



The big dry

Combating the drought

The drought is slowing tightening its grip around the country and feeling the effects more than most is the turf management industry. Aside from looking to the heavens with increased urgency, a number of clubs are being forced to seriously evaluate their future water needs and undertake a variety of projects to ensure their survival. In this edition's lead story ATM looks at how the drought is impacting golf clubs and looks at the ground breaking sewer mining project at Pennant Hills Golf Club.

Open any newspaper or flick on the evening news these days and there's a high probability that leading the headlines will be some item relating to the drought. Whether it's news of another sporting code cancelling a season or preseason due to hard and unsafe grounds or a snippet of a forlorn farmer standing over dying crops or cattle, there is little doubt that the drought affecting many parts of the nation is foremost in the consciousness of most.

As the general populus gets used to showering with buckets at their feet, piping greywater from washing machines to water gardens and being actively encouraged by water authorities to adopt the very 'un-Australian' practice of 'dobbing in' water wasters, turf managers could be forgiven for proclaiming 'You think you've got it tough!' In many cases turf managers have been battling the affects of prolonged drought and declining water quality for years, watching with heavy hearts as the turf surfaces they try to carefully nurture are slowly strangled by Mother Nature's ever-tightening grip.

The stories are the same everywhere you go, from Adelaide to Sydney, from country Victoria to rural NSW. When ATM conducted a ring around in early February to gauge how those courses under water restrictions were faring, the response was fairly unanimous – "We're doing it bloody tough."

Take Mark Crittenden at Cumberland Country Golf Club. Course superintendent at the Sydney course for the past 14 years, Crittenden hasn't been able to give his kikuyu fairways a full irrigation cycle in four years. While he has an exemption to water tees and greens, for the past three years the club has spent in excess of \$330,000 tanking in water just to keep fairways alive.

While Cumberland's turf surfaces manifest the physical impact of the drought, behind the scenes the club is also feeling it. The club has lost valuable revenue from cancelled trade golf days, membership numbers have dropped significantly, while Crittenden has had his maintenance crew cut back by three to just seven.

Despite the situation, Crittenden says the club has remained very positive and he is doing his best as a superintendent to keep members informed of the situation through regular newsletters and communication.

"It's been pretty diabolical," reflects Crittenden on the past four years. "Some guys might say well at least you don't have to mow fairways and roughs, but it can get pretty disheartening, particularly when about four years ago we had the course as one of the best in the west of Sydney. We've been tanking in water for the past three years now. We bring in around 230,000 litres every day at a cost of \$700 which is a significant outlay over a year.

BY BRETT ROBINSON

A common site at a lot of golf course these days. This dam, at Eastwood Golf Club, would normally hold up to 30M but midway through summer was down to between 5-7M

"Fortunately having kikuyu fairways has been a blessing. It's an incredible grass. Some think of it as a weed but for us here, if we didn't have kikuyu we would definitely be in a worse position. We had a little bit of rain at the start of the year and it's amazing how quickly it came back."

It isn't for lack of trying that Cumberland finds itself in this current situation. Over the years it has sunk a bore 325m but got nothing, while the course's location makes harvesting stormwater and sewer mining unfeasible.

Despite the hard times, there is some light on the horizon for Crittenden and his staff. The club currently has a development application lodged with Holroyd Council to get a pipeline installed which will pump 500,000 litres a day from a natural spring located in an old Boral quarry about 4km away.

The water will need to be treated, as it is not of high enough quality for greens irrigation (Crittenden may look at passing the water over limestone chips to take out any excess salts) but such is Crittenden's optimism that the project will come to fruition that he has scheduled fairway renovations for November.

While Crittenden plays a waiting game, his NSW colleague Daniel Metcalfe at Beverley Park Golf Club is also biding his time. Relying solely on mains water to irrigate tees and greens, the course is eagerly anticipating the arrival of treated effluent from a sewage treatment plant which will be constructed by Kogarah Council on land adjacent to the course.

The council has been trialling sewage treatment for the past 18 months and the project, which has received state and federal government grants to the tune of \$2.2 million, will ensure that Beverley Park, as well as the council's other parks and sports grounds, will have a guaranteed water source for the future.

