COMMONWEALTH OF AUSTRALIA

Official Committee Hansard

HOUSE OF REPRESENTATIVES

STANDING COMMITTEE ON SCIENCE AND INNOVATION

Reference: Coordination of the science to combat the nation's salinity problem

WEDNESDAY, 12 NOVEMBER 2003

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HOUSE OF REPRESENTATIVES

STANDING COMMITTEE ON SCIENCE AND INNOVATION

Wednesday, 12 November 2003

Members: Mr Nairn *(Chair)*, Ms Corcoran *(Deputy Chair)*, Mr Martyn Evans, Mr Forrest, Ms Grierson, Mr Hatton, Mr Lindsay, Mr Anthony Smith, Mr Ticehurst and Dr Washer

Members in attendance: Ms Corcoran, Mr Martyn Evans, Mr Nairn and Dr Washer

Terms of reference for the inquiry:

To inquire into and report on:

The Commonwealth's role in managing and coordinating the application of the best science in relation to Australia's salinity programs.

In conducting its inquiry, the Committee will give particular consideration to the:

a) use of salinity science base and research data (including the development of new scientific, technical and engineering knowledge) in the management, coordination and implementation of salinity programs;

b) linkages between those conducting research and those implementing salinity solutions, including the coordination and dissemination of research and data across jurisdictions and agencies, and to all relevant decision makers (including catchment management bodies and land holders); and

c) adequacy of technical and scientific support in applying salinity management options.

WITNESSES

Committee met at 1.02 p.m.

McGRATH, Dr John Francis, Manager, Technical Services Branch, Forest Products Commission of Western Australia

CHAIR—I am pleased to declare open the sixth public hearing of the House of Representatives Standing Committee on Science and Innovation in its inquiry into the coordination of science to combat the nation's salinity problem. On 13 August the committee was asked by the Minister for Science, Peter McGauran, to inquire into this issue and report back to parliament. This inquiry was advertised nationally and written submissions were sought from interested departments, organisations and individuals. We are conscious that there has been a great deal of attention paid to the problem of salinity. Our focus is on managing and coordinating the application of the best science in relation to Australia's salinity problems. We are certainly pleased to be in Western Australia and we are aware of the significance of the salinity problem in this state. We are looking forward to learning as much as we can about the management of the sciences in addressing the salinity problem here.

We welcome our first witness, Dr John McGrath. Thank you very much for being here this afternoon. Although the committee does not require you to give evidence under oath, I should advise you that the hearing is a formal proceeding of the parliament. I remind you, as I remind all witnesses, that the giving of false or misleading evidence is a serious matter and may be regarded as a contempt of parliament. I also remind you that the committee prefers all evidence to be given in public. However, at any stage you may request that your evidence be given in camera and the committee will then consider your request.

We received a submission from the Forest Products Commission of Western Australia and it has been authorised for publication, so that is all on the public record. Would you like to start off this afternoon with some opening comments, before we ask some questions?

Dr McGrath—Yes, thank you very much. What I thought I would do is work through the summary of that document and highlight what I think are the major issues. Firstly, why would FPC be interested in this? The Forest Products Commission had a major role in initiating a number of reafforestation schemes on farmland in Western Australia. It is mostly known for its commercial projects in that area. A number of those projects have had quite considerable environmental benefits from an agency that has had involvement in the area of reafforestation for environmental management and commercial benefits for quite a considerable period of time.

Secondly, FPC has been involved in developing state policies in relation to reafforestation, in particular for salinity control. Directly the Forest Products Commission—and partly in its former incarnation as the forestry part of Conservation and Land Management—has been responsible for nearly 100,000 hectares of revegetation within just over a decade. Most of that has been in commercial blue gum plantations but, more recently, in *Pinus pinaster* and a variety of other species for revegetation in lower rainfall zones with a range of environmental benefits—salinity amelioration, carbon sequestration et cetera. Lastly, and quite central to the committee, CALM and the Forest Products Commission have used and still use science to direct their operations. We directly undertake research and, where appropriate, commission it, so we span quite a range of the issues the committee might be interested in.

In terms of the specific issue of science transfer, one of the key issues that has become apparent in the last decade or so of working with these new revegetation schemes is that where there is a reasonable degree of certainty about the science and technology or techniques that are being used, then the technical transfer is very rapid; uptake is very good. That is not quite so where there is uncertainty. Where there is perhaps a lot of debate or even more than debate about some of the issues, then the science or the uptake of technology is nowhere near as rapid.

Moving on to some of the areas that we see as gaps in relation to the reafforestation for the treatment of salinity, as a background comment it is fair to say that there is reasonable agreement that, if we could completely revegetate some of these landscapes that are becoming saline, we would solve the problem. Nature had the system in balance before a lot of these systems were cleared and there is fairly good evidence that, despite a bit of hysteresis in the process, we could reverse it. The issue then becomes whether that is practically and economically feasible. If we are going to obviously maintain viable agricultural enterprises then complete revegetation of southern Australia is not really an option. That has been quite a realisation that has come into this business in the last decade or so.

That raises a few questions—and I do not think there is any great intention to revegetate broadly across the landscape—such as: where and how we might take the revegetation activity for its best effect? That is probably one of the issues we see as a real key in the use of revegetation in the amelioration of dryland salinity. That is the business of how much revegetation is needed and where and how we do it.

Some of the key questions that flow on from that—and we can deal with some of those things perhaps a little later, the business of needing to target the revegetation—is the business of how we make those things commercial, even in their own right. That needs a clear definition of products. For people who are familiar with some of the funding and projects going on in Western Australia at the moment, a large amount of the work in this area is being directed at a project called the Search Project which is about identifying new species and new products that can be used to ameliorate salinity which are commercial in their own right.

The business that used to be called plantation silviculture, which is really the management of the plantings in whatever form they take, is obviously a pretty key issue. The experience with the blue gum plantations, of which there are now nearly a quarter of a million hectares in southern Western Australia, was that some of the technology from previous plantation areas was directly applicable, but there was very much a need to either modify or develop new techniques. That is probably going to be very similar for any movement into medium- to low-rainfall zones.

In summary: what do we need to know? One of the key questions, as I said, is the circumstances where partial reafforestation of cleared catchments will most effectively either stabilise or reverse salinity. It is a key question as to whether partial revegetation does work. Spinning out from that is the need to resolve the issues related to where the trees are placed in these landscapes. The ‘how’ is how we develop the new industries and the products.

A further key question in terms of the commerciality of these things is how we make them viable as products. We need mechanisms where the products and services—not only the products that are produced, but the environmental services that are provided—can be traded in an economic fashion. We have all heard about carbon trading schemes and things like that. The idea

there is to try and develop a marketplace for the trading of some of the other environmental benefits—biodiversity benefits, water quality benefits—and how they might be valued and traded. That is a key question. Whether that is a science role, I am not sure, but it is something that has to be dealt with.

One of my colleagues asked a question about the role of science—whether science is really necessary or whether we just use the processes of trial and error, adaptive management, and try to do things in a structured way. The experience we have had, as an agency, in the last 10 or 15 years would suggest that both approaches are necessary. Trial and error—adaptive management—is necessary on an operational scale, but to back that up you need some good quality science and an understanding of the processes.

As an example, science probably has a role in resolving some of the controversies that might arise in this area. A good example of that was the work that was done or is being done in Western Australia, not so much on the reversal of salinity but on the causes of salinity. Twenty-five or 30 years ago there was some scepticism about whether land clearing was the reason for the development of dryland salinity. There was some key work done with a number of catchments which were deliberately cleared and the response in those catchments was monitored over time. Unequivocally that demonstrated the processes and the rate at which those processes happened. That was a good example. It is a reverse of where we want to be at the moment but it is a very good example of how science has been used in this area.

There is a need to fully clarify whether partial reafforestation can be used as a mechanism to reverse dryland salinity in specific locations or more broadly across the landscape—whether we can stabilise or reverse salinity with partial revegetation. A key issue—which gets back to that issue between adaptive management and science or technology—is the scale at which we do some of the work. All the issues to do with partial revegetation revolve around scale. Can we do them? Can we demonstrate these things at a scale that landowners are comfortable with and which demonstrate at a broad scale that these mechanisms can be effective? There is no point in just demonstrating on a plot scale that we can reverse salinity. We have to do it at a landscape scale, because that is the scale where the problem is occurring.

As to the mechanisms, we would say that one of the key issues is this area requires significant research investment. We have a view that perhaps it is not being adequately met at the moment. There is a need for an increase in funding. One of the key issues in terms of the direction of that funding is that there is probably a very real need for the users of the research to be included in the prioritisation of research. On R&D and corporation bodies et cetera, we need people who are end users to be there, setting the priorities. It should not just be a business of research people setting priorities for research projects. The people who are involved in setting the priorities need to have a strong industry basis.

We made a suggestion—and you probably all read that and maybe even smiled—that up to five per cent of the National Action Plan for salinity money might be directed towards R&D. Whether that is a realistic aim I am not sure, but it was really to highlight the issue—that is, we believe there is a really significant need for decent funding in this area. In terms of the extension, one of the key terms of reference was the issue of whether the information that has so far been developed and potentially will be developed hits the target and makes it down to where it needs to be. That may very well vary across Australia. In Western Australia there have been some very

good efforts in the medium and longer term in extension of technology and information to land managers and farmers. That is something we believe is done quite well.

There are three terms of reference. As to the first term of reference—the use of science and whether the uptake is adequate—we believe there is and has been reasonable uptake of science and technology in the area. Secondly, the key issue—and I made this comment at the beginning—is that, where the information is well substantiated and well presented and where there is a body of people who believe that the right direction is being taken, the uptake is good. Where the certainty about the information is less, the uptake is less. A key role for science and technology is to make the debate an informed debate so that the information is well picked up.

As I said, the linkages between the research and the implementation areas are fairly good. Perhaps that in some ways reflects the perspective of the agency that the FPC spans across, from the technology area right the way through to the implementation on the ground. We have some fairly good links with both ends of that spectrum, with CSIRO and the universities at one end and land management and farming communities at the other.

The third term of reference is that the adequacy of the technology and science that is being input into the salinity area needs to be improved or there needs to be more of it. A key area is the business of revegetation and whether partial revegetation is commercially practical. A key mechanism in making that all work is the length of time that we do some of these things. Some of the R&D funding that comes out for landcare is very short term—between one and three years.

We are dealing with a problem that has taken many decades to arise. It is not likely to be reversed or even stabilised in the short term, and I think the funding has to reflect the long-term nature of some of these processes that need to be undertaken. That is the brief summary that I wanted to give you.

CHAIR—Thank you, Dr McGrath. You mentioned trial and error. How much error has there been in your trials so far?

Dr McGrath—Can you elaborate a little?

CHAIR—You were talking about some of the blue gum forests, and I got the impression from the language you used that maybe some of them have been less successful than others.

Dr McGrath—Yes.

CHAIR—Is that some of the 'error' in the trial and error approach to the problem?

Dr McGrath—It is fair to say that with the blue gums that industry developed very quickly. It is probably also reasonable to say that the development of the industry got a little ahead of some of the technical base behind it. Certainly, there was planting of blue gums in some areas perhaps in the early nineties which would probably now not be considered to be a wise move. That was probably not so much error in the research, but that the research in terms of where we could plant the trees lagged behind the commercial activity. People were making commercial decisions almost with a lack of information, and that has certainly led to lower profitability in some areas.

CHAIR—Was that lack of information, though, because it just wasn't available or was it because they did not know where to access it? Was there some work done that might have been able to assist, but they did not know it had occurred?

Dr McGrath—In the very early part of it there was a definite lack of information. In the subsequent three to five years it was probably a bit of a lack of transfer of that information. Subsequent to that—the latter part of the nineties and the last two or three years—the information has certainly been available for people to use. It is a little bit of both. There was a lag in the development of that information and there was probably a bit of lag in the transfer of that to some companies.

CHAIR—It has been suggested to the committee by various people who have put in submissions that nationally we need some sort of central database or central repository of scientific information related to salinity, so that whoever is working in the area has somewhere they can go and ask, 'What has been done?' Would you support such a move?

Dr McGrath—In terms of a database which identified what work had been done, people use the term 'metadatabase'. It is not the data itself but a database of data. It tells you what the data is, who owns it—if there is such a thing as ownership—and where and how it might be available. I think a mechanism such as that would be invaluable. Whether the placement of the data itself in a central repository is the way to go, I am not sure. Particularly in commercial areas, where people might have intellectual property issues to deal with, they may or may not be comfortable with that. One step back is identifying the data available and where it is, and that is an excellent idea.

Ms CORCORAN—At page 1 of your submission you talk about information gaps. Could you talk about that a little—where they were and the implications. Later, on page 5, you talk about conflicting messages.

Dr McGrath—In relation to the information gaps, I have made the comment a number of times that the key issue is whether partial revegetation or reafforestation—whatever you want to call it—can reverse salinity.

Ms CORCORAN—The gap is not knowing whether or not it will reverse?

Dr McGrath—Yes, and that creates uncertainty. As I said, the ecological experiment—if it was that—which was placed on the landscape—it was on the landscape when we arrived a couple of hundred years ago—was that the thing was completely vegetated. The hydrology was in balance. As I said, both plot scale and reasonable scale plantings—and, in fact, some of the blue gum plantings have been key in that, where they have planted areas at a scale which is greater than the plot—indicate that that reverses the hydrological imbalance. The issue then, if we want commercial agriculture and revegetation in the one landscape, is how much revegetation can deliver that environmental effect or the hydrological effect and how much impact does that have on commercial agriculture? It is a balance between two competing things.

Ms CORCORAN—Is there any question in anyone's mind that revegetation may not always be the answer?

Dr McGrath—There are two answers to that. I think there is a fairly reasonable certainty that complete revegetation would—

Ms CORCORAN—No, I was distinguishing between the practicalities of complete revegetation—and I think everyone assumes that that is not going to happen. I was really only taking a step back from that. General opinion so far seems to be that revegetation is the large answer. What I am really asking is has anyone tested that?

Dr McGrath—I can only answer that from a Western Australian perspective. Our hydrology is very different, for example, from the Murray-Darling. It may well be that you would get a different answer from somebody there, but with our local hydrology systems here the answer to that, I believe, is an unequivocal yes.

To illustrate that answer, a problem that we have here in Western Australia at the moment is balancing the water demand for the city of Perth on the Gnangara Mound, which is a local hydrology area—a local sand-plain recharge area—from a bunch of horticultural and agricultural users and a 22,000 hectare pine plantation, which effectively eliminates the recharge. That is a reverse example, but it shows that the revegetation in that area completely controls the recharge. There are numerous other examples in Western Australia, both at a plot scale and at a reasonable scale, where revegetation has been unequivocally used to demonstrate that it can reverse the hydrological cycle.

