

**SUBCOMMITTEE OF THE STANDING COMMITTEE ON
PUBLIC ADMINISTRATION AND FINANCE**

WATER SERVICES INQUIRY

**TRANSCRIPT OF EVIDENCE TAKEN
AT PERTH
MONDAY, 21 JUNE 2004**

SESSION 1

Members

**Hon Barry House (Convenor)
Hon John Fischer
Hon Dee Margetts
Hon Norman Moore (Participating Member)
Hon Ken Travers**

Committee met at 1. 55 pm.

HATTON, DR THOMAS
Deputy Chief, CSIRO Land and Water,
Underwood Avenue,
Floreat, examined:

BATES, DR BRYSON
Director, CSIRO Climate Program,
Underwood Avenue,
Floreat, examined:

TOZE, DR SIMON
Principal Research Scientist, CSIRO Land and Water,
Underwood Avenue,
Floreat, examined:

Hon BARRY HOUSE: On behalf of the committee, I welcome you to the meeting. You will have signed a document entitled "Information for Witnesses". Have you read and understood that document?

The Witnesses: Yes.

Hon BARRY HOUSE: These proceedings are being recorded by Hansard. A transcript of your evidence will be provided to you. To assist the committee and Hansard, please quote the full title of any document you refer to during the course of the hearing for the record. Please be aware of the microphones and try to speak into them. They are for recording purposes, not amplification. I remind you that your transcript will become a matter for the public record. If for some reason you wish to make a confidential statement during today's proceedings, you should request that the evidence be taken in a closed session. If the committee grants your request, any public and media in attendance will be excluded from the hearing. Please note that until such time as the transcript of your public evidence is finalised, it should not be made public. I advise you that premature publication or disclosure of public evidence may constitute a contempt of Parliament and may mean that the material published or disclosed is not subject to parliamentary privilege.

Would you like to make an opening statement to the committee?

Dr Hatton: In responding to your request, I have asked Bryson and Simon to come along because my expertise in water is different from theirs. My expertise is in water supply and allocation to people and the environment and water policy and salinity. Doctor Bates' expertise is in climate variability and change and the impacts that flow on to water supply and agriculture et cetera. Dr Toze's expertise is in water reuse and making better use of some of the water we waste and getting it back into the supply chain. I think between the three of us we cover most of the issues, for instance, under the state water strategy.

Hon BARRY HOUSE: The first question invites you to open up on some of those things. Could you please give the subcommittee an overview of the Commonwealth Scientific and Industrial Research Organisation's interest and research pursuits in the area of water?

Dr Hatton: With respect to Western Australia in particular?

Hon BARRY HOUSE: Yes.

Dr Hatton: CSIRO has about 80 staff in Western Australia who are focused in the general area of land and water management and land and water science. The focus in Western Australia is mostly on water and we go across the areas to which I referred, as well as water remediation and ground water pollution remediation etc. Our strategy over the past five years in Western Australia has been to engage very strongly with the state agencies and the Water Corporation in delivering our science to issues of state relevance. That is not the strategy that CSIRO always takes nationally, but our strategy in Western Australia has been to build the team across those agencies and our agency to get the best outcome from our science and technology investment. That has been done through the water flagship program that CSIRO recently launched, Water for a Healthy Country. We have a state relationship agreement with the Premier's department between that flagship and the whole of government, as well as direct memorandums of understanding with the Water Corporation and the Department of Environmental Protection on the Gnangara ground water resource. We also have MOUs with Curtin University to work on water and with the Department of Agriculture to work on the Rural Towns Program and for the salinity project that has just got up. It is all about a very close partnership and engagement as much as we can. I should also introduce Bryson as the key CSIRO person with the Indian Ocean Climate Initiative, another state partnership. He can elaborate on that.

Dr Bates: Some of you are probably aware of the Indian Ocean Climate Initiative that started back in January 1998. We had two objectives: one was to gain an understanding of the long-term climate variability and why we seem to be locked into a particular dry sequence of years that has been going on since the mid 1970s. The second was to develop and improve seasonal climate forecasting methods. Most of the research to date has been on rainfall decline itself and our work has quite clearly shown that that decline is, in fact, due to changes in atmospheric circulation patterns. From the results that have just been tabled recently at a panel meeting of the initiative, it is clear that we are locked into some sort of new climate regime. The causes of that regime are not really known; we suspect that they are related to changes in a zonal jet, which is a jet stream high in the atmosphere that seems to have moved further south. Low pressure systems and fronts do not come up as far north as they used to, nor do they stay around as long as they used to. There is also evidence that we are getting a blocking of high pressure systems and so on resulting in more drier days than in the past. Most of the impact of that decline is, unfortunately, over Perth's water supply catchments. The situation is not quite as bad as in the wheatbelt, but some drying out of the winter rainfall is emerging. Another source of our funding for work in Western Australia is the Australian Greenhouse Office, through what used to be the Australian greenhouse science program. We do a lot of work on climate change or human-induced climate change. One of the study areas that we have concentrated on has been south western Western Australia. Over the past few years we have started to engage with international organisations on this problem. The International Research Institute for Climate Prediction in New York and the GKSS Research Centre in Germany have come on board as partners to help us with this work as well.

[2.00 pm]

Dr Toze: From the water reuse side, for a while we have recognised that we take water that we do not use and it is discharged, which is a bit of a waste, and that we should use more of it. There have always been other issues or differences of opinion about how it should be used or what it should be used for. The very low rainfall event in 2001 really brought it to the fore. There have been state water strategies, which have led to other things like the state water reuse steering committee. That has really moved things forward. Now we are starting an advancing pattern. The Water Corporation has been quite proactive in moving forward on water reuse. It has been recognised that water reuse occurs very much in regional areas. Regional towns have used most of their waste water. Principally, if they want a green golf course or green ovals, they have to reuse their water.

The failing area has been in the Perth metropolitan area. The CSIRO and the Water Corporation are currently looking at strategies for which way we can use as much of the water as possible. A target of 20 per cent has been set. We have identified ways to meet that 20 per cent target, which we think we can do quite easily. We are looking to see whether we can advance that. We now think we can move that target further and maybe have a target of 26 to 30 per cent.

The issue is that, because we have been behind some of the other areas, funding is still coming forward. The Water Corporation has put in significant funding. The Water for a Healthy Country program is putting in significant funding, but any other funding that is coming through is still slowly getting there. There may be some opportunities through the Premier's Water Foundation and other areas, but the key agencies, which are the Department of Health and the Office of Energy, do not seem to be able to put any funding towards it at the moment. Because they are the regulators, they need to work out how they will respond to this area. To a certain extent we are dragging them along with us and they are trying to make up their policy as we move forward. That is the situation with water reuse at the moment.

Hon BARRY HOUSE: We will concentrate on climate change for a minute. You have already outlined the broad goals of your research. Can you outline the various arguments regarding climate change? What is it and what is supposed to cause it? What are the arguments for and against it; for example, the 100-year weather cycle argument versus global warming? What are the issues and current scientific thinking?

