ROYAL AUSTRALIAN INSTITUTE OF PARKS AND RECREATION 6.3.93
VICTORIAN REGION STATE CONFERENCE
at the Hilton on the Park Hotel
193 Wellington Parade, West Melbourne

MARCH 29-31 1993
"OPTIMUM USE OF OUR WATER RESOURCES FOR PARKS AND RECREATION"

PROGRAM

DAY 1 MONDAY MARCH 29 1993

8.00-9.00 Registration

PLENARY SESSIONS

9.00-9.05 Vic. Region's President's Address - Dr David Aldous

9.05-9.10 National President's Address - Tom Crossen

9.10-9.30 Keynote Address - "Water: A Global Perspective"
- The Honourable Barry O. Jones AO FTS MP

9.30-10.15 "Water for Our Future"
David Heeps, Manager, Water Resources Management Branch, Dept of Conservation and Natural Resources, Vic.

10.15-10.45 Morning Tea

10.45-11.30 "Water - Parks and Open Space" Andrew Taylor - Director, Parks & Recreation, City of Adelaide and Kerry Geale, Controller Parks & Recreation Facilities, City of Wagga Wagga, NSW

11.30-12.15 "Water - Sport and Recreation" Prof. Peter Cullen FTS, Professor of Resource and Environmental Science, Director Water Research Centre, Univesity of Canberra

12.15-1.30 Lunch

CONCURRENT SESSIONS

Theme:	1 Minimising Water Use	2 Communication/Conservation/ Aesthetics	3 Sport and Recreation
1.30	Use of Modern Technology to Conserve Water in the Urban Environment - particularly in Reference to Recreation - Keith McIntyre, Manager Technical Services Unit, ACT Parks & Conservation Services	Water in the Landscape - Nick Safstrom, Director, Loder & Bayly, Consulting Group, Hawthorn Vic.	Whose River is it Anyway? Resolving Conflicting Use - Dr Colin Leigh, Principal Planner, Parks & Waterways Planning, Melbourne Water
2.15	Irrigation Efficiency - The Issues - Geoff Connellan, Senior Lecturer, VCAH, Burnley Campus	" "	Multiple Use of Inland Water Storages - Clarke Ballard, Chief, Water Management, Rural Water Corporation Vic.
2.45	Improved Irrigation Efficiency Through System Design - Bernard Peasley, Principal, Irrigation Design Consultants, Hawthorn, Vic.	Southgate on the Yarra : A Riverside Development in the Heart of Melbourne - David Cole, Director, Buchan Laird & Bawden, West Melbourne	Lillydale Lake - David Joshua, Manager Recreation & Urban Development, Shire of Lillydale
3.15	AFTERNOON TEA	AFTERNOON TEA	AFTERNOON TEA

CONCURRENT SESSIONS

Theme:	1 Minimising Water Use	2 Communication/Conservation/ Aesthetics	3 Sport and Recreation
3.45	Water Audits for Parkland - David Dunstan,Ex-Director Parks & Gardens, City of South Melbourne, Vic.	Ruffey Creek Management Plan : Introduction - David Melvin, Manager Leisure Services, City of Doncaster & Templestowe, Water Design Considerations - Neil Craigie, N.M.Craigie & Associates Developing Multi-Purpose Water Features in a Municipal Park - Alun Chapman, Land Systems, EBC	The Benefits of Water Activities for the Aged - Vanda Fortunato, Lecturer, Physical Ed. & Recreation Department Vic. Uni of Technology, Footscray Campus
4.15	Efficient Water Regimes for City Trees - Dr Peter Yau, Arboriculturist, City of Melbourne	Starting Again - Albert Park Lake - Ann Oldham, Manager, Albert Park, Vic.	Water Recreation for Persons with Disabilities - Dr Anne Binkley, Senior Lecturer, Phys. Ed. & Recreation Dept, Vic. Uni of Technology, Footscray Campus
4.45	Water and Community Health - Dr Sally Ng,Public Health Officer, Infectious Diseases Unit, Health & Community Services, Vic. Using Reclaimed Water - Benefit or Risk? - Robert Eden, Senior Eng. Water Technology Unit, Health & Community Services, Vic.	Melbourne's South-east Wetlands - Geoff Mabbett, Lands and Waterways Manager, South-east Region, Melbourne Water	Water for Children's Play - Sally Jeavons, Coordinator, Recreation Planning & Development, City of Melbourne
5.15	CLOSE	CLOSE	CLOSE

6.30 CONFERENCE DINNER

DAY 2 TUESDAY MARCH 30 1993

8.00-8.30 Registration

PLENARY

8.30-9.15 Psychological Value and Benefits of Water in Parks & Recreation - Dr Brian Nettleton, Senior Associate, School of Environmental Planning, University of Melbourne

9.15-10.00 Implementing Strategies for Optimum Water Use and Reducing Pollution in Major Urban Parks - Nigel Caswell, Manager Parks, Melbourne Parks & Waterways, Melbourne Water

10.00-10.30 Morning Tea

CONCURRENT SESSIONS

Theme:	1 Minimising Water Use	2 Communication/Conservation/ Aesthetics	3 Sport and Recreation
10.30	Xeriscapes for the Future - Stephen Forbes, A/Principal,Horticultural Scientist, Royal Botanic Gardens, South Yarra Vic.	Community Expectations of Water Features for Parks and Urban Streams - Brett Cheatley, Co-ordinator Research, Melb. Parks & Waterways Planning, Melbourne Water	Water Resources for Canoeing - Jane Farrance, President, Victorian Canoe Assoc.

CONCURRENT SESSIONS

Theme:	1 Minimising Water Use	2 Communication/Conservation/ Aesthetics	3 Sport and Recreation
11.00	Selecting Trees and Shrubs for Minimal Water Use - Michael Looker, Lecturer, Environmental Horticulture VCAH Burnley, Vic.	Conserving Water - Getting the Message Across - speaker (to be advised)	Management of Waterways for Rowing - Andrew Geurin, Victorian Councillor to the Australian Rowing Council
11.30	The Use of Native Grasslands for Water Conservation -John Delpratt Lecturer in Nursery Production, VCAH Burnley	Interpreting Water - Rachel Faggetter, Lecturer, Environmental & Heritage Interpretation, Rusden Campus, Deakin University, Vic.	Water Resources for Fishing - Charles Barnham, Extension & Information Officer, Freshwater Fisheries Branch, Dept of Conservation and Natural Resources, Vic.
12.00	LUNCH	LUNCH	LUNCH
1.30	Amenity Grasslands for Dry Times - Dr David Aldous, Principal, Lecturer, VCAH Burnley, Vic.	Wetlands at Coolart and Their Interpretation - Steve Yorke, Warden, Coolart, Vic.	Public Aquatic Centres of the Future - Brendan Sheehan, Recreation & Youth Services Manager, Shire of Melton, Vic.
2.00	Optimum Water Resources for Wetland & Wildlife Systems - Dr Lance Lloyd, Principal Scientist (Water Quality) Rural Water Corp. Vic.	Conservation Values and Interpretation at Werribee Treatment Complex - Martin Stone, Community Education and Relations Officer, Werribee Treatment Complex, Melbourne Water	- Ross Williamson, Facilities Planning Consultant, Dept of Arts, Sport & Tourism, Vic. - David Melvin, Manager, Leisure Services, City of Doncaster & Templestowe, Vic.
2.30	GENERAL DISCUSS. ON STREAM	GENERAL DISCUSS. ON STREAM	GENERAL DISCUSS. ON STREAM
3.00	AFTERNOON TEA	AFTERNOON TEA	AFTERNOON TEA
3.30	**PLENARY** Panel of Convenors and Keith McIntyre - The Future - and Summary	**PLENARY**	**PLENARY** Introduction, Discussions
4.30	CLOSE	CLOSE	CLOSE

5.30 Boat trip to Pipemakers Park - BBQ Tea - Interpretive Tour of Park

DAY 3 WEDNESDAY MARCH 31 1993

Optional Tours 8.00 - 4.00pm

1. Melbourne City & Inner Suburbs
   Melbourne City Council - Street Tree Watering & Control, Royal Parade; Visit Royal Park dryland landscape and Yarra Park
   Royal Botanic Gardens - Xeriscape & Water Regimes
   Albert Park - Renewing an Historic Lake & its Subsequent Planning, Management and Use
   Southgate - Redevelopment Along a Segment of the Yarra Through Melbourne - a most Popular Spot for Residents and Tourists alike

2. Yarra Valley
   Travel along the Yarra Valley Metropolitan Parks to Westerfolds and City of Doncaster & Templestowe Park and Aquatic Centre; Landscape, Land & Water Management and Pollution Control in a Major Riverside Park as well as Melbourne's Newest Aquatic Centre and Major Water Orientated Municipal Park, Outer Eastern Municipality

3. Aquatic Centre Tour
   Highlights of four top quality aquatic centres in Metropolitan Melbourne.

Lunch will be provided on each tour.
Please note that tours will proceed if minimum number of applicants for each tour is 12.

"THE OPTIMUM USE OF OUR WATER RESOURCES FOR PARKS & RECREATION"

CALLING ALL PARK PROFESSIONALS

- *Are you prepared for the next dry times?*
- *Admittedly you have hardly had to take out a hose this year but ...!*
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- *Learn to plant xeriscapes - reduce watering and maintenance costs.*
- *Learn the best techniques for creating swamplands and their value to the park visitors.*
- *Learn about the requirements of canoeing, rowing and fishing enthusiasts for your waterways.*

CALLING ALL RECREATION PROFESSIONALS

- *Are you up-to-date with the latest information on Aquatic Centres, best methods for water use by children, Disabled Persons and the elderly?*
- *How do you provide the best deal and enjoyment for visitors to Aquatic Centres? Inspect 4 of the best in Melbourne.*
- *Make the best use of your waterways for canoeing, fishing and rowing.*
- *Know the best techniques for interpreting the many forms that water takes in parks, from swamps to billabongs, from streams to lakes!*

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VENUE
The Hilton on the Park
Wellington Parade, East Melbourne

USE OF MODERN TECHNOLOGY TO CONSERVE WATER IN THE URBAN ENVIRONMENT PARTICULARLY FOR RECREATIONAL USE

by

Keith McIntyre *

I would like to preface this paper with the following message to managers of irrigated urban amenity turf. **BEWARE OF THE WATER RATIONALISTS**. These people are blood relations to the economic rationalists who infest our nations treasuries and only look at any operation or function in relation to its dollar cost and ignore all the long term social and environmental aspects of that operation. The water rationalists, and I am sure that they are present in this audience, only look at their precious water usage figures and compare the amount of water used by the average community in Perth with that used by the equivalent group in Sydney or Canberra, and come up with the assumptions that the users in Sydney only use half as much as those in Canberra, and two thirds as much as the Perth users. From these statistics they then draw the conclusions that the users in Canberra are very wasteful, and that those in Perth have to lift their game to be as thrifty as the Sydney users.

WATER RATIONALISTS ARE JUST AS DANGEROUS AS ECONOMIC RATIONALISTS - they haven't looked at the whole picture.

When it comes to water usage, the 'within house' use of water is about the same all over Australia. The big difference is in the 'outside of the house' usage i.e. in the garden, and within the garden the lawn consumes between 80 to 90% of that water. This means that the majority of the water used in our urban environment is used maintaining grass.

This fact horrifies the water rationalists, and of course their first and most obvious target is irrigated public amenity turf, because everybody can see it, and it is very easy to target it politically through the media. Whilst some may say that this is fair, I do not, and several aspects of this type of water rationalism must be put in the full context of the whole community picture.

Firstly, the amount of land which is used for public recreation in our major cities is a very small percentage of the total urban area. The amount of this land that is irrigated to provide a more sustainable public amenity is extremely small, compared to the irrigated area inside the fences of private homes and properties.

This point is very important to understand, because the economic rationalists are only looking at the cost of maintaining that piece of grass and not considering its quality and contribution as a community asset. Let us hope these economic dinosaurs will meet the same fate as their predecessors and soon become extinct, but let us try to educate the water rationalists before they too become dinosaurs.

When we are deliberating on how to save water on our amenity turf, I believe we should firstly ask a series of questions about the amenity

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* Manager, Technical Services Unit
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we are about to deprive of its traditional dosage of water. This process should address the following questions:-

a. what use is this area of amenity turf being subjected to?

b. does the community consider that this facility should have a good standard of turf quality throughout the year ?

If the answers to these questions indicate that this facility is used by the community regularly, and its expectation is for it be of a good standard of turf quality throughout the year, then the next decision should be - **how can we provide that amenity at the required standard in the most cost effective way, particularly in relation to water usage.**

Once we have been through the above process, and only then, should we decide whether to irrigate, or reduce the irrigation on any area of public amenity turf. Such a decision should include how much water is necessary to sustain that amenity to the community expectation.

WE SHOULD NEVER GO DOWN THE PATH OF CUTTING IRRIGATION ACROSS THE BOARD, JUST TO SAVE MONEY AND WATER. But how often do we see just that happening. **Beware of the water rationalists!**

If you need to use a certain level of irrigation to grow grass to an acceptable level for community use, then you have to educate the water authorities, and the public, that this is high priority water, and the community at large will have to make other sacrifices in the saving water stakes. All too often public watering is targeted by the press and other members of the community, only because they can see water being **used, and not necessarily wasted** on a football field or park.

How much do we see, or read in the media about the sins of the thousands of people who let water run off their lawns and down the gutter every time they water? Very little - it just isn't news. Public authorities have to **make** it news and focus the attention on the real water wasters in our communities **THE HOME GARDENER.**

Having said all that I would now like to turn my attention to how public authorities such as local government can save significant amounts of water by using new technology.

Climate The climate of any area is the major factor in determining water usage, for amenity turfgrass together with the type of turfgrass that is best suited to that area.

In Canberra for example, we experience up to 100 frosts per year, and these extend from April to September, and sometimes beyond. This has a great bearing on the type of grasses that are suitable for amenity turf in this area.

For instance Couch and Kikuyu are not suitable grasses for amenity turf in Canberra because they are dormant from April to September, whereas the Cool Season grasses such as Kentucky Bluegrass, Tall Fescue, and Fine-leafed Ryegrass are excellent for this climate. They stay green all year round, withstand winter wear, and recover from wear. They do however require considerably more water.

For Adelaide and Perth, Couch is the best grass for their climate, because it grows very well for most of the year, its winter dormancy is only short, and it withstands winter wear.

Melbourne has a difficult climate, because it probably falls in between a Cool Season and a Warm Season area. The Cool Season grasses grow well here, but the winters are mild enough to allow Couch to be used, with varying degrees of success.

Melbourne is probably a little too far south for good Couch growth. Low light intensities, particularly in most Melbourne springs usually means that Couch does not compete very well until December. Melbourne really should be classified as a Cool Season grass area for the sake of the irrigation debate.

Water usage of grasses There is a significant difference between the amount of water needed to maintain Cool Season grasses, and Warm Season grasses.

The following table can be used as a good guide to the comparative water needs of the various turf grass types.

Grass type	Percentage of nett Evaporation to be added as irrigation to achieve good grass growth.
Couch	40-45%
Kikuyu	40-45%
Kentucky Bluegrass	60-65%
Perennial Ryegrass	60-65%
Tall Fescue	60-65%

Table 1. Shows the different amount of water required by the various grasses to keep them in good condition. The values are expressed as a percentage of nett evaporation.

The most important aspect of climate is evaporation, or more particularly nett evaporation, which is total evaporation minus rainfall. Canberra for example, has a very high yearly evaporation of about 1600mm, and the annual rainfall is only 600mm. This means there is an annual nett water deficit (nett evaporation loss) of about 1000mm (1 metre). In simple terms if you have a swimming pool that is uncovered, one metre of water will evaporate from it every year, or you would need to add the equivalent of 1000 mm of rainfall to keep it topped up.

As shown in Table 1 the Cool Season grasses require about 65% of nett evaporation to be added as irrigation to maintain good density under wear, and in Canberra this amounts to 600-650 mm per year. Whereas those areas where Couch and Kikuyu are used, which may have an equivalent nett evaporation loss, would only have to apply 400-450mm of water as irrigation per year.

If we compare the nett evaporation losses, together with the grass type used in the various cities around Australia, the water needs of the communities in these areas become very much clearer than by just comparing the total water usage figures per head of population.

City	Grass type used Cool season CS Warm Season WS	Yearly Nett Evaporation in mm	Water Required in mm.
Canberra	CS X 65%	1050	680
Adelaide	WS X 45%	1400	630
Melbourne	CS X 65%	840	550
Perth	WS X 45%	1160	520
Brisbane	WS X 45%	800	360
Sydney	WS X 45%	660	300

Table 2. Shows the approximate amount of water in mm that has to be added as irrigation to grow good grass in six Australian cities.

This data shows that Canberra and Adelaide have about the same water requirements, Melbourne and Perth have similar requirements, as do Brisbane and Sydney.

It is unacceptable to compare Adelaide and Canberra with Sydney using data based only on water usage per head of population. We frequently see this comparison, and it is quite flawed, because Sydney requires only half the water to maintain turfgrass and home gardens than that required in the other two cities. It is absurd to expect people in Adelaide to exist with only half the grass in their environment than the people of Sydney. Quite simply the Adelaide water authority needs to supply twice as much water to its customers as the Sydney Water Board for their 'out of house' needs.

There are many ways however, in which we can be more efficient water users in the urban situation, particularly as public users.

Need to irrigate In most cities in Australia, indeed I would venture to say in all cities in Australia, there is a need to irrigate amenity turf for some period of the year, particularly if that turf is being subjected to wear.

This means sportsfields, high use areas of parks, race courses, golf courses and bowling greens all need to be irrigated to maintain an acceptable grass cover. The amount of irrigation required and the duration of this irrigation is of course quite variable, as indicated in Table 2 and is totally dependent on weather conditions and grass type.

In cities such as Adelaide and Canberra there is a need to irrigate almost all amenity turf areas for at least 9 months of the year because of the hot summers, and because of their high nett evaporation.

If turfgrass in these areas is not regularly irrigated during the summer, and then subjected to wear in the winter, it very quickly degenerates into dust, and then mud.

THE USE OF MODERN TECHNOLOGY TO SAVE WATER

We have come a long way in the past five years in the field of water conservation in the urban area, especially for parks and sportsgrounds. I am pleased to say that in this field Australia, and in particular the city of Canberra, leads the world. The first of the methods we have employed is the use of computer technology.

1. Computer Controlled Irrigation

The most efficient urban irrigation system yet developed anywhere in the world is that currently being used in Canberra. It is a computer controlled system called COMTROL, and has been jointly developed by J.M. Developments and the ACT Parks and Conservation Service.

It is currently watering about 600 hectares of sports grounds in Canberra, and is controlled by three personal computers. It is also being used by Stirling and Canning City Councils in Perth. It is controlled by radio, and has several very sophisticated aspects, which are very simple for the operator to use, but are based on very advanced software.

The system is based on a philosophy of watering developed by Peter Semos at the Technical Services Unit in Canberra in the early 1980s, and is now the basis for several of the leading computer controlled irrigation systems in Australia and also in the USA, (McIntyre and Hughes 1988).

Comtrol operates on a climate driven model which determines how much water should be applied to turf, and when it should be applied. It uses daily evaporation readings as it's driving force, knowing that grass water use is directly linked to this parameter.

The formula on which all watering schedules are based, and predictions are made, is as follows:-

Available Soil Moisture in mm / cm depth	X	Root Depth in cm	X	Drying Factor #(eg. 75%)	= **A**	[Total Soil Moisture Available to Grass (mm)]
Grass Type Crop Factor	X	Daily Evaporation (mm)			= **B**	[Total Water used by the Grass/day (mm)]

A/B gives an estimate of the number of days between watering.

Table 3. Shows the formula that drives the computer controlled irrigation system Comtrol

For example, given the information [silt clay soil with a water holding capacity of 1.6mm /cm depth; growing Tall Fescue which has a crop factor of 0.6 (60% of nett evap.); a root depth of 10cm; and using a drying factor of 0.75 (75%); on a day where the total evaporation was 5mm] we can compute the following;

1.6 X 10 X 0.75 = 12 mm **A**

0.6 X 5 = 3.0mm **B**

A represents the amount of water available for the grass in the 100mm of soil i.e. 12mm

B represents the amount of water the grass used in that day

A/B represents the number of days before water is required, if the weather remains the same, i.e water on the fourth day.

A-B shows how much water is left in the soil after that day's grass use i.e. 12 - 3 = 9mm.

The whole philosophy of this type of watering is "to water as infrequently as possible without damaging the grass density, and at every watering to wet the whole of the root zone". We call this the **"Smart" Philosophy of Watering**, and it saves water in three ways:

a. the soil is allowed to dry out to a point short of where the grass will stress (# eg. 75% of soil moisture available to the grass before stress), and then only the root zone is topped up to field capacity at each watering. This saves water by developing deep root systems, which allows the grass to effectively use water from rain that otherwise would have been been below the shallower roots in the profile.

b. it only waters the grass when the grass needs it, not when the manager thinks it needs it.

c. it makes much more effective use of rainfall (McIntyre and Jakobsen 1992, IAA seminar.).

This philosophy differs greatly from the traditional method of watering, where the controller is set to come on (for example) Monday, Wednesday, and Friday and the length of time each station should water is estimated. Using the traditional method, it was very difficult to apply water at the rate the grass actually used it, and as a result any manager worth their salt over-watered to ensure the grass did not die.

The use of our model in a computer controlled system ensures that the grass is only watered when it needs it, and approximately the correct amount is applied at each watering, so as to only wet the root zone.

Each station (or zone) on every playing field has its own data base, or WATER BANK. An estimate of the soil moisture content for each station is regularly being made, and the watering schedule for that station is constantly being updated. When it rains, automatic rain gauges collect the rainfall, and estimate the amount of that rainfall that was effective. The algorithms used to calculate this make Comtrol unique in urban irrigation control systems. This rain (in mm)is added to the water bank for all the stations on that field.

Similarly, when the system irrigates, the amount of water that has been applied to that station is accurately calculated, and this is also added to the station's water bank.

Every day the daily evaporation figure is put into the computer, and the algorithms in the software, based on the formula in Table 3, calculate the amount of water the grass being grown on that facility

would have used. This estimate of water use is subtracted for every station's water bank.

The computer estimates when the next watering event should occur and then schedules it. This may be two or three days in the future. If the next few days have a lower than expected evaporation rate, watering is delayed until the soil moisture has been depleted to the pre-determined level, and then it will water.

Each facility is programmed for every day with Green Time, i.e the hours of that day when watering may occur if the manager decides to water, and with Red Time, the time when the manager does not want watering to occur. If a facility is to be used; needs to be mown; or the local authority may not allow watering during certain hours, then these particular times are programmed as Red Time, and watering CANNOT occur during this period.

All the public irrigation systems for a city of 100,000 people can be programmed from one central personal computer, and updated at any time you like. In Canberra we have only three of these computers controlling all the city's irrigation.

The system is controlled by radio, using 'packet radio', a very cheap and effective means of communication. Each field unit, and the base computer has a radio which is similar to the normal sets used in car two-way radio systems. It does not require powerful base stations and large expensive towers on hill tops all around the place, because if a set receives a message, and it does not recognise the code as its own, it immediately re-transmits it to the next set. The system is set up initially so that every field unit MUST be able to contact three others.

The central computer constantly sends out coded messages to all field units, and each time a field site is contacted, information such as rainfall, irrigation details, faults, etc are relayed back to it. The watering regime for every station is re-calculated, and a new schedule is transmitted back to the field within the next 30 minutes if updating is necessary. The central computer contacts every location in a computer area every 30-45 minutes.

This system has allowed us to achieve enormous savings in water use in Canberra and these savings can be transferred to other parts of Australia, and indeed the world, using this technology.

Fault and Data Reporting. One of the most important features of Comtrol is it's ability to quickly identify faults and report them to the manager. Flow meters are installed at all facilities and the expected flow rate for every station is put into the computer. It is then possible to have the computer react when the flow rate drops below, or goes above this level. A higher flow means that there is probably something broken, and a lower flow probably means something is blocked. The computer knows exactly where and when this fault has occurred. If it is a high flow indicating that there is a burst pipe that station can be shut down and the rest of the facility watered.

Reports can be generated in many ways to alert the manager. These include a message on the printer the next morning, or the computer can even ring you up at home if it is considered serious enough.

When we water using the **"Smart" Philosophy** the times between waterings are extended. This means there is an increased probability that rain will fall when the soil is drier, (closer to the grass stress point) and therefore more likely that more of that rain will be retained within the root zone. If the soil had been closer to field capacity when the rain fell then less of it would have been retained within the root zone, because much of it would have drained lower down in the profile and out of reach of the roots.

You may well say "so what! It doesn't seem to be all that important". However in Canberra we compared the two watering philosophies, and proved that it is.

The first model used the traditional philosophy, i.e. setting the controller to water on particular days during the week. The settings used were three times a week in summer, twice a week in spring and only once a week for the rest of the year. It was more precise and sophisticated (and used less water) than the normal overseer who probably re-sets the controller every two weeks or so. The second model used the "Smart" philosophy, where the grass was only watered when the soil had dried out to about 75% of the available soil moisture, and then the whole root zone was wetted.

The amount of water applied at each watering in both models was calculated using the formula in Table 3.

The two models were run using seven years of daily weather data and the water usage for both was calculated. The watering regimes in both models were those for a typical Canberra sportsfield.

The results were astonishing. Over the seven year period the "Smart" system used an average of 81mm less irrigation per year than the other system. Quite simply it had made much better use of the rain that had fallen.

Now that we have Comtrol installed in Canberra on 600 hectares of irrigated turf **we will save almost 500,000 kilolitres of water per year by more effectively using the rain that falls.** This translates to a **massive yearly saving of $280,000 per year.**

The total water usage savings from Comtrol in Canberra, is about 20% on the previous level of irrgation. This includes the effective rainfall component, as well as effeciencies that are gained simply by having better and more reactive control over the operation of some three hundred controllers. This control is now in the hands of three people rather than thirty. We now have better fault reporting, and undoubtedly better public relations within the community.

These sort of savings satisfy both the economic and water rationalists without losing a single hectare of amenity turf. In fact in Canberra the quality of turf has improved markedly under Comtrol.

Computer controlled irrigation based on a climate model driven by daily evaporation will save water, and in some situations a lot of water if the past practices have not been very efficient.

2. Sensor Controlled Irrigation

If irrigation is controlled by soil moisture sensors, then the method used is similar to that outlined in Figure 1. The soil dries out to a particular point, then it switches the controller on and allows irrigation to occur. When the sensor has become saturated, it switches the system off. This is "Smart" irrigation as it will also allow rainfall to be used effectively, as described above.

The Cumings Sensor, an Australian invention, has been on the market for some time. It has proven to be very successful and reliable and will work in the manner outlined above. This sensor is a ceramic block and measures soil moisture tension and does not have to be calibrated for different soil types.

Soil sensors can be used with conventional irrigation systems. This is achieved by placing the sensor in the root zone of the grass sward in between station one and two, with the sensor wired so that it interrupts the common. When the soil is moist, the sensor will not allow the system to water, and conversely, when the soil dries out it allows the system to water at the next available programmed time.

The philosophy of programming a controller attached to a sensor is quite different from the traditional approach. With sensor watering the controller should be programmed for those times you DON'T want to water, and the rest of the time the controller is programmed to water **if the sensor considers it is necessary.** Watering should be done in cycles of usually no more than 30-40 minutes to achieve maximum efficiency.

There is at least one other reputable sensor on the market, and this is made by Townsmen Industries in Adelaide. This sensor, and several others like it used in agriculture, do not sense soil tension, but measure total soil moisture. This means they have to be calibrated to the soil in which they are operating. They control irrigation in the same way as described for the Cumings sensor, i.e. they interrupt the common.

Sensor watering is "Smart", and makes effective use of rainfall.

Rain Switches. There are several devices which collect rain as is falls and when a number of millimetres have been collected the device switches the system off by interrupting the common.

This can be very useful in saving water at the weekends, and where it is not possible to get to all controllers to switch them off when it rains. It also saves the political embarrassment of irrigation continuing in the rain.

These devices work reasonably well but do need constant maintenance.

OTHER STRATEGIES FOR SAVING WATER.

There are several other ways of saving water whilst maintaining good amenity turf where it is most needed.

Cease watering areas that receive no wear. We have used this strategy very successfully in Canberra, by simply removing all sprinklers that were not watering an actual playing surface or a wear area. This was done around all of our sportsfields and in some cases, whole stations were removed.

Last year we removed about 1500 sprinklers, totalling about 40 hectares that are no longer being watered. This represents a saving of about 240,000 kilolitres, or $135,000 per year, without reducing the amenity value of any of these facilities.

In addition fifteen of our low use neighbourhood ovals have had their watering reduced to about 25% of that required to maintain good grass growth. These facilities will gradually decline and may in the future have quite different community use, but the community accepted this change .

This has reduced our water use by a further 170,000 kilolitres per year, and water costs by $95,000. The more significant figure however, is the reduction in mowing costs which amount to about $250,000 in a normal year.

In 1989 City Parks used 18% of Canberra's total water usage, (that included all parks, sportsfields, and schools). In 1993 this figure has been reduced to less than 12% by the various means outlined in this paper. These savings have enabled the ACT water authority to put off building another dam for at least five years. This in itself has saved tens of millions of dollars in interest, because a new dam will cost a couple of hundred million dollars.

So you can see we have had to satisfy both the economic rationalists and the water rationalists, but we have done it in a way that has not significantly diminished our community turf asset. **SO FAR, THAT IS!**

There is probably quite a lot you can do to save your community some water **without diminishing the amenity value of that public turfgrass.**

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WHOSE RIVER IS IT ANYWAY?

Dr Colin Leigh[1]

Karen, I'm sorry but the margins must NOT be less than 17 mm.

ABSTRACT

This paper briefly outlines how the Yarra and Maribyrnong rivers are currently utilised and the range of values attached to them and also outlines statutory responsibilities for their planning, development and management. The conflicts that have arisen over the use of the lower Yarra and lower Maribyrnong rivers are then listed, the approaches taken to resolve the conflicts examined and the lessons learned presented.

INTRODUCTION

The Yarra and Maribyrnong rivers are two of Melbourne's most important recreational and environmental assets. Both rivers have a rich cultural heritage, are visually attractive and diverse, are environmentally important and are used for a range of recreational pursuits.

The Yarra River rises in the rugged hills of the Divide some 90 kilometres east of the central city area. In its upper reaches it flows through forested terrain, between Warburton and Warrandyte Gorge the setting is mainly pastoral while downstream of Warrandyte the river flows through suburban parklands, the City and the docks. The Maribyrnong River, which joins the Yarra in the docks, also has its headwaters in the forested hills of the Divide. The two upper tributaries, Deep and Jackson's creeks, then flow across the pastoral basaltic plains becoming deeply incised before they converge to form the Maribyrnong River. The Maribyrnong remains deeply incised through the northern suburbs before opening out into a wide valley shortly before it joins the Yarra not far from Port Phillip Bay.

The richness and diversity of the two rivers is both a blessing and a source of conflict. The rivers are valued for a variety of reasons and are consequently utilised in a variety of ways. Many of the uses are compatible but some are not, which poses a challenge to those responsible for the management of the rivers.

