

# Water Wise: Learning from the Israeli Experience

## 2003 Australia-Israel Hawke Lecture Adelaide, 30 October 2003

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I want to express my appreciation to the Hawke Center for inviting me to speak here in Adelaide and thank all of you for coming to hear me share some of Israel's experience in this water wisdom series. At first glance, it isn't completely clear what Israel's adventures in the area of water policy and management might offer the fine people of South Australia. So let me start right off by considering the ways our Israeli experience might be relevant for you? Well to begin with Israel and Australia share a common political heritage. Of course we survived an extended British colonial presence, we are a vigorous democracy where everybody votes, and George Bush has managed to learn the names of our Prime Ministers – and can even pronounce them. But actually, I was thinking of a more ecological context.

Last month, one of Israel's most popular politicians, (and certainly our most resilient) former Prime Minister and Nobel Prize winner Shimon Peres celebrated his 80<sup>th</sup> birthday in a gala event attended by more world leaders than you could shake a stick at including a certain past Australian head of state with whom you are familiar. Now Mr. Peres wasn't born as a "Peres" at all. He came over to Israel as a teenager from Poland with the inauspicious name of "Parski." But during a trip to the Negev desert as a young man, he became so inspired by the majestic flight of a raptor soaring over head, that he decided to change his last name to the Hebrew "Peres" – which is Hebrew for *Lammergeier* that glorious raptor that is basically a cross between a vulture and a hawk. So let me tell you, many Israelis miss the days when we had a "Hawk" from the Labor Party running our country – and I imagine there must be a few folks in the audience who share that sentiment regarding Australia.

But this talk is supposed to be about hydrology – not ornithology. And establishing a context for comparison between Australia and Israel is actually not a trivial matter. My country is tiny in its dimensions, taking up only about a fiftieth of the space on the globe as South Australia – not to mention the entire country of Australia that is 366 times bigger than Israel. The rains that we get each year provide our citizens with less than 300 cubic meters a year of water.

That's a good deal less than the 1000-giga liters that you allocate here in South Australia. We receive most of our drinking water from two, tiny, overdrawn aquifers while one third of South Australia lies on top of the great artesian basin, the largest groundwater resource in the world.

Furthermore, the waters we rely on are the subject of considerable international disagreement. Our neighbors think that they are entitled to a substantial chunk of this supply and we have acknowledged that there may be some legitimacy to part of this claim. But when it comes down to the particulars, depending on how other diplomatic winds blowing, it is not always a friendly disagreement. Last I checked, South Australia had no hostile neighbors beyond some of the more overzealous Australian rules fans from Victoria. And of course, when water goes down our drains, it roles clock-wise—quite the opposite of Australia.

Yet, all the same I would argue that there are plenty of reasons why the water wisdom that has accrued in Israel is relevant to South Australia in specific and to your continent in general. For starters, because of our diminutive size, it might be well to consider Israel as a "pilot" experiment for your country. The physical limitations that we face, and the technological leaps of faith we have made during the past fifty years can be framed as "coming attractions" to water managers down under.

For example, it was in the early 1950s that Israel reached the conclusion that recycling wastewater was not only inevitable, but good public policy. I know this is an issue that Australia is spending a good deal of time thinking

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about. Drip irrigation systems have been at the heart of our conservation efforts for about thirty years. I think that today South Australia now realizes that its agricultural sector needs to embrace this kind of technology as well – and the sooner the better.

I understand that South Australia has been investigating the potential of 'banking' reclaimed water in aquifers that can later be recovered for use in irrigation. Well Israel has a couple of decades of experience with aquifer storage and recovery and it is largely a happy one. Today Israel's long-term water policy is actually centered around the potential of desalination to expand supply. Perhaps, you too will one day need to seek similar solutions.

So consider Israel as a time machine to a South Australia of the future. One perhaps with a population that is many times its present size. In this land, water resources really are pushed beyond their maximum limits. We in Israel have made plenty of mistakes during the 55 years that we have had the privilege of managing the waters of the Holy Land, and perhaps if we share them openly, similar blunders might be avoided in Australia.

But before I hang out any dirty laundry, as well as share with you some of the encouraging innovations that we have adopted in Israel, it would be well to sketch out a little history and offer some basic information about Israel's hydrological reality. Luckily, we are a small country, so this won't take much time. But it will be important for understanding the context of specific problems and policies.

Like any of the nomadic tribes of the Middle East, water was always a critical part of our culture – beginning in the early "Israelite days." Although I haven't done the counting myself, I understand that the word "water" appears no less than 580 times in the Old Testament. We all know how Abraham, Isaac and Jacob fought over water resources and courted their wives at the wells. Our Biblical forefathers generally let a reliable water supply for their flocks provide them with their geographical and spiritual center of gravity. Not unlike the Eskimos' reputedly rich vocabulary for snow -- in Hebrew we have numerous words for rain that denote: dews, heavy storms, floods – and even special nouns for the first and last rainfall of each year.

Thus, when the Jewish people returned to their land at the start of the twentieth century, part of the Zionist impulse was to recapture that uniquely indigenous Hebrew relationship with the water of Israel. Water was the key to land reclamation, which in turn was deemed the strategic key to attaining political independence. While the Zionist pioneers bickered over every conceivable subject, in water there was an astonishing record of consensus and cooperation.

A single water utility, Mekorot was formed that coordinated Jewish water exploration and delivery efforts. Not surprisingly, the first head of Mekorot, Levi Eshkol became Israel's third Prime Minister. The second head of Mekorot – Pinhas Sappir – was even more powerful as he served as Israel's Minister of Finance for almost two decades. So water resources in our country enjoyed patrons at the highest levels. As Eshkol once said: "water runs in our veins."

So when a newborn state of Israel woke with astonishment in 1949 to find that it had actually won its war of independence people were thrilled. But they had no earthly idea of how much water had actually been won. The British Mandate's hydrological service was clueless, as they had never done any comprehensive studies. The state of the art in groundwater hydrology in those days was nowhere near the present imprecision. And naturally, Israel's founders were overly optimistic.