Dr Bates: It depends on whether you are talking about climate change due to human activity or to natural variability. It is quite obvious from the instrumental record and the palaeorecord - things such as tree rings, coral rings and so on - that climate has changed in the past. It is also quite obvious that these changes can take place in a matter of years or decades; it does not necessarily have to happen over a long period. Because of that they can be quite sudden. That is the sort of thing we seem to have observed here. There was a distinct change in the climate here in the mid 1970s. There is evidence that something was changing prior to that. Credible atmospheric observations did not start until about the late 1950s, so, unfortunately, the record is not that long. It is obvious from some of the data that is available that something was changing between the late 1950s and the mid 1970s as well, but it has really locked into a new climate regime since the mid 1970s.

When we talk about human-induced climate change, we are talking about alterations of the composition of the atmosphere due to human activity, and not just carbon dioxide, but other gases such as methane, increases in water vapour and so on. These changes essentially lock the heat into the atmosphere. It does not escape into space and we get an increase in air temperature at both a global and a regional level. Because of that there are also changes in precipitation patterns. Unfortunately, southern Australia is one area that is likely to get drier in that sort of scenario.

In terms of the evidence for a human signature in climate change, the evidence is growing that we are affecting our climate. People would still argue against that, but the evidence is growing. The Intergovernmental Panel on Climate Change, a UN-appointed body to regularly assess the evidence on climate change, is becoming more and more strident that humans are having an effect on the world's climate, and we are seeing it in the instrumental record. Where we do find some difficulty, particularly when we get down to the regional level and look at what is happening here, is that, with the work that is going on with the Indian Ocean Climate Initiative to date, we see some consistency in what we would expect with human-induced climate change in our climate record. However, it is consistency; it is not proof. I am not saying that what we are seeing is due to human activity. With all matters of science, we start with a hypothesis that is fairly benign and then we try to disprove it. If we start with the hypothesis that we are dealing with natural climate variability, it will be very hard to give anyone an ironclad guarantee that that hypothesis is wrong and that what we are

observing is human-induced climate change. However, as I have said, there is some consistency and I think that is a cause for concern.

Another point I will make is about what the State is doing about the climate changes we are experiencing. The Indian Ocean Climate Initiative is starting to attract attention from the eastern States, and I am now involved in negotiations with a number of research funders in the eastern States to start a similar initiative in the Murray-Darling Basin. The message is that what has been happening in Western Australia over the past six years is very much a trendsetter for what people want to happen in the eastern States, and they are only just starting to get the momentum going now. In terms of the national scene, this area is seen as a national laboratory for adaptation to climate change, and as time goes by it will become also an international laboratory, because this is one area of the world where there is a clear climate signal. That signal is very consistent with human-induced climate change, and we are being forced to adapt now rather than think about adaptation in 50 years or so. I do not know whether I have covered all the committee's questions.

[2.10 pm]

Hon BARRY HOUSE: The next series of questions is on the Indian Ocean Climate Initiative, which you have covered pretty well, perhaps with one exception - the funding. I will just read the questions. Please explain the Indian Ocean Climate Initiative to the subcommittee. What is the administrative structure, and how is funding obtained for this research? What predictions can the Indian Ocean Climate Initiative make about climate change and future rainfall levels in Western Australia?

Dr Bates: As I said, the initiative started in 1998 as a result of an approach I received from the Water Corporation and the Water and Rivers Commission. They were becoming concerned about what they were seeing in the dam in-flow record for the past 20 years. It was quite obvious that we seemed to be locked into a regime in which winters with well above average rainfall and dam in-flows had disappeared. We organised an international workshop at our Floreat site in 1996, and within about a year and a half the initiative started. The funding for that initiative basically comes from the state partners involved in it. The major partners are the Water Corporation, the Department of Environmental Protection, the Department of Agriculture, the Fire and Emergency Services Authority - I think it is also involved - and the Department of Conservation and Land Management. The way it is set out is that each of these organisations makes a contribution to a pot of money. The research partners, which are three divisions of CSIRO and the Bureau of Meteorology Research Centre, offer the same amount of money. At the moment the budget is \$500 000 a year from the State and \$500 000 from CSIRO and BMRC. The work done by the initiative has, for the first time, characterised what has been happening to the climate of this region. We have, for the first time, come up with hypotheses about what is causing this, not only locally but also on a hemispherical scale. In seasonal climate forecasting we are getting indications that we can make improvements there, and some of the work I was personally involved with a few years ago indicates that there is a degree of predictability that we had not anticipated. Over the next two years the greenhouse effect will take a higher role in the direction of the work than it has before, because the question is being asked about whether we are seeing the early onset of human-induced climate change. We will be taking that issue more seriously, whereas in the past it has been kept in abeyance, because people really wanted to understand what had happened in the past and why it was having so much effect on dam in-flows and ground water recharge.

We started a new round of funding at the beginning of this financial year. We had some trouble - personally, I found this very disheartening - getting the \$500 000 for research that we were looking for. It was only because Dr Bruce Hobbs' Office of Science and Innovation offered \$250 000 a year for the last two years that we actually got on the budget, which I found quite incredible, given the problems facing the State.

Hon JOHN FISCHER: I have just been going through this Western Australian water assessment. I ask this question because I find it incredible that a magazine like this provides everything except the rainfall figures for the past 50 to 100 years. I accept what you are saying about the debate about the inducement of climate change. I have very recently read, although I cannot quote it, a lot of very strong opinion that this is really sunspot activity. I am not disputing what you are saying, because I think it is probably on the ball. With the exception of 2001, which was a severe drought, by how much has our rainfall decreased in recent years? There is a strong feeling in some quarters - it is a view that I hold - that much of the run-off into dams has been reduced because we have not done any clearing around those dams.

Dr Bates: The rainfall decline really depends on what part of the south west you look at. It is not uniform across the south west. One of the worst afflicted areas, which I mentioned earlier, is the Perth water supply system.

Hon JOHN FISCHER: So are we actually below average for the past 25 years?

Dr Bates: We are seeing that it is not just a matter of the decreasing rainfall amount, it is also the frequency characteristics. When you think of the dry spell, it is the number of consecutive dry days. Those dry spells are increasing in length as well.

Hon JOHN FISCHER: What about the actual rainfall?

Dr Bates: Over the water supply catchment, it has dropped by 20 per cent. If you look at the decline in areas like the two capes, people would have said five years ago that there is no decline, but a slight decline is beginning to emerge now, although it is quite a small number compared with the 20 per cent figure. At the eastern edge of the wheatbelt, it is in the order of five per cent or so. It is really the water supply catchment area that has suffered. You mentioned the clearing issue. We have been having discussions about that with the Department of Environment. As a result of the last federal budget, the Australian Greenhouse Office has received money to do impact and adaptation research. One of the areas it wants to look at is the south west of Western Australia. There is one issue we have in mind with the water supply catchments. How much of the decline can we assign just to the change in the climate, or is it due to human activity on forest management and mine rehabilitation in the water supply catchments? At the moment, that is a scientific question, and I cannot give you a scientific finding, because the work is yet to be done.

Hon DEE MARGETTS: One of the presentations at the "Whether the Weather is Climate Change" seminar was about some modelling. Has CSIRO done any of its own modelling about the potential impacts of relatively small changes in the climate on the biodiversity of Western Australia?