Another example, if you want one, is the blue gum revegetation that has happened in the Denmark catchment. The Denmark catchment was 90 per cent under native vegetation. About 10 per cent of the medium to upper level part of the catchment was cleared in the mid to late sixties through to the early seventies and, as a result of that, the water quality in the Denmark River had started to decline—become saline—and that trend has been reversed with the almost complete vegetation of that 10 per cent of land in the upper Denmark catchment. There are a number of other examples. I believe that it does work in our system.

Ms CORCORAN—That is commercial revegetation, isn't it? Are old land users changing what they do with their properties and moving to forests, for want of a better word, or are we dealing with people who are new on the land deciding to revegetate commercially? If it is someone who has done other things and has now decided to revegetate, how did that decision get made? What was the process?

Dr McGrath—I do not want to use the blue gum model as the only model, because the majority of Western Australia's salinity problem is in an area that is not really suitable for those broad scale blue gum plantations. As you said a moment ago, there is a broad recognition that broad scale revegetation is not going to be the answer in those areas. The drivers that lead people to change their land use in the medium to lower rainfall zones may well be different to the blue gum country or the high rainfall country. In the high rainfall country it was essentially an economic decision. The blue gum prospectus and investment companies came along with commercially attractive propositions for people, so people who had been farmers for a long time changed their land-use activity because it was commercially—

Ms CORCORAN—Because the scheme was promoted to them?

Dr McGrath—Yes. It was promoted to them as a commercially viable scheme, and for them it was a commercially viable enterprise.

Ms CORCORAN—By the Forest Products Commission?

Dr McGrath—The Forest Products Commission to some extent, but a whole range of commercial forestry companies. The Forest Products Commission has probably had a hand in about 25 per cent of the blue gum industry. The other three-quarters of it has been done completely independently of FPC. FPC's own commercial involvement in the blue gum industry is very small. It has really acted as an agent for a range of both local and international investment companies. It was a commercial decision that those farmers made.

What I understand your real question to be is whether those conditions or those drivers are the same for revegetation in the medium to low rainfall zone. I am not sure. It is an emerging issue, I guess, as to what drives people. From talking to people, care for the environment crops up in quite a lot of forums in terms of people's motivations for being there, as well as commercial values.

Mr MARTYN EVANS—We talked a bit about the research side, and my real interest goes to how well you think we are doing at coordinating that. The old established research areas, like medicine and the general physical sciences and so on, have the established groups like NHMRC, the ARC and so on. In general terms we are spending a lot of money on salinity. If you aggregate all of the money that state and federal governments spend on salinity, it is enormous. It may or may not be enough, but it is a large amount of money.

Dr McGrath—Sure.

Mr MARTYN EVANS—Obviously, governments at all levels and of both persuasions see it as a very serious problem. We are spending a lot and putting a lot of political capital and national and state effort into addressing it. Your submission goes to the core of science possibly being an important part of focusing that effort correctly, identifying the right areas to plant, determining the correct ratios—'Can we sustain agriculture in the right areas?'—and so on.

These are very important questions of focusing that effort. What model should we then turn to in focusing that research effort, if we picked up your ideal of five per cent or some notional number of hypothecation for research—and there is a lot of merit in some kind of number like that, or at least some dedicated research component of this funding—to make sure that our effort is directed in the right way and not wasted? What model should we have? Should we have a model—indeed a structure, as we do with the traditional science areas—given the magnitude of our effort on salinity and the importance of the overall effort to attack salinity? Should we have a coordinated science model then to say how our research base here is directed, especially since, as you quite rightly observe, we may need to have some of these programs running over a 10-, 20- or 25-year period? This speaks to me of something which needs a long-term model and a sense of direction which goes beyond a simple casual grant system or something.

Dr McGrath—It is a good question. I was tempted halfway through your question to say that there are a couple of examples where there has been an attempt to coordinate not just research but the technical activity in agroforestry and reafforestation, and you are obviously aware of the

joint agroforestry venture. That has been obviously a mechanism whereby a number of the RDCs have got together and said that there is a problem, that we all have some responsibility or some involvement in and we would like to coordinate our activity.

I think that goes part way towards answering your question. My view is that we do need some coordination. The issue of how we achieve that for longer term projects is really interesting and I will put a plug in for the state system here. The state agencies—and I come from a forestry background, which tends to take a fairly long-term view of a lot of the land management issues—were very good in the past at doing that and they provided essentially the research infrastructure for a lot of shorter term studies.

If I can use a native forestry example, and there are probably examples like this in every state, there is a series of long-term forest management sites—they are larger than trials—that were set up many decades ago and they have been incredibly useful in teasing out the long-term impacts of management in native forestry. A similar system would be incredibly useful in any inland management area.

The state government agencies, when they were well funded enough to create those systems, did quite a good job. It begs the question as to whether another system might have done as good or better a job but it was a job that was done relatively well. I think one of the key questions you have got to address in answering how you achieve that is to identify agencies or entities that have a long-term future or a long-term responsibility for an issue so they have a management role in the medium to long term so that they will exist.

This is not meant to be critical of universities. I used to do a lot of work with a number of the university people, but a lot of the work that comes out of the university funding system is very short term. Three years is a very long research project in a university environment. I think you have got to somehow entrain a series of agencies that do have a long-term commitment to this area and the funding mechanisms will probably be quite different from short-term JVAP things.

There are two answers to your question, I guess: certainly the integrated model and whether JVAP is exactly the right model, but something along that line where it puts together resources and the priorities from a number of different agencies is a good idea. How we achieve the longer term part of that I am not sure. It probably would be as commissioned longer term interactions for funding or something like that. But it is a real issue and a classic issue.

I mentioned this long-term funding issue. A classic example is that I mentioned the longer term catchment studies that had been to demonstrate unequivocally the impact of clearing. While they have been very valuable and continue to be, they are not monitored right at the moment. The funding base for that has disappeared because of a lack of funding for the state agency that ran that system. While they are still there and still will be valuable in the future, right at the moment that funding base is not there. It is a really good example of what happens if we do not get it right.

Mr MARTYN EVANS—And we could find some way through that, of getting a joint Commonwealth or state model which would perhaps establish priorities and ensure that there was a long-term basis for handing out ongoing funds to research which could then be

established. People could be sure that they would maybe get a grant that could go for that seven-year or 10-year period; that they will commit to modelling that funding for 10 years.

Dr McGrath—Yes.

Mr MARTYN EVANS—Do you interact with some of the other state agencies in terms of data availability with mining and the like? A lot of data may already be out there with your colleagues in the state which would have an impact on salinity. Is there much interaction with that?

Dr McGrath—The answer is yes. We interact directly, but not too much, with the mining people but certainly with Agriculture and the Water and Rivers Commission and, to a lesser extent in this particular area, the Water Corporation, which are more a commercially oriented body. The Water and Rivers Commission, Ag, CALM and the Forest Products Commission all consult. Their work varies across areas. Sharing of data generally happens through joint projects. We have a number of joint projects. There are a number of state and federally funded projects that span across the agencies and they provide a very good forum for that sort of interaction. An example is the CRC for Plant Based Management of Dryland Salinity. That tends to amalgamate or collect people from a number of agencies together under a number of projects. That is a good example of that interaction happening.

Dr WASHER—John, thank you for your delivery. Could you give an example with some of these questions. We identified chlorides as being a problem in salinity to plant material. Do you know why, for example, chlorides cause plant necrosis or cellular death in plant tissue.

Dr McGrath—It is direct toxicity in terms of necrosis within the plant material. The direct toxic effect of the chloride iron on the cells' metabolism basically kills the plant cell by cell. You see it in patches on leaves or initially as a marginal necrosis because that is an area where the chloride accumulates. Transpiration and the movement of water through the leaves et cetera ends up at the extremities and you just get a concentration of it in those areas. That is why specifically you see it working its way in from the edge.

Dr WASHER—Thank you, John. I was not trying to be smart about it.

Dr McGrath—That is all right.

Dr WASHER—We have been talking about why we cannot grow plants on it—

Dr McGrath—That is an easy answer to fix. There is a second effect of salt, which is an indirect effect, if you like, and chloride plays a little role in that; sodium perhaps more so. The other part of the sodium chloride issue is the osmotic effect, so you get a concentration, which is essentially why plants do not grow in sea water. It is very difficult for plants to extract water out of sea water because they are working against an osmotic gradient. You have a high concentration of salt outside and you are trying to drag the water in from that, so the plant basically suffers from a drought effect. There are two effects, but a direct chloride toxicity is a cellular and metabolic problem.

Dr WASHER—You mentioned carbon credits, because we were talking about trees, and the blue gums, *P. pinaster*. At what time would you consider when these trees mature that they become, instead of positive carbon takers, negative or positive carbon givers-back?

Dr McGrath—There is a day's lecture that goes along with that.

Dr WASHER—Yes, I know.

Dr McGrath—No, sorry, I am not trying to be smart either. It takes a long time for the sorts of trees that are being planted. The carbon accumulation goes on for many decades. You will run into a point where there is a plateauing of that carbon accumulation and then subsequent to that a decline. For most woody perennials—trees, things that you harvest as a log—that process takes between four and seven decades, depending on your species, before you get to a plateau. With less woody perennials and more shrubby woody perennials—native species and things like that which go through a quicker life cycle—you might be looking at less than a decade for a lot of that. It varies with your species but it is quite a long time with the commercial woody perennials.

My comment about the day's lecture is that there is a huge science. Chris Mitchell, the CEO of the carbon accounting CRC, is in Western Australia this week. He would probably occupy you for a week to give you that answer.

Dr WASHER—I asked because it is all part of the science of what we are going to do in these saline areas. The opposite is the *pinaster* plantings out through the Gnangara Mound. I think you would agree that the water mound is about 110 metres deep. It is a medium level aquifer, which would pump for the whole city.

Dr McGrath—As I understand it, the water that is being extracted from the Gnangara Mound is from the surficial aquifers. There are basically three aquifer systems on the coastal plain: the surficial unconfined aquifers, as I understand it; the Leederville aquifer, which is that one that you were talking about, which is about 100 metres down; and the Yarragadee, which is half a kilometre down, or something like that. It is my understanding that the water that is extracted from the Gnangara Mound is from the surficial, unconfined aquifers, and obviously that is the water that the trees have a direct influence on.

Dr WASHER—The Gnangara *pinaster* pine plantation is destined to be cut down over the next 20 years.

Dr McGrath—That is right.

Dr WASHER—It is going to be veneered timber et cetera.

Dr McGrath—Yes.

Dr WASHER—The reason for that is the increase of chloride in the water. I believe that the chloride in the water in that aquifer has increased because of dry years and increased usage et cetera, and the water quality and the amount of water available have reduced.

Dr McGrath—Yes. There is a real big project or, again, a debate going on—one of the uncertainties. We are trying to resolve it. The Forest Commission has only a small involvement in it. Even though they are our trees, the science or the technology is being mostly done by the Water Corporation and CSIRO. I do not know that there is an issue with water quality on the mound at this stage. One of the issues is the accumulation of chloride underneath vegetation. Obviously the rainfall comes in with chloride; all the water is removed and the chloride is left behind to some extent. You get a build-up of the chloride in the soil profile and in the aquifer, and the evidence, surprisingly, that the CSIRO people have found is that under the pines there is a lower accumulation of chloride than there is underneath the native vegetation.

That is counterintuitive, but what happened, they believe, is that the banksia woodland was cleared for the establishment of the pine plantations, and it is about a three- to four-year process between when the land is cleared and the native vegetation burnt and the process of putting the trees in the ground happens. While there is limited vegetation in that area, there is a very large flushing of that profile because it is very porous. What they think has happened is that the chloride has been flushed out of those profiles underneath the pines.

When you look at the chloride profile, there is an accumulation in the root zone of the pines but underneath the root zone there is less than there is under the banksia woodland, as a result of that perturbation. It is a really good example of how, when you change some of the settings in the system, you change perhaps more than you think. I am not sure that there is good evidence that there is an accumulation of chloride and salt in that aquifer at this stage.

I think the real issue is that the pines at a sufficient density can eliminate recharge, so you eliminate recharge from the aquifer. Essentially it is a competition for water, because it is not pumping it out but it is not letting it get in. The focus of the program in that area is to work out what density of plantation we can manage or what is commercially viable for the LVL plant that also allows sufficient recharge for the aquifer so that we do not dry up Perth's water supply. That is, hopefully, an understandable explanation.

Dr WASHER—You mentioned agroforestry in your submission. Is that practised much in WA? Do we get a lot of agroforestry? You mentioned blue gums, *pinaster* et cetera. What trees would you use as part of agroforestry? What would be the mixture?

Dr McGrath—It depends on how you define agroforestry. If agroforestry is integrated trees and agriculture, then the answer is that there is not a whole lot in Western Australia, because a lot of the tree planting and the revegetation on farmland has been extensive revegetation. Somebody tried to define all trees on farmland as agroforestry, but I think that is trite. If it has a plantation on it, then it is probably plantation forestry, in my view.

The species that can be used for agroforestry are broad. The selection of species needs to be made for the environment you are in. If you wanted to practise it in the high rainfall zones, things like radiata pine and blue gums and some of the faster growing south-east Australian eucalypts for saw logs would be appropriate. As we move out through the rainfall zones, then the suite of species that we would use would be quite different. It is probably fair to say that the biggest area of agroforestry as such would be the 10,000 or 12,000 hectares of oil mallee plantings that have happened out in the lower rainfall zone. That is probably the biggest. It is not a concentration, but is the biggest area of agroforestry, as such.

CHAIR—Dr McGrath, you gave an unequivocal yes to an earlier question as to whether planting or revegetating would solve the problem. Why are there so many drains being built in Western Australia, if I understand that information correctly?

Dr McGrath—That is a good question. I answered whether revegetation will work on the basis of whether technically it will work. While it will work, there are probably some circumstances where, because the land is already salinised—you have a saline valley system or whatever that needs to be drained or have something done to it before any trees can grow there—there is a reason to get rid of the water. Drainage can be useful for not only salinity amelioration but also the amelioration of waterlogging.

You are probably well aware that the combined effect of waterlogging and salinity is much greater than either one by itself, so there are probably good reasons to drain. There are probably certain circumstances where there are high value assets—farms, roads or other infrastructure—where drainage may well be a useful option. My answer was not meant to say that other forms of amelioration are not useful or do not have a role. They obviously do.

CHAIR—Is there an overuse of drainage in Western Australia?

