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ENVIRONMENT AND NATURAL RESOURCES COMMITTEE

Inquiry into Melbourne's future water supply

Melbourne — 27 October 2008

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Dr. S. Maheepala, principal research scientist, land and water division, CSIRO.

The CHAIR — Thank you very much for coming, Shiroma. I know you have been here since 2.00 p.m. We appreciate the fact that you have been here for the whole of the public hearing today.

I remind you that all evidence taken at the hearing is protected by parliamentary privilege under the Constitution Act 1975 and is further subject to the Parliamentary Committees Act 2003. Any comments you make outside the hearing may not be afforded such privilege. You have heard that we are recording your evidence. We thank you for agreeing to come and see us and also for sitting through the rest of the hearing. I ask you to present your evidence, and if there are any questions later, we would appreciate it if you would answer them.

Overheads shown.

Dr MAHEEPALA — Thank you very much. My name is Shiroma Maheepala, and I represent CSIRO. I am from the land and water division. My background is that I am a stream leader at CSIRO. A stream is a research program called integrated water systems in the Water for a Healthy Country flagship program. I am a civil engineer by training, and I have a PhD in water resources engineering. I specialised in integrated water systems and other systems modelling. I have spent 15-plus years at CSIRO, and I am based in Melbourne.

The key message that I would like to get through today is first of all that the submission is based on data drawn from the public domain as well as from CSIRO research with industry partners as well as CSIRO strategic research. We believe there are many options for Melbourne. Melbourne will need to develop a portfolio of options to secure sustainable water services. The optimum portfolio is based on many factors.

It depends on the climate; it depends on the population; it depends on how vulnerable the water system is; and the engineering feasibility of existing technologies as well as emerging technologies and environment implications. What I mean by that is resource use, energy use and greenhouse gas emissions. We cannot avoid those things. We need to consider social acceptance, including the level of service — what is acceptable in terms of severity, frequency and duration of restrictions. Defining the best, or the optimum, portfolio for Melbourne is not a simple task. It is a complicated task requiring a lot of analysis.

Now I will go into a couple of the supply options mentioned in the submission. One of the things we talk about is demand management or further water savings through water efficiency. If you look at water consumption in 2004–05 and also in 2006–07, these two bar graphs compare water consumption in those two years. If you take the total water consumption you will see that in 2004–05 it was 330 litres per capita per day. It reduced to about 305 litres in 2006–07.

If you break down the water consumption into residential sector water, because the total includes commercial, industrial and other things, the residential water consumption in 2006–07 was 185 litres per capita per day. If you take the indoor water consumption out of this residential amount, it was about 150 litres. I want to put that into context. I am trying to compare the water consumption in Melbourne with Brisbane in the second graph.

Note also the European water consumption. As you can see our water consumption in 2006–07 was about 185; but if you compare it with Brisbane's water consumption today, it is 135 litres per capita per day. North European water consumption is 125 litres per capita per day.

You will see there are opportunities to have further efficiency in our water consumption. But you have to consider that Brisbane's water consumption has been achieved under severe water restriction conditions. They are on level 6 water restrictions. Northern European countries have apartments and they have small gardens so the context is a bit different, but what this shows is that we can go beyond current water consumption levels. Our view is that water conservation efforts have already reduced residential water consumption significantly. There are opportunities to go further but there is a limit for this and we believe that going beyond 300 litres per capita per day would be a bit difficult but perhaps you could go up to 250 litres per capita per day with more uptake of water-efficient appliances and also bringing in emerging technologies like smarter irrigation technologies. For urban planning it is reasonable to assume 300 litres per capita per day at least now.

I move on to a second option, which is stormwater harvesting. As we heard today from a couple of speakers, of course stormwater is available in Melbourne and the magnitude of stormwater is about the same as our water supply, but there are many factors and challenges in how to use stormwater. One of the challenges is water quality because it is a highly contaminated and polluted stream. The other major challenge is storage: how do we store this water? Water-sensitive urban design is one way of addressing water quality issues.

