Cart water by road and rail

Rural communities have often had to resort to transporting water by road during dry spells to fill up rainwater tanks and property dams. In the recent drought, many families have used government subsidies to call on water tankers to replenish their domestic supply.

The proposal of transporting water by road and rail is an expansion of the existing small scale system of water tankers, utilising the existing road and railway network that extensively covers Australia to move vast quantities of water from wetter areas to dry, for all water uses.

As our road system is far more extensive than rail, it is assumed this would be the chief mode of transport for an integrated water transportation system.

Australia's rail networks comprise 40,000km of track. Australia's rail system currently hauls over 36% of all domestic freight compared with 35% by road and 29% by sea. The average train could typically cart 9,000 tonnes of water. (ARA, 2001)

In the early 1980s, the Victorian Government trialled the use of giant plastic bladders to cart water to drought stricken towns in empty coal wagons. The experiment was abandoned after a flooding in the main Melbourne railway goods yard. The railways were equipped to cart coal but not large quantities of water. (The Age IN Infarmation, 2002)

Issues

Large scale transportation of water around Australia would put pressure on dams and over allocated river systems which are providing for their local area.

There are specific health requirements for carting water which highlight the need to ensure special care particularly with the quality of the water (for example, NSW Health, 2002 & Vic Health, 2002).

The majority of Australians live close to our road and rail system. Greatly expanded rail and truck movement on roads over long distances will have environmental and social implications.

Emergency Water on Wheels

In the height of the drought last year, Victorian towns of Wallan, Kilmore, Broadford and Wandong/Heathcote Junction ran out of water. The Sunday Creek Reservoir, the towns' water supply, is still at 6% capacity. As a result the towns have been carting in water since November 2002, using idle trucks that usually transport milk from farms in better times. Broadford currently has five trucks carting 1.08ML, eight times daily from Seymour, 30 kilometres away. New roads and infrastructure have had to be built to accommodate the trucks. Residents are currently restricted to water use inside the home only. (Healey, 2003)

The Australian transport sector accounts for 73.9 million tonnes of Australia's total net greenhouse gas emissions, representing just over 16.1% of Australia's total emissions. Greenhouse gas emissions from the transport sector are also the fastest growing emissions of any sector, rising by 20.3% from 1990 levels. (AGO, 2003)

About 90% of all transport emissions come from road transport, including cars, trucks and buses. In contrast, rail contributes 2% of greenhouse gas emissions from the transport sector. The dominant energy supply utilised by road and rail transport is diesel, a non-renewable fossil fuel. Diesel contributes 70% of road network emissions, despite only making

A Furphy

(Photo courtesy Furphy Pty Ltd)

The humble water cart has a long history in Australian history. The Furphy family made water carts during the First World War to be used by the Australian army overseas. The carts, emblazoned with the family name, are where the Aussie expression 'furphy' comes from. Legend has it that the drivers of the carts, and the soldiers that congregated for a drink around the carts were gossips. Hence all rumours became 'furphies'. The Furphy family, who reside in Shepparton Victoria, still operate their famous water cart. (ABC, 1998)

It has been found that rail is three times more energy efficient than trucks per tonne of freight hauled (ARA, 2001).

up 10% of all road users. (ARA, 2001). The vehicle type with the highest average fuel use is fully laden trucks. Energy will also be required to run the pipe and pump system that will convey the water to the mode of transport.

Increased truck movements would contribute significantly to noise in urban areas, traffic congestion, accidents, and air pollution. Transporting water by road and rail will inevitably mean significant increases in consumer costs of water, to cover transport costs, road and rail maintenance, and the cost of water.

New infrastructure may have to be built to cope with the increase in demand and land allocation issues will have to be addressed. A typical single railway uses a land reservation of 15 metres wide and costs around $1 million per kilometre to build. In contrast a two-lane highway needs a land reservation of 50 metres wide and costs around $2 million per kilometre to build (ARA, 2001). The Federal Government spent $1.74 billion on roads in 2002-03 (Anderson, 2002).

There is potential to save costs by using rail carriages that would otherwise return to the inland empty, to be used as water transport. A bladder would have to be installed in rail carriages to make them water tight and prevent contamination of the water, and equipment made to fill and empty the bladders.

Back o' Bourke

"During this recent drought, water was transported to Byrock, about 90km from Bourke in NSW, in 27kL tankers, 5 times a fortnight to meet domestic demand. Each load was costing $300, which is about $11 per kilolitre for drinking water."
Sean Rice, Director of Engineering Services, Bourke Shire Council, April 2003.

A cost comparison estimate has been made for transporting water from Melbourne to Shepparton, and from Parkes to Bathurst, a distance of about 160km. The cost by rail was just under $15/kL while the cost for road was a little more than $15/kL. (HWA, 2003)

A final comment...

Carting water by road or rail is a very expensive way to move water around and should be avoided. However, in times of severe drought, it is an appropriate way to alleviate shortages in small towns and on farms. For long distances, the rail network makes far better economic sense.

Divert a river inland

Many people have noticed the difference in rainfall between the coastal areas and the inland and wondered why some of the flow in the coastal rivers can't be diverted inland.

The idea is not new. In 1929, Dr John Bradfield, noted engineer, and designer of the Sydney Harbour Bridge, came up with a proposal to turn central Australia into a Ghirraween, or 'place of flowers' as he called it. Bradfield set off on horseback with basic equipment through the Queensland rainforests to map the best points for dams and diversions (Fullerton, 2001).