Dr McGrath—I do not know whether I am qualified to answer that question. The issue, I believe, with drainage is not so much whether it can work in a local sense but what happens with the effluent water. It is reasonable to describe it in most cases as effluent, because it is contaminated. It is contaminated with salt, obviously. What you do with that is the key question. Where the drains end up depositing that effluent in other sensitive areas or on other landowners' land, you would have to think that there is an overuse of the drain. Where there is a safe way of disposing it, it is one of the better options for that particular land; it is probably okay.

I think I would answer that in an equivocal way. Where there is a safe disposal point, it is probably okay to use drainage. Where there is not, I think it is a mechanism that should be really carefully looked at before it is used. Just to reiterate that point, an example would be the depositing of saline water into the lake systems in the inland. Perhaps that is not a good thing to do, either from the point of view of overfilling them and waterlogging areas that have never been full of water, but also depositing much more salt in those systems.

Ms CORCORAN—One of our jobs is to try and sort out whether or not scientists and researchers are actually talking to the land users. I am wondering if the drains are an example of farmers or land users doing the best they can to cope with the problems they have on their property without recourse to the best science available? Am I jumping to conclusions here?

Dr McGrath—My earlier comment that I thought the transfer of information was reasonably adequate—which is, I guess, where you are coming from—refers mostly to that area of revegetation where there has been quite a lot of effort by agencies like FPC, funded with federal money through the Farm Forestry Advisory Service and ongoing through agriculture. Part of FPC's programs is to engage farmers and other landowners in that process, but that is one end of it. At the other end, in terms of drainage and the options there, I am probably not qualified to comment on whether that information is getting through, I am sorry.

CHAIR—A number of submissions have criticised the extent and quality of extension services in getting information out. In fact, a number have said that part of the reason this is a problem is that a lot of traditional extension was done by various state agencies and they have, over time, gradually withdrawn that. Farmers now are maybe getting information from some of their agribusiness people—Elders, Wesfarmers, those types of people—which once upon a time was available through various departments. Extension is a key issue of the information flow. Do you think that criticism and that sort of reason for the problem is valid?

Dr McGrath—Our submission came from the perspective that we bring to that, which is that we invest a reasonable amount of effort in that because we need to get the information that we want across to the target audience. Perhaps that provides a perspective where we think the information is hitting that target. It is an absolutely correct perception that the effort that the state agencies in general currently put into that area of extension is less than it used to be. If that is creating a problem, then that is probably right. Certainly there has been, as you point out, a shift in emphasis since, probably, 15 years ago.

CHAIR—Thank you very much for your evidence this afternoon.

[2.00 p.m.]

GEE, Dr Dennis, Chief Executive Officer, Cooperative Research Centre for Landscape Environments and Mineral Exploration

WILKES, Mr Paul, Deputy Chief Executive Officer, Cooperative Research Centre for Landscape Environments and Mineral Exploration

CHAIR—Welcome, Dr Gee and Mr Wilkes. Do you have any comments to make on the capacity in which you appear?

Dr Gee—I am a member of the board of the CRC. Our head office here is in Perth. We are a consortium of many people with wonderful characteristics.

Mr Wilkes—I am a geophysicist by background. My long-term position is as senior research fellow in exploration geophysics at Curtin University but I am seconded to the CRC LEME for its duration.

CHAIR—Although the committee does not require you to give evidence under oath, I should advise you that the hearing is a formal proceeding of the parliament and remind you, as I remind all witnesses, that the giving of false or misleading evidence is a serious matter and may be regarded as contempt of parliament. I also remind you that the committee prefers all evidence to be given in public. However, at any stage you may request that your evidence be given in camera. The committee will then consider your request. The committee has received your submission and it has been authorised for publication, so it is all on the public record. Would you like to start off with some opening comments, and then we will have questions.

Dr Gee—I would like to invite Paul to give a 10-minute summary of our programs and the content of our submission.

Mr Wilkes—There are six main things I would like to say in this opening discussion. They are in our submission but they are things I think are particularly relevant. The first is to stress the importance of regolith and explain what a regolith is, because it is not an everyday term that we hear on the radio. We use the term regolith to mean everything from fresh rock to fresh air, so it is all the unconsolidated material above basically hard rock at usually considerable depth. That depth can be anything down to 200 metres. Regolith is very important in the Australian context. It is very much a feature of an old and very weathered landscape. What we are about in our CRC is applications of regolith geoscience to first of all mineral exploration and secondly natural resource management, particularly environmental issues.

Regolith is critical and we would like to get this term strongly in people's vocabulary. It is not a matter of just looking at soils. Soils are just the top part of regolith. It does include water within the regolith. That is a key issue. The regolith is basically the major place where salt is stored. Salt is actually in the regolith. It is important to map where it is in the regolith, to map how it is moving and to know what the mechanisms are for its movement within the regolith. Those are key issues on which we are bringing our science to bear to good effect.

I will give a bit of background about CRC LEME. We have been involved in some major NAP funded projects in South Australia, on the Murray, in the Riverland and away from the Murray as well, in South Australia; also in Queensland, the Lower Balonne project, which includes Cubbie Station, which has become quite notorious in recent times. We have also been working in Victoria in collaboration with state agencies, with BRS and various other groups—and certainly with community groups; that is very much a feature of the work we have been doing.

Our leader, Ken Lawrie, who heads up our program 4, which is all about salinity hazard and risk mapping, came back last week from a meeting in St George which very much involved the community. That is a regular feature of the work we do. We explain to the local people what we are doing and why we are doing it. We get feedback from them. We get a lot of information from them on the local agricultural scene and how things have changed. It is a two-way interchange and it is very important to have this interchange with the locals. It is very much a feature of our work and something we value and recognise as critically important.

The third thing I would like to say is that basically this brings a whole combination of different science together. There is no one, simple solution to salinity problems in any given area. We are somewhat hostile to the idea that you can just describe this, as has been done in the past, as 'ultrasound of the earth' or 'five simple steps'. I think you know exactly what I am talking about. It is more complicated than that. We owe it to the locals to explain the complexity. The people on the ground are smart people and have a lot to offer. We should not talk down to them or simplify it, because I think that just creates the wrong impression.

The simple terms tend to suggest that we can simply solve the problem and that is often not the case. I would like to stress it is a quite complex business. There are lots of different branches of science involved. There is geology, geophysics, hydrogeology, agricultural science and engineering and they all have to be implemented within a social framework whereby the locals take ownership and understand what is going on. I think those are very important comments to add to this.

We see that the current model of devolution down to the CMAs is not working to best effect. We do not think this is the way to do good science in a timely or cost-effective manner. We certainly see the CMAs have every reason to be involved but we would like to see a different model whereby we actually use the skills and the datasets that are present in the federal agencies, like Geoscience Australia, in the state geological surveys, in the state NRM agencies, in CSIRO, in the number of CRCs who are involved in salinity—and there is quite a group of those, as you would be aware; at least half a dozen—and also major players like the Murray-Darling Basin Commission. All these people have a role to play and I do not think we are getting the best out of them with the current arrangements.

As you are aware, when NAP started, projects were going to be initiated down through AFFA, through BRS, into organisations like CRC LEME et cetera. This changed a while back and now the money goes to the states, to CMAs and it is working the other way around. We are not really convinced that is the best way to spend the money or to get the best science, or to do it in a time-effective manner. We would like there to be another look at the overall funding model and the way that things are organised.

A possible model is the model that occurs with the state agencies: the state geological surveys done by Geoscience Australia through the National Geoscience Mapping Accord. If you want to hear more about that, Dennis has been very involved in it, because he was formerly the director of the Northern Territory geological survey. We would offer that as a suitable model for doing things better in this area of work.

I talked about the various CRCs working on salinity and there are quite a number. We are very aware, as are some of the others, that we need to work more closely together to avoid duplication and to get the best out of all the CRCs. The ones I am talking about, as well as our own, are clearly catchment hydrology, freshwater ecology, plant based management of dryland salinity, irrigation futures, and spatial information. There are one or two more, but those six or so in particular have major projects going on in salinity work at the moment.

I have talked about a simplistic description of science and I think we need to get away from that and to explain more carefully what it is we are doing. We find that the farmers and the locals do appreciate us doing that. What they have said to us is that they want good science and they want to understand what is going on. They do not want simplistic descriptions.

The last thing I would like to say in these opening remarks is that we have done some research recently on the effect of line spacing on airborne electromagnetic surveys and their effectiveness in salinity mapping. We have traditionally gone for spacings that have been what we have probably used in mineral exploration: a few hundred metres line spacing. We have done some recalculation of the results and dropped lines out and seen that we could have got many of the results by flying five times wider than originally; sometimes even more than that. Of course, on an area basis, that brings the cost down very considerably. Cost is certainly a factor for airborne EM. Typically the costs are $60 to $80 per line kilometre, which is pretty expensive. But if you can fly five times as far apart, or 10 times as far apart, then of course on an area basis you bring the cost down or, for the same amount of money, you can fly much bigger areas of ground. That is really going to affect the economics of airborne electromagnetics. Airborne electromagnetics are an important tool—not everywhere, but in many of the environments we work in—to help us map salinity and work out solutions.

The other thing I should add is that the important thing is not to just do the sort of science we are doing, but to work in with the end users. I talked about CMAs et cetera, but it is very critical that we engage really well with the end users. That is happening particularly well in South Australia at the moment, where we presented our results of about 12 months of project work to engineers and to the people locally. This is now having an effect on salt interception schemes. They are coming back with subsequent projects and more questions. In fact, South Australia has been a very good example because they ask really specific questions up-front.

When people ask very direct questions then we have a chance of answering them. It is when the questions are more broadscale that you can say, ‘Yes, maybe this and maybe that,’ but if you ask really good questions, which happens in South Australia, then you tend to get really good answers. Sometimes we just have to say, ‘No, I’m sorry, we can’t answer that one. That is outside the scope of the methods we are using.’

They are just a few opening comments I had to set the scene. If I may just quickly say I have brought some annual reports from this last year and I have enough copies for all the committee. I will lodge those.

CHAIR—It might be useful, Dr Gee, if you wanted to tell us about that agreement with Geoscience and how it works.

Dr Gee—Yes. It is a good analogy. It was an agreement made between the directors of the state geological surveys and the CEO of Geoscience Australia who was the chief federal geoscientist. They came to an arrangement whereby they would set out, in a semiformal manner, which collaborative projects they would jointly embark upon, which ones they would not wish to collaborate on, who would do what within the collaborative arrangement, who would be funding it, who would be supervising it and who would be the possessor of the IP and collective decisions on its dissemination—because the states and Commonwealth had a similar role, using this geological analogy.

I sat on many of these conferences—they are called the Chief Government Geologists Conference of Australia, which technically was a subcommittee of one of the ministerial councils dealing with mines and energy and resources. If you translate that into this arena we are now speaking of, there should be an appropriate federal Commonwealth agency that would convene this but not necessarily chair it.

The essential thing with the Chief Government Geologists Conference was that it went around on an annual rotation and it just promoted the most marvellous cooperative spirit. Everybody knew what everybody else was doing. I would say it is totally the opposite to the current state of scientific research directed at remediating salinity and other environmental problems. There just does not seem to be an overarching coordinator which is effective and respected. I think the model I have spoken about may go some way to achieving that.

CHAIR—You say that the current agreement between the Commonwealth and the states with respect to the National Action Plan does not do those things?

Dr Gee—No, I do not believe it does. In fact, we have suggested that it is the devolution back down to the local level which has, surely, some wonderful benefits in some regards, but it seems to have stifled scientific cooperation, scientific progress, the generation of new science and I do feel that people are doing their own thing in an uncoordinated manner.

CHAIR—Would you say that it is highly likely that some of the projects that have been funded at that local level are perhaps not utilising the best science, as a result?

Dr Gee—I think it is likely. I would not like you to press me on any examples, but we come back to something Paul said, in that many people are looking at the water and at the soils, but I think LEME tries to bind all this together by looking at the regolith, which is the system that controls all the processes relating to water movement and salt movement and all the other processes in it.

If I could use an analogy, I think practising NRM, remediation, is a bit like practising medicine without an understanding of anatomy. The 3-D architecture of the regolith is in fact the

anatomy of the systems that are confronting all of these people who are addressing NRM matters, without the basic science. If you are looking at only the top metre, you are likely to miss some important aspects of systems.

CHAIR—Maybe it would be fairer to say that, because of the lack of rigour in that sort of agreement, the risk is higher of things happening that do not utilise the best possible science. Would that be a fairer thing to say?

Mr Wilkes—And I think some of the local NRM projects are not getting the benefit of datasets that already exist, often in the state geological surveys. A recent interesting case was here in Western Australia, when the Yarra Yarra catchment was interested in making soil maps from airborne geophysics. Quite by chance, GA happened to be flying a survey north of Meckering, which was to do with seismic risk and earthquakes and nothing at all to do with NRM applications, but somehow the contact got made. Max Hudson, who is the local chairperson of the Yarra Yarra catchment, heard about it and got in contact with me and asked, 'What can we do with this data?' This case has probably worked out all right, but how many more have not worked out all right, because the right connections were not made? That is just a local example.

Ms CORCORAN—I want to follow up about the model you talked about, the national geoscience model. Your earlier comment was about locals needing to be involved and to know what is going on. Under that model how do locals get involved?

Dr Gee—The current arrangements still would prevail. I am thinking aloud now, but the chair of chairs of the catchment management authorities could be part of this council or conference or coordinating body.

Ms CORCORAN—So you still have the CMAs?

Dr Gee—Goodness gracious me, yes. I am definitely not suggesting that we do not have the CMAs. Local interests are absolutely vital. But they tend not to be the users of the science, or the commissioners—those that commission the sites.

Ms CORCORAN—I think you were in the room before when the previous witness was here and the question was asked about the proliferation of drains.

Dr Gee—Yes, I was.

Ms CORCORAN—I asked a question about whether or not that was perhaps an example of the land user not having access to science. Did you want to respond to that question?

Dr Gee—Yes. I think that there is no firm scientific basis for the penchant for cutting large swathes across wonderful countryside when you do not understand the groundwater flow systems. Sure, there is good reason for stopping fresh water going into the watertable in some circumstances, where this will prevent salination, but you need to know where the salt resides—that is, above or below the watertable—because that is absolutely fundamental. If it is below the watertable, it is dissolved and then it concentrates by an evaporative method. If it is above the watertable, it is going to be flushed anyway. Different situations must require different remedial

engineering programs. If you knew those groundwater flow systems at the regional and the catchment scale, you might be inclined to adopt other remedial methods.

Ms CORCORAN—At the risk of oversimplifying the situation, this is an example then of the land user coping today with his problem, without necessarily understanding the science behind it. How does the message get through to the landowner or the land operator that what is happening is not necessarily appropriate?

Dr Gee—I think it is up to organisations like the CRCs—and there are many of them—to promote their science more widely to the people who have responsibility for designing and recommending the remedial activities, who take input from the scientists and the local CMAs. I think that we have to talk to each other much more, and there has to be more overarching coordination.

