Submission

By Brian Chatterton,

International water management and farming adviser and former Minister of Agriculture, Fisheries and Forests in the South Australian government.

Introduction.

The theft of water in the Murray Darling river system is being undertaken by two completely different groups. There are individual irrigators who exceed their entitlements defined by their water right. There is much larger theft taking place under the management plan for the rivers administered by the Murray-Darling Basin Authority.

This second theft is of particular importance to South Australia as the downstream state. The situation is not unique to Australia. The US state of Montana is suing the upstream state of Wyoming on the Yellowstone river for the theft of some of its share of the river flow. In this case the reduction in river flow has been caused by greater upstream consumption. As in Australia that increase in consumption is within the diversion limits (in volume terms) set by the water management plan as will be explained below.

This submission is based not just on my technical expertise but also on my political experience as a Minister in the South Australian government. The policies I propose are not only technical solutions but incorporate possible legislation.

Definitions.

Allocation

Allocation is an authorised amount of water to be taken from the river, a canal, or pipe for irrigation purposes. It will vary from year to year according to the needs of the crop and supply available but the allocation indicates the maximum amount the farmer may take. It does not necessarily have any further implied conditions or property rights.

Consumption.

Consumption is the amount of water actually consumed in the process of irrigating by the crops on the farm. It is important to make the distinction between allocation and consumption. Allocation (or abstraction) is the water delivered to the farm but the consumption is the water actually lost to the river system through evaporation and transpiration (ET). By definition it is not available for other uses.

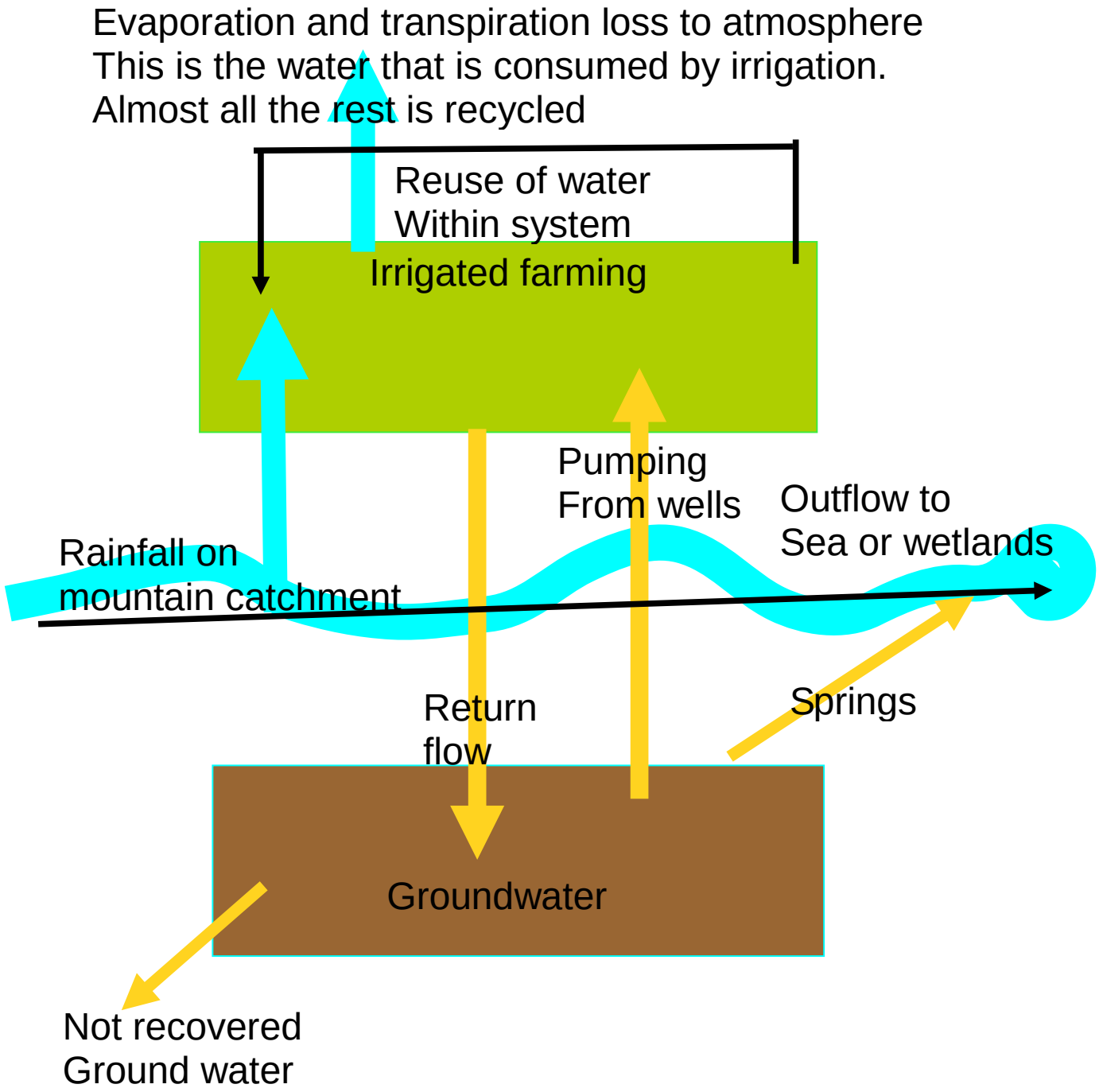
The table below gives some figures for different types of irrigation in terms of use or application efficiency. That is the ratio of consumption through ET to the total water delivered. The consumption is the amount that disappears into the atmosphere through evaporation from the soil surface and transpiration from the leaf surface. This is the water that is lost from the river basin.