Bradfield's plan, announced to the Queensland government in 1936, was to harness the mighty flood-flows of the tropical rivers of North Queensland – the Tully, Johnstone, Herbert and Burdekin – and divert them via the Flinders, Thomson, Cooper and a series of channels, to irrigators inland. Leftover water would end up in Lake Eyre, theoretically creating evaporation and bringing rain to the arid interior. (Fullerton, 2001 and Johnston, 1997)

There have been several reviews of the Bradfield scheme by both the Queensland Government and the Federal Government. The reviews in 1947 and the early 1980s found that the scheme could not stand up to scientific or economic scrutiny – the scheme would involve great economic and environmental cost, but deliver little real benefit. (NRM, 2002)

Similar schemes had been mooted for the NSW coastal rivers, especially in times of drought. The NSW government ordered a review in 1981 that was carried out by consulting engineers Rankine & Hill. This review investigated 22 coastal catchments and multiple options for each catchment and found that while a few were physically practical, the costs were "too high to justify construction". (Rankine & Hill, 1981)

The technical problem with schemes to divert the rivers inland is in the method of transferring the water from the coast to inland.

For a scheme to work using gravity alone, a tunnel would need to be drilled through the Great Divide. In the Rankine & Hill study, the length of tunnel required ranged from just under a kilometre to 67 kilometres depending on the location. This however reduces the size of the catchment and consequently the runoff water available for diversion. To capture more water, the dam or weir would need to be further down the catchment and pumped up to the tunnel. This however would use significant amounts of electricity given the amount of water to be pumped and the fact that the Great Divide is several hundreds of metres above sea level. (Rankine & Hill, 1981)

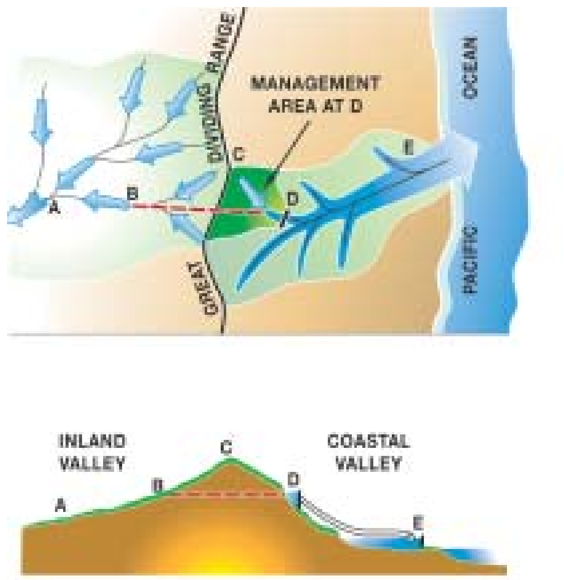

figure 62 - Method of diversion (Rankine and Hill, 1981, adapted by News Ltd)

Issues

While the government reviews of the concept of diverting rivers inland have shown it to be uneconomic, the environmental ramifications are likewise prohibitive. The impacts of diversions include impacts on the rivers from which the water is removed, impacts on the rivers where the water has been added and impacts on the areas where the water is used (Hart, 1999).

The NSW Government Independent Inquiry into the Clarence River System noted that "it is apparent that any proposal to divert substantial quantities of water from the Clarence would present significant risks to the health of riverine ecosystems, and those activities and values dependent on them" (HRC, 1999).

> "Freshwater flowing to coastal waters is not wasted. It is important for other connected or downstream estuarine and marine ecosystems; these natural flows supply sand to replenish beaches, carry essential food for aquatic plants and animals, and provide triggers for fish movement and spawning" (Qld Govt, 2002).

The Queensland Government's review of the Bradfield Scheme noted that "diverting water westwards would interfere with the environmental flows necessary to keep a waterway healthy and could actually contribute to salinity. Allowing aquatic plants and animals to move from their native catchments risks upsetting delicate ecological balances. Ecological balance in waterways naturally depends on periods of wet and dry" (NRM, 2002)

The reduction in water flows in our coastal rivers could damage our fishing industry which has been estimated to be worth $2,480 million a year, and includes $2,169 million worth of exports (ABS, 2003). Diversions also threaten to damage the Great Barrier Reef by changes to the delicate estuarine balance (Fullerton, 2001).

In the recent drought, while large areas of the inland were affected, many coastal areas were also suffering from lack of rain and subsequent water retrictions. Any diversion would cause serious community concern (HRC, 1999).

A major river diversion scheme has already been constructed in Australia: The Snowy Mountains Scheme was constructed to divert water from the Snowy River through the Great Divide into the Murray and the Murrumbidgee and at the same time generate electricity. At Jindabyne Dam, over 99% of average natural flows is diverted annually.

At Orbost in Victoria, the lack of flows has also meant that seawater now intrudes many kilometres upstream from the Snowy mouth, impacting on local landholders. Following a strong community campaign to restore flows in the Snowy, an agreement was reached in 2000 to restore 21% of the original flow within 10 years. The ultimate objective of the plan is to boost the Snowy River's flow to 28% of its original level, which is the minimum flow that scientists say is needed to bring the river back to a state of good health. (MDBC, 2003)

The amount of water generated from diverting coastal rivers inland is dependent upon the quantity of water within the diverting river. It would be, however, practically impossible to divert the total flow of a coastal stream inland. This is due to the fact that only the part of the flow that occurs at the diversion point is available which would only be a minor part of the catchment runoff. Environmental flows to retain the health of the waterways would have to be accounted for. Furthermore, it would be impossible to create the storage capacity to divert large floods. (Rankine & Hill, 1981)

> It has been suggested that it would be cheaper (and economically better) to give every person west of the Great Divide a million dollars than to build the diversion scheme (NRM, 2002).