The first water policy makers reckoned they had at least 3,000 million cubic meters to draw from each year. I think you call cubic meters -- kiloliters in these parts – but what ever the unit – that's a lot of water. In fact, it was far too much water; the renewable resources were about half that. So the first lesson from Israel's experience is to try and get the inventory right or you'll find yourself in deficit very quickly.

The first Israeli water engineers understood quite well, however, that the water system would be based on three major sources of water. For this part of the lecture, I hope you won't mind if I rely on some power point slides to make the picture a little clearer. So here we go on a very brief aquatic tour:

Based on a thirty-year average, Israel relies on an annual recharge of 1.55 billion cubic meters. That would be

“giga liters” for you Australians. Most of this reaches three major water sources. The largest of these – about 800 million cubic meters -- can be found in the Jordan River Watershed, which eventually flows into Israel’s only fresh water lake -- the Kinneret or the Sea of Galilee, as you probably know it. When you subtract the 300 million cubic meters that we lose to evaporation, we’re left with a sustainable supply each of year from the Jordan River basin of 500 million. As you can see, the Kinneret is a lovely lake, the lowest fresh water lake in the world. And while for a brief period it eutrophication was racing ahead and oxygen the lake was dropping, conscientious watershed management arrived just in time to return the lake to a steady state.

In the 1960s, we completed our legendary National Water Carrier – well at least the carrier is famous in parts of Tel Aviv and Tiberius. It transformed the Kinneret Lake into our “national reservoir.” Basically, Israel’s National Water Carrier was the hydrological equivalent of socialism. The government decided to take water from the rich in the Galilee and deliver it to the parched lands of the south. It was an enormous undertaking. It took eight years to blast through the necessary tunnels and lay the colossal 108-inch pipes.

During that period, the project consumed 80% of Israel’s entire budget for infrastructure. Little wonder our train system was never developed. But when it was done, the Carrier provided 2/3s of the country’s water, eighty percent designated for agricultural irrigation. Today, the amount the National Carrier’s waters going to domestic use has risen considerably. By the end of the decade, agriculture’s allocation may be only 20%. But the Carrier continues to change the hydrological balance of power between the north and the south of our country.

One of the interesting things that the National Water Carrier did was create a national water grid. It linked up the plentiful yields of the Jordan River basin with our ground water sources in the center of the country. This allows the government today to play “bartender” and mix different water sources with their different qualities. For instance, Kinneret water tends to be saline. No problem; it can be diluted with waters from a cleaner aquifer and get below any drinking water thresholds. Another result of linking the country’s water supply to the Sea of Galilee is that it suddenly made Lake Kinneret’s situation a topic of national interest. Newspapers print the water levels every day on the front page and during the winter, before we check the sports scores, we have to see whether the lake picked up any more volume during the night.

So one lesson from Israel is that by creating a single, integrated water delivery system -- you can get the public involved in national water challenges. This can be very important for galvanizing political support for water quality objectives.

Now I suppose I should move on to Israel’s two other major sources of water: the aquifers that I mentioned previously. The coastal aquifer runs along the Mediterranean shoreline inland several kilometers: all the way from Haifa, our lovely port city, down through the Gaza Strip. The coastal aquifer receives about 300 million cubic meters of rainfall in the sandy lands above it, although frequently it will be recharged with water from the Kinneret as part of the national carrier scheme. I think it would be fair to say that this aquifer is a very sick one. It has been plagued for some time by the pathology of over pumping.

Israel’s earliest water managers inherited a very clean Coastal Aquifer. Salinity levels were wonderfully low – not much more than 50 mg. per liter at the natural background levels. The engineers were well aware of the consequences of drawing down the ground water levels too far in an area contiguous to the Mediterranean Sea. Still, the need to increase water supply to provide food and employment for the deluge of post-war immigrants who sought refuge in the new Jewish state forced them to sink dozens of wells there. The resulting “vacuum” of course was quickly filled by salt water and indeed by the 1950s the city of Tel Aviv’s wells were too saline for drinking.

The trend that started then has not changed appreciably. On the average the concentrations of chlorine – a reflection of the salt in our wells -- has increased 2.4 mg/liter each year and so we now have average rates of 200 mg/liter. That is the average, which means that at the extremes, the concentrations are much higher. To present the patient’s symptoms another way -- in the year 2000 -- 16% of the water pumped from the Coastal aquifer did not meet Israeli drinking water standards, which by no means are the most stringent you’ll find in the world.

So what have we learned from the contamination of the Coastal aquifer? Well we’ve learned that it is a lot

easier to salinize an aquifer than to take the salt out. It's basically a case of inter-generational justice. To provide a quick solution to short-term problems, Israelis for many years will be paying a heavy hydrological price. It is hard to criticize the original water engineers in Israel. They had a lot on their tray. But truthfully the lesson is that every generation has a moral obligation to balance their water budgets.

The Mountain Aquifer – is our third major source of water. Indeed, this is a generic name referring to three separate sub-aquifers – the largest of which flows parallel to the east of the coastal aquifer. It is called the Yarkon-Taninim aquifer. The name comes from springs that feed two rivers: the springs that feed the Yarkon river are 15 kilometers from the coast and they used to offer abundant quantities of water to the Yarkon which was largest river in the center of the country. (The river still flows through the heart of the Tel Aviv metropolitan region. But after the diversions of the springs to the desert, the River is mostly made up of treated sewage these days and has lost its roar.) But it's called the Yarkon-Taninim aquifer and the Taninim part –means “crocodiles” in Hebrew. They actually used to frequent this coastal stream. Now the Palestinian species was never as ferocious as the critters that Paul Hogan likes to harass. But they were hunted into extinction all the same, probably sometime before the first world war.