We take the view that we provide the knowledge for use by the people who are involved in remediation, and the catchment management authorities are one further step down that chain. For that reason, I think we would prefer that we talk to the state agencies, who are talking to the CMAs. I do not think there would be great value in us immediately promoting ourselves to the CMAs to the exclusion of the state agencies.

Ms CORCORAN—You talked about the line spacing, which can be much wider now.

Dr Gee—Yes.

Ms CORCORAN—We hear evidence from a number of different places of landowners or land operators saying to us that the data is around, but it is on too broad a scale. It is on a subcatchment basis, not on an individual farm basis.

Mr Wilkes—My background is airborne geophysics. What we found with our salinity mapping from airborne EM and related scientific studies was that most of the conclusions of what was going on on a catchment scale—which, of course, affects the local farms and paddocks scale—could have been seen with lines spaced five or 10 times further apart than we actually flew. We have done similar studies in other areas with airborne radiometrics.

We flew an area near Merredin a year or two back, which we flew at 25-metre line spacing—20 metres above the ground with modified crop dusters—and we got fantastic detail. We could have flown that 150 metres, so we could have flown that six times wider than we did. It is a matter of matching the use of the technology to what we are trying to solve.

Dr WASHER—With the airborne electromagnetics, what part of the electromagnetic spectrum are you using? Are you using gamma radiation?

Mr Wilkes—We are using frequencies up to about 50,000 hertz and as low as a few hundred hertz. We are transmitting an electromagnetic field from an aircraft, so it is an active system. We are not just measuring what is present naturally. We are stimulating what is going on by having these modified aircraft that have large coils wound around wing to nose to wing to tail—all around the aircraft—and they tow very sensitive receivers below and behind the aircraft. We are creating a magnetic field from the electric current where it runs through the coils around the

aircraft. This then energises anything that is conductive in the ground, which sets up a secondary magnetic field which we pick up in the receiver.

If we used high frequencies, like 50,000 hertz, we would be measuring the top few metres. If we used much lower frequencies, down to a few hundred hertz, we would be measuring rather deeper and getting more depth penetration.

Dr WASHER—What are you talking about? What depth are you getting down to with accuracy and so forth?

Mr Wilkes—We are typically looking down to about 100 metres.

Dr WASHER—That is deep!

Mr Wilkes—In some cases, particularly where it is more resistive, we can look down a couple of hundred metres. This technology came out of mineral exploration, as you might imagine—for example base metals—and in the right sorts of environments you can see large base metal conductors down to several hundred metres. In the case of what we are doing now with salinity investigations, we are typically looking in fair detail at the top 100 metres. We do this in two different ways. Sometimes we do it in what we call a frequency domain and sometimes we do it in a time domain. By using the appropriate times or frequencies, we can govern the depth at which we are looking, if we are looking at the whole section.

Dr WASHER—How are you using the economics, the area and the scale to justify this? You mentioned the cost before.

Mr Wilkes—Everything typically comes back to a per hectare cost, in terms of what you investigate. We are trying to get these costs down to less than $1 or so per hectare, and then we will see much wider adoption of this sort of technology. That is the sort of cost we already have from airborne magnetics and gamma ray measurements, but we are trying to bring the costs down to an affordable base so we can do it on larger areas.

We flew an area in northern Victoria, for instance—around Benalla—and we could have flown the whole of the area right up to Shepparton and important irrigation areas for the same money had we realised we could have flown five times further apart.

Dr Gee—The important thing is that all these systems are used from the one platform at the same time to give an integrated picture of the salinity distribution and the pathways for groundwater flow. I know the argument has been expressed in recent years that we can get just as much out of low-level, high-resolution airborne geophysics with the gamma ray radiometrics simply by integrating the land forms with the interpreted flow paths related to dolerite dikes, for example, that are picked up with airborne mag. But if you have that vital third component and integrate that back with the landscape models and the mag, you have something which is effective and useful, despite some of the epithets that have been cast its way in recent years, mainly because it has been too expensive.

Dr WASHER—The gamma radiation really comes more superficially.

Dr Gee—Absolutely.

Dr WASHER—You mentioned engineering—and I want to come back to that—as a solution to this problem, if there is to be a solution economically to some areas. Is it true that proof by drilling is pretty good for airborne electromagnetics? Are you fairly confident of that or do you really have to get in there and drill it up, as we do with ore, at the end of the day?

Mr Wilkes—No, we have done quite a lot of drill comparisons, particularly in South Australia and Queensland. We found that we had to modify some of the processing software to make sure that we got the most accurate depiction of conductivity with depth. We were getting quite a good picture qualitatively initially, but some of the depths were somewhat wrong. In the last six months or so we have worked out some new routines to calibrate against boreholes in key areas within the study area, so we now feel confident that we can put a much more accurate picture together.

Our work in Lower Balonne is a particularly good example of that. The first maps that were produced by the contractor who flew the survey are now seen to be fairly wrong in detail. We have produced much more accurate figures now and much more accurate maps that fit with the boreholes and fit with the experience of the locals on the ground. There is a much higher correlation now between borehole results and airborne geophysics.

In relation to your previous question about airborne geophysics, many of these things also have ground equivalents. We have the same sort of equipment on quad bikes and, if necessary, we do it just by walking continuously, with operators. If you want to do things on a paddock scale, quite often you have to come down and either walk them or put them on quad bikes and just control exactly where you want them.

Dr WASHER—Can you give an example of an engineering feat that we would be utilising currently to resolve any salinity problems that we have?

Mr Wilkes—South Australia is particularly interesting. One of the things we did there was towed some systems behind a boat on the Murray River. We put the equivalent of a ground system on floats, kept all the water out of it, towed it behind a boat going down the Murray River and measured the conductivity of the subsurface—not just the river itself, but the material underneath the river and out to the sides. We very rapidly detected some hot spots in conductivity that had not been mapped before, which has quite a dramatic effect on where to position some of the salt interception schemes. This equipment was put together for a cost of less than $1,000.

Dr WASHER—Your salt interception would be borehole pumping?

Mr Wilkes—That sort of thing, yes. To give you a local example, we did some airborne geophysics—airborne EM, magnetics and radiometrics and equivalent ground checks—in the Lake Toolibin area of southern WA. This found some palaeochannels we did not know existed. We are now using these palaeochannels as mechanisms and pathways for pumping. That is quite a nice example locally.

Dr WASHER—In a previous submission, we heard about the formation of salt in this regolith, as you call it, from leaching of ancient rocks full of salt to ancient seabed concepts to airborne salt precipitation. I see Dr Gee shaking his head. What do you feel is the most likely of all these?

Dr Gee—I think that it is universally agreed that the salt that we see in our sedimentary basins, our drainage basins, virtually throughout the whole of Australia is maritime salt—that is, it is brought in by rain—and it is a function of our ancient landscapes, our flat landscapes and our high evaporation rates. I cannot think of an example where there is natural rock salt that is contributing to salinity, but sure enough someone will be able to find one for me. It is the maritime influence, and it is a natural part of our regolith system.

I can perhaps understand that there might be some situations where you should disturb it and flush it out. There would be other examples where you should not disturb it, some examples where you would put trees back on it, and probably some examples where you would start digging trenches. You have to know the systems and the distribution of the salt. That, I think, is where the salt is coming from. We would all agree on that.

Dr WASHER—What would you estimate? Would it be 50 kilograms a hectare per annum roughly on the coastal plain here of precipitation of salt?

Dr Gee—Yes, about that. That would not have any effect, because of the rapid run-off and the low evaporation rates. It is only in the flat areas where the high evaporation—

Dr WASHER—Would that be the range we are talking about—in that vicinity of kilograms per hectare—of precipitation in these areas?

Dr Gee—I do not know those figures.

Mr Wilkes—We will come back to you on that.

Dr Gee—I think we can say that rain has 30 ppm sodium chloride in it, roughly.

Dr WASHER—That is still a lot of salt at the end of the day, if it evaporates and just sits there.

Dr Gee—Yes.

Mr Wilkes—We are looking over a long period of time, so the water you are talking about has existed for thousands of years.

Dr Gee—Or even 20 million years with the wheat lands areas.

Ms CORCORAN—Everyone probably knows the answer to this question, but I do not. You are talking about the salt being caused by—it is maritime salt.

Dr Gee—Rain.

Ms CORCORAN—Brought in by the rain.

Dr Gee—Yes.

Ms CORCORAN—Yesterday, or thousands of years ago?

Dr Gee—Yes, it rained a little bit yesterday and last winter and the previous winter and this has been going on for hundreds, thousands and millions of years. You could do a little simple arithmetic on a per hectare basis of 30 parts per billion falling on a unit area and evaporating far more quickly than it can run off. Over a period of 20 million years—and these certainly are the time frames that we are speaking of—virtually all the salt that fell over the 20 million year period is going to be right there in front of you, in a salt lake, or down there five or 10 metres.

Ms CORCORAN—That was my question: it can be down there?

Dr Gee—All that salt that fell, yes.

Ms CORCORAN—Yes.

Dr Gee—That came down 20 million years ago and it has not stopped.

Ms CORCORAN—The salt that some people are calling rock salt came from the sky?

Dr Gee—I do not know this term. 'Rock salt' is not a term that we would like to see you thinking about.

Mr MARTYN EVANS—There was one area I wanted to explore with you. You say the time taken to initiate research projects can be very lengthy in your submission at 3.4—'It can take two years to get a project started, resulting in high overheads,' and so on. What are the primary stumbling blocks to that? What causes it to be two years, in some cases? Obviously that may be a worst-case scenario; possibly also a bit of an average maybe? What is the primary cause in that kind of fairly long bureaucratic overhead?

Mr Wilkes—There are a number of different causes for that. First of all, it is getting all the approvals in place for the projects to take place. What we have to do now is enthuse the CMAs so that they want some of these projects to happen. You have to sell the ideas right down to the grassroots level and then wait for them to come back up again to some extent. I do not see it as being a very efficient way to do things.

Also, the CMAs are very poorly advised, on the whole. They have very few people advising them; often a single consultant, who has a limited range of experience. That is a problem. One of the problems I referred to in the document was that there are a large number of CMAs, so how do we get around all the CMAs who are thinking of doing something? Which are the ones that are well organised? Who are the ones who have a valuable asset that is at risk, where it is really important to do something? There is a lot of groundwork to do.

Also, there is the way the rules have changed. In WA, of course, the government not signing on to the bilateral agreement with the Commonwealth until extremely recently has certainly held

up work here in the west, so we have been concentrating more on the east. Fortunately, our partners are spread across the country so it is no big deal for us to work anywhere at all and we are happy to do that. Even the work we have done in South Australia took six to 12 months to get started. There were long, tricky negotiations to get that started. In fact, one of our prime partners in South Australia was the Bureau of Rural Sciences, BRS. They had the rug pulled from under them because initially money was going to flow from the Commonwealth down through AFFA into BRS into work that we were doing with them. That all changed. The BRS was no longer able to supply money in the same way to initiate projects on a timely basis. BRS left the centre because of that. They were no longer able to put money into the centre. In fact, at one point in August 2002 they said that, because of their need to bring money in from outside, they would have to compete against us and no longer be part of the cooperative research centre. That was very tragic and was a pretty traumatic thing to happen to a centre.

We have evolved a new agreement with BRS, but BRS is still a competitor. They are forced, even though they are a Commonwealth agency, to find money externally to keep their operation going. We think this is a total mismatch and they should be basically a policy area, rather than a policy and project-doing area. That has been certainly a factor with BRS. We have had to renegotiate some of the agreements that have BRS involved in South Australia, Queensland and elsewhere. There are a whole range of factors as to why it has taken so long. We think this is quite tragic, because it is an urgent problem and everyone wants to get on with it reasonably quickly. We need to have straightforward guidelines on how to use NAP or NHT or any other source of money, agree the science, use the best available datasets—as we have been talking about before—and get on with the job, keeping the locals very well involved and in touch.

Mr MARTYN EVANS—Do you find the same problem about the length of term of the funding? You have short-term funding availability that only lasts a year or two or three, whereas many of these issues are likely, because of the nature of the problem, to extend over quite a long time?

Mr Wilkes—Yes, absolutely. We are a CRC that currently has seven years life. We are in year 3 right now and we fund some of the positions of people doing this work, particularly in Geoscience Australia at the moment, but elsewhere in the centre, on the money we raise externally. If we chase projects that do not turn out to be winners, or do not turn out to get funded, then we have expended a lot of time and effort without getting any return at all for those projects and we are still trying to support the key people, key scientists we need to do the work, so the time frames are a mismatch.

Mr MARTYN EVANS—But in terms of the science itself, salinity research is a long-term proposition.

Mr Wilkes—Absolutely.

Mr MARTYN EVANS—Yet do you find the funding time frame horizon is—

Mr Wilkes—It is too short.

Mr MARTYN EVANS—incompatible with the science?

Dr Gee—It can be tackled on a modular basis, though, with a series of interrelated short, sharp projects of a duration of six months or so. Much of our work that has been done recently in South Australia has been of this time frame, but we would like to think that it does integrate with other projects and collectively builds the scientific database. Sure, it has to go on for many years but we can accommodate a series of short, sharp contractual arrangements. In fact, it is probably a good management mechanism because you then are judged on your deliveries. I think we can be judged pretty well on that. We have delivered an enormous amount just in the last six months under these short, sharp contracts. I think our record is pretty good on that.

Dr WASHER—In the philosophy of the funding, if I could use an analogy, we seem to have a criticism—and I think it seems justified—that we are funding the pieces of the jigsaw, but we are not funding the people to put the puzzle together adequately to make it whole. We have the CRAs as little pieces of the jigsaw, but no-one is actually putting the whole picture together in a constructive way. It has been researched in a scientific way but randomly trying to put it together. Is that an analogy? It is a crazy kid's analogy, but would you say that is where we are doing it wrongly?

Mr Wilkes—I think we know how to put it together, but I do not think the messages from individual, very successful projects are getting out to the people who need to hear these messages. There is a communication issue here and we need to make sure we have case histories out now from South Australia, or from Queensland, from Victoria, from elsewhere that are examples of best practice and actually show from go to whoa how they work and what benefits they have had. We need to share that information around.

Dr WASHER—If we are going to pump the salt out—I am going back to an engineering proposition of sinking a borehole—are you using submersible pumps? What type of pumps are they? Where are we going to pump it? Hypothetically, Dr Gee, I have found a saline water flow into a river that is feeding the city or whatever and I need to stop it. Are you going to sink a bore? What are you telling me now? What am I going to do? What sort of pump am I going to use? I know it sounds silly, but I am dealing with a very saline dam. Do I need stainless steel? Is it submersible pumps? Where am I going to pump the stuff when I have it? I cannot put it into the water flows. What would you do?

