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The Murray-Darling Basin

Wendy Craik

Paper prepared for presentation at the “Water For Irrigated Agriculture And The Environment: Finding a Flow for All” conference conducted by the Crawford Fund for International Agricultural Research, Parliament House, Canberra, Australia, 16 August 2006

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SESSION: BALANCING THE DEMANDS FOR AGRICULTURE AND THE ENVIRONMENT: WORLD BEST PRACTICES OR DISASTERS?

The Murray–Darling Basin

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Introduction

Everybody who comes from Australia knows a lot about the Murray–Darling Basin (Figs 1, 2). The basin is located in the south-eastern corner of Australia, covers 14% of the country — a million square kilometres — and has only two million people.

It is, however, very important economically. It produces something like 40% of the value of Australian agricultural production and about 70% of irrigated agricultural production, which leads to a lot of food processing and manufacturing. It is also important for tourism, for the environment, for rural communities and for mining. The environmental area is particularly significant: the basin has 16 RAMSAR - listed wetlands and a number of world heritage listings as well. There are two major river systems — by world standards — in the basin, the Murray River and the Darling River. Average annual long-term run-off is about 24 000 gigalitres (GL) and average annual diversions are about 11 000 GL — but I emphasise these are long-term averages.



Figure 1. The Murray–Darling Basin

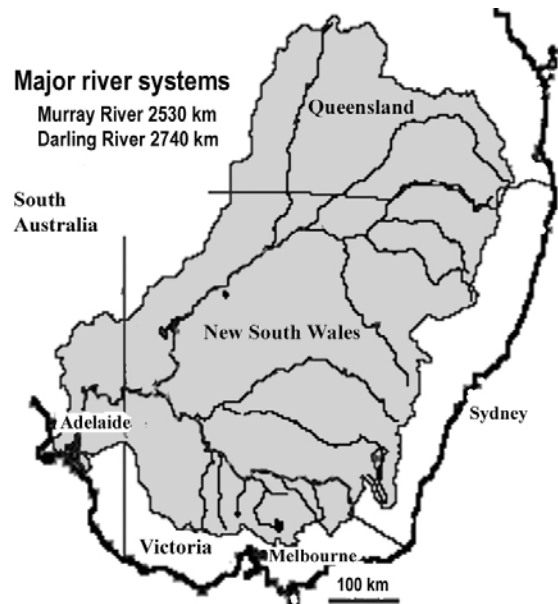


Figure 2. Snapshot of the MDB. The average annual runoff is 24 300 GL; average annual diversions are 11 400 GL

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The MDB Agreement

An intergovernmental agreement covers the area of the Murray–Darling Basin. It has a number of features which provide a useful arrangement to work with. The Agreement covers all six jurisdictions that have an interest in the basin. It is on-going: it has no termination date. It has rules about water sharing, cost sharing, construction of infrastructure, about management and about consultation.

The River Murray Waters agreement was first put together in about 1915 after some 22 years of negotiation. It has obviously gone through amendment and additions, but the fact that it is such an enduring agreement indicates that it actually works. The charter of the Commission and the Ministerial Council is:

to promote and coordinate effective planning and management for equitable, efficient and sustainable use of land, water and other environmental resources.

Most of our focus these days is on the shared water resources and the issues that are going to affect those resources.

The structure of the Commission and the Ministerial Council (Fig. 3) is necessarily complex, as six governments are involved in the basin. All six have an interest in the Commission and its structure. The Ministerial Council has up to three ministers from each government, representing land, water and environment.

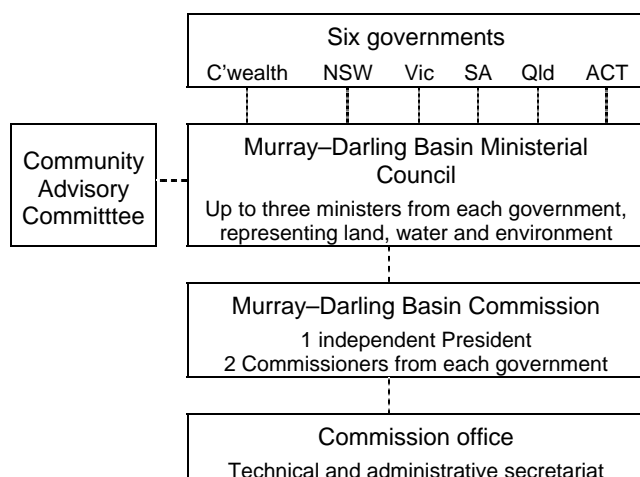


Figure 3. Our organisation

The executive arm is the Commission itself, which has two commissioner from each jurisdiction, an independent president, two deputy commissioners, and the Commission office that I head up to provide the technical and administrative secretariat. The Ministerial Council has also established a community advisory committee of 20–25 people who provide advice directly to the Council.