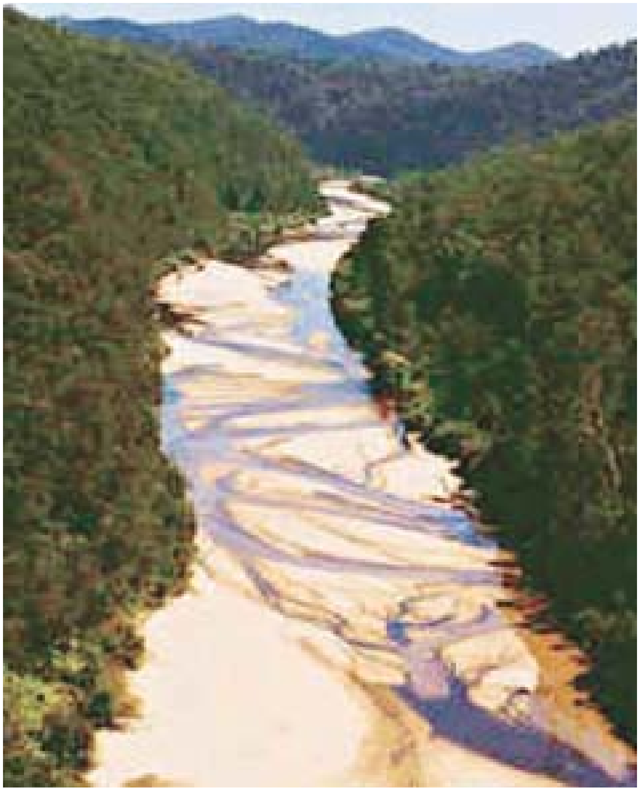

figure 63 - The Snowy River, reduced to 1% of its original flow (Craig Ingram)

It has been estimated that the Bradfield Scheme would cost in excess of $3.5 billion, with a further $145 million needed each year to cover pumping costs alone (NRM, 2002). This works out at a cost to irrigators of about $380 per megalitre (HWA, 2003) considerably more than the $3 per megalitre that the Queensland Government introduced in January 2003 (Qld Govt, 2003).

The Rankine & Hill Study had several options for each river diversion; for the Clarence River, 23 options were investigated. Updating the 1981 Rankine & Hill Study estimates, the cost to irrigators of the water diverted from the Clarence ranged from $163 per megalitre to $2,807 per megalitre (HWA, 2003). This compares with existing irrigation charges that are less than $10 per megalitre (IPART, 2001).

A final comment...

The water obtained from diverting coastal rivers inland is very expensive and would have serious impacts on our coastal rivers and communities. An expanded irrigation program would likely compound salinity problems, which threaten much of our farmland.

Piping water from the Ord to Perth

After learning that the Ord River in the northern Kimberley region of Western Australia expels 50 tonnes of water per second into the Timor Sea during monsoon, Alison Woodham from Sydney suggested that water from the Ord River could be piped to the capital Perth, to meet their increasing domestic demand.

It is 30 years since damming the Ord River created Lake Argyle, the second largest reservoir in Australia, and a new agricultural region. This scheme plans to tap into the waters of the lake, and pipe it 1,840km south to water storage near Perth.

Inflow to Perth's dams have halved in recent years. The demand for water from the integrated Perth-Mandurah Goldfields and Agricultural water supply scheme in 2001/02 was 300GL. (GHD, 2002)

The annual rainfall of Kimberley is 789mm whereas the rainfall of Perth is actually higher at 869mm per year (BOM, 2001).

The pipeline, which would take an inland route, would have to be pumped to an elevation of over 400 metres due to the terrain between the two destinations. Three parallel pipelines would be required to move the proposed amount of water. (GHD, 2002)

The Great Man-Made River Project

The Great Man-Made River Project in Libya is the largest water transport project in the world. It was launched in 1983 and the water will be moved through pipes four metres in diameter, over 1200 kilometres of desert plains and another 700km of rocky plateaus, cliffs and dry river beds.

The total depth of wells which have been drilled for the project is more than 70 times the height of Mount Everest. 1300 wells have been drilled, some up to 500 metres deep, pumping 6.5 million cubic litres of water per day.

The first two stages of the scheme are complete and supply Tripoli and Benghazi with water. The cost of the completed scheme is enormous too - over US$25billion. It has impacts on the water supplies of poor neighbouring countries and the scheme has a limited lifetime as it is pumping out more water from the aquifer than is going in. (www.gmrp.org).

The proposal to bring water from the Kimberleys to Perth was the subject of two comprehensive planning studies in 1988 and 1990. Both reports were on the basis of supplying an extra 300GL of water to Perth up to 2052. Last year, the Western Australia Water Corporation conducted an independent review into the two feasibility studies. It found that although a pipeline is technically feasible, the huge financial costs would not bring benefits to Perth consumers, and the environmental and economic costs of high

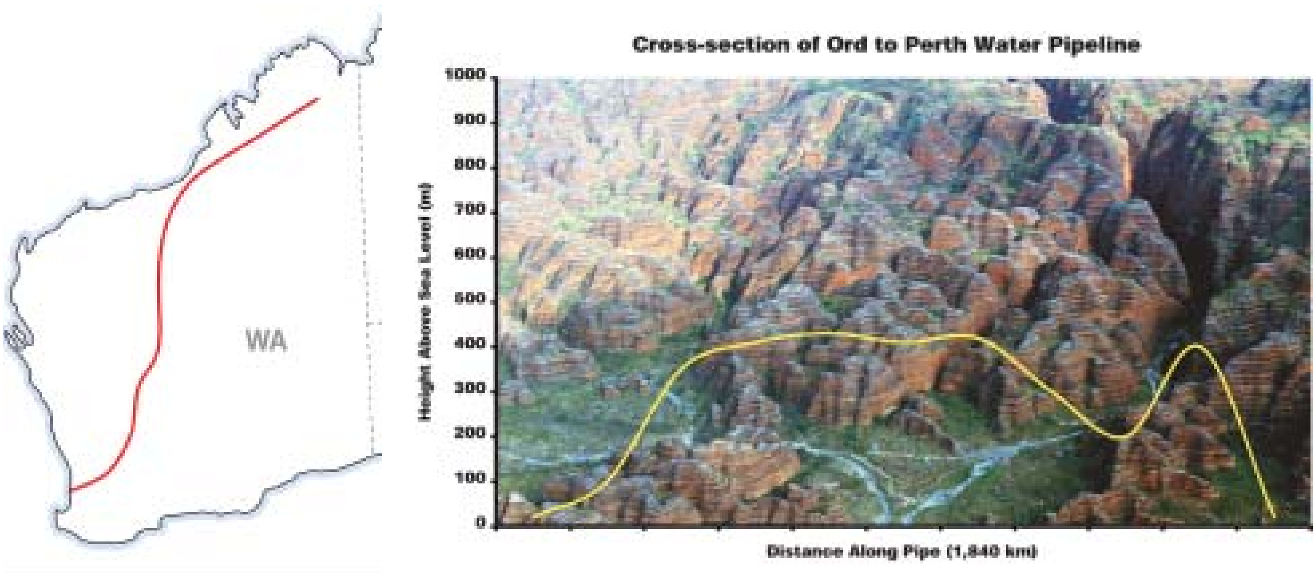

figure 64 - Map and cross-section of the proposed Ord to Perth pipeline (adapted by News Ltd)

