SUPPLEMENTARY SUBMISSION NO. 164

Standing Committee on Agriculture, Fisheries & Forestry

Inquiry into future water supplies for rural industries and communities

SUPPLEMENTARY QUESTIONS FOR THE CSIRO

1. **Please expand on the assertion in your submission that future rural water supplies depend on an 'improvement in clarity and intent' by the States?**

   The context of this comment is the confusion and uncertainty that exists when one attempts to understand the principles that underlie the policies and regulation of water retention, use, re-use and conservation within the different States. For example, the policies and guidelines used for deciding the allocation of water access entitlements vary considerably between States (even where the same catchment exists). It is also not clear that there is a shared vision with respect to the priorities for water use with respect to human need, environmental need, economic use for primary production, secondary production, amenity and recreational use.

   - **How can the Commonwealth contribute to achieve this improvement?**

   This is clearly something that States need to undertake. The best that the Commonwealth can do is to act as a catalyst to encourage this improvement by:

   - Facilitating the process of reform by, for example, helping to establish and resource an inquiry into opportunities to improve the ways that water entitlements, water allocations and conditions associated with use are managed.
   - Through future CoAG processes, setting benchmarks for the definition of these arrangements and, if the Committee judges appropriate, making financial transfers to States conditional upon attainment of these benchmarks.

2. **How will the CSIRO's 'Healthy Country Flagship Program' contribute to the formulation of a national water policy?**

CSIRO's Healthy Country will contribute to policy formulation at levels from regional and thematic to State to Australia-wide.

Australia-wide, the entire Healthy Country Flagship is based on the concept of Water Use Benefits. It is likely that the Council of Australian Governments in the consideration of further water reform will emphasize the need for water accounts – that is, understanding water across the landscape and its uses.

To build on this emphasis, Healthy Country will demonstrate how, based on an understanding of use and the benefits gained or forgone from particular uses, better

decisions might be made. Water Use Benefits assumes that better decisions in allocation will be made if we have better information upon which to evaluate trade-offs. Water Use Benefits also assumes that decisions will be made in a community context, preferably through empowerment of communities with information and decision making roles. Both these assumptions underpin the direction and continuing progress being made on natural resources policy in Australia.

Healthy Country also provides input to policy at regional and thematic scales by focusing on key and tactical regional issues [Great Barrier Reef Plan, Perth and Wheat lands, Metro Sydney and Melbourne, Murray, Tropical Rivers] and integrating its work within the three broad themes of urban, irrigation and dryland/river.

At Attachment 1 is an example of Water Use Benefits activities based on the Murray node of Healthy Country
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3. What are the basic features of a 'healthy working river'?

A working river is simply a river that has been modified from its natural condition by human use. It is generally acknowledged that a working river in its best possible condition will not attain the full health of an unmodified river, commonly through a loss of biodiversity or ecosystem services.

- **What is the science underpinning this area?**

  The science of river health assessment is well established. Measurements of river health use indicators such as the shape of the river, sediment characteristics, habitat condition, water quantity (flow), water quality, biodiversity, and ecosystem processes such as primary production, energy transfer through the food web, system metabolism, and fish production. Comparing these attributes among rivers gives a scientific basis for determining river health.

  It has been suggested that a sustainable working river might have a maximum mean annual flow extraction not exceeding 33%, whilst a managed working river would have a maximum of 67% of its mean annual flow extracted. The scientific basis for such systems is relatively new, and there is a need for the percentages to be fine-tuned if this type of system is adopted.

- **How is the environment's optimal share of available water determined?**

  The optimum allocation of water for the environment is determined by the environmental objectives for a given river. Allocation is based on the timing, duration, frequency, variability and amount of water required, and includes both high flow and low flow periods. A number of scientific methods have been developed for determining environmental water allocations. The central element to these methods is identifying how to provide the water needs of as many parts of the environment as possible, within the constraints of water availability. Thus, the optimising process is based on obtaining the best

environmental result with the water available, rather than optimising the amount of water required to achieve specific targets.

Optimising water allocation to meet broad environmental objectives under different flow scenarios requires detailed scientific modelling with extensive environmental and economic data to identify the best outcome. In the absence of sufficient data, expert opinion is commonly drawn from scientists, managers and water users, but the level of certainty about the results depends on the amount of available data. Our ability to identify optimal allocations is limited by scientific understanding of the complexities of environmental water needs.