USES AND VALUES

Culturally, the rivers are important both to the Koori and to Europeans. The Yarra in particular has deep spiritual significance to the Koori, forming part of their dreaming and featuring prominently in their oral

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history (Gardiner, 1991). Too many Europeans the lower reaches of the two rivers are important because Melbourne and its port grew up along them and many historic buildings and structures survive and because the two rivers have for long been venues for pleasure trips, regattas and river festivals such as Moomba. The middle reaches of the Yarra are also 'etched' in our culture because they were captured for posterity on the canvasses of the Heidelberg school of artists.

To many the attractiveness of the two rivers lie in their rich and diverse aquatic and riparian flora and fauna. Although along many reaches of both rivers little natural vegetation remains and the fauna is depauperate, some reaches of both rivers and their tributaries are flanked by native vegetation of state and even national significance that is home to a number of rare and endangered species, none more so, for example, than Victoria's faunal emblem the helmeted honeyeater, which survives precariously along a short section of Yellingbo Creek, a tributary of the upper Yarra. Not surprisingly, such flora and fauna and habitats are zealously 'guarded' by individuals and conservation groups.

Yet others are attracted to the two rivers for recreational pursuits such as rowing, canoeing and fishing or to participate in or watch the festivals and regattas that take place on the lower stretches of the rivers from time to time, while many choose to ride or walk along the riverside trails that have been extended further and further upstream over the past decade. In recent years, recreational use of the rivers has been steadily increasing as access is improved and as Melburnians become more aware of the recreational opportunities that are available.

Tourists and also many Melburnians, particularly school children, become acquainted with the two rivers through trips on the tourist boats that ply the lower reaches. At present there are only a handful of such boats operating but as more berths become available and with the moratorium on licences being lifted, more can be anticipated, which will undoubtedly give rise to more intense commercial rivalry and to the need for careful river management.

The more utilitarian functions of the two rivers should not be overlooked. A significant part of the Port of Melbourne still straddles the lower reaches of the two rivers, both have water supply dams in their headwaters and water is pumped from the middle Yarra to a storage reservoir. In addition, water is also extracted from the two rivers under licence for irrigation and stock. An issue relating to water extraction is, of course, the question of sustaining environmental flows.

Finally, the role of the rivers as drainage lines and conduits for flood flows should not be forgotten. A number of severe floods have been recorded along both rivers since European settlement and more can obviously be expected. The responsible drainage authorities have a statutory and moral responsibility to protect lives and property but flood control works can, if insensitively undertaken, dramatically alter the form and nature of a watercourse and set the scene for confrontation with environmentalists.

Given the range of activities that have taken place on the two rivers, the varying values placed on them and their more utilitarian uses, it is hardly surprising that conflicts have arisen. This paper examines the nature of some of the conflicts that have emerged in recent years and discusses the approaches that have been taken to resolve them. As a prelude, the roles of the many agencies with statutory responsibilities for the planning, development and management of the rivers and adjoining land are briefly outlined, as such agencies clearly have major roles to play in conflict resolution, and because conflicts have arisen between agencies as a result of their very different charters.

STATUTORY RESPONSIBILITY

A relatively small number of bodies have statutory responsibilities for the planning and management of the Yarra and Maribyrnong rivers but the list is considerably extended if adjoining riparian land is included (Leigh 1991). As river use and adjoining land use are often closely inter-related both are considered below. Agency responsibility is briefly outlined under the following headings; drainage and floodplain management, river use management, land use planning and management, flora and fauna and aboriginal and European heritage.

Drainage and Floodplain Management

Melbourne Water is responsible for drainage and floodplain management for the Yarra River and catchment upstream of the docks except, somewhat illogically, for the upper parts of the Merri and Moonee Ponds creek catchments. In the case of the Maribyrnong River, Melbourne Water is responsible for the lower half of the catchment and the Rural Water Corporation for the upper half. Melbourne Water's powers and responsibilities stem from the Melbourne and Metropolitan Board of Works Act 1958 while those of the Corporation stem from the Water Act 1989. In addition, the municipalities have certain powers relating to drainage under the provisions of the Local Government Act.

Water quality is generally the responsibility of the Environment Protection Authority pursuant to the provisions of the EPA Act 1970. The Authority monitors water quality and issues licences and sets standards for discharges into rivers. One section of the Act provides for the EPA to prepare State Environment Protection Policies (SEPP's), which once gazetted are government policy documents. In 1984, a SEPP was gazetted for the Yarra and tributaries and in 1988 one was gazetted for the Waters of Victoria, which includes the Maribyrnong. The municipalities also have responsibilities for water quality under the provisions of the Local Government and Health acts and Melbourne Parks and Waterways (a business enterprise of Melbourne Water) has been recently charged with monitoring and improving water quality in the metropolitan region.

River Use Management

Responsibility for the management of water-based uses within the designated port reaches of the two rivers rests with the Port of Melbourne Authority. Upstream it rests with Melbourne Parks and Waterways, except along the upper Maribyrnong where such activities as do occur are controlled by the Rural Water Corporation. With respect to the area that it controls, Melbourne Parks and Waterways manages the two waterways for a range of recreational uses and regulates commercial tourist boat operations. Legislative power is mainly derived from a MMBW Act by-law, the Waterways By-law, which was introduced in December 1992 to replace a less comprehensive River By-law.

In addition to provisions contained in the Waterways By-law, all boats are also subject to relevant provisions in the Marine Act 1988 and Regulations passed thereunder. Responsibility for this act and regulations rests with the Marine Board of Victoria.

Land Use Planning and Management

Responsibility for the preparation of land use planning strategies and schemes generally rests with the municipalities and with the Department of Planning and Development, although in the upper Yarra area the Upper Yarra Valley and Dandenong Valley Authority plays a significant role. Planning schemes do not, however, apply to Crown Land whose use is

determined by the Minister for Conservation and Natural Resources based on advice provided by the Land Conservation Council, an independent body with its own enabling legislation, the Land Conservation Act 1970.

The management of riparian land along the two rivers as well as is the responsibility of numerous private landowners, a number of municipalities who own or control open space areas along the watercourses ~~and~~ certain government bodies, particularly the Port of Melbourne Authority, Melbourne Parks and Waterways and Melbourne Water who manage extensive parkland along the two rivers ~~and~~ the water supply catchments in the upper Yarra area, ~~and~~ the Department of Conservation and Natural Resources ~~who~~ manage or indirectly control areas of forest reserve, parklands and various other areas of Crown Land, including the water frontage reserves along the upper Yarra.

Flora and Fauna

In addition to

Flora and fauna are afforded protection under certain planning controls and by the legal obligations and moral responsibilities of public land managers, but ultimate responsibility for protection rests with the Department of Conservation and Natural Resources by virtue of specific legislation. The Department is responsible for the Wildlife Act 1975, which relates to both aquatic and terrestrial fauna, for the Lands Act and the Crown Lands (Reserve) Act, which provide for the management and protection of forests and vegetation on Crown Land and for the Flora and Fauna Guarantee Act 1988 which provides procedures for listing and protecting species or communities in danger of destruction and for identifying potentially threatening processes.

Aboriginal and European Heritage

The Yarra and Maribyrnong rivers and adjoining lands were, as were most waterways throughout the state, frequented by the Koori and are spiritually important to the local Koori community. The protection of aboriginal sites is the responsibility of Aboriginal Affairs Victoria (formerly the Victoria Archaeological Survey), which is located within the Department of Health and Community Services. The empowering legislation is the Archaeological and Aboriginal Relics Preservation Act 1972. The Koori community has a direct control over sites and significant areas because under the provisions of the Federal Aboriginal and Torres Straits Islander Heritage Protection Act, its approval is required before any site or significant area can be altered or destroyed.

With respect to European heritage, historic buildings and structures within the two valleys can be protected through the Historic Buildings Act which is administered by the Historic Buildings Council.

CONFLICT AND RESOLUTION

It is not surprising that conflicts have arisen over the use of the two rivers given their limited navigability and widths, the range of values attached to them, the number of bodies with direct and indirect management responsibilities, the number of riparian landowners and managers and the number of agencies with responsibilities for the planning of riparian areas. For example, along the Yarra River 18 municipalities have river frontages and along the Maribyrnong eight. In recent years there have been conflicts between river user groups, within user groups, between user groups and management agencies and between the planning and management agencies.

The nature of some of the conflicts that have arisen in recent years along the lower, navigable reaches of the two rivers are outlined below together with the approach taken by the river manager, Melbourne Water, to resolve the conflicts. The degree of success achieved by Melbourne Water is explored and some lessons for the future suggested.

Conflicts

The lower reaches of the two rivers have for long been popular venues for recreational activities, although popularity has waxed and waned over the years. In recent years, more and more people have been venturing on the rivers reflecting the increasing popularity of rowing and canoeing/ kayaking and the increasing popularity of the two rivers as venues for regattas and festivals. Another trend in recent years has been the increasing concern over the 'health' of the rivers and adjoining areas.

A range of issues and conflicts emerged generating complaints to the river manager, Melbourne Water, and letters to the press and to the Minister. The range of conflicts can be gauged from the following list:

- Rowers and canoeists frequently complained that the tourist boats did not observe the speed limit or the rules of the river thus endangering them. They also complained that the wash from one boat in particular was a hazard.

- Conversely, the tourist boat operators claimed that the rowers and canoeists did not heed the rules of the river, e.g. they came around blind bends on the wrong side of the river and rowed at dusk without lights.

- The tourist boat operators claimed that an increasing number of river closures for special events was damaging their trade.

- Some tourist boat operators lobbied Melbourne Water in an attempt to ensure that no more operator licences were issued.

- Disputes between operators and with Melbourne Water arose over the allocation of berths controlled by Melbourne Water and there were disputes between operators relating to touting for passengers, resulting in physical confrontation on more than one occasion.

- The power boat industry and private owners informed Melbourne Water that in their opinion the interests of private power boat owners were being neglected. They were of the opinion that the possibility of restricting power boats should not be contemplated and that their use should be encouraged through the installation of boat ramps.

- Some conservationists were totally opposed to water skiing being allowed on the rivers during special events.

- At least one riparian land manager complained that Melbourne Water's river maintenance works were environmentally insensitive.

- The public in general were becoming increasingly concerned with the quality of the water and with litter in the two rivers. Concern over water quality may often have been more perceived than factually based but litter when present is visible for all to see.

- Many complained that Melbourne Water was not adequately 'policing' the rivers.

Melbourne Water became increasingly concerned at the range of conflicts that were emerging and that it had no policies to guide it, two attempts to produce a water-based uses policy for the lower Yarra and Maribyrnong rivers during the 1980's having floundered. Matters were brought to a head by issues relating to the tourist boats, particularly the questions of berth allocation, the numbers of boats that should be allowed to operate and the fees that should be charged for operating and mooring licences. The fees charged were ridiculously low, the fee for a tourist boat to berth at a central city location being only $11.50 per annum. Melbourne Water, or rather Melbourne ratepayers, were heavily subsidising the boat operators.

In May 1991, the Board of Melbourne Water instructed that a water-based uses policy should be prepared for the lower Yarra and lower Maribyrnong rivers, that the possibility of introducing commercial, market rentals for licences should be investigated and that no new tourist operator licences should be issued while the policy was being prepared.

The Regulatory Review Board advised that any significant changes to the fees, which were listed in a Schedule to Melbourne Water's River By-law, would require a Regulatory Impact Statement. It was therefore decided to take the opportunity to review the by-law thoroughly to ensure that it complemented the policy and to remedy some known deficiencies.

The Process

From the outset it was decided that those preparing the policy and reviewing the by-law should meet with as many user groups as possible and with other agencies with responsibilities for the planning and management of the two rivers and adjoining land. Meetings with representatives from the rowing clubs, the Canoe Association and with the tourist boat operators proved to be particularly useful. The groups appreciated the opportunity to meet with the river manager and present their views in a co-ordinated manner, gain a clear understanding of the process that would be followed and to learn what Melbourne Water's current position was on a number of issues e.g. the user-pay principle. In return, Melbourne Water gained a lot of useful information and a clear appreciation of the user groups views and concerns.

Predictably, a number of old grievances were aired at the meetings but a number of interesting points emerged: all parties were of the opinion that there was room for all on the river if the rules were followed, while the tourist boat operators all agreed that the current fees were far too low but were opposed to the introduction of user-pays principles or market rentals, claiming that they would be forced out of business if these approaches were taken. They believed that it was appropriate that they should continue to be subsidised because they were an asset to the river and a major tourist attraction.

The issues raised by the various groups and agencies were gathered together in an Issues Paper under the following categories: Environmental Management, Safety and Risk Management, Use of the River, Mooring of Boats, and Promotion. The Paper was widely distributed and formed the basis for discussion at a workshop run by a professional facilitator and attended by almost 100 river users and administrators.

There was surprising agreement at the Workshop on environmental issues, on the need to promote the river for tourism and on the need for regulations relating to safe navigation and safety in general as well as a consensus that there was room on the river for all if a spirit of co-operation was adopted, the rules were followed and if Melbourne Water adequately 'policed' the river. Predictably, there was lack of agreement on the number of tourist boats that should be permitted and on whether user-pay and market rental principles should be introduced.

From Melbourne Water's point of view the Workshop was a success by providing additional information, confirming and clarifying views and concerns held by various groups and establishing where there was common ground and support for the introduction of certain policies. It appeared that the participants also thought the workshop to have been a very worthwhile event with a number commenting that it was the first time that all river user groups had been able to meet and discuss issues of mutual concern. A number expressed the view that the user groups and the river manager should meet regularly.

The views expressed at the Workshop were collated and used to help formulate a water-based uses policy and a new Waterways By-law. The two documents were then placed on public exhibition together with a Regulatory Impact Statement, a statutory requirement for all new by-laws.

Forty submissions were received, the nature of which came as somewhat of a surprise. Approximately half objected to sections in the By-law and Policy restricting access to privately owned power boats to part of the lower Maribyrnong River and to the Yarra River upstream of Dights Falls, while another group ~~of submitters~~ objected to sections in the Policy advocating the principle of eventual public access along all river frontages and advocating that market rentals should be charged for private jetties. There were, somewhat surprisingly, no objections to the new licence fees based on user-pay principles, although the increases are substantial, to the policy of charging market rentals for berths at wharfs and jetties owned or managed by Melbourne Water or to the policy stating that there should be no restrictions on the number of tourist boat operator licences issued, save on environmental and safety grounds.

The protests against the proposed restrictions to power boats came as a surprise because the issue was not raised at the Workshop and was not a new proposal being essentially re-statements of recommendations contained in two strategic planning reports that had been publicly exhibited and reviewed by independent panels. The power boating lobby, not necessarily users of the two rivers, were alerted to the documents by an advertisement informing of the Policy and By-law that was placed in a boating magazine. The group wrote to a number of politicians claiming that they were being discriminated against and that it was preposterous to suggest that they had any adverse affect on the environment. Melbourne Water decided to re-examine the likelihood of environmental damage occurring if there were no restrictions on power boats. As a result it was decided to lift the restrictions on the Maribyrnong River but to retain them on the Yarra upstream of Dight Falls, where the river is narrow, often shallow and the riparian vegetation is of high quality.

The group of private waterfront owners were incensed for three reasons: because they opposed any suggestion that they should lose control of their water frontages; because they were opposed to paying market rentals for their jetties, even though the jetties alienated part of a public asset; and because they claimed that they had not been consulted. The residents were correct in stating that they had not been consulted as a group or individually, the reason ~~for this~~ being that the issue of market rentals for private jetties emerged ~~so~~ late in the process and it was decided that additional consultation was not necessary given the issue would be brought to the attention of the jetty owners during the formal exhibition period. With hindsight it would have been better to have met with the group earlier even if this had meant delaying the exhibition of the By-law and Policy.

A meeting was held with a number o waterfront residents to try ~~and~~ to resolve the two issues. It was agreed that the policy would be amended to include mention of landowners rights with respect to the rezoning and acquisition of land and that the issue of market rentals for private jetties would be deferred and further explored in consultation with residents.

In addition, meetings were held with a number of other submitters and amendments were made to both the By-law and Policy. The amendments to the By-law were submitted to Parliamentary Counsel for endorsement and it was gazetted on 12 December 1992. The Water-based Uses Policy for the Lower Yarra and Maribyrnong rivers was adopted by the Board of Melbourne Water in November 1992.

LESSONS LEARNED

It is probably inevitable that there will be competition for the use of limited resources such as the Yarra and Maribyrnong rivers. However, it became clear during the preparation of the By-law and Policy that many conflicts can be avoided if a river manager has a clear set of policies, is prepared to consult with user groups and to bring the groups together to discuss existing and potential problems.

It became apparent during the meetings with the groups and at the Workshop that a number of conflicts had arisen through misunderstandings and could be easily resolved, that there was a willingness by all parties to work together, and that there was almost unanimous support for certain approaches and courses of action, particularly with respect to environmental protection and enhancement, safety and risk management as well as the promotion of the two rivers. Clearly there is an onus on Melbourne Parks and Waterways to ensure that consultation continues, and that informal meetings be occasionally held to which all user groups would be invited.

The question of enforcement of the provisions of the By-law and of conditions contained in mooring and operator licences was raised on a number of occasions. There was no opposition to the concept of rules and regulations; but there was consensus that they be enforced in a consistent and equitable manner. It was felt that Melbourne Water had been lax in enforcing the rules and was not effectively 'policing' the river.

The value of consultation was reinforced throughout the preparation of the By-law and Policy Statements, but a factor that must be taken into account, when preparing project timetables and budgets, is that consultation is usually time consuming and often unpredictable in nature. A related factor is the time required to comply with mandatory statutory procedures. The preparation of the By-law and associated Regulatory Impact Statement involved considerable interaction with Parliamentary Counsel and the Office of Small Business (the Regulatory Review Board), both of which were understaffed with the result that there were often long delays before drafts of the two documents and amendments were approved.

CONCLUSIONS

The Waterways By-law and the Water-based Uses Policy provide the framework for the multi-use management of the lower Yarra and Maribyrnong rivers, although the co-operation of all users is clearly required. Considerable responsibility rests with Melbourne Parks and Waterways as the river manager. It will need to ensure that all user groups are aware of the by-law and consistently take action against those who continue to breach the rules and regulations after fair warning. To do this effectively it will have to devote adequate resources to 'police' the river, a task that many have suggested has not been adequately undertaken in recent years. It is also important that Melbourne Parks and Waterways carries out the actions listed in the Policy document that it has stated

that it will undertake, for example, that it will prepare hazard maps for the lower reaches of the two rivers, and will maintain the jetties for which it is responsible. The river manager must lead from the front if it expects user groups to co-operate.

The scene has been set for the further development of the lower Yarra for water-based tourist activities. Southgate, Scienceworks, the Congress Centre, Polly Woodside, the Tennis Centre, the Botanic Gardens, and in future, the Casino, are destinations for river cruises and potential locations for a range of water-based activities. The development of new ventures and the expansion of existing ones will require even greater co-operation between the user groups and the river manager if conflicts are to be avoided. However, if potential problems are identified early and a tolerant approach is taken, all can benefit from the development and promotion of the rivers as two of Melbourne's most important cultural, recreational and tourist assets.

Please note that the views expressed in my paper do not necessarily reflect the view of Melbourne Water or Melbourne Parks & Waterways.

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David. Copy faxed to Trevor Arthur - 9/3/93 4PM Geoff C.

FAX D. DAVID ALDER VCAH Burnley

IRRIGATION EFFICIENCY - THE ISSUES.

Geoff Connellan *

8/91383

URGENT PLEASE

ABSRACT

The achievement of improved water use in public open space is dependent upon the adoption of efficient irrigation practices. Efficiency needs to be evaluated in terms of both the system itself and the way it is managed. The elements of irrigation efficiency terms are defined and areas of potential improvement identified. Greater opportunity for efficiency increase would appear to be in management related practices rather than in irrigation hardware issues. Achievement of real efficiency in the field is dependent upon the adoption of one or more of the many water efficiency strategies that have been promoted in recent years. The need to address the issue of the relatively low adoption rate of improved irrigation practices in public open space areas is discussed.

INTRODUCTION

The current focus on responsible resource management has exposed open space managers to many suggestions on how to better maintain areas with less water. Improved efficiency and water conservation are correctly presented as being worthy goals. Achieving these in irrigated park and recreation areas involves much more than the consideration of system hardware. Efficiency in its simplist form is a measure of the proportion of outputs compared to the inputs. In the case of irrigation systems, it is the proportion of water used by the crop compared to the amount delivered to the site. High irrigation efficiencies are the result of several inter related elements including irrigation hardware, the crop, the climate, the soil and the management of the area. Highly efficient equipment does not guarantee high irrigation efficiencies. For example, the best system in the world will produce low efficiency if it is not turned off when the soil already has adequate soil water through rainfall or previous irrigations. In order to evaluate the effectiveness and efficiency of an irrigation system, it is necessary to assess the individual efficiency components that determine the overall efficiency.

EFFICIENCY AND PERFORMANCE INDICATORS

The thorough analysis of an irrigation system involves examination of all parts of the irrigation process that may result in water wastage. There are numerous efficiency concepts that could be considered including conveyance, application, distribution, use, consumption and storage. These efficiency terms have been defined by Israelsen and Hansen (1962) however a simpler grouping is more

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appropriate for urban sprinkler irrigation systems. The two major sources of water loss can be attributed to either ~~be~~ those that are equipment based ~~and~~ by those that are management based. The combination of these two categories provides a measure of the overall efficiency of the system.

The Overall Irrigation Efficiency (E_o) is a measure of the amount of water used by the crop (W_{oc}) compared to the amount supplied to the site ~~over~~ during the ~~whole~~ irrigation season (W_{os}).

$$E_o = \frac{W_{oc}}{W_{os}} \times 100\%$$

This term is a rating of how well the system performed ~~over~~ during the ~~complete~~ irrigation season. It includes all areas of loss and inefficiency.

System performance can also be expressed as an index as well as an efficiency term. The Irrigation Index (I_i) is a measure of the amount of water applied compared to the amount consumed by the plants. This latter amount is estimated using evaporation data and plant characteristics to estimate plant water use. The Irrigation Index is expressed as a ratio of the depth of water applied (mm of water) to the depth required (mm of water). An Index value of 1.0 would represent an excellent system as the correct amount of water ~~was~~ would have been applied.

$$I_i = \frac{\text{mm of water supplied to area}}{\text{mm of water required by plant}}$$

As the majority of systems apply more water than is required, the value of Ii ranges from ~~around~~ about 1 and up to 3, with some even higher, Kah and Willig (1992) reported on a selection of systems having an average value of 1.8, with the range from 0.8 to 4.8.

The relationship between the Overall Efficiency (E_o) and the Irrigation Index (I_i) is:

$$I_i = \frac{1}{E_o} \times 100\%$$

System Application Efficiency

The System Application Efficiency (E_a) is a measure of the proportion of water reaching the plant root zone compared to the amount applied by the sprinklers (W_a) during an irrigation cycle. It is assumed that the amount used by the crop is the same as the amount delivered to and retained in the root zone.

$$E_a = \frac{W_r}{W_a} \times 100\%$$

The E_a term needs to include all losses that occur from the time the water leaves the sprinkler to the time it is deposited in the root zone. The sources of these inefficiences and losses can be categorised as follows:

a. Uneveness or non- uniformity of application
b. Atmospheric losses - evaporation
   - wind drift
c. Soil surface loss - runoff and ponding
d. Subsurface loss - deep drainage or percolation below the root zones

Unevenness of application ?

Non uniformity from sprinkler irrigation systems is a major factor in determining the system effectiveness.

Sprinkler Uniformity: Many design, product and operational characteristics directly affect uniformity including the sprinkler head design and nozzle configuration, sprinkler layout, hydraulic operating conditions, and prevailing climatic conditions. The designer of the system should be striving to achieve, through head selection, layout and operating conditions, an irrigation system that applies the water as uniformly as circumstances will allow. The relationship between uniformity and System Application Efficiency (E_a) should be appreciated. It is not possible to have an efficient system if the water is not applied uniformly. Uniformity and efficiency go hand in hand.

The rate at which water is applied close to a sprinkler head is greater than that towards the edge of the wetted area. It is therefore necessary to overlap sprinklers in order to achieve good uniformity. Two methods are in use to measure uniformity.These are the Christiansen Coefficient (Cu) and the Distribution Uniformity (Du). Both uniformity coefficients are determined by placing receptacles at regular spacing within a representative section of the operating system. Readings of the amount of water applied over the area are then taken and results analysed.

The Distribution Uniformity (Du) value is the preferred indicator of performance for turf and landscape irrigation systems (Shaw and Zellman,1992). The Du value is obtained in the following way:

$$Du = \frac{\text{Lowest 25 \% of readings}}{\text{Average of all readings}} \times 100\%$$

A low value of Du means that a quarter of the irrigated area is significantly underwatered. To ensure that all areas receive an adequate amount, it is necessary to operate the system long enough to provide the underwatered areas with an average amount. The Scheduling Coefficient (SC) is the modifying factor used to adjust upwards the irrigation run time so that all of the underwatered areas receive the desired amount. This will necessarily mean that that the majority of the area will be overwatered.

$$\text{Scheduling Coefficient (SC)} = \frac{1}{Du}$$

Example:
The irrigation system has been found to have a Du of 0.84. The SC value is 1.19 (1/0.84). The system will need to be operated for 1.19 (an extra 19%) times the theoretically required time.

Atmospheric and Soil Losses: The amount of water lost by these processes is difficult to establish with reasonable accuracy. In developing a system every effort should be made to keep these losses to a minimum. Under periods of high evaporative demand, small droplets can evaporate directly into the atmosphere. Amounts approaching 10% of sprinkler delivery have been reported by several authors, including Pair (1969). These losses will obviously be greatest during the hottest part of the day. Night time watering is therefore justified. Evaporation can also occur from water on foliage and the soil surface. As wind speeds are generally less than half at night than during the day ~~and again~~ night time watering is justified again

Good irrigation design involves determining the infiltration characteristics of the soil in the irrigation site area. The head type, nozzle combination and operating conditions should be selected so that the system precipitation rate and control strategy allow all water applied to move into the soil. Designers need to be aware of high precipitation rates due to non uniformity, decreasing soil infiltration rates with time on some ssites, ~~and also~~ reduced infiltration as a result of compaction. as well as

It is very difficult to apply water to some soils and not have some drain below the root zone, particularly in free draining coarse sands. The key to keeping this aspect of loss to a minimum is to only apply an amount to replenish the soil water. High precipitation rates and shallow roots (eg. turf) increase the likelihood of deep drainage in turf areas. Management can be used to reduce the risk in turf areas by encouraging deeper root systems (McIntyre, 1987 and Neylan, 1987).

Scheduling Efficiency

A well designed sprinkler system needs to be astutely managed in order to achieve high efficiency over the ~~complete~~ irrigation season. The soil moisture level in the soil profile is changing continuously as a result of depletion by plant comsumption and addition by rainfall and irrigation. Selecting the correct irrigation amount and applying it at the right time requires either continuing monitoring and adjustment by the manager or some form of automatic control equipment. The Scheduling Efficiency term (E_s) is a measure of the water programmed to be applied compared to the amount actually required by the plants. by using

$$E_s = \frac{\text{Plant water requirement } (W_c)}{\text{Programmed amount } (W_p)} \times 100\%$$

This efficiency term can be determined on a weekly, monthly or yearly basis. The greatest opportunity for efficiency gains is in smarter management of irrigation systems, in other words, increasing the Scheduling Efficiency. The two major strategies that can be adopted are monitoring of soil moisture directly, using sensors, ~~and the~~ continuous modelling of plant/soil moisture availability based on weather data.

or by

There are a multiplicity of devices that can be used to provide input signals to irrigation controllers so that watering can be initiated or cancelled according to plant needs rather than time. (Connellan,1992a).

Supply and Delivery Losses

An amount of wastage should be allowed to cover pipe leaks, equipment failure and unintentional operation of the system. These losses ~~are~~ kept to a minimum ~~through~~ the selection of appropriate and quality components, ~~sound~~ installation and conscientous maintenance.

can be

By the correct system

ACHIEVING EFFICIENCY GAINS

Identifying the areas of potential efficency gain is relatively easy compared to the task of achieving real gains on the ground.There has been extensive publicity about the need for water conservation and numerous strategies have been presented to improve water use in public open space areas. The adoption of these solutions does not appear to be extensive. The number of irrigated sites actually using soil moisture sensors would appear to be small compared to total number of irrigated sites. How can this situation be improved?

Awareness of the problem is the first step in the process of achieving a behavioural change. The next step is that the proposed solution must be a workable solution. It must meet the needs of the area. Saving water but reducing the quality of the plants below acceptable standards is not a workable solution.It is therefore important that a range of solutions be demonstrated to open space managers. A project is currently being conducted in the Municipality of Camberwell (Connellan, 1992b) to field evaluate and demonstrate differing water managemet regimes for a sports area. Adoption is likely to be improved if irrigation practictioners can observe first hand workable solutions.

There is a need for greater effort to be put into the evaluation of better water management techniques for public open space areas. Much research effort is directed at the harvesting, storage and conveyancing of water to the sites where it is consumed, whereas very little is directed at the way in which water is applied through irrigation systems and effectively used for plant growth.

CONCLUSION

The efficiency of irrigation systems need to be quantitatively assessed, using Overall, Scheduling and System Application efficiency ~~terms~~, so that sources of wastage can be identified and

formulae

practical solutions recommended. The Irrigation Index provides a valuable measure of the total system performance and should be used more widely to promote efficient systems and highlight poor systems. Greater energy, ~~including~~ promotional, educational and research, ~~needs to be directed to achieving~~ a higher level of adoption of efficient irrigation practices in public open space areas.

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"MULTIPLE USE OF INLAND WATER STORAGES"

Mr Clarke Ballard

ABSTRACT

The Rural Water Corporation owns and operates about 50 large water storages in inland Victoria. The recreational use which is allowed depends on the size of the storage and the purpose for which the water is used. The Corporation is a financially autonomous organisation which regards recreational users as a customer group who have needs which must be met, and who should pay for the service provided as other customers do. At present, our market research tells us that recreational users are generally fairly happy with the level of service they receive. However it is clear that they contribute less than a fair share to the Corporation's costs. There is a real difficulty in finding cost effective ways of collecting any charges that may be imposed.

INTRODUCTION

Water storages are often used for several different purposes such as irrigation supplies, urban supplies, hydro-electricity, flood mitigation and recreation. The Rural Water Corporation is a water resource agency that permits multiple use at most of its storages and my objective today is to outline our practices and experiences in relation to this multiple use as it applies to inland water storages.

ROLE OF RURAL WATER CORPORATION

The Rural Water Corporation, formerly Rural Water Commission, came into existence on 1st July, 1992. Essentially the Corporation's objective is to provide rural water services in a totally commercial manner (RWC 1992) which will ultimately involve customers in meeting all of the costs in the provision of such services. As a part of providing water services, the Corporation is required to exercise certain powers, responsibilities and functions under the provisions of the Water Act, 1989. Such matters include the authorisation of diversion of water from watercourses and the extraction of groundwater and waterway, catchment and floodplain management.

