

Community action on water

Executive summary

We live in an age of uncertainty. No one knows for sure what will happen with global warming. Some people think it is just a myth to help sell newspapers, but the odds are that it is for real so it is prudent to take protective action. In the short term we can do nothing to reverse the basic causes of global warming so we had better learn how to live with it. The greatest danger for most people is water scarcity with more of what we are experiencing now; longer periods of drought broken by random severe rain storms.

Governments may like to tell us that they are in control and certainly they have some grand plans but the community has to accept that the days of the Government providing abundant water are over.

Governments are failing to address the key threat – the increased threshold for run off. The increased energy in our weather systems means higher temperatures and stronger winds which inevitably means higher evaporation and hence drier soils. Rains which would once give run off into our dams will be simply absorbed by the soils without run off. At one time when the soils were moist a 20 mm rainfall may have given run off, now it is typically 50 mm before there is run off and in the future we may be looking at a 100 mm threshold.

Governments, with their classic approach to water management can do little to protect society from this rising threshold but communities and individuals can. They can take action themselves to manage this risk of water shortages and have a perfectly viable life style taking advantage of simple but effective technologies to manage water at the local level.

As climate change progresses the already dry arid regions, most of Australia but particularly SE Queensland, are likely to receive a triple whammy

- *drier soils in the catchments areas giving less runoff
- *less rainfall and
- *an increasing population.

Is this necessarily a formula for disaster? No. Currently we only catch a minute proportion of the rain that falls, our dedicated catchments are only a very small proportion of the total land area and the bulk of the rainfall falls as smaller rains which simply wet the dry soil without runoff.

The solution lies in harvesting the smaller but more reliable coastal rains over a much larger area wherever they may fall. The simple but effective technologies of water harvesting resolve the problem of catching water over the entire area, not just catchments, making use of both large and small rains.

But there is a snag. Water farming catches and uses water in local areas: they are intrinsically small scale local schemes which are not in the vision of the current water bureaucracy which is focused on mega engineering schemes. Just spending money does not solve the problem – there must be more intelligent thought.

If we are to survive the effects of global warming we must undergo a fundamental shift in attitudes in how we manage our water - learning to harvest and use water locally.

But the change is not just technology, indeed many of the technologies have been in use for hundreds of years. The real revolution is the change to communities taking action to collect and manage their water locally. It is a social revolution in our management of water.

The role of traditional dams needs to change. Currently many of our dams are approaching empty. At some point in time, no one knows when, there will be a major rain and the dams will fill. Local captured should be used whenever local water is available substituting for water which we currently take from dams. The water from these freak rains captured in our dams should be regarded as emergency water for the next long period until the next freak rain.

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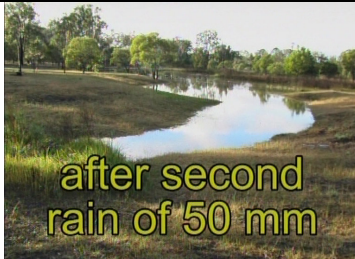
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Threshold runoff - the heart of the water problem

	<p>In my DVD 'Water and the Whistle Blower' I mimic a conventional catchment area and measure how much water must be applied to get run off (into our dams). In the first case I take an area which is already moist and show it takes less than 5 mm of rain to get run off.</p>
	<p>I then repeat this with an area which has not received any rain and has been exposed to the full sun for some weeks. It takes some 115 mm of rain before there is any run off.</p>
	<p>Our classic catchment areas (which are only a minute proportion of the total land area) are generally covered with vegetation. Even after a short dry period the top soil will be dry and in a drought like we have just experienced, the trees will have sucked out the water down to a couple of metres.</p>
	<p>Before there is any run off this soil has to be wetted. The normal showers and light rains which occur quite regularly, even in a drought, will have no impact on the water supply situation. We only get run off with a heavy rain, almost a freak event.</p>
	<p>Global warming means increased evaporation, more absorbent dry soils, and less run off into the dams. The threat of global warming is not simply the possible reduction in rainfall but the higher evaporation.</p>

A hotter climate means higher evaporation, which in turn means drier soils. There has to be a certain minimum amount of rain before there is any run off into our dams, a threshold amount. In a moist climate this may be as little as

20 mm. With the current drier climate in much of our catchments 50 mm may be a more relevant figure. With global warming this threshold may rise to nearer 100 mm. The effect of the raised threshold can be seen by examining the size of the rainfalls over time.