Dr Gee—If it is highly saline you would not pump it. If it is stable you would leave it there.

Dr WASHER—Leave it alone, you reckon?

Dr Gee—You could try and extract the salt, but that is a boutique operation, I suspect. I would have to say I do not quite know where you put the salt. You just have to make sure that you are not increasing the salinity by the evaporative effect of, say, excess irrigation. Where you start irrigating you make sure that you do not let saline water filter down through into good groundwater areas. In that respect, that is another program we have contributed to. The airborne EM has been mapping the irregular distribution of aquitards, or clay layers, in an otherwise porous medium. We can give some guidance on where to irrigate and where not to irrigate. But if you are asking me, Dr Washer, the panacea for how you solve the salinity issue, where you put the salt: you just have to manage it. That is the challenge we are facing and we all must contribute to from the geoscientific, the hydrological and the engineering point of view.

Dr WASHER—Dr Gee, I was not trying to put you on the spot. I am just demonstrating that we have a long way yet to go in research.

Dr Gee—Absolutely.

Dr WASHER—It sounds simple until you really tease it out to the end. Everyone says, 'Hang on, I've hit a wall now.' That is a good point. Thank you.

CHAIR—Can I come back to the role of the CMAs. Is there a danger in the way it is operating now, with CMAs being often advised by a consultant, that NAP becomes just a bucket of money that could keep people employed?

Mr Wilkes—Yes. I think I pointed out in the submission that there is a danger that the consultant—and not pointing to anyone in particular—may recommend work from which he gets some remuneration. He may recommend things in which he can be involved downstream. I think you are not getting the best use of the money that way.

CHAIR—Let us return to this model we talked about. Who, at the Commonwealth level, would be the most appropriate body to be part of some sort of agreement, along the lines you talked about before?

Mr Wilkes—There are several. Geoscience Australia, for sure, and probably Environment Australia also. Some of the people are more involved in water, so AFFA certainly has a role here as well. There are a number of different agencies.

CHAIR—They are all separate departments?

Mr Wilkes—Yes, they are, answering to different ministers.

CHAIR—With different goals. Do you see currently some entity there that could oversee all of this?

Mr Wilkes—It probably should be in the hands of Geoscience Australia. I think it is fundamentally in their bailiwick.

Dr Gee—Or BRS.

Mr Wilkes—BRS certainly has a role there at a policy level. BRS is an agency within AFFA, and AFFA certainly should have a role in this. AFFA does have a role currently, in recommending how NAP money is spent.

CHAIR—What about the role of Land and Water Australia?

Mr Wilkes—That is entirely possible, too. There are several agencies. They need to work out the best way of getting a good arrangement.

CHAIR—With respect to the various CRCs that have a role in this, what is stopping all the CRCs getting together on this?

Mr Wilkes—To an extent we all have our own agenda, our own different time frames. We all start at different times. We have different things driving us. There is more collaboration going on right now and we are planning joint workshops in March of next year, between particularly CRC for Catchment Hydrology, CRC for Plant Based Management and ourselves to evolve joint projects, rather than just feeding into each other's projects. There is nothing fundamentally stopping us. We are starting to work more towards making that happen. I suspect there could be some external things that help to foster collaboration.

CHAIR—Is the CRC association a body that could somehow or other facilitate some of this?

Dr Gee—It is very active in doing this. We do meet once a year, as an association, to talk about just these things. I take the point that we need to be more proactive in liaising with the other CRCs, but there is always something that gets in the way of it.

If someone came to me today and said, 'Dennis, we'd like to liaise more closely with you on your regolith model,' I would say, 'Wonderful! But look, I'm up to my armpits in alligators because I've got a second-year review. Come back next month.' Then someone else has a five-year review, and somebody has got this, and so on. There was a review of the CRC program recently. One of the points that came out is that they do tend to be a little bit overbureaucratic and overregulated. But, no, this is our New Year's resolution, our new month's resolution, our new week's resolution: that we must talk with these people more.

LEME started as what we called Landscape Evolution and Mineral Exploration. It was producing models for geochemical exploration for mineral explorers virtually 100 per cent of the time. Then it was realised that the science that was developed, the regolith science, could be applied to natural resource management. We have only been going two years. We have set up our programs and we have got to the stage now where we have recently held very significant and useful talks with the CRC for Plant Based Management of Dryland Salinity and the CRC for Catchment Hydrology. We do now have formal projects. I suspect it has been due to proaction on our part.

Mr Wilkes—I think we have been the ones mainly chasing this. We do have some joint student projects, particularly in South Australia, and some work on drains, as it turns out, which are co-funded by the CRC for Plant Based Management and ourselves and are jointly supervised by scientists from both groups.

CHAIR—You do not have very much of a private sector involvement in your CRC, do you?

Mr Wilkes—No, we do not. It is really quite hard to get an SME, for instance, to commit to a seven-year plan. The rules of the CRCs are quite strict; you have to try and maintain the commitment that you make at the very beginning for a whole seven-year period.

CHAIR—That has been relaxed, though.

Mr Wilkes—Is that right?

CHAIR—The most recent round of CRCs has got much greater involvement of SMEs.

Mr Wilkes—I had some discussions with Minister Peter McGauran here in Perth just over a year ago. We met over dinner with Minister Peter McGauran, a couple of his advisers and quite a few CRC senior people. He asked this very question about how to get SMEs more involved. I think we will see that SMEs can come in for a shorter duration. They might come in for three or four years and then drop out again.

CHAIR—Even shorter periods, potentially. With the CRC for Spatial Information, for example, utilising a business association as the private sector player, small firms could participate in a particular project for six months or so.

Mr Wilkes—Yes, that would be beneficial, for sure. I must say that when I was talking about a new model, I was not excluding SMEs and consultants—far from it. I described the higher end, where they would not have a very valid role.

Dr WASHER—I know the state took up the $40 million offer from the Commonwealth only recently and they were to put $40 million in themselves. It is early days, but historically this state has been involved in research and development on salinity for some considerable time. What is your impression in terms of the state and its relationship to the dissemination of that information out to the ground and the CRCs, to all the people involved?

Mr Wilkes—You are quite right, WA has been involved in this for a long time. I understand that was part of the problem in getting the agreement signed with the federal government, that the federal government was not prepared to recognise the prehistory of the work we had done here in the west. That was quite tragic. The dissemination to people at more of a local level has been mainly through the WA Department of Agriculture and CSIRO Land and Water. I heard someone say in the previous discussion that some of their extension activities had been chopped off now, so some of this has gone out but it needs to be revisited and we need to up the dialogue and make sure it gets out to the right levels.

Dr WASHER—Why I asked that specifically is because we were in New South Wales and we took presentations from people, and the state government came in last. They had some incredibly good projects but what they did not say was that no-one knew about them. All day we had listened to people who should have known, according to them, but did not know; or if they did, they certainly did not reveal their knowledge of it. It seemed that they had developed these great projects: they had put the model up, got it on the drawing board, done the sketch, written the book, put it away in the library, gone home and that was the end. Has anything like that happened here in WA?

Mr Wilkes—It is hard to say. I hope not. CSIRO Land and Water—people like Tom Hatton—have been very vigorous in getting out and talking with locals and talking about reinvigorating some of the towns in the wheat belt, for instance. It is happening, but not enough.

CHAIR—Thank you very much for your submission and evidence this afternoon. It has been very useful.

Resolved (on motion by Dr Washer):

That the exhibit from the CRC for Landscape Environments and Mineral Exploration, *Annual Report 2002-2003*, be received as evidence to the inquiry and authorised for publication.

Proceedings suspended from 2.54 p.m. to 3.21 p.m.

EDMONDSON, Mr Rex, Chairman, Natural Resource Management Council of Western Australia

HATTON, Dr Thomas Joseph, Member, Western Australian Salinity Research and Development Technical Committee

McFARLANE, Dr Donald John, Chairman, Western Australian Salinity Research and Development Technical Committee

CHAIR—Welcome this afternoon, Dr McFarlane, Dr Hatton and Mr Edmondson. Do you have any comments to make on the capacity in which you appear?

Dr McFarlane—I am also a director with the Water and Rivers Commission.

Dr Hatton—I am from the CSIRO, but appearing in a capacity similar to Don's.

Mr Edmondson—I have some handouts here that back up the Natural Resource Management Council of Western Australia.

CHAIR—Although the committee does not require you to give evidence under oath, I should advise you that the hearing is a formal proceeding of the parliament. I remind you, as I remind all witnesses, that the giving of false or misleading evidence is a serious matter and may be regarded as contempt of parliament. I also remind you the committee prefers all evidence to be given in public. However, at any stage you may request that your evidence be given in camera and the committee will then consider the request. We have your submission which was authorised for publication, so it is all on the public record. This afternoon if we could start with maybe some opening comments, then we will have some questioning.

Dr McFarlane—Perhaps I would just ask Rex to outline the role of the NRM Council, because the R&D technical committee that I chair is actually a subcommittee of it. It will put it into context, I think, to see what the council's responsibility is.

Mr Edmondson—The Natural Resource Management Council was formed in Western Australia with the incoming Labor government and it took the place of the old Salinity Council, which was really a project-driven organisation that was made up of quite a large group. The NRM Council—and the handouts are just coming around—is a more high level policy instrument in its terms of reference and membership. It shows where this technical committee fits. There is a flow diagram there that shows you where it fits in the process. The technical committee is a committee of the Natural Resource Management Council.

Dr McFarlane—I will give a bit of information about the R&D technical committee. We were formed about seven years ago now. We have played various roles within the state. One of our first tasks was to come up with the R&D priorities for the state. Given that there are a number of researchers in salinity, each with their own vested interest, it was difficult to get representatives from Western Australia to attend particularly national forums—as part of the National Dryland Salinity Program—and say exactly what the state priorities were.

One of the first things we did was get the various research groups together. We workshopped at some length and came up with a consensus as to the most important things we required in Western Australia. We have gone back periodically and looked at that again. Being able to represent our needs on a state basis, rather than have individual sectional groups go out and talk about what they would like to see money going into, has been very powerful.

We were also asked by the Salinity Council around 1998 to review the Salinity Action Plan, which was then the blueprint for managing salinity in Western Australia. They wanted us to do an evaluation as to whether the things that were in the plan were going to be effective or not. We did a very intensive analysis of the sorts of solutions that could be done for salinity and came up with the conclusion that a lot of the things in the plan would not be effective. In Western Australia we have been dealing with salinity for a lot longer than most other states in Australia.

Most of our best practices have been singularly unsuccessful, although there are some bright opportunities in certain areas. There are certainly some very economic niche solutions but if you take the broad wheat belt valleys, there are very intractable problems in a lot of cases. That was certainly very important and it greatly informed the next state document that came out, the Salinity Strategy published in 2000, which was a much more pragmatic document and did not set targets that were unachievable. We feel as if we have had a big influence from a salinity research point of view, over where the policy is currently in the state.

In the last couple of years a task force has reviewed salinity in this state. There was a task force report that identified three roles for government in managing salinity. One was capacity building of communities that are affected by salinity. Another is to save some of the very important natural assets that the state has—water resources, towns, nature conservation values, roads, those sorts of things. The third one was to help develop innovative solutions. This is why we are very keen on your inquiry.

To develop new solutions is a legitimate role for state and Commonwealth governments to play. There were three legitimate roles for state and Commonwealth government. The title of the task force report was *Salinity: a new balance*, because basically they were saying that we have the balance wrong currently. We are investing heavily in capacity building when we do not have the solutions to redress the salinity problem correctly. Finally, we have some very major assets which are being lost every year and we need to have some urgent intervention to save them because they are irreplaceable assets.

CHAIR—Picking up on what you have just said, do you have some concerns about where the funding under the National Action Plan is likely to end up because of those reasons you have just given?

Dr McFarlane—Yes. The National Action Plan so far has targeted continuing to build capacity and has not, we think, put enough money into developing alternative land and water uses, or to target interventions which will save assets. We have tried, in our negotiations with the Commonwealth, to insert some of those later points. The Forests Products Commission, I believe, have already given you evidence today. They had a major project in to try and get a project up under the National Action Plan to increase the planting of perennials in the state. At this stage it has not been accepted by the Commonwealth that that can be funded under the National Action Plan.

We also had a major project to reclaim the Collie River, which was something that we thought would have major social, economic and environmental benefits for the state. But at this stage the Commonwealth has not seen fit to accept that as a project. Most of the projects to date have been funded under the National Action Plan to increase capacity building and particularly to put out facilitators and coordinators—quite often untrained in technical matters—when we still do not have solutions in a lot of cases for them to extend.

CHAIR—What is the reasoning given by the Commonwealth over the Collie River? Are they saying that that is a project that is the domain of state agencies and does not fit with the terms of the National Action Plan?

Dr McFarlane—At this stage they have not ruled it out, but it has certainly been very difficult for them to rule it in as well. They are saying that they believe that the major beneficiary could be the state's Water Corporation, which is a water supplier. We tried to explain to them that the major water allocation from the Wellington is to the irrigators in the Collie irrigation district. They have 68 gigalitres of allocation and Water Corporation is at the moment negotiating a much smaller allocation from the dam. There are also other benefits to improving the Collie which will flow to the Collie community and there will be some environmental benefits as well by reclaiming a saline resource.

Dr Hatton—This is not in direct answer to the question of why it did not get up, but just to add weight. The fact is that in this entire nation only two water supplies have apparently ever been recovered from secondary salinisation, despite all of the public and private investment in salinity management over the last 30 years. The first was the Mundaring, up in the hills here, which was recovered in about 1920. It was only briefly deforested. They quickly found there was a problem. They quickly put the trees back. The second one is apparently the Denmark in the southern part of the state. It looks as if it might be recovering as a catchment, as a water supply. It was only ever 18 per cent cleared and that was fairly late in the piece. Shortly thereafter, in the early eighties, about 60 per cent of that was put back to commercial blue gums. It looks now like it might just be turning over.

We do not have a lot of runs on the board in Australia in recovering stuff that has become salty and the Wellington Dam in the Collie River Valley is a major water resource for the metropolitan water supply. It is sitting there at 800 parts per million. We only need it to get down to about 500 parts per million to bring it back online as a new water resource for the state, and it would be an icon project for the nation. The engineering designs and the other strategies are in place and it is a sitter for a real early run on the board, I think, for Australia.

CHAIR—In your covering letter to the submission you said:

> ... there appears to be a developing culture in some salinity-related agencies that is more competitive than cooperative. This seems to be resulting in a duplication of efforts and in an overt focus on aspects of science which are less likely to result in managing salinity effectively.

