, the contract requires AWS to transfer title of the plant to the Board. The Board is obliged to pay AWS the value of the plant at that time.

Relationship of the Board and AWS

The contract expressly confirms that, although it imposes contractual obligations upon the Board, it does not unlawfully restrict the Board in exercising its statutory functions.

Except in certain limited circumstances, such as emergencies, the Board agrees that Prospect plant operated by AWS is to be the sole supplier of treated water for most of the Sydney area.

AWS acknowledges that the Water Board has made no representations on the amount of water it will require under the contract.

Two phases of the contract

The contract contemplates two phases. The works delivery phase includes the design, construction and commissioning of the plant. The operating phase is the period of the contract during which AWS operates the plant to provide treated water to the Board.

Works delivery phase

EIS Determination and development approvals

The contract obliged AWS to obtain all licences and approvals required for the works delivery phase other than development approvals and the EIS Determination, which were the responsibility of the Water Board.

Clause 4.12(a) of the contract required AWS to "ensure that Works Delivery takes place in accordance with the terms of the EIS Determination and the Development Approvals". This is qualified by clause 4.12(e), which provided:

"Without limiting the Partnership's obligations contained in Clause 4.12(a), if a Court or an Authority (including the Board) lawfully and properly determines that in order for Works Delivery to take place in accordance with any terms of the EIS Determination which are referred to in Schedule 28, the Partnership must undertake work or perform obligations in respect of that term over and above the scope of work specified in Schedule 28 and the Partnership then undertakes that work or performs those obligations, the Board shall pay to the Partnership the reasonable Costs and Delay Costs directly incurred by the Partnership in undertaking such additional work or performing such additional obligations except to the extent that such additional work or obligations arise out of or as a consequence of a breach of this Agreement by or on behalf of the Partnership or any negligent or intentional act or omission by or on behalf of the Partnership."

Schedule 28 to the contract provided as follows:

EIS Determination – Agreed Scope of Work Clause 4.12(e)	
EIS Determining Authority's Report Clause No.	Agreed Scope of Work
2.2.2.2	The partnership is entitled to direct raw water of any quality into Prospect Reservoir in accordance with Prospect Operational Protocol.
2.2.2.3	Construction of training walls as shown on Drawing Number G002 in Description of Works
2.2.3.4	Construction of clay liner and drainage as per Description of Works. Water quality monitoring to the extent required in the Environmental Management Plan Outline.
2.2.3.7	Monitoring as per clauses 5.3-5.7 in the Works Delivery Phase of the Environmental Management Plan Outline.
2.2.3.8	Environmental expert to be engaged for an average of 20 hours per week (including travel). If total time exceeds 2,500 hours, due to requirements of any authority or the Board, the additional cost will be to the Board's account.
2.2.3.11	Mounding as shown on drawing G080 in Description of Works. Chlorine stack, lime silos and barometric loops are only elements required to be painted green.
2.2.3.12	The residuals and spoil disposal area environmental management plan shall be based on the Environmental Management Plan Outline.
2.2.4.2	The WFP northern fence shall be located so that a wildlife corridor is available as per drawing number G080 in Description of Works.
2.2.4.3	The Scope of Work defined in this Agreement satisfies the requirements of the clause.
2.2.4.9	The Scope of Work defined in this Agreement satisfies the requirements of this clause.
Sections 3-9	No provisions of these sections give rise to an obligation to the Partnership that is not satisfied by the terms of this Agreement.

I shall refer later to the significance of clause 4.12(e) and schedule 28 in relation to clause 2.2.4.4 of the clause 64 report.

Clause 4.12 (f) of the contract provided for the payment of additional costs to AWS if AWS incurred any additional costs because of development approvals which imposed conditions on works delivery additional to the conditions contemplated in the draft conditions set out in exhibit 16 to the contract (not all development approvals had been obtained by the time the contract was signed).

The development approvals did not impose any such additional conditions, but the approvals by Fairfield and Blacktown Councils did require compliance with section 2

of the clause 64 report, with the exception of clause 2.2.2.4 (this appears to have been the intention of the Fairfield Council approval, though it was not clearly expressed).

Exhibit 16 also contained a schedule of "agreed scope of work" for development approval conditions. The schedule said "AWS scope of works in relation to Part 2 of the Determining Authorities [sic] report is contained in Schedule 28 of the [contract]".

In view of the conclusion I have reached in relation to the meaning of clause 2.2.4.4 of the clause 64 report, it is not necessary for me to consider what the consequences would have been, in relation to the development approvals, if clause 2.2.4.4 had imposed a performance standard of 99.9% (3 log) removal or inactivation of pathogens.

Construction and commissioning

The contract required works delivery to take place in accordance with quality assurance plans and other technical requirements with provision being made for progress reports and auditing of compliance.

The contract provided a period of just under three years, starting from the date when certain conditions were satisfied, for construction and commissioning of the plant. Failure to meet that date would have resulted in the payment of financial penalties to the Board by AWS.

The Board's obligation to make payments for water to AWS under the contract did not start until the plant had been successfully commissioned. The process of commissioning included a 30-day operating trial during which time the plant was required to satisfy the commissioning criteria specified by the contract for 25 days, including all of the last five days of the trial. The commissioning criteria were more rigorous than the water quality criteria the plant was to meet during the operating phase. For example, the commissioning criteria required two hourly tests for turbidity with a maximum allowable reading of 0.5NTU (equal to the relevant water quality criteria) but a daily average of not more than 0.3NTU.

Operating phase

Clause 10 of the contract regulates the operation of the plant. Clause 10.1 provides:

"During the Operating Phase, the Partnership shall operate the Works and Assets in accordance with Good Operating Practices, the EIS Determination and otherwise in accordance with the terms of this Agreement."

Performance standards

The contract imposes performance standards upon AWS, as operator of the Prospect plant, for the quantity and quality of water delivered by the plant. The plant is required to receive and process up to 3,000 megalitres of water per day. The quantity

and rate of delivery is regulated by the Prospect Operational Protocol, a document which forms part of the contract as an exhibit.

AWS is also obliged to process the raw water supplied to it by the Water Board so that it satisfies the "water quality criteria" defined by the contract. These criteria are set out in a schedule. The important criterion, for present purposes, is that of turbidity. This is a measure of the cloudiness of the water. AWS is required to achieve a turbidity of not more than 0.5 NTU in its filtered water. However, this obligation is only applicable provided that the raw water supplied to it by the Water Board does not exceed 40 NTU. These were appropriate standards at the time but should be reconsidered, in the light of contemporary knowledge and expectations. They will be addressed in the Final Report of the Inquiry.

If AWS fails to meet the water quality criteria the contract provides for penalties by reducing the tariff payable to it by the Water Board.

The contract also provides "water quality objectives" for which a breach carries no penalty. The contract merely requires AWS to "endeavour" to operate the plant so that the treated water satisfies these objectives. The water quality objectives include a goal of less than 0.3 NTU turbidity, which is a more rigorous standard than that provided by the water quality criteria.

The schedule to the contract which sets out the water quality criteria and water quality objectives is an appendix to this report.

A further schedule to the contract lists the testing regime for each of the water quality criteria. In relation to turbidity, this includes measurement in the storages, in the raw water provided to the plant, in the treated water provided by the plant (six hourly tests with data provided to the Board on-line), at key points in the system and at the consumers' taps. The Board has the right to have the tests carried out by AWS independently audited.

The contract provides for a quality assurance plan for the operation of the plant and for auditing of compliance with the plan.

Chlorine levels

The water quality criteria do not include the elimination of coliforms as required by the 1987 NHMRC Guidelines. This is because clause 10.9 of the contract, and the Prospect Operational Protocol which forms part of the contract, require AWS to operate the water filtration plant and the associated chloramination plant to achieve chlorine levels specified by the Board. The Board thus reserves to itself the responsibility to determine chlorine levels necessary for appropriate disinfection. The performance standard for chlorine levels is the extent of compliance with the levels required by the Board.

The contract provides for the sale of the Board's chloramination plant to AWS for \$7.5 million, with a consequential adjustment to the tariff to be paid to AWS by the Board.