"We have been told it will come online in about 10 months, but you know how these things go," says Metcalfe. "When it does come on Beverley Park will be one of the better off courses in the area."

As well as treated effluent, Metcalfe was also planning on sinking a bore in late

February and was confident of getting some good quality water from the structure which also supplies Mona Vale and Cromer golf clubs to the north.

SAME ISSUES, DIFFERENT STATES

Over in Adelaide, the driest state capital in Australia, Andy Blacker and his staff at Thaxted Park have been furiously handwatering all summer and all non-turf maintenance projects have been put on hold as the crew concentrates on keeping the course alive.

Levels are that critical in the course's five dams that mains water has been required to irrigate greens and tees, and for the first time in a long time the club has instituted a water levy for members, which has brought in between \$40-50,000. Blacker says the members have been very understanding given the widespread drought and the realisation that golf courses and turf facilities are doing it hard.

"The main problem which has compounded the restrictions has been the length of the season," says Blacker. "The August-September-October period was some of the driest months we've had in a long time and we only received 15-20mm when our historical average is between 60-80mm.

"Ironically, even though it has been one of our longest dry periods, we have actually managed to reduce water usage on our greens. If there's one thing the drought has done, it makes you really examine how you apply water to the course and how you need to be spot on so as not to waste any."

In Melbourne, which is currently at Stage Three restrictions with Stage Four triggers not far off, two of the country's most famed layouts – Metropolitan and Victoria – are doing it particularly tough.

"We're not in the best shape but we are hanging in there," admits Victoria Golf Club superintendent Ian Todd. "We knew before spring there was the potential for a tough period ahead so we took a few steps to



minimise wear and traffic on the course. We have brought in a 'rough-only' policy for carts which are no longer allowed on fairways and that has been pretty successful. Members have also been asked not to invite as many guests although we haven't really policed it too much."

A few kilometres away at Metropolitan Golf Club and superintendent Richard Forsyth has watched his dam levels get to critical level over summer (when ATM called in early February he had just 8M remaining) while at the same time declining bore water quality has exacerbated an already trying situation.

"It's really a case of the 'haves' and the 'have nots'," laments Forsyth who hasn't irrigated fairways all summer. "You look across the fence to Huntingdale and the fairways are nice and green whereas ours are white. It's a bit hard particularly when you now how good you can get the fairways.

"Our greens and tees, which we've been handwatering within the current restrictions, are fine, but our fairways have been hit hard. Even if we do get a bit of rain I can't see them getting back up much above 80 per cent cover come winter."

To help Metropolitan get by over the summer, the course received an unlikely helping hand from a benevolent neighbour. Huntingdale Golf Club superintendent Mick Freeman approached Forsyth before Christmas with an offer to set up a temporary line to pump water from a disused bore on his site to top up Metropolitan's dwindling resources.

Forsyth estimates that Metropolitan has taken around 10M and says that the extra water has been a lifeline. "It was a very neighbourly gesture on Michael's behalf and without Huntingdale's help we would be in a lot worse position than we are now," says Forsyth.

Aside from resorting to naked rain dances, Forsyth says the club is investigating a variety of options including stormwater harvesting as well as continuing the push, along with other sandbelt clubs, to have a pipeline constructed from the Carrum treatment plant in south east Melbourne.

A sign of the times. Melbourne's Marcellin College makes it clear to the public where its irrigation water doesn't come from

COMBATING THE DROUGHT – A TECHNICAL PERSPECTIVE

The ability of a plant to survive unfavourable external moisture stress is known as drought resistance (Kim et.al. 1988). Plants can survive drought in a number of ways – either escape, go into dormancy, increase their water absorption capability, while some possess xeromorphic features or have a physiological capability to endure dehydration. The escape and dormancy mechanisms are a specialised means of plants avoiding drought while the increased water absorption and xeromorphic features merely delay the onset of dehydration.

Escape: Most annual plants that germinate, establish and produce seed when soil moisture levels are favourable, escape drought (e.g. *Poa annua*).