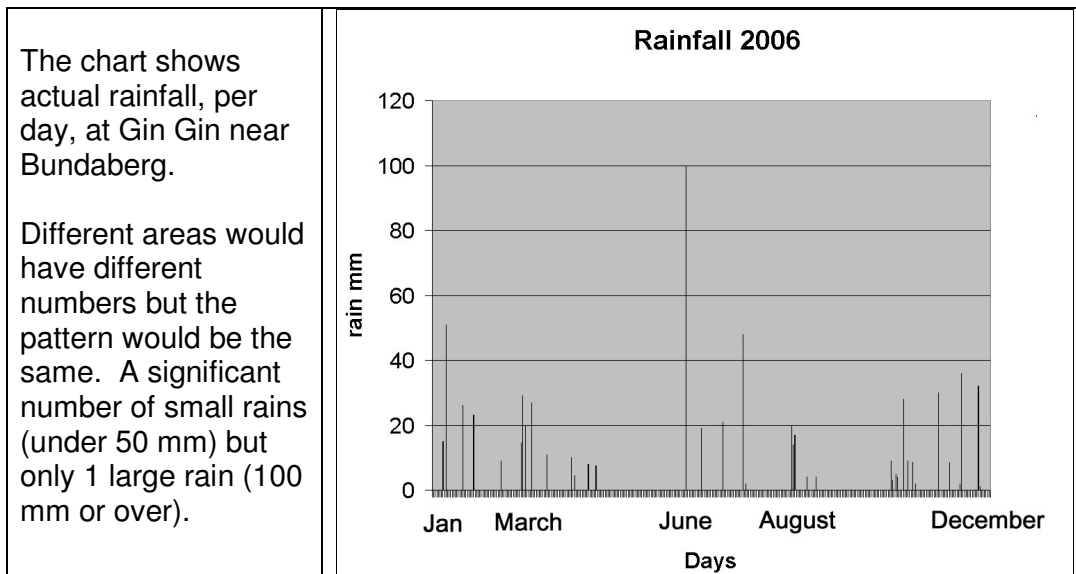
Even if there were no changes in rainfall patterns due to global warming there would be a substantial reduction in runoff into our dams. Factoring in predicted changes in rainfall patterns, longer periods without major rains, indicates that many of our water supply systems would essentially collapse, becoming completely incapable of supplying anywhere near demand.

This threshold to runoff is probably the single most important factor in managing the water crisis yet to date seems to be totally ignored in the public debate.

Relying on traditional water supply technologies eg dedicated catchments and dams, means major conurbations like Brisbane will become increasingly dependant on freak rains - this is a red alert.

The effect of rainfall patterns.

Over a number of years I have measured how much rain must fall before there is any run off (into our dams). Typically it takes at least 50 mm and if the soil is really dry up to 100 mm is needed before there is any flow. Rainfall records show the number of these big rains is very limited, once a year if we are lucky and there may be several years between these large rains.



If the runoff threshold were only 20 mm there are numerous times when run off to the dams would occur. In fact the bulk of the rainfall comes in numerous small rains. As the run off threshold rises to 50 mm there is only one rainfall

event when there is run off. The amount of rainfall collected is then only a fraction of the total rainfall. This is what happened with our dams in 2006.

If global warming intensified so the soil is so dry that the runoff threshold rises to over 100 mm there would be no collection of water in our dams. This is the real threat of global warming to water supply.

We can use this data to calculate the amount of run off into a dam. The total amount of water harvested is 212 mm out of a total rainfall of 682.5 mm ie only 31% of the rain that fell was actually harvested.

With this data we can estimate the effects of climate change. If evaporation increases by 20% with rainfall remaining the same the amount of rain captured is 122.5 mm a reduction to 58%. If on top of this we had a 10% reduction in rainfall the amount of rain captured would drop to 54 mm a reduction to 25% ie the amount of water captured will be one quarter of our current level of capture.

It may seem scary that our water supplies could be cut to 25%; - **but there are solutions!** we just have to change the way we harvest our water. Climate change by itself need not be scary, what apparently scares people is the social change necessary to adapt to these technologies.

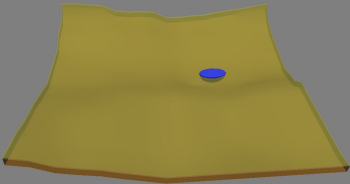
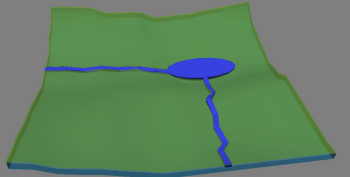
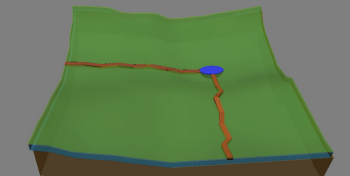


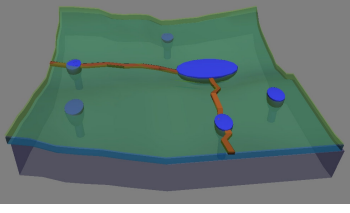
The solutions

Let us start by looking at how much water actually falls as rain.