I put on the table today that managed aquifer recharge has the potential to address storage issues. It is something that was not discussed today in earlier presentations. In CSIRO we are quite advanced in managed aquifer recharge technology. What you do in this technology is basically you collect stormwater and pass the stormwater via a plant — it is like water sensitive urban design feature — and where you provide some biological treatment, then this water is artificially injected to the aquifer, and then you recover it at a later stage.

This graph, the red and the blue chart, shows that around the circle are the injection wells, and in the middle are the recovery wells. The red shows fresh water or you inject stormwater through those white holes and then you recover water from the middle, so that what you are recovering is freshwater.

In Adelaide basically they went from injecting water, recovering water, to bottle that water, and recently I understand that the Premier of South Australia drank that water. There are quite a number of aquifer storage recovery projects around Australia. I apologise for the small map but what it shows is that in some cases we are investigating aquifers storage potential, in some cases we are doing trials, in some cases we are more advanced.

In Melbourne a couple of years ago, a project was done, funded by Smartwater in Victoria, where we looked at aquifer storage potential around Melbourne. This graph shows that these dark blue areas are the high potential areas for storing stormwater or whatever water the aquifer is suitable for storing of water. This is at the very early stages. We have only identified potential areas for storage. Trials are needed to assess the feasibility of this technique but it is a potential technique.

In terms of recycled water, we currently use recycled water from two treatment plants in Melbourne. The total amount of effluent recycled is about 22 per cent of the production, but it is mainly for on-site use, for irrigation purposes, as well as for irrigation agriculture and sporting grounds. The untapped amount of this resource is about 200 gigalitres per year.

What are the possible ways of using this resource? There are three ways for using this resource. On is to recycle water to households via dual reticulation. It is okay for new developments but it is a very big challenge for brownfield or existing areas. The challenge is how to provide dual reticulation for brownfield sites because it is highly dangerous and there were lots of challenges. Therefore potable water saving from that option is gradual as Melbourne grows.

The second option is the use of recycled water for large scale industrial uses. Of course we need to find large scale industrial users and then think about how to provide recycled water for industrial use. The other option which John touched on is indirect potable recycling. Indirect potable recycling you can call centralised recycling which is when you treat water to potable standards and then return it to existing storages. That is what indirect potable recycling is.

In CSIRO we are doing some research in this area. We are looking at indirect potable reuse in south-east Queensland. They have a proposal to use treated water from their treatment plant back into Wivenhoe Dam. They have identified seven barriers for this approach. These barriers are really lack of understanding of this option.

The first barrier is the characteristics of the source stream, or the influent going into treatment plants. There are hospital wastes and industrial wastes going into the treatment plant and how we tackle that is a barrier.

The second barrier is effluent; the characteristics of the effluent from the treatment plant; and understanding characteristics and risks associated with those things. Barriers 3, 4, 5 are challenges associated with tertiary treatment. It is understanding what is involved in micro filtration, reverse osmosis and what the characteristics of the water stream coming out from these treatment technologies.

Finally, we need to understand when this stream is put into storages how it is going to impact with the natural environment. When finally it is supplied to users, what are the risks associated with that. There are lots of unknowns in this circle so understanding those unknowns is a major thing but it is certainly an option that can be considered.

I move on to the desalination option. There are two ways of doing desalination. One is local desalination, and the other one is centralised desalination. For local desalination the big challenge is how to dispose of the brine. If we are taking it into deep ocean, then there is no problem, but to discharge it to Port Phillip Bay is an environmentally sensitive area and therefore it is a challenge. We do not see a major role for locally-based desalination plants, but the story could be different for centralised desalination.

In centralised desalination energy is considered as the major issue, but you need to put this energy use in total context. I did a bit of calculation to understand energy use and try to compare it with other things so that you can put this into a context.