Relative to the Coastal Aquifer, the Yarkon Taninim aquifer is pristine. Here much of the water tapped is deeper and far older than that in the coastal aquifer. Most of it really is ancient water. Every year about 300 million cubic meters is added to the total supply, so that's considered the sustainable yield for the aquifer. Of course, our appetite tends to be a wee bit more than nature provides. So here too, over pumping has started a process of salination as well, although it is not nearly as extreme as in the coastal aquifer

The trouble is the Mountain aquifer is a transboundary resource. It spans the border between Israel and the West Bank. And this makes it a tricky subject.

I remember an interesting meeting in 1993 when some Israeli and Palestinian water wonks got flown to Zurich by the Ford Foundation so for the first time, we could sit and talk over the issue of water in an atmosphere of civility. Naturally, the Palestinians started claiming rights to the water in the Mountain Aquifers. As they see it, the rainfall that recharges the aquifer falls in the West Bank. From there it flows beneath the ground to the east to where it is pumped out in wells inside Israel. Seeing as the Palestinians are the upstream “riparians,” they reckon they should be entitled to keep all the water that falls on their land. Of course most of the Israelis argue for a different legal paradigm – that of historical rights. After all, Israel was the first nation to develop this water resource and the rainfall had flowed quite naturally into our wellheads and been utilized for many years.

Professor Haim Gvirtzman, who is a brilliant but somewhat politicized professor of hydrology from Hebrew University stood up to field the attack and gave an interesting spin on “historical rights” to water. He told the Palestinians that his carbon testing suggested that most of the water drawn out and used today is actually about three thousand years old. Like I said that aquifer really is deep and old. Gvirtzman argued that if we open our Bibles and count a bit, we'd find that King David was running the show 1000 years ago in the West Bank. Accordingly, Palestinian arguments shouldn't hold.

So what kind of wisdom does this sort of zero-sum debate hold? A debate that has been conducted so frequently, that both sides have wearied of it. Well not much. If you ask me, I think we've learned that there's no real intellectual honesty on the issue of international water law. It's all about where your country is sitting. Thus, Egypt loves historical rights theories. (They had better or they'll lose their strangle hold on the Nile.) So does Turkey that's happily sitting up stream. But Iraq, an unfortunate downstream riparian clearly doesn't love the idea. The point is that equitable allocation has to be the basis for resolving these disputes – not deciding whether historic rights or riparian rights is the definitive legal principle. Equitable allocation means compromise, which presumably will leave no one happy, but hopefully nobody thirsty as well. That's what you'll find in our peace treaty with Jordan and hopefully that's how our peace treaty with the Palestinians will look.

Now Israel's general environmental history is fascinating, and I have written a 546-page book about it. But the truth is – you can cut to the chase with these basic figures: In 1948 there were less than a million people in Israel. Within a decade there were two million. By 1970 there were three million. 1980 – 4 million. And you can carry it on until we reach our 6.7 million citizens of today.

Given this astonishing, geometric growth, and our ideological commitment to agriculture, that means that we've had to steadily increase water supply. This isn't to say, that we haven't worked hard on cutting demand. We can always do more and I'll talk a bit about this later. But, even as the most water efficient Western nation, a fast-growing Israel in an arid region needed to expand its water resources. And until recently, none of our neighbors were selling any.

So in addition to the three natural reservoirs of water, for almost fifty years Israel has expanded its supply through an aggressive program that tapped what we call generically: marginal waters – This includes saline wells, floodwaters and effluents. Together they provide 430 million cubic meters – more I might add than either of the major aquifers.

A word about each is in order as our experience with them is part of the accumulated wisdom I'm supposed to be sharing. And once again, I'll supplement the narrative with some slides. The deserts of Israel in particular are home to saline "fossil aquifers." To a certain extent, water extraction here is probably closer to "mining" but in some areas, such as the Arava rift valley that sits as a catchment for a large mountainous area, recharge is probably sufficient to replace present withdrawals. Or at least so the water ever-optimistic water managers tell us.

Typically these waters are high, not only in salt but in other minerals, such as fluoride. The old-time kibbutz members down south in the Arava are starting exhibit symptoms of hyperfloridemia, the blackening of teeth and more seriously brittleness of bones that comes from years of imbibing high fluoride waters.

Nonetheless, these waters are still being used for the surprisingly successful desert agriculture – most impressively dates. After going through reverse osmosis, they are used for drinking as well. I might add that for thirty years now, on my kibbutz, like the whole of the Arava regions, houses have three taps in every kitchen and bathroom: Hot water; cold water; and drinking water. It is, I'm sad to say, a vision of the future for the rest of Israel, and perhaps, one day in South Australia as well. So the lesson is that brackish water is still water and new communities in South Australia who live above brackish aquifers might be "wise" to install separate delivery systems.

Floodwaters have been the target of work by the Jewish National Fund. As I'm a member of the international board of the Fund that sits in Jerusalem, I suppose, the great Israeli tradition of shameless self-promotion requires that I say a word or two about our efforts in this regard. David Ben Gurion, our founding father and first Prime Minister wrote dolefully about all that good water that was getting wasted as it flowed into the sea without benefiting the thirsty soil. Even today, about 50% of Israel's rainfall ends up flowing to the Mediterranean.

Capturing rainwater run-off, especially in the semi-arid desert is not a new idea. The ancient Nabiteans were harvesting runoff all over our Negev desert quite effectively just about the time when Jesus was walking on water in the north. But only in the last few years has our country made a major effort to "harvest" runoff.

Ever short of funds, the government left the work to the Jewish National Fund, which is a sustainable development corporation owned by the Jewish people worldwide. Although rainwater harvesting is a simple idea, it is not an inexpensive one. So far the JNF has built 164 reservoirs, about half of these capture floodwater runoff. The new reservoirs have expanded Israel's freshwater supply by a little more than 6% and helps ground water recharge.

