



# Reviving a river basin

by Ian Edmonds

**W**ater from the Burdekin River in north Queensland could be used to supplement flagging supplies in the Murray River Basin by floating the water in bags to the NSW-Victorian border, then transporting the water into the Murray River via the Snowy Hydro Scheme.

Currently, there are no water bag schemes operating in Australia. However, Western Australian company Watertow is in the process of commercialising the concept of using 350ML water bags to transport water from the Fitzroy River to Perth. A US company has developed and trialled the Spragg Bag technology that zips together a line of up to 60 water bags, each of capacity 17ML, so that up to 1GL of water can be towed by a single tugboat.

While the food basket of Australia, the Murray River Basin, is drying up, the northern tropics are flooded with rain that flows into the Coral Sea. In the 40 days between 5 January and 17 February this year, 20,000GL of water flowed over the Burdekin Dam wall. This was an average flow rate of 500GL/d and about 100 times the current average daily flow rate of the Murray River. This situation motivates this new approach to the problem of transporting the abundant fresh water in the north to the drier south.

Piping water over long distances is extremely expensive in infrastructure and operating cost. According to the document "Direct connection pipeline-Burdekin to South East Queensland" published by the Queensland Department of Natural Resources and Water, the cost of a 900 km pipeline to supply about 1GL/d from the Burdekin Dam to Brisbane would be \$14 billion. Based on this estimate a pipeline from

the Burdekin River to the Murray River, a direct distance of 1800km would cost \$28 billion.

When fresh water is enclosed in an impermeable membrane or water bag, it floats on sea water. Water bags containing many thousands of tonnes of water can be towed over large distances with the only energy cost being the energy to overcome water friction on the bag. If an ocean current flows between the water source and the point of supply the water bag can be floated on the current with zero energy expenditure. The East Australian Current (EAC) flows from the Coral Sea down the Australian coast at a speed of about 3km/h. It takes about 32 days to flow the 2300km from the coast near the Burdekin River in North Queensland to the sea off Tathra in NSW. Tathra is less than 200km from the headwaters of the Murray River and this distance is the only part of the scheme requiring pipes.

### The scheme outline

Water bags, 250ML cigar-shaped containers made from plastic fabric, are filled with fresh water at the Burdekin River. The water bags are towed by tug boat 100km out through the Barrier Reef and released into the EAC to begin the journey south. At Sydney, the EAC divides into huge eddies that may swing in close to the coast or flow further off shore. For this reason each bag is accompanied by an unmanned power pod that provides up to 250km range to correct for deviations from a straight line path in the EAC.

The progress of the water bags south is monitored by beacons on the power pods until the bags have arrived offshore of Tathra.

The Burdekin River flooding this year. The Burdekin Falls Dam capacity is 1806GL.

## Could water transported in bags from Australia's northern tropics, where rain is abundant, be used to revive the drying Murray River Basin?

As a result of eddies the towing distance from the EAC in to Tathra is likely to average about 200km.

Tathra has a nearby natural water storage reservoir, the Wallagoot Lake. After discharge into the lake the water bags are collapsed and rolled into a form which may be transported back to Northern Queensland by ship or rail along with the power pods.

Tathra is chosen as the end point as it is close (80km) to the headwaters of the Murrumbidgee and Snowy River systems and is within 160km of Lake Jindabyne in the Snowy Mountains Hydroelectric Scheme.

The headwaters mentioned lie on the Great Dividing Range about 1.2km above sea level. Thus, water discharged at Tathra can be pumped over a relatively short pipeline (80km) into the headwaters of the Murrumbidgee or Snowy Rivers and in another short pipeline (80km) pumped into Lake Jindabyne. From Jindabyne the water flows through the Snowy Hydro into the Murray River.

The advantage of the scheme outlined is that water from the Burdekin is transported by the EAC a distance of about 2300km at near zero running cost to a location close to the reservoirs and powerstations of the Snowy Mountains Hydroelectric Scheme and the Murray River. The effective running cost relates to sea towing cost over distances of about 300km and water pumping costs over distances of about 160km and a lift of about 1.2km. The infrastructure cost relates to the cost of a moderately large number of water bags, one charging facility in Queensland, one

discharging facility in NSW, two pipelines each of length about 80km and one water pumping station near Tathra.

### INFRASTRUCTURE COST

#### The sea going link

The sea link comprises water bags, power pods, means of charging and discharging the water bags, tug boats to tow the water bags and pods into and out of the EAC and gantries to load empty bags and power pods on and off freighters.

The costing of this scheme will be based on a 1GL/d or 365GL/a supply to the Murray River Basin. Assuming the water bags can hold 250ML, the 1GL/d supply requires, each day, the charging of four bags in North Queensland and the discharging of four bags in NSW. The sea distance is 2300km and the travel time in the 3km/h EAC is 32 days. Thus 128 water bags are required for the sea link and at any one time 128 bags would be floating south on the EAC with an average distance between bags of 18km. Each bag is accompanied by a radio controlled power pod that is essentially a 2t petrol tank and a 115HP motor. At any one time about 22 pods and empty bags would be being shipped north by freighter. Thus the total number of water bags and pods required to deliver 1GL/d would be 150.

It is estimated that a 250ML bag would cost \$125,000 based on the area of fabric required and each power pod would cost about \$50,000. The cost of 150 bags and pods would be \$26 million.

