C O R R E C T E D V E R S I O N

ENVIRONMENT AND NATURAL RESOURCES COMMITTEE

Inquiry into Melbourne's future water supply

Melbourne — 16 March 2009

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Dr P. Coombes, director, Bonacci Water.

The DEPUTY CHAIR — I declare open this hearing for the Environment and Natural Resources Committee's inquiry into Melbourne's future water supply. I welcome Dr Peter Coombes from Bonacci Water to the hearing. I also note apologies from our Chair, Mr Pandazopoulos, and from Christine Fyffe. This is a public hearing. Anything you say today is recorded by Hansard and is protected by parliamentary privilege under the Constitution Act and the Parliamentary Committees Act. Anything you say outside the hearing will not be afforded such privilege. I ask you to make a brief comment and then leave time for questions. Would you like to start your presentation?

Overheads shown.

Dr COOMBES — I have brought a presentation that has got a few slides in it to inform what I have to say, if that is okay with the committee, because I think it is probably more instructive to see some of the pictures and diagrams as well as the words.

The topic of the presentation is 'Towards sustainable water strategies — inclusion of decentralised options to balance uncertainty'. It is fair to say we are very uncertain about our water futures. I was a member of the Prime Minister's Science and Innovation Council working group on water for cities in 2006 looking at this problem for the entire country. Our conclusion was that we cannot count out any option. We need the decentralised options, we need people to contribute and we need the big things as well. That is really the thrust of what I have to say.

My first chart looks at the efficiency of the Thomson Dam that supplies Melbourne. The way to understand this chart is on the vertical axis, with run-off in millimetres per year — that is, the amount of water that hits the surface and ends up running off into the dam. On the horizontal axis is rain in the catchment — that is, the amount of rain that actually falls on the catchment. As you can see, there is a very wide distribution of annual run-off into the dam. This is natural variation. Throughout my presentation I am going to comment about the way we talk about and analyse water. One of the problems is we assume everything happens on average. As you can see from the natural behaviour of the catchment supplying the Thomson Dam there is profound variation in the run-off to the dam. I challenge anyone to assume there is an average response of that catchment, because that is simply scientifically inaccurate. By the steep nature of the curve, as rain decreases on the catchment the run-off decreases dramatically. That paraphrases what is really happening in our current environment. Small reductions in rainfall generate very large reductions in run-off into our Thomson Dam.

Regardless of our work with the national committee looking at water futures for Australia, still the majority of Australian water supplies are from inland dams that are dramatically affected by the warming of our inland catchments. Very little water comes from elsewhere in our cities. Just for Hansard, that is 83 per cent of water comes from dams. It still remains the case that the majority of Melbourne's water supplies come from dams.

My next chart is quite profound. One of the jobs I had on my year with the Prime Minister's science and innovation council was to have a look at the amount of water available in all our cities. There are four capital cities shown, but I only want to focus on Melbourne. If you look at the blue bar, that is on average the amount of water demanded from the centralised water supply system — the dams and what have you — per household. The red-purple bar is the amount of wastewater discharged per household in Melbourne. If you look further across, the light green bar is the amount of stormwater per household discharged. From a layperson's point of view, if you put the green bar on top of the red bar — therefore stormwater run-off is added to the volume of wastewater discharged per household in Melbourne — we have nearly twice as much water available in Melbourne than we actually demand to supply Melbourne.

This is the profound point: there is no reason why any city in Australia, particularly Melbourne, should have a water crisis. We have plenty of water, not not enough water; we are just not using it. This is actually the same for any city we have analysed in Australia. We analysed 50 cities as part of my brief. These results have won national awards, and they are verified by international peer review, so there is no question of these results. The challenge committees like this one and we citizens of Melbourne have is: how do we use this water we have already got?

If we just look at a household water balance for a so-called typical house — and I do not believe in average or typical houses; they do not exist — for example's sake, if we take the business-as-usual case, which is the first bar on the left, it is assuming all houses in Melbourne are demanding water from the centralised system. If we

move across to the next bars we are assuming that each house in Melbourne has water-efficient washing machines and appliances, so we are getting about a 20 per cent reduction in demand for mains water for that point. If we step across one more, we find something like a 40 per cent reduction in demand for mains water for those houses that have a small rainwater tank — 3000 litres — used to supply laundry and toilet use and maybe outdoor use, and the water-efficient appliances. If we step across to the final chart we have a 70 per cent or 80 per cent reduction in mains water demand by simply using the small rainwater tank, water-efficient appliances and recycled water. It could be greywater if it is a built-up area, or it could be third-pipe recycling. That is a profound result, and it is not hard to get there.

I want to talk about the opportunities. This is the crux of my presentation to this panel. It is always stated that it is too hard to retrofit and that the problem is so big we cannot do anything about it. My argument to this panel is: water demand is made up by every single household, every single business and every person in a community, so it is the sum of the small bits that become a large water demand. People who argue that the water demand in the future will be some large number and therefore it cannot be managed so we cannot retrofit do not understand the system.

If we consider that the population growth of Melbourne is greater than 1 per cent per annum — for argument's sake let's say 1 per cent — and if we include all new dwellings and buildings in sustainable water planning, then by 2050, 30 per cent of our dwellings will be sustainable. If we accept — and this is a fact for Melbourne — that the urban renewal process is a process of the city evolving into something else, which goes on every day, we see that a city does not stand still. It is not fixed in stone — it is to some degree — and the city is constantly renewing itself like any modern city. The urban renewal rate in Melbourne is somewhere between 1.5 per cent and 3 per cent. That means buildings, houses, factories and the urban fabric are changed, renovated, pulled down and rebuilt in a constant flux. If we say it is 1.5 per cent, which is conservative, that would mean that 44 per cent of our existing dwellings and buildings and our urban fabric by 2050 could be retrofitted or be built in a sustainable manner.

The company I work for currently was involved in CH2, the Melbourne council house which was the first major inroad towards a sustainable building. If we take those sorts of approaches and whenever we could retrofitted appliances with low energy, low water usage and low wastewater discharges, and if we aimed for a water balance and an energy balance that minimises dependence on external supplies, those decentralised strategies would add capacity to our ageing stormwater, sewerage and water supply infrastructure systems. Over a decade ago I gave evidence with others in the national Parliament about the $150 billion national debt we will have to replace our buried infrastructure in Australia. That has grown exponentially since then.

When we put water pipes, stormwater pipes, pumps and what have you under the ground and in our urban systems, they do not behave in the way they did when they were in pristine condition. They age and their capacity changes and as the city becomes more dense, so the ability of that infrastructure to supply a service is compromised very quickly. If we are going for a denser urban area to accommodate larger populations, the demands on that buried infrastructure will be quite massive. The elephant in the room for urban water planning is the fact that we may have to replace and upgrade most of our buried infrastructure if we are not clever about decentralised strategies. Potentially that could add a $100 billion price tag to Melbourne's urban form over the next 30 years. A decentralised approach to help out the centralised approach could offset that very substantial cost of replacing infrastructure.

Following the thrust of my argument, in my view and without trying too hard and without assuming that retrofitting is too hard, we can get to 74 per cent of our dwellings with decentralised strategies to make them more sustainable in our city by 2050. We have a chance here to make our urban environment what we want it to be if we tap into the planning schemes — the state and local government planning schemes — to ensure we step up to the new Melbourne rather than thinking that we need to build one big thing to get us to a sustainable Melbourne, because we will not get there overnight; we have to plan for the city to evolve in the way we need it to. Clearly such an approach would dramatically reduce demand for water and requirements for centralised infrastructure.

This is an old chart, but it is instructive. It was made for a former water minister. The demand growth in Melbourne is much larger than when this chart was made three years ago, but on the vertical axis is regional water demand in megalitres per year. The red line is the business-as-usual scenario of continuing as we are, and that is considerably worse now with our population growth. The pink dotted line in our projected water futures,

where we have dramatically decreased our water demand growth, is just putting water-efficient appliances and small rainwater tanks on new houses; it is a dramatic impact. The green line shows the effect of putting water-efficient appliances, small rainwater tanks and third-pipe recycling in new estates. As you can see from the light green line on the chart we have actually flattened our demand curve for Melbourne's future. That has dramatic impacts on the security of our water resources and the requirement for additional centralised infrastructure. Currently we are trying to complete the independent detailed analysis of Victoria's water future, and I will submit it to the committee hopefully before it deliberates.