The amount consumed varies from an average of 50% for flood and furrow to 90% for drip irrigation system.

Table 1.

PRESSURISED IRRIGATION SYSTEMS – APPLICATION OR USE EFFICIENCIES %			
Sprinkler systems			
System type	Range	Average water consumption through ET	Possible return flow*
Lateral move	65-75	70	30
Centre pivot (high pressure)	65-80	70	30
Centre pivot (low pressure)	75-90	80	20
Stationary guns	50-60	55	45
Traveling guns	65 -70	70	30
Drip irrigation systems			
Surface	85-95	90	10
Sub surface	85-95	90	10
Surface irrigation			
Flood and furrow	25-80	50	50

- Possible return flow. I have added this row to table to emphasise the fact that the water not consumed as ET must go somewhere. It is not a claim that all this water will return to the river system but it needs to be accounted for in the management plan.



Return flow.

Return flow is the term used to describe the balance of the allocation. That is the water not used by the crop through evaporation and transpiration.

To take a simple example of a pasture irrigated by flooding. The water enters and spreads across the paddock. Part of the paddock receives excess water. This must happen in order that the water reaches the other side of the paddock.

The excess water has to go somewhere otherwise the paddock will become a swamp. It soaks into the soil. This is the return flow. Most of the return flow reenters the river system. A small part may soak into a deep aquifer where it cannot be recovered economically but most of this excess water finds its way back to the river or irrigation system. South Australia is highly dependent on the return flows from the up stream states.

Table 2.

This is a simplified model of four riparian states on a river. In the Murray-Darling Basin the three upstream states are not neatly arranged in a line so the model has little relevance to them but their collective impact on the fourth state – South Australia - is relevant.

The basis of the model is an average flow of 400 units allocated to each riparian on an equal basis. That is then modelled at 50% efficiency (50% return flow) and 90% (10% return flow). This modelling is done again with a 25% reduction in the river flow.