- **Should the environment have priority over other users?**

Australia has environmental obligations under the United Nations Convention on Biodiversity. Intergenerational equity in Australian river environments has diminished as a result of land and water use. The current decline needs to be reversed for future generations to inherit healthy rivers. There are warning signs in the form of increasing salinity, tree deaths, sediment accumulation, and increasing numbers of threatened species, that current use of some rivers is unsustainable. If the degradation cannot be reversed, then use of rivers may become unprofitable, with no revenue source to restore the environment. The cost of restoring rivers is greater than the cost of preventing degradation. The environment needs at least equal priority with other users to prevent river management from becoming a financial burden for future Australians.

4. Under what circumstances should water users be compensated for reduction in entitlement?

- Decisions about the payment of compensation involve complex considerations and political judgement. Conceptually, compensation is payable either for breach of a contract or a duty of care. A case can also be made for the payment of compensation in situations where financial or social hardship is involved.
- Payment of compensation to people who, as a result of a risk they have taken, do not become as wealthy as they had aspired to become, occurs but is difficult to justify.
- There is, as expressed in the fine print of the OECD definition of the Polluter Pays Principle, a case for the provision of transitional assistance when this results in a speedier transition than would otherwise be the case.
- Applying these concepts to the current water debate, a case could be made for paying compensation when:
    - a government has clearly breached the intent of a water licence; and
    - on the grounds of the fact that a government has a duty not to over-allocate a resource for reductions needed because at an earlier time more licences were issued than was known to be sustainable;
    - when an administrative error has been made.

- A strong case can also be made for significant transitional assistance when, as a result of the rapid emergence of new understanding, it is decided the most appropriate form of change is a rapid one. Much of the past legacy that we are now dealing with is due to ignorance not mismanagement.

5. Do we need to radically change land use practices in order to achieve sustainable water resources?

Yes. There is no doubt that changed land use and its attendant change in vegetation and ground surface condition during the last 200 years has changed the balance in hydrologic processes. In turn, the quantity and quality of water reaching our storages and rivers has changed. In catchments, the most obvious indicators of changed condition are increased salinity and increased turbidity. In most river reaches, the effects of changed river flow conditions leads to increased bank erosion while grazing and poorly controlled developments next to rivers, on the flood plain and in riparian areas causes loss of habitat, and increased sediment load (turbidity). The other element of changed hydrology resulting from land use change is associated with changed groundwater recharge and discharge. Increased recharge as the result of reduced evergreen vegetation cover changes the groundwater equilibrium causing more discharge. This discharge is almost always more saline in the old soils of Australia and is the major driver for dryland salinity. Rivers and water bodies are almost always the recipients of this increased salt load.

Engineering options such as diverting major salt sources and pumping intercepted groundwater is one way of treating the symptoms. Treating the cause involves changing land use and in particular the vegetation type and pattern.

The comments above focus primarily on the supply and catchment component of water quantity and quality. Water availability and its condition are also strongly influenced by water extraction and drainage returns from irrigated areas. Land use change that brings about decreased use of irrigation water per unit of profitable production also has the potential to increase the quantity and quality of water available for other uses.

- **How could that be done?**

Addressing the cause of saline discharge and its driver, increased recharge from changed vegetation water use, means increasing the proportion of perennial evergreen vegetation on the landscape. Evergreen tree cover as well as perennial shrubs and grasses can all be part of the solution. Bringing about this change while preserving the opportunity for land users to manage profitably will need new and innovative solutions.

Currently we do not have comprehensive, tested land use solutions that can be recommended for most localities. We do have some insights, tools and measurements to guide necessary developments. There is some evidence that we can double productivity in selected areas and so provide the opportunity to reduce the area of currently unprofitable and environmentally damaging land

use. However, to develop this, adapt and innovate for a better water future requires commitment to research and testing at a collective scale that is extremely difficult under present funding, administrative and planning arrangements.

- **What savings could be achieved from irrigated agriculture?**

Prior to the introduction of water trading in the mid 1990s, there was evidence to suggest that a 10% reduction in water supply to almost any irrigation area in southern Australia would cause little decrease in productivity. Now, with the increasing realisation of the value of water, surplus water is increasingly traded and the window for reduction in supply to not effect production is rapidly closing. This statement assumes that delivery and farm application systems remain the same. Indicative evidence from the extensive range of current practice suggests that it would be possible to achieve 20 to 50% reductions in water use per unit of production for many commodities **provided** delivery losses are decreased, more controlled forms of irrigation **and** skilled management were employed. The limitations to realising these levels of reduction are the capital costs of new systems, the increased operating costs and the need to increase management capability. Accompanying this is the need to retain the "saved" water for environmental or other use. If this retention is not done explicitly, any "saved" water will be used to increase the intensity and/or the area of irrigation.