The organisation, in an Australian context, is unusual in that it is not a straight government department nor a statutory authority, nor does it fit under Corporations Law, so we experience the pluses and minuses of not having the normal framework of most government organisations.

Every state manages its natural resources in the way that that state thinks is best (Fig. 4) — and water is no exception. Our challenge in the Commission is to harmonise those different ways for the best common outcome.

Variability

I wish to point out how the Murray–Darling Basin relates to Australian water resources as a whole, and the wider world. The basin has only 6% of Australia’s surface run off, but it supports 70% of our irrigated agriculture. Most of our water is in northern Australia, where little is tapped for agriculture.

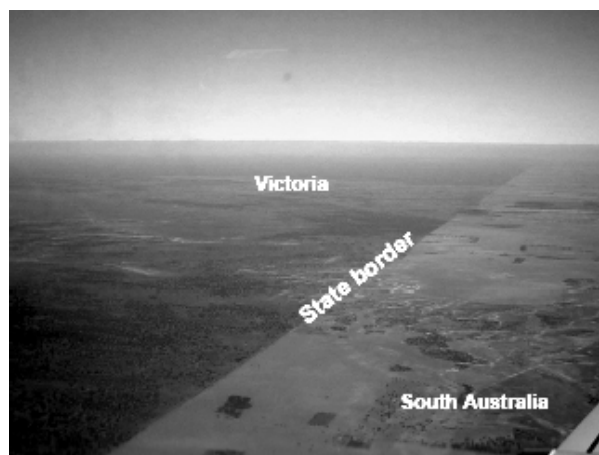


Figure 4. The consequences of differing administrations are evident in border areas

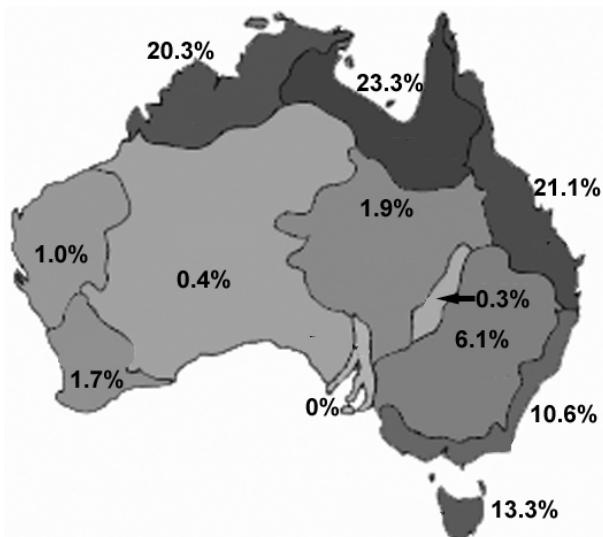


Figure 5. Distribution of Australia’s surface run-off. Note the variability, and compare the Murray–Darling Basin with northern Australia

Table 1. The ratio of maximum:minimum annual flows of world rivers

Country	River	Ratio
Brazil	Amazon	1.3
Switzerland	Rhine	1.9
China	Yangtze	2.0
Sudan	White Nile	2.4
USA	Potomac	3.9
South Africa	Orange	16.9
Australia	Murray	15.5
Australia	Hunter	54.3
Australia	Darling	4705.2

Figure 5 illustrates the great variability within Australia, while Table 1 demonstrates how variable Australian rivers are compared to other major rivers of the world.

The ratio of maximum to minimum flow of many of the major rivers is around 2:1; the Orange River in South Africa is similar to the Murray River with ratios of about 15; but the Darling River, with a ratio of nearly 5000:1, is either boom or bust. So variability is a real challenge for water resource management in Australia, and of course that variability is a function of rainfall. As well as having geographic variability in rainfall throughout the basin (and of course Australia), annual variability in rainfall is very significant (Fig. 6). Climate change may add further to the variability already recorded in the system that we have to manage.