If we step further down into more aggressive strategies — rainwater tanks and demand management in all new houses plus 2 per cent of existing houses — we start to reduce the demand profile of Melbourne. The opportunity is profound. There is a lot of conversation about rainfall in Melbourne. As this is one of my research areas, I wish to alert the committee to discussions about Melbourne rainfall that are based on the lowest rainfall location in Melbourne which has the least reliable rainfall and which only makes up 4 per cent of the spatial area of Melbourne. I alert you to the wider chart that shows 39 rainfall zones across Melbourne. The majority of Melbourne has more rainfall, and far more reliable rainfall, than Brisbane. We need to consider these facts in our urban planning.

There is much discussion about step change in rainfall because we have reduced run-off in the dams, but it is not that well related. Most climate scientists cannot really relate rainfall to increasing temperatures that well, and we need to question the modus operandi of some of those claims. Let us look at the Lara area. This is the sequence of annual rainfall. First of all, according to that rainfall record we are not in the worst drought. The worst droughts in that region of Melbourne were in the Depression years and in the World War II years. As you can see from the annual record, we are in significant drought, but it is not the worst, and there is no step change in the record.

If we move to Melton, where most people would think that the worst climate change impacts would be obvious, let us look at the very long sequence of annual rainfall there up to the present year. I challenge anyone to see even a drought impact in that rainfall record. We do not have a step change in rainfall in Melton; nor do we have an obvious climate change impact. What we have is four or five droughts that are worse than the current drought in the Melton rainfall record. We need to be very careful about generalising about rainfall and climate change. It depends on where you are, and I will take you through a few more.

If we look at Yarra Ranges, which is a very high rainfall area, from the length of record available to us it is obvious that we have a drought there. It is not the worst drought, and there is no evidence of a step change in rainfall. However, if we take the inner city rainfall location of Glen Eira it looks a little like this. We have two steps down in rainfall. Is it a heat island effect? Is it the fact that rain gauges are now surrounded by buildings and roads which affect their ability to record low rainfalls? Or is it indeed an inner city based climate change effect? However, this rainfall gauge is similar to the one that most of our decisions are made on for Melbourne. Having shown you the other rainfall locations, if you generalise this rainfall record to all of Melbourne in your planning, you are making a massive mistake. I recommend that the committee understand the spatial influences of the climate and related behaviours across Melbourne; they are profoundly different.

By the way, this is work I did for DSE. I do not know if it has seen the light of day, but I am presenting it to the committee because it needs to be explained. It took three years to be commissioned because some of the powers that be did not want an alternative thinker like me to have a go, and under parliamentary privilege I am quite willing to point this out. One of my conclusions to this hearing is you do need independent thinkers, and they do need to be accounted for in your thinking.

This is water demand from detached and semi-detached houses across Melbourne. You can see from this result that the darker the colour, the higher the water demand. You can see immediately that you cannot plan for Melbourne by assuming an average water demand across the whole city; it is simply not right. The highest water demands are greater than 329 kilolitres per annum and the lowest ones are 159 kilolitres per annum. There is a factor of 2 change across Melbourne; it depends on where you are. So we cannot dumb it down, as we are currently doing, and simplify this. We need to get in and understand how water demand changes across our city, because one of the true opportunities available to planning for Melbourne is to understand the way people use water and to get towards efficient housing.

Again if we unpack the details of water demand, if we look at the demographics in the Lara area, the top graph you are looking at is the distribution of household sizes. By that I mean the number of people in the household. If you understand statistics, you will know because that distribution does not have a bell curve shape that you cannot assume an average house in that area will produce the average water demand. In fact in this area you will be 40 per cent in error if you make that assumption. This is profound, given we use averages in our water planning. So we need to be careful about the detail.

The lower graph on the bottom there also shows that the distribution of housing types is very important and changes the way the average works. If we step up to, say, the Melton area, you see the distribution of household sizes is dramatically different from the Lara area. So the average from this place has no relationship to the average from the last place. If we look at Yarra Ranges, you see that the distribution of household sizes, meaning the number of people in houses, is profoundly different to the norm of the last two locations we looked at, and it follows that it is profoundly different right across Melbourne. That means the average house in each of these locations does not produce the average water demand, and when you compare them to each other — they cannot be compared using averages. They could be compared, but in a very misleading manner.

If we take an inner city set of demographics, what we find here, as you would expect, is there is a bias towards one and two-person dwellings in the inner city of Melbourne, which we rightly expect, but again it is not a normal distribution, so therefore the average house in inner city Melbourne does not produce the average water demand. We can see from the lower chart that the distribution of dwelling types is completely different in the inner city, so we are dealing with a different animal.

So one of my recommendations to the committee is that the detail matters are going to completely change your results. If you are not using this sort of detail in your water planning, including in your systems analysis of the reliability of your reservoirs and desal plants or whatever else you are going to build, you will get it wrong. So we need to plan for that very carefully. Keeping in mind the distribution of higher water use across Melbourne, you see there is a band through the centre of the Melbourne statistical districts.

The next chart is the frequency of rainfall across Melbourne, and unlike what the media reports, Melbourne has a very even distribution of rainfall. It is not accurate to say last month it did not rain much, therefore Melbourne does not have a very reliable rainfall. On average, over a reasonable period of time, Melbourne has one of the most reliable rainfalls in Australia. If you are in the east of Melbourne, on average over time it rains as much as every second day, on average. If you are in the west of Melbourne, it can be every fourth day, on average. But you will notice there are profound differences between, say, rainfall in Melton and Brimbank and Moreland and some of the inner city areas — the frequency of rain — and the Wyndham and Lara areas. If you take the Wyndham and Lara areas, they have more frequent rainfall but lower rainfall depths. This is a different thing to just saying the locations got lower rainfall. More frequent rainfall is quite valuable for opportunities like rainwater harvesting and stormwater harvesting, and it is quite a problem for, say, Melbourne Water, who have to manage waterways, because they do really have a stormwater problem to manage, especially as we urbanise those areas.

The higher temperatures are the dark colours. The temperature bands across Melbourne are very strongly related to the higher water demands across Melbourne, so that is obviously an outdoor influence, but not just an outdoor influence; it is an indoor influence as well. Higher incomes are in the inner city areas, Nillumbik, Melton and Wyndham new areas, and they correlate quite strongly to higher water demands.

If we look at the yield from 3000-litre rainwater tanks connected to 100-square-metre roofs — a conservative assumption — that are supplying laundry, toilet and outdoor use across Melbourne, the range of annual rainwater harvested by this system is between 25 000 and 100 000 litres per annum. The average across Melbourne — and you cannot have an average — is around the 70 000 to 85 000 litres per annum. It would make a substantial contribution to Melbourne's future. If you take the lowest rainfall location in Melbourne, as all reports of this area do, you are going to get 25 000 to 40 000 litres per annum, but the lowest rainfall location in Melbourne only takes up 4 per cent of Melbourne's spatial area. So we need to be very careful about how we project forward the performance of alternatives.

There is a fair bit of nonsense about economics of rainwater tanks. We have published a number of international publications on this topic. In 2012 it is projected by the ESC and others, and maybe our utility bosses, there will be a doubling of the water price. There is only one location across Melbourne where the cost of rainwater

supply is more than half the price of what mains water will be in those areas. I do not know where the other very high costs come from. I will forward this report, the DSE report that was accepted by DSE and shows all this analysis to the committee.

Getting to my comment about ageing infrastructure, this is a complex graph. This is a graph about the deterioration of stormwater infrastructure, to give the committee a view of what is happening. The red line is the deterioration of the structural condition of the infrastructure — so its physical shape and form. If it is concrete pipe, it is going to be starting to crack and get holes in it and the pipes will fall apart. The green line is the change over time of the hydraulic capacity of that system. What that means is the change in the ability of that system to provide a service to society. Most of our planning assumes we put the infrastructure in and it performs that way from the day it was put in for the rest of its life. That is simply not the case. We are not accounting for this problem. As soon as you have a long pipeline or anything that is transporting water, its ability to provide a service deteriorates rapidly over time — or you throw a lot of money at it to keep it working.

If we take this to view, on the left-hand axis from my left hand is the structural condition of the assets. So it is saying that structural form deteriorates over time. On my right hand is the reduction in the actual hydraulic capacity of this stormwater system. This is based on the entire Newcastle system, which is about the size and demographic of the Geelong region, and it was internationally acclaimed research I did a decade and a half ago. So if we say the average age of stormwater infrastructure in Melbourne is, say, 60 years — which it is not, but just for argument's sake — which it was in Newcastle, the capacity of the stormwater system to actually provide the service it was designed for is reduced by 40 per cent. That means more nuisance flooding, more water in driveways and more damage to property and so on.