Emergencies

When the Board becomes aware of an emergency, it is required to give AWS a reasonable period of time to deal with it. If it does not do so, the Board may take any action it considers necessary to overcome the emergency, including shutting down the plant or directing employees and agents of AWS on the operation of the plant.

If the emergency is due to some fault on the part of AWS, the Board's costs of dealing with it are to be reimbursed by AWS.

Tariff structure

The tariff structure payable by the Board to AWS under the contract has two components: an availability charge and a usage charge.

The availability charge is designed to cover a portion of AWS' fixed overheads, including financing costs. It is a daily amount payable to AWS for making the plant available. The Board is liable to pay this amount regardless of the quantity of water provided by AWS.

The daily usage charge is the amount paid by the Board for each megalitre delivered by AWS. The charge is calculated in accordance with formulae set out in a schedule to the contract. There is no guaranteed minimum usage charge but usage charge rates vary depending upon the volume of water required by the Board and other factors.

If AWS fails to meet the performance standards in the contract, provision is made for the tariff paid by the Board to be adjusted. A schedule to the contract sets out the formulae for determining the extent of the reduction in the tariff if AWS is unable to meet the quantity of water required or if it fails to meet the water quality criteria. The formulae take into account the importance of individual criteria and the severity of the failure to comply.

No reduction is made in the tariff if a failure to meet water quality criteria is a result of the Board supplying raw water which does not meet the raw water criteria or a result of AWS complying with the Board's directions to vary the target level for chlorine residuals, chlorine to ammonia ratio, pH or fluoride. No reduction is generally made in the tariff if a failure to meet water quality criteria results from an emergency not due to the fault of AWS.

Provision is made for adjustment to the tariff to take into account upgrades to the plant requested by the Board. The tariff may also be adjusted to take into account increased (or decreased) costs of operation resulting from a change in the law or the requirements of a relevant authority, for example, in relation to health or environmental requirements.

Research requirements

Clause 10.29 of the contract provides:

"The partnership shall ensure that research and development is carried out at the WFP [water filtration plant] in accordance with Schedule 14 with the objective of optimising both the Partnership's Treatment Processes and the WFP as part of the Board's Water Supply System."

Schedule 14 deals with the aims of the research and development program, its management reporting procedures and budget. The schedule also contains an

indicative list of topics recommended for consideration by the proposed management committee as areas appropriate for research and development. The five topics include:

"*Giardia* and *Cryptosporidium* monitoring in raw water sources and overall removal process efficiency."

Upgrading the plant

The contract also makes provision for possible upgrading of the plant. This is significant for there is no doubt that, combined with research and increasing scientific understanding, the need for upgrading at some future date was clearly contemplated. Clause 17.3(a) provides for upgrading in a variety of specified circumstances:

"The Board may at any time by notice to the Partnership ... request the Partnership to upgrade, expand or alter the Works or the Assets or to change the partnership's Treatment Processes for any reason, including, without limitation:

- i. the availability of new technology, within Australia or overseas;
- ii. the Board desiring or being obliged to change the quality of treated water it provides to its customers;
- iii. a change in the Board's customers' patterns of demand for water;
- iv. a change in the quality of Raw Water; and
- v. a Change in Law."

Provision is made for the consequences of such upgrades, including changes to the tariff to be charged to the Water Board, and to the performance standards required of AWS under the contract.

Default and termination

The contract lists a number of possible breaches by AWS, which are said to constitute "events of default". These include, in relation to the operation of the plant:

- i. abandoning the plant;
- ii. failure to operate, maintain, modify or repair the plant in accordance with the contract;
- iii. failure to ensure that the plant continues to have the capacity to process the volume of water specified by the contract;
- iv. failure to rectify non compliance with water quality criteria within five days of receiving a notice from the Water Board to do so;
- v. transfer of its right to own and operate the plant without first obtaining the Water Board's consent;
- vi. insolvency;
- vii. acts vitiating insurance cover;
- viii. default by AWS under specified collateral agreements which is likely to affect AWS' ability to comply with its obligations under the contract; and
- ix. failure to comply with obligations to effect upgrades to the plant under clause 17.

AWS may request a reasonable extension of time, within set limits, and submit a program for remedying the event of default. The Board is obliged to agree to this course if the program and timing are reasonable.

The Water Board may be guilty of an event of default by failing to make required payments to AWS or by breach of other obligations under the contract.

The contract provides for the service of a notice for an event of default and, if the other party fails to remedy a default within a set period of time, the party serving the notice may elect to terminate the contract. Following such a termination, ownership of the plant is to be transferred to the Board and AWS is to be compensated for the value of the plant. Formulae for the payment of compensation are set out in a schedule to the contract and take account of a number of factors depending upon which party is in default.

Chapter 19: Was there a contractual obligation to comply with clause 2.2.4.4 of the EIS Determination?

As I have indicated, clause 4.12(a) of the contract requires AWS to ensure delivery of the works in accordance with the terms of the EIS Determination and relevant development approvals. However, this obligation was modified by clause 4.12(e), which incorporates schedule 28. There was no reference to clause 2.2.4.4 in schedule 28 although sections 3-9 were excluded. Accordingly, clause 4.12(a) applies to clause 2.2.4.4 of the clause 64 report although this was probably not intended. I was told that the exclusion of sections 3-9 was to ensure that any obligations in section 7 were not included in the contract. However, as the obligations in clause 2.2.4.4 are separate, although no doubt derived from section 7, I do not believe the desired outcome was achieved. However, the intention of the parties is plain.

Clause 10.1 requires AWS to operate the plant in accordance with, among other things, the EIS Determination. Although there were specific performance standards in the contract, if the EIS imposed further requirements they were intended to become obligatory. It may have been that the consequence had cost implications. The plant may have required modification, which would have increased the tariff to the Water Board.

It is clear, irrespective of the financial consequences for either party, that it was intended that the plant should be provided and operated in accordance with the requirements of the clause 64 report. It could hardly have been otherwise if the requirements of the *EP&A Act* were to be met.

Mr John Shirbin, the partner at Clayton Utz advising the Board about the contract, appreciated the position. In a written report provided as part of his presentation to the Board on 20 April 1993 he confirmed:

"The WT Co [water treatment company] is obliged to comply with its Environmental Management Plan (an outline of which will be in a Schedule) and all environmental laws, licences and approvals, including the EIS Determination."

An executive summary of the proposed contract prepared by Clayton Utz on 7 July 1993, and provided by the Water Board to the Parliamentary Joint Select Committee upon the Water Board noted:

"The WT Company must operate the Water Filtration Plant in accordance with Good Operating Practices, the Technical Standards, the EIS Determination and all environmental and other laws and regulations. It must also comply with its Environmental Management Plan."

It follows from the form of clause 4.12(a) and clause 10.1 that clause 2.2.4.4 became a requirement of the contract. If it imposed a performance standard then the plant must meet that standard. Disinfection of the backwash was also required unless the Manager Bulk Water relieved the plant of this obligation.

Did the parties intend that AWS would be bound to remove or inactivate 99.9% (3 log) of pathogens?

During the preparation of the clause 64 report, the parties continued to negotiate the terms of the contract. Once the report was finalised, it was necessary to reconcile its obligations with the contractual obligations intended to bind AWS. If the clause 64 report provided obligations on the filtration plant outside the parameters already agreed for the contract, either the contract must be renegotiated or the project abandoned. The latter possibility was by this stage of the process almost impossible for the parties to contemplate. Because the environmental evaluation had been undertaken after the preferred tenderer had been chosen, difficulties in reconciling the environmental parameters with the contract were always a significant possibility.

This difficulty is evident from the correspondence, particularly between Shirbin and the Water Board. There are also a variety of file notes and some correspondence with AWS on the issue. The central problem was to find a way to incorporate the obligations of the clause 64 report in the contract and determine who, between the Water Board and AWS, would bear the costs of compliance.

On 22 July 1993 Freehill Hollingdale & Page, solicitors for AWS, sent Shirbin a list of comments on a draft of the contract. These comments included:

"In the definition of 'EIS Determination', it is assumed that copies of the determination and its related report [that is, the clause 64 report] will form Exhibit 7. We do not agree with this approach. The EIS and its report are too vague to constitute contractual obligations. We would have no objection if you were to summarise those parts of the EIS and the report which you consider ought to be contractually binding or, alternatively, confirm our existing proposal complies."