Can you give us some examples of that 'competition rather than cooperation'?

Dr Hatton—There are, broadly speaking, two kinds of cultures among salinity research and development providers in Australia, in my experience. There is a culture of those who come

from disparate fields but who all have an industry orientation, usually in primary industries—agronomics, forestry et cetera—and they want to advance their science and industry toward a solution to salinity. There are others that tend to be lumped in terms of hydrologists or people of my ilk, to be honest, who take a more analytical view of the system that is salinising and say, 'What needs to be done? What could be done?'

The latter group has come up, in Western Australia, with some pretty high hurdles over the performance of the kinds of solutions people discuss. If it is trees, then you are going to have to put in an awful lot of trees, and in some places they cannot work any more to fix the problem. If it is lucerne or something else, in many places there is simply no way that those sorts of things can find the hydrological leverage on the system, in our estimation. That creates a conflict between research providers who would like to advance lucerne, advance trees—advance their thing—and the people who say, 'It ain't going to work,' or, 'You need more of it.'

In redressing the balance, there is a large national investment in the development of the greener types of solutions. Yet we have peer reviewed hard science—not just from one provider of research but from quite a few different providers of research and different teams of researchers—that has shown that in Western Australia the preponderance of assets at risk reside in the broad valleys that are salinising, and those assets are not going to be protected through those means, for the most part.

It is an ongoing intellectual and political tension among research providers. There are people—scientists—that would say we kill trees, and the future of trees, in the wheat belt on the information we have provided. Those sorts of statements do make it difficult to operate cooperatively sometimes; yet we muddle on. The R&D technical committee has provided a forum where those debates have been held in this state. There is progress there, I would say.

Mr Edmondson—My background is farming, and still is. The broad valley that Tom just spoke about is in my face every day. Certainly we have seen over the last, now, 15 years—where calculations were done—that we would need to replant, say, 20 per cent of those wheat belt valleys to recover.

In many cases that has been done and, of course, we now know it is probably more likely 80 per cent. During that process the farmers have turned to the scientists and said, 'Well, in wheat belt country we need large paddocks to work with; 80 per cent of revegetation is unacceptable. Give us some other options.' We, as farmers, find it frustrating to sit and watch the process that Tom just spoke about, where there is quite strong competition between the organisations for a limited amount of funding. Certainly in this state it is the only area I know where the scientists get in the one room and at least try to come to some agreement.

Also, in Western Australia we get very frustrated that the models that are given to us by the Commonwealth always have a Murray-Darling tag on them. Whilst that is not written in lights, the model is quite clear. Western Australia is quite different to that process and we are continually frustrated. The funding models are all geared around Murray-Darling systems and we find that a bit difficult to swallow.

Mr MARTYN EVANS—Clearly that Murray-Darling issue is important because it highlights the way in which the funding model is developed and the way it is allocated. It says something

about those who provide the funding and so on. We, as part of our inquiry, obviously will look at ways in which government might allocate the funding which we might recommend. We have traditional scientific funding models in NHMRC, ARC and so on—competitive grant models. But we have an overarching group there—the NHMRC, say, or the ARC—who define a set of criteria and a bit of framework for the policy and there is a national debate about the policy for that. That changes from time to time as research priorities change.

Should we have some kind of framework like that for defining a salinity strategy? Obviously, from time to time we do have that in salinity research—or not so much salinity research but in salinity management. We have not really done that at a national level for salinity research, where the states and the CRMs might get involved and we could then have some group that attempts to define a salinity research strategy, and then has some control over a salinity research funding allocation on a grant basis and so on. Have you any contribution to make about how we might try and better target, on a more traditional scientific model, a research based funding scheme?

Dr McFarlane—You will have seen, in our submission, we believe that the National Dryland Salinity Program has been particularly effective. It is open to all states to be full members of that program and for other groups, like the Murray-Darling Basin or the GRDC, for instance, to be represented as well. There has been some very effective brokering of research priorities across the nation. Also, there is a technical committee under the Board of the National Dryland Salinity Program. We think there have been two phases and, at the moment, the National Dryland Salinity Program does not look as if it is going to be in favour in future. We feel it would be a loss at the national level if we were to lose something like the NDSP. There is a lot of corporate knowledge that has built up over time, both within state agencies and in Commonwealth agencies, by going to those forums. For them to hold national workshops to prioritise particular areas I think has been a very valuable process.

I was on the Board of the National Dryland Salinity Program for a while and was aware of some very good reviews that were done. We had reviews for engineering, for the productive use of saline water and land, for the role of local government in salinity and there was one on institutional arrangements for salinity. Those sorts of things can be done very effectively at the national level. Support for things like the Joint Venture Agroforestry Program is also very important because there are certain things that can be done most efficiently at the national level, provided you also have input from people who are practical land and water managers. If they are done from a very theoretical basis—the point I think Tom was making earlier on—then you can have people following a narrow disciplinary area and it might be excellent science, but it may be completely disconnected with the needs of practical land and water managers.

You have mentioned some other funding models and my feeling is—with the Land and Water Australia area, particularly the National Dryland Salinity Program—that we really need more of that sort of thing, not less. I would be very concerned if the trend is to go away from that coordinating role of NDSP.

Mr MARTYN EVANS—You mentioned the difficulties you have had with people not applying the actual science you had developed, saying that you had killed trees—that emotional sort of response you get from the hard science when it delivers answers that people do not really want to hear, because it conflicts with their emotional response to the problem. That is common

in other areas as well, but especially salinity, because it is a very long-term problem and people are emotionally attached to their favourite solution and the like.

It also conveys the impression that it is not easy to communicate some of that science out there and that many of the practitioners out in the field may not get access to the science that is done when it is undertaken. What feelings do you have about that, in terms of the communication of the science to date? The extension people out in the field and the catchment management authorities: how good are they, in your experience, at picking up the practical results of the science undertaken? The farmers are out there on the land. How easy is it for them to translate the work that is done and pick it up through the catchment management authorities, through the extension officers and get that result, so they can work with the latest and most authoritative work that is done in the field by the scientists that is funded?

Mr Edmondson—There is no question that there is a particular skill in translating that high-level science to a farmer. We have been blessed in this state in that we have a team of born and bred scientists that have come up from our regions, lived in rural communities, worked in there and now reached a high level. I must say Tom is an exception; we imported him. But in the main, our scientists here—from what I hear from the eastern states—are extremely highly regarded. We are lucky they do have the particular skill to be able to translate that raw science.

There is no question that it is a problem. I was at a meeting with a group of farmers when the first of the airborne geophysics was shown to them at Woodanilling some 20 years ago. They looked at the coloured maps on the wall and said, 'Wow! These are pretty good.' But once they went out into the paddock with the maps, the maps got put away and they said, 'Well, there's a scald there, and there.' All that science they thought was pretty good in a group forum, went out the window once they got into the paddock. There was never strong support in Western Australia for the Commonwealth's model of airborne geophysics that was offered some five or six years ago, because we have been exposed to it in this state for a long time. If I dare to say, I believe it was bred here. Certainly they have been researching it here some 25 years—perhaps even longer. We had seen it for a long time and understood it reasonably well—not the high-level stuff—but because the research was done on farms at Cuballing and Brookton and areas like that, we were familiar with it and never really took to it in Western Australia. But in the main we are pretty close to our scientists, I believe. They understand what language they need to use with us and the method of communication is quite good.

Dr McFarlane—One thing we talk about in our submission is the need to technically skill a number of the coordinators and facilitators that are going out under the current NAP and NHT extension. There have been different types of coordinators and facilitators and those sorts of things—I do not know how many—who have gone out there under the different programs, but a lot of them do not have adequate technical skills or experience to take complicated land management issues and fit them into an industry basis. The farmers out there are very much industry focused, either in the grains industry or the grazing industry—some of them are increasingly getting into trees—but you really need to have the confidence of those industries and understand the constraints on them, to be able to then go in and expect understanding of some very complicated landscape hydrology and what will work and what will not work.

On the economics side, we really do need people to have skills we are not currently giving them in the field. They tend to be people who are in a state agency—say the Department of

Agriculture—and they understand the industries and pick up those skills and become very valuable over five, six or eight years. But to take new graduates out of universities and put them into regional areas and expect them to sell a very complicated message like salinity to people who are managing multimillion dollar businesses, is a big ask.

One of our pleas is to invest a lot more in those people and give them time to develop, give them careers and give them the access to the skills so that they can provide an information brokering role between the scientists and the land managers particularly.

Dr Hatton—A strong trend in salinity R&D in this state is the direct engagement of the scientist with the community in doing the research. That is dinkum. It is very costly. We would probably get best value out of scientists if they were just doing science and somebody else was left to take it out to the community, but we cannot operate that way and it actually does not work that way. For my scientists now, in CSIRO—and I think you will find in the other technical agencies—almost all the research projects are either with an industry group or the Avon Catchment Council, or a local set of farmers are engaged in the research with us, and it is really effective. It has also been effective in getting our priorities right about what we should be working on.

The old extension model, where there was a second-hand translation of the material, has largely gone away. The biggest impact CSIRO has had on Western Australian salinity is where we have worked directly with the people who have the need. It is the most fun, too.

Ms CORCORAN—Rex, you made the comment before that the farmer sees the coloured maps on the wall and thinks they are great, but gets out to his paddock and they go out the window. Why does that happen?

Mr Edmondson—As farmers we live and die on observation. These days we are businessmen as well, but we go out into the paddock and make an assessment quickly on what we see. It is all visual, with experience, knowledge, sometimes even gut feeling and risk. It is the visual skill that we have and we do it with whatever our crop is, whatever our animals are, and we do it with the landscape. A predictable and lovely map on a wall, coloured like a rainbow, is pretty good in a group for a discussion and you will want to know exactly where you are in that colour, but once you get out in the paddock, it is back to the old methods that you were brought up with, where it is a visual skill that farmers have that keeps them in business.

Ms CORCORAN—Given all that and, Dr McFarlane, your earlier comment about the need for our extension officers to be more technically skilled, we have heard evidence before about extension officers coming out to farms, but the farmer does not want to know about it and says, 'What would this scientist know? I've been on the land for a million years; my family has always been here.' Is that a problem?

Dr McFarlane—Yes. I think the message is changing, too, if we use that same analogy of the airborne geophysics. I was actually an exploration geologist and started applying ground based geophysics to salinity problems when I moved from earth science into agricultural science, and I got very excited about the ability of geophysics to diagnose problems.

After we had done airborne geophysics for a number of years, I could see also that we did not have very many solutions coming out of it. It was great to continually refine and diagnose the problems better—and you could understand why the salt was being stored in some areas and what the structural controls were over groundwater flows—but after many years if we did not have the solutions to apply and use that insight that the airborne geophysics had it was not a useful tool.

Once we have the solutions, airborne geophysics could become one of the most important tools we have. It is almost as if we have to advance all of our areas of science along in a way where they complement each other. With things like airborne geophysics, we have got ahead of the solution. We are better and better at diagnosing problems and predicting where problems will occur but, even if we are very good at predicting where they occur, if we do not have an economic answer how does that help us? It is almost like someone who is good at diagnosing measles telling you where the spots are going to appear on the patient. If you do not have an answer to the measles disease, there is not much point in continuing to invest in that area.

I have gone through a roller-coaster ride with geophysics. I got very excited when I applied it in the early eighties, particularly when it got airborne and we started doing larger and larger areas. It gave us an insight into things under the surface that we had no idea of, but I was indulging myself. I do not know of too many situations where airborne geophysics has resulted in a significant problem being solved. Therefore, I have come around much more to things like digital elevation models—things like satellite remote sensing—and applying broad solutions.

Lucerne, for instance, if it can be adapted into some of our more harsh environments, could become very effective over large parts of Western Australia, because it is a broad solution that you can apply for periods of time over large parts of landscapes. If our research has shown anything, it is that you have to apply a solution over a large part of the landscape. Applying it to five, 10 or even 20 per cent of the landscape does not have much of an impact. It might buy you a little bit of time, but it does not solve the problem. It just delays the onset of the problem.

I am not sure whether I have answered your question, but you can see that in some ways you need to invest in people so that you have credibility with the people who are making major decisions as to how to manage their land. Once you have that credibility, those people are very effective. Some of the people, particularly in Western Australian Department of Agriculture, who have been out and worked with industry groups and are accepted by farmers are in huge demand, because they know what the farmers' constraints are and they have the insight into what may work in their particular situation. We just have too few of them.

Ms CORCORAN—You have answered my question. I was trying to tease out the factor that makes them credible with the farmers, so that they are listened to. Tom, when you do your CSIRO projects, you really get in there with the community people and work with them and you talked about the importance of all of that. I wanted to take that one step further. Is there a situation there where, in fact, the community is driving what you do?

Dr Hatton—Absolutely. On a very broad scale, they are driving a shift in our investment away from certain kinds of solutions that we had hoped would be effective and focusing them on the solutions that are being adopted problematically across the wheat belt, and I am talking about drainage. While we were investing a lot in looking at how effective trees, lucerne and other

things can be, people were coming to their own conclusions in the community. They were starting to experiment, without a lot of design or engineering expertise, with other kinds of solutions, with no technical support—an almost unresearched area. Some estimates say there are 12,000 kilometres of these structures in the wheat belt here. There is no regional planning for them. It is unmanaged.

Rex can elaborate on that, but that gap has driven a change in our investment program on a broad scale. We are engaged with drainage and engineering solutions now in a big way, because the community demands it.

Ms CORCORAN—Because the community demands it and because you think it might be a real solution?

Dr Hatton—Yes, absolutely.

Ms CORCORAN—You made the comment before about it being a lack of funds rather than new knowledge that limits effective salinity management. Is that because you think that the answers are found now and it is a matter of applying them?

Dr Hatton—No, I did not mean to imply that at all. On a local scale—for instance, if we stay on drainage—there are certain places in the wheat belt where the locals have concluded that drainage works. From our measurements in a few places, from their point of view they are probably right, both economically and by any other measure. From the downstream environment point of view there may be some problems, because the discharge is not managed in any way, really.

They are not looking at opportunities and there is no technology, or very little technical understanding, to create opportunities to manage that discharge for the benefit of the whole community. There are some economical solutions, but some externalities that come with that. That is not being dealt with very effectively at the moment, either technically or in terms of policy.

Mr Edmondson—Could I expand on the first question you asked Tom? There are a number of projects in this state—and I know your itinerary and you will see one at Dumbleyung—where the community established the project, started to develop it through what was then NHT and eventually got to a point where they said, 'Well, we just can't do this without a scientist.' The project was shared with CSIRO, but it was the community that went to CSIRO and said, 'We've got as far as we can; we need you in here.' There is one at Dumbleyung and there is one at Narembeen.

Dr Hatton—And Yarra Yarra.