Dormancy: Turfgrasses can survive drought by going into a dormant state. Although the leaves of the plant may die the buds in the crown, rhizomes and stolons survive and initiate new growth when soil moisture levels are favourable (e.g. couchgrass and kikuyu). Buds are extremely drought hardy due to the small cells that are devoid of vacuoles. The brown, dead leaves of a dormant turf can also act as a mulch to reduce water loss by evaporation.

Water absorption capability: Some turfgrasses have a greater potential to survive drought due to an extensive root system. This means its available reservoir of water is much greater, however, this is only advantageous if water is present at the lower soil depths (e.g. couchgrass and tall fescue).

Xeromorphic features: Some turfgrasses possess inherited structural modifications that reduce water loss by transpiration. Species such as couchgrass and tall fescue are examples. Xeromorphic features include decreased leaf surface, altered size, number, spacing and location of stomata, increased cuticle thickness, surface hairs and the ability to roll or fold leaves.

Varieties which have excellent drought resistance include couchgrass, kikuyu and various native grasses; the fescue varieties (hard, tall and red) have good resistance to drought, while *Poa annua* and bentgrass have poor tolerance.

Kim et.al. (1988) studied the comparative

drought resistances among 11 major warm-season turfgrass species, and also among 22 couchgrass, five St. Augustinegrass, six zoysiagrass, and four centipedegrass cultivars.

Researchers measured a plant's drought resistance by how well and how quickly shoots recovered after stress. Significant differences in drought resistance showed among turfgrasses not only in shoot recovery but also in leaf firing. Leaf firing refers to loss of green color and eventual browning/desiccation of leaves, tillers, and whole plants in response to continued drought stress. Leaf firing is a good measure of drought resistance because it integrates drought avoidance and drought tolerance aspects together.

There was an opposite relationship between leaf firing and shoot recovery for each species and cultivars. This means that those turfgrasses that turn yellow or brown earlier tend to have poorer post-drought stress shoot recovery (i.e. poor drought resistance). Most zoysiagrasses and centipedegrasses showed good to excellent drought resistance with minor leaf firing, with couchgrass generally possessing excellent drought resistance. Santa Ana, Tifway and Tifway II have only medium drought resistance and high leaf firing.

The ability of a grass to withstand drought conditions can be related to the root system of the grass. Grasses with deep root systems have a greater drought tolerance than grasses with shallow root systems. Couchgrass can have a root system of 2-2.5 metres providing the plant with a huge water reservoir for growth and survival.

In contrast, Kentucky bluegrass has a root system of about 150-300mm while closely mown bentgrass has a root system of 50-150mm. Of the cool-season grasses tall fescue probably has the best drought resistance because of its deep root system.

A plant's ability to recover from drought conditions is also important and this varies between grass species. Couchgrass and tall fescue after prolonged drought have the ability to recover within 15 days of being watered. Bentgrass could take up to five months while Kentucky bluegrass is unlikely

to recover at all. In general, plants with deeper root systems recover more quickly.

MANAGEMENT OPTIONS

When facing periods of drought or limited water availability, there are several management practices that can be implemented to improve the survival rate of turf. Here are some points to consider:

- Slow vertical leaf extension (i.e. vertical growth rate) is an important component of water saving strategies.
- Increasing the mowing height stimulates a deeper root system which will give a stronger plant with greater water scavenging potential. Increasing cutting heights will shade the crowns of the plant and soil during periods of high temperature. This protects the plant and reduces soil evaporation loss.
- The mowing frequency should be kept to a minimum, however, this depends greatly on the quality of surface and type of use (e.g.: green compared to fairway). The more often grasses are mown, the greater their water use is.
- The application of nitrogen fertilisers stimulates leaf growth and with an increase in leaf extension there is an increase in evapotranspiration. Excessive applications of nitrogen produce excessive leaf growth to the detriment of root growth and depth.
- Another important nutrient affecting water use is potassium which reduces water use. Potassium also hardens the plant, giving it greater heat and drought tolerance and improved wearability.