In an apparent reflection of his instructions, Shirbin made the handwritten note next to the comment:

"The EIS Determination has legal force. Must be complied with. We can't paraphrase it."

Discussion continued until, on 10 August 1993, Garling, bid manager for AWS wrote offering a draft document which was intended to resolve the issue. The document, Schedule X EIS Determining Authority's Report Scope of Work, stated:

"The Board and the Partnership have agreed that compliance with this scope of work will discharge the Partnership's obligations, under the WFA [water filtration agreement, referred to as the contract in my report], to meet the cost of compliance with the EIS and the subsequent Determining Authority's Report, as exhibited in this Agreement.

If subsequent interpretations of the Determining Authority's Report, by a Court or Authority with relevant jurisdiction, give rise to the obligation for the Partnership to carry out work and/or incur additional expense to that described in this scope of work, then the Partnership will be obliged to carry out such work and/or incur such additional expense. In such a case, the additional expense, including any Delay Costs incurred by the Partnership, will be reimbursed to the Partnership by the Board."

The proposed schedule sets out each of the modifications listed in section 2 of the clause 64 report and the extent to which each was to impose any obligations on AWS. As to clause 2.2.4.4, the proposed schedule stated:

"the Works have not been designed to ensure a minimum 3 log removal or inactivation (99.9%) of pathogens. The design described by this Agreement does not include disinfection of backwash supernatant. The Board will advise if and when an upgrade of the plant is required, under Clause 17 of this Agreement, to satisfy the requirements of this section."

Although the ultimate contract does not include these words, there can be no doubt that AWS was making it plain it would not be bound by a performance standard which required 99.9% (3 log) removal or inactivation of pathogens. The document concluded:

"General No other provision in the Determining Authority's Report results in an obligation to the Partnership which is not already satisfied by the terms of this Agreement."

The Appointed Board approved the project with AWS at its meeting on 19 August 1993, although negotiations continued and a further draft of the contract was produced on 25 August 1993. On the following day Shirbin wrote to Trickett, the DWP engineer in charge of the Prospect contract, and indicated that he had again reviewed the clause 64 report and Garling's Scope of Work schedule. He forwarded a draft schedule 28 and sought instructions as to whether any contractual obligations were to be imposed on AWS under clause 2.2.4.4.

Shirbin discussed the matter with Trickett on the same day. He was instructed that no work was required to be done by AWS in relation to clause 2.2.4.4. He understood

that as a consequence the Water Board did not require any contractual obligation to be imposed upon AWS arising from clause 2.2.4.4 of the clause 64 report.

On 3 September 1993 Garling faxed a revised schedule 28 to both Trickett and Clayton Utz. For relevant purposes this was the form of the schedule that appeared in the final contract. It made no reference to clause 2.2.4.4 . This was because it was intended that no contractual obligation would arise from the clause. The consequence was that, because of the form of clause 4.12(a) and clause 10.1, the parties had unintentionally created an ambiguous situation.

It is clear from Garling's Scope of Work schedule that a contractual obligation to remove or inactivate 99.9% (3 log) of pathogens was not acceptable to AWS. AWS knew the plant could not always achieve 99.9% (3 log) removal or inactivation, although I doubt that the DWP engineers were aware of this view.

The issue which the parties became concerned with in relation to clause 2.2.4.4 was who should pay for any disinfection of the backwash supernatant if this was required. It was clearly agreed that this would be the obligation of the Water Board. The negotiating parties never considered that a performance standard for removal of *Cryptosporidium* and *Giardia* would be imposed on the plant. If the Water Board required disinfection of the backwash, this would be an upgrading and dealt with under clause 17.

I am satisfied that, irrespective of the appropriate construction of the documents, neither party intended that AWS would be bound to achieve 99.9% (3 log) removal or inactivation of pathogens. It is my view that a court would not require AWS to accept such an obligation under the present contract.

Chapter 20: Why the Water Board did not include the removal or inactivation of *Cryptosporidium* and *Giardia* in the contract

Those responsible for the contract at the Water Board have given me four reasons for not including a specific requirement to remove or inactivate *Cryptosporidium* and *Giardia* in the contract itself.

1. The efficiency of removal or inactivation of *Cryptosporidium* and *Giardia* could not be effectively measured.
2. There was a standard for turbidity in the contract, which was an appropriate surrogate measure for *Cryptosporidium* and *Giardia*.
3. They were confident that the plant would in fact remove or inactivate 99.9% (3 log) of *Cryptosporidium* and *Giardia*.
4. They were awaiting directions from health authorities.

Each reason deserves examination.

Could the plant's efficiency of removal or inactivation of *Cryptosporidium* and *Giardia* be effectively measured?

During the course of the Inquiry, it has been put to me by the parties to the contract that the difficulties of measuring the removal or inactivation of *Cryptosporidium* and *Giardia* made it impossible to impose this obligation on AWS. This statement is at odds with the claim made by some of the DWP engineers that they believed from overseas experience that a plant of the designated type would take out 99.9% (3 log). Furthermore, I can find no evidence that this position was put to the EMU or Wilson, or indeed identified by anyone as a problem. It is not mentioned by Manzi in his memorandum of 8 April 1993. It is clear that recent events have demonstrated the difficulties of measuring the efficiency of removal of pathogens, but I am not persuaded that this was the reason this obligation was not imposed in 1993.

Garling tells me if the Water Board had sought to impose the obligation "the first question we would have asked is, 'okay, how are we going to measure it?'" This suggests that the issue was never raised.

Was turbidity an appropriate surrogate measure for *Cryptosporidium* and *Giardia*?

I am satisfied that in 1993 it was common to relate the efficiency of a filtration plant to its capacity to reduce the turbidity of the raw water. There was also considerable interest at the time in particle counting as a measure of efficiency. Whether there is a true correlation between either measure and the removal of pathogens was then, and is today, a matter of uncertainty.

Manzi tells me that "(t)he water filtration contract ... contained a surrogate measure of 3 log removal, expressed as a turbidity specification and ensured by good operating practice, which reflected the only practical method of requiring three log removal, and which reflected best international practice at the time."

I am not satisfied that the turbidity parameters in the contract which were taken from the US EPA *Surface Water Treatment Rule (SWTR)* could be assumed to provide 99.9% (3 log) removal or of both *Cryptosporidium* and *Giardia*. In fact the two concepts are not necessarily related. This was made plain by the Aquatech report. Treated water of acceptable levels of turbidity may not have required a specific level of reduction of pathogens. AWS' refusal to accept a contractual obligation to remove 99.9% (3 log) indicates that they did not accept that the turbidity parameters would ensure 99.9% (3 log) removal.

Nevertheless I am satisfied that the turbidity levels provided in the contract were appropriate at the time. As I have explained, the contract could not have provided 99.9% (3 log) removal or inactivation of *Cryptosporidium* and *Giardia* and, by imposing turbidity levels consistent with world's best practice, the engineers of the DWP acted appropriately.

Could the Water Board be confident that the proposed Prospect plant would remove or inactivate 99.9% (3 log) of *Cryptosporidium* and *Giardia*?

An important reason advanced to me by officers and former officers of the Water Board for not specifying a requirement for the removal of *Cryptosporidium* and *Giardia* is that they were satisfied from their own inquiries that the plant would achieve 99.9% (3 log) removal or inactivation. This view was published in the clause 64 report and was included in the Water Board's submission to the Parliamentary Joint Select Committee on the Water Board, presented on 30 July 1993. The view was communicated to Broad, the Managing Director, and he, in turn, made public statements to this effect and informed the Minister.

If the officers were confident that 99.9% (3 log) removal or inactivation could be achieved, it is difficult to understand why it was not included in the contract. However, the conclusion itself should be tested. It is doubtful whether the belief should have been sustained in light of the written advice of AWS on 28 July 1993, which stated:

"As you are aware, the Prospect WFP has not been specifically designed to remove *Cryptosporidium* and *Giardia*. However, filtration processes are generally acknowledged to remove significant proportions of micro-organisms such as *Giardia*."

and the letter of 10 August 1993, enclosing Garling's "Scope of Work" document which noted:

"The works have not been designed to ensure a minimum 3 log removal or inactivation (99.9%) of pathogens."