This is my second graph on stormwater impacts. I am putting stormwater up because it is a very important issue for Melbourne. It is an opportunity as well. The intersection of managing our water supplies and our stormwater assets and the health of our rivers and bays should be explored more fully. It is not just about supplying water; it is also about how we manage the whole set of infrastructure. To explain this chart, on the left-hand side is a term known as 'effective impervious area'. It is the amount of hard surfaces that are directly connected to waterways, say the Yarra and the bay. On the horizontal axis is age and on the right-hand axis is waterway health. As our systems age, if we follow the red curve, the reduced hydraulic capacity of our stormwater systems has the impact on our waterways of a higher amount of impervious surfaces impacting from a city. But if you add to that the increasing density of a city to take greater populations — going up to the second red curve — you are dramatically increasing the impervious area impact of the city on its waterways. That dramatically increases the flood risks, with damage to property and so on, and dramatically declines the health of our waterways — the Yarra River and our urban creeks and the amenity that is probably valuable. There is profound value in actually managing these issues.

Our next graph is the same chart, the same small rainwater tanks connected to 100 square metre roof areas. The darker the colour, the greater the reduction in the annual average stormwater run-off volumes. The range of results is around a 20 to 40 per cent reduction in stormwater run-off, which will have a dramatic impact on improving the health of our waterways and reducing flood risk if we have that policy throughout the city. Just so there is no misunderstanding, urban areas generate massive increases in stormwater run-off compared to the natural environment. Within a city we need to manage those increases. If we are outside a city in our upper catchment, we have the opposite impact of needing to add environmental flows. In the city we have too much water entering our system, so this is a positive outcome.

There is a lot of discussion about greenhouse gas emissions. At worst case the present situation with rainwater pumps is supplied there. The greenhouse gas emissions of mains water supply are of the order of, if you count it all, 500-plus kilograms of CO_2 equivalents per megalitre of water supply. This is without counting the reductions in greenhouse gas emissions created by water-efficient appliances, so if you add water-efficient appliances to a rainwater strategy, your net greenhouse gas emissions result, as published in the Prime Minister's science innovation council document, is no increase — there is an energy balance in the house. If you were just counting rainwater, using current water strategies, which are not going to continue into the future, there would be an increase of about 500 kilograms of greenhouse gas equivalents per megalitre. But that is not the case. My own house in Newcastle has been monitored over the last 10 years. Because it has water-efficient appliances and a rainwater system, we have got a 20 per cent reduction in greenhouse gas emissions. The water-efficient appliances actually balanced the slight additional energy impact of a rainwater pump. One thing we do in water planning unfortunately is we still do not account for the system. A household system is just like

a large urban water system — you have trade-offs and balances, so water-efficient appliances reduce the energy impact, and that can balance the slight energy increase that is created by a rainwater pump and so on.

Unfortunately no capital city urban water supply will have the low-energy profile that they have had in the past. Some have never had a low-energy profile, but Melburnians have been quite lucky because they have been able to utilise gravity to an extent. The future mains supply scenarios of long pipelines, desalination, larger recycling schemes and whatever are going to cost us to about 3000 kilolitres of CO_2 equivalents per megalitre of water supply. In that situation the net decrease in greenhouse gas emissions from a rainwater strategy is going to be of the order of 2000 kilograms of CO_2 equivalents per megalitre. We can actually reduce the impacts of our centralised supplies by having a decentralised strategy. But there is innovation in this space, as there is anywhere else in the water industry — or there should be if we aim for innovation. Low-speed, low-energy pumps are getting us down to less than 200 kilograms of greenhouse gas emissions per megalitre. My own farmhouse has a direct current diaphragm pump that produces less than 50 kilograms of CO_2 emissions per megalitre of rainwater supplied. That is a very low energy profile. These products are in the market at the moment and should be encouraged.

Moving to the big system, the blue sequences on this graph are rainfall over the Thomson Dam. The green sequences on this graph are run-off into the Thomson Dam catchment. This goes back to the turn of the century. I acknowledge that the Thomson Dam did not come online — and 'Thomson' is spelt wrong; there is no 'p' in 'Thomson', sorry about that — until about 1982 or 1984. If we look at the rainfall, the inland catchment, I did not bring along a chart of temperatures, but we have had about a degree or so increase in temperature over the catchment over the last 100 years. We have had a range of different catchment management philosophies over the last 100 years which have dramatically impact the catchment — the current fires will actually have some effect as well, as you would be quite aware — logging and a range of policies. But what is obvious in the rainfall is that Melbourne had a high rainfall period in the 1950s to 1960s in the catchment, far lower rainfall periods since and lower rainfall periods before, but you have had a decline in rainfall the sequence for the last 100 years over the Thomson Dam catchment.

Our analysis of the stream flow to that area, which is the green sequence, shows dramatic decreases in run-off over that period. What we are showing here is, yes, there is declining rainfall in the Thomson catchment, which is very different to the rainfall over Melbourne — they are different things, different scientific issues. Currently we are generalising what happens at the Thomson Dam for all of Melbourne and our water strategies. That is not correct; it should not be done. However, the reduced rainfall, which is a slight reduction in rainfall over the catchment, has translated to very large reductions in run-off for two reasons. The first is that, because of the increasing temperature and change of rainfall pattern over the catchment, spring rain has shifted to summer. We are all talking about how it did not rain much in February, but we forget how much it actually rained in December. If your August rain shifts to December, which seems to have happened in that catchment, the rainfall, no matter how much it is, is falling on a drier catchment. My point is that it pays to actually unpack what is really going on rather than generalising. It is my observation that there is plenty of generalisation and not a lot of detailed analysis.

If we have a look at the relative impacts of climate change and climate variability in our catchments and in the city on yields from the Thomson Dam versus a 3000-litre rainwater tank in the lowest rainfall location in Melbourne, we get quite profound results. Again this is an award-winning international publication, which I will forward to the committee. On the vertical axis is the yield from the catchments and the rainwater tanks divided by the median yield from the whole sequence.

On the horizontal axis is the rainfall in any year divided by the median rainfall from the whole sequence. If we have a look at the dark blue line, which is very steep, it is showing the natural variation of expected run-off into the Thomson catchment because of natural variation in climate. It is quite profound. The variation is large, very large, as you can see by how steep that line is. If you look at the dark blue dotted line under that, that is the impact of expected climate change on the yield from that catchment. This is different from just taking the last couple of years and dumbing down our analysis, because we have got climate change industry saying that is what the future holds. That will give us a very misleading and inaccurate view of our water futures. We cannot throw out our understanding of natural variability, which is far greater than climate change effects, because if you add the natural variability plus the expected the expected climate change, you can get profoundly worse answers than we are currently predicting and we can find genuine opportunities for better water management.

To take my point, if you take the lowest dot on the climate change axis, so it is one of the worst years in the natural variation of the dam without climate change, put the impact of climate change over the top of that, which means there will be almost no annual yield from that catchment, that is a very different answer to just taking the last five years of climate and saying, 'I am just taking a bit of stream flow off of that because of climate change'. We need to get back to the science here and analyse our systems properly.

If we look at small rainwater tanks in the lowest rainfall location in Melbourne, you notice there is just a light green solid curve. You notice the steepness of the curve is far less dramatic than that of Thomson Dam. It is because the natural variation in climate has less effect on urban roofs and their ability to harvest water. The light green dotted line under that is the same climate change effect. You see that the rainwater tanks are considerably more resilient in the face of climate change than are inland dams.

A few numbers to verify this: the climate change reduction in run-off is about 28 per cent in the Thomson Dam catchment, and the equivalent reduction in rainwater yield is only 7 per cent in Melbourne at the lowest rainfall station. We are throwing the issue of climate variation out with the bathwater at the moment by saying in much of our planning, 'Just use the last five years of data', which is a mistake. It is going to get us into trouble. As you can see, the climate variation is far greater than the climate change, and this the natural variation in our system that we seem to have forgotten about because we use averages. It shows a 40 per cent reduction in rainfall in the Thomson catchment, which translates to a 70 per cent-plus reduction in run-off in that catchment. The equivalent reduction is a 25 per cent reduction in rainwater yield. This would also translate to stormwater harvesting in Melbourne, not just rainwater tanks. Inner city solutions, because of the different rainfall profile and the different response of Melbourne's rainfall profiles to climate change, are profoundly different to dams. That will always be the case if dams are a long way inland.