		Average flow		Reduced flow	
Irrigation efficiency		50%	90%	50%	90%
Crop water use	units/ha	0.5		0.5	
Riparian 1					
Incoming supply	units	400	400	300	300
Water right	units	100	100	100	100
Area irrigated	ha	100	180	100	180
ET Crop	units	50	90	50	90
Abstraction	units	100	100	100	100
Return flow	units	50	10	50	10
Riparian 2					
Incoming supply	units	350	310	250	210
Water right	units	100	100	100	100
Area irrigated	ha	100	180	100	180
ET Crop	units	50	90	50	90
Abstraction	units	100	100	100	100
Return flow	units	50	10	50	10
Riparian 3					
Incoming supply	units	300	220	200	120
Water right	units	100	100	100	100
Area irrigated	ha	100	180	100	180
ET Crop	units	50	90	50	90
Abstraction	units	100	100	100	100
Return flow	units	50	10	50	10
Riparian 4					
Incoming supply	units	250	130	150	30
Water right	units	100	100	100	100
Area irrigated	ha	100	180	100	180
ET Crop	units	50	90	50	90
Abstraction	units	100	100	100	30
Return flow	units	50	10	50	-60
Sea					
Incoming supply	units	200	40	100	-60*

Supply/Right		50%	90%	50%	90%
Riparian 1	%	400%	400%	300%	300%
Riparian 2	%	350%	310%	250%	210%
Riparian 3	%	300%	220%	200%	120%
Riparian 4	%	250%	130%	150%	30%

* This is obviously only a theoretical position as farmers are not going to irrigate with sea water.

The table above illustrates:

1. The reduced security of supply as of each group of farmers from the upstream areas to the down stream areas.
2. The reduced security when flood irrigation is converted to drip.
3. The reduce security is converted to a crisis in the last downstream group or state when drought is combined with increased irrigation efficiency caused by converting to drip. Drought is perhaps an exaggeration. In 1988, the coefficient of variability of annual flows for the Murray-Darling was 1.12, nearly four times the world average of 0.33. (Finlayson & McMahon 1988). Even a moderate reduction can cause a downstream crisis. The 25% reduction in flow modelled above is likely to occur 3 to 4 years in 10. Of course storage will soften the impact on flow volumes but ultimately the most effective means of securing South Australia' position is to talk in consumption terms rather than volume terms. That means each state would have to control their consumption as well as the gross volume.

Return flows have become a controversial subject as many in the water management administration have tried to down play their significance. Denying the existence of the return flows is of course denying the law of conservation of matter -indeed the models used by the BoM to prepare Australia's water accounts include a term for return flow, yet these return flows somewhat strangely, are assumed to be zero when projecting “water saving” through improved farm efficiency. If the water is not used by the crop in the form of evaporation and transpiration it must go somewhere. In a number of inquiries the return flows have been dismissed at totally insignificant or in a rather contradictory argument that their reduction is a good thing.

This argument states that the return flows (if they exist) are salty and polluted with fertilisers and other chemicals. That is often true but they must still be accounted for otherwise the whole management system collapses.

The MDBA claim that the return flows are zero makes the Murray Darling system unique in the world.

Water rights

Water rights have a greater implication of ownership that is not included in “allocation.” Farmers need stability of water supply in order to invest in their farms. Water rights provide them with an entitlement or allocation over time. Unlike land rights their stability cannot be complete because the supply is variable due to droughts. The degree of ownership is discussed below.

Free floating water rights

Water rights are linked to the land in most countries around the world. In Australia the free floating water right was a basic principle of the water market. The link between the land, the crop and the irrigation method was broken when the water right became a tradable title.

While the breaking of the link between the water and the use of the water was essential for

the water market it also broke any link between the allocation (or abstraction by) of water to the farmer and the actual consumption.

The immediate impact of this new free floating water right was a large unearned bonanza for flood irrigators. Most of these are in the up stream states. They had water rights for 100 units when they were in fact only consuming 50 units on average. Some consumed as little as 25 units. Most downstream irrigators of vines and fruit trees had converted to drip irrigation. They consumed 90 units out of every 100 units of water rights.

Where has all the water gone?