While there is certainly opportunity to decrease irrigated water use per unit of production in all commodities, being able to do this in a cost effective way is much more difficult. Rather than having a diffuse and loosely directed strategy to reduce current water extraction in stressed river systems, it may be more cost and water quality effective to reduce water use in selected areas where the prospects of improved productivity are low and the environmental effect of current and continuing irrigation practice are high. The physical, social and economic adjustment that this would entail would be politically challenging, but the net benefit for sustainable water supplies may be better than blanket actions. More analysis is needed to assess the merits of the different approaches.

6. What research is currently being undertaken by CSIRO into climate systems and their impact on Australia?

Research into the climate system and the impact of the climate system on Australia is the focus of a new CSIRO Climate initiative that integrates the climate research across 13 Divisions in CSIRO. The research themes include:

- Impacts and adaptation: this Theme is outcome-focused, delivering integrated assessments of likely impacts of climate change (greenhouse) and climate variability (droughts and floods) that provide policy options for public and private sector decision makers in key agricultural, water and other sectors.
- Mitigation: also outcome oriented, this Theme delivers options for both land-based (forestry/agricultural) and industry (combustion and automotive

technology, end use efficiency, etc,) technologies to deliver wealth and social outcomes whilst reducing greenhouse-gas emissions to the atmosphere.

- Forecasting: use of advanced natural and social systems modelling to provide targeted forecasts of the impact of greenhouse gas scenarios on selected energy systems options, and/or the impact of year-to-year and decadal climate variability and change on industry sectors.
- Enabling science leading to the development of new highly integrated methods for providing policy options for industry and governments that overtly reflect the trade-offs between wealth, social, environmental and inter-generational outcomes; Sustainability Science.
- Enabling science that underpins the further development of Australia's leading edge climate and weather modelling and forecasting capabilities for application in the above Themes.

The impact of climate on Australian water resources is a central theme in the Healthy Country Flagship (10 times increase in social, economic and environmental benefits from water use by 2025). Healthy Country is focussed on four regions, the regions of North Queensland bound by Great Barrier Reef, the Murray-Darling Basin, south west Western Australia and the Melbourne mega-metropolitan region.

The current CSIRO investment in CSIRO climate research (incorporating the climate science, impact, adaptation and energy components) is estimated to be about $40M, while the initial CSIRO investment in the Healthy Country Flagship is of the order of $16M in the current financial year.

7. What is the likely impact of global climate change on Australia's water resources?

The impact of climate change on water resources is likely to lead to increased water stress as a result of both an anticipated decline in precipitation for much of the country over coming decades and, more immediately due to the impact of already higher temperatures on evaporation. Although increases in stream flow are possible in northern Australia if summer rainfall increases, decreases in stream flow seem likely for southern Australia. Estimated changes in stream flow in the east-central Murray Darling Basin range from 0 to –20% in 2030 and +5 to –45% in 2070. This would result in sharpened competition between different water users. Low volume flows are the most sensitive to these changes.

In south-west Western Australia, a further reduction in rainfall would aggravate existing impacts of a lowered precipitation rate and stream flow, adversely affect water supplies for both agricultural and urban communities. Reduced rainfall in the south-west of Western Australia and the Murray Darling Basin would reduce recharge to ground water, limiting this as a resource but thereby slowing the onset of dryland salinity.

More frequent high-intensity rain in some other areas may have some benefits, contributing to ground-water supplies and filling dams but would also increase the risks of flooding, landslides and erosion, particularly in catchments with urban development (www.dar.csiro.au/publications/projections2001.pdf).

- **With what degree of certainty can these forecasts be made?**

Climate change projections (or 'scenarios') are not forecasts. Rather, they constitute a set of plausible futures. The levels of confidence that can be ascribed to these scenarios vary from place to place, and with the size of the region(s) of interest. They also vary with time as new knowledge and greenhouse gas emission projections become available, and the performances of global and regional climate models improve.