Manzi says he interprets AWS' qualification as the usual caution in commercial negotiations. As to the basis of his belief that the plant would take out 99.9% (3 log) of *Cryptosporidium* and *Giardia*, Manzi tells me:

MANZI: "(It was derived) from the testing and sampling that we had done and from what the international people had told us. In other words, we were advised by US EPA, for instance, in their rule, that a plant designed like this should provide 99.9% removal."

I have previously discussed that it may be inappropriate to interpret the US EPA SWTR as confirming 99.9% (3 log) removal or inactivation from the plant.

Trickett also says that he had a belief that the plant would provide 99.9% (3 log) removal or inactivation. He thinks that this was based upon the SWTR, which provides for removal or inactivation of 99.9% (3 log) of *Giardia* from a filtration plant with

appropriate disinfection. His evidence provides no basis for the assumption in relation to *Cryptosporidium*.

Nicholson was part of the DWP and involved in the program from its inception. He was the technical manager in charge of the proposed Macarthur plant. He says:

NICHOLSON: " ...The US *Surface Water Treatment Rule* was suggesting that for the type of technology that we were using you would get a minimum of 2 log removal, and that's the way they have gone. US EPA have never specified a log removal; rather, they have specified gone towards specifying credits for technologies. We believed that on the back of that, plus the fact that we had deep media beds, were using some polymer aids, polymers and polymer aids also on the basis of the pilot plant work and on the fact that at the time the requirements we had set on turbidity and other factors in the contract were going to drive the contractor to operate their plants pretty well."

The evidence of Browning and Murray reflects quite a different understanding. Browning states that:

BROWNING: "... it wasn't a tender evaluation criteria. If it had have been ... we would have been looking for a minimum of 2 logs removal. I mean, sometimes you can get two and a half. I'm talking about just over the filters. It's a physical removal, because disinfection will add half a log or so for, say, *Giardia*, but it doesn't do anything for *Cryptosporidium*."

Murray is asked:

QUESTION: "We've been told it was the view of the Water Board at the time that this plant would take out 99.9% (3 log) and therefore you just didn't have to worry about a contractual term, it was just known in the industry to be the case. How do you respond to that?"

MURRAY: "I think it's difficult to make that assumption because the only testing that had been done to our knowledge in Australia was based on a dual-media filter which wasn't even a tendered process and we got a number from that which was one day's testing, and looking at what was happening in the States there were a lot of water treatment plants that were having trouble achieving 80% removal of particles. Only very well-operated plants, well supervised, were achieving 99% removal of particles and there has been some talk that cysts are easier to remove than particles but I haven't seen any information to verify that. I'd say that it wasn't my understanding that it would automatically remove 99.9%, no. Certainly most engineers and scientists wouldn't assume that without checking with sound testing."

The seeding test

Manzi, Trickett and Roddy cite Hutton's *Cryptosporidium* seeding test in the pilot plant as a basis for forming the view that the Prospect plant would effect 99.9% (3 log) removal. The test produced a 99.99% (4 log) removal of *Cryptosporidium*. However, this finding should have been viewed with great caution.

The seeding test was conducted once only using a dual media filter (unlike the single media filter proposed for Prospect). The oocysts were added to the inlet of the filter in a large "spike" of 900,000 and 13 samples of the filtered water were taken at intervals thereafter. In a report produced in May 1993, Hutton said:

"These figures must be interpreted cautiously in the light of a number of factors. Only approximately 14% of the effluent from the filter was sampled. This means numbers of oocysts coming through the filter between 15 and 40 minutes may have reached peak levels that were considerably higher than those detected. The use of a large slug dose may also have affected the mechanism of removal. Natural contamination is likely to extend over a longer time and removal efficiencies may be different.

Le Chevallier et al (1991) investigated filtered drinking water supplies for the presence of *Cryptosporidium* oocysts. In the majority of plants investigated, removal efficiencies of 2-2.5 log₁₀ were achieved by clarification and filtration. Removal efficiencies found in this experiment were much greater than those reported. However, Ongerth et al (1989) reviewed research into filtration performance. They found filtration plants experience three periods when filter efficiency is lower than normal: immediately following backwash, at the end of the cycle just prior to backwash, and when significant changes in flow rate, turbidity, or chemical treatment occur during a filter run. These periods of inefficiency have been confirmed by tests done on the Water Board plants. During these periods oocysts may be more likely to pass through the filter into the treated water. These conditions were not fully tested during this experiment, and removal efficiencies for the entire filter cycle are likely to be lower. In addition the filter bed used in this experiment was much deeper than those used in most full-scale plants, which may have resulted in more efficient removal."

Because of the limitations of the testing there is little support for a conclusion that the Prospect plant would achieve 99.9% (3 log) removal of *Cryptosporidium*.

Orchard Hills test

Reliance was also placed upon the results of testing filtration efficiency at the Orchard Hills plant. These indicated a removal efficiency for *Cryptosporidium* of 99.77% (2.88 log-sic). In a written statement provided to me, Manzi says:

"The Orchard Hills Water Filtration Plant best represented the Prospect Plant, because it used direct filtration. We expected the Prospect Plant to remove many more particles because:

- the Orchard Hills filters were a modified old design with overall media depth less than half of the Prospect depth
- no polyelectrolyte coagulant aid or filter aid were then used at Orchard Hills, whereas the Prospect plant would use both coagulant aid and filter aid. This would result in significantly increased particle removal."

These tests were conducted by Hutton in May and June 1993. The description of the Orchard Hills plant in Hutton's report states that it used a two-stage sedimentation and filtration process. That is, it used a conventional filtration process not direct filtration

(sedimentation prior to filtration can be expected to increase the rate of removal). The report also states that coagulation was enhanced by use of polymers.

The testing at Orchard Hills could not be used to reliably predict the degree of removal of *Cryptosporidium* at Prospect.

The conclusions in the report were based on a relatively small number of samples, with a total of 140 organisms recovered in raw water samples and three organisms recovered in treated water samples.

Moreover, the finding of 99.77% (2.88 log-sic) removal may be misleading. The calculation was made by comparing the average raw water concentration of *Cryptosporidium* with the average treated water concentration for all samples taken during the tests, including tests conducted on days when no *Cryptosporidium* was found to have been present in the raw water samples. A more valuable calculation would have been to determine the extent of removal for those tests conducted only on days when *Cryptosporidium* was found to have been present in the raw water samples. This would have indicated a substantially lower removal efficiency.

Use of such a small study, on a filtration plant which differed considerably from what was being proposed for Prospect, to predict *Cryptosporidium* removal rates was unreasonable.

It follows from consideration of all of the evidence that the Water Board was not entitled, at that time, to be confident that the Prospect plant would achieve 99.9% (3 log) removal or inactivation of pathogens.

Should the Water Board have waited for health authorities to specify requirements for *Cryptosporidium* and *Giardia*?

It is apparent that by 1993 the health authorities had not been able to specify requirements for *Cryptosporidium* and *Giardia*. This position remains today. However, various authorities have suggested that the issue should be approached by imposing performance criteria on filtration plants.

The position taken by Wilson was that rather than wait for the science to catch up, the Board should be pro-active in the matter.

Chapter 21: The decision not to disinfect the backwash

Report on need to disinfect backwash

Clause 2.2.4.4(a) of the clause 64 report required consideration by the Manager Bulk Water of the need to disinfect the backwash.

In November 1994 Trickett prepared a report on disinfection of the backwash waters to assist the Manager Bulk Water to make his decision.

The report has the curious preamble:

"The purpose of this report is to demonstrate that the processes proposed for the Prospect, Macarthur and Woronora Water Filtration Plants will satisfactorily achieve three (3) log removal of pathogens and hence disinfection of supernatant return will not be required."

The report noted that *Giardia* had only been detected once in tests of the Board's storages but that *Cryptosporidium* had been detected in all storages. The report observed that *Giardia*, being larger than *Cryptosporidium*, was more easily removed by filtration and that it was more susceptible to chlorine.