The short answer is up in water vapour. The increasing loss of water through evaporation and transpiration has become possible as farmers expand their irrigation with the encouragement of the Murray-Darling Basin Authority and subsidies from the Australian Government.

When the Murray Darling water market was first implemented the Federal Minister boasted that it was a win win scheme. Farmers would change to more efficient irrigation systems such as drip and then sell their surplus water. The sale of the surplus would fund the investment. Of course the ”surplus” was an illusion. It was not a surplus but the return flow which had already been allocated to another farmer down stream. It was robbing Peter so Paul could sell the return flow to Mary. It was claimed that farmers would benefit and the country would benefit from expanded production from expanded irrigation.

This scenario is based on a failure to understand the hydrology of the river system.

Let us say the farmer has 100 units of water. He uses them to irrigate his vines using a furrow system. The efficiency is 50%. That is 50 units are consumed and nearly 50 units are returned to the river system. He or she invests in a drip system. The vines still need 50 units of water. The irrigation system is 90% efficient. That means the farmer needs 55.5 units of water delivered to the farm. There are 44 units of the water right that are now surplus to requirements. These can be sold to another farmer. The purchaser invests in a new vineyard with drip irrigation so 90% of the 44 units is consumed and 4.4 returned to the river.

These farmers have followed the Minister's advice. Before the water market allowed these trades to take place 50 units were consumed and 50 units returned. After the trades and the investment and the expanded area 90 units were consumed and 10 units returned. That is where the water has gone – in increased ET and reduced return flow.

The Minister was not stating his personal opinion but that of the water managers. It is extraordinary that they could collectively make such a fundamental mistake. Where did they think the extra water was coming from? Obviously they had forgotten the physics they learnt at school about the conservation of matter. Why were they advising governments throughout Australia to invest in drainage schemes if there was no return flow?

What they had done was to confuse water savings on an individual farm for water savings for the whole river basin. It is a common mistake that is still being made around the world. International development agencies have provided Morocco with millions of Euro to upgrade irrigation systems to drip in regions where the water level in the aquifer is falling due to over pumping. The farmers have used the water “saved” to extend their irrigated area and the water level is still dropping. Morocco is not by any means the only country to fall into this trap.

I am not advocating a return to flood and furrow irrigation. The new methods have many agronomic advantages although certain types of sprinkler irrigation may improve efficiency as they apply the water more evenly but, because the water is thrown into the air more water evaporates before it hits the crop.

If the irrigation system is changed then the return flow must be taken into account not used to expand the irrigated area.

Why has buy back failed?

The answer to this question is just as simple. The the Australian Government (through the states) has purchased water rights to put in the environmental account . This represents a specific volume but it disregards the water consumed by the crop and the subsequent return flow. The discrepancy is very large.

Flood and furrow irrigation has an average efficiency of 50% but a range of 25% to 80%. It is obvious that those farmers who obtain only 25% efficiency are obtaining a very low return on the capital invested in a water right. They are the farmers who will benefit most from selling their water right. These low efficiency water rights are then purchased by the MDBA and effectively cancelled. For every 100 units that are purchased as little as 25 units may be added to the the river flow. The other 75 units have already being returned to the river. It is hardly surprising that the buy back has not solved the problem. Translated into the language of the supermarket the slogan would be “Take one and pay for four.”

The Australian government effectively pays for 100 units but only 25 units are available for the environmental account.

Of course a side effect is to reward the most inefficient irrigators at vast expense to the taxpayer.

Why has the water market failed?

This is a more complex question as one must first determine what the market was supposed to do.

One of the primary aims was to manage the water of the Murray Darling Basin to respond to and manage supply and demand. Adam Smith's “invisible hand” of the market was considered to be superior to the administrative decisions of ministers and administrators. This was put to the test during the great Australian drought. The Chief Executive of the MDBA said that the market was handling the situation as the price of water had increased three times and twice as much water had been traded. It is easy to mock this remark in retrospect but few people challenged this comment at the time, The problem with the market as the manager is that supply is determined by the rainfall and runoff not by price. A high price for water does not make it rain. On the demand side consumption is determine by rainfall (you don't need to irrigate if it rains) and temperature/wind which determines the rate of evaporation and transpiration. Again these occur independent of the a high price for water.