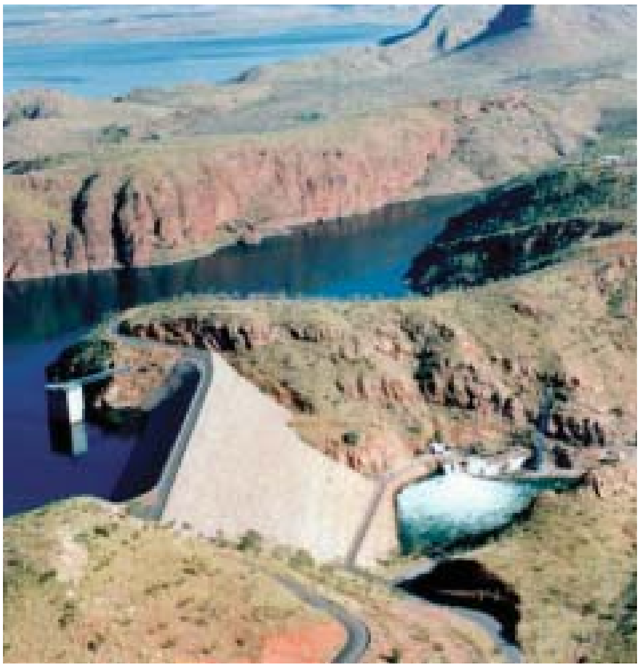

figure 65 - Ord River Dam in the Kimberley Region of Western Australia (News Ltd)

greenhouse gas emissions had not been factored in. (GHD, 2002)

This year the Western Australian Government published a State Water Strategy, which outlines their plan for meeting increasing water demands. It focuses on water conservation and efficiency within all sectors, water reuse, and high water prices for water 'guzzlers'. (WA Govt, 2003)

Issues

Taking large amounts of water from the Ord River and depositing it in southern Western Australia will change the ecology of both areas.

An environmental flow has been set for the Ord River, which takes into account current and planned water allocations for the Ord River irrigation area.

The Ord Irrigation Scheme provides about 310GL for irrigators (Fullerton, 2001) around Kununurra in Western Australia. These allocations fully commit the Ord River water resource and there is no 'spare water' from this system to direct to the south (GHD, 2002). Water extraction for Perth would therefore be at the expense of environmental flows.

The construction and operation of the pipeline would be a significant contributor to greenhouse gas emissions. The estimated project costs in both feasibility studies did not make any allowance for off-setting the costs of comparatively high greenhouse gas emissions.

The estimated energy consumed to pump the water through the pipeline would be 14kWh/kL, which is over 3 times higher than the energy required for seawater desalination. Even if the pipeline proved to be economically feasible, there are doubts that the project would gain environmental approval on this issue alone. (GHD, 2002)

An additional water storage facility approximately the same size as the existing Canning Dam (90GL) would need to be constructed near Perth to hold the additional water from the pipeline. It has been noted by WA Water Corporation that the suitability of land near Perth for the construction of the dam would pose social and environmental problems. (GHD, 2002)

Water from the Ord River may create water quality issues, due to the warm tropical waters being fed into the Perth water supply and would require full treatment. (GHD, 2002) Translocation of organisms from one catchment to another could be an issue.

An Ord River pipeline was proposed to supply 300GL of water to Perth. The actual cost of the pipe is estimated to be between $1,500 and $2,400 per metre (GHD, 2002).

The costs to consumers of buying water from the Ord River pipeline have been estimated at $5.50/kL or $5,500/ML (GHD, 2002). This is far and above the current price for water in Perth which is between $0.40/kL and $1.47/kL, depending on consumption (WAWC, 2003).

An estimation of the total cost of the proposed Kimberleys to Perth pipeline would be a minimum of $10 billion allowing optimistic engineering solutions. The annual operating cost of the pipeline is estimated at $100 million per year. (GHD, 2002)

A broad estimate of water treatment cost would be $120 million for the 300GL (GHD, 2002).

It has been suggested in one option that a dam be constructed on the Fitzroy River, since the Fitzroy River catchment is 50% greater than the Ord River catchment. This would obviously inflate capital costs significantly.

The reality is that by the time you had built the Ord River pipeline one third of the way to Perth, it would have been cheaper to have built a desalination plant.

A final comment...

The WA government has recently looked at strategies to meet its water demands in the 21st century. The prohibitive financial and environmental costs of an Ord pipeline have meant it is likely to remain a pipedream. Demand management and desalination are far cheaper options.

Pipe water from Tasmania

It has been proposed by Benjamin Isaacs via the Farmhand *Fencepost*, that water could be piped from rainy Tasmania to the mainland in order to alleviate water shortages.

Some areas of Tasmania's mountainous west receive an average annual rainfall of over 3,500mm (ABS, 2002) with many receiving more than 1,000mm per year: for example, Cradle Valley receives 2,808mm and Lake St Clair 1,511mm (BOM, 2003). Areas around Melbourne, however, receive less rainfall: Melbourne averages 657.3mm, Dandenong averages 778.7mm and Warragul 1,035.2mm (BOM, 2003).