Dr McFarlane—Could I clarify that, because it is one of the things we put in our submission about the lack of funds and it is probably poorly expressed. What we are saying there is that there is an engineering solution to just about any salinity problem, but in most cases they are not cost effective. Unless you have an asset that is of a very high value, the engineering solution is far too expensive. If it were a matter of, 'We have to solve a salt problem,' it can be solved. There is no new engineering or science that is needed. It can be solved. It is just like dewatering

mine sites. You can do it, but what we have found is that there are very few assets that reach that economic threshold.

Certainly, a place like Lake Toolibin—which is one of the last remaining freshwater lakes in the wheat belt in Western Australia—is worth spending lots of money on, because it is a very rare asset. You will be going to see Katanning, where there is a lot of work going on, because here is a major rural town that is being affected by salinity. Clearly, that is an instance where you would invest a lot of money in an engineering solution. Where we think we may be able to recover them in time in a much more cost effective way, we may be putting in partial solutions to hold them, so that we do not lose them completely.

We did a situation statement in 1995-96 with a section in it asking, 'What impact has salinity had on nature conservation values in the state? What are the threats? Are there threats to extinction, for instance?' We had a lot of trouble coming up with very many species. Once we had invested, under the National Action Plan, $10 million a year in the state agencies, one of those agencies—CALM—went out and did a survey of what was in the areas which were likely to be affected by salinity and found there was enormous endemism and unique species all through these wheat belt valleys.

We always thought that it was the sand-plain heaths where a lot of the biodiversity in the landscape was located. Once we started looking, we found that there were many hundreds of species which were endangered through salinity. It just shows you that, with a small amount of strategic investment, you can go away from thinking there is almost nothing at risk here to thinking that there is this enormous biodiversity at risk from salinisation.

Dr WASHER—Dr McFarlane, you mentioned the Collie River and the Wellington Dam and the salinity—and I think Tom mentioned it too—being at a level that is not suitable to drink. What was it?

Dr McFarlane—At the moment, it is a bit over 1,000. You will be seeing that. You will be going to East Collie and talking to some of the farmers tomorrow, so they will be able to tell you exactly what it means.

Dr WASHER—We have a problem in Perth, where we are short of water. We have now had 20-odd years of drought, and it does not look like changing. To get the salinity back to a potable level, to get it to the city, what would we have to reduce it to?

Dr McFarlane—It depends on the ability to shandy the water. At the moment, the Water Corporation has asked for an allocation from Wellington Reservoir. They are willing to take it as it is, because they have an ability to shandy it in some other dams to bring it up, but if there was to be a significant amount of water moved they do not have the ability—the fresh water, if you like—to reduce the salinity. That is why the main beneficiary will be the irrigators. They are taking water—sometimes 1,200 milligrams per litre—to irrigate soils which are becoming more and more saline.

Dr WASHER—You said the project that was put forward to get money from the National Action Plan was rejected. What did that involve, as a thumbnail sketch? This is a lesson in management of salinity. I guess it involved, for example, engineering feats and planning feats

et cetera. Did it involve the cooperation of farmers? Can you flesh that out a little bit, to give us a picture of a study that you obviously thought was valuable.

Dr McFarlane—We started out with about 25 potential solutions, and we got it down to about five. We had a workshop about a year ago, and we have been developing those more thoroughly. It is now down to two solutions, but the one that is particularly attractive at the moment is to divert water from the East Collie branch—which is the most saline of all of the tributaries that run into the Wellington—into mining voids. This is an area where coal is mined, and there are areas that have been dewatered to take the coal out and there is a need to get water back into those voids before they become acidic. If you do not get water back into the voids the sulphide oxidises and you get acidic water.

One of the opportunities is to take some of that saline water out of the East Collie and put it into the mining void. Around that mining void there is also an aquifer of lower salinity water, and we were concerned that that saline water would leak out of that void and contaminate some of the surrounding groundwaters in the basin. We would like to proceed with that, but only if we have an ability to take that saline water out of the void, if we need to, treat it—through desalination, for instance—put it back into the system and take the brine that remains through a pipe out to the ocean.

At this stage, we do not have the capacity to treat the water that we are planning to put into that mining void, but that is certainly looking to be the most promising of the options. That is not the only thing we have done in the Collie. There has been an enormous amount of tree planting there, both commercial and non-commercial, over the last 20 years. The government has spent about $70 million, in current dollar terms, purchasing land and revegetating land. This work—preferably collaboratively under the National Action Plan—is the last thing that needs to be done to get the salinity level down to probably about 600 milligrams per litre.

Dr Hatton—Amongst other features that are associated with getting the Collie plan to where it is now, a multi-agency technical recovery team has provided ongoing advice, analysis and review of some of these proposals—the solutions that Don referred to—and has had long-term engagement with the community, facilitated by the state government, so that those people are put into occasional regular contact with the land-holders and other stakeholders in the Collie.

The Collie, in particular, is building upon 30 years of experimental research and monitored responses to some of the kinds of solutions that are now being built into the recovery plan. In fact, the Collie is home to the only set of large-scale tree planting salinity experiments that I know of in Australia. Unfortunately, we are not monitoring them at the moment due to lack of funds, but all those elements are coming together, I think, for the Collie to be realised as a recovered catchment.

Mr Edmondson—From a community point of view, the catchment of the Collie is not a typical Western Australian wheat-growing area. It has traditionally been grazing country. It was pretty widely accepted in those communities that they would put trees back into the landscapes, and you will see that as you drive through it. There has probably been more tree planting in that region than in any other part of the state, that I am aware of, apart from the straight out agroforestry.

It is a community that has been committed to the Collie project for, I would say, 15 years. The community was bitterly disappointed at the debate that went on around the project when it was put up for the Commonwealth, where it seemed to be focused on who was cost shifting rather than, 'Let's get on with it.'

The community put a lot of effort into it. There are some unique views there, including one from a group which has a proposal to put the water into that mine void. The community is totally committed to that, right back to Darkan, 80 kilometres east of that site. There is a very strong community view on that project.

Dr Hatton—I would like to add to Rex's comment about the Collie being distinctive. This is something that I have come to appreciate while working in Western Australia. I started in the Murray-Darling years ago. Because our river systems really are very different—and I could go on at length but I won't—you can have a surface catchment defining a regional NAP catchment, a very large thing. But they do not flow from one end to the other continuously; they are often disconnected for very long periods of time. The communities in those locales may have very different visions or strategies on how to manage their subcatchment than another part of the same NAP region. In fact some of our NAP regions, including the one that Collie is in, are extremely heterogeneous: there are a number of very distinctive catchments, cultures, groupings of people, industries, within the same one. They do not all flow in and out from one to the other.

This makes regional level decision-making and investment processes a little bit fraught. It is not like the Lachlan or the Murrumbidgee. For instance, in the northern agricultural region, there is a subcatchment with a very advanced group which has done a lot of work: technical underpinning, structure, knowledge, a vision and a governance model proposed for managing the flows. That subcatchment has never discharged into the rest of the downstream part of that regional system in the history of settlement in Western Australia. It is truly disconnected. They want to race ahead with their ideas, but it still has to go through a regional process that has very distinctive bits that may have other assets in other kinds of communities. It is rough.

Dr WASHER—If the National Action Plan rejected that proposal but the state government had put in half the money, the government must have some say. Who makes the final decisions? Who are the decision makers in the proposal? It surely cannot be just the Commonwealth.

Dr McFarlane—At the moment, the Commonwealth have said that if the South West Catchments Council put the Collie as one of their highest priorities, if not their highest priority within all of their regional strategy, then they will reconsider it as a funded proposal. It has not been completely ruled out. We see other examples where similar works in South Australia were advanced ahead of a bilateral being signed, and certainly before regional strategies were accredited. We are wondering why it is possible in some areas and not in others. As I say, it is a sore point between the state and the Commonwealth.

CHAIR—You do appreciate the difficulty that these sorts of joint things create.

Dr McFarlane—Sure.

CHAIR—There is always a grey area. From the Commonwealth's point of view, protecting the taxpayer is a function which really should be the realm of the state. I know it is hard for

people on the ground to understand that. As local members we hear all the time, 'I don't care who's responsible for it. I just want it fixed,' but there are differing responsibilities.

Mr Edmondson—I understand completely. I was at the table. In Western Australia the community was involved with the development of the bilateral agreement, so we were at the table with the Commonwealth and state people. We heard the debate between the state and the Commonwealth over the Collie, so those of us who were there understand the differences. We thought we were dealt with a bit harshly.

CHAIR—It sounds as though not all is lost yet.

Dr McFarlane—I have been involved with national and state things for almost 20 years—since the National Soil Conservation Program, would you believe—and they are all called partnerships. I think that word 'partnerships' is getting almost overused now. The groups who have the skills and knowledge really need to be listened to and incorporated around the table. The Commonwealth is critically important, because I believe a lot of the stuff that needs to be done—for instance, in new industry development and innovative research—has to be driven from the Commonwealth level. I am a strong believer of that. The states, though, have much to contribute, because they have been land and water managers for a long period of time, and to deal them out is to lose a lot of expertise in resource management that the Commonwealth does not have under the Constitution. They really need to be major players in this, whatever your persuasion is about the role of the states.

CHAIR—Absolutely; no question about that.

Dr McFarlane—The third group is communities, particularly through the regional groups. You do not make any partnership or progress unless you have community groups at the table. The fourth one that is sometimes involved very successfully and sometimes forgotten is industry—for example, the rural industry research funds. When industry have been involved in landcare, research management type areas, they have been incredibly successful because they also bring in a lot of land-holders that are not traditionally brought in under the landcare or conservation banner. When you have those four groups around the table, contributing their skills and knowledge and they are listened to and respected, you make very rapid progress.

I want to contrast that with the National Action Plan and say why I think the National Action Plan is having difficulty in Western Australia. We have felt that the state has not been listened to. A lot of the development of the National Action Plan was done at Commonwealth level and the sign-off of things at a federal level before we even knew that there was a National Action Plan. We have never been able to renegotiate anything that was signed off at the early stage and, therefore, while it is called a partnership program, we feel that it was put together at a federal level without involving us in perhaps better ways of carrying it out.

I will compare the NAP with the Regional Partnerships program, another national program in which I was involved. It involved the community, regional groups, state agencies and the Commonwealth and, in some cases, industry, all sitting around and contributing for what was probably a lot lower investment and a much more effective outcome because all the parties were respected and trusted and listened to. Under the National Action Plan we have tended to be disconnected, the regions—and I am a very strong regional proponent, so don't get me wrong—

are developing regional solutions under the Commonwealth program but the states really feel disempowered under this, as if they do not have input. There are not many programs happening at state level.

CHAIR—Previous witnesses have said they are concerned at the way in which going directly to the CMAs is working; that the expertise is not in the CMAs and consequently it may be that the best science is not finding its way to projects on the ground. Would you agree with that criticism?

Dr McFarlane—Quite often the solutions that you come up with, if you look at them from a local or even a regional level, are not necessarily the best ones. Sometimes, when you get regions or states together to tackle things, you come up with solutions that are possible across a large part of the landscape. Under the current National Action Plan I am concerned that there will be treatment done to land which is not of high value to farmers. We have seen this in many of our demonstration catchments: you go there and people say, 'Yes, you can fence out that bit of area' of bush or rock or creek or salt because it is not part of their productive farming systems. But if you try to do something with the major part of their land, which is where their income is from, all of a sudden it is a different thing.

We need to make major land use changes over that part of the land where the farmer's income is coming from. To do that you must have a very good farming system, you will have to be credible with those farmers and you have to show that it is an economic solution. Under the National Action Plan, I do not see that we have the ability to develop those broadacre solutions to make a real impact on salinity.

CHAIR—The program you said worked you referred to as Regional Partnerships?

Dr McFarlane—It was the Regional Partnerships program where there was negotiation between the Commonwealth, the regions and state agencies.

CHAIR—Which portfolio was it under?

Dr McFarlane—It was under Primary Industries portfolio. It included Environment Australia—or ANCA as it was at that stage—the rural adjustment fund and NHT were putting money into it. In some cases we also had the Australia Council putting money in. It was brokering across all Commonwealth agencies that could have an input into issues in an area. It was very effective in the one that I helped negotiate on the south coast of Western Australia.

Mr Edmondson—Chair, there are two models for that in Western Australia: the one that Don referred to—and I am closely involved with that; we farm in that region—and the other one that came on the end of that program was the Gascoyne Murchison Strategy in the Murchison district of Western Australia pastoral areas. That has been recognised as one of the most successful of those packages that were put up at that time. There were several put into western New South Wales; very marginal areas. I think it is generally viewed by the Commonwealth that the GMS was the most successful.

CHAIR—There is currently a program called agricultural partnerships. I think there is one starting in South Australia and we are trying to negotiate for one in the area that I represent and one in Queensland, which are a similar sort of model.

Mr Edmondson—That program picked up a lot of things, such as the people or organisations involved that Don just described on the south coast, but where I guess I've always been critical of those programs is, because it's taxpayers' money, no-one will trust their arm and take a risk. Most people in business are doing that all the time. I have said many times to federal people, 'You're going to have to trust your arm before this will work.' Whilst they did not trust their arm with the Gascoyne Murchison and the south coast one, they put in such a broad sweep of programs that you were able to mix and match. For example, in the pastoral areas, they were able to buy back pastoral leases and take them out of production. Nobody was hurt in that process: the pastoralist received his share of the capital; the country was taken out of production. There are many examples like that—bore capping; all of those things. I am sure you have all heard of them. Put that package together and it is good.

CHAIR—I have one other matter. Dr McFarlane, I think you were saying that solutions were needed over a large part of the landscape. AFFA made the comment that one of the advantages of airborne EM is that you can target interventions. Is that consistent, or is this an example of what Dr Hatton was saying of applying a model from the eastern states to the west?

Dr McFarlane—It is where we were in our scientific thinking in 1983. We went out and tried to find areas where there was high hydraulic conductivity in the topsoil and the subsoil, for instance, and assumed that they were the areas where most of the recharge would be occurring and, if we were to selectively revegetate those areas, we would solve our salt problem. I remember working on a catchment in 1983 and applying ground based geophysics to that problem at that time. Soon after that, we did work in the Toolibin catchment—which you will be seeing on your trip—and we found that most of the recharge was occurring through heavy clays in the bottom of the landscape. Over large parts of the landscape and in major events the water was going in over perhaps a third of the landscape in big flood events.

The thought that the water gets in in a few selective areas and that ground based or airborne geophysics would be able to identify them and you can selectively revegetate them and solve a problem we think now is not appropriate in our situations and we suspect it is not in a lot of cases in the eastern states.