In the Adam Smith model a high price should increase supply and decrease demand. That obviously did not happen during the drought. It is significant that the international enthusiasm for the water market as a manager is now declining. Even the World Bank which still supports the market concept strongly no longer gives prominence to this supposed benefit.

Another justification for the water market (and the one that is now most prominent) is that water will move from low value crops to high value crops through trading. The crop with the highest return to water in Australia is vegetables. There is no evidence that vegetable production in the past was restricted by an inability of farmers to access water. The whole argument is water centric. It implies that the return to water is the sole objective of farmers. In fact vegetable growing is restricted by markets. Australians cannot or will not eat any more vegetables and exports are limited by the cost of air freight. Growers are also restricted by the supply of labour and growing vegetables carries a high degree of risk. To consider only the return to water is to take a simplistic view of the choices faced by farmers.

Property Rights

When the free floating water right was introduced it was seen as a simple division of the previous land and water right into a land right and a water right. It was natural that the water right should carry many similar rights as the land. Most of the land was held as freehold. Of course the water rights had to take account of reliability of supply but otherwise they carried few restrictions. This was considered necessary in order to trade them easily in the market.

Freehold property rights are not easily defined. I have used two examples in my seminars which illustrate the wide divergence.

The first is a carpet. You can buy a carpet and then use it how you like. You can put it on the floor, hang it on the wall or store it in the hope it will increase in value. You can sell it or even destroy it. Your right can be considered as an extreme form of ownership.

The next is a car. This is a piece of freehold property and you have a certificate provided by the government to prove it. You need a licence to use it. It has to be insured against third party claims. You can only drive on one side of the road. In cities there are congestion charges and tolls on motorways.The manufacturer has to meet certain standards and you are not allowed to destroy it except in a certain manner. My argument is that controls on the use of freehold property are not new and should be applied to the water right.

Land was similar to the carpet model during the 19th century but during the 20th century legislation such as the Soil Conservation Act and the Native Vegetation Act nudged land ownership slightly towards the car model. Neither of these Act have any relevance to irrigated land so the water rights are nearer to to the carpet model than the car model.

Urban freeholders already have their land rights constrained by the rights of the community around them through the Planning Act.

Reform

The Irish joke tells of a traveller seeking directions to a village. He stops and asks a farmer who after a moment's thought says “If you want to go there I would not start from here.” It is no doubt intended to mock the Irish but it is quite a profound analysis. I would not start with a free floating water right. I have been advising governments in North Africa and West Asia to adopt the Conservation Lease as a form of water title but the free floating water right is already in place in Australia and such a radical change to the Conservation Lease would be too politically disruptive. It would be politically impossible to reach agreement with the other states and Commonwealth.

Instead I recommend a couple of Acts to move the water title away from the carpet model and nearer to the car model.

Water Right (regulation of consumption) Act.

The first measure is the Water Right (regulation of consumption) Act. This Act would introduce a further limit on the water right. As well as the volume of water allocated and the reliability of supply the title would include the amount of water consumed. This would be determined by an audit of the farm and it irrigation. Initially the new regulations would apply to sales and purchases of water. The new owner of the water right would have to comply with the limit on water consumption as well as the limit on overall allocation by volume. The new water right would show two amounts. The first would be Net Water Consumption and the other Gross Water Allocation. The new owner cannot exceed either.

There are many who will claim that this consumption audit is not technically possible. Dr. Chris Perry in his submission to the Senate Enquiry points out that it is already happening in Idaho

in the USA. The authorities buy back water on the basis of consumption not allocation. That means a farmer who is applying 100 units to the land, but under a buy back scheme he will be paid for only the 75 units consumed. Critics will also claim it is too expensive and time consuming. The cost will be substantial but the benefits are even greater. The MDBA authority has already paid out billions of dollars on the basis of "Take one pay for four." It would save billions if it adopted the "Take one and pay for one" slogan.