The idea behind this proposal is to transfer water from Tasmania's wet regions into Melbourne's water reservoirs. The pipeline could link up Hydro Tasmania's Great Lake on the Shannon River south of Launceston with Melbourne Water's Thompson Reservoir in the Great Divide, which would be approximately 700km in length. The water would then be transferred to the Upper Yarra Reservoir and then to Silvan Reservoir for distribution throughout the Melbourne metropolitan area.

Water for the pipeline would be competing with the current needs of the Poatina hydropower scheme. While Great Lake is more than 1,000 metres above sea level, Great Lake is the main storage for the Poatina Power Scheme used by Hydro Tasmania to supply the Launceston area and accounts for 12.1% of Tasmania's long-term average power output. The Poatina Power Scheme utilises the energy from the water dropping 830 metres; and water would need to be taken only after it had been through the power station. (Hydro Tasmania, 1999)

Water would need to be pumped after the water had left the Poatina power station across Bass Strait and up to the Thompson Reservoir in Victoria.

Basslink

It is easier to transfer electricity than water; Tasmania and the mainland will soon be connected by a 295km undersea electricity cable, among the longest of its type in the world. The cable, called Basslink, will run from Loy Yang in Gippsland, Victoria, across Bass Strait to Bell Bay in northern Tasmania, and will allow the trade of electricity between the eastern states. Basslink will also include a fibre optic telecommunications cable link. (Basslink, 2002)

While an underwater drinking water pipeline of this size does not seem to have been undertaken anywhere in the world, smaller pipelines over smaller distances have been constructed. For example, a pipeline has been laid from Puerto Rico to the small offshore island of Vieques (Vieques-island.com, 2003) and from Ngela to Tulagi in the Solomon Islands (SIWA, 1995), though both were relatively short.

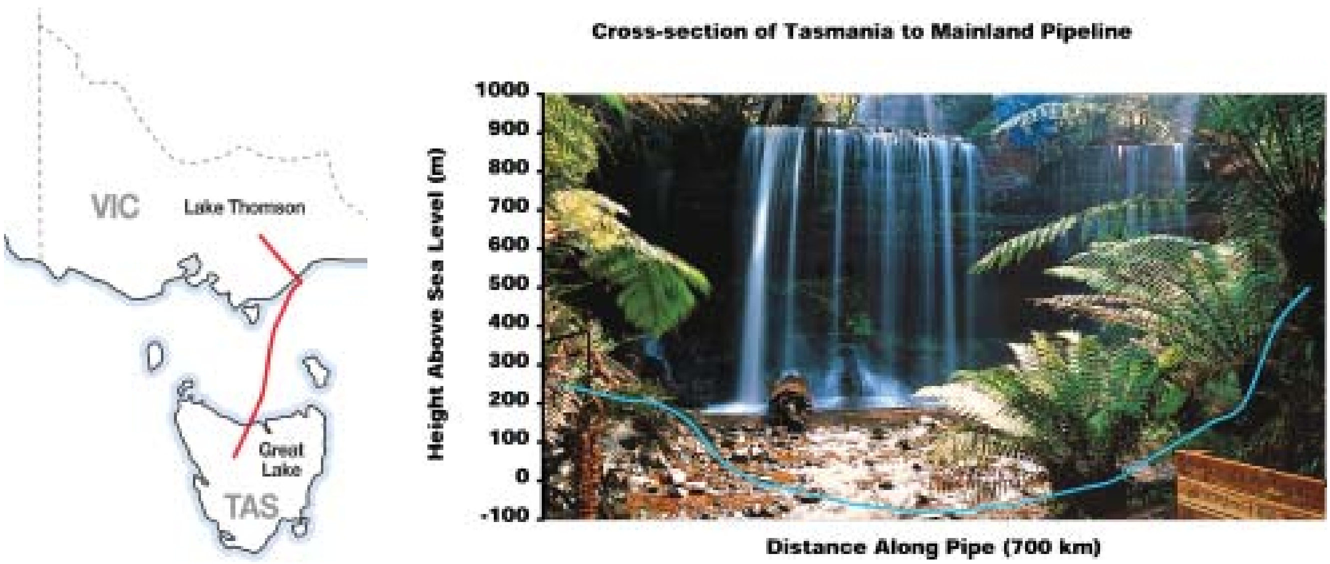

figure 66 - Map and cross-section of the proposed Tasmania to mainland pipeline (adapted by News Ltd)

It's in the bag

American Terry Spragg has invented a way of transporting freshwater across the ocean without the need for pipes. The 'Spragg Bag' is a flexible bladder larger than the body of a Boeing 747 aeroplane, which can hold 17ML of water secured by giant zippers. The freshwater filled bag was trialled in the United States, where it was successfully towed from Washington to Seattle. According to Spragg, as many as 60 bags, looking like giant waterbed mattresses, could be towed by a single tugboat. He hopes that transporting water to the Middle East will create peace in the region: "I won't really be happy until these are off the coast of Israel and Gaza". (Dawson, 1996)

(Spragg & Associates)

Bass has an average depth of 50 metres to 70 metres (CSIRO, 1997) and the pipeline would be several hundreds of kilometres in length (HWA, 2003). There is currently a pipeline between Tasmania and the mainland: the Tasmania Natural Gas Pipeline is a long subsea and underground pipeline connecting Bell Bay Power Station near Launceston to Longford in Victoria (DEI, 2002).

Issues

Water in the Shannon River is fully allocated; taking water from Tasmania and pumping it to Victoria would affect the river health and marine ecology in Tasmania as well as the local communities reliant on the river.

It is recognised that two centuries of European settlement in Tasmania has placed pressure on the river systems of the island. In the northern coastal rivers where water is proposed could be diverted to the mainland, all water has been allocated for human uses and environmental flows, with no 'spare water' available.

Healthy river flows are crucial to the estuary system in Tasmania. The large fishing industry in this region would be negatively impacted if water was diverted for use on the mainland. In Victoria, there could be water treatment issues due to the translocation of organisms foreign to the mainland.

