

**Submission provided by Barry Croke**

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Author's note: This paper has not been presented in the style of a scientific paper with extensive substantiating data. The author will respond to requests for such information.

## MURRAY-DARLING BASIN PLAN – IMPLEMENTATION REVIEW 2023

### SUBMISSION

This week I became aware of the Productivity Commission's (PC) May 2023 20 page document calling for submissions. A wet day provides an opportunity to address a few of the points the PC is intending to review.

My comments provide a quick 'kitchen table' commentary of observations that have been shaped by a career as an agricultural scientist, an educator, primary producer and irrigator for 50 years, together with office bearer in many professional and producer organisations (Appendix 1).

In motoring parlance the view comes from a 1941 model early classic that has been fortunate enough to have had detailed association with many facets of life in the riverine plain of northern Victoria.

#### **1. Language and accuracy in these comments**

Many of my comments relate to government departments and organisations and may well incorrectly attribute fine detail to responsibilities. The plethora of government organisations in this water space (e.g. Goulburn Murray Water, Department Land Water Environment and Planning and now DEECA, Catchment Management Authorities, Ag.Vic and at federal level MDB Commission and Authority, Productivity Commission, Competition Commission and the Department of Agriculture are just some of the outfits with interest in the topic.

In more recent years each of these government organisations seems to have become interested and anxious about their future, identity, role and authority from centralized bastions shielded by anonymous computer screens. This does not gain the acceptance of communities and the citizens they are supposed to serve. Increasingly citizen recognition of these organisations too frequently is from the perspective of threat and hopeful irrelevance. Certainly not conducive to willing involvement. We have created a two-fold problem.

Firstly that of partitioned considerations. Comment comes from separate bureaucratic groups in the context of their own aspects of the total issue without a structure able to view the whole integrated system. We can then be left with politicised statistics on integral parts, which if considered alone and modified, can destroy the integrity of production systems or even irrigation schemes.

Secondly there is the increasing problem of cultural difference. Too often staff and consultants representing agencies seem to come from another world. They are ignorant of the systems in which most regional people work and invest. These very occasional visitors face an enormous gap in understanding the local cultural drivers and have limited ability to fully understand perspectives. Inability to provide useful responses destroys their credibility.

I am mentioning this because government policies, particularly in the regions, are seen as increasingly remote and out of touch with the lives we lead.

Language reflects the different cultures and understandings in our society. The introduction and key questions on page 4 of the Productivity Commission May 2023 document serve as an example. The second paragraph states "The MDB Plan is about protecting and nourishing the Basin through floods

and droughts". The first reaction on reading this is how can there be any possible chance of the PC achieving a sensible review when they are so ignorant about the Plan.

There is no way I can accept that the Plan protects us through floods and droughts. The Plan has been irrelevant in my considerable experience of these events. Certainly creation and management of storage structures by agencies has some very small impacts but it is absolutely wrong to suggest some organisation can provide safeguards against more extreme events. The language is symptomatic of a group in society who expects government to maintain pleasant conditions each day. It won't happen on planet Earth.

The use of the verb 'nourish' to describe one of the MDB Plan's roles is simply preposterous. Nourishing is about food for life and growth. This food is the energy provided by food chains in our biosystems. This capture of solar energy by photosynthesis and the subsequent availability of sugars and carbohydrates is the food source that energizes life processes.

Most definitely the MDB Plan does not run these energy food chains. Admittedly the MDB Plan can be associated with an extremely small portion of the water used in photosynthetic systems with a terrestrial location. Again champions of the MDB Plan are deluding themselves seriously to make this claim and misleading in conveying an incorrect fact about Plan responsibility.

Obviously it is a worry when MDB officials and their associated groups live in another world where mental constructs of reality are removed from fact as I understand issues.

## **2. Targets and efficiency**

The PC seems intent on accepting the targets as an irrevocable truth. My considerable experience suggests otherwise and indicates realistic management of target volumes and their implications to communities in the Basin have never been properly analysed. This is not an argument for another day. It is a thorough analysis that has not even commenced, and perhaps there may be need for argument afterwards. However thorough analysis would obviate much of the argument.