Dr Bates: One of the problems we have had, and one of the problems you would have had, is that whenever you speak to scientists they complain about not having enough money. I will put that on the table. One of the problems we have always had with doing climate change impacts and adaptation research is that, since 1996, the federal Government has not been supplying money for climate change impacts and adaptation research. What money was available - it was not even increasing in real terms - was going to what was regarded as climate science, which is doing climate modelling, essentially. That situation has now changed, with the recent budget, which has made \$2 million available this year, increasing to \$4 million after four years. Not all of that will be spent in the south west of Western Australia, but the Australian Greenhouse Office has already indicated that it sees this area as a prime focus for doing impacts and adaptation research. One of the problems we have in this country is that we have done a particularly poor job in impacts and adaptation research, because we have not done any integrated assessments. We had not looked at the simultaneous impacts on water supply, forestry, agriculture, biodiversity, and so on. In the past there has usually been a fragmented effort, in which one group looked at water and another, which is not talking to the water group, is looking at agriculture, probably in different regions of the

country. That is one of the things I am hoping to address in my new role to get people to focus on a few areas and do an integrated assessment.

[2.20 pm]

Hon DEE MARGETTS: This is an obsession I have had for some time - it is one of my obsessions. Has any thought been given to bringing together the information that is out in the community? Obviously to have an integrated approach you would need terrestrial, marine and other information. Of course, there are people in the community who have done baseline studies on a range of integrated ecological systems. Has any thought been given to funding a process to bring that information together, rather than trying to reinvent the wheel? It seems to me to be the bleeding obvious. We know that individual groups and communities have been working on a particular species for 25 years or more and other people are monitoring seabird research and stuff like that. Has any thought been given to funding conferences or processes to bring that kind of information together?

Dr Bates: I would certainly hope so. I am aware of the sort of thing you are talking about. I know of some groups that have stated that they are observing that mobile ecosystems are moving in the landscape as a result of the changes in climate that we are seeing.

Hon DEE MARGETTS: Marine seabirds; yes.

Dr Bates: There are even signs of that in terrestrial ecosystems.

Hon DEE MARGETTS: It is harder for trees to move.

Dr Bates: Yes. Tom also wants to make a comment about this. Certainly in our work, one of the things we want to do is to focus not just on the economics but also the social aspects of a problem. That involves community consultation. We will be moving in that area.

Dr Hatton: The one thing I would add, and this is one step removed from the specific attempt to bring community knowledge into this issue, is that in the Water for a Healthy Country flagship program we are making a major investment in something called knowledge exchange for natural resource and water management so that the data and knowledge that is generated by the boffins is not just the province of the boffins but, rather, through the Internet, there is a facilitated platform for the community and other interested stakeholders to add their knowledge to a conversation about whatever topic they are engaged in. We are trying to create a national platform for knowledge to be exchanged rather than just delivered, which is the old extension model of science and technology. We are investing in that this year and we will see how far it goes. It will be a platform for what you are asking for and not exactly what you are asking for.

Hon DEE MARGETTS: I was fascinated to see some modelling about banksia bushland and proteaceous heath. Of course, I am in constant contact with modelling or data that is coming out on seabird research and pelagic fish. Bringing a lot of that kind of information together seems to be necessary at some stage.

Hon BARRY HOUSE: I am sure you will attract a lot of theories as well as ideas.

Hon DEE MARGETTS: Data has been collected over decades.

Hon KEN TRAVERS: I want to clarify one point. You were saying that there has been a 20 per cent drop in rainfall in the Perth catchment. Did you also say that on top of that, the pattern of the rainfall has added to a further decrease in the amount of run-off? Is that what you were saying?

Dr Bates: No, but what you are saying is right if you look at the past six years. A graph is freely available on the Water Corporation's Internet site, which has a bar plot of inflows into Perth's dams. It is quite detailed. If you look at the inflows from the 1970s to about 1996, there is something in the order of a 40 per cent decrease in the inflow. If you look at the figures for the past six years, there has been a further 14 per cent decrease on top of that. Some analysis of that has been done in the past few months and I think this can be explained in terms of the climate. We had

a run of winters with very dry days across the region, more so than in the past. There have not been intervening years in which particular days within those years have had rainfall over the region. At the moment we are getting more and more days in which there is no rainfall over the region. That has occurred in the past six years or so. It seems as though we are locking into a dry climate regime.

Hon KEN TRAVERS: The amount of rain and how it falls are separate issues that will impact on that.

Dr Bates: That is right. The time between the frontal systems is also critical. The longer that time becomes, the more opportunity there is for the soil profile and for water supply catchments to dry out before the next rainfall arrives.

Hon KEN TRAVERS: Is it the same for the hills catchment and the Swan coastal plain, or are they different?

Dr Bates: They are slightly different. The hills region has been badly affected. I do not know whether you would call the capes region the Swan coastal plain, but there has been a very small decrease there. It is almost like going from zero to a high increase over Perth water supply catchments, and then when you move further east the decline drops off again.

Hon KEN TRAVERS: I am talking about the Perth part of the Swan coastal plain.

Dr Bates: If you look at the records at Pearce airbase and Perth airport, there has been a strong decline; there is no doubt about that.

Hon JOHN FISCHER: If you look over the past 100 years, 1914 was when there was the big disaster. I am going through the Water and Rivers Commission production. I cannot imagine why a production such as this would not include rainfall figures as well. That did not surprise me, coming from the Water and Rivers Commission. If you go back prior to 1911, what do your records show? Is it cyclical?

Dr Bates: This is a very important point. One of the real problems we have is that once you go past the early part of the twentieth century, very few rainfall records are available. The closest one to Perth that goes back that far and is credible is the record from Rottnest Island, which I think was terminated when they decided to make the lighthouse automatic rather than manual. I think it was later restarted. The only other high quality record is for Arthur River, which is down towards Albany. That is it. When you look at the records that are available from the 1870s on and take them at face value - there are a lot of questions about the observation practices used at that time, which are not accepted now - there is an indication that things were dry back then. If you look at the means of all the pressure data and so on that is available in places like Kerguelen Island and things like that, it indicates that things should have been drier back then. Kerguelen Island is at latitude 50 degrees south. The anecdotal evidence at least is that we have seen dry periods like this before. This is where you run into the problem of determining whether it is a centennial-scale climate variability pattern or whether it is due to human-induced climate change. At the moment the jury is still out. This is where we have some problems. In terms of the historical information we have, we will not be able to say with any reliability what was happening in the late 1870s and early twentieth century. That will make our job of deciding whether this is human-induced climate change or climate variability even harder.

Hon BARRY HOUSE: Most of your comments have been about trying to analyse what has happened. The last part of the subcommittee's question was: what predictions can you make about climate change and future rainfall levels in Western Australia?

Dr Bates: If you look at the climate modelling runs that have been done at the CSIRO since the late 1980s, you will see that every time a new climate model has been put out the south west of Western Australia has come out as being drier in the future than it has been in the past. There is a high level of confidence that this region will be dry. Where you run into a problem is in asking

whether it will be drier than it is now. I have heard that stated in public but I am not convinced that that is necessarily true. If you look at the climate model runs that have been done, you will see that the conditions we are experiencing now are consistent with the worst climate change scenarios we have out until about 2100. We could face a situation in which, yes, things could get worse, or we could be observing the onset of climate change 25 to 50 years earlier than might have been expected to be the case. The sensitivity of the climate models supporting our policy is possibly not quite right. Different model runs in different climate modelling centres around the world do not agree about how rainfall decline will occur in the future. Like our model, some show a steady decline to 2100. The Hadley Centre model in the UK shows sharp steps downwards, as with the major step in the decline we have seen; however, the centre projected this to occur 25 years in the future. Essentially, evidence tells us that we must get used to things being drier than we might have experienced in the 1950s or 1960s, and to use a more adaptive style of management rather than relying on the historical record as the basis of the plan.