Tasmania's Great Lake was once Australia's largest natural body of persistent fresh water. Marshes surrounded the fringe of the lake, which have not recovered since the water level was first raised by a hydroelectric scheme in 1916. The frequent fluctuations in water level from power station operations have continued to place pressure on this area, with the Lagoon of Islands under ecological stress. (DPIWE, 2003)

The Victorian Government recently undertook the development of a water resources strategy for the greater Melbourne area to ensure that a safe and reliable supply of water is delivered to Melbourne in the next 50 years. This review, overseen by a panel of experts, focuses on 'living with what we have', and encourages water efficiency, pricing adjustments, community education, greater regulation and catchment protection. It did not suggest a pipeline from Tasmania as one of the possible water supply options. (Vic Govt, 2002)

While studies into the water that may be available downstream of the Poatina power station have not been carried out, it has been assumed that perhaps 250,000ML would be taken each year. (HWA, 2003)

The estimated capital cost to construct a pipeline from Tasmania to the mainland and its required pump station is $7.5 billion. Operating costs are estimated at $150 million per year. Based on these estimates, the water could be available for approximately $2.80/kL or $2,800/ML. (HWA, 2003)

This amount is in addition to the costs to distribute the water to customers. The Melbourne water distribution authorities (Melbourne Water, Yarra Valley Water, City West Water and South East Water) would then need to add their costs onto this raw water cost. Current prices for water in Melbourne are around $0.75/kL.

A final comment...

The Victorian Government recently looked at strategies to meet its water demands in the 21st Century. The prohibitive financial and environmental costs of a pipeline from Tasmania have meant it is likely to remain a pipedream.

Pipe water from PNG to Australia

> The Fly River, Papua New Guinea's largest river, has a combined flow of 4.5 million litres per second, almost five times that of the river Nile. The Darling and Murray rivers, the two biggest in Australia, have a combined flow of water that is only 6% of the Fly River. (Samarasinghe)

Papua New Guinea, situated only 100km or so north of Cape York, enjoys heavy monsoonal rains and wild flowing rivers. It has been suggested by Benjamin Isaacs via the Farmhand *Fencepost*, that some of this freshwater could be shared with its neighbour by way of a pipeline across the Torres Strait in order to irrigate inland areas of Queensland. (Samarasinghe)

A proposed water pipeline would most likely follow a similar Torres Strait route to the proposed gas pipeline to connect southern PNG to Queensland. To be effective, the pipeline would need to continue some way through Queensland since rainfall in Cape York is several metres a year. One option is to collect water from the Fly River in southwest PNG and pipe it to the headwaters of the Diamantina River in Queensland, approximately 850km west of Rockhampton and only 600km north of the NSW border. This pipeline would be approximately 2200km long, with two dams constructed on both rivers to collect and release water. Gravity would allow the water to travel some of the way, but pumping would be required to reach the Diamantina. (HWA, 2003)

Papua New Guinea has very high rainfall. Along the Fly River, it ranges from 10,000mm per annum in the highlands to around 3,000mm per annum near the coast (Swales, 2003). Northeast Queensland receives the highest annual average in Australia with a region near Cairns receiving 4,436mm (ABS, 2002). Most of the Queensland coastline receives between 900mm and 3,200mm annually. Winton, near the headwaters of the Diamantina River receives 415.6mm of rain a year. (BOM, 2003)

Use of surface and subsurface freshwater in Queensland increased by 97% between 1983 and 1997, with a significant proportion of that going to irrigated agriculture. The government has recently released Queensland's Water Act 2000, the first comprehensive review of Queensland's water legislation since 1926, which points the way forward for the state's water future. The Water Allocation and Management Plans (WAMP) are being prepared for most river basins. A pipeline from PNG was not considered as part of the water future for Queensland. (Qld Govt, 2002b)

Issues

The environmental and social issues, which arise from transferring water from one catchment to another, may be magnified if this engineering feat across two countries were to be considered.

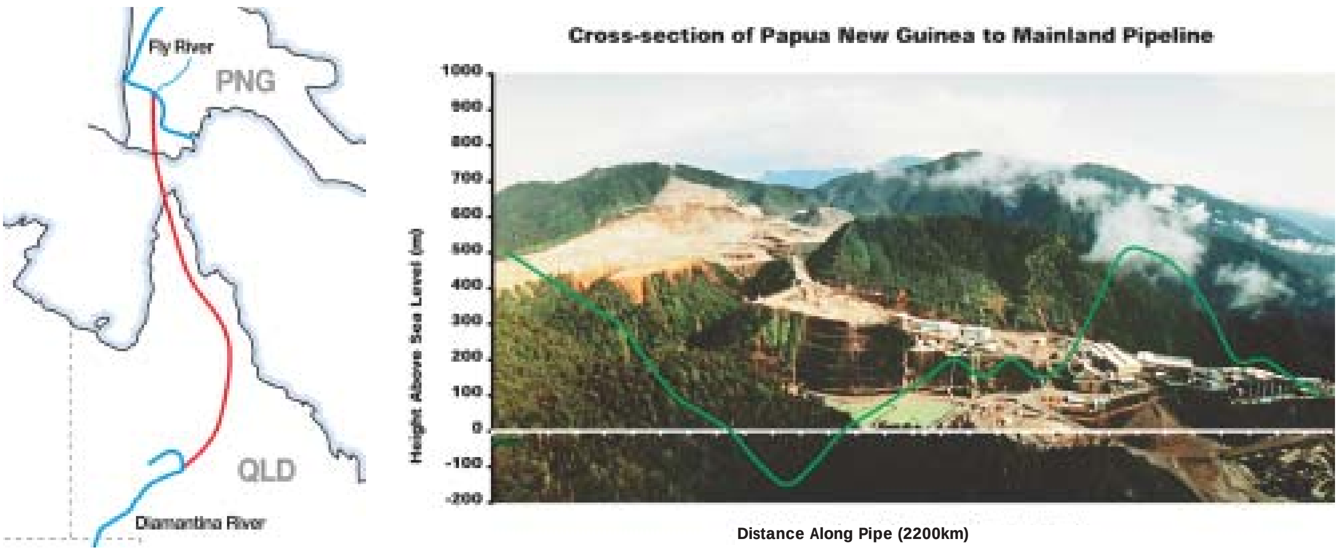

figure 67 - Map and cross-section of the proposed PNG to mainland pipeline (adapted by News Ltd)

Papua New Guinea's river systems are wild, supporting diverse aquatic ecosystems and communities that rely on them. The Fly River flows for over 1,200km from its source in the Western Highlands down to the Gulf of Papua, and have the most diverse freshwater fish fauna in Australasia (Swales, 2003). Damming and large-scale extraction of water from the Fly River will seriously affect the river and estuarine ecosystem.