The report identified the following recorded *Cryptosporidium* removal efficiencies:

Survey of US plants 99%-99.68% (2-2.5 log) removal
North Richmond 99.34% (2.18 log) removal
Orchard Hills (during supernatant return) 99.77% (2.88 log-sic) removal
Prospect Pilot Plant (single run with spike) 99.99% (4 log) removal

The report said:

"The removal of *Cryptosporidium* at Orchard Hills and North Richmond Water Filtration Plants was inferior to the removal by Prospect Pilot Plant and may be attributed to:

- the large numbers of oocysts used in the pilot plant test;
- the use of filter aid at Prospect Pilot Plant (which will be used at Prospect, Macarthur and Woronora WFPs);
- a greater depth of media at the Pilot Plant (as will be used at Prospect, Macarthur and Woronora WFPs);
- the Pilot Plant (as is proposed for Prospect, Macarthur and Woronora WFPs) terminating the filter run at slightly lower turbidity than used at Orchard Hills and North Richmond; and
- the Pilot Plant process being fully optimised."

but noted:

"The number of oocysts detected in the raw water during testing at Orchard Hills and North Richmond was very low, a total of 140 from 60 samples at Orchard Hills and a total of 37 from 16 samples at North Richmond with zero oocysts detected in 16 and 5 samples respectively. With such few oocysts and such few samplings it is difficult to prove a removal rate of 99.9%. Also at Orchard Hills and North Richmond treated water samples of 100L and 1000L respectively were tested while at both plants 10L

raw water samples were used and this technique has probably distorted the calculated removal rates."

Nevertheless, the report concluded:

"From the data discussed above, it is reasonable to assume that the new water filtration plants will achieve three (3) log removal of pathogens and that disinfection of the supernatant return is unwarranted. This assumption should be confirmed after commissioning of the plants."

In reaching this conclusion the report also relied upon a finding that the use of polymer-enhanced sedimentation should remove 90% (2 log) of cysts from the backwash water before its return to the plant inlet.

The report made the following recommendations:

- "1. Disinfection of the supernatant before return to the plant inlet not be provided in the Prospect, Macarthur and Woronora Water Filtration Plants.
2. The Board monitor for *Cryptosporidium* in the raw water, filtered water and the supernatant return to confirm satisfactory removal.
3. The Board require the Water Treatment Companies to ensure that their plants are always run in an optimal manner for pathogen removal, and that turbidity is continuously monitored to indicate filter performance and the Board confirm this by regular audit.
4. The Water Treatment Companies be required to investigate the *Cryptosporidium* removal capability of their plants and the optimisation of their plants using particle counting as part of the Process Optimisation Agreements."

The decision of the Manager Bulk Water

Quill was the Manager Bulk Water and accordingly had responsibility under clause 2.2.4.4(a) to be satisfied that disinfection of the backwash supernatant was not necessary to ensure overall 99.9% (3 log) removal of pathogens.

Quill says that in reaching his conclusion that disinfection was not required he relied upon Hutton's seeding test and the later tests at North Richmond and Orchard Hills plants. Like Trickett, he considered that the deeper filter beds at the proposed plants, compared with Orchard Hills, would enhance efficiency. As to the objective of 99.9% (3 log) removal or inactivation of pathogens, he says:

QUILL: "... all I was aiming for was a turbidity related specification. The 99.9% figure came about in a very sort of circuitous way and I actually don't know where it originated from because through all of the discussions I've had with people like Trickett and Nicholson and Manzi and so forth, we were always talking about turbidity targets. That was always in the context of what the experience was in the States where they had a design rule which required 0.5 NTU turbidity and with that sort of level of treatment on the raw water you would have you know, the expectation was that you would get a very high level of removal."

It is apparent that Quill was confused about the basis upon which his determination was to be made. In order to dispense with disinfection of the backwash waters, he had to be satisfied that the plants would achieve 99.9% (3 log) removal or inactivation of pathogens. However, in his evidence he referred to measures of turbidity and the requirements of the contract and it is not clear whether he made this decision on the basis required by clause 2.2.4.4.

He says:

QUESTION: "As I understand this report, it's all about identifying whether you'll get 99.9% removal, isn't it? ..."

QUILL: "Yes, yes. Except the contract never called for 99.9% removal."

On another occasion he says:

QUESTION: "As I understand this report the removal efficiency you were aiming for was 3 log. Is that right?"

QUILL: "I think this is where the difficulty is in my mind because I can't separate the determining authority's report from the actual specification for the plant."

and:

"...I was asked to make a decision based on information that I had been given whether or not disinfection of the supernatant was required. Now, the information that was given, together with other knowledge that I had, convinced me that we could safely not disinfect the supernatant and still achieve the performance required from the plant.

QUESTION: "Was that performance 3 log removal?..."

QUILL: "I agree with it in that sense, but I can't divorce myself on the other hand from the requirements of the contract. That's the problem I have."

When asked whether the report demonstrated 99.9% (3 log) removal or inactivation, Quill says:

QUESTION: "... as you appreciate the numbers in this report wouldn't themselves lead you to that conclusion."

QUILL: "If you just simply read this report ... on its own, literally, you could form the view that you're putting to me. However, the problem I've got is I can't simply take this report in isolation from the other information that I had access to and the knowledge that I had; that's the problem."

QUESTION: "But you can't show me any report or any document."

QUILL: "No, I can't."

Whatever may have been the process by which the decision not to disinfect the backwash was made, the contemplated monitoring was implemented.

The results of analyses submitted to me have not indicated a problem with *Cryptosporidium* and *Giardia* at Prospect under normal operating conditions. However, it is clear that under some circumstances, the plant may not perform at its optimum and treating the backwash waters should be considered. The matter is further discussed in the Final Report.

Chapter 22: Approval by the Appointed Board

Briefing the Appointed Board

I have previously indicated that the Appointed Board changed during the tender process. The new Board took office in February 1993 and thereafter received regular reports on the proposed water filtration plants.

In early April a detailed presentation was made. Although this concentrated on the financial aspects of the projects, it appears the summary technical evaluation sheets for each of the projects dated 13 November 1992 were tabled at that meeting.

The Board members requested a presentation on the draft contracts to ensure that they understood "the commitments covered by the contracts". Shirbin, the solicitor acting for the Water Board in relation to the contract, made this presentation to the Operating Executive on 16 April 1993 and then to the Appointed Board on 20 April 1993. Goyal, and Mr Mick DeGiorgio, the Board's Senior Solicitor, were in attendance with Shirbin at the Board meeting for the presentation. The minutes do not record any discussion on the removal of pathogens.

The briefing paper prepared by Shirbin and submitted to the Board refers to the requirement that the plant operator comply with the EIS Determination and that the Board will bear "the risk of any challenge by any group to the EIS Determination or the development approvals". There is no reference in the briefing paper to the removal of pathogens. I also note that neither Manzi nor anyone from the EMU was in attendance during the presentation to the Appointed Board.

I am satisfied that although the Appointed Board was advised that the EIS process was being conducted, it was not made aware of any issue concerning the removal of pathogens.

Broad determined the EIS on 11 June 1993. This was reported to the Appointed Board at its meeting on 13 July 1993. The Managing Director's report also referred to recent "sensational reports in the media about the health risks posed by the possible presence in drinking water of *Cryptosporidium*". This was a reference to public statements made by Mr John Archer, author, on the presence of *Cryptosporidium* in the water supply. On 6 July 1993 he and Manzi had been interviewed on radio and Archer

suggested that people should be warned to boil their water. Manzi responded by confirming that *Cryptosporidium* had been found in the water supply but that, following discussions with the Department of Health, the Board did not believe there was a need to boil water. Manzi also said that the proposed water filtration plants would enable the Board to "manage and guarantee the safety of Sydney's water". The matter attracted considerable media attention. On the following day the Department of Health issued a press release seeking to reassure people. It stated that the Department did not recommend people their boil water but that "if people with a severely lowered immune system choose to boil their water on the advice of their doctor" then that was "fine".

The Managing Director's advice to the Appointed Board was that "the publicity surrounding this matter has helped to raise public consciousness of the need for the Drinking Water Program and the Water Treatment Plants in particular".