The word efficiency is part of the MDB vocabulary. And it is a good concept if you know the numerator and the denominator. This can lead to all manner of sensible comparisons about resource use and the processes involved.

Repeated use of efficiency measures is nonsense if the words are never accompanied by the actual measures. At meetings I enjoy asking fellow participants what they are. Responses normally take the King's language to a lower level.

How can citizens in the Basin, let alone the majority who live elsewhere, talk sensibly about this concept when it is a mystery?

## **3. How can arrangements be improved?**

The PC would appear to be the appropriate group to consider my suggestions because it would seem to be interested in the overall picture of resource use in the Basin for the ongoing long term interests of our nation. Perhaps the following points about what we have learnt plus the need for risk analysis in regions could be considered.

### **3.1 What have we learnt?**

**3.1.1** On-going inequality in access to consumptive pool. Since circa 1994 Victoria has abided by the Basin's cessation of development and further allocations of water from the consumptive pool. Even a modest farm dam can be built only if there is purchase of High Reliability Water Share from the consumptive pool that is equal in volume to the dam's airspace.

We have learnt that this behaviour seems to be unique to Victoria when elsewhere unhindered development and capture of surface water proceeds. Even when detected there are numerous examples of illegal banks and dams not being decommissioned. The MDB Plan has earned a reputation of not providing a similar fair go.

The MDB Plan continues to disregard the discrepancy between the volume of the water entitlement (essentially airspace in a reservoir) and the volume taken from the consumptive pool. The stored volume transferred in a Victorian water account for next season has a water accounting loss of 5% applied (evaporation loss). However water delivered beyond the reservoir in a particular season will incur much greater losses. Most deliveries will be within the range of 50-90% of the volume released from storage. This delivery efficiency needs to be recognized according to actual performance. The present disregard of losses in delivery overlook a large volume of water and make MDBA overall accountability appear inadequate.

**3.1.2** Water Tariffs. Tariffs for irrigation water are State arrangements although they do include a small charge for the water storage in MDBA reservoirs. With the separation of water from land in 2007 the Victorian water tariffs were changed markedly. The major part of the annual Goulburn Murray Water (GMW) charges is Delivery Share (DS). The amount of DS reflected the property's water ownership pre 2007 (100 ML = 1 DS). Although water ownership was no longer tied to a specific land title the creation and existence of the DS was to represent a relationship between that original land parcel and the delivery capacity of the GMW channel servicing the farm. By according most of the water bill to DS, GMW were assured of a fixed charge that maintained their revenue irrespective of water delivered.

In the tumult of events like drought and commodity price depressions circa 2007 many irrigators either sold out or chose to use sale of a capital asset, water, to generate cash flow. Such sales were even encouraged by government departments.

Basin Plan policies which encourage "fire-sales" of irrigator's water are usually translated by bureaucrats into being the acts of "willing sellers". These "willing sellers" control the wisdom of interfering with an integral part of the region or irrigation scheme.

The consequence is that modernized channels (a \$2 billion project) now deliver much less water and there is the continued existence of the DS charge on that land. On our farm this was a \$55,000 p.a. cost. We sold our farm without the water and the new owner, who has changed enterprises to dryland cropping and cattle feedlot, still pays the DS charge and complains about what is effectively a tax to support an agency his business does not need.

With so much water having been sold out of the Shepparton Irrigation Region we now have significant areas of farmland burdened with this tax. This now unirrigated land is at a major

competitive disadvantage because of the charge, when compared to cropping country outside the irrigated region.

A simplistic solution would be for Victoria to declare the concept of DS invalid and revert to payments to water authorities being centred around delivered water volumes. This would work except for one basic fact – the water volumes are not in the region. Prior to the drought (2004-08) some 2000 GI was delivered annually and now our region might budget on around 600 GI annually. This 600 GI is perhaps optimistic as Basin policy is being geared to accessing more downstream deliveries to service permanent plantations whose water demands in anything less than an average year will see further significant water sales in both the temporary and permanent market.