ASSETS

To carry out these tasks we operate and maintain many assets such as storages, channels, pipelines etc. Of specific interest to this conference is the fact that we have 49 sizeable, and in some instances very large, storages on which we generally permit some form of recreation. Only three of the 49 storages are closed to recreation use by the public and this has been done in the interests of water quality protection, given that the prime use of water in the three storages is domestic. Some of the larger and more well known storages that are used for recreation are Lake Eildon, Lake Eppalock, Lake Dartmouth and Lake Mokoan.

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590 Orrong Rd Armadale Vic 3143

ACTIVITIES

Activities permitted on our storages range from passive pursuits such as picnicking, walking and sightseeing to more active recreation such as fishing, swimming and boating, including water skiing. At Lake Eildon we authorise over 700 houseboats to use the lake.

PUBLIC FACILITIES PROVIDED

The on shore facilities available for the public at most of our storages consist of toilet blocks, boat launching ramps, barbecues and shelters, rubbish bins, mown picnic areas and car parking. The extent of the foreshore area or marginal strip varies from storage to storage. At Lake Eildon two sewerage barges are provided to enable licensed houseboats to dispose of effluent wastes.

OTHER FORESHORE USE

In addition to the provision of public facilities, the Corporation also authorises commercial, club and private use of certain areas of foreshore land, usually under a formal lease or licence arrangement. For instance we lease land for a hotel (Lake Eppalock) caravan parks (15) club sites (83) boat hire, kiosks etc. Foreshore grazing, private jetties and boat launching ramps are also permitted under licence.

Overall, we authorise a wide range of activity the foreshore and on water and this in turn has potential to, and indeed in some instances does, create management environmental and financial problems.

MANAGEMENT

Historically, the pressures for recreation commenced with the completion of each storage. Municipalities saw the value of encouraging visitors to their respective localities and exhorted the Corporation to provide facilities to complement their vision and expectations from State owned assets within their municipal boundaries.

The "boom" construction period for many of our now popular storages was the mid 1950's to 1970's, money was plentiful (at least compared to now) and the Corporation made public facilities and commercial opportunities available at most of its storages.

In hindsight, we would like to think that a weekend on a houseboat at Lake Eildon, an exhilarating water ski on Lake Eppalock or a quiet fish in a flat bottomed boat at Lake Dartmouth would bear testimony to the wisdom of the "planners" of the day. There is plenty of evidence (from usage alone) that people are enjoying our storages and that recreation is reasonably compatible with the storage and supply of water for rural Victoria.

Zoning of Water Storages

Despite the wide range of water based activities allowed on our storages, the incidence of conflict between the various recreational groups is low. The Corporation is the Boating Authority under the Marine Act 1988 at 26 of its major storages and thus exercises direct control over on-water activity at those

storages. By formally zoning the water area, incompatible activities, for example swimming and water skiing, can be physically separated. The geography of the storage itself dictates speed and activity zones to some degree. For instance, submerged trees will render a stretch of water unsuitable for high speed boating but ideal for angling.

While it is impossible to completely satisfy the needs of competing recreational activities, all user groups are extensively consulted in the zoning process and, we believe, a reasonable balance struck.

THE COST (DOLLARS)

The Corporation obtains revenue from houseboat licence fees, from payment of market rentals by its commercial lessees and from grazing licences. Club site holders and private licensees (jetties etc) also pay annual fees. A relatively small sum is obtained from the placement of toll barriers at selected storages.

In the Management Review that led to the corporatisation of the former Rural Water Commission, recreational users of storages were identified as a customer group who were meeting less than their fair share of costs (GH&D et al 1992).

In total, annual revenue from use of storages (land and water) is $1.78 million while our cash expenditure is $2.4 million, leaving a cash shortfall of $0.62 million. The public use component of revenue, mainly from houseboat licences, is $0.43 million. Recreation or public use is regarded as a business initiative of the Corporation and further sources of funding are being sought as we strive to "balance the books" and ultimately obtain some profits. Examples of possible funding sources are, a proposal to fix a boating fee for use of our storages, and the re-negotiating of existing leases for Caravan Parks (as a commercial exercise).

On the expenditure side, we incur costs in constructing, maintaining and patrolling areas and facilities, administration and policing of houseboat licences and recreation planning.

Our experience has been that generally speaking existing authorised recreational use has not had any deleterious effect on water quality or storage management. Accordingly, the Corporation is keen where appropriate to maximise recreation usage as a business activity.

User pay philosophy is well and truly with us and we believe that further opportunities exist.

THE COST (ENVIRONMENT)

As we all know, invite the public to an attractive recreational area and you invite pollution of some kind, no matter how small. The task is how to contain pollution and preserve the beneficial use of the water. Recent outbreaks of blue green algae have focussed water managers on water quality, as the algae can make water unsuitable for various uses including recreation. Task Forces and monitoring programs have been put in place and although the relationships are not yet fully understood it is clear that nutrients (phosphorus and nitrogen) and temperature are critical factors in algal blooms. Nutrients may originate from stormwater or sewerage discharges to catchments or streams, excessive use of fertilisers on agricultural land and general runoff.

The effect of all this on the recreation user? Skin and eye irritations to swimmers as well as a range of other symptoms if accidentally ingested. At Lake Mokoan and Melton Reservoir we have had cause to close the reservoir to boating etc because of the presence of blue green algae. At Lake Eildon, Caravan Park proprietors have complained of lost customers because of algae blooms. This is an emerging problem for recreationists, generally not of their making but a "major" issue for agencies. At some locations (particularly Lake Eppalock) recreational use may be a significant contributor to algal blooms.

Other pollution problems that we encounter and that do emanate from recreational use, are the proliferation of rubbish on foreshore, oil spillage from power boats (not a lot of evidence that this is a large problem) and sullage disposal from houseboats on Lake Eildon.

For water quality protection, boats containing sleeping accommodation or a toilet are prohibited on all Corporation storages except Lake Eildon, which is uniquely suited to houseboating. The Lake is easily accessible to the Melbourne metropolitan area (where the majority of our houseboating customers live) and has a large expanse of water with many secluded sheltered inlets.

Houseboats are licensed by the Corporation for use on the Lake and are required to contain onboard sewage holding tanks. We provide pump-out stations and rubbish disposal facilities on the water. The general pattern of houseboat usage is that the boats are taken out for several days at a time and anchored overnight by the shoreline, however when not in use houseboats must be moored at one of the privately operated marinas on the Lake.

We have since 1983 frozen the number of houseboats permanently moored on the Lake. While there has been pressure on the Corporation to release additional licences, it would be undesirable to increase the numbers to a level which could create conflicts with other recreational users or diminish the seclusion enjoyed by existing houseboat users.

The need for future containment of sullage onboard houseboats is an emerging management issue, however it is our experience that the controlled presence of houseboats has had no significant adverse effects on the water quality of Lake Eildon. This is in sharp contrast to the River Murray situation where in the absence of formal management controls, pollution and overcrowding problems do occur.

Overall, apart from the action taken following the incidence of blue green algae growth we have not had to ban or restrict authorised recreational activity in recent times. About five years ago we took action to ban over the transom exhausts on motor boats using Pykes Creek Reservoir - for noise reasons.

Nevertheless, there is no time for complacency, and water resource managers are coming under increasing scrutiny from other authorities and the community to improve standards. Recreational users do not have an un-fettered right to the future use of storage waters and surrounds, and while the Corporation's experience supports the status quo and some future expansion within agreed guidelines, a proper and contrived balance is always an objective when multiple use is allowed at a storage. It is also clear that recreational users are under-contributing to the cost of their activities at present.

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THE OPTIMUM USE OF OUR WATER RESOURCES

FOR PARKS AND RECREATION

Ruffey Creek Management Plan

1. Introduction

David Melvin

Manager Leisure Services

City of Doncaster and Templestowe

2. Waterway Design Considerations

Neil Craigie

N. M. Craigie and Associates

3. Developing Multi Purpose Water Features in a Municipal Park

Alun Chapman

Land Systems EBC

PS You've done all the hard work!

Dave leave as is
& because you have
3 holes
Thanks

ABSTRACT

In 1992, the City of Doncaster and Templestowe ~~commenced development~~ started preparation of a Master Plan for the Municipal Gardens, located off George Street, Doncaster. A Working Party was established and consultants were engaged to assist with the development of the plan.

Melbourne Water contributed resources to the project to address water way management problems associated with Ruffey Creek which runs through the park.

This paper outlines the planning process adopted by Council to develop the Master Plan and provides a summary of the issues incorporated in the plan.

INTRODUCTION

The City of Doncaster and Templestowe acquired the site of 68 hectares for the Doncaster Municipal Gardens from the Thiele Family in 1974. Following ~~the~~ acquisition ~~of this 68 hectare property~~, a number of development plans were prepared, however, implementation has been ad hoc. As a consequence, development has been incremental and no cohesive theme is evident.

The Municipal Gardens have been consistently recognised as the ~~cities~~ city's 'Jewel in the Crown'. The large tract of land is strategically located within the municipality and provides ample opportunity for the development of a range of recreation services and facilities for residents.

Council initiated a review of the existing plans and endorsed the development of a new Master Plan for the Municipal Gardens. Consultants were engaged to undertake this work.

In addition to improving the range of recreation opportunities available in the park, consideration was given to improving water way management in order to address problems of safety, erosion and flooding. This work was undertaken by Neil Craigie of N. M. Craigie and Associates. A summary of the work is provided in part two of this paper.

The Master Plan for the park was prepared by Land Systems EBC. A summary of the work is provided in part three of this paper.

PLANNING FRAMEWORK

The "Open Space Strategy", prepared in 1991, provided a planning framework for the development of open space in the municipality. The Strategy recognised the importance of the site and recommended that 'a review and update of the master and management plans for the Municipal Gardens be undertaken' and that the project be listed as a priority one project within the Council's park development schedule.

The reasons listed in the Open Space Strategy, for giving the project such a high priority were;

- According to the findings of the Household Survey, which was conducted during the preparation of the Open Space Strategy, the Municipal Gardens is the most popular Council managed area of informal open space in the Municipality,
- Current management of the Municipal Gardens tends to be on an ad hoc basis without complying with any set park objectives,
- Non-compliance with the master plan and management plan leaves the park open to possible inappropriate allocation of resources.

Council supported the recommendation to review and update the master plan for the Municipal Gardens and provided $30,000 in the 1991/92 financial year to employ consultants to assist with the review.

~~MELBOURNE WATER~~

David, can you • extend typing to give 17mm margin both sides 20mm top - bottom
• Can you have your typing on disc so the ~~typeface~~ it can print out in pages?

20mm

MELBOURNE WATER

Melbourne Water were approached for funding to undertake a Water Way Management Plan. The Board recognised that the project had the potential to;

- address water management issues arising from the rapidly eroding Ruffey Creek that bisects the park,
- provide an opportunity for Local Government and Melbourne Water to undertake a joint project that would integrate park planning and design with environmental stream management.

Melbourne Water contributed $5,000 to the project and this money was used to engage a specialist consultant.

WORKING PARTY

To guide the development of the plan, Council established a Working Party comprising 4 Councillors, 3 community representatives, a representative from Melbourne Water and council officers. The group participated in all elements of the project, from the initial selection of consultants to the presentation of the draft Master Plan to Council.

The important task of co-ordinating the project was undertaken by Leonie Wyld, Co-ordinator Recreation and Open Space Planning with the City of Doncaster and Templestowe.

CONSULTANTS

In April 1992 the Council commissioned a consortium of consultants, headed by Land Systems EBC Pty. Ltd., ~~in April 1992~~, to undertake the project. The sub-consultants were Jan Bruce and Associates, who undertook ~~the~~ community consultation, N. M. Craigie and Associates, who developed the Water Way Management Plan and Ecological Horticulture Pty. Ltd., who undertook research and provided recommendations concerning flora and fauna.

COMMUNITY CONSULTATION

Community consultation, to determine public needs and expectations, was an important element of the project. Local schools, residents, park users, Councillors and council staff all participated in the consultation process. The consultants undertook the following community consultations;

- a park users survey was conducted over a period of two weekends and one week in July 1992. One hundred and seventy eight visitors to the park were interviewed by trained interviewers,
- a BBQ was held in the park and residents were invited to attend. The consultants gave a talk on the project and presented concept plans for discussion. Approximately seventy people attended the event.
- two community meetings were held. Approximately thirty people attended each meeting.
- observation of park users was also undertaken in order to determine ~~usage~~ patters and times of use,
- a schools' survey was conducted to determine the views and interests of school ~~aged~~ children,
- interviews were conducted with council staff to ~~identify~~ obtain staff views on management and recreation issues,
- meetings were held with key agencies, including Melbourne Water and the Department of Conservation and Natural Resources
- interviews were also conducted with Councillors to determine their views on the development of the park,
- a public meeting was held at the Council offices. The consultants

presented the draft plans and invited public comment. Approximately seventy five people attended the meeting.

- finally, members of Council's Disability Advisory Committee were interviewed in order to identify the access and usage requirements of disabled users of the park.

The consultation produced a wealth of information. This material was fed back into the planning process and assisted the consultants and the working party identify the key issues that were important to the community and the users of the park.

PROJECT AIMS

The aims of the Municipal Garden's Master Plan project, as outlined in the consultants brief, were;

- Establish an overall concept which reflects the aesthetic, natural and cultural heritage and function of the park,
- Protects and enhances the aesthetic, natural and cultural heritage of the park, including Ruffey Creek,
- Provides a range of recreation opportunities consistent with community expectations and values of the park;
- Provides maximum opportunity for residents to be involved in the project.

RECOMMENDATIONS

The draft Master Plan was completed and presented to Council in February 1993. Council received the document and has placed it on public exhibition for a period of one month.

The major recommendations contained in the Master Plan are;

- the development of a path and trail system in the park to improve public access.
- the development of a lake in the centre of the park that will serve the dual purpose of providing an attractive focus to the park as well as providing an important drainage and flood mitigation function,
- the remodelling of Ruffey Creek, using 'soft engineering' techniques, to address safety, erosion and litter problems,
- the provision of a unifying theme for the park,
- the provision of a range of leisure opportunities within the park,
- the preservation of important historical and floral elements in the park.
- a change of name to reflect the historic as well as the physical elements of the park, the name adopted by the Working Party being Ruffey Lake Park.

CONCLUSIONS

The Master Plan for the Municipal Gardens necessarily addresses a broad range of topics, from flood mitigation to the provision of new recreation opportunities for the community. When developing the plan, Council and the Working Party endeavoured to maximise the opportunity for public comment to ensure that all elements contained in the plan were considered by the community. However, reaction tended to focus on the specific concerns raised by residents living immediately adjacent to the park. While this is common, the challenge remains to ensure that all residents have a stake in

the planning process.

The development of the Master Plan has provided an opportunity for Council and Melbourne Water to work co-operatively to integrate park planning and design with environmental stream management.

In addition, the Master Plan has established an overall concept which protects and enhances the aesthetic, natural and cultural heritage of the park, including Ruffey Creek; and provides a range of recreation opportunities consistent with community expectations and values.

Implementing the Master Plan will involve the input of considerable resources by Council, Melbourne Water and the community over a ten year period. The capital cost of implementing the Master Plan is estimated to be $5,500,000.

The Master Plan has not yet been adopted by Council. The Plan is currently on public exhibition for one month and will be presented to Council in April 1993. At the earliest, funding for the project will not be allocated by Council until the 1993/94 financial year. To date, Melbourne Water has not indicated if funding will be provided for the development of the lake which forms the centre piece of the Plan.

Copies of the draft Master Plan are available from the City of Doncaster and Templestowe for $50 per two volume set.

LITERATURE CITED

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PART 2.

WATERWAY DESIGN CONSIDERATIONS

Paper prepared by Neil Craigie and Associates

1. EXTERNAL ISSUES

Significant flooding, erosion, litter and water quality problems plague the Ruffey Creek and its tributaries.

The issues of water quality and litter transmission are of regional concern for the management of the Yarra River, as well as being critical inputs into the park which influence options for future development of the waterways.

A unique opportunity is afforded for mitigation of these broader catchment problems as part of the park development. It is significant to note that by virtue of their size, form and location, the Gardens offer the only remaining sites in Ruffey Creek catchment, which are capable of addressing such issues.

The attendant design requirements for these external factors, greatly influence the waterway development options through the Gardens, in particular those for flood mitigation and water quality management.

The downstream flooding problems on Ruffey Creek can only be addressed by a major retarding basin. The only suitable site for the basin embankment is within the park, downstream of the junction with Bonview Road Drain.

The embankment height will have an important visual impact, serve as a linkage pathway for recreation and maintenance access across the valley, and the borrow pit excavation offers scope for use as a permanent lake. If the latter possibility is taken up and properly designed, then it would eliminate a significant section of unsafe eroded creek.

Water quality improvement facilities rely on wetland filtration and sedimentation processes, which in turn need:

- adequate space,
- proper hydraulic design,
- provision of suitable vegetation species,
- protection from high sediment and litter loads.

This use will compete for space along the valley floor, require careful design to avoid aesthetic and maintenance problems, and entail provision of upstream protective works.

2. LOCAL CONSTRAINTS

- areas along the valleys are affected by deep, fast moving water during floods, by progressive stream channel erosion, and by location and form of man-made drainage works, all of which lead to significant safety concerns.
- water quality status is very poor in all drains.
- high litter loads enter via the piped drainage systems and are deposited in the park or carried downstream.
- the valley floor areas are subject to waterlogging in wet seasons.
- the valley floors through the park are typically narrow and flanked by steeply rising land, so that a permanent lake would have to be built "on-stream".
- given the topographic constraints, and costs of earthworks and flood overflow provision, a permanent lake of adequate size to have "landmark" status could only be provided in the park if created as part of a major flood control facility.

3. LOCAL OPPORTUNITIES

- improvements ~~in~~ trails ~~facilities~~ ~~would~~ follow from addition of new creek crossings and halting ~~of~~ erosion.

- restoration of stable waterways ~~with~~ wetlands, native vegetation and small ponds would greatly enhance public safety, passive recreation values and environmental quality.

- creation of a permanent lake would enhance environmental habitat quality and provide a focus for passive recreational uses and possibly the theme for the park.

- restoration of the reed swamp on Bonview Road Drain would provide a valuable water quality management tool, and one that could be emulated ~~on~~ Roseland Grove Drain.

- modification of form and location of existing drainage structures would mitigate present waterway safety and aesthetic problems.

4. RECOMMENDATIONS

~~Owing to topographic character~~, the areas which are subject to the greatest waterway related constraints, have very limited spatial extent, ~~and~~ are prone to waterlogging in winter, ~~are~~ also likely to attract the bulk of increased demand for access and recreation in the future.

Accordingly, waterway design form significantly affects the theme of the overall park development.

(a) Waterway Forms

Restoration of natural waterway form is recommended, subject to satisfactory mitigation of public safety threats by way of bank stabilisation and flow velocity control. Several willow trees need trimming and/or removal because of their direct contribution to bank erosion.

Channel stabilisation measures need to ~~emphasise~~ "soft-engineering" techniques, such as use of rock chutes to control erosion and encourage pool and riffle formation, and revegetation of banks with indigenous species.

(b) Flood Mitigation

A major retarding basin should be constructed within the park. The embankment can only be located downstream of the Bonview Road Drain confluence. The borrow pit should be designed to create a large permanent lake.

The permanent lake will need to bypass low flow (first-flush) stormwaters, because aesthetic appeal and water quality are to be dominant considerations.

(c) Litter Screening

Revegetation of streambanks will increase trapping of litter with the attendant visual and maintenance problems. Litter screening must therefore be carried out as close to its source as practicable.

Modification of the pipeline terminal structures ~~entering~~ the park ~~is~~ are appropriate, except in the case of the Victoria Road structure, where an alternative "soft-engineering" trial structure is contemplated.

(d) Modification of Existing Drainage Structures

The pipeline terminal structures entering the park should be modified to address visual intrusion, park accessibility, maintenance access, safety and security, litter screening and dissipation of flow velocity and turbulence.

Modification may involve relocation and consolidation with a proposed additional pipeline ~~in~~ the Roseland Grove ~~case~~.

(e) Water Quality Management

Since water quality treatment facilities will compete for the limited space in the narrow valleys, existing waterway features which already provide such benefits should be protected (eg. Bonview Road Drain reed swamp) and, wherever possible, waterway stabilisation works should be adapted to assist in water quality management.

On Roseland Grove Drain, a reed swamp should be developed similar to the Bonview Road Drain.

On Ruffey Creek, a sequence of three pondages fringed with native reed/melaleuca species, but also featuring open water and clear bank areas, is recommended between Victoria Street and Church Street. The first of these pondages would primarily act as a sediment trap for coarser materials.

To control erosion, aerate stream flows and meet topographic and aesthetic constraints, these pondages should be separated from one another with graded rock overflow chutes and terminate around the old quarry site in a series of rock riffles and runs.

The rock chutes separating the pondages are proposed to be designed to also act as litter filters, as a trial alternative to the expensive modification of the Victoria Road outlet structure for litter screening purposes.

5. ESTIMATED CAPITAL AND MAINTENANCE COSTS

A "minimum works" scenario is firstly considered. This refers to the extent of works required to resolve only the present erosion and safety problems. Costs for additional litter trapping, water quality improvement, and lake/retarding basin construction are then considered in turn.

These estimates are "order of cost" only, based on experience elsewhere and quantities taken from very preliminary design work. They do not include any allowance for special landscaping features such as extra plantings, seating, pathway construction, shelters, and signage, nor do they include contingencies or overheads.

Maintenance costs for "soft-engineering" works are estimated at 5% of capital expenditure. This is a reasonable longer term average figure. In the first couple of years after construction, costs could reach 10% of capital expenditure. Lake/wetland de-silting is assumed to be necessary on a 5-8 year cycle.

Item	Capital	Maintenance
Minimum Works	$205,000	$10,250/yr
Addition of Litter Screening	$65,000	$18,000/yr
Addition of Water Quality Improvement	$50,000	$12,000/yr
Addition of Major Lake-Retarding Basin	$745,000 *	$17,250/yr
ESTIMATED TOTALS	$1,065,000	$57,500/yr

* 70% of the capital cost of the entire waterway management budget.

PART 3.

DEVELOPING MULTIPURPOSE WATER FEATURES IN A MUNICIPAL PARK

Paper prepared by Land Systems EBC

NOT BOLD Type

As Landscape Architects and Site Planners, ~~Land Systems EBC~~ are constantly involved with the design of water in the landscape - not only as an aesthetic compliment to a design but also as a valuable means of improving water quality, increasing biological diversity and providing flood retardation.

Beginning with our work on the River Torrens Linear Park in South Australia, which has been underway now since 1975 and has run to four stages with a total value of $34 million, we have become involved with a growing number of sophisticated drainage systems both in parkland settings and in large broad acre subdivisions where urban run-off has been improved by filtering through purpose-designed macrophyte beds. Probably the most outstanding of these systems would be that found within the new lake at the Range subdivision in Williamstown, designed by ~~Land Systems EBC~~ for the Urban Land Authority. Here a 10ha freshwater lake complete with macrophyte beds has been established to take the stormwater run-off from the new 60ha estate and to discharge clean water into the Bay.

not bold type

Similarly we have ~~undertaken~~ designed a new 6ha lake for Vic Roads at Merlynston and a series of ponds and lakes, again for the Urban Land Authority at the major new 600ha subdivision of Roxburgh Park, north of Melbourne. In this case a major new parkland system has been created with a series of smaller ponds draining into a 4ha lake. Sources of eutrophication, such as detergents, fertilisers, heavy metals, bacteria, organic matter, pesticides and suspended solids will be removed by wetland vegetation planted around the inlets to the water bodies.

Design Philosophy

To create a multi-purpose water feature, it is essential that both functional and aesthetic considerations are resolved early in the design process.

To establish aquatic plants successfully, depths of no more than 2.0m are required, with lake edge gradients ranging from 1:16 to 1:5. Topsoil depths should be no less than 100mm, while it is recommended that only indigenous plant species ~~are~~ employed. Once planted, the plants ~~species~~ will colonise to close any gaps in the vegetation cover and, over time, the wetland will become a self-regulatory ecosystem.

Aesthetically, there are many considerations that have to be taken into account in designing a visually attractive water system in a parkland setting.

- The water feature must be designed as an integral component of the park, taking full advantage of the ~~attractive draw that water possesses~~. features attractiveness of
- Particular attention must be paid to the edges with treatments reflecting the formality of the situation, eg. timber wharfs for a more urban context, graded and planted banks for a more natural effect.
- Water in a park may have various forms and it is useful to consider a combination of these, particularly where creeks are concerned, to create added visual interest. These may include lakes, ponds, wide slow-moving stretches of water, rapids, rock-chutes and waterfalls - all of which can be created artificially.
- Traditionally, concrete structures such as weirs and outfalls should be disguised with rocks, planting and landform. As a guide, "soft engineering" techniques should be employed wherever possible.
- Access should be encouraged to the waterside, with landings, jetties, fishing points and boardwalks.

- Finally, it is useful to remember that water is often viewed from afar so that a lake may have important scenic qualities beyond the nearby park - **an important consideration when determining adjacent land values.**

Ruffey Lake Park

Not bold → **Land Systems EBC,** in conjunction with subconsultants, Jan Bruce and Associates, Neil Craigie and Associates and Ecological Horticulture, won the brief to upgrade the Doncaster and Templestowe Municipal Gardens (proposed to be renamed Ruffey Lake Park) from an under-used and degraded reserve to an attractive parkland of regional significance.

At present the Gardens are composed of steep valley slopes descending from prominent hill tops to Ruffey Creek and its tributaries.

Existing planting is scattered and intermittent with much of the indigenous vegetation and pine windbreaks in decline. There are few paths or sitting areas and Ruffey Creek itself, is badly eroding with 4 metre high unstable banks reaching far upstream creating a worrying safety hazard. Furthermore, considerable flooding has occurred downstream of the park within the last five years.

The proposed design solution seeks to develop the following major themes:

- Provide a redefined identity for the Park centred on a new lake and improved wetlands.
- Preserve the existing "rural" character ~~that exists at present~~.
- Exclude "activity areas" from the valley to preserve its visual integrity and concentrate them on the fringes of the Park.
- Visually link the hilltops with ~~R~~otundas as major features of the Park.
- Create an indigenous planting framework with a secondary structure of exotic tree planting.
- Rehabilitate Ruffey Creek to improve water quality, reduce erosion and enhance wildlife habitat.
- Emphasise the existing topographical and historical assets of the Park within the new design.

Not Bold

The report prepared by ~~Land Systems EBC~~ also recommends a complete re-organisation of ~~the~~ park management ~~regime~~, with less emphasis on grass-cutting and more on developing a parkland structure.

The cost of the proposed works would be $5.5M, of which $1.0M will be required to construct a lake and upgrade Ruffey Creek.

Most importantly, the water feature in Ruffey Lake Park will provide the missing central focus around which the new Park can develop. The way is now open for Doncaster and Templestowe to create a major new Park with a unique character of its own.

PUBLIC AQUATIC CENTRES OF THE FUTURE

Aquarena - A Clear Alternative

Place at end of paper

David Melvin

Manager Leisure Services

City of Doncaster and Templestowe

Box 1 Doncaster

No separate page pls

It costs too much!

300+ pleb

Title
x David Melvin

INTRODUCTION

In the 1960's, flushed with Australia's success at the Olympics, Local Governments embarked on a major swimming pool construction program. While Council's exhibited commendable enthusiasm, the majority of pools that were constructed were outdoor, unheated competition pools. Although the facilities met an initial short term need, many facilities quickly demonstrated that they were not profitable and that they did not cater for the general recreational interests of the communities they served. The old Doncaster and Templestowe Swimming Centre was one such facility.

Council recognised the need to upgrade the centre and in 1990 approved the construction of a new indoor complex to replace the existing indoor pool hall. Council established an Aquatic Leisure Centre Committee to oversee the development of the project, ~~The Committee~~ was delegated considerable power to expedite the development of the centre.
and which

The Project Management firm McGinley and Associates were engaged to manage the development and construction of the facility. The architectural firm Henderson and Lodge were then engaged to prepare plans for the centre.

Following Council approval of the plans, construction commenced on 14 October 1991 and the centre was completed and opened to the public one year and three days later.

Facilities ~~included~~ provided in the new centre include, a 25 m pool, a learners' pool and a wading pool, a spa and steam room, gymnasium and aerobics room, a creche, cafe and change facilities for ~~the~~ disabled persons.

There are a number of interesting features at the centre. Firstly, the centre uses a unique water treatment system for the indoor pools called Hydrozon. Secondly, the centre features a major work of art executed in glass by the Melbourne artist David Wright. These features are covered in ~~this paper~~.

HYDROZON

Water Treatment Method

The new Aquatic Leisure Centre, AQUARENA, constructed by the City of Doncaster and Templestowe, has broken new ground following the installation of HYDROZON, a unique water treatment system for indoor pools.

Swimmers at AQUARENA can enjoy swimming without the problems traditionally associated with heated indoor swimming pools. The HYDROZON system achieves this by operating without chlorine. Swimmers can therefore enjoy the benefits of ozonated water without the accompanying problem of eye and skin irritation and the unpleasant smell of chlorine.

The pools at AQUARENA featuring the new water treatment system are the heated indoor pools. They are the 25m pool, the learners' pool, the wading pool and the spa.

The HYDROZON water treatment process was developed by HYDROELEKTRIK Gmbh. The system has been independently assessed and fully endorsed for use in public swimming pools and spas by the Hygiene-Institut Des Ruhrge Biest, Gelsenkirchen, Germany.

Gregory Industrial Equipment, based in Sydney, are the suppliers of the HYDROZON system in Australia. ~~The company is based in Sydney~~.

SPECIFICATIONS OF THE SYSTEM

The main feature of the HYDROZON process is the complete absence of chlorine in the water treatment process. ~~In simple terms~~ The system operates by generating ozone on site so that it can be used efficiently and precisely where it is needed instantaneously. This is important because ozone is unstable and from the moment it is produced, it ~~is trying to become oxygen once more.~~ highly to oxygen releasing oxygen to oxidise contaminants it is quickly reduced

Most ozone generators produce ozone at 1.5% by volume in air. The HYDROZON ozonators produce ozone at 3.5% and place it into contact with the recycled pool water instantly. This ensures that bather introduced contamination in the pool water is destroyed by ~~the process of~~ oxidation the moment it comes in contact with the ozone.

~~Author~~ position + address

This process takes place outside the pool and after destroying the bacteria, the remaining ozone, which is entrained in the air in the pool water, combines with sodium bromide in a secondary chemical reaction to form bromine. Bromine then becomes the residual disinfectant to be returned to the pool to prevent cross infection among bathers.

Ozone cannot exist in a free form in the pool water in the presence of bromine. For this reason a granulated activated charcoal filter is not required to destroy the ozone that remains in the water after it passes through the HYDROZON ozonators. In fact, the designers have made every effort to keep the ozone active throughout the filter stage in order to maximise the exposure of the water to the ozone. In addition, no secondary cooling system is required for the ozone generators as the heat generated by these units is returned directly to the pool water.

The suppliers claim that the system is entirely safe because the ozone is sealed within the oxidator vessel and any remaining ozone gas is destroyed in a small granulated activated charcoal filter before the air is discharged into the backwash line.