Here, I would be remiss if I didn't mention the impressive contribution of Australia's Jewish community to the effort. A one million cubic meter reservoir was built in the valley of Beit Shean in the early 1990s to the tune of 2 million Australian dollars. And then a few years later, 3 million dollars was raised to build a reservoir in the Besor basin, down in the Negev desert. The reservoir can hold 1.5 million cubic meters of rainfall that would otherwise, evaporate or be a drop in the Mediterranean Sea. It's a one-time investment and barring earthquakes, a source of water that will last forever. So here again, South Australia can find a lot of wisdom among Israeli engineers should ever need to learn how they eventually got to building reservoirs in optimal locations.

Finally, and the most important of the three marginal water sources of all – there is effluent recycling. Israel may not have been the first country on the planet to understand the potential of sewage as a water source. But it

probably was the first to tackle the health and agricultural aspects with any scientific rigor.

In a rare coalition, officials at the Ministry of Health and Agriculture worked together to create a safe program for the country to irrigate with sewage. When Israel was established, there were relatively few sewage systems in Israeli towns and practically none in the kibbutzim and in the Arab sector. For the Socialist, Spartan kibbutz founders, flush toilets were considered a bourgeois luxury. And the Arab communities simply lacked the resources for infrastructure. Cesspits were the default disposal system of choice.

But as population density increased, overflows created huge problems. Sewage systems go built, went on line but without treatment at the end of the pipe, they created a mess: beach closings, well contamination and mosquito infestation. Indeed 90 percent of the mosquitoes in Israel were traced to untreated sewage outflow. And agriculture was always thirsty for more water.

So in 1953 the Ministry of Health promulgated the first irrigation standards in the world. The standards disqualified raw sewage for irrigation completely. Originally, these were non-binding guidances, but soon enough took the form of proper regulations. The Ministry limited effluent recycling to cotton, fodder and produce that isn't consumed raw. Like a lot of Israel's laws, compliance with these guidelines was far from perfect and gastrointestinal illness was a big part of our public health profile for many years. During the 1970s, 6 percent of hospitalizations in Israel were related to digestive track problems and a great deal of these had origins in sewage recycling. But we did get better.

By 1956, TAHAL our water planning authority made a master plan for wastewater treatment. It was one of the rare instances where water planners proved pessimistic. No more than 150 million cubic meters of sewage was planned for recycling. Today we reckon that as the new generation of sewage treatment plants goes on line, we'll have three times that amount. For the engineers among you, pretty much all of our recycled wastewater undergoes secondary treatment with activated sludge. This is expensive and consequently has left smaller communities, especially Arab villages behind. There are some nascent efforts to introduce less resource intensive biological treatment for these situations, but nothing that I would yet categorize as "water wise" in particular.

The lesson that needs to be learned, from our extensive experience with waste water reuse is that secondary treatment, really isn't enough. In 1990 we passed regulations under our Public Health ordinances which are known as the "20-30" regs. This refers to the 20 BOD and 30 suspended solid ceilings that were set as discharge standards for municipal polluters. In practice, the standard mandated activated sludge. But, it soon become clear that these standards were way too primitive.

You see, Israel's sewage treatment standards were based on European regulation. The Europeans were driven by the ambient conditions in their rivers. Well anyone who has been to Israel knows that "rivers" is something of a misnomer in the Holyland. Streams are a more appropriate term. And their low flow does not have nearly the assimilative capacity or dilution factor of a Rhine or a Danube. So basically, organic materials overwhelmed our streams when copious quantities of effluents started to be discharged into them, and there was insufficient oxygen for everything but the toughest of fish species. Of greater concern are the industrial effluents that reach the streams.

So what's the wisdom? Well I would suggest that before a country makes a serious financial commitment to sewage recycling, it needs to have a very tough set of industrial pretreatment standards in place and they need to be meticulously enforced. Otherwise, factories will blissfully pass on their nasty residues to a municipal sewage system that has no technical way of breaking these chemicals down. So one of two things happen. If farmers use these effluents for irrigation, they start to systematically contaminate their own ground water. Or if the water reaches the streams, you get periodic fish kills.

Many of you may heard about the great tragedy that occurred on July 14, 1997 when a delegation of Australian athletes were crossing over the Yarkon River into a stadium outside of Tel Aviv for the opening ceremonies of the Maccabiah games. The Maccabiah is something of an ersatz Jewish Olympics that takes place every four years. And these Jewish Australians had brought a strong delegation to the competition. The bridge leading over the river and into the stadium was shoddily constructed so that when the Australian athletes crossed it, they

went toppling into the waters below. Four of them died – three from exposures to toxic substances. Many more became sick from the water. It remains a source of shame and embarrassment for Israelis. And ultimately it reflects a catastrophic lack of water wisdom. Wastewater reuse, my friends is a serious matter.

The good news is that we have started to set a more stringent series of standards for wastewater treatment, which requires different levels of treatment for irrigation and for stream discharges. The question is: are they tough enough? Most of the top scientists that I know think that ultimately, given Israel's ambitious sewage recycling strategy, treatment had really needs to reach drinking water levels of stringency. That's a bit of wisdom that really needs to be emphasized. Especially in arid regions, where rains don't help enough with dilution, drinking water standards should be the objective for sewage treatment plants.

Well now that we've run through the basic sources of Israeli water and what we have learned from them – I suppose I should answer the most common question we hear from outsiders: Is this water enough?

And of course, in the great Jewish tradition of elusiveness I'd have to answer – that depends who you ask.

Swedish hydrologist Malin Falkenmark has set 1,000 cubic meters of water per person a year as a minimum level, below which a country suffers "water scarce" and 1,700 cubic meters annual per capita she calls "water stressed" Other experts set a minimum of 1,100 cubic meters to define scarcity. That is presumably the volume required to grow the necessary food for a nutritious, albeit low-meat diet. Well – if these numbers are legitimate, our planet is in real trouble. About a third of Africa is seriously water scarce and that number should go up to about 1 billion people within twenty years. In the Middle East- 9 of our 14 neighbors are in trouble.

To give you some perspective, let's talk about your per capita statistics. Australian per capita levels were very abundant allocation in 1950 at about 41,733 cubic meters per person each year. But like us in Israel, most of Australia likes immigrants. So water supply per capita is dropping fast. By 1995 you and were down by more than 50% to 19,198 cubic meters/person —but that's still a good ten times above the cutoff line for scarcity.