Energy use by Melbourne's proposed desalination plant is 5.3 kilowatt hours per kilolitre of water desalinated. If we assume 40 per cent of Melbourne's supply comes from desalination, and the energy used for desalination per household is about 4.6 megajoules per day, this is about the same amount of energy used by an average fridge in an average household. So we just need to put it in context. I am not saying that desal is good but we need to understand these figures.

If you then compare it with the energy use of rainwater tanks, which is 1 kilowatt hour per kilolitre based on a 5 kilolitre rainwater tank, desal uses about five times the energy of rainwater tanks. I am not saying rainwater tanks are good or bad but I am saying that you need to understand the energy consumption of these options as well as greenhouse gas emissions.

At the beginning I said there are many options. In CSIRO the message that I am trying to get through is that we need to analyse them in detail to understand the best option for Melbourne. When we are analysing for a best option we need to take a systems approach. We cannot take a narrow approach for analysing options. Sometimes we need to look beyond the water system and we need to look beyond the broad urban system. In CSIRO we are developing some tools to help understand the implications on a broader scale as well as within the system scale.

We have a model called the stocks and flows model and it is trying to understand the interactions between population growth, urban development and resource use. In this graph we are trying to show virtual water or embedded water use in Melbourne. The purple part of the graph is showing the direct water use, and the yellow part of the graph is showing water use to feed and clothe Melburnians.

The red part of the graph is showing how much water is used in the products exported from Melbourne. So what it is showing is that the direct water consumption is about one-ninth of the total water flow across Melbourne. My message is that if we want to save water, we need to look beyond water systems, and we need to think about urban–rural trading and other broader aspects and to come up with strategies and policies to address them.

Another tool we have been developing is the HydroPlanner. One of the things we are saying is that to do this portfolio analysis you need to look at the total water cycle. You need to look at the total water cycle at city-scale but there are no models available to do water quality and water quantity analysis together for different water management options. For example, if you are bringing in desalination, stormwater harvesting, recycling, indirect potable recycling what is the implication of all these things for your system in terms of your water flows and in terms of your constituent flows? You need to understand the basics to address environmental implications, energy implications, infrastructure requirements and lots of other things. They are the building blocks.

This slide is about a study we recently did for Canberra. They were interested in looking at stormwater harvesting across Canberra and to understand the implications of that on their supply side. What would happen to their storage levels, what would happen to their restrictions and what would happen to their receiving water quality but to address these questions at the same time. What this graph is showing is the flow in the Murrumbidgee River due to stormwater harvesting. Before we did this analysis there was a concern that if we do stormwater harvesting, it will reduce flows to the Murrumbidgee River.

But what happens, as this graph shows, is that there is a positive flow: more flow increases to the Murrumbidgee due to stormwater harvesting. What is happening is that, because we are taking less water from our storages, that means more water can be released to the environment, and it really improves water flows in the Murrumbidgee River at the very end — that is, below Canberra.

To understand that, we needed to model the whole of Canberra from supply. As you can see on this slide, these are the supply catchments. This is where Canberra is, and these are all other catchments. So basically the model is trying to address the whole system.

I am at the end of my presentation. The message I want to get through today is that there are a number of supply options available for Melbourne, and we need to understand the environmental, social, functional and economic implications of these options. We know some things and we do not know some other things, but we need to understand these to make some decisions.

Melbourne will need to develop portfolio options and then portfolio assessment must consider interactions between stormwater, wastewater, water supply, receiving water and urban/rural systems. We need to consider emerging technologies. Of course we need to consider risks and uncertainty, and it is coming from climate as well. Climate is a very big uncertainty factor. It is not a simple task, but it will need to be done, and tools are emerging to help us do this analysis.

The CHAIR — Thanks for that. Just with technologies, because your submission covers quite a bit of that, I would like to delve a bit more into that. I think you mentioned emerging technologies in relation to aquifers. In trying to think ahead, noting that things are changing so rapidly and what might be viable, where do you think the biggest advantage is and in what areas of emerging technologies that is? Is it in desalination, aquifers, some of the harvesting technologies, or something else out there?