In August, the Board obtained a report from Macquarie Corporate Finance Limited entitled Report on the Commercial and Financial Arrangements of the Water Treatment Plants. Manzi's progress report to the meeting of the Appointed Board on 10 August 1993 stated that Macquarie Bank "considered that the current commercial and financial arrangements are generally in accordance with the Board's commercial principles. They believe that these contracts are breaking new ground in Australia and hence cannot be compared with the normal commercial practice. The Bank also found that the logic behind the detailed analysis of the Board's computer modelling of their [sic] financial impact of the Projects is sound. The Bank has not raised any major concern but have [sic] highlighted possible risks on some issues that are still being negotiated".

The minutes of the meeting of the Appointed Board on 10 August 1993 do not record whether there was any detailed discussion about the negotiations for the Prospect contract. Again Manzi's briefing paper did not refer to the removal of pathogens. However, the paper did note that the tender had expired on 16 July 1993 and that management was negotiating with the tenderer on the additional costs to be paid by the Board as a result of the delays in signing the contract. It is clear that by this time there was increasing commercial pressure on the Board to sign the Prospect contract.

The Prospect project is approved

On 19 August 1993 the Appointed Board approved entering into the Prospect project with AWS. It also approved entering into the Macarthur project with North West Transfield.

At that meeting the revised costs of the Prospect project were submitted to the Appointed Board. The net present value of Prospect was now assessed at \$270 million. This was a reduction of \$15 million in the November 1992 net present value assessment that had been used as the basis for selecting AWS as the preferred tenderer for Prospect. Although the revised valuation included the increased costs associated with variations to the tender and delays in commencing the project, it also took into account reduced water demand projections that reflected the Board's current demand

management strategies. There was also a reduction in interest costs to reflect anticipated lower interest rates.

Broad was appointed as the Water Board's Attorney to "sign all documents" and "to do all things necessary on the part of the Water Board in relation to the documents" to give effect to the Prospect project.

The contract for the Prospect Water Filtration Plant was approved by the Minister under section 12(4) of the *Water Board Act 1987* on 6 September 1993 and was signed on 10 September 1993. The contract in its final form was not submitted to the Appointed Board for approval as this had in effect been delegated to the Managing Director.

Chapter 23: Were the Board's decisions appropriate?

The final decision to appoint AWS as the preferred tenderer for the Prospect Water Filtration Plant turned on two factors, price and technological capacity. AWS offered a price which was assessed to be significantly less than the other two consortia which tendered for this plant. However, AWS was unable to "entirely satisfy" the Board about its filtration technology before it was selected as the preferred tenderer. It was prepared to give a guarantee that it would use anthracite in its filters (as proposed by the other tenderers) in the event that it could not produce the required filter run times using its preferred sand media.

I am satisfied that the process by which the Water Board selected AWS was appropriate. However, some aspects require comment.

I believe the "packaging decision" at the tender stage, which excluded the preferred tenderer for Prospect from being awarded any other water filtration project, had some inherent risks. It provided the opportunity for a tenderer willing to take the risk to bid only for Prospect. AWS did this and successfully enhanced its chances of success. The Water Board's decision to exclude the preferred tenderer for Prospect from winning another project had the potential to reduce the competitiveness of the overall tender process. It could have been forced to accept the tender which was neither the lowest price nor the most technologically superior for Prospect. Fortunately for the Water Board, AWS was the lowest tenderer for Prospect by a significant margin, there being approximately \$40 million difference, in net present value terms, between AWS' tender and Wyuna's price. Although AWS had a difficulty in proving its technology, this difficulty was overcome by the guarantee.

In the circumstances of this Inquiry, a most significant matter is the question of whether the contract should have required removal or inactivation of 99.9% (3 log) of pathogens. I have explained the sequence of events. I am satisfied that, because of the statements made by the DWP engineers to those responsible for the clause 64 report,

the clause 64 report assumed that the plant was capable of achieving 99.9% (3 log) removal or inactivation of pathogens and intended to impose this criteria as a performance standard on the plant. However, the relevant clause failed to make good this intention.

I am also satisfied that it was the intention of Wilson and the EMU that the rate of removal of *Cryptosporidium* should be used to define the operating efficiency of the plant. If this could not be done, Manzi should have taken the matter to Broad for further consideration. The issue should not have been left to the ambiguous drafting in the clause 64 report.

A great deal has been learnt about *Cryptosporidium* and *Giardia* and water treatment since 1993, particularly during the recent events. I am satisfied that if 99.9% (3 log) removal or inactivation of pathogens had been imposed as a requirement under the contract, it would have been difficult to audit compliance. It would not have been effective as a contractual term. Accordingly, although the intention of the authors of the environmental determination may not have been embodied in the contract, the failure to include 99.9% (3 log) removal or inactivation as a contractual term is of no practical consequence. Furthermore, I am satisfied that, if the Water Board had required AWS to achieve 99.9% (3 log) removal or inactivation of pathogens, this would have led to a far more expensive plant. On the evidence available at the time, additional expenditure on water treatment would not have been appropriate.

The Water Board did impose obligations on AWS to achieve defined maximum levels of turbidity in filtered water. These levels were assumed to be an adequate means of defining water quality. The levels chosen were appropriate having regard to the contemporary circumstances.

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Appendices

A Letters Patent

NEW SOUTH WALES

ELIZABETH THE SECOND, by the Grace of God, Queen of Australia and Her
other Realms and Territories, Head of the Commonwealth.

To Mr Peter David McClellan QC

By three Our Letters Patent, made and issued under the authority of the *Royal
Commissions Act 1925* and in addition to your Commission dated 5 August 1990,
We hereby, with the advice of the Executive Council, authorize you as
Commissioner to inquire into and report to Our Premier of the said State on the
following matters:

- (1) the process of calling and evaluating tenders and awarding the contract for
the construction of Prospect Water Filtration Plant; and
- (2) the preparation and terms of that contract.

to the extent that such matters are relevant to your Commission dated 5 August
1990 to inquire into the management of the outbreak of Cryptosporidium and
Giardia in Sydney's water supply.

AND OUR further will and pleasure is that you do, as expeditiously as possible,
but in any case on or before 17 November 1990, deliver your report in writing of
the results of your inquiry to the office of Our Premier in Sydney with, or as
part of, your report pursuant to your Commission of 5 August 1990.

AND pursuant to s. 25 of the *Royal Commissions Act 1925* it is hereby declared
that Division 2 of Part 2 of that Act, and in particular s. 17 of that Act, shall
apply to and in respect of the Commission the subject of these Our Letters
Patent.

Entered on Record by me, the Registrar of Writs, on 17 October 1990, page 104 of the Record of Proceedings and Filings - 40998.

John Robert Clarke
Registrar of Writs
17 October 1990

IN TESTIMONY WHEREOF, WE have caused these Our Letters to be made
Patent and the Public Seal of Our State to be hereunto affixed.

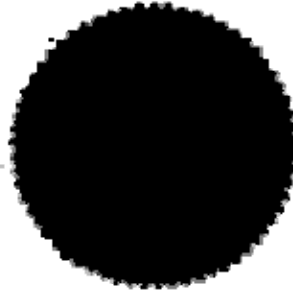
WITNESS His Excellency The
Honourable Gordon Satchell,
Companion of the Order of
Australia, Governor of the State of
New South Wales in the
Commonwealth of Australia.

Dated this ~~21st~~ 22nd day of October 1998.

By His Excellency's Command,


Governor.


Governor.