FULLY AUTOMATED SYSTEM

The water treatment system installed at AQUARENA is fully automated and can be controlled from a remote site via a modem. This has particular benefits for Council and the operators, as the head office for GIE is located in Sydney. It means that the company can monitor the operation of the plant and, where necessary, make adjustments to the system without the need to physically visit the site. In addition, it provides pool management with the ability to discuss operational issues with the supplier without the need for the supplier to be on site.

The automated system also reduces labour costs for it is no longer necessary to conduct regular inspections of the plant. The "hands free" operation provides management with the ability to concentrate on customer service.

Finally, it provides management and the public with the confidence that the system is delivering high quality water to the pools at all times the system is operating and that any operating problems will be automatically diagnosed, and in most cases, automatically rectified by the plant.

The system has now been operating at AQUARENA since mid October 1992. To date there have been no operating problems with the plant and customer satisfaction with the system is very high. In particular, members of the public have appreciated the lack of chlorine in the air and the water. This has been a very attractive feature of the Centre, drawing positive comments, particularly from people who suffer an allergy to chlorine. Swimmers have also been very complimentary about the quality and clarity of the water in the indoor pools.

ART COMMISSION

In 1990, the Doncaster and Templestowe Council adopted an innovative art acquisition policy. The policy allocates one percent of the total project cost in any new Council building development for the commissioning of works of art.

With funding provided solely by the City of Doncaster and Templestowe, Council appointed a sub-committee to seek a work of art that would be at once challenging, bright, enjoyable to users of the centre and a major artwork in its own right.

An exhaustive commissioning process saw over eighty artists respond to an Australia wide advertising campaign. Three short listed artists were then invited to present detailed submissions, including models of their proposed works.

Following extensive analysis, Council selected Melbourne artist David Wright's proposal for a slumped glass sculpture to adorn the entrance and east facing window of the Centre.

David Wright has been working in glass for twenty-six years. He has had work commissioned for Parliament House in Canberra, the Australia Post Queen Street Memorial Window at Melbourne's GPO, and one of Australia's

largest glass commissions for St. James Church in Sydney.

The work has contributed to people's enjoyment of this magnificent new centre. It also served as the source of inspiration for the graphic artists engaged by Council to develop the corporate logo, signage and uniforms for the centre. As a consequence the centre has a unifying them that ties all elements of the centre together.

FUTURE EXPANSION

When Council established Aquarena it resolved to set aside the profits generated by the centre to fund on-going development and expansion.

From the first day of operation it was evident that the centre was meeting community expectations as attendance and membership numbers rose rapidly. Planning is now under way to determine development priorities which will be funded from the accumulated profits of the centre.

Council recognises the need to continue to upgrade the centre and provide new services for residents. By continually improving the centre usage numbers and membership retention rates will remain high and the centre will continue to provide an important services to the community.

CONCLUSION

Council and the community are very proud of this magnificent new centre. Public response to the water treatment system and the art work has been very positive and clearly justified the original cost of installation.

"BENEFITS OF WATER ACTIVITIES FOR THE AGED"

VANDA FORTUNATO
LECTURER
DEPARTMENT OF PHYSICAL EDUCATION AND RECREATION
VICTORIA UNIVERSITY OF TECHNOLOGY
MELBOURNE MAIL CENTRE
MELB. VIC. 300.

"Youth, large, lusty, loving-
Youth, full of grace, force, fascination,
Do you know that Old Age may come after you,
With equal grace, force, fascination?".
-Walt Whitman

Recent studies have shown that exercise is vital to the total well-being of older persons (Crandall, 1980). It also has been indicated that moderate exercise can retard the effects of ageing and may be able to reverse some age related effects (Ostrow, 1984). Regular exercise will strengthen heart and lungs and decrease the likelihood of heart attack. Increased exercise combined with proper dietary controls can produce weight loss through a reduction of excessive body fat; it also results in the gradual disappearance of aliments such as daily fatigue, sore joints, stiffness, and poor circulation. Improved digestion and elimination and more restful sleep may be promoted. Exercise may improve an older person's personal appearance by shaping and toning muscles, improving complexion, increasing strength and flexibility, and improving posture. Regular exercise may improve feelings of well-being, accomplishment, and pride and may therefore motivate an individual to give up smoking, unnecessary drugs, and other unhealthy habits. It may provide a release of tension, relaxation, the opportunity to develop interpersonal relationships, and enjoyment (Teaff, 1985).

The role of physical activity in the ageing process has been of interest to mankind since as early as 3,000 B.C.. In the Middle East and China, scholars attempted to explain how balanced physical and mental activity might influence longevity. Hippocrates, in ancient Greece was the first to note that regular exercise might retard the ageing process. Later, Plato went on to give credence to that moderate exercise could help preserve the body and mind by ordering "particles and affections which are wandering about the body." Despite these early thoughts on the benefits of exercise to the elderly, throughout much of history the tendency has been to think that age-related changes were inevitable and uncontrollable (Sager, 1983).

In modern Western society, the relationship between ageing and exercise is characterised as inverse. That is, with ageing there is a tendency to do less exercise. This decline may be related to cultural values that urge us to "slow down", "act our age" and "take it easy". Until recently it was felt that this decline in activity was caused by biological changes associated with ageing that naturally limited our ability to exercise. Bortz (1982), noted the similarities between the physiological changes that occur with ageing and the response that occurs in people of any age when they are subject to periods of long inactivity.

There has however, been a distinct lack of research conducted on the aged population which has attempted to examine the potential health and lifestyle benefits that could be attributed to participation by the older adult in an organised water based "fun type" exercise programme. There is no published data on the effects of a water based exercise programme on the function and health of the older adult. This paper will examine benefits from previous land based exercise programmes conducted on older adults from North American populations which have shown improved function in such things as balance and co-ordination and improvement in strength and measures of cardiovascular fitness, and relate these benefits to water based activities.

PHYSIOLOGICAL CHANGES ASSOCIATED WITH AGEING AND THE EFFECTS OF EXERCISE:

Cardiopulmonary Function:

With age the heart muscle decreases in mass and contractility. Cardiac mass, however, is directly related to heart strength. This reduction in strength influences three major processes:

(1) the duration of systole;

(2) the volume of blood expelled from the ventricles; and

(3) the blood pressure generated.

Decreased contractility of the heart muscle is probably due to infiltration by connective tissue as well as by the formation of small scares. Because of these changes, it takes longer to expel blood from the heart, while at the same time allowing less time for filling. This in turn contributes to the maximum heart output (deVries, 1970).
The vital capacity of the lungs declines 40 to 50 per cent as we age. This may be due to:

(1) lung tissue becoming less elastic;

(2) the thoracic cage becoming stiffer;

(3) decreased lung surface; and

(4) decline in alveolar function.

The total surface area of the lung decreases from 80 to 60 square meters. Alveolar decline may be the result of loss of elasticity, which results in the closure of some air sacs and the reduction or cessation of capillary blood flow to some alveoli (Smith & Gilligan, 1984).

Most research on endurance type training among the elderly suggests that regular participation improves cardiopulmonary efficiency (Sidney, 1981). The evidence for this generalisation is based on epidemiological and experimental research. de Vires (1970) found that regardless of prior habits of exercise, the maximum oxygen consumption (VO2) increases 10 to 30 percent with a programme of aerobic exercise. It has also been noted that aerobic exercise lowers the blood pressure 5 to 10 mm Hg,

although it has been suggested that this decrease is due to reduction in anxiety experienced by participants in programmed exercise (buccola & Stone, 1975).

Muscular strength:

Skeletal muscle declines with age. Calloway and Zannie (1980), suggested that the rate of decline after the age of 25 is 2 to 3 per cent per decade. Smith and Gilligan (1984), found a muscle mass decline of 20 to 25 per cent with age that is accompanied by a parallel decline in strength. Muscle-mass declines include a reduction in both the number and size of muscle fibres. Studies have shown that there is a dramatic decline of strength endurance after the age of 60. Harris (1977) found the greatest loss of strength with age occurs in the leg and trunk muscles, this has significant implications for the mobility of elderly individuals.

Moritani (1981) in his studies with the elderly showed increases in strength and significant improvement in muscle function through training after a one year aerobic programme. In a study conducted by Sidney, Shepherd and Hamson (1977) they found a 10 per cent increase in lean body mass and muscular strength.
Train ability of older people in relation to muscular strength and endurance does not apparently differ from younger people, if the age groups are compared on a per centage of change basis (Moritani, 1981).

Muscular Flexibility:

A gradual loss in the range of joint motion has been observed with age. It may be due to shortening of muscles, calcification of cartilage, ligaments and tendons, and the prevalence of arthritic conditions. Joint flexibility is important for the efficient performance of ordinary, every-day activities. A joint may lose a considerable range of motion through inactivity or degenerative disease (Adrian 1981).

Joint flexibility is modifiable through training across age groups. In a study conducted by Munns (1981), on a group of 20 participants who averaged 72 years of age. Munns found an increased range of motion in all joints after a 12 week flexibility programme. The percentage increases for each joint was: neck, 28 per cent; wrists, 13 per cent; shoulder, 8 per cent; knees, 12 per cent; ankles, 48 per cent; and hips and back, 27 per cent.

Neuromuscular:

Associated with ageing is the lengthening of rapid muscular reaction time. Nerve conduction velocity declines between 10 and 15 per cent with ageing and leads to increased reaction time for muscle contraction. This may be the result of (1) chemical and structural change at the synapse, (2) change in nerve fiber itself and (3) changes in muscle fiber. It is also probable that the central nervous system contributes to the change in neuromuscular efficiency. Fast - twitch muscle fibres needed for quick all-out contractions show greater changes with age than do slow-twitch fibres. Slow-twitch fibres are significant for prolonged endurance activity. This differential change may be related to noticeable declines in quick reactions and more gradual declines observed for muscular endurance (Spirduso, 1980).

Spirduso (1980), after extensive studies on exercise and neuromuscular change proposed that exercise:

(1) Aids in greater synchronisation of motor units and reduces random firing of neurones;

(2) enhances blood flow to the various parts of the brain;

(3) maintains hormonal regulator systems that to some extent control the integrity of the nervous system;

(4) delays reductions with age of oxidative capacities of the brain and in Neurotransmitter transmitter substances; and

(5) retards the age-related decline in fast-twitch muscle fiber.

Bone Strength:

Loss of bone mass is a universal characteristic of ageing. It starts earlier in women around 35 and progresses at a more rapid rate of 1 to 2 percent per year. Men are also affected, but the process starts at about the age of 50 and proceeds at a rate of only .5 percent per year. The impact of bone mass loss is far greater in women, an by the age of 75 fractures related to osteoporosis are widespread in this group. Fractures related to osteoporosis are significant for the elderly population in general (Aloia, 1981).

When stress is placed on bone through weight-bearing exercise, calcium content and resistance to fracture are increased. In a three year, low intensity exercise programme for the elderly, Smith and Redden (1976) noticed a 4.2 percent mineral content among exercisers and an average 2.5 per cent decrease in the non exercising control group. Smith, Redden and Smith (1981) noticed some change even in the very old. They studied 12 female nursing home residents, all in their 80s. Chair exercises were provided for 30 minutes, three times a week for one year. The bone mineral content of the group increased 2.29 per cent while members of the control group lost 3.28 per cent.

Psychological and Social Benefits:

Numerous articles discuss the psychological and social benefits for older adults participating in exercise programmes. According to Ingraham (1977), most individuals experience a heightened sense of well-being after exercise. Exercise increases energy levels, improves self-concept, and enhances life satisfaction. Haber (1977) suggested that physical activity creates a state of independence. Furthermore, Haber noted that a healthy body achieved through exercise can function more independently and therefore enhance one's psychological well-being.

Arnold (1977) noted that participation in a group exercise programme promotes social growth and development. Through interactions with others in an exercise programme, older adults enjoy companionship and feel part of a group.
Alexiou (1977) suggested that exercise is an outlet for tension. Without activity, tension accumulates in the individual that can produce muscle contraction causing pain and fatigue. Alexiou also suggested that exercise is an effective way of achieving relaxation.

As stated ealier there has been no empirical research on the benefits of water activities for the aged. Various authors have written on the perceived benefits of water based activities for the aged.
The author of this paper intends with a fellow colleague to undertake an in depth study which will look at the physiological and social-psychological benefits of water based activities for the aged.

Water is an excellent medium for performing land exercises due to the following reasons:

(1). the buoyant effect of water on the human organism makes many movements that are difficult or impossible to perform on land relatively easy; and

(2). the resistance of water against the body part being moved makes the exercise more beneficial by increasing the workload of the muscles involved.

A water temperature of about 28 degrees is recommended for water exercise to stimulate circulation and aid relaxation. Handrails in the water and ropes stretched across the pool are excellent aides for the poorly coordinated. In addition, if the water is shallow, benches can be placed in the water for use by the physically disabled with who may have limited leg mobility. Or a pool with stairs at the shallow end can be used for the same purpose (Moran, 1979).
Water exercises are extremely beneficial in developing muscular strength, improving muscle tone, developing stamina and endurance, enhancing coordination, flexibility, and agility, improving circulation, and developing confidence. Correct body positions and breathing should be emphasised during the exercise sessions. Exercises can range from walking across the pool to using all parts of the body through all ranges of motion (Moran, 1979).

NOTE: **The author strongly recommends that any person intending to commence an exercise program consult with their doctor first.**

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NAME Ms Ann Oldham,
Manager Albert Park Reserve.

ADDRESS

Dear Ann.

MESSAGE Comments on your paper are mostly written on the paper I know how much work is required to produce a paper and I greatly appreciate you agreeing so readily to expand on the technical + other aspects. If I could receive it by Tuesday, I would be most grateful indeed.
Other points on which I should like to comment.
Why were the excavated areas filled with sludge? How was it stabilised. Was any consideration given to mounding to reduce noise levels especially vehicle traffic?
Who is preparing the landscape plan. Who else is having an input into the plan? What are the main elements that are likely to make it different from the existing plan. Is there an ongoing budget? Will there be increased charges from tenants, park users, etc.
Ann, many thanks indeed

FROM Trevor.

My apologies for the delay; but I have had a lot of interruptions
No doubt you will put my remarks in your own words in context. I'm sorry some of my comments are a bit random.

IF TRANSMISSION IS FAULTY PLEASE PHONE **3 848.7329**

"STARTING AGAIN - ALBERT PARK LAKE"

Ann Oldham

ABSTRACT

Prior to European settlement, the area in the vicinity of the Park was very low lying marsh. Within the Park lay a brackish lagoon, a large sheet of shallow water, that spread out into the marsh lands and drained towards where St. Kilda Railways Station is now. It is believed that these lagoons were formed thousands of years ago when the Yarra River once flowed through the area.

Sailing and rowing enthusiasts in the early days of Melbourne (1860's) thought that with some work, the lagoon could be deepened and developed into an expanse of navigable water. About the same time, others advocated an improvement plan, including proposed dredging, because at that time Melbourne's lack of a good drainage and sewerage system virtually turned every depression, swamp, lagoon or waterway into an open sewer.

The original establishment and use of the Lake over the years has had a strong emphasis on recreational boating activities. Water weed has plagued the lake for over a hundred years and many types of control have been tried including weedicide and machinery. Over the years, a build up of nutrient rich sediments has led to the lake becoming choked with weeds.

An intensive investigation of possible solutions identified removal of sediment as the best answer. In June 1992, the process of draining the lake and removing approximately 180,000 cubic metres of sediment began. This is the first stage of implementation of the long range vision that Melbourne Water has for improving Albert Park.

It is anticipated that this dredging operation will be complete by the end of March 1993. Freshwater ecology studies recommended development of new wetland areas and ongoing water quality monitoring as part of a strategy for improving the ongoing health of the lake.

INTRODUCTION

Melbourne Water was given responsibility for Albert Park Reserve in January 1992. The Vision for Albert Park is that it becomes:

- A high quality lakeside city park
- A home for amateur sporting and recreation activities
- An outdoor venue for public events and activities
- A tourist feature which enhances the metropolitan open space network

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Melbourne Parks and Waterways - Albert Park
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"STARTING AGAIN - ALBERT PARK LAKE"

Ann Oldham

The most visible challenge at Albert Park is the need to renew and upgrade the Park environment and built assets. Sensitive landscaping and quality new buildings which raise the status of the Park will be the criteria for assessing future development plans. Safety, security and social behaviour problems in the park need to be addressed to improve public perception of Albert Park as a quality lakeside city park.

The aim will be to cater for new uses whilst maintaining traditional activities. A balance needs to be struck between broader community activities and traditional sports uses in order to widen the appeal of the Park. The efforts to restore the Lake environment and to include wetland areas for wildlife habitats demonstrates how the Park can be developed to include more passive community activity.

DISCUSSION

Albert Park Lake Restoration

The Lake restoration works are the first stage in a series of improvements planned to the Park outlined in "Albert Park - The Vision" management plan. The aim of the $3 million lake project is to eliminate one of the main causes of the weed problem which has choked the lake in recent years.

Albert Park Lake is a shallow, 48 hectare artificial lake fed by rainfall and stormwater runoff from city streets. Water entering the lake contains high levels of nutrients and over the years the lake has become choked with nutrient rich sediments to a depth of up to 70 cm. The sediment has promoted excessive growth of algae and weeds causing odour problems, damage to the lake ecosystem and disruption to water sports and recreation activities.

Controlling nutrients and weeds with chemicals has proved unsuccessful Removal of the nutrient rich sediment that has accumulated over the last 60 years was determined to be the best solution. The lake was drained in two stages. The sediment was then removed from the lake bottom and used to fill excavated work sites in the Park. Sediment removal was a major operation which involved a combination of pumping and scraping of material using heavy machinery. From an ecological point of view, the restoration works are the first step with respect to accumulation of nutrients in the Lake.

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"STARTING AGAIN - ALBERT PARK LAKE"

Ann Oldham

Albert Park Lake Monitoring

As an urban water body, Albert Park Lake represents an ecological resource with high potential nutrient availability. Colonisation by water plants and animals is a natural process that will begin again to some extent once the lake is refilled. The availability of nutrients will speeds this process.

There is a colonisation sequence for plants invading a new ecological resource, such as the refilled lake. From a public amenity point of view, some of these developmental stages are more desirable than others. As a consequence, lake management has two major objectives:

1. To limit the rate of build-up of nutrients so as to slow the biological development process and increase the time prior to plant growth becoming a nuisance.
2. To instigate management actions that will pause the developmental process at stages that are most compatible with the desired beneficial uses.

A major action of ongoing management is monitoring. To be able to manage the lake it is necessary to know what the present condition of the lake is and how fast it is changing. A monitoring program is being established to track the lake condition. The monitoring and inspection program will detect the invasion by weeds and highlight the need for some action. Possible responses could include mechanical removal or spot herbicide use.

Ongoing management actions will depend on building up an understanding of lake ecology, seasonality and the rate of the developmental process. Monitoring programs and special studies are being developed to meet these informational needs.

Albert Park Lake Design Features

Design solutions directed at reducing the input of sediment to the lake have been incorporated in the lake dredging program. Several sediment traps have been constructed within the lake to minimise the input of sediment and nutrients from a number of major drains that empty into the lake. Wetland areas within the lake are also being constructed to allow for the growth of beneficial water plants. In addition to providing wildlife habitats for water birds, emergent macrophyte stands will act as a sink for nutrients, reducing the resources available to water weeds and nuisance plants.

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Albert Park Lake Activities

In addition to providing a focal point for the Park, Albert Park lake is an important urban resource for both ongoing and event specific water based activities. The lake is used regularly by Park-based clubs and schools for Sailing and Rowing regattas, Model Yacht races, and Speed Boat races. There is also Sail and Paddle boat hire. are available for hire
↑ is there a restriction on size. Conflicts between speed boats & other uses. Is fishing possible or profitable. Yabbying?
The lake provides the setting for other events and activities enjoyed by the public. A perimeter trail is used daily for jogging and walking. Lakeside picnics are especially popular on the weekend. Annual events, such as the Fox FM "SKYSHOW" attract thousands of people who enjoy a fire works spectacle enhanced by the reflective quality of the lake.

A new Lake Use Policy will be developed over the next year with the aim of broadening access to the Lake. A Landscape and Recreation Facilities Development Plan for the entire Park is currently being developed and should be completed in June 1993. Proposed new lake based recreation activities, including fishing, are being evaluated as part of that process. Opportunities for improving the lake environs for increased public amenity and enjoyment of the lake are also being considered.
who is doing the plan.
Has a priority plan been developed for future works. any indications of budget?
Public Consultation - what is proposed?
Friends of Albert Park Lake
Interpretation activities

CONCLUSION

The Albert Park Lake Restoration Program was the first step in implementing a strategy for improving the whole Park. This major operation will be followed up with an ongoing Lake maintenance and monitoring program. The Lake represents an important setting for water related activities and an asset which increases the amenity of the park for public enjoyment. In the future, the challenge will be to make optimum use of this water resource for recreation, passive enjoyment, and as a habitat for birdlife.

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Prior to European settlement, the area in the vicinity of the Park was very low lying marsh. Within the Park lay a brackish lagoon, a large sheet of shallow water, that spread out into the marsh lands and drained towards where St. Kilda Railways Station is now. It is believed that these lagoons were formed thousands of years ago when the Yarra River once flowed through the area.

Sailing and rowing enthusiasts in the early days of Melbourne (1860's) thought that with some work, the lagoon could be deepened and developed into an expanse of navigable water. About the same time, others advocated an improvement plan, including proposed dredging, because at that time Melbourne's lack of a good drainage and sewerage system virtually turned every depression, swamp, lagoon or waterway into an open sewer.

The original establishment and use of the Lake over the years has had a strong emphasis on recreational boating activities. Water weed has plagued the lake for over a hundred years and many types of control have been tried including weedicide and machinery. Over the years, a build up of nutrient rich sediments has led to the lake becoming choked with weeds.

An intensive investigation of possible solutions identified removal of sediment as the best answer. In June 1992, the process of draining the lake and removing approximately 180,000 cubic metres of sediment began. This is the first stage of implementation of the long range vision that Melbourne Water has for improving Albert Park.

It is anticipated that this dredging operation will be complete by the end of March 1993. Freshwater ecology studies recommended development of new wetland areas and ongoing water quality monitoring as part of a strategy for improving the ~~ongoing~~ health of the lake.

INTRODUCTION

Melbourne Water was given responsibility for Albert Park Reserve in January 1992. The Vision for Albert Park is that it become:

- A high quality lakeside city park
- A home for amateur sporting and recreation activities
- An outdoor venue for public events and activities
- A tourist feature which enhances the metropolitan open space network

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The most visible challenge at Albert Park is the need to renew and upgrade the Park environment and built assets. Sensitive landscaping and quality new buildings which raise the status of the Park will be the criteria for assessing future development plans. Safety, security and social behaviour problems in the park need to be addressed to improve public perception of Albert Park as a quality lakeside city park.

The aim will be to cater for new uses whilst maintaining traditional activities. A balance needs to be struck between broader community activities and traditional sports uses in order to widen the appeal of the Park. The efforts to restore the Lake environment and to include wetland areas for wildlife habitats demonstrates how the Park can be developed to include more passive community activity.

DISCUSSION

Albert Park Lake Restoration

The Lake restoration works are the first stage in a series of improvements planned to the Park outlined in "Albert Park - The Vision" management plan. The aim of the $3 million lake project is to eliminate one of the main causes of the weed problem which has choked the lake in recent years.

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Controlling nutrients and weeds with chemicals has proved unsuccessful Removal of the nutrient rich sediment that has accumulated over the last 60 years was determined to be the best solution. The lake was drained in two stages. The sediment was then removed from the lake bottom and used to fill excavated work sites in the Park. Sediment removal was a major operation which involved a combination of pumping and scraping of material using heavy machinery. From an ecological point of view, the restoration works are like resetting the clock with respect to accumulation of nutrients in the Lake.

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CONCLUSION

The Albert Park Lake Restoration Program was the first step in implementing a strategy for improving the whole Park. This major operation will be followed up with an ongoing Lake maintenance and monitoring program. The Lake represents an important setting for water related activities and an asset which increases the amenity of the park for public enjoyment. In the future, the challenge will be to make optimum use of this water resource for recreation, passive enjoyment, and as a habitat for birdlife.

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WATER AND COMMUNITY HEALTH
1. HEALTH RISKS OF WATER CONTACT RECREATION

DR. JOHN CARNIE* AND DR. SALLY NG*

INTRODUCTION

There can be many constituents of water that can affect human health and well being, through a deterioration in aesthetic qualities and taste and also by directly causing illness.

These constituents could be inorganic substances either naturally present in water such as iron, sodium and chloride or which enter the water supply; they could be organic chemicals such as pesticides, aromatic hydrocarbons from petroleum spills or trihalomethanes which are by-products formed during chlorination of water; and lastly they could be micro-organisms which have the potential to cause disease.

This paper deals mainly with the last of these groups of constituents i.e. micro-organisms and their relationship to community health.

The potential for disease transmission through water-borne infections applies to drinking water supplies; to primary contact recreation, where there is direct contact with the water such as in swimming, water skiing and surfing; and less so to secondary contact recreation where the probability of swallowing water is less as in wading and fishing; and lastly to the reuse of waste water, the so-called grey water.

The modes of transmission of water-borne infections could be through ingestion i.e. swallowing of water; through contact with the skin or mucous membranes of the eyes, nose, mouth, or ears; or through inhalation of airiborne water spray particles of sprays.

This paper does not deal specifically with the problem of contamination of drinking water supplies except to note for comparison the microbiological standards currently laid down for such supplies.

COMMUNITY HEALTH IN RELATION TO CONTACT RECREATION

As noted above, contact recreation could be either primary or secondary with the former involving immersion of the body and the possibility of both ingestion and direct contact with water-borne organisms. The amount of water accidentally swallowed during such activities may vary with the age and the degree of skill of the person but is said to not exceed 100ml for any individual per day. (National Health & Medical Research Council, 1990). During secondary contact recreation the possibility of ingestion of water is much less likely but there can be direct contact with skin or mucous membranes.

Organisms with the potential to cause illness generally find their way into recreational waters through pollution by faecal matter of human or animal origin. These organisms may be -

(a) bacteria such as Campylobacter, Salmonella including Salmonella Typhi and Paratyphi the causative organisms of typhoid and paratyphoid, Shigella, Yersinia, Pseudomonas, pathogenic E.coli, Vibrio parahaemolyticus and Vibrio cholerae 01 which causes cholera;

(b) viruses such as Rotavirus, Hepatitis A, Norwalk and other similar viruses collectively called Small Round Structured viruses (SRSV);

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(c) parasites such as Entamoeba histolytica which causes Amoebiasis, Giardia and Crypotosporidium;

(d) fungi such as Candida albicans which causes thrush.

Indicator Organisms

In order to assess the suitability of a given body of water for different purposes it is necessary to test for the presence of micro-organisms. It is rarely possible to test for all the different types of organisms given above and this would be impossible for routine monitoring purposes. For this reason we have to depend on testing for certain "indicator" organisms whose presence or absence can be taken to correlate with the presence or absence of faecal pollution. Regulatory authorities depend on the quantitative evaluation of such indicator organisms in the setting of standards of water quality.

Some of the micro-organisms that have been used as indicators of water pollution include faecal coliforms, E. coli and faecal streptococci. Obviously the choice of a suitable indicator is influenced by its survival characteristics in different types of recreational waters ie marine or fresh waters.

Dufour in 1984 set out the characteristics for the ideal indicator organism for monitoring faecal contamination of water. These are that the organism should:

be present where the pathogens are;
be unable to grow in aquatic environments;
be more resistant to disinfection then pathogens;
be easy to isolate and enumerate;
be applicable to all types of water;
not be subject to antibiosis;
be absent from sources other than sewage or be exclusively associated with sewage;
occur in greater numbers than pathogens;
have a direct relationship to the degree of faecal contamination; and
correlate with the health hazard from a given type of pollution.

Of these characteristics the most important appear to be that the density of the indicator should have a direct relationship to the degree of faecal contamination and that the indicator density should correlate with the health hazards from given types of pollution. Many regulatory authorities use levels of faecal coliforms or E.coli but Dufour (1984) has suggested that enterococci (a subset of faecal streptococci) may be a better indicator for marine waters. It should be noted that the actual demonstration of pathogens such as Salmonella and Shigella would only be attempted for special studies and not for routine monitoring.

The median decay rate estimates (ie the time required for 90% of the microbial population to die-off) has been reported (Dufour, 1984), to be 3.9 days for E.coli in fresh water and 0.8 days in sea water, while for enterococci the rate is 4.4 days in fresh water and 2.5 days in sea water. Survival times of pathogenic organisms are known to vary considerably from 24 hours for Vibrio cholerae in surface waters to three to four weeks for Salmonella Typhi and Paratyphi. Payment (1984) suggested that there may be no correlation between the currently used bacterial indicators and the presence of viruses in surface waters.

Current Microbiological Standards

The National Health and Medical Research Council (NH&MRC) in their guidelines for recreational waters used for primary contact recreation have recommended a microbiological guideline of a median value not exceeding 150 faecal coliforms per 100ml for a minimum of five samples taken at regular intervals not exceeding one month, with four out of five samples containing less than 600 faecal coliforms per 100ml. They have stated that in practice this equates to the widely used geometric mean level of 200 faecal coliforms per 100 ml.

In Victoria, the State Environment Protection Policy established in 1984, gives a bacterial water quality objective for the tidal segment of the Yarra River, that the "geometric means of E.coli organisms shall not exceed 200 organisms per 100ml based on not less than five samples taken over a period of not more than 42 days nor shall more then 20% of the samples exceed 400 organisms per 100 ml".

These standards are similar to those set overseas. For comparison the Canadian guidelines for recreational water quality (Tobin and Ward 1984) states: "the geometric means of not less than five samples taken over a 30 day period should be less than 200 faecal coliforms per 100ml. Resampling should be performed when any sample exceeds 400 faecal coliforms per 100ml".

In contrast, the guidelines issued by the NH and MRC for drinking water quality in Australia (1987) states that "no scheduled sample should contain any faecal coliforms in 100 millilitres". They also comment that where two or more faecal coliforms per 100ml are found, immediate resampling is required and immediate investigation should be undertaken to determine the source of contamination, complemented by remedial action.

Types of Illnesses Recorded

A number of studies have attempted to show an association between immersion in various recreational waters and the subsequent development of illness. These prospective epidemiological studies sometimes referred to as "Cabelli style studies" (Saliba and Helmer 1990) from the name of the researcher who initially used this study design, consisted of subject recruitment of swimmers and non-swimmers with an initial beach interview followed by interviews 7-10 days later to determine the incidence of various symptoms. Microbiological water quality is also determined at the time.

Problems with these types of studies however include the uncertainties as to the degree and duration of water exposure, difficulties in obtaining medical confirmation of illnesses reported and the confounding effects of other factors such as foods consumed at the beach. These lead to difficulties in the interpretation of any association between illnesses and exposure to polluted water and in ascribing any cause - effect relationship. With these reservations in mind it can be noted that Cabelli et al (1979) found that at New York beaches with "barely acceptable" microbiological quality there were increased rates of diarrhoea, vomiting and abdominal pain among swimmers as well as increased eye, ear, nose and skin symptoms. The gastrointestinal symptoms were severe enough in about half the cases for the person to stay home, stay in bed or seek medical attention.