Compared to the Australian resources and the Scandinavian criteria of Dr. Falkenmark – Israel is in sorry shape – way below the poverty line. We only have about 300 cubic meters per person per year. But the way some of our neighboring countries talk about Israel, you'd think that we're hydrologic millionaires. We're not.

Here's my read on the matter: I have spent most of my adult life living on kibbutz. These communal farms are probably the last refuge for Marxist utopians and although I am neither Marxist nor Utopian, it is nice to live in a society where every one makes the same income regardless of where they work. One of the surprising things you learn about living in perhaps the most "egalitarian community on the planet" is that envy is a universal human characteristic. And it is most prevalent among the poor. Members of kibbutzim spend a shocking amount of time evaluating the size of their neighbor's TV screen as opposed to their own, or the new tiles in their neighbor's bathroom. The point is, that by any objective standard, their possessions are identical. But the strongest envy, is reserved for the smallest differences, between the poorest of people.

Well that's the dynamic in my larger neighborhood of the Middle East. Israel has less than a third of the water we would need to reach the enviable level of being merely "water stressed." Compared to South Australia, Israeli scarcity is acute. But, when Jordanians or Palestinians looks over the border, they see abundance. And they don't think to compare with Turkish or even Syrian resources where there really is plenty of water. So they feel a lot of disgruntlement about Israeli water usage. The truth is, however, that we're all incredibly poor. Jordan already has less than 300 cubic meters a person a year. And my students from Amman Jordan tell me that during the summer months, water only runs a couple of days a week, and woe be the housewife who forgets to do her laundry on that day!

In the heady days, when our government diplomats were talking to Arab diplomats out in Oslo, the voices of extremism were temporarily silenced by the common sense of moderation. Initially, the negotiators didn't move much past those early discussions in Zurich. At least publicly, Palestinian's would claim: "Israel stole our water." We'd say: "No we didn't." "Yes you did" – "No we didn't." You know, the kind of mature dialogue my three-year-old daughter has with her friends when they argue over toys. The point is that we were locked in the paralysis of a zero sum game and getting nowhere fast.

So imagine our surprise when negotiators in Cairo unveiled the so-called “Oslo II” Interim agreement in 1995. Pragmatism and decency seem to have prevailed: Israel recognized that the Palestinians were entitled to more water – and heavens knows they are. The Palestinians accepted that any ultimate solution would require the development of new sources of water. And no less important, a Joint framework for protecting water quality in shared resources was established.

This critical vision is only one of many casualties from the past three years of violence. Eventually, I hope the terrorists will come to their senses, the dust will settle, and we can pick up where we left off. But Israel’s ability to deliver the water will still be linked to expansion of supply.

So where is the new water to come from? Much has been written over the years about Turkey – which is our region’s “hydrological” super power – and its willingness to sell water to its neighbors. It might be through a pipeline, old oil tankers or via giant, plastic “medusa” bags floated down the Mediterranean. These schemes have never panned out for a few reasons. When you start calculating the costs of the entire delivery route, they really weren’t cost effective.

Secondly, Israel, is ultimately not that enthusiastic. As a past Water Commissioner explained: When we finally get around to realizing Isaiah’s vision in the Middle East – and the lion starts to sleep along the lamb – I want to be the lion. It really might not be prudent for Israel to entrust such a critical resource as water to the good will of a Moslem country, not withstanding Turkey’s remarkable and courageous friendship with Israel.

So this brings me to the most serious additional source of water – desalination. Now desalinated seawater doesn’t amount to much of our water resources today. And I don’t have a great deal of water actual experience to share as of yet. But were I to give this talk in five years, desalination is probably all I’d talk about.

For we stand literally on the verge of a new age for Israel’s water resources -- desalination will soon change the way that most of us are thinking about scarcity – and supply and demand.

A new \$200 million plant should go on line by the end of 2005 at Ashekelon on the southern Mediterranean Coast. Built by the French Vivendi conglomerate, it will provide 50 million cubic meters a year. That’s four billion liters of water a month. Another Mekorot run, \$120-million, plant at nearby Ashdod will come on line a year later and add another 45-million-cubic-meter.

And only a few months ago, the Ministry of Finance finalized the contracts for a couple more plants. Compared to past estimates, this new generation of desalination plants is cheap. First of all they shouldn’t cost taxpayers. As BOT projects, private investors, (usually joint Israeli-international consortiums) put up the money and hand over the operation after 25 years. More important, the price they have committed to for producing the water is astonishingly modest. There have been some significant breakthroughs in the materials used for the membranes in the reverse osmosis plants reducing energy demands. The more recent tenders are talking about roughly 2.5 shekels or 55 cents for a thousand liters of water. That’s less than a penny for a liter of water that meets all drinking water standards.

So thank the Lord, technology is not static, and current discussions about increasing supply are not the same as they were even five years ago. So the next wise lesson from Israel that might be worthy of note is this

*Desalination is going to be a critical component in any long-term sustainable water strategy.* I daresay this will eventually be the case for most arid countries, at least those lucky enough to have reasonable access to the sea.

Many environmentalists are suspicious of these capital intensive technological fixes. But I think my green credentials are pretty good and I am full of hope. It will take a few years to get them operational - and Israel being what it is – the question isn’t whether they will be delays, but whether they will be measured in years or decades. But when they finally open their faucets, not only people will benefit, but also, the many creatures of the land. God may not have blessed the Promised Land with any petroleum reserves. But he did give a shockingly rich biodiversity for a country our size. Twenty six hundred plant species, 700 vertebrates including



454 bird species, 128 species of mammals, including numerous African immigrants, like hyenas and gazelles. Yes we share Israel with a virtual arc-full.