B Prospect WTW Contract No. 8193 Summary Table of Evaluation (as at 16.9.92)

CONSORTIUM EVALUATION ASPECT	NSW WATER SERVICES	WYUNA WATER	
1.Environmental Assessment	1. Future expansion destroys rare Acacia 2. Very little surplus construction spoil.	1.Rare Acacia and Spotted Gum Impacted 2.Pumping residuals minimises impacts.	1.R 2.R 3.N
	NOT ACCEPTABLE - ranking 2 (GOOD with 30m shift of CWT)	NOT ACCEPTABLE - ranking 1 (GOOD with minor earthworks mods)	(AC
2.Project Delivery Assessment	1. No works program 2. Surface drainage problems 3. Coffe dam design problems 4. RWPS needs improvement 5. Early construction access problems	1. Good coffe dam proposal. 2. Licences/Approvals not acceptable 3. Higher raw water demand	1. L 2. M 3. F 4. F 5. F 6. F
	NOT ACCEPTABLE - ranking 2	NOT ACCEPTABLE - ranking 1	
3.Process Assessment	1. Multiple flow paths. 2. Filter media performance at prototype/pilot plant during filter run and backwash poor. 3. Chemical storage minimal. 4. Residuals handling system design minimal. 5. Low channel velocities.	1. Process tested successfully 2. Baffled tanks/mechanical mixing 3. Conservative residuals treatment 4. Multiple flow paths. 5. Fluosilicic Acid proposed 6. No pH lowering chemical proposed. 7. Flowmeters not defined.	1. M 2. M 3. M 4. M 5. M 6. M 7. M
	NOT ACCEPTABLE - ranking 2	ACCEPTABLE - ranking 1	(AC
4.Operation Assessment	1. Clear water tank size small 2. Reservoir bypass - out of service long time 3. Chemical storage on reservoir side channel	1. Minimal downtime of by-pass channel 2. Residuals pumped to quarry. 3. Redundancy built into all plant design	1. L 2. L 3. L
	NOT ACCEPTABLE - ranking 3	GOOD - ranking 1	
5.Overall Ranking	2	1	

**C Prospect WTW Contract No. 8193
Summary Table of Evaluation (as at
24.9.92)**

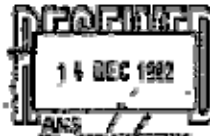
CONSORTIUM EVALUATION ASPECT	NSW WATER SERVICES	WYUNA WATER
1.Environmental Assessment	1. Future expansion destroys rare Acacia - 2. Very little surplus construction spoil +	1.Rare Acacia and Spotted Gum impacted - 2.Pumping residuals minimises impacts +
	GOOD subject to 30m shift of CWT ranking 2	GOOD subject to minor earthworks modifications - ranking 1
2.Project Delivery Assessment	1. Surface drainage problems - 2. Coffor dam design problems - 3. RWPS needs proving - 4. Early construction access problems -	1. Good coffer dam proposal + 2. Licences/Approvals not acceptable - 3. Early construction access not addressed - 4. Residuals waste depot detail poor -
	ACCEPTABLE subject to resolution of the above - ranking 2	ACCEPTABLE subject to resolution of the above - ranking 1
3.Process Assessment	1. Multiple flow paths + 2. Filter media performance at prototype/pilot plant during filter run and backwash poor - 3. Chemical storage minimal - 4. Residuals handling system design inadequate - 5. Low channel velocities -	1. Process tested successfully + 2. Baffled tanks/mechanical mixing + 3. Conservative residuals treatment + 4. Multiple flow paths + 5. Fluosilicic Acid proposed - 6. Flowmeters not defined -
	ACCEPTABLE subject to resolution of 2&4 above - ranking 3	GOOD - ranking 1
4.Operation Assessment	1. Clear water tank size too small - 2. Reservoir bypass - out of service long time - 3. Chemical storage on reservoir side channel -	1. Minimal downtime of by-pass channel + 2. Residuals pumped to quarry + 3. Redundancy built into all plant design +
	ACCEPTABLE subject to increase in CWT size - ranking 3	GOOD - ranking 1
5.Overall Ranking	ACCEPTABLE 2	GOOD 1

D AWS Letter to Sydney Water dated 10 December 1992



NSW Water Services Pty Ltd
ADDRESS
GPO, Box 541,
487 East Street
Sydney NSW 2001
Australia
Tel 02 285 9416
Fax 02 285 9455

Mr David Menz
Manager
Drinking Water Quality Program
Sydney Water Board
P.O. Box 2
GULDFORD NSW 2164



10th December, 1992

Dear Sir,

Re: Warruput Water Treatment Plant - Contract #193

Following the technical evaluation programme that the Water Board has undertaken on the tendered process of NSW Water Services, we would like to confirm our commitment to the following principles and undertakings:

- (i) The responsibility for the effectiveness and efficiency of NSW Water Services' process design will remain with NSW Water Services ("NSW WS") at all times under the terms of the Water Treatment Agreement. The technical evaluation programme undertaken by the Water Board and acceptance of the NSW WS bid will not result in the Water Board taking any liability or responsibility for the efficiency of the NSW WS process.
- (ii) Any upgrade to the process that becomes necessary in order to meet the initial requirements of the draft Water Treatment Agreement ("WTA") will be carried out by NSW WS with no resultant change to the tariff or cost to the Water Board.
- (iii) Without limiting the general undertakings given in (ii) above, NSW WS will, at its own cost:



- should the crushed sand media not prove adequate, change the media to anthracite provided the anthracite shows satisfactory results ;
- size residuals thickener capacity to handle backwash production based on three backwashes per day ;
- size residual centrifuge capacity to handle the solids loading at maximum flow of "design" raw water ;
- provide hydraulic scouring system in the inlet channels to prevent settling of slimes under low flow ; and
- make final selection of chemical dispersion system following additional testing during preferred tenderer stage.

Should you have any queries regarding the above, please do not hesitate to contact the undersigned.


P. M. Kelly
Managing Director

Noted and accepted to make a file


H/12

Robert Tindall

E Clause 7.7.3 in the clause 64 report

- For a few conventional plants in California, the supernatant is returned to the inlet of the filter, in the outlet of the clarifiers. This process has been shown to degrade filter quality to some extent and definitely reduce filter run times.
- For some smaller plants, the filter wastewater is equalized and then returned to the front of the plant for solids removal in the clarification process. This approach is not considered desirable by most regulators but if the clarification process is appropriately sized and the coagulation system can be appropriately balanced, this technique can be effective.
- A practice that has been discontinued in the United States, but was effective, was to return the filter wastewater to the source water (impoundment) ahead of the plant and allow the solids to settle and then recycle the wastewater. This has been discontinued due to discharge regulations.

To address the increasing concern regarding the presence of protozoan cysts in drinking water, some utilities are starting to disinfect their supernatant recycle flow with either ozone or ultraviolet light. Chlorine disinfection of the recycle flow is not so common due to concerns about generation of chlorine disinfection byproducts. Recycle flows have been identified in England as contributing to a Giardiasis episode.

Filter wastewater solids (mudcake) are separated and disposed of via several different means including:

- coagulant assisted equalization/settling basins with residuals disposed to a surface water. This is not commonly practiced and violates regulations in most areas of the US;
- coagulant assisted equalization/settling basins with residuals disposed to the sewer;
- coagulant assisted equalization/settling basins with mudcake drying beds, and ultimate land disposal of dried residuals;
- coagulant assisted equalization/settling basins with residuals drying lagoons having a six-month filling/drying cycle, and ultimate land disposal of dried residuals;
- coagulant assisted equalization/settling basins with further downstream thickening and conditioning followed by mechanical dewatering and ultimate land disposal of dried residuals;
- coagulant assisted equalization/settling basins with residuals applied to land treatment and disposal.

Disposing of solids residuals to a surface water is still practiced by some utilities in the US, but this practice is becoming increasingly rare as both residuals disposal and surface water discharge regulations become more stringent.

Land disposal of residuals is accomplished in one of basically two methods:

- landfill (as specified)
- land application or spreading.

Disposal of settled residuals to the sewer is generally the least capital cost. It may have a high operating cost, however, depending on sewer capacity. In some instances, however, sewer capacity is not available, so either drying beds, lagoons, or mechanical dewatering is required. If land is available and relatively inexpensive, then either drying beds or lagoons may be preferred. When land is not available or is relatively expensive, mechanical dewatering often becomes the best residual handling option.

In general, European practices are similar to contemporary US practices.

Conclusion

Following examination of overseas practices it is concluded after considering other alternatives, that the recycle method of handling filter backwash supernatant is the most appropriate. The Water Board will consider disinfecting the recycle stream as Chlorin and Cryptosporidium organisms have been detected in the water supply.

Modifications to the Activity

The Water Board will require the water treatment company operator to return the filter backwash supernatant to the head of works after being treated by disinfection unless disinfection can be shown to not be required to the satisfaction of the Water Board's Manager Bulk Water to ensure removal of pathogens so that the overall treatment process ensures a minimum 3 log (99.9%) removal or inactivation of pathogens.