Cabelli et al (1982) further showed that for beaches in New York, Louisiana and Boston at a level of enterococci of 1 per 100ml the gastroenteritis rates were equal for swimmers and non-swimmers but at a level of 100 per 100ml swimmers had gastroenteritis rates one and a half to twice that of non-swimmers.

Cheung et al in Hong Kong, (1990) Seyfried et al (1984, 1985) in Ontario, Alexander et al (1992) in the UK, and Ferley et al in France (1988) showed that swimmers at both marine and fresh water beaches appear to have higher illness rates than non-swimmers especially in relation to gastrointestinal, respiratory, ear and skin infections.

In this context it is interesting to note the results of a study we conducted in Melbourne in 1992 following the Australia Day superswim in the Yarra. We obtained interviews with 107 of 118 swimmers who participated (82 males and 25 females), seven to ten days after the swim and with an equal number of controls of the same age and sex distribution.

The E. coli levels in the section of the Yarra used for the swim varied from 320 per 100ml to 710 per 100ml on the day of the swim and the geometric mean levels for the month of January varied from 509 per 100ml to 645 per 100ml depending on the test site. You may recall that the State Environment Protection Policy (1984) gives as a water quality objective for that section of the Yarra that the geometric mean E.coli levels should not exceed 200 organisms per 100ml.

We enquired about fever or symptoms affecting the respiratory tract, gastrointestinal tract, eyes, ears and skin and to our surprise we found that there was significantly less illness reported among the swimmers then the controls.

One possible reason for this finding may have been a bias in the reporting of symptoms. At the time there had been some publicity concerning pollution of the Yarra and the swimmers would have been aware of concerns regarding the microbiological quality of the water. If they were however dedicated Yarra swimmers they may have felt inclined to under-report any symptoms if they felt that there was a possibility of future Yarra swims being cancelled on the basis of the study results. On the other hand if there was a true difference between swimmers and controls, it may have been related to better physical fitness on the part of the swimmers. The fact that the Yarra swimmers were far more likely to have swum in public swimming pools before or after the Yarra swim may be an indication of regular physical exercise. If this was the case, the duration of exposure to the Yarra water may not have been sufficient to cause significant symptomatology.

The difficulty in correlating outbreaks of illness in association with recreational waters with the microbiological quality of the water is shown by a recent outbreak of gastroenteritis in members of a life saving club at a beach in Port Phillip Bay. We found that 24 persons reported illness with onset between 7 and 21 January 1993 with the peak of illness on 15 January. The symptoms included abdominal pain, headaches, nausea, diarrhoea, fever and malaise. There was found to be a statistical association between swimming and illness (odds ratio 3.7) but the confidence limits for the odds ratio were very wide (1.54 - 97) reflecting the small sample size.

There had previously been collapse of the Epsom Road main sewer in Kensington on September 1 and November 26 1992 leading to a flow of sewage into the Maribyrnong River and eventually Port Phillip Bay. The Environment Protection Authority had been monitoring E.coli levels in the Bay and beaches had been declared unsafe for swimming on several occasions between September 1992 and January 1993. The E.coli levels in the water from that beach had been tending to rise each month from late 1992 peaking at 11,000 per 100ml. on 27 January. This was however 12 days after the peak of the outbreak while the E.coli levels on January 14 (at the time of the outbreak) were low.

This emphasises the fact that E.coli levels do not necessarily reflect the levels of all other organisms particularly viruses. The actual cause of this outbreak could not be determined because only four faecal samples could be collected - which were negative for bacteria, parasites and viruses.

We have so far considered the health risks of water contact recreation. The next part of this paper deals with the potential risks of re-use of waste waters.

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WATER FOR CHILDREN'S PLAY

Sally Jeavons

ABSTRACT

Play is an important activity in child hood. It is a pleasurable and assists children to develop confidence and a sense of identity. There are also a number of benefits of play as informal education in developing life skills and qualities which are admired in adults.

Water has an important role in play environments:

- Firstly in its natural state, especially in urban wastelands or creek corridors, water meets a range of play needs that are difficult to meet in other ways especially in designed play areas.

- Secondly, water has an important role in designed settings or play programs, as a tool which encourages play, attracts children, facilitates certain experiences and provides a range of benefits.

- Play can also be used as a tool to help children learn about water as a natural element, its role in the world, its properties and its dangers.

This paper describes waters role in these situations using slides of local and overseas examples.

Issues of safety and danger are also discussed in context with children's need for risk and challenge.

WATER FOR CHILDREN'S PLAY

Sally Jeavons

1. INTRODUCTION

Play is a particular type of behaviour common to adults and children. Because of its enjoyable, non-threatening nature and its acceptability beyond convention, it is a primary communication and developmental tool.

For children, play activities are a method of dealing with life and mastering skills necessary to develop self confidence. Play is communication, where words are not essential. It is a language of expression within which secrets are shared and feelings explored. If it were not for play's important role in development it would no doubt be given even less attention by government and parents whose focus is often efficiency and producing tangible outcomes in their harried worlds.

Lets not be romantic about play, but lets recognise that it is an important part of childhood, and that childhood is important, but under constant threat.

Play has a range of benefits, the most important of which is its contribution to creating a well balanced adult who has high self esteem, social skills, initiative and independence and is able to adapt to the various challenges that life will present.

Water has an important role in play environments:

Firstly in its natural state, in park settings, or urban waste land or creek corridors, water meets a range of play needs that are difficult to meet in other ways, especially in designed areas.

Secondly water has an important role in designed settings or play programs as a tool which encourages play, attracts children, facilitates certain experiences and provides certain benefits.

Play is also a tool to help children learn about water as a natural element, its properties, and its roles in the world, and its dangers.

Waters role in each of these situations will be dealt with in turn.

2. WATER IN NATURAL PLAY SETTINGS, ESPECIALLY AS THEY ARE FOUND IN URBAN ENVIRONMENTS.

Water is often found in a relatively natural or undesigned state in urban areas, in abandoned creek corridors, former industrial sites, quarries and undeveloped urban lands.

Water in natural environments and more recently in these urban waste lands is keenly sought after by children. In many cases the only remnants of natural environments left for children to explore are the bits that have been left after planning or development. These are often creek corridors; the too hard basket of urban development.

What Makes These Urban Watercourses Attractive

Many of you no doubt occasionally reminisce about the secret place, the deserted quarry or the overgrown creek where you spent much of your time as a child, (unbeknown to your mother) and which is no longer there today. These environments are often cherished as play environments because they are diverse, open to exploration and adventure, and they have not yet been manicured, managed organised or mown. They are rarely dominated by adult presence and they may be a source of collectables, loose materials, water and landmarks which become enshrined in fantasy, childhood rituals, explorations and challenges. In these environments children may take control, manipulate the physical environment, hold secrets, take risks, retreat in privacy and play out fantasies.

I'd like to dwell on these neglected urban waterways a little, as these places are rarely considered as part of an open space system or as having value for play, and they are rapidly being lost. However some interesting comparisons can be made about the play value of, and the behaviour that occurs in, these rough watercourses,as compared to purpose built play equipment areas. These urban wastelands offer essential experiences which all children should have access to, and which are rarely offered in purpose-built play areas.

The Value of Urban Watercourses to Child Development

The types of experiences which are available to children in playgrounds and on play equipment are quite limited, especially in the form that playgrounds generally take.

Play equipment has an important role in the development of physical agility, co-ordination, and social skills through interaction with other children and their families. However they are unable to provide opportunities for exploration, interaction with nature, manipulation or control by children to the same degree possible in these wild unmanicured places.

If we examine the characteristics of these neglected watercourses and rough landscapes, and the play opportunities that they present, there are many that have considerable importance to child development. A number of authors have shown a direct relationship between the development of specific human qualities and the presence of certain attributes in the physical environment. **There is strong evidence to suggest that by encouraging experimentation, and maximising the possible range of sensory experiences, changeability, and the number of loose parts it is possible**

to assist in the development of creativity.(as cited in Jeavons)

Nicholson suggests that in any environment both the degree of inventiveness and creativity, and the possibility of discovery are directly proportional to the number and kind of variables in it.

In children under 3 or there abouts, thought processes are dominated by representations of the real world, hence their physical environment has a major role in influencing children's thinking. The more opportunities children have to play with as many different kinds of things as possible the more inventive they will be. In providing a large range of environmental stimuli we draw them beyond their habitual domain into a perceptual more boundless world (Moore & Young 1978).

Given water's qualities, especially when present in these rough urban landscapes where a range of other environmental stimuli are present, there is potential to influence the development of children's thinking. Water is a highly sensory medium, a loose material, and a construction agent for children. It is changeable, in appearance, in form and in temperature. It effects change; it can be a vehicle, a digging instrument, an ornament, a binding agent and a solvent all in one. It may also support whole ecosystems of life, even in a temporary puddle its qualities may be adjusted by what it is mixed with, and its rate of flow.

Moving water is one of the major experiences through which a child senses are amplified. Because of the tremendous individual differences between children we need to give them all, the greatest opportunity to develop all senses, as we do not know on which sense (hearing, sight or touch) a child will be most dependant later on(Mead 1966).

A number of authors agree that landmarks found in urban watercourses such as trees, rocks and the eater itself are valuable to children's emotional wellbeing for shelter, comfort and confiding in, as a source of inspiration or fantasies and treasures or collectables.

Many a kid has posted letters to the fairies in holes in the river bank, or the hollow branch, or stored treasures under a special rock, wept at the feet of a favoured tree or looked for wisdom in pools during times of distress.

In remnant waterbodies and watercourses basic life forms are often found and these are of great value to children. In Carlton Gardens there are two ponds. One is relatively run down and has become rather wild and inhabited by a range of aquatic creatures. Consequentially the lake is a favourite yabbying and taddying ground for many children in the central city. No playground is likely to offer this richness of life forms and games for the hunted and the hunter, that this small sanctuary does.

Because of their innate value to children, we need to protect these relatively wild, or remnant bits of water in urban environments with all their diversity, life and potential treasures, for children to explore, but also those landmarks and perhaps the unruly aspects of water courses we might feel we should tidy up.

Water and Risk

Water in its relatively natural flowing state or as a large body, is very changeable and influenced by the weather. Its vast energy and unpredictable course provides the risk and challenge so attractive to children and adults.

Play environments should have risk and challenge and allow strangeness to be encountered, to enable a child to experience adventure and to learn, so they may develop skills, adaptability, and environmental competence (Mead 1966). **This risk must be appropriate to the developmental age of the child, but the child should not experience danger** (Hart 1982).

Hart points out there is an important difference between risk, or challenge or unpredictability, and danger. Risk and challenge are necessary for children to test their abilities, to learn new skills, and experience a sense of adventure. Danger is where the risk is not able to be overcome by learning through experimentation, because it is beyond the physical and perceptual abilities of the child.

Traffic is an example of a form danger for young children. Until 11 of 12 years a child's sense of judgement is not adequately developed to readily distinguish between fast and slow or near and far, so retrieving a ball, for example, may be perceived more important at the time, than the implication of an approaching car.(Sandels 1975)

Similarly for a toddler who cannot swim and who does not understand she cannot breath in deep water, a swimming pool with steep sides is also a danger.

Urban Waterways As Retreats

We must acknowledge that the relatively low use and remoteness of urban watercourses or wastelands, is an advantage for children. These settings, because they have little adults presence or may be remote, often fulfil an important role as retreats for children.

Many of us nurture fond memories of childhood. Many of these fond memories involve fragments of the natural environment which were special as a retreat, or in pursuit of tranquility and peace.

We sat on the beach taking it in turns to draw pictures in the dirty sand. We made tiny shell and seaweed gardens and had wedding parties for our dolls (Kent 1988).

This sentiment is consistent with the notion that among other things, children find solace in natural environments and water assists in the facilitating that soothing, contemplative experience. In the same way people watch waves role onto a beach, or leaves float down a river, children need places where they can escape. We may take these activities for granted. But many urban children rarely have access to those places. Creek corridors and urban wastelands for many children provide this much needed sense of detachment and escape.
Related to this notion of escape, or relief from roles and surroundings is the value of creek corridors for children to seek privacy.

All children should be allowed to develop independence and self esteem, without stress, through play environments which allow them to experience a sense of privacy, territoriality, and a sense of autonomy through psychological separation (Cited in Jeavons 1993).

As adults we look for places of resort from which to get way from children. But it is not often realised that children also need to be at peace with themselves and away from the pressure of adult world. Stress in children is becoming a significant social problem as a result of limited opportunities for children to experience privacy. Without privacy also children are unlikely to develop independence and self awareness. Woolfe and Laufer have identified having secret places; being alone, not being bothered by people and controlling access to place as the critical requirements of privacy. In many instances our urban waterways still provide these opportunities.

Development in Urban Creek Corridors

We have been fortunate that so many of our urban creeks have been retained for as long as they have and that some have been rejuvenated, fuelled by the growing concern for the natural environment. Unfortunately conservation is not always a child's friend. The conservation movement has led to a lot of "cleaning up"- and this cleaning up has had a big impact on childrens use of urban waterways. The biggest change is that the corridors have become the domain of adults, where children no longer feel comfortable exploring or having secret environments and can no long have the control that they seek.

The clearing of exotic vegetation for replacement with native species, stabilisation works, and the insensitive construction of shared footways, have all contributed to the loss of play value through loss of diversity, loose materials, a sense of control and removing resources for some specific activities such as bird watching and dam building. This occurs mostly because of the lack of understanding about what is valued by children, and because little consideration is given to how to protect these qualities whilst providing other opportunities for corridor users.

In 1990 I visited a creek in Tokyo which had been totally reconstructed for children play. The Komatsugawa-Sakaigawa River; Shinsui Park. It had its own source of water which was recycled

through the system. It is a closed system so that drains etc do not run into the creek. Each reach of the river has been designed to cater for different experiences. There are reaches where the corridor is narrow with a walking trial or boardwalk at it side, areas of formal garden through which the creek winds, more open sections with abutting play facilities, those including play structures in the creek itself, waterfalls and pools.

3. WATER IN DESIGNED PLAY SPACES.

Water has the distinction of being the most desired and the least provided play element in children's environments (Moore 1974).

Diversity is a key to ensuring play experiences are satisfying and designed spaces are well utilised. Desirably a child would have access to a wide range of play settings including bush settings, wildlands, equipment areas and places for social interaction with other children and adults. However given that children's territorial range is often largely restricted by parental activities and physical and cultural barriers, it is important that children's purpose-built play environments have a diversity of experiences available within the one space. The inclusion of a water feature can be a great asset in this regard.

Water as an Attraction

Water can be a major draw card in a playground
Too often we forget what holds children's attention and what they like, and we go on building the same things which children tire of quickly.

Even from the tap or in designed settings water has an attraction because it can still be controlled, and manipulated. It moves, provides stimulus and sensory pleasure, has great energy and therefore it provides challenge and often some risk.

Play occurs when a child interacts with another child, an object or setting. Play commences and continues as long as there is an appropriate response from the object or person, which acts as a stimulus for the child. Water is an excellent play medium because it is so versatile. The responses and types on interactions with water are endless provided the opportunities to manipulate water are supplied. Also, for a child, it has some very important properties; it may be eaten,it can be spilt, but not broken, and it is not considered valuable enough to worry if it escapes.

Ways of Providing Water in Play Settings

Water does not have to be provided at a massive scale to provide developmental opportunities and pleasure for children. Mead makes the point that provided the pattern is complete, the scale can be reduced

and the details of the arrangement can be different. A child can learn about animals as well from a fish in a fish pond as from a Kangaroo in the bush. This is an important concept for small designed spaces because a small fish pond, or a plant with a pool of water in its centre, can easily provide children with experiences of nature Similarly taps or buckets or hoses appropriately located, and often in association with sand or simple utensils, are often all that is required for children to experience the sensory delights of water.

There are a variety of ways of providing permanent water in purpose-built play environments and local parks. The usual forms are channels, pumps, sprays, or ponds.

Channelled water can be provided in local parks with opportunities for children to paddle, fill vessels, and to float leaves etc. Local examples include natural looking channels such as Lake Petobe in Warnambool, a bluestone channel at the Womens Peace Garden at Lynch's Bridge, a water feature in Brickmakers Park, and a Lake and channel system in Kings Park in Perth.

Old fashioned handpumps converted to accommodate mains pressure are also popular ways of providing water without taps being able to be left on. In housing estates providing simple ways for children to access water protect the fire hoses from misuse.

Spray aprons are also a popular way of providing water play, but maintenance of jets, surfaces, taps and pumps is often high and paving must be high quality to protect feet from glass and sharp objects which lodge in or break on paving. Local examples include Atherton Gardens estate in Fitzroy Banksia Gardens in Broadmeadows, Walker St Northcote estate. Most of these sited examples are rarely operable, because of vandalism or lack of maintenance.

Ponds are a simple way of including water in a play area on a temporary basis. At St Kilda adventure play area a bath tub and a hose provides water play . A pond can be made simply by stretching tarpaulins over timber edges. I have seen this often in Sweden. Also in Sweden I have seen relatively large areas of open water in housing estates confined only by a concrete gutter one or two inches high. Water can be swept out if required, and of course in winter it becomes an ice skating area.

Water is often provided in formal settings for ornamental value. Slight changes to the edges, or inclusion of vegetation can increase the diversity of water activities for the local child population without distracting from the ornamental value.
Ponds made at least partially accessible to children through using stepping stones or bridges across them. Fountains can be made accessible by elevating them so children can run underneath or having them very shallow. Local examples of these include the Coles Fountain in Parliament Gardens, the High Court in Canberra, Darling Harbour and Commonwealth Park in Canberra.

On the outskirts of Tokyo in a large aquarium there is a recreation of a beach swash zone with living starfish, anemones, crabs and other sea life that can be handled by children. This is a reflection of the attraction of this activity for children and the lack of opportunities for children of Tokyo to experience these first hand.

There are an increasing number of parks that have designed watercourses which operate only after rain. This is quite a nice compromise between the cost of providing closed systems which recycle water using pumps etc and which are susceptible to break down, and those which utilise run off and reinforce the changing nature of our natural environment.

An increasing number of housing development particularly in Nth America are designing landscapes that accommodate runoff that filter it in vegetated swales and allow it to temporary ponding, which can be utilised for children's play without barrelling and channelling the water and making it inaccessible to children. Australians had been very slow to utilise natural drainage systems for environmental and human benefits in residential settings.

4. PLAY AS TOOL TO FOR CHILDREN TO LEARN ABOUT WATER

Familiarity and continuity are essential ingredients in children's worlds. These are necessary for children to learn, and failure to take these needs into account may lead to severe conflict in children. Familiarity means exposure to as many elements whilst young (Margaret Mead 1966).

Mead suggests that understanding the basic elements, and nature,also help children understand science and the world around them so they may adapt and tolerate enormous specialisation and even deprivation. Water is an excellent tool through which children can learn about science; liquids, volume, space, hot and cold, wet and dry, and about lifeforms. If a child is able to feel comfortable with these properties and know how they react to certain situations they are much more likely to be competently able to deal with potentially life threatening situations or change. We hear of many children being burnt while experimenting with fire in secret, because they have never been exposed to fire.

Apart from the developmental potential of water play as informal education, there is an opportunity to provide children messages about important issues such as conservation, salinity, waste management and pollution control, through their play. As water appears abundantly available via a tap in cities, a conscious effort must be made to send messages about conservation to children.

Safety Issues Concerning Water in Public Places.

A child can drown in 2cm of water. Where still water is to be provided it should be designed carefully to restrict access where necessary.This can be done by design considering children's ergonomic capabilities. I have never heard of a child drowning in a bird bath for example, because they are generally raised above the ground.etc.

I feel water in play areas needs to be identifiable to children as such ie; flowing, in containers, coming out of jets and the like. I think the problem with drownings in pools is that there is often no way back for children, that the water is apparently no different from the rest of the ground surface except that it moves and its enticing. Pools are often at grade, the edge is sudden and toddlers will sink silently like a stone without thinking to hold their breaths, or knowing that they are in danger.

In ponded water the design, material and slope of the edge is critical in determining whether it is safe for young children. There must be routes of escape, a slow introduction or trigger to what can be expected further out, and slip free texture. Virtually no children drown in the swash zone at the beach, or in urban creeks unless they have been barrel drained. In Holland virtually no children drown in the myriad of channel and canals that sweep through urban areas and the country.

As Mead suggests the scale is not necessarily important it is the pattern of how water is provided that is important

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WATER RESOURCES FOR CANOEING

Jane Farrance

ABSTRACT

The major emphasis of the paper is to stress the importance of liaising with canoeists. Canoeists use all of the river from source to sea, lakes and dams. Canoeists use the river itself, not merely the environs. Because of this we normally have a different perspective to bank users. Most authorities ignore the river itself and develop only the environs. We hope to change their perspective. The paper details the different types of canoeing and their differing needs, and a vision of what is possible - what canoeists hope for by the year 2000.

INTRODUCTION

The Victorian Canoe Association is over 60 years old, but it has only been in the last few years that we have begun to talk to Authorities in charge of water ways. For too many years we were unable to talk to the public authorities and have had to make do and work around decisions made by such bodies. The most important point canoeists can make is;

'talk to us'.

Canoeists cover an enormous range of the community, we consist of male and female, the very young, the very old, the elite Olympic athlete, and ~~the~~ disabled persons

We use all types of water from the rapids of the mountain stream to the estuary, into the sea itself. We use lakes, dams, swimming pools, in fact any type of water can be used by canoeists.

Canoeing involves having the courage, strength and skill involved in whitewater as well as being able to enjoy the serenity, peace and solitude of the quiet backwaters and billabongs of our land.

Few people participate in all types of canoeing, most specialize in flat water, white water or sea paddling.

Many view canoeing as a recreation, but the better paddlers usually move into competition.

Most people have their own view of what canoeing is, but few people have a total understanding. Thus background information for our needs on the waterways is required - the following describes some of those needs.

Note

Canoeing and kayaking are both included when we talk about canoeing.

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ASPECTS OF CANOEING

Touring

There are three types of canoe touring, flatwater, whitewater and sea. Touring is simply going from point A to point B at whatever pace is desired, on whatever type of water is preferred. This is the most popular type of canoeing.

Needs: Are basic and simple, merely a place to put in and a place to pull out. No sophisticated structures or buildings. However, some very popular areas need a landing to protect the banks. Some areas require protection from motorcraft.

Fishing

Fishing is one of many other interests which can be pursued ~~via~~ from a canoe. Canoeing rather than being the primary interest is merely the vehicle to enable other pursuits. Other interests are photography, bird watching, painting and hunting.

Needs: As for the tourer, the only requirements are a place to put in and pull out with peace in between.

Recreation

Covering a host of activities, a family dam with a canoe, a holiday house, or a house boat. The canoe never actually goes anywhere, it is just there to have fun with, to paddle around, use as a diving pontoon, collect items from the bank. Or as so well quoted 'just messing around in boats'. Most commonly used on lakes, dams and beach areas.

Needs: Access to the water.

Sailing

Not normally seen in Australia.

Needs: As for most small sailing craft

Squirting

A new form of kayaking involving gymnastics of a craft which is designed to stand on end, flip and dive under the surface.

Needs: Not yet defined as the sport is so new and still developing, but basically a safe rapid without hidden snags or dangers under the surface.

Education

Not a specifically different side of the sport but still with specific requirements. A suitable safe area with both flat water and small rapids for use by people without experience.

Needs: Suitable water, with good access. A boat shed nearby with office space and commercial facilities.

Slalom Competition

An Olympic sport, in which only the better white water paddlers become involved. It is a difficult sport which requires courage, skill and strength. Paddlers have to negotiate 'gates' which are poles suspended above the rapid. The paddlers have to control their craft to move all over the rapid with great precision and speed.

Needs: Slalom paddlers need areas in which they can hang gates permanently. They need areas where they can have controlled water. Below dams are perfect if the authorities will guarantee a constant flow for the duration of a competition.
Vehicle access to such areas.
Slalom paddlers need a world class facility for training and competition, currently Victoria has nothing.
Good possible sites are Dights Falls, Angusvale on the Mitchell River and the base of any dam.

Whitewater Racing

An event run on whitewater approximately 3 to 7 kilometres in length. World Championships and large international events are held annually. Australia sends a team to these events every year.

Needs: Access points for vehicles and constant water flows.

Marathon Racing

A marathon is any event longer than 10 kilometres. Another World Championship event in which Australia is most successful, producing several World Champions. These events are held on natural water courses, which are generally flat water in nature, although portages (carrying craft and running) around obstacles, are a part of international competition.

Needs: Access at start and finish must be good to get the longer craft on the water. Snags occasionally have to be removed if blocking the river.
Protection from motor boats.

Sprint Racing

Another Olympic aspect of canoeing with short sprint events from 200 metres to 2000 metres. Again Australia can boast World and Olympic Champions in this area of the sport. Simply to paddle one of these sleek racing craft requires great talent and skill.

Many protected, deep lakes throughout Victoria could be developed into top sprint courses.

Needs: A wide flat waterway where 9 boats can paddle abreast. An even depth of water free of water weed and reasonable protection from wind.
Access to vehicles and craft with good landing for these fragile craft.
De-snagging if required and protection from motor boats.
Rowing courses are identical to canoe sprint courses.

Polo Competition

A new game to gain World Championship status for the first time in 1994. In Australia it is normally played in swimming pools, however overseas venues are usually rivers and lakes.

It is a fast growing sport with over 50 teams in Victoria alone. Teams consist of 5 players with the goals suspended at each end of the pool. The game is played with a waterpolo ball.

Any venue with flat water and lights can be made into a polo area. Polo players often train under Princes Bridge using the lights of the city, however this often creates problems with other river users.

> Needs: Polo players cannot afford to hire pools for training so training is done on rivers and lakes. As with most international standard sports people, most training is in winter. Polo players require flatwater with lights. Under bridges is ideal as the pylons can be used as goals.

Thus there is a wide range of needs and requirements for canoeists. We cannot list from 1 to 10 what our needs are, as those requirements will be specific to the area, the natural character of the area and the type of canoeing which is practiced in that specific location.

This is why our most important need is for you to;

'talk to us'.

CONSULTATION IN PLANNING

Landings

Most decisions about water are made from the land. Canoeists view the river from a different perspective, not from the banks and environs but from the river itself. Governments spend many thousands of dollars on the banks, so the public can enjoy the river. But the money spent on the river, the water itself, for the enjoyment of the public who actually get on the river is negligible, except for the very mouth of the rivers where motorized craft operate.

Canoeists are quiet, we leave no trail, it is not obvious where we have been, or even if we have been there at all. Canoeists only leave a footprint upon entry and exit to the river. Thus to protect the few very popular areas where access can be gained to the river it is important to provide canoe landings to protect the environment. We are very happy to say that Melbourne Water has acknowledged this need and several canoe landings have been provided during the last few years.

Where to place these landings is a decision which must be made by the authority in charge, in conjunction with the canoeists. One prime example of where not to place a landing was the original canoe launch ramp at Westerfolds Park. To reach the landing canoeists had to carry their canoes 200 ~~meters~~ metres along the river bank, squeeze through a narrow gap in a fence, then negotiate five ~~huge~~ 60 centimetre high steps, then enter the water. The obvious occurred, paddlers just put in where they always had and nobody used the ramp.

With the new bridge at Fitzsimons Lane, that landing has been removed. There is another landing inside Westerfolds Park, great for the Board of Canoe Education courses but for the many paddlers using the river outside park hours, ~~there is no~~ it is facility, so paddlers scramble down the bank creating their own track.

vitable

Yarra Valley Metropolitan Park

Whereas the landing at Homestead Road is exactly where paddlers require it and is constantly in use. The road in has been improved, parking bays provided and it is very well accepted and used by the canoeists.

Summary: Our requirements are simple. Landings need to be appropriately positioned, well designed for access ~~of~~ by paddlers and their craft, and built to withstand flooding.

River Works

Whenever river works are being planned canoeists should be consulted. It is so easy to ruin an area for canoeing, or make it a focal point for the area, with little or no extra cost.

As an example, I again use Fitzsimons Lane. This area had long been used by canoeists for teaching basic strokes, including basic whitewater handling, on the small rapid under the bridge. It is used by touring canoeists as an access point and many competitive canoeists used it as a training venue.

When the new bridge was being built, canoeists met with the authorities involved, but not one of our requests was granted yet the cost to the works would have been negligible.

What Could Have Been Done: When stabilizing the banks, rather than making the river straight like a drain, the banks could have been shaped to create eddies and features. The cost of making the area one of the best training areas for canoeists in Melbourne, would have been nothing.

We once had a facility where several groups of beginners could be taught the basics of moving water techniques at the same time. We could teach one group at the top of the rapid, one in the middle and another one at the bottom. Now we can only use the bottom of the rapid as there are no eddies, no area from the start to the finish of the rapid where a group can wait. Now paddlers are just flushed down to the bottom. An excellent area for canoeists is now lost with no advantage to any other user group, no positives benefits to anyone, a valuable resource we once had and used, wasted. is now

Canoeists also requested that lights be mounted on the bridge both upstream and downstream. The Canoe Association was prepared to pay for this and for the on going use of the electricity. We would have had a key to the lights, which would have been issued to user groups as required. There are no residences in the area which would have been effected a by such lights. This request was denied.

Thus canoeists lost an area which slalom, recreational and polo paddlers could have used for both training and night competitions. No other community group gained from this lack of lights, no cost was involved to the public - why then were canoeists refused this public facility?

The canoeists third request was that bolts be inserted into the bridge pylon, so slalom paddlers could erect ropes for both training and competition purposes. Again this was not a costly exercise, it effected a no one, but it ~~did not occur~~ was not done. Canoeists regularly run training and competitions in this area, each time ropes are erected they are tied off on nearby trees or on steel stakes driven into the ground. These simple bolts would have made course erection much easier and quicker, no damage would have been done to the pylons and no other group would ~~be~~ have been disadvantaged. A simple easy request is denied - why?

Here we have a potential facility next to Westerfolds Park which hosts the Victorian Board of Canoe Education Boat House, a facility which is regularly used by many different types of canoeists, teaching groups, slalom paddlers, downriver paddlers, polo paddlers and recreational paddlers. Yet even basic, no cost requests are ignored. Now there is no launching place, no naturally shaped banks, no lights, and no anchor points for slalom ropes, just a man made drain.

This area could have been developed as a focal point for canoeing. Disappointingly, it is just another case where we continue to make do with the decisions of Government Authorities, ~~which~~ who can ruin rivers for canoeists.

However, there is still a positive to this area, it would still cost very little to ~~instate~~ install all the preceding ~~ideas~~ facilities, even though the perfect opportunity was lost.

TRAINING NEEDS

Difficulties of Slalom Training

Danielle Woodward is now a household name, an Olympic Silver Medallist in canoe slalom at the Barcelona Games. This is a whitewater event, so she needs moving water and slalom gates for training. Danielle, who lives in Alphington in Melbourne is not alone with these requirements. Of the 14 members in the 1993 Australian Slalom Team 10 are Victorians. Where then do they train? Most live in Melbourne and train on the Yarra.