The rejuvenated GMW delivery network has an outlook for significant underutilization, despite a recent upgrade in excess of \$2 billion. Downstream irrigator demand brought about by encouraging new irrigation development in the arid zone together with Basin Plan indications that perhaps 450 GI + 315 GI is to be withdrawn from the consumptive pool must imply serious issues for irrigators. How will the extensive GMW irrigation scheme be capable of being self-funded while delivering such small water volumes at an affordable price? Ultimately there will be few irrigators left using big water volumes. The GMW account holders will mainly fall into two categories.

- Owners of farmland that could be serviced by the GMW system who do not irrigate but continue to pay for Delivery Share.
- Households across northern Victoria who depend on the GMW channel network for stock and domestic supply.

As the delivery cost burden moves toward 'stock & domestic' customers the true cost of delivery (typically 1 or 2 ML/yr) will be well out of reach for householders. This will leave a serious problem for critical human water needs. For many decades in the past these critical human water needs have been heavily cross subsidized by irrigators. It is essential that the Basin Plan address this imminent certain dilemma facing delivery of 'stock & domestic' water.

It is easy for the MDBA or Commonwealth departments to dismiss water tariffs as a State responsibility. Indeed they are. But irrigation water tariffs are extremely complex reflections of the cost of a service that must accommodate prior land settlement policies, the human populations that were attracted to areas and the ability of farm land, through primary production, to generate community wealth that ultimately pays for the operation of a water delivery network.

Any MDB Plan is an integral part of the future of irrigation regions because the Plan's actions and encouragements are at the core of future water volumes that shape the tariff.

An irrigation region is a complex set of primary production systems where the components such as agronomic and horticultural skills, land, irrigation scheme infrastructure, water, product processing and markets are integral parts. Without any single part the irrigation region becomes ineffective.

### **3.1.3 Wastage of public funds – millions wasted because of imperfect systems analysis.**

Water policy associated with the Murray Darling Basin has wasted public money and the current MDA Plan seems intent in continuing to accumulate more wastage.

Some examples:

(a) Our farm received over \$600,000 from Canberra. Most was used on two projects; upgrading farm channels to 20 MI/d delivery capacity and on another part providing a piped extension from the backbone channel. Additionally whole farm plans were funded and excellent tax benefits were accorded to work done. Furthermore the GMW channels supplying our farmland needed several new automated outlets and new channel structures next to our farm costing well in excess of \$500,000 that were provided by the renewals program government funding of \$2 billion.

In the 15 years after 2000 we used well over a million dollars of our own funds to install centre pivot irrigators, laser grade and install 120 high flow bay outlets.

All this public and private expenditure which underpinned a highly productive farm is now redundant. Our former farm is now part of a 15,000 acre aggregation held by an investment group whose enterprise interests centre around appreciating land values, stripping properties of improvements, eg. sheds and equipment. Broadacre cropping and limited irrigation restricted to underground water exploitation rather the consumptive pool water administered by GMW and MDBA.

What has happened on our farm is not unique. A similar story now exists across several thousand hectares of country and with current trends is assured of continuing.

(b) In the early part of this century I was part of the committee which succeeded in gaining the initial billion dollars of Victorian money to upgrade a water distribution system that was unable to provide an adequate delivery service (timeliness and MI/d flow) and incurred delivery losses of around 30 percent of water released into channels. Following formation of the Northern Victorian Irrigation Renewals Program (NVIRP) I continued to serve on its various committees. With the further assistance of over another few million dollars of irrigator money collected by GMW the rationalized delivery system was upgraded to a standard that portrays world best practice and is capable of delivering over 2000 GI annually. It can do this with better than 90% deliver efficiency (water released into network : water delivered to customer) on one essential proviso. There must be a significant volume delivered to customers along each of these channels. Otherwise evaporation and seepage in underused channel pools becomes significant and together with conveyance losses to more dispersed customers can only depress achievable delivery efficiencies. At the heart of these efficiencies are the features of the MDB Plan which shape the volumes of available irrigation water.

As time goes on irrigators will disconnect from the system when they can afford to pay out their DS (ten times of the annual fee). Where possible irrigators are already showing a strong preference to exploit underground water reserves which will have another set of limitations.