[2.30 pm]

Hon DEE MARGETTS: Various people have talked about our last period of drought being a period of El Niño. That cycle has changed. I understand that we are already changing back into another El Niño. Is that correct?

Dr Bates: There is a higher than 50 per cent chance that we are heading into another El Niño. The work we have done for the Indian Ocean Climate Initiative shows that El Niño has more impact on south west Western Australia than people thought was the case in the early 1990s. There is not a one-on-one relationship between the Southern Oscillation Index and rainfall in the region; that is, as the index goes up or down, it does not mean that it will be drier or wetter. It is intriguing that the underlying value of the Southern Oscillation Index over the record, which goes back to the 1870s, indicates that El Niño has tended to be more frequent and more intense since the mid 1970s than was the case in the previous 100 years. There is a one-to-one correspondence in the underlying behaviour of El Niño and what has happened in the region. A lot of work has been done on what people perceive to have been a global climate shift that took place in the mid 1970s. Regarding atmospheric circulation patterns in the region, particularly in terms of winter rainfall, a marked change in behaviour occurred around that time.

Hon BARRY HOUSE: I move on to open up another topic; namely, extracting water and injecting water into aquifers. The committee has heard evidence and received submissions regarding the impact of extracting water from, and reinjecting water into, aquifers. Can you comment on any research regarding possible effects of extraction from aquifers, and can you comment on research regarding recharging aquifers with reused or treated water?

Dr Hatton: Yes. The Commonwealth Scientific and Industrial Research Organisation has been very active, with the resources available, in the assessment of ground water supplies and their sustainability nationally, and on the Swan coastal plain in particular, for 25 or 30 years. That has led to an understanding of the sustainability of the Gnangara aquifer in particular, which suggests that a sustainable level is achievable. The sustainable rate of extraction has been exceeded, and the observed water level decline with the Gnangara is consistent with our estimates concerning water extraction and the rate of fall - and why. Therefore, a consistent picture emerges of cause and effect in a broad scale. There is a great deal of uncertainty about the detail of the degree that different aquifers are interconnected from place to place. If something is done at a lower level, how will it affect areas above it, and how quickly will this take place? Some uncertainty exists on the nature of discharge offshore, and the volumes involved. That situation tends to calibrate what happens onshore for us. Some uncertainty exists about the relative share of blame for the falling aquifers over the past 20 years; that is, how much of that fall is due to public extraction, private extraction, pines and a drying climate? The picture is unclear. We have only approximate views on that

matter. I do not know whether you want more detail on the general picture of the Gngangara. I can provide that detail.

Hon NORMAN MOORE: What is your approximate view on the effect of deep bores into the Yarragadee affecting the more superficial aquifers?

Dr Hatton: Work on isotopic and chemical signatures of the various waters in the various layers from place to place indicates that they are not very connected. If you pump deeply locally, it does not seem to send water downward and leak locally. It does so in other places. Our concern is that if a largely confined aquifer like the Yarragadee is depressurised anywhere, it tends to depressurise it regionally. One very quickly transmits the change of head a distance from where it is pumped. That is the nature of confined aquifers. With the unconfined aquifer and superficial aquifers, one has a local draw-down effect - and that is it. The fact it is not connected from place to place does not entirely obviate our concerns. If it is pumped anywhere, leakage will not be induced elsewhere. I do not know whether that exactly answers your question. A great deal of concern and uncertainty is evident.

Hon NORMAN MOORE: As a vast volume of water is in the Yarragadee aquifer, it is important from our point of view to determine how much can be used. Bearing in mind climate change, the volume of water we can consume is a serious question. I guess a lot more work is needed on that subject.

Dr Hatton: We would be more confident in our answers if we had a little more work. We know that this water tends to be pretty old. At first approximation, this gives a conservative approach to its use because it is not replenished at a great rate. It is a fantastic emergency resource. I think we all recognise that it is there to be used in a real pinch. However, we expect that a small amount could be used sustainably relative to the volume of the resource. The size of the bucket down there may be misleading in terms of its sustainable use.

Hon NORMAN MOORE: By sustainable use, do you mean the impact on the environment from lowering the aquifer?

Dr Hatton: In part, that is right.

Hon NORMAN MOORE: If you were prepared to forgo the wetlands, could you use a lot more?

Dr Hatton: That is not the only impact one might expect from depressurising a regional, confined aquifer. I have technical uncertainties in my mind about subsidence risk. As large regional aquifers are depressurised, how much land subsidence would be expected? That is not well understood. Also, as such aquifers are depressurised, a degree of salt water intrusion from the river, from under the land and from the coast under the land could be expected. This would affect private bores for gardens, and supply bores potentially, although these tend to be well inland.

Hon JOHN FISCHER: Would that not affect the rivers more on the top aquifer level rather than drawing from below or the deep aquifers?

Dr Hatton: Most of the current salt water intrusion is through the withdraw from the superficial aquifers in the suburbs of Mosman Park, Attadale, Cottesloe etc. If water were drawn from the deeper aquifer, it would have the potential to entrain salt water right up. This would pull back the boundary from which it is currently discharging and pull it back further under the land. That would create the potential for intrusion. Also, this could poison wells in the deeper aquifer; that is, it would eventually pull the marine water into the bores themselves through depressurising the aquifers. I do not know if you want to answer this question, Simon; you know as much about this as I do.

[2.40 pm]

Dr Toze: As Tom said, the principal problem is that when water is drawn off, the amount of water flowing out to the ocean creates pressure and the water discharged out to the ocean just stops. The

pressure of the ocean then literally forces its way back in. This is seen in many places around the world. It is not just an abstract idea. California has huge problems with it. California has been injecting water into the aquifer to stop salt water coming in because the aquifers in California have been overpumped. They have multiple layers. If there were connections somewhere where we have not been able to predict - certainly from the river - we would be getting into the superficial layer, but there are unknown connections between the superficial aquifer and particularly the Leederville, the next one down. We have seen some of those influences - the potential interactions between the two aquifers - with some of the work we have been doing with the injection method; fortunately, the other way. We were putting in fresh water and then pulling it out. We thought that the water would become saline but two and a half times the amount of water we put in was still fresh water. We gave the Water Corporation fresher water than it started off with, which was very fortunate for us. That shows the types of interactions - even unanticipated interactions - that can happen. We do not understand the system well enough.

Hon BARRY HOUSE: What about the percolation effects of treated waste water and grey water being inserted back into the aquifer? Is much research being done into that?