Flat water slalom training is usually done in the city, close to the freeway. The paddlers, who train early in the morning and late at night, before and after work, through our long cold winter, use the lights of the freeway to see where they are going. Marathon and sprint paddlers have the same problem, as do rowers. However, slalom paddlers also need gates to train on, and the closest set to Melbourne are on the Yarra behind the LaTrobe Golf Course. The paddlers have to sneak into the golf course car park which is privately owned, often they are asked to leave. There are no lights so the paddlers get on the river before daybreak, warm up on the flat section and as soon as it is light enough to see, begin their training.

The next element of this sport is rapids, there is only one low grade rapid in Victoria, on the Goulburn River, where there are permanent gates for training but even this venue is subject to irrigation needs.

This is how our Olympic champions have to struggle to train. We have no facilities in Melbourne or Victoria for our Olympians to train. Yet overseas countries are continually building slalom courses for their athletes, recreational paddlers and indeed for tourists.

In 1992 Melbourne Water needed to do some erosion control and bank maintenance in the Dights Falls area. They worked with the canoeists and whilst protecting the banks, made a facility for whitewater paddlers that is aesthetically much more pleasing than the drain-like effect of the Fitzsimons Lane bank work. By using normal natural river features such as rock ledges and shaped banks rather than the bluestone lined, straight drain ~~effect~~, we can have a more naturally attractive area, erosion protection and a recreation and competition facility. The Dights Falls area is a start with more works and support, this area has the potential of being good enough to hold State and National events. Yet at the time of writing this paper, we do not yet have permission to erect slalom gates so our Olympians, and Australian team can train on this facility. It is strange that we love the success and national pride we get from seeing our athletes become the best in the

world, yet at home, we make it so difficult for the most basic of their needs, training.

A VISION

Dights Falls

Canoeists have a vision about this area, it has so many advantages, closeness to the city and a rapid in a parkland setting. So few cities have such an asset, certainly no other capital city in Australia has such an advantage.

If developed we could;
- run State and National championships at the site,
- run canoe courses for inner city schools and community groups, who normally would have to travel long distances for such an experience,
- have permanent boat shed and commercial facilities such as boat hire, restaurant and the like,
- have a tourist attraction no other Australian capital city could match,
- have rafting experiences in the middle of Melbourne,
- service not only whitewater paddlers, as the flat water paddlers could develop the area immediately upstream of the Falls and downstream of Johnston Street bridge. The polo players could use the area above the falls with the erection of permanent goals on either bank,
- do more for the community, by including a climbing wall, bike hire, a conservation and environment display and education area.
- promote the history of the site, both geographical and historical, and the potential goes on.

This has the capacity to be the centre of canoeing in this State, indeed of this Country.

The idea is not new, it has been done in many areas all over the world. France has seven slalom sites built at the base of power stations, the cost - negligible. Germany has its world famous Augsburg Slalom Course, most European countries have multiple courses. Nottingham in England has designed an international standard slalom course next to the Rowing and Flatwater Racing Course. In America there are over a dozen courses. In Wausau, Wisconsin the rapid in the centre of town was developed and now is one of the main tourist attractions of the area, attracting many international visitors. The Junior World Championships are to be held there in 1993 and 1994.

This is just an outline of what can be done at minimal cost for great return on two areas of the Yarra River. There are other potential sites, where low cost improvements will help develop the use of our rivers for recreational purposes, with very little environmental risk.

OTHER PROBLEMS

Protection from Motorized Craft

Canoeists and motors do not mix. It is important that certain areas of rivers and waterways ~~do not allow the~~ use of motor craft. We do not envisage a total ~~banning~~ of such craft but just a balance between areas for motors and areas for non motorized craft. The current status is satisfactory for canoeists.

Example - the Yarra River where motorized craft are, in the main, banned upstream from Dights Falls and strict speed limits are enforced in the lower regions.

Areas which are designated for water skiing and motor boat racing are not suitable for canoes.

National Watersport Centre

A great idea, but not ~~working~~ ≠ feasible at the moment for canoeists cost being the major factor. Canoeing does not have a high profile and rarely does it receive media attention, unless there has been a drowning. Thus we do not have an active spectator base. Even when we charge an entry fee to Carrum, we do not cover costs. Simply put, we cannot afford to use the facility designed for flatwater canoeing and rowing. Instead the major users are the motor boat racers who create erosion and bank degradation. When we use the centre, we have to use the back half only, with no facilities, no toilets, no changing rooms, just a piece of flat water suitable for racing. That water is subject to winds and uneven depth, making racing unfair and unsatisfactory.

De-snagging Of The Rivers

Generally this is not a problem with our native flora. Most paddlers are happy to go around natural growth and fallen logs. Occasionally we may require a log moved or channel cleared for a popular area to be made safer or for an event.

However, the Hybrid Willow which infests many of our rivers is a major life threatening problem. These willows, dip their leaves and branches into the water where, they soon produce roots creating a heavy fibrous mass which ~~pulls~~ drags to the bottom where they take root. In this way they leap frog across the river, choking the flow. The trees are very dangerous and several canoeists have drowned because of them. These trees need to be eliminated from all our rivers and replaced with Australian native flora which do not create these dangerous, choked areas of river.

It is also important how such clearing should occur. Simply cutting them down leaves even more dangerous stumps. Letting the cut branches float down stream creates other dangers and there is always the risk the cuttings will take root further down.

Facilities

Ideally Canoe clubs would like to be able to build clubhouses and boat sheds on several sites of the Yarra and Maribyrnong. There are currently 4 such sites, all very old and in constant use and demand. However the population of Melbourne has expanded and many more people live much further out and there is a need for clubs in the ~~more~~ outer areas. Most youngsters want to go canoeing, they cannot unless they have an adult to drive both them and their craft to the river. How easy it would be, if the boat was at the boat shed and the young people could just cycle down to the shed and go for a paddle. Unfortunately this is not the case, but it is a vision.

Canoeing has a huge recreational base, and it need are ~~which have~~ only a few basic requirement ~~of~~ for safety and access. The smaller competition areas have more specific requirements. Australia has many Canoeing World Champions and Olympic medallists, Australia revels in their success, we need to do more to support them in their endeavours with the creation of better facilities.

To enable the best value for time and dollars spent on both recreation and competition it is vital that all the authorities involved;

'talk to us'.

Joe Powell (2A)

Conference Dinner Address

WATER THEM GERANIUMS

A mile or two farther I saw the loom of the bark hut they lived in, on a patchy clearing in the scrub, and heard the voice of the selector's wife - I had seen her several times: she was a gaunt, haggard Bushwoman, and I supposed the reason why she hadn't gone mad through hardship and loneliness was that she hadn't either the brains or the memory to go farther than she could see through the trunks of the apple trees.

'You, An-nay!' (Annie.)
'Ye -es' (from somewhere in the gloom).
'Didn't I tell yer to water them geraniums!'
'Well, didn't I?'
'Don't tell lies or I'll break yer young back!'
'I did, I tell yer - the water won't soak inter the ashes.'

Geraniums were the only flowers I saw grow in the drought out there. I remembered this woman had a few dirty grey-green leaves behind some sticks against the bark wall near the door; and in spite of the sticks the fowls used to get in and scratch beds under the geraniums, and scratch dust over them, and ashes were thrown there - with an idea of helping the flowers, I suppose; and greasy dish-water, when fresh water was scarce - till you might as well try to water a dish of fat.

Many of you will recognise that extract from Henry Lawson's short story, *Water Them Geraniums* . Lawson was pretty good for melancholy and quite a dab hand at pessimism. He sketched a picture of an exhausted, poverty-stricken woman battling the hill-billy conditions of a New South Wales selection frontier to

make a place for her family. Mrs Spicer's geraniums are the tie to more respectable, civilised standards. In the poor urban environment of Britain from which I escaped, the battlers' equivalent comfort was differently expressed, because there was neither space nor garden: there, the stoic measure was 'Just a picture to hang on the wall'. Tonight, I anoint those humble geraniums as symbolic of the struggle of an immigrant society to come to terms with Australia, or to make a place we don't, at least, feel ashamed about - a new home, *in the driest of the inhabited continents.*

Although we are often drawn, or at any rate are guided, to his works, Lawson himself was rather too caught up in the details to see the bigger picture, which was this: the Australians were engaged in a massive experiment with their environment; and , given their small numbers, the scale of that engagement was probably unsurpassed in the history of the modern world. The experiment was studded with dismal failures, yet it was also lit with spectacular successes. And the efforts of great and ordinary Australians in the appraisal and management of water resources have been and for the foreseeable future always will be critical to the story of how we adapted and adapted to this challenging country. That off-the-cuff observation leads to others. For example, to the extent that our standard histories repeatedly scrub round the relationships between water, land and community, they do not serve us very well at all.

If some of you are beginning to type me as a serious environmentalist, you might be right, but the species includes so many different types. I take the view that a good sense of humour is as well worth preserving as most other things. I noticed an interesting piece the other day which made a

valuable indirect comment on our concern for the world's rapidly disappearing forests. In the USA - probably in California, of course - an enterprising tradesman has developed a kit which allows you to put together your own coffin right now, before all the best wood goes. He assures the squeamish types that his product comes complete with legs, so that it can be used as a handsome coffee table and conversation-piece until the big day arrives. Who said you can't take it with you when you go? When I was researching my book on the history of water management in Queensland, I was very intrigued by the frontier characters up there. On the Cape York Peninsula there was a famously self-sufficient man who had done all the romantic stuff - prospecting, fishing, hunting, living with the Aborigines, ranching and timber-getting and all the rest, including a good deal of bumming around, and always eccentrically or perversely: surviving with colour on the edge of the extreme, he seemed incapable of doing anything in a normal or recogniseable fashion. Apparently he died as a recluse in the middle of nowhere, and it was some time before his body was located. The poor man had expired with a ripe mango in his pocket, and before they found him he had literally given his all in the cause of enhanced rural production - marking the sacred spot, all too exactly at the hip-pocket level, the searchers discovered an unusually healthy mango tree. When National Party supporters tell you that it's all about blood, sweat and tears, don't dismiss them too lightly!

Not really the right stuff to follow the dessert, and in any case I think I can establish the main points with more conventional information. Many years ago, one of my younger students made the sage remark that the distinguishing feature about Australia was that it was full of geography but had hardly any people. It might have been better put, but at the time I thought that

signalled the beginnings of a good critique on the neglect of the environmental factor in history courses that were still dominated - like their European counterparts - by cultural and political themes. It is more pertinent, at this stage, to remind you of a few home truths. Forgive me if it's all too simple; repeating a bit of old ground can be useful, as any teacher here will attest.

Briefly, the combined discharge of just two of the good-sized rivers in Papua-New Guinea, the Fly and the Sepik, almost matches the aggregate discharge for *all* Australian rivers; the Yangtse-Kiang is twice as good, assessed in this elementary way, as *all* the Australian rivers; the Mississippi and Ganges are each about one-and-a-half times larger; and the discharge of the great Amazon may be as much as twenty times that of the Australian *total* . Comparisons of annual variations in flow are still more worrying: in Europe, ratios for annual variations in maximum-minimum flows range from 3:1 to 10:1; here, they are between 300:1 and 1000:1, and a variation of 10000:1 has been reported for the fickle Darling River. Furthermore, over 60 per cent of our surface runoff is located in the tropical north, far from the developed south and south-east where nearly all of choose to live. Much of the continent is arid or semi-arid, and in the north and in the interior evaporation rates are more realistically given in metres. That, together with a wide seasonal variability which produces a community-driven demand to even out the floods and droughts, is naturally a major reason why several of our larger cities spend so much on water storage - but the scale, once again, is astonishing: for example, even in the 1960s, when its much-needed sewerage programme was still incomplete, Brisbane required twice as much water storage as London, yet London was then about nine times larger than the

Queensland capital.

So water imposes enormous financial burdens, but it has also been associated with extraordinary burdens of hope, which are part of the same geranium factor. Many of the romanticised feats of exploration were associated with a consuming quest for a fabulous 'inland sea', and for a 'great river or desired blessing' running into north-western Australia from the outback of New South Wales. By the 1880s, those myths were gone but the Great Artesian Basin was being conjured as Nature's compensation prize - a veritable underground sea, or at least a gigantic lake. I tried to relate some of the early history of our artesian resources in my recent book on Queensland. It hasn't rated in the orthodox accounts of exploration, but in fact occupies an interesting transition between the heroic era and the modern period. Rather more science and technology was involved, but there was certainly no shortage of environmental speculation: where did the water come from - Papua-New Guinea, the Andes, the Himalayas, even the Bay of Biscay, were offered as good candidates; was it a very ancient, 'fossil' resource, capable of being mined away; what about the fascinating stories of blind fish in the curiously warm bore waters, the frogs falling out of the sky in the weird interior; was the mysterious reservoir fed by ordinary rainfall, and if so who could say where the 'intake' was; when the bores appeared to be drying-up (principally because of natural declines in pressure after the first round of rough exploitation, but that was not fully understood for a time), what was to be done to assist the vast new commercial region dependent on them, then almost as large as France and Spain put together ? It is a very Australian story, sadly neglected and by no means finished - in fact there is now a fresh wave of innovation based on the refurbishment of old

wells and the introduction of more sophisticated monitoring and control procedures.

The history of the artesian waters is tied-up with technical innovations in the much more glamorous oil business, and with the complexities of groundwater research, which is yet another underrated historical theme. Science and technology have made immense contributions to our very survival on this ancient continent: it is almost as though Australia was reserved from the advanced nations until at least the rudiments of modern scientific method were established. But that too is only part of the story. What about Sidney Kidman, the 'cattle king', who controlled an amazing chain of 100 stations running from the Kimberleys in the far northwest to the Flinders Ranges in South Australia? The chain encompassed approximately 260 000 square kilometres, or 100 000 square miles - all put together to try to beat the recurring droughts by moving around the country. His contemporary James Tyson did much the same, and possibly a bit better, though on a slightly smaller scale. But the point to make is that the Australian environment challeged all comers, and that the contest was never left simply to the 'experts'. Kidman was reputedly the biggest landholder in the British Empire at one stage, and his Cecil B. de Mille operations deserved a movie or two. Similarly, the epic family sagas of the Duracks, those remarkable *Kings in Grass Castles*, outshine most of Hollywood's efforts, and are so distinctively Australian. Many of our early ranchers, the squatters, were undoubtedly explorers in their own right, and in their very practical quest for water and grass they established the primary outlines of Australia's regional geography. It won't do to leave it all to flash explorers and science and technology.

The water mark is easily traced in any authentic reconstruction of the national experience. I need only touch on a few random examples. The importance of the goldminers in our social and political history is now quite well understoood, but far less is known about the early environmental impacts of mining. Woodlands were cleared and entire hillsides were stripped to the bone to supply fuel and pit-props; water cannons and ugly dredges devoured the valley sides and stream beds, and dramatically altered local ecological systems. But even the earliest mining operations required a good deal of water, and special regulations were introduced in the 1850s to ensure that the resource was not hogged by individuals. Those novel legal moves were built upon later when water frontages were virtually nationalised to assist government-sponsored irrigation schemes.

And irrigation itself goes to the very heart of the Australian experience - our geranium impulse writ large as 'making the desert bloom as a rose'. It is also connected, however, to darker areas of the national psyche: the need to raise production to justify, internationally, our occupation of an enormous territory; the need to diversify our economy while 'decentralising' our investments of people and money in case of invasion, and therefore the related, deep-seated need to be as self-sufficient as possible in food production. The intense debates over the economic worth of irrigation in the 1960s and 1970s - 'Australia wet or dry?' - probably gave the strongest anticipations of the injection of the dreaded 'economic rationalism' into our lives; certainly, the discourse they encouraged made many hitherto complacent Australians look harder at the environmental and economic limits to reasonable growth. In the 1940s and 1950s, the Snowy Mountains Scheme

seemed to be what we had been waiting for - at last, a project characterised by the kind of scale and audacity of vision which was truly worthy of Australia. A generation later and water was still on the national agenda, but we were arguing about the Ord River Scheme, and whether or not to flood Lake Pedder. Community values were changing, and as usual that would be reflected in changes in water management.

Water is a dangerously taken-for-granted thing, especially in the cities. The mundane act of turning on a tap seems to turn off intellectual curiousity - about the prodigious feats performed to harvest and deliver the essential resource in reliable quantity and quality. Part of the trouble seems to be that we are still locked into an old world, specifically British mind-set which labels this precious resource as simply another 'utility', like gas and tramlines. Another likely culprit is the characteristically fragmented nature of the education curricula, at all levels: that was also inherited, and thank goodness things are changing fast, but for too long there was a very foolish separation of science and technology from the humanities and social sciences. Little wonder, then, that the interpretation and management of an absolutely critical resource, even on this, the driest of the inhabited continents, failed to attract the attention of leading historians and writers who have done so much in other ways to help us to appreciate Australia's special qualities. I can only imagine that, confined within a particular version of 'literacy', they must have taken a very superficial look and found it all a little too 'dry' for their tastes.

I feel sure that the coming generation will correct the omissions of their forebears. They will be able to communicate not only a better appreciation for the centrality of the resource

in our national experience, but also, by the same enterprise, a better sense of collective and individual *responsibility* for it. And from time to time they will be able to shed light on inherited dispositions, and perplexing institutionalisations, which hamper modern attempts at dialogue. One good example is the 'closed catchment' policy of the former MMBW. The policy is being lauded now in the packaging of that strange export, Melbourne water, but not so long ago it made many people furious - particularly recreationists. How were they to know that it all began with an understandable paranoia about water-borne typhoid fever, which regularly killed hundreds of Melburnians in the nineteenth century? It was the *community-endorsed* institutionalisation of this fear about water quality that gave us those closed catchments.

Time is running on, and I need to do something to bring these notes together. Allow me to return to my Queensland researches. I was privileged to meet hundreds of Australians from many backgrounds, and of course they all had strong opinions on water. During the pilots' strike I had to move around that vast state in a tiny hired Cessna. It was an exhilarating, sometimes hair-raising and always exhausting experience. One of my busier days began at 4.30 a.m. to catch a flight over the Dividing Range and then over the sunburnt plains, putting down to refuel on remote runways, and chasing off the occasional Kangaroo and brolga-sized plains turkey. Later, roasted and half-blinded by the light, I would be met - on the Tablelands, say - and would be whisked off to a barbecue (naturally) to address a gathered host of engineers, irrigation farmers, active and retired politicians, local councillors and amateur and professional historians. Some of the older farmers had pioneered the development of irrigated fruit and tobacco -

elsewhere, it might be sugar, or rice - and most of the others wanted to get their two-bobs' worth in about the overrated or underrated roles of experts and politicians. I finished my last interview just before midnight. We are all so largely composed of water, after all, even after a Queensland barbecue or a dinner at the Melbourne Hilton, and we are entitled to exercise a God-given right to voice an opinion on the subject. Water and democratic rights are not readily divided.

My pilot's name was Angus Archibald Morton Douglas - extraordinary in itself, since he was a German immigrant. Angus's grandparents had been Scottish immigrants to Germany; he had been trained, he said, by the Luftwaffe and the RAF. Thereafter his strange career had him flying Lear jets for Mexican governors, then nipping in and out of Bolivia, landing in isolated Italian paddocks on unspecifiable missions from Switzerland, and crop-dusting oil-palm plantations in Malaysia, before doing something of the same in Australia, mixed up with a bit of stunt-flying on the side. An absorbing character, one day he assured me very confidentially that he had decided to drop the 'von' from his name - thus, 'Angus Archibald Morton *von* Douglas' - because it didn't seem to get him anywhere in Australia. I wasn't too sure how to react when he told me, with great pride, that there was absolutely no reason to worry because his greatest claim to fame was his uncanny ability to land the plane on any reasonable country road. When we put down in Mt Isa - an amazing polyglot community, where I was able to quiz a mixture of miners, mining executives and local government officials (some of whom who were busily creating a miniature tropical rainforest in those arid wastelands, using treated effluent), Angus enjoyed a spirited encounter with a highly committed Glaswegian, a former shop-steward, who took

exception to the Scottish von's (admittedly rather drastic) solutions to the unemployment crisis. The locals were ready for World War 3. Water and mining again, this time in a modern context, was my topic - but water has the splendid habit of finding its own way, while drawing in all and sundry en route. I found the lively concoction of Scots, German and frontier Australian a heady brew indeed.

And there are other ways in which water and democracy go hand-in-hand. I remind you of the hint I offered earlier concerning the need for different kinds of literacies and the building of bridges between disciplines. Broad-based water studies require and promote the kind of democratic milieu that such notions respect - and hopefully, if the written products are successful, they will bring more people into the interchange, with commensurate returns in improved participation, better citizenship. In addition, water histories like most types of water research make one an evangelist for the singular importance that must be attached to Nature's independent dynamic. The time is surely long gone when we could pretend to be insulated from Nature: if an honest reading of the Australian experience teaches anything, it is that we ignore the environment at our peril. The history of water management is of course, by definition, also the history of mismanagement - in farming, grazing, mining, town and city supply, secondary industry, recreation, urban and regional planning, and so on. I do not have to stress, to this audience, that not one of those fields can be considered unrelated to water management.

Which re-introduces, in this closing section of my little talk, the use of what I have called the 'water key' in the re-writing of Australian history. Politicians, colonial governors, generals

and the like, have been given too much space in our orthodox literature. If we want to understand why Australia looks the way it does - its urban as well as its rural landscapes, and in some detail as well as in the broad sense of the great farming and grazing belts and the location and appearance of settlements and homesteads - and we should, if we propose making a genuine home here, then we need to come to terms with the historical role of the appraisal and management of this fundamental resource. We will find new events, and any number of new heroes and heroines, hitherto ignored by the partial histories of the pioneers of Australian history, who had so little to say about science, technology and the environment. Then, reaching out and shaking hands with those rediscovered agents of change in our negelected past, we may find some inspiration to make urgently-needed changes today.

Again, the adoption of that perspective shows water in yet another democratic and democratising role, which may be its greatest virtue: in Nature's democracy everything is indeed connected with everything else, and will have its say whether or not we poor humans like it. The relationship between water, soils and tree cover is special, and so often we have got that wrong, or abused it to our great cost. A little known South Australian scientist named Tepper put it very well in 1895 when he said, ' *Verily, the sole tendency of Australian cultivation and civilisation appears to be the creation of small paradises and very large deserts* ', and here in Victoria both Baron von Mueller and, in this century, Judge Stretton - who headed the famous Royal Comission into the 1939 bushfire disasters - appealed to the public to show a better understanding of these ecological relationships. Stretton emphasised what he called *'the inseparable trinity'* of water, soils and tree cover, and some

community groups were immediately inspired by that message. The current growing preoccupation with 'land degradation' is intimately connected with this idea of nature's democracy and especially with the pivotal role of the water theme in so many respects - the several types of water erosion, often quite savage throughout Australia; the pollution of streams and other water bodies, which is associated with land-based abuses; the grim spectre of salinity in and beyond the irrigation districts.

I have just completed a short book on the history of land and water management in the Murray-Darling Basin - once more, as it happens, an area as large as France and Spain combined. The Basin includes some 40 per cent of our total national population that is actually resident on rural holdings; it produces about a third of our total output from industries based on natural resources; and it includes over 40 per cent of our wheat-growing land, half of the aggregate number of sheep and lambs, three-quarters of the irigated land and the overwhelming proportion of our cotton, rice and grape production. And it has been under severe stress from land degradation since the white invaders dispossessed the indigenous stewards, to the extent that large areas may go out of production regardless of what is done in the short-term, or be taken quite quickly out of production in order to salvage a deteriorating situation. What is desperately required, not only in my view, is a 'bioregional' approach which recognises the inter-relationship of land, water and community and adopts the Murray-Darling Basin as a great *national* project. If the Snowy Scheme was right enough for the development-orientated past, Murray-Darling bioregionalism offers an even more vital challenge which holds out the promise of a more sustainable republic in the twenty-first century. If it demands a more sophisticated dialogue, with much more

diffusion of good information, then that is no more than we have come to expect from our times. The trick is to share the problems first, then and only then try to market solutions.

We seem to have come a long way from Henry Lawson's Mrs Spicer, and yet she is still with us. The variously expressed democratic imperative to which I have been alluding asks for the full engagement of all the Mrs Spicers. I have suggested that the water key introduces us to an enormous range of individuals and groups overlooked by orthodox scholarship, but I want to add that, in the process, it also yields this advice: we have achieved most when governments and people have worked in partnership and with some degree of mutual respect. Therefore small communities - as ours undoubtedly is, by world standards - won't get very far if they don't pull together. Well presented, the goals of ecologically sustainable development can bond us in addressing common problems, and water management is clearly central to the challenge. But the scientific and technological experts and their political masters must be sure to consult *and be guided by* the Australian public every step of the way. Whatever their walk of life, Australians have shown an interest in water in what they do far more often than in what they say. Mrs Spicer was an exception, but we cannot disregard with impunity the tenacity in her dying words - when she seemed to be 'past carin' ':

'... She called me and said she didn't feel well, and I'd have to manage the milkin'.'
'Was that all she said?'
'No. She said not to go for you ; and she said to feed the pigs and calves; and she said to be sure and water them geraniums.'

PSYCHOLOGICAL VALUE AND BENEFITS OF WATER IN PARKS AND RECREATION

* Dr Brian Nettleton

ABSTRACT

"Never in his life had he seen a river before. All as a-shake and a-shiver, glints and gleams and sparkles, rustle and swirl, chatter and bubble. The mole was bewitched, entranced, fascinated."

(Kenneth Grahame)

Evidence is presented from various types of investigations that illustrate the effects of water settings on human emotions. Some implications for park design are discussed.

INTRODUCTION

According to Lyall Watson (1986) the first known representation of what we might now call a recreational/park landscape was the scratching of a natural scene onto a piece of antler. The scene was that of a reindeer shown grazing in grass and sedge along the banks of a river. The importance of this river view to our ancestors might be explained through culturally orientated theories which indicate that certain societies tended to encourage their inhabitants to revere nature and to link water settings with a range of positive emotions. Etchings such as these would gradually come to influence perceptions and attitudes towards the scenes depicted on the objects. On the other hand, it could be argued that over long years of human evolution, the process of selection favoured those of our ancestors who developed a tendency to respond with positive feelings to water settings which were of utmost importance to their survival and well-being.

Writers advocating this type of biologically oriented psycho-evolutionary theorising (Appleton, 1975; Driver & Greene, 1977; Humphrey, 1992; Kaplan & Kaplan, 1989; Martin, 1992; Orians, 1986; Sugan & Druyan, 1992; Ulrich, 1983) suggest that individuals would be favoured who easily learned and retained two types of adaptive responses. These were, first, restorative responses following periods of stress or taxing activities and, secondly, the paying of attention to, and development of liking and approach behaviour for, certain contexts that favoured well-being or survival. A common theme underlying the above perspective, is that individuals are innately predisposed to respond positively to many natural settings, particularly those containing water. The theories, in one way or another, are each concerned to elaborate and provide supporting evidence or the position, so aptly expressed, many years ago, by McDougall (1908).

> "An inherited or innate psycho-physical disposition which determines its possessor to perceive and to pay attention to, objects of a certain class, to experience an emotional excitement of a particular quality upon perceiving such an object and to act in regard to it ... or at least to experience an impulse to such action."

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In a subsequent investigation (Ulrich, et al 1991) subjects were first stressed by viewing a film depicting serious injuries connected with a work setting. Following the stress condition, the subjects viewed a video presentation of natural and urban settings. Physiological measures obtained included heart rate, blood pressure and skin conductance. Questionnaires were also administered to obtain information on subjectively perceived emotional states.

The results clearly showed that viewing natural settings, including water scenes, was much more strongly associated with recovery from stress than when viewing urban scenes. There were also some indications of a tendency, as noted by Kenneth Grahame, for turbulent water scenes to be more arousing than tranquil water.

Implications

If we accept that everyday lie in urban conurbations is associated with an increasing pace of life (Levine, et al 1971) and an associated increasing level of stress, then the above results appear to indicate a preventive health function of the provision of readily accessible 'natural' water settings for city dwellers.

Some Examples of Water and Health in Urban Settings

In an investigation making use of 154 students at four American universities, respondents were asked to describe an occasion when they had felt especially stressed and had chosen to go to a particular place or setting. (Francis & Cooper-Marcus 1992). They were asked to indicate the emotion which prompted the action, the place chosen, the important elements of that place and what happened to their mood during the time they spent there. When experiencing stress, there was a marked preference for seeking outdoor 'natural' settings. Apart from mentioning areas which included pleasant 'natural' landscapes, water figures prominently in many of the descriptions, especially by women. A typical example is presented below.

> "There was a grove of trees across the stream which was quite wild,
> as well as the one I liked to sit with my back to, with the water
> at my feet ...
> shade, quiet, the quiet bubble of the waterfall as it fell over the
> 12-18" drop.
> The woes of female teen peer pressure were soothed in this place."
> (Francis & Cooper-Marcus, 1992)

In these water dominated settings, the major change of mood experienced by almost forty per-cent of the sample was attaining a state of calm or balance, tranquillity and atonement to nature.

Investigations such as the one reported above have convinced Cooper-Marcus that future research in urban design should focus upon the ways in which the provision and design of natural open space could significantly reduce stress in urban settings.

> "The more I investigate environment-behaviour interactions,
> the more I am convinced of the need to delve more deeply into
> the emotional and health components of peoples' experience ...
> As our cities (and probably, too, our older suburbs)
> become more densely built up, the visual, symbolic,
> air quality and stress reducing aspects of accessible natural
> areas will become more and more important."
> (Claire cooper Marcus, 1990)

Evidence of the type requested by Cooper-Marcus was provided by Acquino-Ong (1992) in a pilot study of the stress reducing functions of natural outdoor spaces in three Victorian universities. A convenient sample of thirty students in each university completed a questionnaire which included a measure of stress developed by King, et al (1987). They were required to complete the measure in relation to stressful situations encountered in daily life at the university and when they were in their favourite outdoor space. The results clearly showed the stress reducing functions of natural landscaped areas sprinkled throughout the university campus.

The most preferred outdoor spaces at all three universities included water settings. These were the south lawn at Melbourne University, the pond near the library and Hall's Lake surrounds (Monash University) and Elm's Lawn (Latrobe University).

Tranquil spaces which included a small lake or pool were cited most often as the landscape element that best assisted their recovery from mental fatigue.

In sketches drawn by respondents depicting their ideal outdoor campus spaces almost eighty per-cent included water settings.

As time and space will only permit one final illustration of the psychological effects of water on human emotions, it may be appropriate to revisit Mole's river experiences. The dynamic alternation between excitement, anxiety and relaxation experienced by the mole may well be the sort of emotional experience that is a vital ingredient of certain addictive recreational activities. This is certainly the conclusion reached by Elias and Dunning. (1986)

> "In leisure occupations, seemingly antagonistic feelings such as fear and pleasure at not simply opposed to one another ... but are inseparable parts of a process of leisure enjoyment ... In that sense one can say that no satisfaction can be had from leisure occupations without short wisps of fear alternating with flutters of delight, and in some cases, through waves of this kind." (Elias & Dunning, 1986 p.106)

Emotional Effects of a River Experience

A preliminary in-depth study, designed to explore the extent to which different river settings elicited changes in emotions, was carried out in which two beginner kayakers were engaged in a half-day trip down the Upper Yarra River. The trip, which lasted approximately three and a half hours, was from Jumping Creek to Pound Bend. The section includes numerous small rapids of level 1 and 2 standard.