It remains to be seen how historians will interpret these developments in a couple of decades. They have such powerful influences on our overall use of natural resources and the overall economic, environmental and social benefits that can be achieved.

The MDA Plan now has a framework of policies that disregard billions of recent dollars invested in irrigation infrastructure (scheme and on-farm), processing capability (eg. 50% underutilization of stainless steel), and community capability. Most importantly this exists in a temperate climate zone where a unit of water achieves greater plant productivity.

### **3.2 Risk analysis in Irrigation Regions**

Irrigation regions are complex production systems with several parts integral to their ongoing success. A literature review I completed forty years ago showed that over the last 2000 years the majority have failed due to reasons like infrastructure breakdown, salinity and associated drainage deficiencies, climate change and shifts in water availability, pest and diseases and markets.

Risk of failure is always a possibility. The benefit we have these days should come from better understanding integral parts well enough to evaluate risks in the system. Nowhere in MDA Plans am I aware of risk assessment associated with different irrigation regions.

#### **3.2.1 Opportunity for equitable water market participation**

The only factor recognized as a legitimate determinant of the fate of an irrigation region seems to be the way in which market forces operate in the water market. These can be relatively short term perturbations brought about when new developments encouraged by cheap land in the arid zone, taxation policies designed to attract investment and new age monocultures dependent on export markets. Whatever the actual nature of the new developments thorough evaluation of long term viability is rarely undertaken. The prevailing driver is financial outlook over about a decade and the opportunity for clever traders to take advantage of a relatively complicated water market and water ownership rules with sophisticated computerized equipment that can outcompete run of the mill irrigators.

Water becomes the pawn which is expertly manipulated in the market place to hopefully ensure the long term sustainability of many new developments which do not own sufficient water in their set of assets. Additionally these operators have access to finance to achieve success in the market place and are able to easily outcompete the financial resources of conventional farm enterprises. The market place for water now has players with quite different chances of success.

Intervalley transfers are an example of potential inequality. The MDB Plan allows big cashed up entities to acquire a water release in an instant. Staged releases with defined parcel sizes for water transactions could assist if numerous buyers were to acquire the smaller water parcels at the time of release.

#### **3.2.2 The past two decades in the Shepparton Irrigation Region**

Until about 20 years ago our region enjoyed the security of the 2000 GI that GMW seemed to be able to deliver. This water was allocated under the most conservative regime used in the MDB with no water beyond a set water right being allocated until the volume to satisfy next season's water right was in storages. In the 20 years up to 2000 our farm was able to access 200% of water right in just over 80% of years because of reasonable rainfall in catchments and because of many 'sleeping' water rights that were subsequently activated by water trading. In our region irrigation enterprises were developed with reasonable confidence that this would be the prevailing availability of water.

The five years of extreme drought with associated minimal value for livestock, minimal water availability and the extraordinary opportunity to trade on the temporary water market at ridiculous prices, was concluded in 2008 by a severe crash in milk prices and the consequent devaluation of fodder prices such as maize for silage. This extremely abnormal set of circumstances then had to accommodate water being traded out of the region.

Water trade, especially of permanent ownership of water share, to regions downstream was made possible by investors with success to finance (largely overseas) and able to forego the necessity of immediate cash flow needed by conventional enterprises. Owners of these troubled enterprises, by necessity, became “willing sellers” and for many it was an important crutch to prop up their exit from farming which assisted many aging owners but transformed districts.

A typical example of how the water market is drawing water out of the Shepparton Irrigation Region is provided in the following example. Page 29 in the May 3 Weekly Times advertises a typical arid zone permanent planting of almonds for sale. It has 733 ha of almonds, 314 ML of High Security Water and 3270 ML of General Security water. Assuming 20% allocation of General Security is available for a prudent planning year then the property’s water assets provided  $654 + 314 = 968$  ML. With a need for at least 10 ML/ha/yr some 6300 ML has to be procured on the temporary market and investors will pay dearly to use a variety of water market products (e.g. temporary purchase in season or by lease over a period, carryover capacity, right to store purchased water in the air space belonging to another water share owner). This water purchase assures the sustainability of their prior investment. It is in this scenario that a Shepparton Region irrigator who normally produces annual irrigated crops will sell a parcel of 500 ML for \$700/ML and have a year’s rest. The Productivity Commission must assess what this does for a region’s productivity.