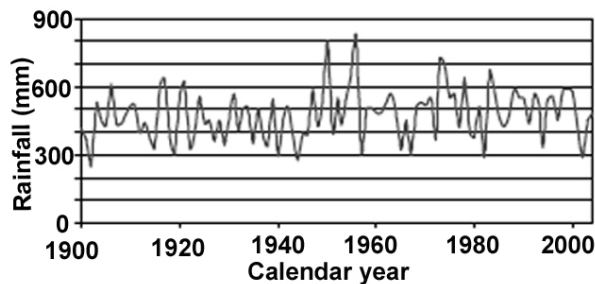


Figure 6. Annual rainfall averages

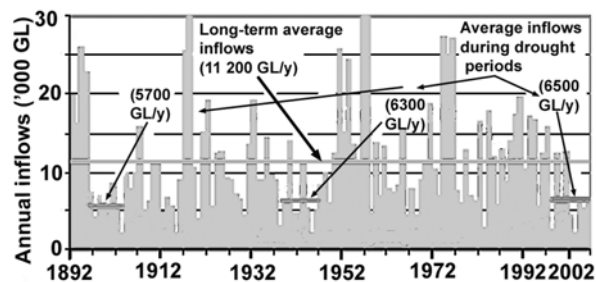


Figure 7. River Murray inflows, including the Darling River

The variability in rainfall obviously leads to variability in inflows. Figure 7 shows inflows — including those of the Darling River — over the last 110 years for the Murray River. The long-term average inflow for the Murray is about 11 200 GL a year. The low histograms on the left of the graph reflect the Federation Drought, at the turn of last century, when average inflow was about 5700 GL a year. In the current drought the average inflow has been about 6500 GL a year (see the right-hand side of the graph). So the inflows we are experiencing now are about the same as they were at the time of the Federation Drought. Of course it is important to point out that at the time of the Federation Drought there was nothing like the water diversions that we now have on the river. The question that we are starting to ask ourselves is ‘Is this figure of about 6000–6500 GL a year a new annual average inflow that we should be working around, or should we still be using the long-term figures that we have — are we really moving into an era different from the period that we have based most of our work on?’

Agriculture and water availability

Obviously variability in rainfall and consequently in inflows into the Murray leads to variability in water allocations to irrigators.

Figure 8 illustrates the effect of variability in water allocation on a crop that is particularly sensitive to water availability — rice. The black line shows the water allocations on the Murray from the early 1970s up to the present time: in the last 5–10 years allocations have been a lot lower than they were previously, and rice production (the grey line) reflects that.

How is agriculture as a whole in the basin affected by water availability? Figure 9 shows the total area of irrigated land in South Australia, Victoria and New South Wales. We don't have very good data on areas irrigated in the basin alone, but since the basin contributes something like 70% of the irrigated agricultural production the figures shown are a good indication of the relationship between water availability and production. The area of irrigated land in the three Murray states has decreased a bit since 2000–2001. The 'water use' line is total groundwater and surface water extraction in those three states in the Murray–Darling Basin in those particular years.

Clearly we need to get better data on the precise area of irrigated land, but I do think this figure is indicative. It does show that farmers are actually taking out and perhaps using less water per unit area, suggesting increased efficiency.

The major use for irrigation water in Australian agriculture is for grazing: about 30% of water extracted.

The evolution of management

At about the turn of last century, the time of the Federation Drought, there was conflict between the states about use of the river — mainly over navigation rather than irrigation, though irrigation did feature. Then the River Murray Water Agreement was signed in 1915, really setting up arrangements so that development of the river could occur — we got infrastructure built on the river and all the water-sharing rules.

From about 1920 until about 1980 development proceeded along the Murray River: the Hume Dam was completed in 1936; the upstream Dartmouth Dam was finished in 1979; lots of weirs and barges were built. Over that same period, and particularly in the second half of it, the amount of irrigation diversions — water extracted from the river — increased throughout the length of the river.