Taking the entire continent we receive almost a million litres per day per person. Now this is just unbelievably huge - some 2,000 times the water needed. Just taking the Brisbane area alone shows there is enough rainfall to supply the entire city needs simply from the rain that falls on the city. Even in a drought there is still plenty of water; it just needs an alternative way of harvesting the water. We need to make use of the smaller but more frequent and reliable rains over the total available area (not just the dedicated catchment areas).

We need to use such techniques as leaky dams, percolation holes, wicking beds etc to capture and store the water in the soil. Leaky dams copy this natural process and are by far the most cost effective way of storing water.

This is not a difficult engineering problem, the hurdle is attitude. We need to adopt a totally different philosophy of catching the rain locally.

	<p>Here we have a dry catchment. The soil is dry and will absorb the first part of any rain that falls without runoff.</p>
	<p>If we are lucky and receive a heavy rain, say 100 mm or more there will be enough rain to wet out the soil, after which water will flow into the dam. Large rains are essential freak rains and are an unreliable source of water.</p>
	<p>However a light rain just wets the soil without any runoff into the dam. Most of our population is in coastal areas which receive reliable small rains, but the water is wasted, it is just absorbed into the soil and evaporates.</p>
	<p>Micro dams are deliberately made leaky, often with a percolation hole in the base. They catch and hold water from a small rain and then allow water to soak deep into the ground where the water is protected from evaporation.</p>
	<p>Roads collect large volumes of rain which flow through culverts which can easily be converted into micro dams to get the water deep into the ground forming an artificial water table supplying water to a lower level dam or a bore.</p>
	<p>The simple fact is that there is far more water held in the soil than in all the dams and lakes. Large volumes of water can be stored, essentially for free, in the land surrounding the main dam. As the water is pumped out of the dam the water in the surrounding areas will slowly seep into the dam.</p>

Currently many of our dams are approaching empty. At some point in time, no one knows when, there will be a major rain and the dams will fill. The temptation then will be to relax back to a state of comfort and use that water in the way to which we have become accustomed. This is absolutely the wrong philosophy. The water from these freak rains captured in our dams should be regarded as emergency water for the next long period until the next freak rain.




Everyday water used for routine applications should come from these local sources of water harvested locally.

One of the great dangers we face with the current water management system is that after the next heavy rain, the politicians and water managers will allow use of the water in the reservoirs when ample water is available locally. This is just inviting problems in the future. Water in the reservoirs should be held in reserve.

The eco village

But how do we know these alternative solutions work?

I live in an eco village where we have no water bureaucracy to supply us with clean water or dispose of our waste water, we have to do it all ourselves. We cannot afford massive capital expenditure and have had to go back to the basic physics to understand how rainfall is converted into water supply and develop simple, low cost but effective technologies.

	<p>This small dam has a nominal capacity of 9 mega litres. After extracting 18 mega litres the dam was still more than half full due to ground water seeping into the dam. How much more water could have been extracted is not known because it rained and filled the dam.</p>
	<p>In our case water is pumped from the dam into tanks which gravity feeds the community through inexpensive polythene pipes. This is utility water for general use, particularly for irrigation. Clean water for drinking and household use is collected from the roof and stored in tanks.</p>
	<p>The dam is a community asset; this is a small scale way of harvesting water locally. These techniques could be applied widely throughout the country but we would have to overcome this fixation with mega projects.</p>

Any one with eyes and a willingness to look can observe results. Our village just inland from Bundaberg, is in one of the driest regions in the Queensland coastal strip. Further south, near the NSW border they benefit from the winter rains. Further north they benefit from the summer cyclones.

We are a small eco village, without any major infra structure in a particularly dry region yet using these simple technologies we have a perfectly adequate water supply.

In theory we should be in dire straights, but the simple fact is we are not - we have adequate water while residents in the major cities, served by the billion dollar water utilities are suffering from ever lowering dam level and tighter water restrictions.

The proof that these technologies work is open for any one to see for themselves.

Living the experience

We live these technologies everyday. Even if there is no rain, just a heavy dew, we can lie in bed listening to the water filling our water tanks and in the morning check the level to see that we have collected some 40 litres of water.

We contrast this with the city with a million homes potentially collecting 40 million litres just from dew overnight, but currently largely going to waste.