I am going to finish on an example, and it is a controversial example. I will take the parliamentary privilege protection here. When I was still a professor at Newcastle University, the City of Greater Geelong approached me and said, 'We have a 25-square-kilometre-plus urban growth area. We wish to make it sustainable. We have reports from the local utility that say we cannot do anything else, we just have to do what we have always done before because anything else costs too much or it will not work'. I agreed to help the City of Greater Geelong, and I have since moved to Melbourne and joined a practice here, although I have retained my professorship. Their view is they wanted an alternative systems analysis, which we did.

You guys are probably aware of this. It is a land area of well over 2300 hectares which is ultimately going to provide about 22 000 dwellings for an expected population of 55 000 people. It wisely includes precinct-based plans with mixed land uses. The red hatched area is where it is. It is between Geelong and Torquay. You will note from that area the lake areas below it are Ramsar wetlands, and we have a responsibility to protect the waterway health of those wetlands.

I am going to go through this very quickly because I am almost out of time, but we actually analysed a range of options. The point of difference in doing this is that in water planning we normally get the preferred option, and I think that is unwise. We need to get back to having a range of options critically tested. Normal water planning reports actually dismiss a range of options in one line or half a page saying they are not viable and then do the detailed analysis of one option. What we agreed to do with the City of Greater Geelong is actually do the detailed planning of a wide range of options so they could be accurately compared. You cannot actually do a water study by uncritically dismissing 20 options and then doing a full analysis of one or two options and saying that was the best option, because you have not actually compared the options. I do not know if that is clear or not, but for the last 20 years our water planning has been held up by what I call the uncritical dismissal of most options and the full analysis of one or two options.

If we are going to compare options and make state planning decisions, we need to make sure we have fully analysed each option in an equivalent and transparent manner. It is something we do not do in the water industry at this point in time. Option 1 was known as the business as usual, which is the basis for comparison. We are currently in a committee and I am working with a World Bank economist. Barwon Water is on the other side of the argument, and the definition of the business-as-usual case moves on a daily basis. We probably need some sort of umpire in future analyses of options to decide what the business-as-usual case really is so then we can compare options. Did the business-as-usual case have a Black Rock sewer in it in this case or the Pettavel main, or did it not? Hang on, those two are actually supplying a service to the rest of Geelong as well as the

growth corridor. How do you count that properly? There is a lot of grey area in how we are defining our basis for comparison. I want to alert the committee to this. We need to sort that out.

Option 2 was rainwater tanks used to supply laundry, toilet and outdoor uses. We did 2a with 3000-litre tanks and 2b with 5000-litre tanks. Option 3 was rainwater plus water sensitive urban design. Option 4 was wastewater reuse for supply through third-pipe systems; 4a was from the Black Rock sewer outfall, which is now the Barwon Water preferred option. At the time no-one was accepting reuse. The treated wastewater would be used for toilets, outdoor and public open space use. Option 4b was new wastewater treatment plants within the Armstrong Creek development so they could reduce the amount of transport infrastructure, because the highest cost in the water industry is the infrastructure to transport water around, not the treatment infrastructure. Option 5, which was popular with the community, was water-efficient appliances and water-efficient gardens — water-efficient housing in general.

It is my view that we have not touched the surface of how sustainable and efficient we can make our housing. On my watch I was one of the many people behind getting to BASIX in New South Wales, and since then I have seen the eaves disappear off houses, which has a massive impact on the sustainability of those houses and the amount of water and energy that is used in cooling systems. We have a lot of ground to make up that we have lost over the last decade on simple issues like that. We can go a long way with sustainable housing; I do not think we have touched the surface. We might have to have some good, solid discussions with housing industry groups to get there, but it is my view that the community wants that option.

Option 6 was a combination of small rainwater tanks and water-efficient appliances and gardens. Option 7 is what is known as the integrated water cycle management option, which is rainwater tanks for indoor use, which is laundry and hot water in this case; wastewater for toilets, outdoor and public open space; water-efficient appliances and gardens; and water-sensitive urban design. What we mean by water-sensitive urban design is that rather than putting big detention basin in place that consume very large amounts of land and very large constructed wetlands which cost a lot of money to maintain and also consume large amounts of land, the plan is to decentralise, with prettier landscapes and streetscapes that are more livable but more decentralised in the way they manage stormwater.

The diagram here shows for argument's sake where two wastewater treatment plants — that would be membrane bioreaction modern plants that could be enclosed in a house or other structure for amenity. There would be very little odour and very little land take, and they would be far easier to manage than our traditional wastewater treatment processes. They could be fitted in there, and in so doing in those two locations it would dramatically reduce the size of the sewer infrastructure in between them.

The annual rainfall in Geelong shows that we are in a drought, but you have to look hard to see the drought sequence there. It may not be the worst drought on record either in Geelong. Contrary to much discussion in the media and elsewhere, Melbourne has an even rainfall distribution for the most part. That means the amount of rain in any month is pretty similar across the year. Melbourne has the most even rainfall distribution of all cities in Australia. Obviously within drought periods that distribution shifts to different times of the year, but over the longer term it has got an even distribution. Even over the last 10 years Melbourne has had an even distribution of rainfall. We did a test to make sure we have not had a changed distribution of rainfall. The only thing we have noticed over the last 10 years, which you can see on this chart, is that we are trending to more rainfall in October–November–December than we have had before, and a bit less rainfall in the spring.

For the whole urban growth area, which includes a new CBD, 22 000 dwellings and commercial hubs and so on, the daily water demand for business as usual, which is option 1, is about 22.5 megalitres per day. The impact of rainwater tanks just on the detached dwellings in there and cluster rainwater tanks on units is reducing our water demand by about 20 per cent. The water-sensitive strategy includes the rainwater tanks. That is why it has got a 20 per cent reduction in daily water demand.

The wastewater reuse strategy, either from Black Rock or for treatment plants within Armstrong Creek, is producing about a 40 per cent reduction in water demand using the third-pipe system. Water-efficient appliances and gardens are producing about a 30 per cent reduction in water demand. The combination, which is option 6 — next to the water-efficient appliances chart — shows that the combination of small rainwater tanks and water-efficient appliances and gardens produces greater reductions in water demand than the wastewater reuse system, so it is about 45 per cent. Options 7B and 7A, which are the integrated water cycle

management solutions — rainwater, water-efficient appliances and gardens, and third-pipe recycling — have reduced our water demand between 70 per cent and 80 per cent from this entire urban growth area. I have put this forward because this is possible in any urban growth area in Melbourne.

This is wastewater discharges. Clearly if you have got water-efficient appliances or recycling from local wastewater treatment plants, you have got a dramatic reduction in the volumes of wastewater you are discharging from your urban growth area. If you were discharging wastewater all the way to a treatment plant on the coast and sending it back again, which is option 4A, Black Rock, you obviously do not have any reductions in wastewater discharges.

These two charts show the reduction in stormwater infrastructure — the top one is detention basins and the bottom one is area for constructed wetlands — from the different water-sensitive urban strategies compared to business-as-usual and the two rainwater-tank options. In the urban growth area there was the possibility of losing up to 200 hectares of land under these old-style, centralised-basin approach to managing stormwater. Using a water-sensitive urban design strategy of treating water where it falls, rainwater tanks and stormwater harvesting at the smaller scale presents the community back with up to 150 hectares of land that is now not lost under these basins and wetlands. The value of that gain on its own is greater than the cost of all the infrastructure in the stormwater strategy.

This is a very important graph. The existing stormwater run-off volumes from the side is the bar on my left. They are quite low from the entire urban growth area. As soon as we develop that area we create massive increases in stormwater run-off volumes, which is the urbanised problem for all of Melbourne. This is typical. As we move through the things that we might do, including the business-as-usual option that has got large wetlands in there that have infiltration and then evapotranspiration, the use of rainwater tanks and the use of water-sensitive urban design strategies, we can reduce some of those stormwater volumes back to two or three times what happened in nature, but we still have far too much stormwater leaving these catchments. Anyone looking at this graph, with this very large urban growth area, will realise that further investigation of stormwater harvesting is a viable option for Melbourne in some form and needs to happen. This is different than rainwater harvesting, which is also a viable option for Melbourne. Melbourne has too much stormwater running off because of all of its hard surfaces.

Three slides to go. This is the economic evaluation of all those different scenarios. I have circled them for clarity. The two rainwater-tank scenarios produce a positive net present value for the entire urban growth area. That is because we are counting all of the benefits. When we do water supply strategies, if we just take the utility or the monopoly perspective, we are not counting all the other benefits for society, like reducing the size of wetlands, improving the water quality in our area and reducing the requirement for other stormwater infrastructure. Most sustainable solutions, most decentralised solutions have more than one benefit. If you put in water-efficient appliances, they are reducing the energy required in your household, they are reducing the water demand in your household and they are reducing the sewer flows from your household. If you are only valuing water-efficient appliances as your water saving, you have undervalued the contribution.