The lesson from this experience is the damage done to the region due to loss of water, loss of economy of scale in a delivery system, write-off of expensive subsidized on-farm improvements. Another lesson is associated with environmental damage to rivers now required to carry extraordinary out of season flows to newly developed irrigation areas. Additional conflict is also developing as regionally funded irrigation channels are being required to assist to convey water to other regions without recompense from downstream irrigators in order to by-pass constrained sections of the rivers. These are the dilemmas which the MDB Plan needs to address in conjunction with the States.

The over-riding lesson is that sets of circumstances can now destroy the vibrancy of irrigation regions, take from them the confidence that underpins investment and cause enormous waste of prior investment in infrastructure and enterprise capital.

The MDB Plan shows no sign of providing stability when another cycle of difficult circumstances prevail. The notion of irrigation security is debatable. Policies that tied water to regions could achieve greater certainty, especially when storage volumes were associated with gazetted irrigation districts and access to storage volumes was able to provide for next year’s water allocation.

Our region, in which decades of irrigator experience with conservative Victorian water allocation policies, gave them a high degree of comfort. The region was lulled into complacency thinking their water share was being held in a manner similar to a prudent bank manager. We seemed to have a system that could alleviate the region of the extreme consequences of drought. The possibility of trading water out of our region, especially in times of small allocations combined with the urgency of downstream demand, had never been contemplated especially in circumstances of local drought and low farm produce prices.

### **3.2.3 Future projections for water in the Shepparton Irrigation Region**

It is an essential function of the MDB Plan to include detail analysing future water projections for our region that includes a range of scenarios. Each of these scenarios must include risk analyses that

examines a range of irrigated enterprises and must importantly assess the region's economic performance and the benefits of diversity in production systems.

The following fundamental observations have been used to outline an apparent framework within which this regions' irrigation agriculture will operate. Based on current plantings in the MDB and environmental allocations and catchment behaviour in the past decade it seems reasonable to predict about 600 GI annually would be used in this region rather than the 2000 GI of two decades or so ago.

The prediction takes no account of reduced water harvest in the catchment due to climate change influences. Nor have the MDB Plan's talk of an additional 450 GI being taken from the consumptive pool plus the possibility of some 320 GI having to be purchased by the government to compensate for works not done. Admittedly only a portion of this possible extra 770 GI would come from the Shepparton Irrigation Region. But because the southern part of the MDB is connected for trading purposes competition for water in the much reduced consumptive pool will become intense. Obviously the complexity of these yet to be implemented possibilities must be thoroughly evaluated before they are adopted. This analysis must take precedence over the MDBA apparent preoccupation with the deliverability of this water to lower reaches of the Murray. The MDBA's current approach seems to be prioritizing the possibility of conveying this water rather than establishing the social and economic wisdom of removing the water from regions in the temperate zone.

To return to the 600 GI scenario. This scenario will have greater seasonal variation for a variety of reasons; climate change, more intense market at the extremes.

The actual acceptance of 600 GI suggests the region has been coerced into submission. It is worth reflecting on what this means and compare it with various transects that could have been driven along in our region; Stanhope and Tongala, Katandra and Yarroweyah, Katunga to Katamatite East. A diversity of irrigated enterprises once lined these roads.

It is worthwhile pondering how much land could be irrigated with 600 GI in terms of 'square miles'. This example assumes 200 ha per square mile (261 ha) is irrigated and that the balance is lanes, channels, infrastructure. Irrigation water used at 8 MI/ha/yr would require 1.6 GI per square mile block. This would enable 375 such blocks to be irrigated. How does this relate to the transects previously mentioned? Well a 20 mile by 20 mile area would contain 400 such blocks. Wherever this theoretical irrigation area could exist in our region, it would be a miniscule blob on a map.

This consideration shows that the term Shepparton Irrigation Region may have become redundant. Another set of words will be needed to describe the largest "stock and domestic" system known.