Dr MAHEEPALA — Our view, and also my view, is that technologies are emerging in the membrane area — this is advanced treatment. What it means is that if we were to consider stormwater as a potential supply source, or for indirect potable recycling, those options require at once water treatment. These treatment technologies, membrane technologies, are emerging. In CSIRO we are doing membrane technology development.

For stormwater harvesting with managed aquifer recharge we are mainly using biological treatment with wetlands and ponds and then trying to use aquifer characteristics to treat water naturally. But it depends on the stream of water that you want to inject into the ground: if it is highly polluted, contaminated with industrial stormwater, then it has to go through some sort of a treatment technology. In the past a lot of energy was required for advanced treatment, but new technology is now emerging and the energy used for these new technologies is small compared with previous technologies. It is emerging, it is available, and in countries like Singapore they use advanced treatment technologies for their stormwater fresh reservoir in Marina Barrage and also for indirect potable recycling.

Mrs PETROVICH — Thank you for your presentation today. I was quite interested in your conversation about recycled water. One of the options for the eastern treatment plant upgrade is to use recycled water for the Latrobe Valley. Can you explain to me whether there are any difficulties with using recycled water in power stations?

Dr MAHEEPALA — I cannot comment on that, I need to get back to you.

Mrs PETROVICH — If you would take the question on notice, I would appreciate it. Thank you.

Dr MAHEEPALA — Okay.

Ms DUNCAN — Thank you for your presentation. You talked a little bit about savings that could be gained from demand management. We heard earlier from the previous presenter that there was a view that there was still a lot to be gained from demand management, and you talked about a figure of some 200 litres per day per person. You would be aware that Queensland is looking at its target of 140 — in fact it has gone beyond that. Why would you not think Melbourne could do at least as much; and why do you think we could not maintain that level of water consumption in the long term?

Dr MAHEEPALA — One of the things is that Melbourne is the garden state by definition, and at the moment our restrictions are not as harsh as Brisbane's. Brisbane has achieved those things under level 6 restrictions. People are prepared to do those things under severe conditions. But is Melbourne prepared to do that? I do not know. Our belief is that it is not a sustainable solution in the long run. We could be wrong, but given that there are other options available, one question is: why not think about other options, rather than pressuring the residential sector?

We are basically putting the pressure on the residential sector to reduce water consumption. Do we want to continuously do that, or do we want to look beyond the residential sector? The immediate sector is the industrial sector, and the next immediate consideration is looking beyond urban water — looking at other possibilities. For example, as is shown in my virtual or embedded water graph, water is used in large quantities for other things. Can we somehow free up some water and bring it to the residential sector? We do not believe pressuring the residential sector is the way to go.

Mr INGRAM — Thank you for a very good submission.

The CHAIR — I just have one last question on technologies or ideas. I refer to a comment on page 15 of your submission. Other submissions we have received have referred to the fact that our sewage treatment system is very reliant on a large use of water for the cleaning up of the system.

In your submission you talk about the potential to separate the black water from other parts of sewage waste. Can you talk a little bit more about that — the viability and the challenges of that and whether there are any projects like this anywhere in the world where they treat their sewage in a dual way?

Dr MAHEEPALA — I will touch on your question, but I will take the question on notice because I am not the expert in that area. Tony Priestley, who was the key author of the submission, is the expert in that area. Very briefly, we believe separating black water, grey water and urine is the way to go because then you can recover nitrogen phosphorous from black water and it can be used for fertiliser. There are opportunities like that. So you use less water for flushing toilets; that is water saving. That is for water supply. But there are other advantages and benefits of doing that. One of the major benefits is recovering phosphorous and nitrogen for fertiliser use. But I can get back to you.

The CHAIR — If you could take the rest of it on notice, I would appreciate looking at that.

We will conclude there. Dr Maheepala, thank you very much for your submission and your patience with us as well. I remind you that a copy of the transcript will be forwarded to you from this hearing within the next couple of weeks with instructions. I will close the hearing, and I thank everyone for attending today and helping us out.

Committee adjourned.