The Water Board will continually monitor the management of filter backwash supernatant and ensure that best available technology economically achievable is adopted at the Prospect WTP as better information becomes available on pathogens in drinking water.

7.7.3 SUPERNATANT FROM FILTER WASHWATER

Submission No. P31.

The submission stated that as Prospect Reservoir is 'Specially Protected Waters' under the Clean Waters Regulations 1972 the discharge of wastes to the Reservoir would not be permitted.

The concept design for the Prospect Water Treatment Plant includes the disposal of filter backwash water supernatant to Prospect Reservoir.

The EPA has indicated that discharge to the Prospect Reservoir would not be permitted. The most appropriate alternative method of disposal is by recycling to the plant inlet but this will have an impact on the treated water quality in regard to viruses and parasites. Of concern to the Water Board are the possible protozoan cysts of *Giardia* and *Cryptosporidium* which have been identified as possible contaminants.

A separate study titled *Water Treatment Plant Filter Washwater (1993)* considers the likely effect of a system which returns the supernatant to the plant inlet after it has been treated by chlorination (sedimentation) in regard to these parasites. It addresses concerns with regard to water quality.

The report outlines the options for disposal of filter washwater supernatant which include:

- return to the plant inlet
- discharge to adjacent dam storage
- discharge to sewer system.

Discharge to the sewer system would probably be relatively viable at Prospect in regard to proximity to existing sewer infrastructure.

A recent study by PPK (1997) titled *Feasibility Study for Disposal of Sludge from Prospect WTW to the SHSOS* concluded that disposal of the residuals to the sewer would not be acceptable as a general practice due to limited hydraulic capacity, existing problems with surcharges and overflows, and contravention of the Water Board's trade waste policy.

Under the Sydney Water Board's proposed 1994 Trade Waste Policy the discharge of water treatment residuals or washwater supernatant would not be permitted without pretreatment to reduce suspended solids to less than 200 mg/L and aluminium, iron and manganese to less than 100 mg/L, 50 mg/L and 10 mg/L respectively.

Discharge to adjacent dam storage is possible at Prospect. However the EPA will not permit this method due to the classification of the storage (Class B - Specially Protected Waters).

Return to the plant inlet is the most appropriate method in terms of minimizing wastage of water (the backwashing process uses up to 2% of total plant flow) and lowest impact on services and the environment. The percentage removal (raw water versus finished water) of parasite cysts drops slightly if the washwater supernatant is returned to the plant inlet.

However, the analysis further indicates that better data are required on likely concentrations of *Giardia* and *Cryptosporidium* in Sydney's water supply in order that the treatment plant's disinfection system can be designed to ensure that the risk of exposure of the population to infection is acceptable.

Giardia has only been detected once in water in a Water Board's storage dam. In late 1988, *Cryptosporidium* was found in all the Water Board's storage dams and at the four locations tested in the reticulation system. The Water Board has commenced an investigation program to determine its distribution, concentration, seasonal variation, stability, source and health risks, using the latest techniques and information from overseas.

Treatment of the supernatant to reduce or inactivate such pathogens will be required by the Water Board unless it can be shown that such disinfection is not required and there is no risk to human health.

The Water Board will consider a number of methods of disinfection, such as superchlorination, UV, ozonation, ultrafiltration and will require the most appropriate method to be installed at all four water treatment plants.

The following section examines overseas practices.

Overseas Practices

CH2M Hill provide information on overseas practices which covers water treatment plants in general. Preference is therefore made in some instances to clarifiers. The plants proposed for the Water Board's DWP are contact (in line) filtration plants and do not have a clarification step. Methods of residuals disposal are also set out.

In the US, filter washwater is either returned to the plant inlet or discharged to a surface water. Few utilities discharge filter washwater to the sewer due to the relatively high flow (2-8% of the total plant flow), limited sewer capacity, and desire to maximise water production and conserve water. Due to increasing regulation of surface water discharges and the desire to maximise water production, many utilities are opting to return their filter washwater to the treatment process. In almost all of these cases the filter washwater is flow equalised and then clarified in a settling basin. The solids and supernatant are then processed separately. Return of the filter washwater supernatant is normally accomplished in one of the following ways:

- Most commonly, the supernatant is returned to the head of the plant, prior to the coagulation process, especially for a direct-line filtration plant.
- For some conventional plants, the supernatant is recycled to the clarifier influent. There is usually a coagulation step prior to the clarifier.

F Treated Water Quality Objectives and Criteria

SCHEDULE 10

TREATED WATER QUALITY OBJECTIVES AND CRITERIA

PART A WATER QUALITY OBJECTIVES (Clauses 5.1 and 10.4)

PARAMETER	UNITS	WATER QUALITY OBJECTIVE
TURBIDITY	NTU	Less than 0.30
TRUE COLOUR	HU	Less than 5
IRON	mg/L	Less than 0.20
MANGANESE	mg/L	Less than 0.030
TOTAL ALUMINIUM	mg/L	Less than 0.20
TOTAL COLIFORMS		0
FAECAL COLIFORMS		0
TRIHALOMETHANES	mg/L	0.2 maximum for any reading 0.1 maximum based on annual average of samples
FILTRABLE ALUMINIUM (passing 0.45µm filter)	mg/L	Less than 0.100
pH		Within ±0.2 of a variable target between 7.6 and 8.3
CALCIUM CARBONATE PRECIPITATION POTENTIAL	mg/L as CaCO ₃	> - 6
FLUORIDE	mg/L	0.9 to 1.5, Target 1.00
CHLORINE RESIDUAL	mg/L	Within ±0.2 of a variable target between 0.2 and 1.5
CHLORINE: AMMONIA		Within ±0.3 of a target between 2:1 and 8:1
TASTE AND ODOUR		Not objectionable to taste and odour panel

Schedule 10 - continued

All remaining parameters documented in 1987/NHMRC/AWRC Guidelines		As per 1987 NHMRC/AWRC Guideline Document
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PART B WATER QUALITY CRITERIA (Clauses 10.3 and 10.5)

PARAMETER	UNITS	TREATED WATER QUALITY CRITERIA
TURBIDITY	NTU	≤ 0.50
TRUE COLOUR	HU	≤ 10
IRON	mg/L	≤ 0.20
MANGANESE	mg/L	≤ 0.030
TOTAL ALUMINIUM	mg/L	≤ 0.20
TASTE AND ODOUR		Not objectionable to taste and odour panel
FILTRABLE ALUMINIUM (passing 0.45µm filter)	mg/L	Monthly average of daily readings less than 0.100
pH		Daily average within ±0.25 of target. Initial target 7.9
FLUORIDE	mg/L	0.9 to 1.5, target 1.0
CHLORINE RESIDUAL	mg/L	Within ± 0.2 of target. Initial target 0.7
CHLORINE: AMMONIA		Within ±0.3 of target. Initial target 3:1
All remaining parameters documented in 1987 NHMRC/AWRC Guidelines (excluding bacteriological criteria)		Compliance with Guidelines

Note: If the Board nominates a chlorine ammonia ratio which is greater than 4:1, the Partnership will not be responsible for any objectionable taste or odour that may occur as a result.

G List of legal representatives and advisers

Witness / interested party Legal advisers

Sydney Water	Mr T. Bathurst Q.C. Mr S. Clark (Clayton Utz) Mr P. Silver (Clayton Utz) Ms K. O'Flynn (Clayton Utz)
Mr David Manzi	Mr P. Silver (Clayton Utz) Ms K. O'Flynn (Clayton Utz)
Mr Graham Trickett	Mr P. Silver (Clayton Utz)
Mr Jack Withford	Mr P. Silver (Clayton Utz)
Mr John Shirbin	Mr R.J. Ellicott Q.C. Ms K. O'Flynn (Clayton Utz)
Mr Paul Forward	Mr G. Kent (Blake Dawson Waldron)
Mr Ron Quill	Mr P. Silver (Clayton Utz)
Australian Water Services	Mr R. Gyles Q.C. Mr K. Broadley (Freehill Hollingdale & Page) Ms C. Murphy (Freehill Hollingdale & Page)

A complete list of the persons interviewed for this report will appear in my final report.