Other methods of helping improve the drought tolerance of turf include:

- Increase cutting height in spring.
- Fertilise with control release fertiliser in spring (ensure there is adequate soil phosphorus for root growth).
- Decompact soils in early spring to improve moisture storage and stimulate root growth.
- Where there is very little water available it may be better to allow the turf to go into dormancy rather than have it in a weakened state with small and inadequate quantities of water.

◀ A HELPING HAND

As golf clubs rush to secure alternative water sources and ensure their future, a large number of projects have received funding through the Federal Government's Community Water Grants scheme. Golf clubs around the country have taken full advantage of the first two rounds of allocations (March and November 2006) receiving in excess of \$8.1 million across 181 projects, an average of \$45,000 per project.

Across both rounds the scheme has handed out around \$123 million, with the amount allocated to golf course projects making up about seven per cent. In round one, 92 projects were awarded grants totalling \$3.356m (33 clubs received the maximum grant of \$45,454.55) and despite the number dropping slightly in round two, 89 projects reaped around \$4.8 million, or nearly 8 per cent of the total allocation (Table 1).

While returning (e.g. conversion from cool-season to warm-season grasses) was ineligible for round two, projects that were allocated grants included:

- Construction of dams to store stormwater/waste water;

- Stormwater diversion;
- Installation of waste treatment systems;
- Installation of rain water tanks;
- Irrigation system upgrades to improve water use efficiency or to cater for treated effluent/waste water coming online;
- Construction of washdown bays and recycling systems to recycle wash water;
- Construction of wetlands to aid in nutrient stripping and to reuse water for irrigation;
- One golf course in Western Australia was given a grant towards installing synthetic greens.

The big winners in round two included Goondiwindi Golf and Country Club (\$227,273), Royal Hobart Golf Club (\$227,273), Mona Vale Golf Club (\$226, 818), Long Reef Golf Club (\$226,455), Shortland Waters (\$222,727), Tasmania Golf Club (\$159,572), Barwon Valley Golf Club (\$94,092) and Bannockburn Golf Club (\$91,728).

Goondiwindi's grant was for the complete upgrade to an automatic irrigation system, while for the two Tasmanian courses the money will be spent on tapping into treated effluent drawn from the Coal River Water Recycling

Scheme (see ATM Vol 9.2 for an in-depth look at this project).

Mona Vale Golf Club, home to NSWGCSA president Andy Hugill, was successful in winning a grant which will be used to construct a wetland cell to treat stormwater taken from a total catchment area of 142 hectares. The club plans to rehabilitate sediment ponds and install gross pollutant traps as well as upgrade the irrigation system.

Round three applications of the Community Water Grants scheme is expected to be open in mid-2007. Golf clubs can register for information updates through the scheme's website (www.communitywatergrants.gov.au) as well as find out more information on guidelines and how to apply.

BREAKING NEW GROUND

One of the most radical and groundbreaking projects to combat the drought is currently underway at Pennant Hills Golf Club in Sydney's north west. Home to superintendent Richard Kirkby, the club is set to embark on the final stages of a project which will see the installation of a sewage treatment plant on the ▶

course which takes directly from sewer pipes running underneath the course.

The sewer mining project is the first of its kind being undertaken by a golf club in Australia and has the potential to revolutionise the way in which golf clubs irrigate in the future. The project is the result of an exhaustive 10-year process the club has gone through examining various water source options and will spell an end to the club's reliance on potable water.

As of the second week of February, Pennant Hills started commercial negotiations with Zenon Membranes, the largest manufacturer of treatment plants in the world, to supply a treatment plant which will turn raw sewage into Class A water sufficient to irrigate the entire course, tee to green.

The Pennant Hills project is Zenon's first foray into the golf industry and will be carried out in conjunction with Water Technology Australia. Pennant Hills has gone for a plant that boasts 'membrane technology', which gives the best quality water outside drinking quality water. According to the club's general manager Stewart Fenton, construction is expected to start in March and all things going to plan the plant will be officially commissioned on 1 November, 2007.

The system works like this. From an offtake well which will be constructed near the 18th tee, sewage is gravity fed into the plant where it first undergoes a chemical process. Oxygen is pumped into the sewage and then removed quickly allowing the bioreactor bacteria to eat as much of the sludge as possible.