We can see that 20 mm of rain give us some 5,000 litres of water in our tanks. We can see the water running off our roads, filling the culverts which act as leaky dams, and watch the water slowly sink into the ground. Even if there is no surface water flowing into our dams we know that this water will eventually filtrate through and help keep them full in dry times.

We can see how much rain is needed to get flow into our dams and how often they are filled by surface runoff. Not very often – in a very good year maybe twice but lately there may be several years between the dams filling.

But as we draw water from the dams in the dry periods we realise that as the level drops the water in the soil is slowly seeping into the dam helping to maintain our supplies of utility water for our plants.

Spreading the word – social change

We think about the cities, dependant on freak rainfall to fill their dams and supply all their water, while wasting all the reliable smaller rains. We hear the political spin about drought proofing our cities; it is just not possible to drought proof a city relying on freak rains. With the threat of global warming it is total folly to have a major city totally dependant on freak rainstorm for its water supply.

Relying on a narrow engineering focus is no way to manage the effect of climate change on water supply! We have to be more creative in our thinking looking outside the traditional mega engineering projects of dams, desalinisation and recycling - all useful technologies in their place - but not the

solution to climate change. There are solutions if we use our intelligence and adapt to the changing conditions.

But the solutions are not just some new technology, they involve a fundamental change in society from one in which water is supplied by some hopefully benevolent bureaucracy to one in which local communities take responsibility for managing much of their own water catchment and use.

Of course the traditional infra structure of dams and pipe lines will still be used but the role will have changed from one of providing virtually all the water used by society to that of managing reserves of water to be available in emergency situations in extreme climatic conditions.

Climate change – a new ball game

Climate change creates a new ball game, one we have never played before, the rules have changed, and we have to adapt by being smarter.

The tragedy within the Australian water scenario is that despite the huge amounts of money being spent and the proliferation of departments and water commissioners there is a total fixation with the engineering mega solutions, whether new dams, desalination or major pipe lines.

Water farming, harvesting the water and storing it in the soil for use locally is essentially a local operation. Within all our maze of political infra structure there is no organisation to implement these small schemes.

Global warming will force a social change on us, whether we like it or not, in which individuals and local communities are responsible for managing the majority of their water needs, harvesting and using the water on a local basis.

Further information and contacts

I produced the DVD 'Water and the Whistle blower - an independent assessment of the effect of global warming on water' to generate a public awareness of the dangers of climate change and the steps that could be taken to ameliorate the effects on our water supply.

I have also written widely on the water crisis, produce DVD's and give talks to local community groups. If you would like further information you can contact me at colinaustin@bigpond.com.au.

Colin Austin's story

In the early seventies engineer Colin Austin realised that computers would revolutionise the design process. He wrote a piece of software that transformed the international design of plastics moulds using scientific principles rather than 'gut feel'. So successful was this software that the company that Colin founded (Moldflow) became the most successful exporter of technical software in Australia, a multi-million dollar company selling in over 48 countries throughout the world.

Colin became internationally recognised as the leader in his field of computational fluid flow. The company became world famous for a series of innovations which sprung from Colin's concepts of how to manage research, a process he calls 'speculative research' pursuing unconventional approaches on the hunch they may just work out, high risk with many failures but the one success could literally change the world.

He became increasingly concerned about environmental issues, particularly the management of what he sees as the world's most critical resource - fresh water. He examined the research programs around the world, saw they were largely financed by Governments, what he calls 'competence research', highly organised and planned but almost over organised, killing off those high risk - high reward creative ideas.

Colin felt that with his expertise in fluid flow simulation and armed with the technique of 'speculative research' he may just be able to change the way we think and manage our water.

He sold his multi million dollar company which gave him the resources to set up a research group of some dozen highly talented and creative researchers to tackle those high risk projects which were being ignored by the ever cautious bureaucratic approaches of Governments.

At first his group focused on irrigated agriculture with a number of innovations. One was the development of micro flood irrigation which unlike conventional flood irrigation can apply precise quantities of water and replaces the traditional open channels which lead to major losses of water by evaporation and leakage.

He continued his software development with scheduling software which enables precise application of water by calculating plant water usage.

While these are important technologies, Colin was getting frustrated by the limited horizons of the bureaucracy who encouraged wasteful usage patterns by making cheap water readily available at highly subsidized prices. However his life was about to change when he was invited by World Vision to go to Africa to see if he could work out a way that local people could grow sustenance food in the periodic droughts which cause so much hardship.