Dr Toze: Infiltration into the aquifers has been going on in Western Australia since the suburbs were developed. I would be putting it a little unkindly if I said that it is unmanaged. Stormwater infiltration basins can be considered infiltration. Percolation is when water runs off the roads and into an aquifer. That is fortuitous; it depends on rainfall. It is not controlled; it is allowed to spread. In regional centres in Western Australia, effluent is mostly discharged by letting it seep into aquifers. It is then discharged into the sea, particularly along the coastal zone. Mandurah and Bunbury are classic examples of that, and I understand that it is also done in Geraldton, although I have not seen it. We are progressing to take that concept and make it a managed system. We want to manage the waters going in. We know what the quality of the water is. We understand the processes involved once we get the water into the aquifers so we know the risks that are involved and the quality of the water coming out. We can manage the system to achieve a quality of water that is suitable for what we want to use that water for in a managed area within an aquifer. Although we can do it, we are not letting it spread in an uncontrolled sense; we are putting it in an area that can be controlled.

The Water Corporation has investigated injecting drinking water into the Leederville aquifer by a well system. It is mostly for storage capacities only. The CSIRO has been looking at taking treated sewage effluent and other sorts of effluent - although sewage effluent is by far the greatest amount of water we have - and then, as you say, percolating it through the sand system and allowing the natural cleansing processes to occur before it gets to the ground water needed. We know cleaning processes go on. We are starting to get good evidence that once it hits that ground water, we get very good water quality improvements in the aquifer before we reclaim the water again. An investigation was conducted in Mandurah in which we worked with an unmanaged discharge system. We were looking at how we could reclaim the water and what was the quality of the water. We found that the water quality we recovered from the wells - initially from secondary treated effluent that was not disinfected; it was not good water anyway - at a distance of 60 metres was better quality than background native water and was close to, but not quite, the quality considered acceptable by the Australian guidelines for drinking water. That is where we are moving to. We are investigating several of the mechanisms we can use for how we can get the water into the ground in both a managed and sustainable way. It is important that we do it in a sustainable way to ensure that there are no risks to either the environment or the population. Also, we are looking at where are the most likely regions in which we can use it, particularly in the Perth metropolitan area, which is the greatest source of treated effluent. There are a number of areas in which we could do it. We look at an area and ask why we would do it there if it would not aid anything. We know that we would not destroy the environment, but that it would not have a beneficial impact. There are other areas where it could be done; for example, to the north of the Gnangara mound among the

horticultural area. We might be able to put in water there and the farms could continue to extract that water and use it for irrigation purposes. There would be a net benefit to the State and to the environment in doing that. We are looking at it from that point of view. The costs of that must be considered. Certainly we are looking at it from a triple bottom line approach. Will it be cost-effective economically, socially and environmentally to put it in a certain area as opposed to somewhere else? Sometimes we must look at that because the monetary value does not add up, but there may be other benefits. That is the difficult part we must work with. I recognise that the Water Corporation is supposed to make a profit; it must be financially viable. It is seen at the moment as the major source of funding to enable that to happen. That may be a drain to the Water Corporation if it does not get a monetary return for that outlay unless it is supported by the Government or in another way. They are some of the issues that we must look at as well as the public perceptions and public acceptability of this. It will probably be a major hurdle to get the public to accept this as a viable option. The public likes it as an abstract idea. It is the old nimby approach. As soon as it gets close to them, they start to waver. To a certain extent, some of the public's attitudes have surprised us. It has been interesting so far and I look forward to it being interesting for a while.

Hon NORMAN MOORE: On the notion of reusing water, as I understand it about 100 gigalitres of treated sewage effluent is pumped out to sea in Western Australia. You are saying that between 20 or 26 per cent of that water could probably be reused. Why is it such a little amount? Bear in mind that Broome has a beautiful green golf course because people are happy for the golf course to be watered with that type of water.

Dr Toze: It is literally the amount of water that is used and discharged compared with the amount of water. The other thing to remember is that in 10 or 20 years we may be talking about going towards potable use. We would put in water that would either supplement potable water directly or indirectly. We may be pressurising aquifers so that we do not get that treated effluent, but it is helping the drinking water system. That must be highly treated to be as low-risk as possible. If the member is going to bring it down to the irrigation of parks, golf courses and those types of things, he should know there is a joke that if all the golf courses used all the water that is discharged each year, golfers would have to be taught to scuba dive and use scuba gear. The amount of water used on those areas is very low. We could do that if we were able to distribute it in some form or fashion so that everybody used treated effluent water on their gardens instead of drinking water. The amount of water used would be huge and it could be recycled. The trouble is getting the potable water to each household. How would that be done? Some places in Australia work on a third-pipe system. That comes down to cost. Should the whole of Perth be re-equipped with a third pipe for taking that water? Another possibility is to put that water back into the superficial aquifer and then allow it to distribute back out into the aquifer and people could pull it up with their background bores. It is something we are looking at in the Mosman Park peninsula area, which already has salt water intrusion. However, we must be careful with that because the hydrogeology around that area is not very well understood. We do not want to create a problem which might not be ideal and which could mean that we could not develop the project on a more ideal site because of the problems that were created. It depends on how the water is used and what it is used for. Twenty per cent is a viable start. I think we can go further but we will need to know more information about a range of different processes, including hydrogeology and the biophysical processes, before we can move beyond the figure of 20 per cent. It is easy to reach 20 per cent, which is why it is a good target. However, to move beyond that we must look at how the water is being used and how to distribute the water.

Dr Hatton: The 20 per cent target is easy to reach because virtually all the water from the southern treatment plant can be provided to heavy industry. That target could be reached more easily if the water was purchased by a few large purchasers rather than many small purchasers.

[2.50 pm]

Dr Toze: We can solve the 20 per cent just with industry in the Kwinana region.

Hon DEE MARGETTS: Another angle on this is the ability of the deeper aquifers to -

Dr Toze: All aquifers - upper, lower and middle.

Hon DEE MARGETTS: Okay. The Water Corporation of course has waste that it needs to get rid of in one way or another. There is a proposal to send something like 80 000 tonnes a year of fairly unprocessed biosolids to upper Gillingarra to be distributed as soil improver. What kind of protection or monitoring would be required to make sure that you do not get faecal contamination of crops or of the rather high watertable flowing straight into the Moore River?

Dr Toze: Are you talking about biosolids?

Hon DEE MARGETTS: Yes.

Dr Toze: A national biosolids research program has just been started, in which the Water Corporation is a major partner and is also participating. It is very early days. Some work has been done on heavy metals, which shows that heavy metals are not mobilised. We are just starting with a student research program looking at the movement of pathogens from the biosolids and actually leaching into the crops themselves, because there are quality control issues that need to be known before the crops are accepted by clients. We are just starting off with some of that stuff. Very little work has been done on the movement into the aquifers through the soil profile. It will depend on funding capabilities through the system by either the Water Corporation or other agencies, but there is a start to move towards that sort of thing.

Hon DEE MARGETTS: One would think they would need to do that kind of study before October when they will start to put \$80 000 tonnes a year of biosolids into a watertable like that.

Dr Toze: Some research has been done in other places in the world with other soil types, and the amount of movement of pathogens through biosolids into the soil profile has been shown to be small.

Hon DEE MARGETTS: We know if there is a piggery what the impact of nitrate levels etc tends to be on river systems.