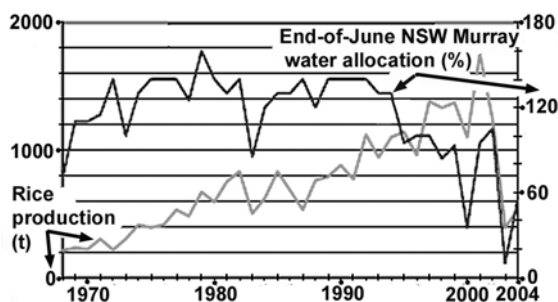


Figure 8. Water allocation vs rice production

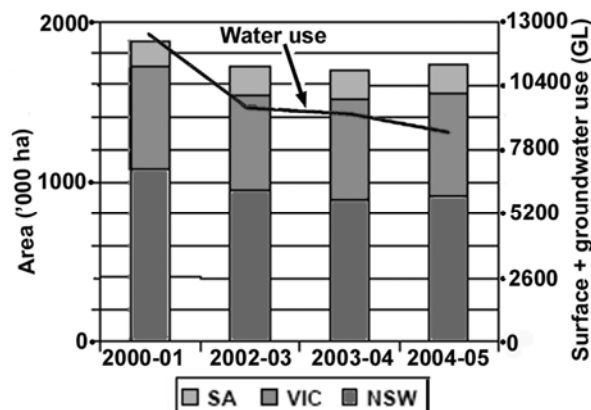


Figure 9. Water use and irrigated land

A broader view

In the 80s concern grew that in addition to the river itself it was essential to extend management to the surrounding catchment. Thus a catchment-based approach was adopted, and in the 1980s and 90s the salinity and drainage strategy was developed. In another catchment-based initiative, we limited surface water diversion by the 'caps' from 1993–94. Concern about river health increased in the late 1990s and early 2000, leading to the development of the 'Living Murray' program under which governments allocating some \$500 million to recover water for the environment and about \$150 million for infrastructure to facilitate that.

Now, beyond 2000, we are still trying to implement the Living Murray and The Cap in all our states. However, there are other risks to the water resources in the basin, and thus risk is a major program now.

What's going to come in the future? Variability is a really key issue in managing the water resources of the Murray–Darling Basin.

Figure 10 is a useful basis for discussion. The dashed line across the middle shows the average annual flow of all the rivers in the basin — 24 000 GL. The lumpy black line that climbs its way up the page is the growth in capacity of major storages in the basin that I mentioned in that period of development of the river — there has been a significant increase in storage. The short broken grey line up the top indicates how much private water storage has added to the major facilities. I suspect that a fair bit of that ‘new’ private water storage is actually a consequence of records catching up with reality, rather than a lot of new storages on farms. The black line at the bottom shows how the growth in water storage is paralleled by the growth in diversions from the river. In this country our storage capacity is about one-and-a-half times the average annual flow of all the rivers. That is not the case of course in places like Europe, where flows are more predictable.

Commission programs

The programs of the Murray–Darling Basin Commission are:

The Cap

The Cap has delivered by limiting surface water diversions. Figure 11 shows the growth in irrigation diversions from 1920 to about 1990. The dotted line that continues on from that shows what would have happened if a limit, ‘The Cap’ line, hadn’t been put in place. The Cap, which is about 11 000 GL a year, was based on 1993–1994 levels of development.

It wasn’t based on the amount of water that was left in the river for environmental sustainability; it was based on the levels of development at the time. The Cap is independently audited each year. It has provided security for irrigators and their entitlements and of course some security for water left in the river.

Basin Salinity Management Strategy

The Basin Salinity Management Strategy is trying to prevent the river getting saltier. We have a target: just over the state border in SA at Morgan we are trying to keep the water in the river above the standard required by the World Health Organisation for drinking.