Stunned by the cultural shock of meeting malnutrition first hand he began to analyse the heart of the problem. Before leaving Australia he assumed that the problem was simply no rain, but he quickly learned that this was not true. The core problem was erratic rain. People simply cannot live where there is no rain. Populations grow where there is on average adequate rain and are then thrown into despair when the rain fails to materialize.

He felt the situation was just like Australia, no one complains about the lack of rain in the Simpson Desert, there is no one there to complain. The problems arise in areas like Perth and South East Queensland where there is on average adequate rain which encourages a high population which becomes threatened when the rain fails to materialize.

He was introduced to the reality of the green drought, when there is enough rain for the crops to start to grow. But a break in the rains, even of a few weeks, but at the critical times when the seed heads should be maturing, means the crop fails completely, resulting in famine.

Realising the problem was erratic rain, rather than no rain; he developed a system called the wicking bed which is essentially an underground pond. Rain, when it occurs, is channeled into this pond which forms a reservoir which allows the plants to keep on growing to maturity even if the rains fail to materialize.

Having experienced the realities of living without proper water supply, seeing people scooping water from faeces infected puddles, experiencing first hand the inevitable consequence of diarrhea Colin was in for a second cultural shock on his return to Australia.

With his eyes opened to a new way of thinking about water, he was hit in the face by the stupidity of the way we manage water in Australia. How we rely on dams which only fill in freak weather conditions to supply the bulk of water. Then how we use that unreliable but valuable water in the most bizarre way when there is plenty of water available literally falling from the sky, free of charge, right on the doorstep. After his experiences in Africa he found it unbelievable that people use high quality potable water for flushing toilets and watering gardens when the simple techniques he had used in Africa, catching water locally and storing it in tanks or in the underground ponds or wicking beds, provides a simple and cheap substitute for potable water.

Colin was stunned not just by the lack of interest from the bureaucracy, but their obsession in pushing ahead with totally unnecessary projects like the Mary River dam. He finds it difficult to believe this attitude is divorced from the revenues arising from the monopoly distribution of water by the Government. He now feels that the only solution is to get this message out to the public at large.

Awards

He has received numerous awards including:-

- 1980 John Derham Award for Technical Innovation awarded to Colin Austin
- 1982 National Small Business Award
- 1983 Governor of Victoria, Export Award
- 1984 Governor of Victoria, Export Award
- 1984 Dept of Trade in Association with Confederation of Australian Industry's Export Award for outstanding achievement.
- 1985 AITA, Cad software solution of the year award
- 1988 Australian Bicentennial Export Award, Services Category
- 1989 Australian British Chamber of Commerce Federal Award for small business export initiative and innovation
- 1990 Governor of Victoria Export Award to Colin Austin for significant export achievement by an individual
- 1990 Government of Victoria Export Award Certificate of Commendation, services category
- 1990 Business Bulletin Small Business Achievement Award
- 1990 Business Bulletin small business achievement award
- 1991 The John Hart Technology Award
- 1991 Rolls Royce/Qantas award together with the Warren Centre award for engineering excellence
- 1991 Governor of Victoria Export Award, awarded for significant achievement by an export product
- 1993 AITA Exporter of the year award
- 1993 ANTEC (USA) best technical paper award for lean plastics manufacture

1994 Southern Cross Award for Excellence awarded by
Technology in Government Committee

1997 Fred O.Conley Award for outstanding achievement in plastics
engineering & technology

2002 Triannual Plastics Industry Award for contributions to the plastics industry

2002 SPE Environmental Award

2002 SaveWater award winner agricultural section

2003 SaveWater award Regional Sustainability

Publications

Publication	Date	Theme
Intelligent Irrigation	1996	Closed loop control of irrigation
The Murray Darling Basin A Technological Solution	1997	Replacing flood irrigation
Soil Moisture Interpretation Made Easy	1997	Guide to soil moisture
Agriflow Making water go further	1999	Replacing flood irrigation
Vision for the Bush	2000	Managing our natural resources
Irrigation Scheduling	2000	Guide to scheduling
Water Right The new thinking on irrigation scheduling	2001	Adaptive scheduling
Sensor based irrigation scheduling	2002	Training course
Reaping the benefits of water saving technology	2002	Implementation of water saving technology
Water, technology and policy interactions	2002	Water policy
Myths and fantasies of sustainable food production in Australia	2003	Critique of DNRE
Irrigation scheduling	2003	Scheduling manual
Making the most of water Micro flood operating manual	2003	Micro flood user guide
Water, Wit and Wisdom- The search for the solution to the water crisis	2004	Book ISBN 06463814-X
Solving the water crisis	2005	DVD
Water and the whistle blower – an independent assessment of the effect of global warming on water	2006	DVD