But in drought years, the waters to the nature reserves start to dry up as Israel's Water Commissioner is faced with some hard decisions. Conservationists justifiably question who gave the Commissioner authority to shut down nature reserves. After all, the animals were there first. But now, with the new desalinated water coming down the pipeline, the Water Commissioner is starting to change his position. For the first time, he is willing to talk about guaranteeing certain flows for nature. This is very good news indeed.

My problem, as an environmentalist, is the prodigious amount of energy that it still takes to remove the salt from water. The membranes have become a bit more efficient, but the temperature on the planet has also gotten a bit warmer. I am thrilled that only a few months ago, Israel decided to build its first electric plant, powered by "natural gas" as a cogeneration facility for desalination. Surely this is a better way to go than the coal that burns in the more centralized power stations. But wouldn't it have been nice if we could have leveraged some renewable and non-emitting energy source as part of the country's present commitment to desalination?

Reduction of green house gasses is one reason and the virtues of thriftiness another that explain why Israel should not rest on its laurels. Israel has learned to be frugal. But we need to become even more efficient.

In terms of conservation, I suppose the most useful water wisdom that Israel can offer South Australia is in the area of agriculture. When Israel's *Jerusalem Report* magazine ranked the top ten inventions of our fifty-five year history, nobody was surprised when drip irrigation topped the list. It even came out ahead of ICQ software and epi-lady hair removal systems. The statistics are quite astounding.

Using low volume drip and micro-sprinkler irrigation systems along with computer automation has increased the farming sector's water delivery efficiency to 90% as compared to the 64% we had in the days of furrow irrigation. Back in 1975, Israeli farmers used about 8,700 cubic meters per hectare; today it's as low as 5,500. And it's not as if yields have suffered. Ah Contraire! Basically, Israeli agricultural output has increased 12 fold during this period, and we aren't using any more water.

The laundry list of "drip irrigation" advantages goes on and on almost ad nauseum and I won't overwhelm with you with the lot of them. But because South Australia is basically an arid state, in true evangelical style, I can't help but take a few seconds to preach Israel's drip irrigation gospel for you:

Rather than flood the plants and trees, water and fertilizer can be literally spoon fed to the root zone. Drip irrigation reduces evaporation. It allows crops to grow well on steep terrain. It works in shallow soil as well as on course sands and clays. Hallelujah – that rare innovation that is both an economic and environmental blessing. And to be sure, I am rather astounded that with Australian rivers' natural flow being so depleted, you haven't subsidized drip irrigation for farmers and proscribed wasteful flood irrigation completely. Amen.

But agriculture is only one sector that conserves. The household "domestic" sector could still do more. Israel has gone ahead and passed laws that fine city governments if they loose even modest amounts of water in their municipal piping systems. We have banned car washing with hoses in the summer time. Some cities have distributed those nifty devices to citizens that reduce water flow (but not pressure) in showers. And recently, the Israel Standards Institute approved as compulsory in public buildings the latest, low-flow toilet ever designed. But the water wisdom lying behind that efficient toilet we actually imported. The technology comes from Australia. So good on you!

As a lawyer, I love legislated solutions. But I know that for conservation in the homes, education is paramount. Television is a powerful teacher. But nothing works like the schools, especially in a country like Israel where children are taught to speak up to their elders. I'll never forget last year when my 8 year old daughter started lecturing me about my dish washing technique –showing me how they taught her at school to keep the tap shut for most of the washing up. This is one area where I look forward to getting reprimanded again.

And ultimately, if we're really serious about reducing demand, we have to look at water markets. So I'd like to say a word or two about water and prices. Some people might try to categorize these comments as belonging to

the realm of natural resource economics. From my experience, most economists who wade into water research quickly become far too theoretical to be of much interest. And remember Harry Truman's request for a "one armed economist" – as all the other ones would argue a position passionately in front of him and then would finish their presentation by saying: "but on the other hand". Still there seems to be one insight that economists can and do offer us. I'm not sure that it's Israeli wisdom per se, nor is it new but it needs to be said.

As a matter of fact, it was Adam Smith himself who first pointed out that water, which is essential to life, is given away freely, while diamonds, which are for most people superfluous and a frivolous luxury – are priced dearly. This didn't seem to make sense to him. Richard Sandor, the American entrepreneur has made the point much less subtly, as Americans are apt to do. He said – and I just love this adage: "When nature is free, it becomes an 'all you can eat buffet.' And I don't know anyone who doesn't overeat at an all you can eat buffet."

For just about all of Israel's history, the agricultural community has certainly been putting down the beverages at the bar at the metaphorical "hydro-café." But given the prices, who can blame them? In Israel we have indeed witnessed some weird phenomena that resulted from misplaced subsidies, some of which may be familiar to you all in South Australia.

I remember clearly an experience in the mid-1970s when I first arrived in Israel and volunteered to work on a small farm in a village called K'far Warburg. As the sun was setting, and the milking was done, my host family would send me down to the fields in their tractor to turn on the sprinkler system. They weren't growing anything in those fields that year, to be sure. But they were concerned that their water quota might be cut if they didn't use up all the water that had been allocated to them in the past.

At that stage of my life, I was just happy to take a joy ride through the village and didn't really think excessively about the depletion of aquifers and salt-water intrusion. But now I do think about them. I think about them a lot. As much as some, simple-minded, environmentalists would like to paint the agricultural community as "the enemy," it isn't. When I look back on the experience, I realize, that there was nothing sinister or evil in the practice. Rather, my adopted family were good people responding logically to the signals of a foolish policy that encouraged waste. In a sense, it was just another manifestation of the famous tragedy of the commons.

So putting prices on water that both reflect its real costs and encourage farmers not to squander is an obvious first step, Mekorot, our national water utility, estimates that its average water cost is about 26 US cents for a cubic meter of water. Farmers, as recent as 1988, used to only pay about a third of that amount. Slowly but surely though, the subsidies have come down and farmers are now paying 88% of the actual expense.

Some farmers find themselves in inconvenient locations –either very remote regions or in high elevations. In these cases their water prices may reflect a special subsidy seeing as the government feels it is in the national interest for them to farm there. That seems fair enough to me.