The only other advantage that geophysics has is to identify areas where water will be either impounded because there is a barrier to flow across the landscape—and we spent a lot of time looking at dolerite dykes in Western Australia and mapping those, using airborne magnetics—or that there are areas where there are fractures or where water will preferentially flow along and discharge into those areas. They are quite good at predicting where discharges will occur but if all you are doing, as I said before, is predicting where the salt problem will occur, it can help you to fence out those areas before they become completely affected. We have used geophysics to do that, but it is not solving the problem.

There was a lot of interest a few years ago about identifying areas you might be able to selectively pump from. There are likely to be situations where that could be effective for solving

local discharge problems, but I have yet to see a highly effective geophysics technique that can identify small areas of landscape which you can treat and have a significant impact on salinity.

Dr WASHER—Let us take a town, because it is expensive to lose a town: the question is, do we have the science and technology to know and identify the soil structures and identify the salt movements to intercept, to drain, to lower the watertable, to do something useful if it is economically reasonable? What do we do?

Dr McFarlane—As I said before, when you get a high-value asset like a town, then a lot of the solutions that are not feasible elsewhere become feasible. Our initial thinking was that we needed to treat the catchments around some of our towns because they would be contributing recharge, which would significantly affect the town. When we did some detailed work in the towns, we found they were generating a fair bit of the water themselves in the run-off from the roofs, in the roads and the use of septic tanks and the imported water that was coming in through our reticulated schemes. In fact, irrespective of whether you had a town that had a cleared catchment around it or not, there was enough water generated within the town for it to develop a groundwater mound under the town to cause a salt problem, if salt was present in the soils under the town.

One of those places is Kalgoorlie. Kalgoorlie-Boulder has a problem of salinity occurring around Gribble Creek. For some time it was thought it must have been contributed to by the local goldmine there but, in fact, some local work was done showing that it was actually the water generated within the town that caused those local groundwater mounds to form and to cause problems for foundations, so you have to diagnose the problem. Certainly some of our towns are underlaid by quite sandy lenses and you can use some effective engineering to remove that water.

In Merredin a couple of bores were operated which were taking water out from underneath the town and it was put through a desalination plant. That water was then able to be used for other purposes. There is a fair bit of interest in Western Australia at the moment on desalinating some of the saline water from underneath towns and using it to augment the Goldfields and Agricultural Areas Water Supply Scheme.

Mr Edmondson—I chair the Rural Towns Program of Western Australia and over the 20-odd years I have been involved in resource management from a community level, it would be the most exciting project ever I have been involved with. Kalgoorlie is not in our sights because it is deemed to be outside the agricultural region and the program was set up to cover rural towns in the traditional agricultural areas. What we have found is—as Don said—that we can use techniques in a town that you could not use over a broad scale. We have done a lot of monitoring and evaluation and science in those towns and tried a number of techniques. Without going into it in detail—we may be able to supply you with some more information later—of the 32 towns involved there are 1,300 bores monitored on a two-monthly basis in this state, along with a lot of detailed work done by scientists, including those in CSIRO who have just done a major program in Katanning. I see you are also going to be there, so you will see the impact that salinity is having in a town such as that.

It is a very exciting project in this state. At the moment it does not have any Commonwealth money in it and I believe it should have. It did have some NHT money in it, over five years the

NHT put about $1 million into it, mainly, once again, for tree planting. The impact on a town with tree planting is really about zero. It makes the town look pretty nice, but it has literally no effect on the salinity, because of this generation of the water.

The information that we have in Western Australia is up to World War II, and the comprehensive waste schemes went right out through that wheat belt. The salinity just about goes vertical. As Don said, it is imported water that is doing it. Septic systems went in and we started to move into a more civilised way of living in rural towns, but with it came salinity. It is quite clear how it all happened.

Dr WASHER—We will have to go back to the outhouses then.

Mr Edmondson—That is right. Just as an aside, my father-in-law always had *Hansard* hanging up in the toilet in their old place which looked out over the river. It was about the only time I have ever read *Hansard*, I might add.

Dr Hatton—I am going to go home tonight and indicate that in *Hansard* it is written that septics brought civilisation to the wheat belt!

Mr Edmondson—If you use Merredin as an example, it has an annual rainfall of about 350 millimetres a year. Water use more than doubled once the pipeline came in, because suddenly people had access to it and, instead of the rusty old water tank that just kept them in water for a cup of tea, they now had water for gardens—and why shouldn't they? But we have to have a better way of managing it.

Dr Hatton—I can expand on that answer. That Rural Towns Program is something we are partnering with strongly. The simple answer to your question is that all the engineering is there to pump water out from these towns and save them. But our thesis is that that is a completely lost opportunity and we are now partnering with the Rural Towns Program and helping them get additional research funds to develop new industries and new sources of water derived from what is now a problem—integrating desalination into these towns; mineral recovery; downstream mineral recovery; new downstream industries that can use the water produced; perhaps fit for purpose. Of course, then there is safe disposal of the brines that you pump out from under these towns. There has been a lack of science and we need to really make it click in these towns so that it goes beyond just pumping it out and putting it in the creek. We are really excited about it.

Dr WASHER—They said you were the man who kills trees. But when I went down to the Great Southern last, most of the trees I saw that had been planted, or were native, were dying. They were certainly in a bad state of repair. They certainly were not pumping watertables, I can tell you. The question is, even now if we go south of Mandurah—and this is not a salinity problem—you can see the tuart deaths and the mallee deaths. When I went to the Great Southern I hardly saw a tree that looked decent in the whole place. They all looked crook. I am sure Rex here can remember the trees used to look better.

We have got 20 years of drought, sure. People put it down just to drought and there are secondary infections, sure, but how much effect do the chlorides and the acidity have? It is the bigger trees. It seems once they hit the watertable and get the taproot down, they just collapse. Is there any work being done? I think there is some work being done by Murdoch and Edith Cowan

universities looking at why our so-called tree plantings, that were so massive, are experiencing so many tree deaths, or at least tree sickness, out there.

Dr Hatton—My understanding is there is some research looking at why the tuarts have declined. That is native forest. There are also concerns about the decline of the wandoo. I think the hypothesis there is mostly related to non-salinity issues—drought et cetera; fire regime perhaps. But in the targeted tree planting for salinity control there have been a lot of failed plantings; there is no question about that. In many of those cases of failure you do not need to be a highly skilled botanist or plant physiologist to figure out why.

This is a feature of where we are now in our wheat belt, with valleys where the watertables are now at or near the surface. They are very salty and in some cases they are also acidic. There is effectively a hysteresis with respect to the role of trees. Logic would normally tell you if taking trees out of the system caused it go one way, putting trees back will cause it to go back to where it was. That is a strong logic and it is deeply flawed. The systems in that sense are hysteretic. Now that the saline watertables are at the surface, you cannot put trees in there again and draw that back down, because they die, or they are ineffective in those locations. In other locations it is a different story.

CHAIR—So that is where the drains are going in?

Dr Hatton—Indeed. There has been some very wise tree planting. I think you will find those trees are hanging in there and maybe doing the job. There has been some really unwise tree planting and, as you no doubt appreciate, farmers put trees where it is often convenient to put them within their farm business, not where a scientist tells them to put them, because it might be in their best lambing paddock or whatever. I think there has been a lot of wasted effort.

Dr WASHER—The people who were here before you spoke to Ann Corcoran off the record about this, and the fact that the geology of the country is such that beyond the scarp a lot of the ancient river systems used to run inland—at least, to the north or south slightly, but basically east or inland—and that accounts for the evaporation of water from the rains et cetera, and brought in from the sea. It precipitates and then drains gradually back. Have you documented or do you adhere to that idea?

Dr Hatton—Don is a hydrogeologist. I will let him tell you.

Dr McFarlane—Certainly the flow of the major drainage systems in the wheat belt is very poor. The gradient of them is quite often less than one in 1,000 and sometimes it is one in 1,500. They were better in the past. There is evidence that there has been some uplift in the west and so the drainage is much poorer than it was. But there is a major drainage divide which is just outside the cleared area, east of which you get major palaeodrainages that go out into the Eucla Basin. They are very important water sources for the gold industry in particular.

The other change in drainages that occurred historically is when Antarctica broke away from the southern part of Australia in the Eocene about 45 million years ago. It broke away gradually. The southern part of the state sagged and all the southern flowing drainages started at that time. The pivot is called the Jarrahwood Axis, south of which areas which were draining north into the Blackwood and into the Avon now drain south into the Southern Ocean. There are some areas

there where the new drainages are cutting across palaeodrainages. You have areas which were traditionally old valley systems with large infilled sediments which are now being cut across by younger rejuvenated rivers that are flowing to the south coast.

But the main reason we have much larger salt problems in Western Australia is the long period of emergence of the Yilgarn Block and the long period of weathering we have had there. We have large thicknesses of clay based regolith from the weathering of the granites that is able to absorb a lot of the salt coming in in rainfall. We have very poor drainage or flushing out of the system, but we also have a very thick layer of clay which is able to accumulate very large quantities of salt.

After clearing, it is that salt which is actually mobilised. One of the reasons why Western Australia has developed a salt problem far earlier than a lot of the other states is that our drainage has been so poor and we have had a long geological history where we could build up such a large, thick, weathered zone. Our environment was just teetering. Some of the valleys were already going saline progressively, when they went in and started clearing. The clearing released a lot of extra water into the system and we have had quite early onsets of salinity. In fact, some of the earliest work on salinity was done by the railway engineers who were finding that the water sources they were using for the steam trains were going saline. To celebrate one engineer, W.E. Wood, we created the W.E. Wood Award, which is now awarded to the best scientist in salinity every year. I have to say we have one of them here, the inaugural winner of the W.E. Wood Award—Tom Hatton. Three of the four winners have come from Western Australia so far. We think that is not just because we helped set up the award! We think it shows how eminent our scientists are.

Mr Edmondson—Also in Western Australia there is no doubt that the scale of clearing of land after World War II increased the development of salinity very fast. Prior to World War II the settlers went out with an axe and a waterbag, picked a nice valley and started to chop the trees down one by one. After World War II we had access to machinery and funds and tax concessions and in Western Australia, because of the land that was available, clearing was done here in a big way.

The million acres a year that you hear a lot about in Western Australia was real. It was being developed about as fast as it was being released. I was involved in it. I have probably cleared more land than any of you in this room—without asking your background. I have certainly burnt more, being a fire captain for a long time when that country was being developed, and we had absolutely no idea what we were heading for at that time.

For one of our CP blocks we got the person from the Department of Agriculture that was the best in the game at the time to plan the property before we cleared it, and we got it horribly wrong. With the science that was available to us at that stage, we thought we were right on track. Looking at it now, my son says to me—in one generation he says to me—'What the hell did you clear that for?' as he fences it out. The scale on which that happened in Western Australia on the light land, where the recharge is, is now coming home to roost, there is no question.

Dr WASHER—Desalination is obviously going to be an increasingly important component to the management of salinity. Where are we at? What are we doing? What is the latest in

desalination? What do we use—reverse osmosis? What are we doing to desalinate on a commercial level, on the scale you are talking about?

Dr Hatton—We are tabling, to the Innovate WA Major Research Facilities initiative on the 21st of this month, a $40 million partnership proposal with the state government and federal government to start a desalination research and development centre in Western Australia, in the wheat belt. Desalination technology is at the point where a major desalination based on sea water at scale can deliver water to a metropolitan situation like Perth for $1.20 or $1.10 a kilolitre. We may be building one soon in Perth as an option for water security. It is my view that there are real community scale opportunities in the wheat belt, which is watered off the same scheme as you have been hearing, to get them off the scheme and use water that is currently a problem.

The real advantages may not be in new membrane technologies, but in integrating new industries and shandying water and some of the clever stuff you do upstream and downstream of the membrane. There are large areas though, in Western Australia, where the feed stock water is of a chemistry that is quite hostile to current membranes. We want to lead the research and development of new desalination technologies. People out there are crying for it. The Shire of Narembeen has access to over 10 megalitres a day of nasty water, pH 3. They want to use it. They want to know if they can burn stubble or burn chairs or furniture to desalinate it and use it for a new industry. It is an exciting time in desalination.

Of course, what we are trying to do is also tie renewable energy to these systems in the wheat belt, so those people can be involved in making the energy that is driving the system, if possible.

CHAIR—Thank you very much for your evidence this afternoon and the submission. It has been very useful.

Dr McFarlane—Can I just make some concluding comments because, looking through our submission this morning and some of the things we were discussing today, we could be seen to be a bit negative about some of the things that are coming out of the Commonwealth. I want to put on the record that we have worked very well and successfully on a number of initiatives that have been Commonwealth funded and we would like to continue to do that, but we would really like a true partnership in a lot of those initiatives.

Certainly the National Dryland Salinity Program is something we really think we should get behind as a nation. The states, I am sure, would be very strong in supporting that one. The National Land and Water Resources Audit, which has had some renewed funding reasonably recently, could be in danger of not being built on if it is not continued in some way. There is the Joint Venture Agroforestry Program, which I think I have mentioned on other occasions. Certainly some of the programs—like Healthy Country—that CSIRO are involved in, we are very keen to partner with.

Let us not forget those rural industry research funds like the Australian Wool Innovations, Sustainable Grazing on Saline Lands and those sorts of things—very exciting, very good partnerships. We would really like to see more of that sort of stuff. I wanted to put that on the record so that it is not seen that we are just having a bit of a whinge and we are typical West Australians that say, ‘It’s always different over here. The Commonwealth got it wrong.’

CHAIR—I understand.

Mr Edmondson—Chairman, might I, too, add some comments because I quite deliberately gave the Commonwealth a couple of swipes along the way. I have been involved with the Australian Landcare Council, I am off it now because I was the longest serving member of it. Where there was an opportunity for a community to talk directly to ministers, certainly at AFFA level and to a lesser extent EA, I have appreciated the Commonwealth's ability to talk to the community. I was the only one invited from Western Australia to talk to the Prime Minister and Cabinet when the development of the NAP plan came up. They were quizzing me on the capacity of our communities to operate at a reasonable level.

There have been opportunities for us and, whilst we might have given the Commonwealth a couple of serves through our submissions, I certainly appreciate the opportunity to talk to the Commonwealth from a community voice point of view. That is still open to me. I have recently been involved with the review of the national Landcare program. That report is in front of the minister now.

CHAIR—That will be out soon, I think. It is part of the budget process.

Mr Edmondson—The Commonwealth has given the community plenty of opportunity.

CHAIR—Thank you again.

Resolved (on motion by Dr Washer):

That the exhibit from the Western Australian National Resource Management Council be received as evidence.

Resolved (on motion by Dr Washer):

That this committee authorises publication of the proof transcript of the evidence given before it at public hearing this day.

Committee adjourned at 4.43 p.m.