Recent state-of-the-art versions of CSIRO climate models represent the features of the current climate systems with a high degree of precision. This leads to confidence in projections of change resulting from changing conditions that influence climate (eg the amount of greenhouse-gases in the model atmosphere). Uncertainties about future human behaviour and thus greenhouse-gas emissions, and shortcomings in climate modelling are included in the ranges quoted in the CSIRO climate projections on water resources. The uncertainties in greenhouse-gas emissions are subject to uncertainties concerning population growth, technological change and social and political behaviour.

Rapid climate change or step-like climate response due to the enhanced greenhouse effect is possible but its likelihood cannot be defined because it is outside the ranges of the predictions.

- **What further research needs to be done?**

The regions where further research is required are those areas identified by the CSIRO Climate Program that also provides the underpinning for the climate applications in Healthy Country. These are:

1. Improved climate science to provide predictions of change at the regional scale and reduce the uncertainties in climate predictions.

2. To date, most studies have focused on surface water yield from individual catchments. More whole-of-basin studies that encapsulate the complexity of water supply systems (multiple sources and uses of water), their operation, and patterns of water use are required.

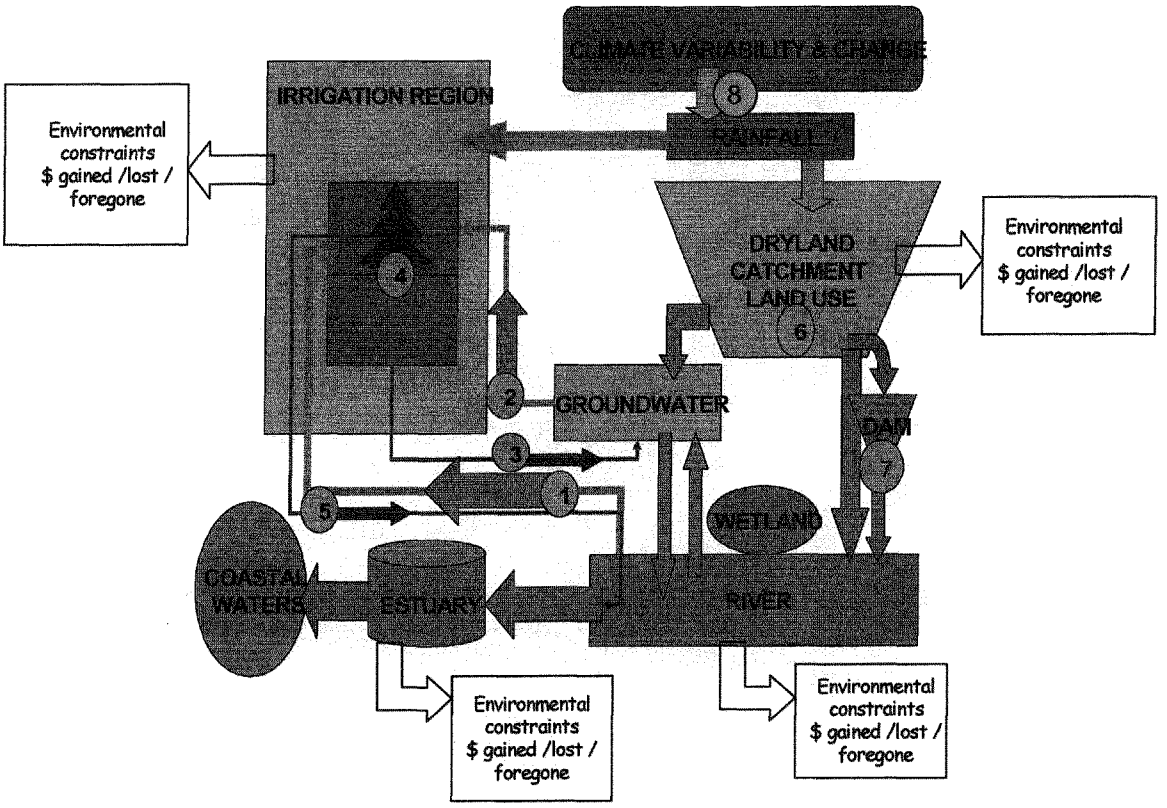
3. Objective studies of adaptation options (eg modified operating rules and/or new water re-use schemes) that consider their acceptability, costs, benefits, side effects and limits are needed. This work must be done in close collaboration with stakeholders and must consider the entire range of environmental problems that afflict region(s) of interest.