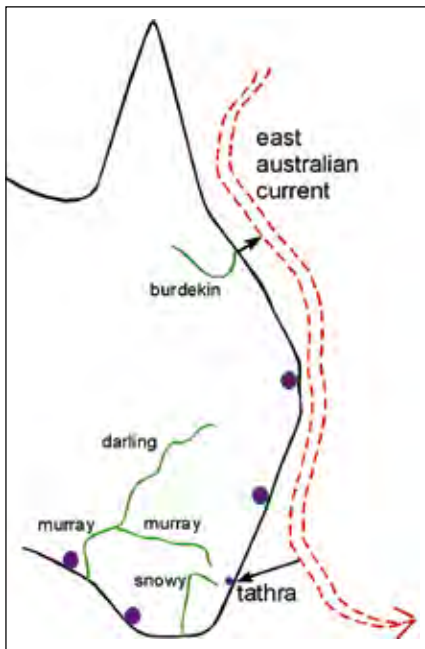
Six tug boats, two at the Burdekin and four at Tathra, would

cost \$12 million. One charging facility and one discharging facility would cost about \$4 million. One unloading gantry in Queensland and one loading gantry in NSW, each of 40t capacity, would cost \$4 million. Two 2000t capacity coastal trader ships to return the pods and empty bags to North Queensland would cost \$4 million. The radio control link to the pods is estimated to cost \$10 million. This gives a total infrastructure cost for the sea link of \$60 million.

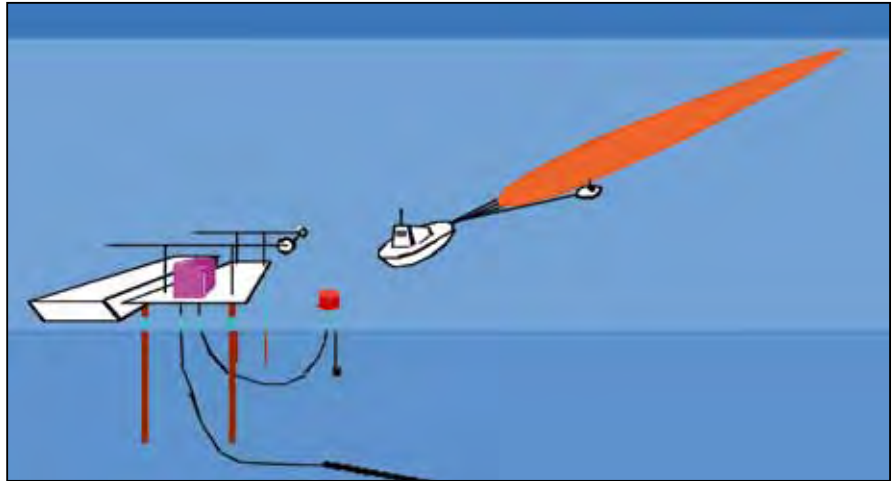
## The pipeline link

The two pipeline links, each about 80km in length, form only about 5% of the length of this approximately 2500km long water transport scheme. However, these pipeline links are the most expensive part of the scheme due to the high cost of large diameter, high pressure, steel pipe. The cost estimate for the pipelines is based on the cost, \$750 million, of the North-South pipeline that will pump Murray River water 70km over the Dividing Range between Goulburn and Melbourne.

Based on this cost, the infrastructure cost of the scheme to provide 1GL/day of northern river water to the Murray River Basin is estimated to be \$1720 million for the pipeline link and \$60 million for the



Outline of the scheme to float water on the East Australian Current from the Burdekin River to Tathra, then by pipeline to the headwaters of the Murray River.



Components of a sea going water transport scheme include a water bag, power pod, tugboat, discharge pipes, loading gantry and barge for freighting water bags.

sea link, a total of \$1780 million, about two billion dollars.

## Operating cost of the scheme

The principal operating costs are associated with the energy cost for towing the water bags a distance of about 100km into the EAC and 200km out of the EAC and the water pumping cost to lift the water about 1.2km up the Great Dividing Range.

Considering the drag coefficient of the bags and estimates of tug boat efficiency, the fuel cost to tow four 250ML bags 300km each day is \$28,000/d.

Assuming electricity is available at 6c/kWhr, the energy cost for pumping 1GL/d up to Lake Eucumbene is \$399,000 per day.

This suggests the total running cost of the scheme is \$427,000 per day. However, a large fraction of the energy cost for pumping can be regained by generating electricity as the water falls down through the hydro electric scheme to the Murray River.

The water is pumped by electric pump 1.2km up to Lake Eucumbene. It then falls 800m down through the Snowy Hydro to the Murray River.

Thus, two thirds of the electrical energy for pumping up the east side of the Great Dividing Range can be regained from electrical energy generated by the water falling down through the generators on the west side of the Great Dividing Range and into the Murray.

## Environmental concerns

The transfer of water from a northern

tropical river to naturally snow-fed rivers in the south may introduce new organisms into those rivers. However, the time of transfer, 32 days, in an impermeable container, would result in a major reduction of live organisms being transferred.

Spilling cargo from vessels at sea is a major concern. However, spilling 250,000t of fresh water into the sea from a water bag would have the same effect as a heavy shower of rain at sea ie, no effect. Collisions with a large vessel such as an oil tanker would simply part the bag and would probably be imperceptible to crew on the vessel.

In the event of a beacon indicating a water bag moving towards a reef or an island or being trapped in an eddy, the accompanying power pod would be started and the bag towed up to 250km to rectify the situation.

Jock Wallace suggested extending the water bag concept to supplying the Murray River Basin. Andreas Luzzi suggested electricity generation using the Snowy Hydro Scheme. Comments were made by Glen Johnston, David Griffin and Bob Swinton.

This article extends a 2007 article called "Northern river water for Australian cities?" by I Edmonds which appeared in *Water*, Journal of the Australian Water Association, September 2007, pg 80-82 which described a scheme to float water from the Tully River to Brisbane. ●

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