The MDB Plan's risk analysis will shed light on the validity of the above.

### **3.2.4 Issues disregarded by current MDB Planning**

The overwhelming theme in discussions about water in the Basin seems to be predicated by volumes of water. The complexity of the system is disregarded, particularly the consequences of allowing the free market across regions for water. The Productivity Commission would be an ideal body to review the consequences of these significant shifts in resource usage.

(a) Scarce water for the Arid Zone or Temperate Zone?

In both these regions our perennial crops/orchards need to be supplemented with irrigation water. State Departments of Agriculture publish weekly precipitation and evapotranspiration (E/t) data that forecasts irrigation water needs for these cultures in the next week. When a 250mm rainfall zone is compared to a 525mm temperate zone, and is accumulated with E/t difference over a year, there is a variation of 6 ML/ha of irrigation water. It remains to be seen if the Productivity Commission will endorse the need for so much extra water being needed to achieve production in the arid zone.

(b) Conveyance losses and damage

The environmental damage and costs of river maintenance caused by high out-of-season flow does not attract quantitative analysis. The MDB Plan just seems to accept these are part of the business of achieving water market demands and so-called environmental flows.

Evaporation and seepage losses also remain unaccounted. Hard data is almost impossible to find. Specific examples suggest an extra 25% of water volume could be needed for arid zone supplies. Yet the MDB presides over a system where one ML at Albury is still 1 ML at Renmark.

(c) Energy costs

The MDB Plan does not consider how its policies have major influences on energy costs and carbon dioxide production. The MDB operate a system in which irrigation systems in the temperate zone mostly involved schemes that delivered water in gravity flow channels and for the most part provided this water to commandable land without pumping.

With the shift of water to the arid zone new developments are invariably outside these gravity flow irrigation schemes. Developers took advantage of cheap land and installed major pumping systems to bring water up from the river then transport it under pressure to fields. Pumping costs are one factor that become part of the developer's planning.

The fuel needed, and the consequences of burning it are really a system wide issue shaped by policy. Perhaps the MDB Plan considers carbon dioxide production to be a responsibility of individual irrigators using the simplistic approach of matching carbon offsets which have nothing to do with preventing carbon dioxide production.

A rough approximation of the fuel (diesel equivalent) to pump a 1000 Gl of water is somewhere between 40 and 60 ML of diesel. Electricity derived from fossil fuels is also another energy source used but requires significantly more carbon to be burnt to provide the energy at the pump site. Perhaps something in the order of half a million tonnes of carbon dioxide is generated in this pumping exercise.

The MDB Plan must address this situation if it is to be regarded as a responsible steward in our irrigation industries actions to address climate change.

#### **4. Climate Change**

For some reason climate change seems to have been an irrelevant issue to activities encapsulated in the MDB Plan. The range of implications is enormous yet we still seem to be operating in a planning environment that will not acknowledge reality.

Adaption to climate change presents a serious challenge because causes and effects cannot be precisely predicted. However the probability of various outcomes occurring can be established and will acknowledge a marked increase in the range of climatic conditions. Public discussion of the following needs to be led by the MDBA so people can better consider their options.

#### **4.1 Catchment performance**

Complex interactions of fire, vegetation type, storm intensity and frequency, seasonal pattern of water yield, are just some of the issues which will modify previous assumptions. The characteristics of a unit of Water Share will change because of these types of factors.

#### **4.2 Murray estuary**

Australian Government Antarctic Division is confidently suggesting a 820mm rise in sea levels by 2100. International predictions indicate much more e.g. long term impact of loss of Greenland ice sheet would lead to 7000mm rise. The maintenance and reconfiguring of a barrage system will become even more illogical when the natural system that ought to exist up to Wellington should characterize the esturine environment that existed pre 1939. This could save some 1000 GJ of current water losses and a fishery would soon develop. A logical policy for the Lower Lakes must be articulated in a MDB Plan.

#### **4.3 Plant performance**

Matters related to the impact of climate change on plant physiology underpin the agricultural systems. The enzyme enhanced activities in the biochemistry of plant cells have a particular temperature range and moisture requirements. Plant yields are the result of photosynthetic and respiration processes in plant cells. An extensive science now describes plant performance in a range of conditions.