And what about those farmers using brackish waters or effluents for irrigation? Until we reach the drinking water treatment level that I like to fantasize about – they are stuck with a product that is inferior: it's smelly; it contributes to the salinity of their lands; it limits the crops they can grow. After all, their reuse of wastewater is ultimately benevolent, helping Israel's cities solve their sewage problems. So in these cases, Israel offers them a discount of 10% to 40%. That seems fair enough to me as well.

So we in Israel have gradually begun to raise the price for agricultural water, but it is still less expensive than water paid by industry and domestic consumers who are paying the full costs. Overzealous economists may be frustrated that we haven't cancelled subsidies altogether. But our agricultural lobby in Israel is almost as tough as yours in Australia and with all due respect, they've already made some huge concessions. As Prime Minister Arik Sharon, himself is a farmer, and his ranch enjoys the water subsidies, it is difficult to imagine him embracing a free market position regarding water. Frankly, I'm not sure that we should.

Let me share another lesson that is becoming increasingly clear. I have lived on a kibbutz for most of the past fifteen years, and can honestly say that most of my best friends either are or were at some time farmers. My wife milked cows for over a decade when she wasn't working at the local R & D center for desert agriculture. We get along quite well, most of the time. So, based on my own matrimonial success, I also believe very strongly

that environmentalists and farmers can be natural allies. We need to be. And if greens and farmers haven't joined forces in Australia yet, it is high time they find a way to start working together.

Agriculture has an absolutely essential role in holding back the pernicious sprawl of Israel's cities. Green advocates need to make their peace with the one sector of the population that is always outdoors and usually more in touch with "the land" than they are.

In this context, I also have a confession to make. I believe in subsidies for agriculture. I think that from an environmental perspective they are justified. Here's why: Dr. Aliza Fleisher from Hebrew University recently did a "willingness to pay" survey among Israel's public. She asked them what they were willing to pay to drive along the lush, bucolic landscapes of the Huleh and the Jezreel valley. Most of these verdant valleys' are more or less farmed wall to wall by kibbutzim and the patchwork quilt of cultivated lands is a glorious sight to see. While both were fairly unpleasant, malaria-ridden swamps even eighty years ago, today they are something of a cornucopia.

Anyhow, it turns out that the Israeli public, that is largely stuck in sweltering, crowded cities, loves to drive out to the country and view this part of their Zionist heritage. The figures that she aggregated came to tens of millions of dollars. Far more, I might add, than the value of the agricultural produce in the fields.

Basically, what we have here is an "externality." Now, usually, environmentalists talk about externalities in the context of a negative cost imposed on the general population by a greedy or irresponsible individual. Say, a polluting factory, that rather than internalizing the costs of pollution control technologies, contaminates the air or the rivers, imposing an "external" cost on the rest of us. In the case of agriculture, we actually have a "positive externality." The farming communities of Israel are offering a recreational (and perhaps even a spiritual) resource to the citizens and visitors. And the thing is, they don't get paid a shekel for it. Now, I think in such circumstances, there is more than ample justification for the government to offer a payment to compensate farmers for these services rendered.

There's really nothing "ground breaking" about Dr. Fleisher's research. The English have realized the historic and heritage value of their country side for a while and have passed laws to conserve the unnatural, but very lovely rural English farming community. I dare say that many of you have probably availed yourself of the thriving "bed and breakfast" accommodations and new economic opportunity that British appreciation and subsidies created.

The question is, of course: just what form should that payment take? Clearly, one doesn't want to subsidize a scarce resource. That inevitably fosters waste and often creates queue line cues or shortages or both. So it was in Israel with bread. When I was in Law School at Hebrew University, bread was subsidized. As a student of very limited means, I would buy a loaf of bread every day and throw out the day old loaf with only a slice or two missing. Incredible inefficiency. Once the subsidies were removed, why, I'd toast and butter my pumpernickel down to the last crumb. Israel's chronic subsidizing of water has created a similar pathology that is just as curable.

At the same time, farmers are right when they argue that every self-respecting country in the world subsidizes agriculture. Indeed, if you followed the talks of the WTO last month, it's clear that our progressive European friends are the champions here. I would also like to add that in Israel, in addition to the usual reasons to subsidize farming, we have unique circumstances that make strengthening the agricultural sector a compelling national priority.

During the 1973 oil boycott, we learned just how readily most countries in the world, especially those in Europe, were willing to buckle under to the economic blackmail and boycott that the Arab oil nations demanded and write us off. Surely, self-sufficiency in food production is prudent public policy after that unpleasant experience. Also, as a nation, the Jews were excluded from holding lands and being farmers in most of the countries in which we languished in exile for two millennia. Returning to Israel was, to a great extent, reclaiming our rights as an indigenous people: the right to cultivate our land and subsidize agriculture like everybody else.

But still it doesn't make sense to subsidize a scarce resource, like water. It does, however, make sense to

subsidize something that we hold in surplus. For instance -- labor. Unemployment, I am sad to report has really hit record highs, as Palestinian terrorism has left our economy reeling. At the same time, the hundreds of thousands of Palestinians who received gainful employment in agriculture can no longer work in Israel due to the associated security threat. Thai workers have been delighted to fill the gap. But the ultimate result does seem like a bit of Israeli lunacy, don't you think. Folks fly half way around the globe to pick tomatoes, while 10% of the locals stay at home unemployed. No wisdom there.

Why not encourage agriculture by subsidizing workers? Why not offer a subsidy for labor that will allow farmers to hire Israelis for a price that is below the market rates for them, but produce wages that are competitive in the labor force. The farmer won't care either way, as long as his checkbook is balanced at the end of the month.

So, to distill all this meandering down to a simple piece of "wisdom" I'd argue: South Australia needs to strive to bring the price of water as close as possible to the market rate – but continue to subsidize farmers through supports to other, more appropriate inputs: like labor or biological pest controls, or soil conservation practices.