We have put in place a number of salt interception schemes to pump salty water out and evaporate it,

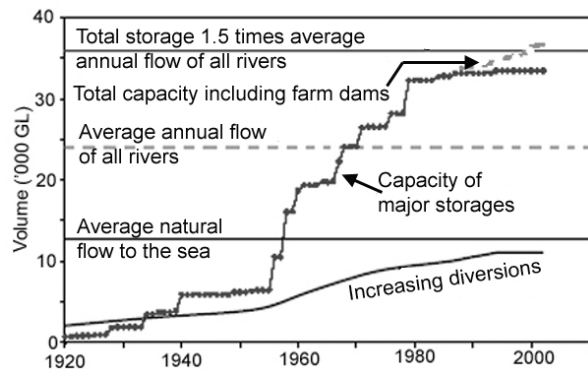


Figure 10. Storage capacity and diversions in the MDB

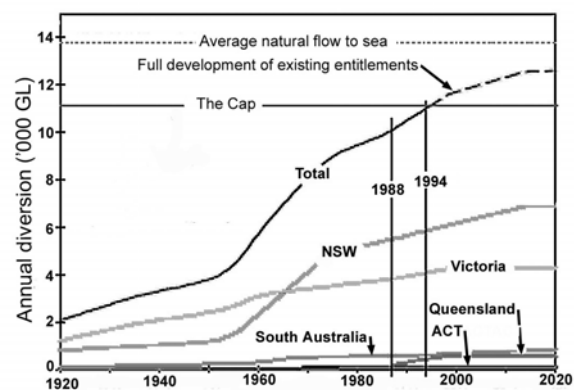


Figure 11. The Cap. The only way for new development is through using existing entitlements, whether through trade or water savings.

and also catchment strategies to change land use to reduce salinity. One fortunate aspect of a drought is that salinity in the river has actually been very low; salt is locked up in flood plains. If we get a large flood, we can expect to see salinity in the river climb quite significantly as that flood recedes.

Native Fish

The Native Fish Program is about restoring native fish population to 60% of pre-European levels. We are putting in what might be known colloquially as fish ladders so that fish can pass through locks and weirs, and re-snagging rivers — having taken all the logs out — to give fish places to breed, and trying to get rid of carp.

The Living Murray

The Living Murray is all about restoring the environment.

For the Living Murray program, six icon sites have been selected in the MDB. Figure 12 shows the locations of five of these; the sixth is the Murray River channel itself. And as I've mentioned, governments have given \$500 million to recover water — either through infrastructure improvements or by purchasing water or efficiencies — for very specific objectives at those sites. For example, we will try to keep the Murray mouth open, to reduce mortality in the red gum forests, to improve colonial bird breeding percentages and to restore fish populations. So far we have projects that will recover about half of the target volume water, 500 GL, but of course given the drought we haven't actually had a lot of that water to do anything with yet. The other aspect of the Living Murray program, however, is using the water that we have more efficiently. With very small amounts of water we've already been able to do a fair amount of flooding of red gum forests and undertake allied activities at those sites.

As well as the \$500 million, there's \$150 million for structures, and recently the Commonwealth government gave us another \$500 million of which about \$100–150 million is for environmental works and measures; and about \$200 million for water recovery.

Sustainable Rivers Audit

We've started very recently a Sustainable Rivers Audit, which is a snapshot of things like fish and macro-vertebrates across the basin. This entails sampling a whole range of rivers over a short period.

Water Trading

The Water Trading program is fostering harmonised water-trading arrangements.

Figure 13 shows the growth in water trade since about the mid-80s. The upper grey line is within-state trade on an annual basis, and the one just beneath it is again intrastate but it is permanent trade. The two lines down the bottom indicate that interstate trade has only just got off the ground.



Figure 12. The six ecological asset management plans are for:

1. Barmah–Millewa Forest
2. Gunbower, Koondrook–Perricoota Forests
3. Hattah Lakes
4. Chowilla Floodplain (including Lindsay–Wallpolla)
5. Murray Mouth and Coorong and Lower Lakes
6. Murray River Channel