There are tens of thousands of irrigation farmers in Australia and it would not be possible to carry out a consumption audit on all of them immediately. The provisions of the Act would require the audit to be carried out initially on sales and purchases.

The advocates of the water market will say that the new rules will inhibit the free trading of water rights. They are right but they will not prevent water being traded. It will require more complicated pricing but I am sure the market can cope. The restrictions on the freedom to trade must be balanced against the development of a river management system that is sustainable.

Water Planning Act.

Increased consumption of water does not take place only when water is transferred. It takes place on the farm if the farmer has unirrigated land. The farmer can change the irrigation method to one that is more efficient and use the return flow that is "saved" to irrigate more land.

If a farmer has an allocation of 100 units and uses it irrigate a vineyard using furrow irrigation only 50 units are consumed by the vines and about 50 units return to the river. If the farmer converts to drip irrigation about 56 units of allocation will meet the needs of the vines (at 90% efficiency).. Thus the farmer can expand his or her vineyard using the 44 units "saved". The net effect is a consumption of 90 units instead of 50 units. Farmers planning to expand their area under irrigation will have to apply for planning permission and carry out a consumption audit to demonstrate that their overall consumption remains the same. With an expanded area of vines this would be a problem, but if a farmer decided to convert from vines to olives (which consume less water) a greater area of olives could be irrigated within the same Net Water Consumption.

If they merely upgrade their existing irrigation system they would generally not need planning permission. That is, a change from furrow to drip for vineyard would not significantly change the loss through ET. It would mean however that the farmer could not sell his "savings" because of the new Net Water Consumption requirement. Some types of sprinkler irrigation actually increase consumption within the actual allocation. There may need to be a list of approved irrigation systems.

Resource tax

So far the Australian taxpayer has been extremely generous towards the irrigators of the Murray-Darling Basin. They have subsidised the irrigators to change their irrigation systems and have purchased their water rights back to put them in the environmental account. . This buy back has often been at the extremely high price of "Take one and pay for four." The intended impact reducing the volume of water allocated in the form of water rights was calculated to improve the sustainability of the river system and for irrigators specifically the changes are supposed to improve the quality and reliability of their water.

If this buyback scheme is to be effective, the capital value of the water rights will increase. Should the irrigators contribute to this particular scheme for improving their water supply?

So far all the cost has been borne by the taxpayer and the benefit for the has accrued to the owners of water rights.The environment which was supposed to benefit has not gained to any substantial degree. Should the owners contribute at least something to the improvement of the system? They will claim they already pay for their water but this is for the distribution of their water

not the management of the resource. They pay capital gains tax when they sell or inherit their water rights but these capital gains taxes are unfair because they are levied at such variable intervals. One farmer will keep his water right for fifty years and then pass it on to his daughter who will pay capital gains tax. But in another case a farmer may only keep his water right for twelve years before passing it on to a relative.

I suggest an annual resource charge based on the capital value of the water right. As the value varies from year to year so it would need to be a rolling average. This charge would reimburse government for the management necessary to maintain a viable and sustainable river system.

Conclusions

Montana is suing Wyoming for reduced water flow in the Yellowstone river. They claim this is due to the use of more efficient irrigation such as drip being used in Wyoming. While it would be useful for the South Australia government to discover more about the arguments in the case I don't think that court challenges are an appropriate means of determining water policy. In Australia our tradition is to resolve these issues through the political process.

The two Acts I have suggested would go long way to resolving the current crisis. Of course there will be opposition but my experience as Minister has been that farmers are not as extreme as their lobbyists and have a good sense of their responsibilities as land and water owners and tend to use these resources in a sustainable manner.

Acknowledgements

I would like to thank Lynne Chatterton, Stephen Brichieri-Colombi and Chris Perry for their thoughtful comments on and
c
o
n
t