The Fly River seasonally inundates the Tonda Wildlife Management Area, which is an internationally significant Ramsar wetland site. Changes to flows could affect this area. The Fly River is tidal in the lower reaches. Maintaining normal flows in the estuarine environment is essential for fish movement and spawning. Many people who retain traditional lifestyles could be displaced or experience negative affects to the health of their waterways if a dam or weir were constructed. PNG law recognises traditional rights and the negotiation over the sale of large quantities of water would require national commitment.

A dam on the upper reaches of the Diamantina would similarly impact on the river's hydrology. Rivers in this region are among the few remaining major rivers with near natural flows and have some of the most variable flow regimes. Maintaining variable flows, water quality and volume are essential to significant areas wetlands in the Basin. Lake Eyre relies on minor flooding every couple of years from the Diamantina River. (SA DWR, 2002)

Australia would have little controls over the quality of water delivered through the pipeline, as the highland catchment would be under PNG jurisdiction. This creates possibilities for contaminated water, high costs of treatment and translocation of organisms. Of particular concern to water quality in the Fly River is the copper and gold mines which operate in the upper catchments.

The construction of an underwater pipeline poses great technical difficulties and maintenance costs. This is compounded by the fact that there is a history of seismic activity in the area. The energy required to build and pump the water would be high.

The quantity of water would be dependant on environmental flows, the size of the dam in PNG and the capacity of the pipeline. It is estimated that 250,000ML per year could be pumped from a dam in PNG (HWA, 2003).

Estimated capital costs for a pipeline from PNG to Australia is $7.1 billion and operating costs have been estimated at $150 million per year. Based on these estimates and ignoring any royalty payments that the PNG government may impose, the water could be available to irrigators for approximately $2,700/ML. (HWA, 2003)

A final comment...

Water from PNG would have to be piped most of the way down Queensland. Such a pipeline would have major environmental, social and international political ramifications, and the water would be unaffordable.

figure 68 - Siltation in the Fly River in PNG (News Ltd)

Build a national water grid

When the Queensland electricity grid was connected to NSW in late 2000, Australia's National Electricity Grid spanned more than 4,000kms from Cairns to Port Augusta. The grid was created so that the best economic use could be made of electricity generation capacity - a generator in Queensland could supply homes in Adelaide. (NEMMCO, 2002)

There have been various suggestions that a water network could be installed across the country similar to the national electricity grid, so that areas with spare water could supply areas with water shortages. There are differences of course. For example, the speed of electricity through copper is perhaps more than 200 million metres per second whereas the usual speed of water through a pipe is less than 3 metres per second.

Barry Dunn and Laurie Hogan from Sydney wrote to Alan Jones with their ambitious 'Water For Australia' scheme involving a national water grid, which they describe as "the best practical and environmental approach to help solve water problems". The proposal seeks to break catchments up into one square kilometre sections, by a water grid laid in a criss-cross pattern across the country. A network of 300mm PVC pipes would be laid underground to store water from where it is in quantity and transport it to where it is needed.

The storages - Water Flow Collectors - are 10ML 'covered billabongs' that contain the runoff from the one square kilometre catchment. All water provided by the grid comes from 'water anchors' such as dams or desalination plants. Pumping within the grid is energised by solar power. The plan also envisages towns reusing sewage effluent for irrigation, wildlife corridors along waterways, drip irrigation and new industries to use the salt from salinity-ridden land.

Additionally Barry and Laurie plan the establishment of mixed species plantation to provide all our timber needs, as "this nation will earn more from the old growth forests by showcasing their pristine beauty to the world's tourists leaving all their biodiversity intact." (Growmax, 2001)

Australia has an area of almost 766 million hectares, of which just over 59% is set aside for agricultural pursuits (ABS, 2003). This excludes areas such as

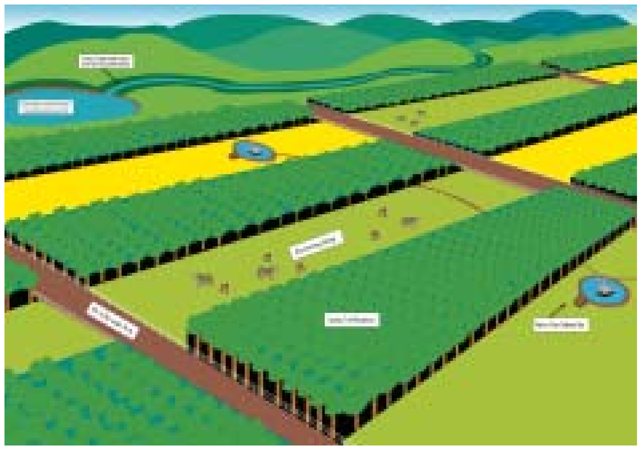

figure 69 - An artist's impression of irrigated agriculture supported by a national water grid
(courtesy of Barry Dunn and Laurie Hogan)

unoccupied land (mainly desert in western and central Australia), Aboriginal land reserves (mainly located in the Northern Territory), forests, mining leases, national parks and urban areas.