Dr Toze: That is nitrate. That is usually land overflow. Nitrate is a diffuse chemical that does not absorb to any soil profile, whereas pathogens usually are highly absorbed to biosolid materials. It is very hard to get them out to study them in the first place. That is one of the reasons the study has not happened. Certainly once they get past there, then they start to move into the soil profile - they get stuck to clay, iron-coated sands - so again their movement is retarded. We know that their survival times in the soil profiles is very small. In fact, some of our research with some of the simple, easily studied microbes like E. coli shows that we struggle to keep them alive for our own research. If I were concerned about it, I would be agreeing with you, but I do not think there is that much movement to create that much pollution. It needs to be looked at from a risk management point of view, but I think the actual risk is still very low to start off with. Again, there has been some United Nations work showing that the level of risk to farmers from biosolids is very low. It is less than the accepted US EPA levels for viral infections from drinking water.

Hon BARRY HOUSE: The next topic is shifting water between regions. We note that Western Australia has shifted water between regions since the golden pipeline was built at the beginning of the last century. There are still many calls to shift water from the Ord to Perth, and research is under way regarding shifting water from the south west Yarragadee to Perth. Does shifting water between regions have any implications; and, if so, can you explain them?

Dr Hatton: I will start with the one that I know the most about, and it is the oldest one, which is the shift of water from the hills, and now the Swan coastal plain, in fact, out to the east, and its reticulation to the wheatbelt as well as the goldfields. That has had great implications both for regional development and regional decline. The implications early on for postwar regional

development are obvious positive implications. However, it has become clear that much of the urban salinity problem in the 30 or 40 rural towns that receive that water is due to the loading of that water into the urban environment, particularly in those towns that are not well sewered, but including the towns that are sewered. The secondary implications of that intra-basin transfer, if you want to call it that, or inter-regional transfer, is that the true cost of getting that water to the end of the pipes is far greater than the price, generally speaking, and in some cases very much greater than the price, so that the taxpayers of Western Australia are to various degrees subsidising 20 to 40 gigalitres a year of water into the rural area. With the Council of Australian Governments water reform and the National Water Initiative and the sorts of principles that should apply according to the Council of Australian Governments, that level of subsidy should eventually be exposed to some sort of competitive entry trading equity environment. If it were, our calculations suggest that even a single bottom line analysis would show that the opportunity for new water to be made in these wheatbelt towns by desalination, for instance, would be cheaper than the current rate of subsidy versus price provided by the Water Corporation.

Hon JOHN FISCHER: I guess they could stop the subsidy to the MetroRail service and use that to develop -

Hon BARRY HOUSE: Let us not get distracted.

Hon NORMAN MOORE: Do you know how much it costs to pipe water from here to Kalgoorlie, because the Water Corporation does not seem to know?

Dr Hatton: We do not know because it does not seem to know. That would be the only place we could get that information. We have estimates, however, that the Water Corporation has provided. It has tried to provide some estimates for our calculations - numbers like if you are on or near the main pipeline, like Merredin, the true cost might be somewhere around \$2.50 a kilolitre. This is really approximate stuff. I really have to put that caveat on it. However, at the end of the pipe at places like Corrigin, well off the main line, or even Katanning, it is much higher than that. That stands against our estimates of what local desalination would cost in a town like Katanning, which might be somewhere around \$2.50 a kilolitre. That is single bottom line. That is not taking into account the environmental and social benefits of pulling that salty water out of the ground so that it does not affect the foundations of the buildings and does not affect the local environment etc, as well as the local employment that this new industry would create for further regional development. That is one example of great opportunities for both water policy reform and new technologies in this area of intra-regional transfer of water.

If we look at the issue of the south west Yarragadee, then it is our view that there is tremendous uncertainty on certain parts of the bottom line in that - much more than others. We would probably take as given the single bottom line analysis of the cost of water as delivered to Perth from such a supply system being something around 80c a kilolitre. Those are not our numbers, but they are consistent with experience. However, the uncertainty surrounding the environmental impacts on the Blackwood and the tributaries of the Blackwood is still high in my view - very high, in fact - and certainly calls for great caution. We also know that scientifically done surveys of attitudes in that region show that there are social issues that would need to be addressed if we wanted to take a true triple bottom line view on that as a future water supply for the metropolitan area.

[3.00 pm]

Hon BARRY HOUSE: Have you been working with the Water and Rivers Commission or DEP on its research into the -

Dr Hatton: We have provided a consultant's role on the social attitude side. To my knowledge, we have not participated in the water resource environmental side of the analysis - the physical sustainability. Is that your understanding as well?

Dr Toze: Yes.

Hon JOHN FISCHER: I would like to make a couple of comments. I agree with you about bringing the water from towns like Merredin. However, I would have thought if the water that goes there is creating the problem, once you stop taking the water there, the town will be short of water again at some stage. Secondly, would it not be a better idea to pump out that water and batch pump it to Kalgoorlie so that the mining companies can use salt water, because they do not need potable water? If you batch pumped it up there -

Dr Hatton: The issue is how to use the water that is causing a problem.

Hon JOHN FISCHER: That is right.

Dr Hatton: I agree with you completely. You can use it for local supply to obviate the need to send water from the coastal catchments out there. About half the water that goes east does not make it to Kalgoorlie; it is taken off the line. Alternatively, as you say, there have been proposals - not from CSIRO, but ones that I am familiar with - to take the wheatbelt saline ground water and pipe that to the goldfields for mineral processing as salty water, and to not necessarily desalinate any of it. Those ideas are grand. I do not know whether they are meritorious, but I think they are sufficiently meritorious to bear analysis. From an outside view looking in, it seems to be a crime to have such a large water resource that is causing a problem in the same region that does not have enough water, if you take the goldfields into that region. We would certainly like to see some more analysis of that opportunity. That would be our view.

Hon KEN TRAVERS: I refer to John's comment. If you stopped putting the water into Corrigin and started to recycle it, would you then run out of water eventually -

Dr Hatton: No.

Hon KEN TRAVERS: - or would there be enough water in place that dropping the watertable would not have any effect?

Dr Hatton: You would not even be able to keep up with the annual rate of recharge of those systems; you would not be able to keep up. Something like five per cent of the rainfall each year in the wheatbelt runs off in the rivers - the run-off we can see in the Blackwood and the Avon etc. About another five per cent or about the same amount goes into an increase in storage of the ground water as a rule of thumb. It is an awful lot of water, and it is just getting worse, as you know; it is still filling up. Long-term sustainable supply is not an issue at all. Supply of energy to drive these systems is an issue, and the disposal of the brines that come out of the systems is an issue, but that is one that I think is fairly straightforward to address with reinjection etc - put it where it was, where we found it. It is very difficult to dissociate any of these inter-regional transfer water supply issues from the energy issue. They all require a lot of energy, whether it is to push water all the way from the Blackwood region up to here, or to push it through a membrane at Kwinana, or to push it all the way down from the Kimberley. It is inextricably linked to the supply, availability and acceptability of energy.

Hon NORMAN MOORE: Surely it comes down from the north by gravity!

Dr Toze: Have you not heard? They have discovered that south is up and north is down.

Dr Hatton: I hope that is in *Hansard*.

Hon NORMAN MOORE: Seriously, if you have any figures on the cost of sending water to Kalgoorlie, I would be grateful to have them.

Dr Hatton: We would only get them from the same place as you would, I am afraid, and that is the Water Corporation.