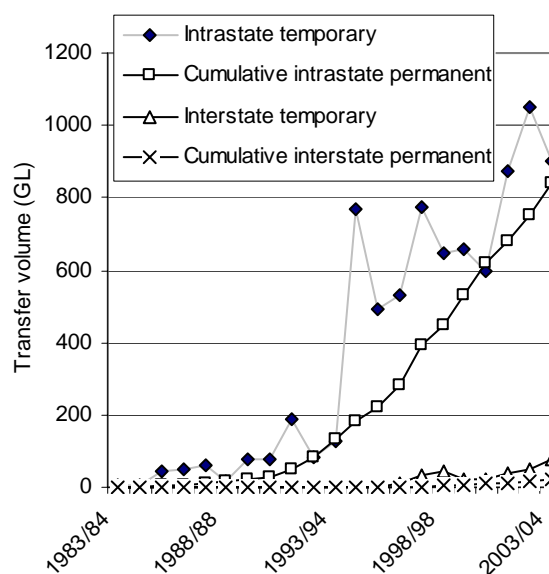


Figure 13. Water trade

The peak in temporary intrastate trade in 2002–2003, when there was severe drought, was very important in getting people through that drought. The Productivity Commission has estimated that trade reduces the impact of drought by about 50%, which is quite significant. The Bureau of Transport and Regional Economics has said that in the area below Swan Hill, where we're running a pilot study on permanent interstate trade, the capital in-

vestment in Sunraysia in irrigated agriculture increased over a period of 10 years by nearly \$500 million, and the capital investment in food processing was up \$300 million. So trade has a very beneficial economic effect. About 1000 GL a year are traded on a temporary basis; this volume could be considerably larger.

Risks to Shared Water Resources

Our newest program is on Risks to Shared Water Resources.

We've identified so far six risks (Fig. 14) to surface water resources, of which climate change is the most significant in terms of likely impact, followed by farm dams. Of course most of these risks are interlinked: they don't operate independently. Although assessing the magnitude of those risks is difficult, the figure is based on best estimates by CSIRO, using the information that we have at the moment. These estimates will change as new information from continuing work becomes available.

Some estimates of the possible effects of climate change may seem small in the short term, but in 50 years time they can be quite significant — for example, in possible reductions in streamflow.

As The Cap came into place, and during the drought, groundwater extractions have of course increased (Fig. 15). The linkage of groundwater to the river leads inevitably to an impact on surface water flows, and of course we're monitoring that.

A systems view is needed

We need to understand the various linkages to develop policy options to deal with the issues of basin management. For example, we can't just look at risks in isolation. While the contribution of each of the six main risks to individual catchments within the basin can be summed to estimate the total impact of those risks on the water resources of the whole MDB catchment, some risks do vary significantly between catchments — so we need a good understanding at that level. I must again emphasise the importance of a systems view.

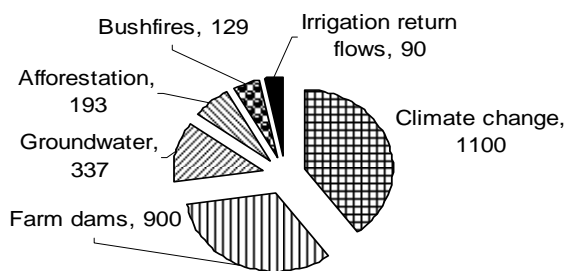


Figure 14. Shared water resource at risk. The best estimate in gigalitres of the impact of the six risks on total Murray–Darling Basin surface water (24 000 GL) in the next 20 years.

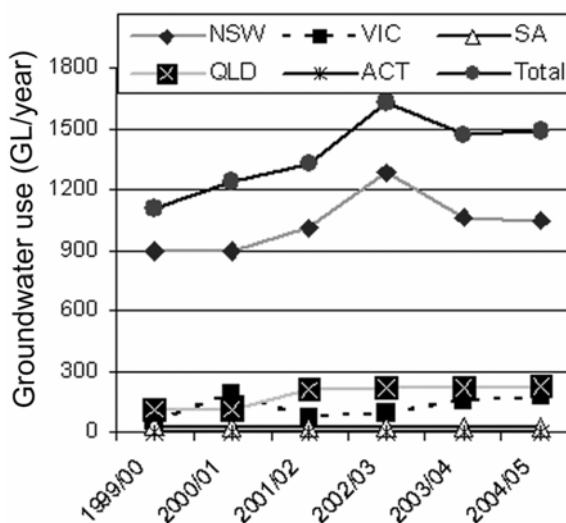


Figure 15. Groundwater use in the basin

Major challenges

Finally, what are the major challenges? Clearly coordination between the six governments is the challenge. It's an expensive process to keep that coordination going, but it is thorough. It is time consuming, but you have to say it works — the agreements have been in place nearly a hundred years; we made some significant decisions. The arrangement is complex, but the question is, how else would you do it?

And finally, a question we were asked was 'are we best practice?' Well, that is for others to judge.