It is the same, too, with rainwater tanks. They are reducing stormwater flows as well as reducing water demand, so you need to count both of those benefits. If we get to the water-sensitive urban design strategy, the substantial benefits from that are from reducing the land take underneath the large basins from traditional stormwater management. The wastewater reuse options on their own for a third pipe supply both have a negative net present value, so they are going to cost a little more to do that in that urban growth area. The water-efficient appliances plus the water-efficient gardens have a positive net present value. The combination of water-efficient appliances and rainwater tanks has positive net present values as well.

The important issue is option 7A and 7B, the full integrated water cycle management strategy that is saying, as we recommended in the Prime Minister's Science and Innovation Council report in 2006, that we need multiple strategies, so we use the rainwater, we go for water-efficient houses and gardens and we use the wastewater within the development. That has a strong positive net present value, particularly if you are not transporting the water from Black Rock.

Just to show you the context of that, this is shown as a levelised cost in dollars per kilolitre. So that you can get a context of how much all this means, the two rainwater-tank scenarios are reducing the overall cost of the water supply by 25 to 40 cents a kilolitre; the water-sensitive urban design strategy is improving the community

cost of whatever water supply strategy you are coming to, in this case by $2 to $3 a kilolitre. The third-pipe recycling strategies on their own are increasing the costs, if it is Black Rock, by about $1.25 per kilolitre, and internal treatment plants by about 80 cents a kilolitre.

Water-sensitive, water-efficient appliances are improving the cost of water by 70 cents a kilolitre, and it is a bit less for the combinations of rainwater tanks and water-efficient appliances. But the integrated strategy that saves so much water and reduces our wastewater discharges, so there is a higher community benefit. Both produce slight decreases in the overall cost of water to the community.

All of these strategies, with the exception of third-pipe recycling on its own, are producing quality outcomes for the community. An important outcome in the current climate is that all of these strategies, bar one, dramatically decrease our greenhouse gas emissions from that urban growth area. The only one that increases the greenhouse gas emissions is recycling from the Black Rock treatment plant. That is because we are discharging all of our sewage to Black Rock, treating it, and pumping it all the way back. The transport cost is going to be the energy burden in the future.

Option 7b, which has local recycling, which could be done by Barwon Water if we convince it to do it, involves probably 2 or 3, 5 or 6-megalitre MBR (Membrane Bio-reaction) treatment plants. It produces rainwater harvesting and water-efficient housing and gardens, and it produces over a 40 per cent reduction in greenhouse gas emissions from that entire urban growth area, which is a great outcome for Melbourne.

There are significant barriers to innovation. In my time back in Melbourne — out of the cloisters of academia and getting my hands dirty again — I find two significant problems. They are known as direct economic dependence and indirect economic dependence, and in my view they create some unacceptable hidden outcomes in water planning in Melbourne — and probably energy planning and transport planning.

Firstly, our state government is the sole shareholder in our water monopolies, whilst also acting as regulator and approval authority for any innovation or alternatives in the market. The reason why we do not have half-cost, greatly reduced cost, decentralised treatment plants at Armstrong Creek is that the water monopoly will not have it, and it says the state will not have it either. We already have banks that want to help the water monopoly provide the money to go to this more sensible solution, but at the moment the state regulation and the monopoly structures do not allow it.

Our water monopolies have served us very well. It is often taboo to make this comment, but we probably do need a more transparent regulatory structure in Melbourne and throughout Australia. We have made great inroads. I am an advisory member of the Australian Government National Water Commission, and we have been working on it for quite a while, but we are talking about 100 to 150-year-old monopoly structures that are quite entrenched. Their economic dependence across those structures is quite entrenched; so we have a wide range of processes that resist change going on that are not obvious to most people who are not working day in, day out, at a high level in the water industry.

I do not know how you regulate this. We have superficial regulation with the ESC in Melbourne and Victoria at this stage, but it is not regulating who is the umpire if you have got a better solution that might include half private sector strategies for, say, a recycling plant at Armstrong Creek. At the moment the process is that the proponents, even if they want the local utility to run it and be a partner in it, have to go to the local utility, which says, 'We have never done this before. We do not want to do it, so you are not going to do it'. How do we get through that nexus? This is the problem we are really facing. It is also my view that we pay far too much for water infrastructure because we are not allowing those innovations at the moment because we hit this monopoly regulatory barrier.

The second issue that is quite uncomfortable to raise — but I have been in the consulting industry, I have been in the government, I have been a national research leader, I have been managing universities and the CSIRO, so I have to talk about it — is the effect of indirect economic dependence. Consultants, universities, CSIRO, the Bureau of Meteorology and many others are reliant on funds from water monopolies to continue their research, and in some cases for the viability of their business. So if they disagree with the agenda or the view of the local water monopoly, they may not do any more research. That actually physically happened to me when I was doing my PhD. If a consulting company, as the CEO of one of our biggest consulting companies said to me

recently, openly disagreed with a strategy of one of the water monopolies, which may be their largest source of funding, because they thought there was a better answer, it would put them out of business.

How do we actually get by this genuine problem of direct and indirect economic dependence? How do you know, as a parliamentary committee, that the advice you are getting is the result of economic dependence or indirect economic dependence or whether it is generally independent? I could say more, but I will not. I think this committee has to be really careful about the sort of information it gets and the economic dependence of the different organisations that are advising it.

In conclusion — and thank you for listening — rainwater, stormwater and wastewater within cities are an untapped resource. I am of the view that it is almost a national disgrace. There is no reason why any of our cities should be in any type of water crisis. Sixty to 90 per cent reductions in mains water demands are possible and have been achieved throughout Australia. I worked on the Gold Coast Water Futures project at Pimpama Coomera. Our audited results on that are currently about a 78 per cent reduction in mains water demands. For example, there are many cases all over Australia that have already achieved this. It is not a question of whether it is possible; it can be done if we allow it.

We cannot generalise about the impacts of climate change and then march forward in making our water policies because, as I have shown you, the results depend on where you are and what water strategy you are thinking about. If you are in an inland catchment that is most affected by increasing temperatures, yields from the catchments are going to decrease and should be expected to decrease; however, we are not seeing those results from coastal and urban catchments, so we need to be careful about how we generalise about climate change. We also cannot generalise about water demands and say, 'The whole city will behave this way', because it does not. The opportunity for future water management is a better understanding of water use across the cities and understanding how to encourage the different parts of the cities to behave differently.

Behaviour change is an outstanding strategy. It is not a structural one; it was not on the list the committee gave me for reporting, but it should be. The synergistic benefits of decentralised water cycle management are often overlooked, and unfortunately in most reports I read in Melbourne — and I get to see most of them by different avenues — they are not even counted. This is because when we do water planning we get a league table of a rainwater tank or a water-efficient toilet or a water-efficient washing machine and a desal plant, and we just add them up independently or subtract them and say, 'That is our water solution'. It is not; they are all systems. If you add something to a system, you change its behaviour. You cannot just independently add up the bits and say, 'That is the answer to your water strategy'. Hopefully, I will get my independent study of Melbourne's water resources finished before the committee reports, and I will show you this.

We need to be careful about making sure we are truly counting reductions in stormwater and water infrastructure. We should not be building too much infrastructure. We should get to optimum delivery of infrastructure. We are not counting the cost of our varied infrastructure and the likely impacts on the budgets of the state in the next 10 years, maybe even the next 5 years, certainly not by 2050; they will be profound. We need to look to how we can reduce impacts on the capacity of that infrastructure and optimise the way we provide it. Gone are the days when we just build it twice as big because we can, because our cities are far bigger and our national and state budgets are far less as a proportion of capita.

Impacts on environment and water security are also overlooked to the full extent. The decentralised water management approach helps the centralised water management approach by providing a buffer against the impacts of climate change. This is one of the dominant opportunities. The availability of local water sources increases with population. What do I mean? If you put in 100 extra houses, you add 100 extra roofs and a 100 extra discharges to the wastewater system, so as the population grows you are actually adding more water that can be used by the population. If your solution to population growth is a centralised solution, every time the population grows to another point you have got to find all that extra water. But if your decentralised strategies are actually reliant on the water being generated by your growth, your sources of water grow with the population, so you have less centralised strategies to supply. I will leave you with Melton rainfall. Thanks for your attention.

The DEPUTY CHAIR — Thank you very much.