Hon NORMAN MOORE: You do not have anything independent of that?

Dr Hatton: Not independent, no.

Hon DEE MARGETTS: I am interested in the issue of water movement as well, but not only for the water quantity issue but also for the quality issues. This relates to the debate on water quality and salinity, which I know Tom has had a lot of interest in, and there has been the odd robust discussion from time to time. Has CSIRO done any modelling on or research into the movement of the Yarra Yarra water system? I have been getting all sorts of hearsay evidence about people who are already putting water into the Moore River in various ways. However, there was discussion that there was research by the Water and Rivers Commission, I think, about where the Yarra Yarra drainage water is coming out and how quickly it goes. Is CSIRO doing something similar, and where could I get my hands on that?

Dr Hatton: I do not know of any original research we are doing on the Yarra Yarra. I have certainly spoken to the Yarra Yarra catchment group about its ideas on drainage in that 300 kilometres of playa system up to and including the Yarra Yarra lake, but nothing downstream of that. Their thesis is that there is no good evidence that the Yarra Yarra lakes have ever discharged, although they may have come close once recently. What they are doing is a terminal enterprise, and therefore why should anybody downstream worry? I have been in that conversation with them, but we have done no original research as of yet on evaluating their ideas. We are currently investing in a project -

Hon DEE MARGETTS: Do you mean discharged from the surface?

Dr Hatton: These are ground water drains, yes. We are currently involved with the Department of Environment in developing a framework that would enable people to look at ideas like that and seriously evaluate the downstream consequences to flood peak, salt loads, salinity, sediments and nutrients of these grand designs that people keep tabling. We feel that the most immediate and best investment we can make on behalf of the people of Western Australia is to give some kind of tool to shed some kind of light on the likely downstream consequences of the WA channel group's ideas or Beacon's ideas or Yarra Yarra. We should deliver that within 18 months.

Hon BARRY HOUSE: We will move on. We have some interesting stuff here, as you can see. The next question on reuse of water has been partly covered, I think. The CSIRO appears to have a number of research projects regarding reuse of water. Can you please explain these to the subcommittee?

Dr Toze: We do not have a number of research programs, but we have one that fits under the banner of the Water for a Healthy Country flagship, which looks at water reuse in the south west. Predominantly, we are looking at water reuse on the Swan coastal plain, because that is where the major demand for reuse of water, or new reuse of water, will be. Most of the regional centres have already been reusing most of their water, as I mentioned earlier, for a long time for ovals and golf courses. Really, as I explained previously, it looks like the best way to reuse most of the water on the Swan coastal plain will be to recharge it to aquifers, either for the agencies to pump again at a distance away or as storage. Alternatively, it may be that if the research shows that it is correct to do so, we will just allow it to distribute out through the superficial aquifer in particular. That is the way we are moving at the moment, and that is the current research.

Of course, we are looking into the distance and looking at research that would come up to what we call indirect potable. Therefore, it is putting highly treated effluent into either Leederville or Yarragadee. It would be water that is basically considered as good a quality as, if not better than, the current drinking water that we have and putting it into the aquifer, which would eventually end up in the drinking water wells. The position might be that it would take 100 or 1 000 years to end up in the drinking water wells, just by the hydrogeology of it. Alternatively, if it looked like government agencies - the regulators like the Department of Health or DOE - were still not satisfied with the risk, or, more likely, the public perception just would not accept that, we would still have the capacity of pressurising these aquifers by putting the water in, but putting them in a position that the water would never be collected by the drinking water wells. At the moment, all our ground

water, except for a little bit that flows into the river, flows out and discharges some distance into the ocean. We do not have that great an idea of the Yarragadee offshore in particular, but we may be able to put that water in along the shoreline or some distance just off the shore so that will create a pressure and stop the salt water from coming in. We are literally creating a pressure so that the fresh water coming down is coming up against the water we are injecting. We continue extracting that water and the injected water is the water that flows out and discharges out to sea. These are the sorts of directions in which we are travelling. There are a number of other avenues that we can investigate. We have one project at McGillivray oval that was started in February this year, when they turned on the pumps. We are now irrigating McGillivray oval with water from the Subiaco treatment plant. That is an example of direct reuse. However, in reality, because of the capabilities we have to utilise the aquifers, that method will probably be the exception rather than the rule; that is, where the water is taken from a treatment plant, piped out somewhere and then reused. We are able to use the aquifers for conveyancing, which reduces the cost of conveyancing, and get improved water quality at the same time. We are able to manage the water far better by pushing it through the aquifers rather than moving it through a pipe, and that is where we are at the moment.

[3.10 pm]

Hon BARRY HOUSE: Have you had any involvement in reuse of a different sort, such as the proposal from Harvey Water principally and associated people to redirect some of the saline water going into the Wellington Dam to mine voids, and then reinvigorating Wellington Dam and using that water for palatable and irrigation purposes?

Dr Toze: Not directly.

Dr Hatton: I have reviewed some of the proposals for the recovery of Wellington Dam, including the diversion at James Crossing, but we have not officially reviewed the disposal of that water on land owned by Griffin Coal Mining Company or anywhere else. I have reviewed the work on how effective it would be in recovering the dam.

Hon JOHN FISCHER: Why would you put salt water into a freshwater catchment?

Dr Hatton: I do not know, we have not worked on it.

Dr Toze: One of the things about water reuse is that we never put saline water into fresh water; if anything, we can go from fresh water into saline water.

Hon JOHN FISCHER: Hon Barry House is talking about a proposal that puts water into the coal voids, and that is exactly what you would be doing, is it not? You would be putting salt water into a freshwater catchment.

Dr Toze: I would like to say it will not be "we"; it will be somebody else.

Dr Hatton: We just have not worked on that. Sorry.

Hon NORMAN MOORE: I gather that you can technically clean the water up even more than we do in Western Australia. In Singapore, for example, it goes through the drinking system five or seven times, it is anecdotal stuff. Which is more expensive: to do that and to use the technology here to clean up the 90 gegalitres of water and put it in the system or to pump the water back into the aquifers to clean it?

Dr Toze: If we were to compare desalination or the reverse osmosis treated sewage effluent method with the seawater method, sewage effluent is the cheaper method because it contains less salt. Therefore, less energy is required to produce the same quality water from sewage effluent compared with sea water. If we treated water to a lesser extent and then passed it through the aquifers, that is cheaper again, as long as the injection and recovery method is sustainable. Usually, we inject or percolate by gravity so it is just a matter of getting the water to where we want it and letting it go in, and it is cheap. If other people such as local councils and private citizens are pumping from their own wells, there is a net saving for the Water Corporation, the council or the

Government - whoever is doing it. The one thing we cannot remove by passaging through the aquifers is salt - end of story. If we want to produce a water that is drinking water quality in some places, we would still have to take out the salt at the end of the process or before. However, we are literally not looking at the water in terms of potable purposes at the moment; in 10 to 20 years we may be looking at it for those reasons. We are looking at the water being fit for purpose; that is, for parks or gardens. The Mosman peninsula runs at salt concentrations of 35 000 parts per million, they state, and the water coming out of the Subiaco treatment plant runs at about 800 parts per million; that is a big difference. If we can put that water in there and it can be pulled out and used for irrigation purposes, that is good. The salt concentration is still within the drinking water guidelines and we could theoretically use it, but people in Perth at the moment have a lot less salt in their drinking water than what is in that water, and they would notice it. Again, it comes down to public acceptability.