While one proposal for a national water grid covers the full 455 million hectares of agricultural land, an alternative proposal covers only that agricultural land that is regularly cultivated for crops, pastures and grasses. According to the Australian Bureau of Statistics, approximately 47.6 million hectares of agricultural land is cultivated each year for crops, pastures or grasses (ABS, 2003).

Issues

The National Water Grid would bring water to where there was little before. Extending agriculture inland by providing more water for irrigation and stock will put pressure on our already stressed native plant and animal ecosystems and exacerbate the salinity problem which plagues inland Australia.

Both of the proposed national water grids would have a large footprint. For the proposed smaller national water grid, the area of the construction activity is about 10,000 hectares. For the larger grid, the area of construction activity would be almost 100,000 hectares. (HWA, 2003)

Moving water around Australia would have health and ecological effects through the translocation of organisms such as cryptosporidium. The proposal aims to transport water that would otherwise flow to the ocean.

To pump the water around the proposed smaller national water grid and to pump the treated

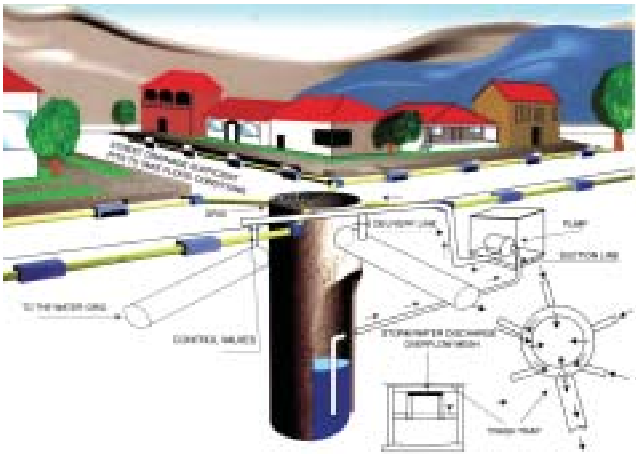

figure 70 - Stormwater collection points on a national water grid
(courtesy of Barry Dunn and Laurie Hogan)

stormwater into the system would require more energy than is currently available with Australia's installed generating capacity. It has been estimated that perhaps more than 10 times the current capacity would need to be installed to provide the energy to run the system. (HWA, 2003) This is not counting the numerous proposed desalination plants. The current installed capacity of power generation in the interconnected power system comprising the Australian Capital Territory, New South Wales, Queensland, South Australia and Victoria is 35,487 megawatts (NEMMCO, 2002).

The runoff from agricultural land could contain pesticides, fertilisers and animal wastes which would need to be treated depending on its use (to a high degree if the water was to be used for drinking water). The removal of the residue from this treatment process would also need to be managed appropriately. There is very little information about how much water could be transported around in the national water grid. The amount of water that currently runs off farms and is not captured by dams or utilised by downstream users is not known.

It is known that current agricultural activities in Australia use about 15.5 million ML per year which is about 9 times the amount of water used to supply customers through piped networks for water, sewerage and drainage purposes (ABS, 2000).

A broad costing has been carried out for the two proposed national water grids.

If the 455 million hectares of agricultural land were to be covered with a one square kilometre network of pipes, then the total cost would be in the order of $3,000 billion and the annual operating cost would be $55 billion (HWA, 2003).

If the area covered by the proposed grid were restricted to cultivated agricultural land, then the total cost would be in the order of $300 billion and the annual operating cost would be $6 billion (HWA, 2003).

To put this in context, the Australian water industry constructs more than $2 billion worth of infrastructure annually (AWA, 2003). To construct the smaller national water grid over a 20 year period would require an eight-fold increase in water construction activity each year, including factories producing pipes.

By assuming a standard pipe size, the proposal does not take into account the varying needs of water users around Australia. Larger pipes and pumps would be needed to make the system capacity match the customer's water needs, increasing the overall cost to construct and operate the network. The proposal also ignores the additional distribution pipes required to tap into the one square kilometre grid network.

A final comment...

The construction of a national water grid would be hugely expensive. There will however be potential for linking up nearby existing water systems by water pipelines to improve the security of the water supply as the population increases in certain areas.

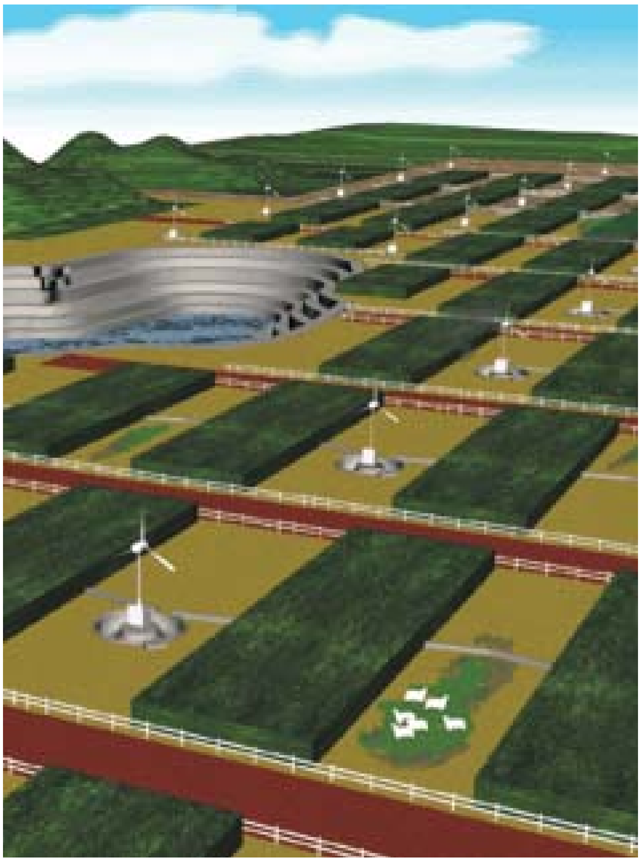

figure 71 - Water is collected in an old open-cut mine and distributed by wind turbines to irrigation areas
(courtesy of Barry Dunn and Laurie Hogan)