Mrs PETROVICH — Thank you very much; that was an excellent briefing for us. It was most informative. I note your presentation did not include desal or piping water from rural to metropolitan areas. Is Melbourne able to become sustainable any more quickly than the modelling you have done? And if your sustainability suggestions had been implemented some time ago — maybe 10 years — how much closer would we be to achieving a sustainable Melbourne?

Dr COOMBES — Thank you for your question. What I will submit to this committee — it is close to being prepared because it has been requested by an international journal, so I have almost finished writing it — is what if Melbourne had implemented more sustainable housing and small rainwater tanks across Melbourne 10 years ago. If you had started doing it at 1 and 2 per cent per annum you would have 60 per cent-plus capacity in your dam at the moment; you would not have water restrictions. If you actually began to implement 10 years ago third-pipe recycling at sensible scales, because there is an optimum scale — bigger is not better for decentralised water strategies. It is not bigger for any modern wastewater strategy, by the way. The optimum size is down at the 2000, 3000, 4000, 5000-house scale, not at the enormous scale we keep building to, because we create massive inefficiencies in the way the infrastructure works. If we actually implemented that 10 years ago and started marching through time with our population growth, the dams in Melbourne would be close to 80 per cent full, and I will take that on notice and report it to this committee.

But if we wait until the last minute to solve our water crisis, we have to build the most in-optimum — if that is a word — the least optimum strategies, because we need to supply the water and we have to do it straightaway. We spend a lot of our time arguing that nothing else can be done, so that when we actually do something it costs the state a lot of money and it causes — let us face it — maximum political grief within the state. What I am seeing, having returned to Melbourne and having strong contact with the community — I do a lot of water studies that involve talking to the community — there is a fair bit of disenchantment. People ask, 'Why didn't we do this 10 years ago?', and I think there must be a bit more strength in water planning.

One of the other things I have tested, which I want to try to get to this committee in time, has to do with some of the policy statements I have heard in the media, including, 'We don't need to save water at the household level any more, because we have got desalination'.

The impact of that, I can tell you now, which I will report hopefully before the committee reports, could be four desalination plants. What water planners in Melbourne have not realised is that the community have probably saved Melbourne from running out of water by their very strong willingness to save water. At least 35 per cent of your water supply, if you like — if you consider it as a virtual water supply — is coming from the community saving water at the moment. If you took that away and said, 'You don't need to do that anymore' — when we built the Thomson Dam; I was still in Melbourne then, and we were told, 'We don't need to save you water anymore' — if you took that community impact away, the state would be far worse off. The community are a resource, a water resource. In my view they are not included in the solution as much as they could be. I do not think it is the 30 to 40 per cent reduction in water use — we have 240 000 rainwater tanks in Melbourne, which came out of my DSE study; people are just not telling the government because they think the government does not like tanks, probably because of what is written in the media. The community is actually saving a lot of water. We have run those scenarios, and in certain circumstances, if we took out the community response 10 years ago, we would not have any water in our dams now. I hope I answered your question.

Mrs PETROVICH — You did; very well. Thank you.

Mr WALSH — Thanks, Peter, for coming in. In your Armstrong Creek report you talk about the fact that Barwon Water probably does not want to get involved because it does not have the expertise or the capital initially. I would have viewed that as probably this direct and indirect dependence theory that you have got. How as policy-makers can we actually get the right government policy that could change that situation without privatising, because I think there would be a community backlash to the thought of privatising our water supply?

Dr COOMBES — I think that is another excellent question. When we created statutory monopolies we actually privatised our water supplies. There is only one owner: it is the state, and probably Treasury is pulling the strings. The community has no involvement in the running of the water utilities anymore. The members of boards of utilities are handpicked for their views; they are not elected. We have virtual privatised monopolies

already, because no-one in the community can have any direct or even indirect influence on the decisions that are made.

Mr WALSH — Supposedly people do that at the ballot box every four years. The general community perception would be that the water authorities are not privatised.

Dr COOMBES — Yes. Getting to your point: many elements of our public water supply system, if you want to call it that, are provided by the private sector now. At Armstrong Creek the preferred solution for us was for the private sector to go out — we had already been to the banks, and they will supply the money — shake hands with Mr Barwon Water and say, 'We will help you get over the line in return for us having co-ownership of this asset for long enough to make a capital return, but it will still be a state asset in a business arrangement'.

I think what you are getting to is that we have narrow business models within the water sector that are not replicated in society now. What we do need is innovative business models, and the first port of call for that is to reduce that monopoly barrier of saying, 'We have always done it this way, so we are not going to do it that way in the future'. One of the great opportunities for the state is to work out how to foster business partnerships to deliver sustainable assets. The barrier we have to get through is that while we already have three consortiums that want to build their own plant there, and they are quite happy to do a deal with Barwon Water and for them to run it, Barwon Water has said no. Barwon Water has moved over the last year from saying, 'No way ever, recycling doesn't stack up' to 'We might do it for Armstrong Creek' as you are aware, but there are arguments behind the scenes. I am involved in a Sustainability Victoria committee looking at this. They say, 'It costs too much; we can't find the capital. We can't do it', but the capital is available to them from the private sector.

All that is needed are some modern business arrangements in the way we manage our monopolies. I do not see any difference between the private sector building a plant because the water utilities do not think it stacks up but they do, having the state allow it to be part of the state's infrastructure and therefore not privatised, and having a desal plant run by a PPP. I cannot see any bloody difference.

Mr WALSH — What you have described is perfect, but how can we as a committee make a recommendation that changes the public policy and that would effectively force Barwon Water to be a bit more imaginative in how it runs its business?

Dr COOMBES — I wrote a submission to the ESC this year, and I recommended a new power for the ESC — that is, one of being the umpire of the public interest and the public benefit of alternative water strategies and assisting to arbitrate in getting to business strategies. I think you need an independent umpire here. In the case of Armstrong Creek, Barwon Water and its consultants, in my view, because of their economic dependence say that nothing else stacks up and we just have to do what we have always done. We came in independently and analysed the strategy, and we said, 'No, if you go to an innovative business solution, you can get to these sustainable outcomes very easily, and we have two banks who want to pay for it'. How do you get from there to there? I think you need an independent arbitrator who says, 'I am going to evaluate the merits of these two diverse points of view'. In our case we know it is because of the limited business opportunity available to the monopoly, and their reluctance to go that way, that they see nothing else benefits. You need to lend the innovation and the business power of the private sector to help you get this other infrastructure. It does not have to be privatised. An independent arbitrator, I think, is what you need. Currently the ESC has a lot of people who are very favourable to the centralised model, so you will need to pick your ESC members very well.

You need to change a bit of legislation in your acts governing the monopolies to allow for these business collaborations. At the moment the only business collaboration you seem to have are these long, drawn-out PPP processes — I was on a schools process for a different type of project — and innovation is lost along the PPP journey because it is death by a thousand cuts. You need to allow the businessman who comes in and says, 'You do not want to do recycling at Armstrong Creek, Barwon Water, but I will. So if I will, can I provide the money, own the asset under your jurisdiction' — which would be the preferred option — 'for the next 20 or 30 years, make my return and then we will negotiate whether you take it on or we continue operating it under your jurisdiction?'. I do not know. I do not think our monopolies have that type of business experience, to be frank. We do not pick our CEOs of the monopolies with that sort of business experience. To be fair to them, they do not have that private sector business experience that gets you to that negotiation point. We need the arbitrator, we need that business experience within the monopolies, and we need to break down the barriers of saying 'Why should we do anything different? We do not have to'.

You also have to break down the barrier of the perception of revenue rather than reduced cost in the dividend back to the state. At the moment we are in bizarre situations where we are sticking to certain centralised solutions because they assist with the dividend to the state, so I am told off the record. But they may increase the cost of running the water utilities in the future by two or threefold. We actually do not account for the reduction in lifecycle operating costs and debt burden into the future for strategies as opposed to just counting the dividend take and the capital costs. We need to also be able to count the true impact on the state of a strategy.

One of the issues we have is the water industry loves this least-cost analysis or levelised cost analysis. What it actually does is discount away all of the operating costs that the state would have to pay in the future to zero, which is not real because in reality the state has to pay year in, year out to run these scenarios. I am worried about your desal plant because they have used a levelised cost analysis, but the reality is that you will have to pay this much and more every year to operate this infrastructure. When they use the water industry's pet levelised cost analysis, it discounts these costs to nothing, so it gives the false impression that the burden to run this accumulating infrastructure from the state is less as time goes on; it is not. As I showed you in my presentation, it is greater as time goes on. Have I answered your question well enough?

Mr WALSH — Well — —

The DEPUTY CHAIR — Not as you would like it, but we will keep going.