Attachment 1: Water Use Benefits and the Murray – investment to:

- Demonstrate Water Accounts in action – a key likely requirement of CoAG II Water Reform
- Rapidly implement the Water Use Benefits system based on these Water Accounts across economic, ecological and social values
- Increase community engagement and ownership of the accounting and benefits systems as a key input to decision making

A systems approach underpins the consolidation and enhancement of the Healthy Country River Murray portfolio

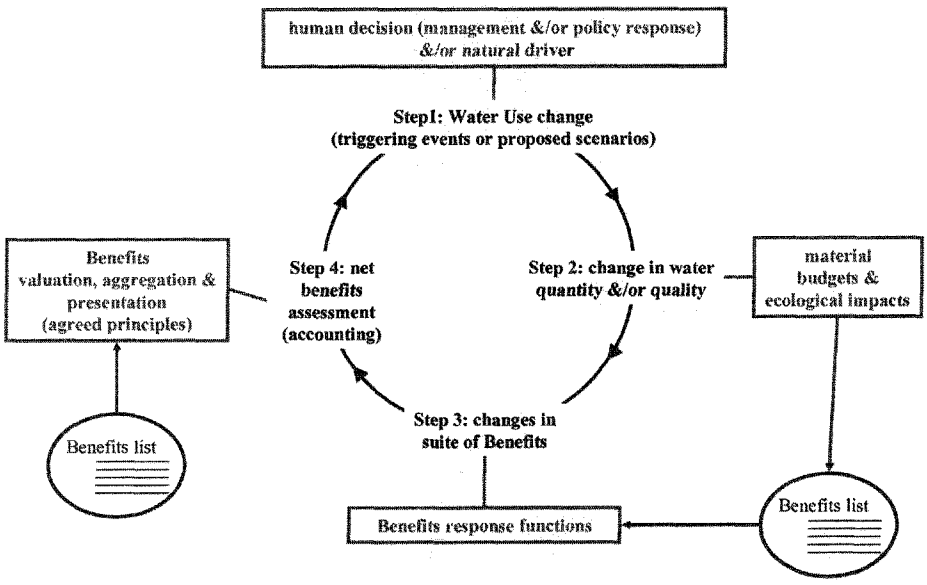
Figure 1 : Conceptual framework showing primary intervention points (#) controlling the generation of Water Use Benefits



The Healthy Country Water Use Benefits framework illustrates integration of decision making, system response and benefits based on water use accounting. The science provided by Healthy Country of systems response, prediction and benefits accounting will:

- demonstrate Water Use Accounts as are likely to be part of CoAG II policy and
- from this base develop Water Use Benefits as a science based system of information to foster improved community decision making.

Step 1: A change in management or policy is seen to drive a change in (*Step 2*) the quantity and/or quality of water and the ecological consequences of the change. *Step 3*: The relationship between the benefits declared as important within a particular system and the quality and quantity of water are defined. These are termed the benefits response functions and are based on water use accounts. A change in water quality or quality in a particular part of the system can then be translated into a change in the benefits. *Step 4*: The overall system response is then determined through a set of principles agreed by the participants. This net response may then lead to another shift in the policy or management, and so on.



Existing Investment: The River Murray Systems project aims to demonstrate how greater benefits can be obtained from wise water use by articulating landscape and river management policy opportunities. This information can then be used for informed trade-offs by the various communities within the basin. The project aims to quantify water benefits in the water benefit accounts framework by drawing together and integrating models of landscape and river behaviour, biodiversity, and social and economic behaviour and response. A social underpinning to the work is essential to ensure community input to the process and continued interchange of ideas and understandings between scientists, policy makers, community and managers.

The Murray is at the forefront of water policy development. *Living Murray* is testing community understanding and acceptance of water reform and progress towards whole of landscape style management. CoAG Water Reform II with its likely requirement for water use accounts will accelerate the processes of change and make it even more imperative that CSIRO's investment in water use benefits is rapidly and comprehensively implemented both technically and with the community's support and interaction.

The Healthy Country opportunity for partner investment provides for a more whole of landscape assessment that flows back to increased effort required within this integrating project.

Our Vision: To provide for the first time a comprehensive and qualitative biophysical and socio-economic model for water use benefits for the Murray based on landscape scale water

use accounts. To apply this model to quantify specific benefits and predict how they might be affected by management actions or policy, thereby quantifying the trade-off opportunities for communities. This information will lead to more soundly based sets of policy options and then decisions at scales from local to regional to Basin wide.