Measurements

i Interviews with the participants during the expedition in which they described their feelings and thoughts.

ii Completion of 'Emotional Appraisal Scales' (Russell & Pratt, 1980) that allowed the plotting of a range of emotions such as relaxation, excitement, fear, anxiety and distress etc.

iii Measures of stress and arousal. (King et al, 1987)

iv Written accounts of the trip.

Results

The emotional appraisals associated with each of the sections are presented below in Figure 1.

FIG. 1 Emotional Appraisals of Various River Settings

The scales were completed at Jumping Creek, just before starting the trip, after the first small rapid, at a quiet tranquil part of the river, during the lunch time stop at Warrandyte whilst contemplating the remainder of the journey around Pound Bend, prior to the largest rapid on the trip, and following the successful negotiation of the rapid. It may be seen from Fig. 1 that different sections of the river were clearly associated with overall positive emotions. These alternated between various levels of excitement, excitement tinged with an element of anxiety (approaching rapid), euphoric excitement (after rapid) and pleasant relaxation (quiet river).

Linear Arousal and Stress Scale

The two mood states, as measured by the LASS scale, altered from situation to situation. At the outset (Jumping Creek) both arousal and anxiety showed an increase compared with the previous day. Both mood states increased slightly prior to the first rapid. In each case arousal was higher than anxiety. In the calm section there was an appreciable drop in the intensity of both moods. The highest levels of arousal were experienced just prior to, and following, the last rapid; whereas the anxiety level reached its highest level before the final rapid but dropped to its lowest level when the rapid had been successfully negotiated.

Written Accounts

The emotional responses charted using the Russell and Pratt Scales and the LASS Scales were supported, in part, by the written descriptions of the experience, e.g.

It is highly likely that an appropriate fusion of both bio-evolutionary and cultural theories will be required to fully understand the complex interactions between humans and their environments. For the purposes of this paper let us examine, albeit briefly, a sample of the types of evidence that illustrate psycho-physiological responses to water settings.

We might start with a somewhat light hearted example of cultural conditioning to which many of our children have been exposed which might lead them to having a favourable disposition towards rivers. This is expressed beautifully by Kenneth Grahame in his portrayal of Mole's first encounter with the river:

> "Never in his life had he seen a river before.
> All was a-shake and a-shiver, glints and gleams
> and sparkles, rustle and swirl, chatter and bubble.
> The mole was bewitched, entranced, fascinated."
> (Grahame, 1985 p.22)

The river setting for the Mole, as he first experienced it, was strongly associated with positive feelings of mild excitement and relaxation.

> "Absorbed in the new life he was entering upon,
> intoxicated with the sparkle, the ripple,
> the scents and the sounds and the sunlight,
> he trailed a paw in the water and dreamed long
> waking dreams. (Grahame, 1985, p.23)

However, as we will find in various investigations, discussed later, there is another quite different emotion that is also associated with some river settings. This is anxiety.

> "Over went the boat and he found himself struggling in the water.
>
> O my, how cold the water was, and O, how very wet it felt.
> How it sang in his ears as he went down, down, down!
> How bright and welcome the sun looked as he rose
> to the surface coughing and spluttering!
> How black was his despair when he felt himself sinking again!"
> (Grahame, 1985, p.23)

To what extent is this dynamic alternation between excitement, anxiety and relaxation that Grahame associates with river settings supported by research of a less imaginative, but perhaps more persuasive kind?

Laboratory Investigations of Water Settings

A laboratory investigation was carried out by Ulrich (1981) in which a number of psychological and physiological measures associated with emotional states were obtained from unstressed subjects after viewing natural and urban scenes. The natural views included several water settings. Questionnaires were utilised to measure changes in mood states whilst physiological measures included electroencephalographic recordings of alpha wave frequencies and heart rate recordings as measured by electrocardiogram. High alpha amplitudes are associated with lower levels of arousal as well as feelings of 'wakeful relaxation'. The results showed a clear cut pattern for water scenes to have very positive influences on effective states. Settings which included water sustained attention and interest much more effectively than urban scenes, and individuals felt far more wakefully relaxed while viewing water scenes.

The Start of the Trip - Jumping Creek:

"An experienced kayaker mentioned, the day before our trip, that there was a lot of water in the river. Whether he meant this as a warning to be careful I'm not quite sure. It just added a little to my apprehension."

"The day was sunny. The river was pretty high but not too worrisome. As we put the kayaks in and did all the things such as checking the helmets, spray covers etc., I was pleasantly excited... looking forward to the trip ahead and what skill levels would be required on the flooded grade two rapids."

Negotiating the First Small Rapid:

"After about six hundred metres of straight paddling there were a few easy rapids. I watched the route taken by my colleague and then followed her. They were mildly exciting. The process was as follows... Paddling along relaxed... would hear and then see the bubbling of white water ahead... I talked to myself about what was required... A mixture of feelings with more excitement than anxiety swirling around together... After the successful negotiation a swirling mixture of feelings again but now more relaxation than anxiety and excitement. It was as though... I've done that nicely and I can just sit back or a moment and savour it."

Quiet Spots:

"Occasionally in slow moving parts of the river... with high banks, willows trailing their signatures at the river's edge, bell birds pinging accompanied by the low gurgling of the main stream, I felt relaxed and content, almost sleepy ... but not for long."

Warrandyte - Lunch Stop:

"We stopped at Warrandyte for lunch. I squeezed out surplus water from my clothes and sat on a warm rock in the sunshine. Lunch was eaten. It was quite relaxing and I was looking forward to the next section. Possibly just a few tremblings of anxiety... There were little sections which would require some techniques... I could practise my eddying skills... mildly exciting. When I thought of the rapid near the end of the trip (level 2 and perhaps a bit harder with the flooding) I was a bit more apprehensive... a kind of mixture of 'nervous excitement'... Would my skills be such as to let me negotiate the rapids nicely ... If I made an error could I compensate without falling out? If I did tip out should I try an eskimo-roll? Most of the time I felt that if the worst happened I would be able to recover without any serious consequences."

Final Rapid:

"As we approached the last rapid (level 2) the river narrowed. The noise was heard long before seeing the spouting water. The noise acted like a conductor's baton alerting me to get ready my solo emotional performance... A quick rehearsal involving concentration, apprehension and excitement. It was as though the strings holding the body together were suddenly tightened up... Played upon by the river rapid they would give out a higher pitched appropriate note... The note was made up of excitement and fear... It intensified as the rapid approached. Then it was action... do this... do that... a quick stroke... a momentary off-balance and a bodily adjustment blurring together, and then it was all over. A gentle manoeuvre

eddying-out and watching for my partner coming through... A sudden loosening of the strings... Relaxation but suffused with a warm feeling ... only high pleasure, high joy."

Discussion

The results are supportive of the claims made by Elias and Dunning (1986) that experiences involving a series of alternating emotions are an inseparable part of leisure enjoyment. They certainly appear to be an integral part of the very enjoyable kayaking experience. For a specific level of kayakers this section of the Upper Yarra River provides an appropriate spectrum of emotional opportunities. This was recognised in part by one of the kayakers.

"As each short stretch of faster moving water was tackled there was this prior feeling of moderate pleasant excitement with just a tinge of anxiety. Accompanying each success the anxiety was replaced by feelings of joyful relaxation... A changing melody all the way down the river..."

These experiences, following each other like 'pearl beads dropping one after one from their string' had the cumulative effect of producing moments of self transcendence.

"As we kayaked down different parts of the river: tranquil pools, rapid flowing water, mystery laden bends, a changing range of emotions, it seemed as if gradually the river, my actions and feelings all fused together. This sort of experience stays with you a long time."

To some extent the personal accounts of the river trip confirmed the emotional responses as portrayed by the affective appraisal ratings and the LASS scale. However they also indicated that the somewhat static model used to analyse emotional episodes (Russell & Pratt, 1980; Russell, et al 1987; Russell & Lanius, 1984; Russell & Snodgrass, 1987) was unable to fully capture the dynamic reverberating nature of the changes in emotional states that Elias & Dunning (1986) felt were such an important part of recreational experiences. A more appropriate analysis of the rapid alternation of excitement with anxiety may be found in 'Reversal Theory' as described by Apter (1989).

Apter (1989) argues that an individual's emotional state alternates between two main modes of behaviour. These are illustrated graphically in Figure 2.

Fig. 2 The relationship between arousal and hedonic tone according to reversal theory. The two hypothetical curves represented by a continuous and a dashed line depict the two modes of behaviour
(Source: Apter, 1989 p.18)

In one mode, the bored individual seeks more excitement. In the other mode, the anxious individual seeks relaxation. The theory allows a consideration of reversals from one mode to another. A reversal can be made, for example, from anxiety to excitement.

It appears that appropriately designed outdoor environments can bring about sequences of reverberating reversals of emotions that humans can find very satisfying.

The half day river expedition may be appropriately analysed in terms of a series of reversals of emotional states brought about by the various river settings. These reversals are illustrated in Figure 3.

Fig. 3 Reversals of Emotional States during River Trip

At the start, mild excitement alternated with little flutters of anxiety (1). Both emotions intensified slightly at the first rapid (2). During the quiet sections of the river the anxiety levels changed to feelings of mild relaxation coupled with moderate excitement (wakeful relaxation) (3). At the sight of the last rapid, increased excitement alternated with much higher levels of anxiety (5). Following the successful negotiation of the rapid the high excitement remained, but was now mixed with a sense of great relaxation (6).

> "A warm feeling... only high pleasure... high joy."

In a recent seminar on Park Visitor Research for Better Management (Hamilton-Smith, 1992) it was suggested that we really knew very little about the measurement and provision of quality experiences in recreation, nor have we attempted to provide, in our parks, an appropriate spectrum of emotional opportunities (Nettleton & Dickinson, 1992).

For these kayakers it was possible to discern something of the blend of activity, competencies and river settings that resulted in recreational 'magic moments':

> "which left them feeling no doubt that something important, vital and memorable had happened in a way that had possibly transformed them or broadened their self awareness." (Royce, 1986)

CONCLUSION

The importance of the research briefly discussed in this paper lies in the ideas it stimulates for the design of appropriate emotional profiles of, for example, walks through our parks and urban areas which can induce not only stress reducing 'wakeful-relaxation' but also 'life the spirits'.

A wonderful example of the creative application of these ideas is the internationally renowned River Walk in San Antonio, Texas. It can be done.

PSYCHOLOGICAL VALUE AND BENEFITS OF WATER IN PARKS AND RECREATION.

B,Nettleton.[1]

ABSTRACT. "Never in his life had he seen a river before. All was a-shake and a-shiver, glints and gleams and sparkles,rustle and swirl,chatter and bubble. The mole was bewitched,entranced,fascinated."
(Kenneth Grahame.)

Evidence is presented from various types of investigations that illustrate the effects of water settings on human emotions. Some implications for park design are discussed.

INTRODUCTION.

According to Lyall Watson (1986) the first known representation of what we might now call a recreational/ park landscape was the scratching of a natural scene onto a piece of antler. The scene was that of a reindeer shown grazing in grass and sedge along the banks of a river. The importance of this river view to our ancestors might be explained through culturally oriented theories which indicate that certain societies tend to socialize their inhabitants to revere nature and to link water settings with a range of positive emotions. Etchings such as these would gradually come to influence perceptions and attitudes towards the scenes depicted on the objects. On the other hand,it could be argued that over long years of human evolution,the process of selection favoured those of our ancestors who developed a tendency to respond with positive feelings to water settings which were of utmost importance to survival and well-being. Writers advocating this type of biologically oriented psycho-evolutionary theorising (Appleton,1975;Driver & Greene,1977;Humphrey,1992;Kaplan & Kaplan,1989;Martin,1992;Orians,1986;Sugan & Druyan,1992; Ulrich,1983.) suggest that individuals would be favoured who easily learned and retained two types of adaptive responses. These were,first, restorative responses following periods of stress or taxing activities and,secondly the paying of attention to and development of liking and approach behaviour for,certain contexts that favoured well-being or survival. A common theme underlying the above perspective is that individuals are innately predisposed to respond positively to many natural settings, particularly those containing water. The theories,in one way or another, are each concerned to elaborate and provide supporting evidence for the position (so eloquently) expressed,many years ago, by McDougall.(1908)

" An inherited or innate psycho-physical disposition which determines its possessor to perceive and to pay attention to, objects

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> of a certain class, to experience an emotional excitement of a particular quality upon perceiving such an object and to act in regard to it...or at least to experience an impulse to such action."

Evolution, Culture and Water

It is highly likely that an appropriate fusion of both bio-evolutionary and cultural theories will be required to fully understand the complex interactions between humans and their environments. For the purposes of this paper let us examine,albeit briefly, a sample of the types of evidence that illustrate psycho-physiological responses to water settings.

We might start with a somewhat light hearted example of cultural conditioning to which many of our children have been exposed which might lead them to having a favourable disposition towards rivers. This is expressed beautifully by Kenneth Grahame in his portrayal of Mole's first encounter with the river.

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> (Grahame,1985.p.22.)

The river setting for the Mole, as he first experienced it, was strongly associated with positive feelings of mild excitement and relaxation.

> " Absorbed in the new life he was entering upon, intoxicated with the sparkle, the ripple, the scents and the sounds and the sunlight, he trailed a paw in the water and dreamed long waking dreams. (Grahame,1985. p.23.)

However, as we will find in various investigations,discussed later, there is another quite different emotion that is also associated with some river settings. This is anxiety.

> " Over went the boat and he found himself struggling in the river. O my, how cold the water was, and O, how very wet it felt. How it sang in his ears as he went down,down,down! How bright and welcome the sun looked as he rose to the surface coughing and spluttering! How black was his despair when he felt himself sinking again!" (Grahame,1985. p. 23.)

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A ~~typical~~ laboratory investigation ~~was~~ carried out by Ulrich (1981) in which a number of psychological and physiological measures associated with emotional states were obtained from unstressed subjects after viewing natural and urban scenes. The natural views included several water settings. Questionnaires were utilized to measure changes in mood states

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In a subsequent investigation (Ulrich,et.al.1991.) subjects were first stressed by viewing a film depicting serious injuries connected with a work setting. Following the stress condition the subjects viewed a video presentation of natural and urban settings. Physiological measures obtained included heart rate, blood pressure and skin conductance. Questionnaires were also administered to obtain information on subjectively perceived emotional states.

The results clearly showed that viewing natural settings, including water scenes, was much more strongly associated with recovery from stress than viewing urban scenes. There were also some indications of a tendency, as noted by Kenneth Grahame, for turbulent water scenes to be more arousing than tranquil water.

Implications.

If we accept that everyday life in urban connurbations is associated with an increasing pace of life (Levine,et.al. 1971.) and an associated increasing level of stress, then the above results appear to indicate a preventive health function of the provision of readily accessible 'natural' water settings for city dwellers.

Some Examples of Water and Health in Urban Settings.

In an investigation making use of 154 students at four American universities, respondents were asked to describe an occasion when they had felt especially stressed and had chosen to go to a particular place or setting.(Francis & Cooper-Marcus.1992.) They were asked to indicate the emotion which prompted the action, the place chosen, the important elements of that place and what happened to their mood during the time they spent there. ~~General feelings of stress were the most frequently reported mood~~. When experiencing stress, there was a marked preference for seeking outdoor 'natural' settings. Apart from mentioning areas which included ~~natural vegetative elements~~, water figured prominently in many of the descriptions, especially by women. A typical example is presented below.

> " There was a grove of trees across the stream which was quite wild, as well as the one I liked to sit with my back to, with the water at my feet...shade,quiet,the quiet bubble of ~~the~~ waterfall as it fell over the 12-18" ~~drop~~. The woes of female teen peer pressure were soothed in this place."
>
> (Francis & Cooper-Marcus.1992.)

In these water dominated settings the major change of mood experienced by almost forty per-cent of the sample was attaining a state of calm or balance, tranquility and attunement to nature.

Investigations such as the one reported above have convinced Cooper-Marcus that future research in urban design should focus upon the ways in which the provision and design of natural open space could significantly reduce stress in urban settings.

> " The more I investigate environment-behaviour interactions, the more I am convinced of the need to delve more deeply into the emotional and health components of peoples' experience... As our cities (and probably,too,our older suburbs) become more densely built up, the visual,symbolic, air quality and stress reducing aspects of accessible natural areas will become more and more important."
>
> (Claire Cooper Marcus,1990.)

Evidence of the type requested by Cooper-Marcus was provided by Acquino-Ong (1992) in a pilot study of the stress reducing functions of natural outdoor spaces in three Victorian universities. A convenience sample of thirty students in each university completed a questionnaire which included a measure of stress developed by King,et.al.(1987). They were required to complete the measure in relation to stressful situations encountered in daily life at the university and when they were in their favourite outdoor space. The results clearly showed the stress reducing functions of natural landscaped areas sprinkled throughout the university campus.

The most preferred outdoor spaces at all three universities included water settings. These were the south lawn at Melbourne University, the pond near the library and Hall's Lake surrounds,(Monash University) and Elm's Lawn.(LaTrobe University)

Tranquil spaces which included a small lake or pool were cited most often as the landscape element that best assisted their recovery from mental fatigue.

In sketches drawn by respondents depicting their ideal outdoor campus spaces almost eighty per-cent included water settings.

As time and space will only permit one final illustration of the psychological effects of water on human emotions it may be appropriate to revisit Mole's river experiences. The dynamic alternation between excitement, anxiety and relaxation experienced by the mole may well be the sort of emotional experience that is a vital ingredient of certain addictive recreational activities. This is certainly the conclusion reached by Elias and Dunning.(1986)

> " In leisure occupations, seemingly antagonistic feelings such as fear and pleasure are not simply opposed to one another...but are inseparable parts of a process of leisure enjoyment...In

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The emotional responses charted using the Russell and Pratt Scales and the LASS Scales were supported, in part, by the written descriptions of the experience.e.g.

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SELECTING TREES AND SHRUBS FOR MINIMAL WATER USE

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Abstract

Plant selection is one of the most powerful tools for developing low water use landscapes. Species known to be more drought tolerant should be selected and grouped together to form more water efficent landscapes. In the long term, however, selection programmes are required to assess more critically the variation which may occur within species to obtain forms with possible better tolerances. Provenance selection has long been used in forestry to improve tree performance but to date has been little used in horticulture. In ornamental horticulture selections may have been introduced into cultivation only once and therefore represent only a very narrow range of the species distribution. Also selection, for the most part, has concentrated largly on variation in appearance rather than functional ability and performance. Provenance trials to assess functional and bilological tolerances as well as aesthetic characteristics would not only help gain immediate improvement in selections for drought tolerance but would also form a basis for long term breeding programmes.

The water requirements of vegetation is one of the most important criteria to evaluate when developing no water and low water landscape schemes. Unfortunately this basic but all important factor is often under estimated by landscape and gardening professionals. The approach used is essentially drawn from the amateur philosophy of maintaining a high water input to avoid any possible signs of water stress rather than from an understanding of how much vegetation will tolerate, before water stress causes significant damage. This philosophy, in turn, has developed from a long history of garden culture which can be traced back to the ancient civilizations. The garden forms of ancient Egypt and Persia and its later adoption into the Islamic paradise garden were developed on making a cool shady retreat and the shutting out of an otherwise harsh environment rather than developing landscapes which more involve their surroundings.

The response of vegetation to high water inputs is to develop a lush appearance and condition (physiology-morphology) which is less able to cope with dry periods when they do occur. The cell walls become thin and because of a raised water table the root system is often confined to the upper surface of the soil (due to deoxygenation lower down the profile) and therefore unable to survive without the frequent addition of water. This process can be

thought of in a similar way to the traditional "hardening off" requirement of nursery stock to prepare it for planting out in the landscape. Stock grown under ideal conditions in the nursery including high water input grows lushly and requires gradual conditioning if it is going to survive the harsher environment in which it will be planted.

Water stress in plants occurs as a result of water loss from cells and is described in terms of a loss in water potential. The pattern of water deficits in trees (determined by measuring water potentials) occurs on a diurnal (daily) and seasonal basis. Short term daily deficits may occur as a result of the roots being unable to adequatly supply the plant with enough water through the day time to compensate for losses due to transpiration. This may occur even when soil moisture is adequate. Tissues are then normally restored at night when transpiration is lower. Seasonal water stresses occur over time when the soil moisture component is depleted and daily replenishment becomes progressively less (Clark & Kjelgren, 1990).

Plant responses to water stress are various. Trees are categorised into spenders if they tolerate desiccation by developing features such as extensive root systems and an ability for osmotic adjustment (adjustment of cell contents to maintain high water potential) which maintain high cell water potentials or conservers if they avoid desiccation by developing features which reduce drying such as closing stomata, thicker cuticles, reduced leaf size and increased root:shoot ratio (Clark & Kjelgren, 1990). The overall effect of water stress can be to reduce growth by altering vital physiological processes such as photosynthesis, hormonal balance and cell enlargement (Kozlowski, 1985).

Several approaches are important in reducing water inputs in the development and management of landscapes. These include more accurate monitoring of precipitation, soil moisture and climate to allow more effective and efficient delivery of water; and a change in the perception for the requirement to have an all year round lush appearance to vegetation eg the brown park where grass dies off during summer and trees and shrubs do not grow as luxuriently in terms of their appearance. This can be acheived through the careful zoning of vegetation to match existing microclimates and use of areas (Knopf, 1991). For example the traditional more highly irrigated turf areas may be confined to immediately around the house or building where it not only provides amenity in a high use area but also significantly reduces heat loads on the building environment, other zones further away may be designated low or no water zones with vegetation chosen which will cope with these regimes.

The zoning of areas relies on an ability to select plants appropriately for a given area. Over much of the past three centuries there has been a strong desire to plant a wide range of species, many of which require substantial environmental modification and in particular high water inputs to sustain. This period has been dominated by the plant collector to the point where the skill of gardening has been to develop conditions to cultivate as wide a range of plants as possible rather than appropriate selection to suit a set of existing conditions.

Plant selection in itself, however, is one of the most powerful tools we have in developing gardens for low water use. Selection of species which are known to be more drought tolerant can be used successfully to develop low and no

water input areas. Many of these species although listed and described in the traditional horticultural literature provide very little actual information on their tolerance to drought. There has been no comprehensive collating or review of the scientific literature, especially studies with an ecophysiology base describing relative plant tolerances. For example in a study of three *Eucalyptus* species in Tasmania, *Eucalyptus pulchella*, *Eucalyptus coccifera* and *Eucalyptus delegatensis*, Davidson and Reid (1989) showed that *E. pulchella* was more drought tolerant than *E. coccifera* which was in turn more drought tolerant than *E. delegatensis*. The study not only gave relative drought tolerance measurements but also the visual appearance (crown damage) and rehydration ability of the species examined. There has been a range of these studies undertaken, all of which provide important information for the selection and management of vegetation for low water use landscapes.

In the long term selection programmes are needed, however, to assess more critically the variation which occurs within species to obtain forms with possible better drought tolerance. A trial using different sources or provenances of the same species *Acer saccharum* 'Legacy' and *Acer saccharum* 'Caddo' (from seed collected on dry rocky hillsides in Oaklahoma) showed marked differences in tolerances, 'Caddo' being generally more tolerant of hostile sites as indicated in the following table:-

Survival % of statewide tree planting after 5 years (adapted from Hensley et al, 1992)

Location	**'Legacy' Sugar Maple**	**'Caddo' Sugar Maple**
Manhattan	60	80
Hays	80	100
Colby	20	60
Tribune	20	100
Garden City	20	100
Wichita	60	100
Average	43.3	90

(On average Colby, Tribune and Garden City received the least rainfall)

Another trial carried out to determine the variation in drought tolerance of various populations of *Eucalyptus viminalis* (Ladiges, 1974) also showed marked differences in drought resistance between populations as indicated in the following table:

Estimates of drought damage in *Eucalyptus viminalis* selected for seedling trials from different sites (Adapted from Ladiges, 1974)

Population	**Rainfall mm/year**	**% Plants killed by artificially imposed drought**
Anakie granite	635	10
Anakie basalt	635	30
Mt Cole	1000	40
Trentham	1040	70

To date, selection for ornamental horticulture has been largely preoccupied with forms based on aesthetic qualities such as larger, brighter flowers and different growth forms eg prostrate, fastigiate etc rather than their biological tolerances. The majority of exotic plants were originally introduced into Australia via the United Kingdom and were collected from locations around the world by plant collectors selecting material for that environment. A large number of these have only been introduced once and represent a very narrow range of the species. The name of the species in many of these cases is therefore often a poor guide to its tolerances. This also applies to the range of native species used in cultivation as many of these have only been introduced on an ad hoc basis with no reference to superior selections for improved functional and biological tolerances.

The term provenance has been widely used to communicate information about sub specific variation and in its broadest sense simply indicates the geographic origin of seed or plants. Unfortunately this term has been vaguely applied. A single specimen or location may be defined precisely in terms of latitude, longitude and altitude or may be indicated by the nearest town. It may even be given as the whole country of origin. The term has also been variously used to describe the dynamics of population genetics rather than mere location. Another difficulty has arisen as to whether it refers only to the indigenous source or subsequent cultivated seed sources which may have specifically adapted to their new environment. More recently the term seed source or seed zone has been applied to indicate its source whether original or cultivated.

Despite these current difficulties in terminology provenance trials (developed by taking material from a range of seed sources and growing them in a common location to compare differences) to obtain forms with economically important physiological features has been extensively and successfully used in forestry. In forestry circles provenance trials and nomenclature, used to develop a practical genecology of a species, has become more useful than differences based essentially on morphological variation in the traditional taxonomic system, especially at the infraspecific or below species level (Turnball and Griffin, 1986). These morphological distinctions may be of little biological importance in the development of forms with superior biological and functional attributes.

To improve performance and provide better plant selections for low water use landscaspes and hostile sites in general, horticultural practice must cease its excessive reliance on the traditional taxonomic system for information about variation within a species. This is not to say that it should turn its back on taxonomy but that in addition to traditional name indicators a system is developed to communicate information about useful variation. It must also take on board and encourage ecophysiology studies in general (Whitlow and Bassuk, 1988). and research into provenance selection.

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INTERPRETING WATER
Interpreting the High Cs

Rachel Faggetter

Water dominates every aspect of our life in this country. Apart from its economic, political and environmental importance, its cultural and social meanings are rich and evocative and its interpretive possibilities endless. A key factor in the process of raising public consciousness about the need to conserve water is interpretation which is creative, imaginative and innovative. To plan and manage effective interpretation involves institutional commitment, consultation and change in conjunction with a re-evaluation of the meaning and significance of water in our culture.

It was a miracle of rare device,
A sunny pleasure dome of ice.
Kubla Khan: S.T. Coleridge

This paper suggests ways in which greater public commitment to the conservation of water can be stimulated by effective interpretation which looks at the cultural and social significance of water in our national consciousness. This approach envisions an integrated approach to ideas and information and change in corporate culture, commitment and practice.

First, what do we mean by interpretation?. There are many definitions, but this is a useful one

> Interpretation is the art of revealing meaning and significance through first hand experience, through encounters with original objects and illustrative media, and through involvement in creative activity.

Interpretation therefore is not just information. Nor is it just signage, or displays or visitor centres. Nor even possum prowls. We interpret by everything we do and everything we say. It is a two-way communication process, collaborative and co-operative. It can be described as the successful and imaginative meeting of needs and interests: the needs and interests of management matched with those of our visitors, clients or audience.

It follows that in the stages of concept development, design, installation and evaluation, all major stake holders need to be involved. This includes not only the people you wish to reach, not only your visitors, but all members of your organisation. Interpretation goes beyond thinking up some 'messages', and getting them across to the public. It is not a "them and us" model, but a partnership. And much depends on the encouragement of the creative and imaginative spirits within our organisations.

Our audiences are voluntary, the settings informal, the mood recreational. Visitor surveys tell us that people want experiences which are not only enjoyable, but are informative and worthwhile. They like to discover, to add to their knowledge. The relation between learning and enjoyment is close and symbiotic and so often it is sparked by the personal. We all treasure the experience of meeting someone with knowledge, insight and passion who enlarged our understanding and transformed our vision.

Commitment. This means that interpretation is not the job of just one officer of comparatively low rank or even of just one specialised group within the organisation. Successful interpretive planning needs the full support and commitment of every level of the enterprise, from ground staff

to the Board. The commitment to interpretation and public communication needs to be made clear and explicit in the mission statement and goal-setting process, in the corporate protocols and management practices and in the budgets.

It reflects a commitment to the idea that an organisation providing a public service needs the informed support and co operation of the community, not only to the successful achievement of the organisation's mission, but because it is the public's democratic right to know. At the same time interpretation builds understanding and support for our mission and goals. Effective interpretation is thus not only a key responsibility, but a golden opportunity.

It is also commitment to the idea that everything the organisation says and everything the organisation does is a form of interpretation and will be interpreted by the audience in some way or other. The medium is indeed both the massage and the message. We all know that hidden or unintended messages can be very powerful.

Consultation. It becomes clear from this analysis that thorough consultation is needed with all the stakeholders, staff as well as the community. This may well mean changes in the corporate culture, and in policies and procedure.

Consultation means the active participation of the audience at every stage of planning and implementation. It is hard to imagine any organisation in our society which does not have a public: users, clients, visitors, audience, market. In the service industry close consultation with audience needs and interests is vital to success.

We need to know who our public are and what they want. We must be prepared to listen and observe. We can learn from focus groups, consultations, interviews, customer surveys, and reports from the front line. Ground staff will often have the best idea of what visitors are interested in. They know how visitors behave and the questions they ask. Community organisations, local government, social welfare staff, schools, chaplains and local newspapers will all articulate community needs and interests.

Some organisations have been perfunctory at this consultation process. In a park just recently I found a sheet which invited the public to 'have their say', but included very little space for comments. It also did not help that the string on the pencil was too short to allow for comfortable writing, even if the pencil hadn't been so blunt.

Human communication is always collaborative, even when a visitor is just reading a notice. The preparation of those words, the design of text and graphics, the ideas and information are the result of a process of communication. Consultation means listening, questioning and absorbing combined with a willingness and capacity to change and revise. The success of interpretation depends on constant evaluation and review, on designing techniques which can be changed easily and on budget provisions which reflect this commitment.

All these things may require changes in our corporate culture and in the way we relate to each other within the organisation. Sometimes we are not practised at working in partnership with their communities, their audiences, their clients or their customers. But if change in community attitudes and behaviour is the desired outcome, then change in the way we do our interpretive planning is essential.

Creativity. How can we think creatively about water? How can we behave creatively about water? Everybody is capable of creative thinking, given the right impetus and the confidence that their ideas, stories and observations are valuable. Some of the most innovative ideas will come from people who know the territory. Yet we still hear of interpretive installations which were designed without the input of local staff. It might take more time and it will involve changing the culture of the organisation, but it will be worth the effort in efficiency and effectiveness. Successful interpretation undoubtedly adds value and it is demonstrably cost-effective.

Creativity often comes best from brain storming. This is the time when turning water into wine comes into its own! A successful brain storm needs a little zing as well as careful preparation to ensure that the participants are relaxed and sparkling.

We may well begin with the Water of Life. It is usually best to start at the centre of our existence, with ourselves. We spend our first nine months in water, our bodies are 70% water, we need to drink between 8 and 10 litres a day and need to excrete a certain amount to lead a healthy life. We are what we drink. Try to imagine a day without any water: two days? a week? The lifeboat syndrome with water, water everywhere and not a drop to drink. Coleridge's Ancient Mariner expressed it perfectly.