From there the 'water' goes into the membrane system where it is treated. Fenton likens the membrane system to a thousand strings of spaghetti with each 'string' containing 1200 pores that are .35 of a micron. At that size they are able to effectively filter out a host of harmful viruses and bacteria such as giardia and cryptosporidium.

After going through the membrane, at which point the water is pretty clear, it then goes through a UV process to kill off anything else that might be in there. According to Fenton the membrane will take out around 90 per cent of harmful bacteria with the UV process nailing the remaining 10 per cent. In order to get the water to drinking quality, it would go through exactly the same process, except after going through UV treatment it would then go through a second, smaller membrane system.

TABLE 1. FEDERAL GOVERNMENT COMMUNITY WATER GRANTS TO GOLF COURSES IN ROUNDS ONE AND TWO OF ALLOCATIONS

State	Round 1 (March 2006)		Round 2 (November 2006)	
	No. of Projects	Total Grants*	No. of Projects	Total Grants*
VIC	28	1,001,000	23	1,072,000
NSW/ACT	23	886,000	37	2,039,000
QLD	16	545,000	10	622,000
SA	15	528,000	9	366,000
WA	5	186,000	3	137,000
TAS	5	210,000	7	594,000
TOTAL	92	3,356,000	89	4,830,000

* Approx figures taken from www.communitywatergrants.gov.au website

"It's a three-step process to get to drinking water and we are using two of those three to get the best possible quality water possible," says Fenton. "As part of our research, Richard (Kirkby) and I went up to Brisbane for a site inspection at another of Zenon's treatment plants. Richard even drank some of the treated water. He hasn't grown three heads yet, so it must be alright."

Once the water has been treated it is pumped straight into the course's irrigation system with any water that is not used going straight back into the sewer.

Once up and running Pennant Hills will be able to pull out whatever it requires which at this stage is dictated by how much the sewage flow is down through the system. Fenton says the conservative estimate for dry weather flow is 675 kilolitres a day which works out about 21M a month, more than adequate for irrigation purposes right across the course.

The water which comes out after treatment is classified as 'Class A fit for intermittent human contact' and has a pH of between 7-7.5. The treatment plant itself is fully automated and will require around eight hours a week of onsite sampling (as required by legislation) and maintenance. Being fully automated, the plant has inbuilt triggers and should any problems arise both Fenton and Kirkby are alerted either by email or SMS.

One of the key components of the project has been the drawing up of a sewer mining agreement with Sydney Water, which Fenton says has taken the best part of 12 months to hammer out. "Seeing that we are the first club to undertake a project like this, there is the expectation in the years to come that other clubs won't have to go through the same pain and suffering because the work has already been done," says Fenton.

"The agreement with Sydney Water assures the club of a water supply for the next 30 years with a 30-year option. We have a guaranteed access to the sewer main flow and part of the agreement is that no-one is allowed to build or take any sewage out of the system upstream from us.

"The Independent Pricing Tribunal has also laid down an arrangement in Sydney where because the club is taking the sewage and treating it, meaning Sydney Water doesn't have to, we don't pay for the water."

The club has received \$1.1 million in funding for the project from the NSW Department of Energy, Utilities and Sustainability (DEUS) as well as \$45,000 from the Federal Government's Community Water Grants scheme. The club has budgeted \$3.5million for the project and the expectation is that it should come in under that total.

"This project has certainly sparked a lot of interest Australia-wide," says Fenton. "I have probably five or six phone calls a week from various golf clubs, community groups and councils. The other week I had AFL Queensland ring, so there has been widespread interest in every aspect of this project.

"It has been a fascinating project to be involved with and to get to the stage where we are at now is very satisfying. We have had a lot of government support – Sydney Water, DEUS – which has been fantastic and the members here have been right behind the project too as they recognise it will secure the long-term future of Penno.

"One of the unexpected benefits is that since we announced this project our waiting list has gone from next to nothing to now being almost a year because the expectation is now that the course is going to improve significantly when we have an endless water supply." 🌱