Finally -- "getting the price right" is something of a truism. The more interesting issue can be found tinkering with the pricing framework to reach a desirable end. For instance, recently, farmers in Israel started to pay a slightly reduced rate for the first 50% of their water allocation. Then they pay a bit more for the subsequent 30% and yet an even higher price for the final 20%. The average price for the whole allocation stays the same, but the price scheme encourages them to conserve water. The Ministry of infrastructure attributes a 15% savings to this "block system" approach to pricing.

Ultimately the water market is a complicated creature because the supply and demand that usually determine the price of a commodity are so unstable. In the case of water – while the demand curve is fairly steady, as all of us from arid lands, know supply bounces about mercilessly. During a rainy year, like this past 2003 deluge, Israel enjoyed twice the precipitation as the previous year. And stochastic variables being, well just that -- unpredictable, the 2004 count, God willing, might be just as good as better. Or God forbid -- disastrous. Now, granted, water prices in a water scarce region are bound to be artificial government creations and never really a function of a perfectly natural market. But even so, surely, it's a pity not to let the price of water reflect the actual hydrological conditions, rather than keep prices high, even after supply has temporarily burgeoned.

Professor Dan Zaslavsky, who is a former Water Commissioner and professor at our Technion University, is one of the gurus that I like to listen to in matters of water. He proposes a system, which is really quite logical for pricing. It is analogous to our electricity allocation. Like anywhere else, there are peak times and down times for electricity demand. During the night, with the exception of some particularly untamed corners of downtown Tel Aviv, electricity demand plummets as Israelis turn in. When factories open their doors in the morn, the demand goes back up and with it –the price.

Hence, the electric company lowers tariffs during the nighttime "down stage" to encourage utilization of the unused capacity. For example, when it is pumping water into the National Water Carrier, Mekorot, the water utility that runs the Water Carriers, usually operates the system's enormous pumps at nights to save money.

It wouldn't be so hard to create a system where farmers or other big consumers could be guaranteed certain amounts of water at high prices. If they prefer they could wait and see what the rains are like. If they turn out to be plentiful, they can buy more at a bargain price. But the cheaper water would not be guaranteed. If rains are, however, in short supply, then they wouldn't be available at all. Farmers could only get the quantities for which they had made a commitment to pay "top dollar" or top shekel as it were.

This means that certain kinds of crops, say avocados or other trees, that need a guaranteed supply of clean water, would utilize the more expensive water sources. Farmers could make their order and know that they'd get all the water the trees need to survive the summer, regardless if it came from desalination plants or local reservoirs. But a truck farmer, who wasn't sure how much watermelon to plant, could wait and see and make the necessary adjustments for his crops.

Israel hasn't adopted this system yet, but I know our Water Commissioner is moving in that direction and I believe that it's only a matter of time until we can offer this as "official" water wisdom from Israel and not simply

another clever academic idea.

Well that's a lot of wisdom for one evening. So I'd like to wrap up by sharing a hydrological metaphor. I first heard it from Shimon Peres, but I can't tell you what his source was.

As I showed you on the map, Israel only has two major lakes. The Kinerret – or the Sea of Galilee and the Dead Sea. They're connected by the Jordan River. Now the Kinerret Lake is just brimming with life. From sardines to St. Peter's fish, there you can find fish to your heart's content. The eutrophication threat that was so alarming in the 1970s has been reversed for the time being and after last winter's rains, the lake is very healthy.

Now compare this convivial and robust lake to the situation in the Dead Sea. The Dead Sea barely has a few feeble microscopic bacteria surviving in its saline brine. The salty lake is positively moribund. After all, that's why they call it the Dead Sea.

So let's for a second about why that is? It seems that naturally, when the Kinerret Lake fills up, it naturally spills over its waters to the Jordan river that carry them down to the Dead Sea. But the Dead Sea has always been a terminal stop for the water. Doesn't share with anyone. With no one to pass the water to, water simply evaporates and leaves a saltier and saltier lake.

This can be seen as a model for life and the virtues of altruism.  
"Take what you need and pass on the rest to the less fortunate."

It is also an ideology for water management. In our peace agreements with Jordan Israel agreed to give them an additional 50 million cubic meters. This was a gift, and the transfer was not because international law said we should, but rather, quite frankly because they needed it. That's about 3% of all the water we have access to. That's a lot of water. When we get past the present enmity and start talking, the Palestinians will also get more. Jewish tradition stipulates that even beggars have to give charity and Israel must share what it has. We have shown that we can and will make hydrological sacrifices. Even during the drought years, Israel met its responsibility to Jordan.

And sometimes I think that our water engineers are too modest. But I am very proud that even during some of the most violent episodes of the past three years, technicians for Mekorot risked their lives to link up Palestinian villages on the West Bank that had been neglected, and were unconnected to the Israeli water grid. Even during a war, civilians deserve to have running water.

Water has never been used as a weapon, during the past three years when Israel felt besieged by Palestinian terrorism. It continued to flow to our enemies from the Israeli grid, even as they were shooting at us. That's because, providing water is a basic human right – something the United Nations is finally starting to promote. There is no reason why Palestinian children should face thirst due to the adults' inability to come to terms.

So the final Israeli "water wisdom" that I'd like to offer, flies in the face of conventional wisdom. Many academics like to write great manifestos about how the next war in the Middle East is going to be about water. Even some important world leaders like the venerable former U.N. Director General Boutros Boutros -Ghali have gone on the record to that effect. But I beg to differ.

The entire debate that we have with the Palestinians over water involves a 300 million cubic meter a year aquifer. Soon we are going to have unlimited water available for 50 cents a cubic meter. You do the math. Compare that 150 million dollar desalination price tag with the costs of just one F-15 fighter jet. My friends, even the most rabid extremists wouldn't go to war when it is cheaper just to make more water. I am hopeful that water can be a source of cooperation in our region and wash away so much of the enmity and hostility that our long conflict has created. Indeed, what better route to reconciliation than common efforts to protect our shared water quality. Surely that is the wisest role that water can play in our troubled region.

Thank you