Ms DUNCAN — Dr Coombes, thank you for your presentation. I need to say something in defence of all the scientists, the people who present as experts to this committee who you are suggesting are telling us porkies because they are controlled by vested interests. I need to just ask you, then, in their defence what Bonacci Water does.

Dr COOMBES — Before I say that I need to correct what you have said — —

Ms DUNCAN — Clarify it.

Dr COOMBES — Obviously not all scientists are telling porkies. However, there is a very strong influence on cash-strapped universities and on CSIRO and consultants and other agencies to protect their revenue streams, and it is far stronger than most people would realise. I have run two research groups, and I can tell you it is very strong on the administrations of universities. Most good scientists are very independent and rebellious people; certainly I am. However, we have very serious problems in the industry that are obvious and talked about everywhere — genuine conflicts of interest.

The Armstrong Creek process is a great example of this. The three consultants who wrote reports for Barwon Water say — and you can find it in the body of the reports — 'We did not count this, this and this because Barwon Water told us not to count it'. They are in the bodies of the reports. People just need to read the reports to find them. The difference between the Bonacci Water report and the three consultants' reports for Armstrong Creek is what Barwon Water told its consultants what not to write; that is the prime difference. I am sorry to tell you the ugly truth, but that is it. I think it is terrible, but there are also a great many consultants and a great many scientists out there who are striving for the truth and battling to be heard, and we need to make sure we hear them. They are not all telling porkies.

Bonacci Water was created on the back of my research and for the Bonacci Group, which designs half of Australia's high-rise buildings, and to attract me back to Melbourne. It was done in partnership with Melbourne University, which offered me a professorship, which I have taken. The group designs and builds high-rise buildings. Bonacci Water is doing a lot of policy work. We have rewritten policy for Armstrong Creek. We have done some work for DSE, although we have been told by the CEO of Barwon Water that we will never get work for government again because we wrote the Armstrong Creek report, and we have evidence of that.

Ms DUNCAN — Where does your money come from?

Dr COOMBES — Not from water monopolies.

Ms DUNCAN — Where does it come from?

Dr COOMBES — Consulting fees.

Ms DUNCAN — To?

Dr COOMBES — DSE, city of Geelong; people who ask us to do consulting. But we do not write what people ask us to write. On notice I am quite happy to give you a list of numbers of our clients who have arguments with me about the independence of our results. It is very important that consulting advice in this country gets back to being fearlessly independent, because people need to act on independent and transparent results rather than on stuff that is influenced.

But you are right in what you say. I am a new director of the Bonacci Group and Bonacci Water, and some of our old directors are worried about whether if we write certain reports as we find them our business position might be at risk, so like any other company indirect economic influences apply. If we go into a downturn, I just wonder if my older and more conservative directors in the company will have sway over me and say, 'We don't want you to write any more independent water studies because it upsets water utility A or B'. It is a complex answer. It is a grey answer; it is not black or white. But I just want to repudiate the comment that all the scientists are telling porkies, because that is not correct.

Ms LOBATO — Thanks for your presentation. I find the whole decentralisation argument and the assessment of specific areas in terms of rainfall and water usage very powerful, and I think we should be looking at areas based upon their rainfall and their water use. You talk a lot about the importance of water tanks, so I wonder: would you recommend that water tanks become mandatory, and if you would, would you recommend that they are mandatory in certain areas — the highest rainfall areas et cetera?

Dr COOMBES — Water tanks work quite well all over Melbourne, as the chart shows. They are a pretty effective strategy all over Melbourne. If you look at the chart for stormwater reduction versus the chart for water savings, the two immediate benefits from the water tanks are reducing stormwater run-off and reducing water demands. So in the higher rainfall areas the impact of reducing stormwater run-off is reduced but the rainwater yield is increased. So mains water savings increase, and stormwater run-off reduction is moderate.

In a lower rainfall area the reductions in stormwater run-off are higher and the rainwater yields are moderate. But throughout Melbourne, because of the even distribution of rainfall and because you have never had a year with zero rainfall, if we have a look at this Melton graph here, there are no zeroes there. That means every year you can harvest rainwater. So when you are harvesting rainwater in the city, you are not taking it from the dam; you are leaving the water in the dam for another day. That is the thing that is not understood about rainwater harvesting and potentially stormwater harvesting. Water use in the city means water is not taken from your dam, so that water is available for another day. It is like a banking system.

I would say I think a BASIX-type strategy for Melbourne is what is really needed. So rather than just saying a rainwater tank, you should reduce your water use by 40 per cent or so, which is achievable easily with water-efficient appliances and a small rainwater tank or maybe greywater or whatever. That should become mandatory, in my view. Doing so will avoid all these arguments. You have to stand up to the HIA and various other organisations who, when we did BASIX in New South Wales, complained that the sky would fall, but the reality is they got on with business and they worked out how to do it. Those who did it well increased demand for their product, because people want sustainable houses.

I think the bureaucracy and the regulators are out of step with what the community want here. I think the Parliament would do well to recommend such a strategy, because it is what 98 per cent of the community want. The community want to be seen to be acknowledged for their contribution, and they want to have some reward for their contribution. Currently the rebate system in Victoria and elsewhere in Australia is not well targeted, but it sends the message that the government of the day values the contribution of the community, so that is the value the community sees with that. Of the 240 000 rainwater tanks that are in Melbourne — half of them could be connected better — only 7 per cent of those people have taken a rebate. So it is not a dominant driver.

Mr VINEY — I also found some of your evidence compelling. What I want to raise with you and ask you some questions about is the commentary that came with it. In relation to the 10-year time frame that Mrs Petrovich conveniently gave you, why did you pick 10 years, and what about you do some analysis going back to what we might have done if we had started in 1992, for example?

Ms DUNCAN — Or 1887?

Mr WALSH — Jeffrey would have done it.

The DEPUTY CHAIR — Do you want to answer that or not?

Mrs PETROVICH — In my defence we could say 10 years of drought.

Mr VINEY — It is a nice Dorothy Dix question. It just happens to coincide with our election to government; that is all. It is a very interesting time frame.

Dr COOMBES — I try to keep impartial to the politics.

Mr VINEY — It would be nice if you did.

Dr COOMBES — I am quite happy to go back to 1992. The reason — —

Ms LOBATO — I think that was Donna's question.

Mr VINEY — And she has already got the answer.

Dr COOMBES — What I did do, to be honest with you, is actually choose the period where the most impact of the drought has affected us, but because I am in the process of doing this study, I am quite happy for you guys to ask me how far back you want me to go, because I think we need to make water management apolitical. As soon as we get involved in the politics and the blame game we are just not going to solve the problems.

Mr VINEY — It is highly political. Can I ask you another question. In your evidence you talked — and it is very compelling, I agree — about the concepts of the decentralised system. Can I ask you: in a decentralised system, who pays — the householder or the state?

Dr COOMBES — In the current manifestation, if it is a rainwater tank, the householder pays; if it is water-efficient appliances, the householder pays; if it is a third-pipe recycling system, it depends on how we get through the regulation at the moment, but the developer pays and ultimately the householder pays; and for the desal plant, the householder pays. It does not matter what you build, ultimately the householder pays.

Mr VINEY — Yes, that is true, but the capital cost has to be paid for up-front.

Dr COOMBES — That is right, yes.

Mr VINEY — So in a decentralised system who pays for the initial capital investment?

Dr COOMBES — There is the interesting business opportunity. I am glad you asked that question. Currently the people who want to be sustainable and put in their greywater systems or their rainwater tanks pay the capital cost. The choice is not, 'Gee, it doesn't stack up; I don't want to pay'; it is, 'Will I buy a new washing machine or a new fridge or a plasma TV, or will I buy a rainwater tank or a greywater system?'. That is the community decision that is currently going on, and the community are acting to do sustainable things at a great rate. However, if we went forward into the future and these sorts of things became part of government policy, we should allow more innovative business strategies. One of the options on the table at Armstrong Creek is that the guys who have gone off to the bank for the decentralised treatment plant have also gone off to the bank saying, 'Can we buy all the rainwater tanks?'.

Mr VINEY — Sorry to interrupt. That is very clear in a new housing development and is already happening. You have got one example, and I could give you countless others where it is happening in a comprehensive way. What I am trying to get at is the retro fit, because the benefits that you demonstrate are very compelling, but there is a capital cost for a retro fit, and I am trying to understand whether in your model it is based on — and if you go back, we did these things 10 years ago and all the rest of it — the householder paying or the state paying for that retro fit. That is what I am trying to get to.