The operational behaviour of plants most obviously related to water use concerns stomata. The varying turgor in stomatal cells regulates carbon dioxide and oxygen exchange in leaf cells and water vapour movement out of cells. Climate change, especially extremes in climate conditions, are now changing the places where given plant types are best adapted.

Agricultural science, rather than the short-term responses of the water market, should be having much more influence on where our nation deploys water for plant growth.

The MDB Plan talk about being guided by science is seriously misleading when their policies can obviously contradict what is known about efficient use of resources to grow plants.

#### **4.4 Environmental outcomes**

Natural ecosystems will have to adapt to changes in climate. MDB Plan statements seem to be predicated on achieving conditions once experienced at various locations to ensure ecosystems of the past prevail.

Those promoting an environmental allocation of water need to develop intended outcomes that leave no doubt that adjustments have been made for a new order. Volumetric allocations create major confusion in interpreting environmental outcomes. Our riverine environments have cyclic conditions (e.g. about every five years) dependent on location. Yet water is allocated annually. In fact surplus environmental water now confounds use of storage capacity reducing available consumptive water not just over a season but also at particular times in a season.

Hopefully the Productivity Commission can initiate discussions on outcomes rather than meaningless reference to volumetric share of water. Nature constantly evolves and we must have acceptable logic that describes why we allocate scarce resource to give an outcome in new ecosystems, as opposed to maintaining the past.

#### **4.5 Farm and Region productivity**

The extent of productivity achievement is determined by many factors in farming systems. The availability (excess through to sub optimal) of some 16 plant nutrients, frost at different physiological stages, temperature range (diurnal and seasonal), solar radiation, water availability and humidity, are some of the key determinants. One or more of these factors, together with plant genotype can interact with soils, insects, fungi, bacteria and viruses to determine the likelihood of achieving potential productivity. Climate change influences the above, and more importantly, is creating interactions which we are yet to fully understand.

The probability of achieving this potential will vary with location. Attaining achievement in an economically attractive system is even more difficult. When it does happen there is an apparent synergy when compared to less optimal combinations of determinants of productive success.

Australia has excellent examples of irrigation schemes/regions where at particular times quite variable productivity has been achieved. This submission cannot explore the vast literature on land utilization.

However the MDB Plan clearly ignores our experience of where synergies are more likely in the longer term and where regions can offer more diverse irrigated industries to assist them with occasional market downturns in some commodities to assure a better regional stability.

#### **Appendix (1) : Author's background**

Undertook B.Agr.Sci., Dip.Ed. and Dip.Ag.Ext. plus M.Agr.Sci. by research (Dependence of Irrigated Dairyfarming and Associated Industries upon Support Energy). Three years at Mildura followed by 20 years at Dookie Agricultural College (Senior Lecturer in Animal Production and Principal during the '80s). Fulltime farming ('89 to '19) involved self-funded growth from a small 40 hectare dairyfarm into a 480 hectare operation with 600 cows, winter cropping of wheat, oats and canola, plus summer cropping of 80 hectares of maize with an overall usage of about 1200 ML/yr of irrigation water. Several major on-farm trials were conducted with irrigation agencies and government departments to examine factors related to irrigation efficiency and nutrient management.

Publications include "Impact of Rising Energy Prices on Irrigated Agriculture and Horticulture" for the 1979 CSIRO Review of Energy and Agriculture.

Board memberships have included : Dairy Research and Development Corporation (7yr)  
Australian Food Ingredient Centre (3yr), National Irrigators Council (4yr), Murray Dairy (6yr),  
Irrigated Cropping Council (5yr).

Chaired : Murray Valley Water Services Committee, Northern Victorian Irrigators, Irrigators Australia Ltd. (predecessor of N.I.C.), Naringaningalook Irrigators, Northern Victorian Irrigation Renewals Murray Valley Modernisation Committee.

Currently member of Shepparton Irrigation Region People and Planning Integration Committee (9yr) and Broken River Environment Advisory Group (4yr)

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