Dr Hatton: I think there is another dimension to this. We want to learn from the mistakes made elsewhere. One of those mistakes was to take a simple engineer's view of the opportunity for reuse and assume it is what the public would accept. That mistake was made in southern California, and we do not want to make that same mistake here. The original research we did on public attitudes about water supply and use made it very clear that in Perth, people are very keen on reusing water. However, when they are asked what they would like to use that water for, drinking is way down the list; it is the last thing they want to use it for. Things that are technically attractive may not be politically or socially acceptable. With regard to all of the reuse stuff, our thesis is about the fact that we need to understand both things to come up with something that will fly; we cannot just consider the dollars and cents behind membrane treatment.

Hon BARRY HOUSE: There are a couple of others areas we want to touch on. Hon John Fischer might be interested in the next few areas -

Hon JOHN FISCHER: I am interested in it all. I have had a briefing from a company that proposed to drop the water from the Wellington Dam over the Darling scarp through a reverse osmosis process. The company tells me that the power would do it because it is only about 1 500 parts per million, and, therefore, that should be a lot cheaper to do rather than the desalination process at Kwinana with sea water. Has the CSIRO looked at that at all; and, if not, why not?

Dr Hatton: First of all, we have not been invited to look at that by the proponent. We are certainly building a more general analysis of the opportunities for desalination generally for Western Australia, but we have not analysed that opportunity in particular.

Dr Toze: It has been thought about internally, but not researched.

Dr Hatton: There is the greater question of whether it is more efficient to do the things we need to do upstream of the dam so that that water does not need to be treated or desalinated, and whether that would, in the long term, be more energy efficient, socially acceptable and economically beneficial rather than forever treating it at the bottom. Again, I am just speaking from intuition. My judgment is that we would want to have a pretty good look at the two alternatives and not just one in isolation.

Hon JOHN FISCHER: I was interested to see whether you had considered that. The costing that was given to me -

Dr Hatton: The sort of analysis one does over the tea table with mates says that there is enough head to theoretically drive that water through a membrane. That is the question. However, I think the question is really bigger than that.

Hon NORMAN MOORE: With regard to investigating an idea like this, you say you had not been invited to look at it. If somebody invited you to look at a proposal, do you say that it will cost \$50 000 or do you do things for the love of it?

Dr Hatton: We consider them uniquely because sometimes they are terribly scientifically interesting, which is the business we are in, and we would grab it and run. At other times we might respond by saying, "Look, this analysis you are asking for can be based on standard knowledge in the engineering fraternity and there is no reason to come to CSIRO. Go to SKM or GHD or whomever. That is the business they are in and we do not want to do their business." Then there is the middle bit where we think there may be some new science in the proposal but we might have to charge for it. We have to be careful that we maintain competitive neutrality in what we do with all those principles. If it is really not going to generate new knowledge for Australia, then it is a commercial price, and there are probably players in that particular market that would do that analysis better than we would if it were all based on current knowledge.

[3.20 pm]

Hon BARRY HOUSE: The committee has received evidence from the Water Corporation indicating that the CSIRO completed a review on cloud seeding in Western Australia in 1996. Has the CSIRO completed any research on cloud seeding since 1996 and can you comment on the findings of the latest research the CSIRO has carried out?

Dr Bates: I am aware of that 1996 report. I do not believe that any new work has been done. If you want the best available information on this, I am not the right person to ask. The best person to contact would be Dr Brian Ryan of CSIRO Atmospheric Research at Aspendale. I do not have his phone number, but he is an expert in this area; in fact, he worked on cloud seeding quite a few decades ago. He is familiar with all the scientific detail as well as its implications.

Hon JOHN FISCHER: Is he Western Australian?

Dr Bates: He is Western Australian by birth but he lives in Melbourne. He will be here again on 2 or 3 August.

Hon JOHN FISCHER: The Tasmanian hydro-electric authority has been cloud seeding for 38 years. It must obviously believe that there is a benefit in it. Some authorities in California and other places in the United States have been doing it for 40 years. They obviously believe it works. What do you think the prospects are for Western Australia?

Dr Bates: A lot depends on the regional setting. There must be moisture in the atmosphere for starters.

Hon JOHN FISCHER: Cloud seeding is only a tool to supplement the provision of water. Obviously water cannot be produced out of nothing. I was recently told that the cost of conducting a 12-month program would be approximately \$12 million. The Tasmania hydro-electric authority states that it enhances its catchment by 250 gigalitres a year. If it were one-tenth as successful in Western Australia, considering that the rainfall here is higher than in Hobart, it would be extremely successful.

Hon BARRY HOUSE: We will take that as a comment. Is there a question in there?

Hon KEN TRAVERS: We are running out of time. These gentlemen have indicated that they are not experts in this field.

Hon JOHN FISCHER: I am just wondering why they have not looked at it in the past.

Dr Bates: When you refer to "they", do you mean the Water Corporation?

Hon JOHN FISCHER: The CSIRO.

Dr Bates: We looked at it in the past. I am going back decades. We moved on. There are good reasons that we moved on. There are more pressing research issues than that one. As I have said, a lot depends on the regional setting that is being dealt with. I am not sure that the evidence is that strong that it would work everywhere.

Hon BARRY HOUSE: Ms Charlotte Verany has communicated with the subcommittee. She introduced her proposal to harvest water to the CSIRO for comment and has presented the CSIRO's comments to the subcommittee. Do you have any further observations on the proposal?

Dr Toze: This is being done by a staff member who works with me. I believe this is where we are harvesting water that has been discharged into the marine environment.

Hon KEN TRAVERS: From underground aquifers?

Dr Toze: Yes, that is what I was talking about. All our aquifers discharge into the marine environment. I will not comment any more on it because the young woman who was reviewing it has been caught up with more pressing work. I can certainly find out more detail later or as soon as I get back. The only thing I would add is that one of the things we are dealing with on the Mosman peninsula has just come up. It was looking pretty good that we would discharge well-treated effluent into the area of the Mosman peninsula. It was pointed out that there are quite strong flows through the limestone that the Mosman peninsula is basically made out of, and that water discharges about 150 metres offshore. Ecosystems have developed to live in that sort of environment. There was concern that if we were discharging water that may not be the best of quality, not drinking or rainwater quality, and that might be a bit more salty, it might affect some of those ecosystems. My only comment is that I have not seen it, but I know of it and we are looking at it. It would have to be done very carefully to make sure that we do not take water from one environment and affect the ecosystem.

Hon DEE MARGETTS: What is the name of the researcher?

Dr Toze: We have been given the proposal. Dr Elise Bekele has been asked to look at it and is looking at it for us. I am not sure whether she has completed that.

Hon BARRY HOUSE: Simon has undertaken to get us any further information if it is available. Do you have any comments collectively or individually about any of the other terms of reference of our subcommittee?

The Witnesses: No.

Hon NORMAN MOORE: I thank the witnesses very much. It has been very illuminating.

Hon BARRY HOUSE: I endorse that. On behalf of the subcommittee, thank you very much; we really appreciate your time.