Dr COOMBES — Okay, let us step back a little more. The modelling is based on when people renovate their houses or pull them down and rebuild them, so it is not going into houses cold, although a lot of people are doing that. They would pay as part of their retro fit. However, there are some profound opportunities that would

only be made available with a different view from the state. There are two banks that are talking to us that would consider providing the tanks as part of their loan for their retro fit or the greywater system, provided there was a mechanism for them to be paid back out of water savings over the next 20 years. Those sorts of business strategies are available. So you are right; at the moment they pay, the same as BASIX in New South Wales — —

Mr VINEY — I guess the subsequent question is: is it reasonable policy to say the future of Melbourne's water supply is going to be based on individual householders making a capital investment in Melbourne's water supply, because that is what you are suggesting is the solution? I am interested in your view on that, because it seems to me that if you are going to have a policy that says, 'We are not going to build major infrastructure', which is the essence of your argument, 'We are going to base it on individual householder decisions', then there has to be, if you like, a leap of faith by the policy-makers and the government of the day, whoever it is, that householders will make those collective decisions to produce those benefits.

Dr COOMBES — First of all, we are not talking about an either-or situation. Nowhere in my presentation did I talk about either-or. We still need a degree of centralised infrastructure, and we always will. In case there is any misunderstanding of what I have said, I have said that decentralised strategies can make a big difference to the way we provide infrastructure and how sustainable and resilient that infrastructure is. Obviously we are not going out to say, 'Remove all the centralised infrastructure or do not build any more'. What I am saying is, 'Plan for a future that includes sustainable houses and uses the local water that is available to us'. If it is a third-pipe recycling system for an estate, obviously it is something that is part of the land release area and the approvals process. It is built into the state infrastructure and therefore it requires whatever approvals process is in place. I think that is fairly reliable.

If it is a rainwater tank, say in Melbourne, regardless of what has been reported in some reports, people do not take them out into the street and stop using them and do away with them. They have not done that in Sydney with BASIX. If they are in place and are part of a supported and equitable roll-out scheme, they continue to provide the service. People just do not take them out and stop using them; that is simply not the case. Water-efficient washing machines — and this is the other argument we have had over the last two decades — have a great impact on reducing energy and water profiles of housing. We used to hear arguments that people get them because they are encouraged by the developers; we have developers who want to encourage that. We have the development industry wanting to mandate water-efficient washing machines. We have just not got there in this state because there are all sorts of other issues.

One of the arguments is that people take them out because they do not like them. I do not think a lot of people are doing that, but some might take them out. When we plan for these things we have to understand behaviour, which we do in the rest of the planning system in providing social infrastructure — child-care centres and so on. We have to plan reliably for how these things will be taken up across Melbourne. If they are mandated, they will be taken up, so the reliable planning asks: are people going to keep the products in the houses? If it is a water-efficient washing machine, they will if the washing machine is good enough. My wife is here today; she has been to many of these presentations. About eight years ago I convinced her to get a water-efficient washing machine. Would you replace it?

Ms DUNCAN — No.

Dr COOMBES — If the product is good enough, the community will keep using it, and you have to change their behaviour.

Ms DUNCAN — There are not that many front loaders in households. They have been excellent for 15 or 20 years. They have always washed better, and they have always used less water.

Mr VINEY — I have another set of question on another issue.

Dr COOMBES — I think your point is excellent. We cannot just assume that it is all going to happen. We have to have policies for the sensible adoption of these strategies, and we have to be realistic.

Mr VINEY — And they have to sit alongside other infrastructure decisions, don't they?

Dr COOMBES — Absolutely.

Mr VINEY — If we come to this government's policy, that is exactly what we have. We have a set of policies about rainwater tanks and providing incentives for them. We encourage low-water appliances and decisions about infrastructure. That is exactly what we have in Victoria.

The DEPUTY CHAIR — Is that a question?

Mr VINEY — The argument has been put, and I am interested to hear the response.

Dr COOMBES — My response is that we could do better. All these things are not counted in water planning. They are in the league table and they are dismissed or they have unrealistic numbers attached to them, particularly things like rainwater tanks, water-efficient appliances — —

Mr VINEY — It is like your assertion that the government's policy is that after the desalination plant comes online we will not need to have savings any more. Where is that government policy? I have not once seen it.

Mr WALSH — The water minister has said it constantly.

Mr VINEY — That is not true.

Mr WALSH — That is true.

Mr VINEY — There has never been any decision — —

The DEPUTY CHAIR — We will move on to the next question.

Mr VINEY — If you come in here to give evidence, you are entitled to respond.

Dr COOMBES — Because you have said that, I will provide the letters written to us by the water minister and Barwon Water and other agencies that have said exactly that, and I will submit them in evidence. I am not making it up; this is fact.

Mr VINEY — But we have a policy of 145 now.

Mr WALSH — One hundred and forty-five — 155, I think. People are going to die of thirst under you!

The DEPUTY CHAIR — You made some comments around a simple approach for Melbourne and how we get to — in particular let us look at new residential areas and whether we should mandate particular strategies. In the committee's looking at this there are a number of options available — whether they be third pipe or whether they be rainwater tanks, and you have raised a lot of them. Governments are not necessarily very good at mandating particular approaches, and in some areas we have seen that one strategy may be more suitable for a new residential area than another. How do you set that policy framework up so that we get the best solutions or allow everything to be on the table to be considered?

Dr COOMBES — It is a very good question. With Armstrong Creek we did not specify; once we went through the proof we did get the feedback, which I have provided — evidence that we do not need to do any of this. We then recommended, and a report went up to the department of planning, that there should be targets for reducing the impacts on our urban growth areas. We knew that in a low-rainfall, drier area, like Geelong, that we could get to a 70 per cent-plus reduction in water demands, we could get to greater than 60 per cent reduction in sewer discharges, we could get a 40 per cent reduction in greenhouse gas emissions and so on and so on. We recommended those simple, lesser targets went into the planning strategy that was used to assess whether or not you get to play in the urban growth area.

It is now well known that the senior executives at the department of planning insisted those targets be taken out. We thought it was fair, and we were supported by most in the development industry; they went with us to a meeting at Sustainability Victoria to say they were keen on these sorts of targets, because people pay a premium for sustainable housing. People want sustainable housing. We thought, to be fair to the development industry and people, we should not specify a particular answer; we should actually say, 'Here is the doable target, and take a bit off so there is room to move'. We said, 'A 60 per cent reduction in water demand in the urban growth area, 50 per cent reduction in sewer discharges and 25 per cent reduction in energy use — they should be the targets that govern whether or not you get your planning panel approval of your land release area'.

That left it open to the market to go off and negotiate answers and work out how to best achieve that outcome in whatever area they are in. I think that is the most equitable and common-sense approach to urban growth areas. We have a new urban growth boundary, and the people who get to play in that should provide a sustainable answer, and that could be governed by simple planning policies that set targets. Then you take out all the arguments about, 'This works and that doesn't work' or 'You should do this' and 'You should do that'. You actually have the targets in your planning policy. Unfortunately the targets did not survive the planning process.

Mr WALSH — Peter, you constantly talk about the 3000-litre tank in your modelling. What was the logic in coming up with the 3000 number, and do the figures improve with 5000-litre or 7000-litre or whatever?

Dr COOMBES — The results change for different tank sizes. The sizing of tanks is a mistake. The performance of rainwater tanks is dependent on water use first, roof areas second and the size of the tank a very poor third. It is one of the greatest mistakes that is trotted out all through the water industry — that if you go to tank size and make the tank size bigger, it is going to solve all your problems. It is a nonsense. If you do not use any water out of your rainwater tank, it does not save any water, it does not collect any more rain and it does not stop any run-off.

Mr WALSH — I understand, but why 3000 litres?

Dr COOMBES — We used it for demonstration purposes in this presentation because it is a small tank. We used it because it is a small tank, and when I walk around the inner city, East Melbourne, Abbotsford and places like that, every second house has got one of about that size. It is doable for people even in a dense urban area. It is the low case. We did propose at the end of our DSE study to put up a Web calculator — because we have got huge amounts of data for DSE — so that people can work out the right size tank or the right water use or whatever for their area, but it has not got through the politics in the department. It is obviously going to depend on where you are, what you want to spend, how much roof you can connect and so on. The best way to do that is to have a Web-based planning tool.

The DEPUTY CHAIR — Peter, thank you very much for that. You will get a copy of the transcript, which you will be able to check for accuracy but not for matters of fact, and you can return that to us.

Dr COOMBES — I want to make the final comment that my comments are not political. We have to move away from political interpretations of these sorts of decisions to get to common sense.

The DEPUTY CHAIR — Thank you very much for your evidence today.

Committee adjourned.