We used to be more conscious of water. Previous generations of Australians carried water bags, copied from the Aborigines, especially when travelling by horse, buggy or car. And we developed the Coolgardie safe. About 5% of us still rely on water tanks. The water closet, sometimes described as the most unfortunate invention of the nineteenth century, was universal in Australian cities only after World War 2.

Our economic and social life is structured by water: the washing machine and the dish washer: the shower and the bath: the hose and the tap: the pool, jacuzzi and spa. Our food is produced with water, and so is everything we use, build or create.

The power of water awes us: its flow and speed and cleansing properties: it powers water wheels and turbines: it wears away stones.

We need to examine the place of water in our culture and to consider those cultural origins which have caused us to misuse water and take it for granted.

Water is part of an integrated natural cycle, a whole catchment, a complete bio-system. Our European-derived cultural mistake of regarding water as an isolated and separate resource has resulted in the tragic environmental imbalances we are now suffering: blue-green algae, salination, erosion, the death of trees, the loss of habitat, the extinction of plants, animals and birds. The Wimmera Stock and Domestic Water supply system which stops the flow of water to Lake Albacutya and Wyperfeld National Park would surely not be built today. It loses more than 90% of its water to evaporation or seepage. Our garden culture is essentially European. Our gardens and lawns, shrubs and flowers are imported and need huge quantities of water. And even as we plant indigenous species, we are finding it difficult to change those cultural habits.

The symbolism of water in our culture can be explored: washing feet and washing hands. When we speak about water we often use words like harness, tame, divert, control, contain, dam, channel. But we can also use cascading, falling, tumbling, rippling, swirling.

Water is always in our imagination. Our writers and artists, photographers and musicians have interpreted the meaning of water in our dry continent, the fear of both drought and flood, our thirstiness and our profligacy. We have very ambivalent attitudes towards water. It seems never to be neutral. I am of the generation which hailed irrigation and the Snowy scheme as the key to prosperity and which now watches in dismay at the appalling environmental poverty it has brought us.

We know that people go to parks and public places in search of peace and tranquillity, an experience to take them away from the pressures of ordinary life, whether to sit by a reflecting pool at lunchtime, or to walk by a lake at the weekend. We know that water is an important part of recreation: swimming, fishing, boating, walking and dreaming.

The design of our water features in parks and public places need to highlight the beauty of water and its fabulous appeal to the senses: its colour, light, feel and movement.

And what about frozen water? Few people know at first hand the beauty of snow flakes and ice crystals. Yet nearly everyone has a freezer and could examine ice crystals through a magnifying glass. Though ice and snow are not part of our outdoors culture, there are opportunities for icy encounters indoors.

The biggest myth of all is that water is odourless, colourless and tasteless, as every water connoisseur knows. While the definition may apply in the laboratory, it certainly doesn't persuade in real life. Different waters can taste and feel distinctive. Think of the interpretive possibilities in masked water tastings or inviting people to describe their favourite water. Presumably Melbourne Water is exporting our elixir of life because they think it is something special.

The microscopic life of water should not be ignored. What do we mean by pollution? What do the microbes look like?

And what about fountains? I would like to argue that we need many more fountains of every conceivable sort.

> Fountains are intended primarily to give joy to the senses. There is nothing to compare with the interplay of light, movement, sound and sculptural imagery in great fountains, which combine the movement and sound of sheets, jets, cataracts of water with richly imaginative sculpture, water plants and foliage, darting fish, reflections and changing lights.

This beguiling description of fountains, albeit rather classical in its vision, comes from the Encyclopaedia Britannica, so we can see that fountains have the power to move even the most serious soul. We don't have nearly enough fountains our cities, and we don't use them enough in our private gardens to introduce a different noise and atmosphere.

Ah, I hear you cry, that fountains are a waste of water. Yet where are fountains most precious, most prized? In the hot dry counties of the Mediterranean and the Middle East. Their peoples value water for its cooling qualities as well as its rich appeal to the senses. Water is scarce and they don't take it for granted For them the fountain is perhaps the greatest interpreter of the meaning and value of water.

We should let our creativity ripple. Why not a water festival? Why not involve artists, especially sculptors, in creating fountains of delight and watery pleasure domes?

My point here is that it is about time that we celebrated water and added value to it. A value not of cash, but of culture. We attach heavy moral messages to water, and it is right that people know the statistics and the figures about waste and consumption and costs and bottom lines. But there is a good deal more to life than the bottom line, and people get discouraged when the news is always gloomy. Some positive and imaginative celebrations of water might help us to become more sensitive and appreciative. To enhance the cultural appreciation of water might lead to a greater consciousness of the need for care and conservation.

Water has enormous significance in every facet of our life in this country. Its meanings are rich and evocative. The interpretive possibilities of water are endless.

The title of this talk referred to the high Cs. It reminds us that successful interpretation needs commitment from the whole organisation, clarity of mission and goals, community consultation, cultural change and coruscating creativity.

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INTERPRETING WATER
Scaling the High Cs

Rachel Faggetter

ABSTRACT

This paper suggests that the successful interpretation of water in public places involves a re-evaluation of the meaning and significance of water in our culture, as well as commitment, consultation and change in the processes of interpretive planning.

To raise public consciousness about the need to conserve water, interpretation must be especially creative, imaginative and innovative.

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The sub title of this talk is Scaling the High Cs. The dreadful double pun is intended. All will be revealed.

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It follows that in the stages of concept development, design, installation and evaluation, all major stake holders need to be involved, and that means the people you wish to reach, including not only your visitors, but all members of your organisation. Interpretation goes beyond thinking up some 'messages', and getting them across to the public. It is not a "them and us" model, but a partnership.

Our audiences are voluntary, the settings informal, the mood generally recreational. Yet we know enough from visitor surveys that people want not only enjoyable experiences, but ones which are worthwhile. They like to discover, to add to their knowledge. The relation between learning and enjoyment is close and symbiotic.

Commitment. This means that interpretation is not the job of just one officer of comparatively low rank or even of just one specialised group. Successful interpretive planning needs the full support and commitment of every level of the organisation, from ground staff to the Board. The commitment to interpretation or public communication needs to be made clear and explicit in the mission statement and goal-setting process, in the corporate protocols and management practices and in the budgets.

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WATER RESOURCES FOR FISHING

Charles Barnham, *PSM*

I am pleased to have the opportunity to present this short paper on recreational fishing (or angling) in Victoria in the context of its dependence on suitable water resources.

It must be appreciated that in the time available I can touch only broadly on the subject of water resources for fishing. The three primary elements in recreational fishing of water, fish and anglers individually and collectively have considerable extremes and a wide range of variables.

Before looking at the water resources needs for the sport and recreation of fishing, it is necessary desirable to provide some broad background of what recreational fishing is and its significance to the community.

RECREATIONAL FISHING IN VICTORIA

Recreational fishing is the taking of fish for personal consumption from Victorian waters by all legal methods permitted under the **Fisheries Act** 1968 and the Fisheries (Recreational) Regulations made thereunder. Some other agencies and authorities have within their own regulations some active or potential restrictions, but these are generally minor. Legal methods of taking fish include hand, line only, rod and line, and several prescribed nets and traps. Thirty-one named fish species are subject to minimum legal lengths, ten species have a bag limit and three have a closed season.

Recreational fishing is available to and is enjoyed by persons of all ages and both sexes, and is probably the largest outdoor participant sport and recreation in Victoria. It knows no barriers of language (except perhaps signs), class, ethnic origin, politics, income or social circumstances.

Unlike many countries, we have in Australia a wide opportunity to fish and considerable freedom of access to the fish resources. Victoria is perhaps fortunate in that within a small area of the Australian continent it has a very diverse range of fish stocks and fishing opportunities.

In 1987 the Department commissioned the Roy Morgan Research Centre Pty Ltd to include in its Omnibus Survey of that year a block of questions aimed at determining the extent of community participation in recreational fishing in Victoria. That survey indicated that 916,000 people aged 14 years and over fished at least once during 1987, with -

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* 62% of those persons living in the Melbourne and Metropolitan area
* 42% fishing in freshwater; 18% mostly in lakes, 24% mostly in streams
* a male/female angler ratio of 7:3
* 25% fishing ten times or more to account for 52% of all fishing trips
* 42% of the fishing population being single; 33% being married with children.

While the taking of fish would seem to be the most important reason to go fishing, a pilot study conducted among the financial membership of Victorian angling clubs (Barnham, Hopgood and Lewton, 1984) produced an interesting result to the questions "What aspects are important to your recreational fishing?" and "Of the aspects listed which in order of priority are the three most important?". The top six responses are presented in Table 1.

TABLE 1 - Important Aspects of Fishing and their Priority

Response	Aspect (%)	Priority Order
Relax and unwind	27.5	1
Outdoor family enjoyment	15.6	2
Enjoy natural surroundings	12.8	4
To be outdoors	12.4	3
Thrill of contest/catching fish	9.8	5
For food	5.5	7

This response was not tested further in the wider general recreational fishing community, but it presents a picture of some relevance to the recreational utilisation of freshwater, estuarine or marine water resources in parks.

The economic significance of recreational fishing has not been studied to the same extent, but the pilot study (Barnham et al, 1984) found amongst other things that on an individual basis the average "serious" angler as represented by members of angling clubs -

* owned fishing assets to the value of $1,200 (excluding boats and associated equipment)
* in the previous year that average angler travelled nearly 4,600 km in the last year to fish
* and spent over $600 on recurrent costs including accommodation, food and refreshment, bait and terminal tackle.

Projected to recreational fishing in Victoria the data from the pilot survey resulted in fishing related assets including boats and equipment of $451.1 million and recurrent expenditures of $80.2 million. A subsequent national survey in 1984 based on the Victorian pilot developed a figure of $2.4 billion spent annually on recreational fishing in Australia.

Whether pursued with a dedicated single-mindedness, as a casual adjunct to a holiday, or as an opportunistic element in a family outing, recreational fishing is a major socio-economic activity in the framework of the community and its needs.

WATER QUALITY IN RELATION TO FISH AND FISHING

None of the social or economic values of recreational fishing are possible without the base resource of fish stocks, and in turn the fish resource is not available without water of suitability quality to sustain those fish stocks.

Water quality on its own is the not the only influencing parameter in terms of a water body containing fish that attract either serious or casual recreational fishing interest. Surface area, depth, deep/shallow ratio, temperature, pH, turbidity, physico-chemical composition (both natural and man-caused), flow, food chain, dissolved oxygen, marginal and in-water vegetation and soil are among the factors which have a bearing on fish survival and growth.

The poorer the quality of the water for natural or man-made reasons, the less likely is the presence of fish species which will attract purposeful anglers or might be fished as a casual adjunct to other activities such as a family outing. In some cases this is irrelevant as the person fishing doesn't have a high priority in relation to the fish being available and is interested for all or part of the period of activity in simply fishing.

The water bodies which hold fish of an acceptable species and size to cater for recreational fishing therefore range from rivers, creeks and anabranches to natural or man-made storages, lakes, ornamental ponds and flood retardation basins. More often than not each of the many types of waters with their own characteristics will produce fish of their own accord suitable to that water or, where fish stocks are manipulated through release of hatchery-produced fish, support fish selected or proven to survive and grow to cater for recreational fishing.

A water resource and the fish it contains that has access for recreational fishing therefore is viewed by either the angler or management in terms of is it shallow or deep, is it a standing body (lake) or does it flow (river), is it clear or turbid, is it cool or warm, and so on.

The very obvious message by now is that there can be no generalisation in relation to water quality and fish stocks, each water body must be considered on its merits, its known ability or its assessed potential.

As the water quality and type can largely dictate the fish species of angling interest it contains, so also can it influence the type of fishing.

Short term changes to water quality can have both short- and long-term effects on fish species presence, abundance and distribution and also whether a water sustains its own suitable fish stocks through natural recruitment or it can and should be stocked with hatchery fish to sustain a recreational fishery.

To illustrate the variables that can apply to fish and fishing as a result of water quality (taking into account the many parameters), one has to look no further than the Yarra River which in part is virtually outside this venue. The river has along its length a range of parks, reserves and public space which afford access for recreational fishing as a principal or subsidiary interest.

It is a river of quite distinct sections in terms of "type" of water, fish species present and the fishing methods used. Three sections show the diversity of just this one water:

- from its outflow into Port Phillip Bay to Dights Falls at Abbotsford the stream is tidal and estuarine, usually turbid, of very slow gradient and usually slow flow. The exception is times of flood or very high flow such as we have unseasonally experienced during the last 6 months when it could be considered largely freshwater.

  Fish species are mixed and include marine/estuarine species from Bay stocks such as bream, tailor, mulloway and flathead present in numbers and size which vary according to salinity levels, along with carp, roach, and brown trout which have moved downstream into the river section. The normal food chain suits some species more than others but that important element can itself be affected by water "quality".

  Fishing methods for some species are quite specific but generally the fishing is with bait which is more of a stationary form of angling in that a location is chosen and fished.

- the Warrandyte-Eltham section of the stream is of slightly better gradient and flow but is usually turbid. It has habitat supportive of a wide range of freshwater fish including the introduced trout, redfin, carp and some roach, endemic native fish such as river blackfish and smaller species, and supports populations of Macquarie perch and Murray cod resulting from angler translocations earlier this century.

  Access is not quite as good as the lower section but the fishing methods broaden to meet the needs of either a range of the species or a particular species. Bait fishing would probably predominate, but lure fishing is productive and fly fishing starts to become a preferred method.

- The stream section Healesville-Launching Place-Warburton is a flowing freshwater stream with much cooler and usually clearer water with higher dissolved oxygen and less effect from man through pollution.

  This water better suits and supports very good populations of trout and river blackfish. Access is not so widely available, but successful fishing methods are all three of bait, lures and flies. Trout can be fished for at all times. Blackfish, being a nocturnal species, are usually fished for successfully late in the day into the night.

Taking the wider range of aspects that make up water "quality" and its impact on fish stocks and recreational fishing, there are several water bodies within the Melbourne urban area that clearly demonstrate the relationship -

* Cherry Lake at Altona was created as a result of flood control works. In surface area it is reasonably large, has good access including public transport systems and is serviced for a range of recreational activities. Although basically manicured the shoreline is vegetated and contributes to the food supply for fish. Fishing is deliberate for some anglers, opportunistic for others and the potential exists for the water to be an excellent venue for junior and novice angler training.

  Its limitation in terms of fish stocks and fishing opportunities is quite simply its depth which, if I recall correctly is an approximate maximum of 1 metre and an average of about fifty centimetres. It is therefore generally a warm, still waterbody with a low level of dissolved oxygen, a habitat that suits fish such as carp which are able to survive and indeed thrive in such an environment.

  Redfin were stocked by the Department in the early 1970's through translocation of fish from Lake Burrumbete near Ballarat, the species generally being able to withstand the particular limitations of water conditions in the lake. The stocking was not a roaring success in the long term. There are few if any other species available which could satisfactorily survive, grow and add to the recreational fishing value of the lake.

* Ringwood Lake within the eastern suburb of the same name is also a flood control/ornamental standing water body. Access is certainly good and it is a very popular recreational area with good facilities. Marginal vegetation is not good and being somewhat protected from wind-mixing its dissolved oxygen level is probably somewhat low. It is a deeper water body that Cherry Lake, but to suggest to a serious angler that he or she should fish there would result in a short and probably explicit response.

  The problem here is very definitely one of water quality as the lakes receives considerable urban surface run-off with its high component of man-made elements most of which are unnecessary and certainly undesirable. The self-supporting fish population consists largely of goldfish, most of which are small and some occasionally display signs of not being in the best of health.

  As a children's fishery with their lack of concern about fish species or quality it is an ideal water. As a more valuable recreational fishery its prospects are limited because of water quality and its ability to safely and adequately sustain in number and condition fish that otherwise might be stocked to support recreational fishing. The obvious species for stocking would be trout, but subject to stocking guide-lines currently being developed, a native fish such as golden perch might be an option.

* Aura Vale Lake at the northern edge of Cardinia Reservoir is a popular recreational area with good access. When it was constructed it was seen as an excellent opportunity to establish and manage a recreational fishery. Major trout stockings failed dismally. The river blackfish population in the inflowing creek stayed in the stream and did not venture into the main water body, and redfin were few in number and often poor in condition.

  It was subsequently found that dissolved oxygen levels are very poor for much of the year, apparently through biological oxygen demands of the bed of the lake.

When and if this water quality problem can be solved, there is little opportunity to enhance the recreational fishing potential of a popular, accessible and well-located water body.

These three examples highlight the fact that it is not possible to consider the availability of water i.e. "water resources" as the be-all and end-all of providing fishing.

DIFFERING NEEDS OF VARIOUS FISHING ACTIVITIES

The recreational fishing community not only comes from the wide demographic mix that is the population of Victoria but has within its particular ranks a wide range of philosophy and methodology.

The top end of the range is the species specialist who will go to such lengths to pursue that interest that it almost becomes an individual crusade to achieve all goals and visit all possible locations. At the other end of the scale is the angler who tosses a line in on the basis that something might be there.

Between those two extremes are those who fish only as part of the annual holiday, or who happen to have some fishing gear around in case their day trip finishes up near a water either perhaps worth fishing or known from someone else to be "worth a try", and those who have an idea of encouraging junior family members to fish as part of an understanding and enjoyment of outdoor experiences.

Extremes exist also in terms of surroundings, company and facilities. Many a serious angler shuns waters which have obvious signs of civilisation including too many other people in the vicinity, while the more casual angler is happy to have a serviced location that suits the individual or group needs.

It is simpler to look at fishing methods first. Extremes exist here also in that methods vary from the bait on a string used most probably by a very junior person to try and catch yabbies from a local ornamental pond to the ultimately-equipped angler who requires or believes is required a considerable collection of some-times very specialised equipment to pursue a particular species or type of fishing.

Disregarding fishing from boats in estuaries, inlets and bays, fishing methodology in water bodies in or adjacent to parks and reserves can generally be divided into three categories - bait, lure and fly, in that order of usage.

In very simple terms -

* bait fishing involves the use of a wide range of live, dead, manufactured or processed food or simulated food items known to be normally eaten by fish or known to take fish on the hook. Some bait items specifically target a fish species, others may take several species. Terminal tackle rigs may vary according to water conditions and certainly will vary according to the species fished for.

An increasingly popular variation is known as coarse fishing involving the taking of fish by specialist bait and gear methods. Coarse anglers frequently return their catch to water. This specially-developed form of bait fishing also involves a single fishing site.

* lure fishing is the use of an artificial attractor with a hook or hooks attached which usually resembles in form or action in the water another, smaller food fish. Bank or shoreline fishing involves casting the lure out and retrieving it, while fishing from boats involves slow-speed trolling of a lure through the water.

  In a land-based situation the angler usually moves progressively along or around the water seeking to cast to fish in various parts of the water, i.e. under cover, near weed beds.

* fly-fishing is a highly specialised fishing method involving the casting of crafted imitations of insects and food items. Its practice is largely associated with trout fishing. Fly fishing is fairly mobile as the angler works along the shoreline, casting out the fly and retrieving to line to recast. Wading is often involved as the angler endeavours to place the fly in water sections where fish are likely to be resting or passing.

  Fly-fishing generally involves the casting technique of as much clear area behind the angler to set the line and fly up prior to the actual cast to water. The land area is therefore more likely to be clear of major vegetation otherwise for many practitioners the strike rate for catching trees, shrubs or anything in the back-cast range greatly increases.

An excellent example of a water body catering to all types of fishing and demands from the individual, serious angler through to the casual fishing activity as part of a family outing is the newly-created Lilydale Lake on the Olinda Creek. The water body is big enough to cater for various recreational uses and has adequate shoreline to separate sev separate several uses.

This artificially created water body is unlikely to provide fish species of interest to most anglers from self-sustaining stocks, even the trout population higher up the Olinda Creek. The potential as an urban fishery for interested person from a wide radius of suburbs and towns was recognised by the Department before the lake commenced storing water and a trial trout-stocking program has been in place for several years.

There would seem to be some problems associated with water quality, water body depth and food productivity as so far the return to anglers from trout stocking has not been good either in fish numbers or quality. The Department, recognising the value of the lake as a recreational fishery will no doubt pursue various options to fully test the recreational fishing possibilities.

The spectrum of fishing methodology then involves the entire gamut of the participants from the serious, highly experienced and well-equipped practitioner to the novice, junior or casual person.

It is not possible by reason of resource requirements or simply the nature of terrain and available access to service the needs of all types of anglers on all waters.

There is however is a major role to be played for a number of types of anglers in developed recreational facilities such as parks where a water resource is available which does or can provide recreational fishing, including -

* family group participation, where fishing may be undertaken by all or part of the group. This a combination of area environment, water resource, fish, access, facilities and services
* junior anglers under their own initiative and mobility. The surroundings are probably less important than the availability and access to water and fish, with facilities and safety being the next important aspects. In the initial stages of this interest the fish species available is of little concern.
* disabled persons who enjoy the recreation but have difficulties not necessarily of access to the area but to the water itself. In referencing disabled persons I am taking into account physical disability to the extent of being confined to a wheelchair. I know personally several such anglers who can fish with and hold their own with the best more mobile anglers where they are able to access the resource. The facilities and services requirements are obvious, and there is certainly a greater appreciation of the outdoor opportunity
* angler groups or clubs for social or training activities, the latter including practical instruction sessions.

CONVENIENCE AND SUITABILITY OF AVAILABLE FISHING OPPORTUNITIES

Convenience of available fishing opportunities covers range of issues which differ according to the recreational fisher's philosophy, methodology, and the basis of the fishing activity.

Access to water bodies by personal transport or public transport (where available) to the target water body is a prime consideration, and this varies from being able to actually reach the chosen fishing location to adequate provision to move safely between the terminal point of transport and the location i.e. walking tracks. For the more determined anglers lack of walking tracks is not a problem as they will make their own way.

The angler who is prepared to make his or her own way in the more natural environment faces hazards of injury to person or equipment, while the more casual and family anglers find a serviced, safer, more open location of benefit in terms of convenience and safety, including capacity to supervise a family group and the availability of alternative attractions and facilities to occupy concurrent or alternative needs.

When it comes to facilities the serious angler will accept as a matter of course the lack of services such as safe drinking water, shelter, toilet facilities and the other trappings that are part of a managed park or reserve. On the other hand there are many anglers whose choice of fishing location can or must be influenced not only by the actual fishing prospects but also the availability of basic or wide-ranging facilities to meet their needs or make a day's outing complete.

Suitability of an available fishing opportunity has to take account of the limitations imposed by either the fish stocks available or the method of fishing.

A small or shallow (Cherry Lake) or poor quality water body (Aura Vale L.) with limited stocks of fish imposes immediate limits on suitability for the serious angler, but the casual or family angler may find such a situation where comfort and other recreational facilities are available a suitable location.

Other water bodies having the required water quality parameters can meet a wide range of recreational fishing usage, and provided that all other elements of access and space are available will enable a high recreational fishing value to be achieved.

Convenience and suitability of available fishing opportunities therefore comes again to the point that each water body has its own capacities, opportunities and scope for catering to recreational fishing of any level or quality.

DIFFICULTIES WITH OTHER USERS AND USES

Difficulties with other users and uses can be actual or can be in the eye of the beholder. After all, while the walker or jogger may object to having a back-cast fishing line whistling through the air over land, the angler has the problem of that other recreationalist posing a problem to the fishing activity.

There is also a question of aesthetics. In some people's minds there exists the view that fishing is not a proper part of the scene of relaxed, passive enjoyment of an area. The Land Conservation Council has clearly accepted that recreational fishing is an acceptable passive recreational use of public land.

Whatever the problem may be, the basic principle must hold that all recreational uses and users have an equal opportunity in management considerations. In rare circumstances there can be identified clear and unresolvable conflicts such as space available, multiplicity of required or intended uses, or suitability for some uses.

Some of the conflicts actually arise or are exacerbated by planners who without adequate knowledge of recreational fishing attempt on paper to preclude or reduce perceived or potential conflicts, occasionally being influenced by strong viewpoints from vested interests. The more you consult and plan, or take pre-emptive approaches to recreational uses, the more disproportionate the perceived problem grows.

One of the problems that can occur is that recreational fishing still holds within its ranks some degree the attitude that it has a right to the resource rather than the privilege of access, or that fishing by its nature relies on no disturbance to water, fish and surroundings to allow other uses.

While it is true to say that fishing and some other use and users of a water resource and its fish are basically incompatible, there are many situations where the uses are separated by zoning.

Boating is a prime example. Many recreational fishers see boating in the vicinity of fishing activity as an absolute anathema in terms of disturbance of water and fish. Other anglers realise a form of value in boating activity through water disturbance stimulating fish movement. Either way the line is usually drawn pretty quickly, after all a speed boat passing by at 30 knots and 10 metres from the angler is definitely going to create problems - not only for fishing.

Powered boat operators have their own view on fishing as nylon fishing line has considerable power to do damage, often in the form of wrapping and compressing into the seals and bearings of propeller shafts.

Unpowered boating and even model boat operations are seen as conflicts by both sides. The question of boating in terms of launching and recovery, speed near shore, shoreline wash, and noise (powered or unpowered) is in most cases a question of zoning and therefore planning in close consultation with the recreational user groups.

Water resources for recreational use usually include swimming. Apart from one planning operation some years ago which proposed fishing and swimming in the one zone (with obviously some potentially interesting results), the possible conflict in a planned area is again resolved by zoning (Lilydale Lake). Where access is unrestricted or not planned there can be some conflict, but this is usually on larger water bodies and streams, and it is rare that there is not enough space for both.

I have noted earlier the possible shoreline conflict where back-casting a line is part of the fishing methodology. Strollers, walkers, joggers and even cyclists are a potential conflict. Indeed in the early 1980's a stocking of trout into Albert Park Lake raised this issue in a wider range where back-casting had problems while the final cast and lines in the water have complications with boating in relation to yachts and rowing.

Aesthetics are an issue with some people. As I have noted before there are people who believe that fishing is not compatible with passive, multi-recreational areas. This objection is based largely on a perception that anglers require too much room, make too much noise, interfere to much with other people and generally are visually out of place.

This not only disregards the principal of equal access if it can be catered for, but also (and probably unknown to most such objectors) disregards the fact that most anglers have a very vested interest in good water quality and general environment for the extent and quality of their chosen recreation. After all, the walker can have gravel, bitumen or concrete paths and the quality of the water alongside is irrelevant; the boater doesn't need to worry about water quality provided it isn't ingested.

Some recreations could well be valid in their objection to anglers, but then that objection might apply equally to all other recreations. Bird observation is one example where the peace and suitability of the environment is critical. I am not implying that bird observers hate anglers or any other recreational activity, but the problem can be there. Zoning perhaps?

Conservation is of course a major issue at times when the protection of existing values is involved or restriction is required of access in areas of rehabilitation. In my experience most anglers accept the need for these actions, usually because it offers potential for fish breeding, food production or shelter.

Conservation can be a problem where anglers practice there own approach to access to a water body which is not compatible with the nature of extent of streamside or shoreline vegetation or soil. While there are far more damaging causes of degradation (cattle, vehicles) and anglers are not alone in wanting to make their own way to a water, some controls may be needed. Any proposal along these lines must of course take the fullest possible account of the needs of the recreation, and this in turn needs to consider the water quality (in its widest sense) and the fishing opportunities and potential.

One of the biggest conflicts associated with angler is litter, and there is no doubt that recreational fishing makes a contribution to this highly undesirable and costly problem. I stress "makes a contribution". In some locations there is no doubt that the mess left behind is largely from anglers, but in many places of public recreational access the litter problem is not entirely that caused by anglers, but very often the angler being the most visible use of the water gets the blame.

NEW INITIATIVES, IDEAS AND CHANGES

I was asked to present as part of this paper new initiatives, ideas and changes.

I think it is clear that there is not a great deal of scope in the matter of water resources and fishing. Our present water resources must be considered finite and the conditions we have are either by good fortune and nature still of good quality or degraded to varying degrees because of the impact of man.

The options in relation to existing water resources must therefore include:

* any actions that address in both the short- and long-term the issues affecting water quality, ranging from siltation of streams from poor land management practices to improvements to systems designed to halt or divert pollution by man of surface water into lakes and streams.

* assessing carefully and presenting practical programs of recreational fishing access to waters currently closed. This is a sensitive issue and rightly so, for such closed waters are domestic supplies of high quality.

  I would point out that there are a number of domestic water storages in Victoria which are open to angling, usually with restrictions such as no boating and no wading. I am not suggesting that this access automatically apply to currently closed waters.

  An inter-departmental committee was formed in the 1980's to address the question of angler access to domestic water storages. The brief included development of draft guidelines for angler access to closed storages. The Committee was allowed to lapse.

An alternative is to create suitable water resources. In this case water bodies that come into being for flood mitigation, water storage or ornamental purposes have in the planning stage the fullest possible consideration of recreational fishing potential.

This should not be interpreted to imply that recreational fishing should be automatically included or come first among potential recreational uses of a proposed water body. Indeed, there will be situations where catering for fishing of some or all forms is impracticable by reason of conditions, size of water body, conflicts of use or purpose of the water body.

Where a decision is taken to include recreational fishing in planning a water, there is also the question of what steps are practicable to ensure the best possible conditions for fish stocks. As has been made very clear earlier, there are a number of parameters of water quality and quantity that could be impracticable by reason of cost or capacity.

To illustrate this point -

* Cherry Lake near Altona would be an improved fish habitat and a better recreational fishing water if deeper sections could have been developed prior to filling. Problems and costs associated with the need to blast the bed of the then swamp negated any action along suggested lines.
* planning for Lilydale Lake included an input from anglers and the Department on actions that could be taken during construction to improve habitat with a view to its potential for trout.

A further action is to review the suitability of waters for different species of fish in an effort to utilise species that are available for stocking to meet the water quality that is available and develop or enhance recreational fishing opportunities.

This brings into question several native fish species considered to be better suited to warmer, slow-flowing or standing waters, golden perch being a prime example. However, there is at the moment considerable and justified concern over the spread of native fish outside their former known range, and any consideration of this option will have to wait the outcome of an Action Statement under the Flora and Fauna Guarantee Act which will develop criteria to enable the assessment on an individual water basis of any native fish stocking proposal.

Obviously there is some scope for existing waters in relation to the condition of shoreline and vegetation, the poor quality of which can contribute to a poor recreational fishery, the better management of which can provide shade and some increase in food production for fish. Provision along these lines does however include the possibility of some control or zoning with the loss of part of the fishing area.

References

Barnham, C A., Hopgood, B W. and Lewton, W F., (1984) A Pilot Survey of Recreational Fishing in Victoria. Fisheries and Wildlife Service, Resources and Planning Branch Technical Report Series No. 8, Department of Conservation, Forests and Lands, Victoria

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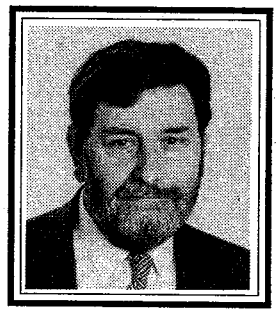

2 March, 1993.

Mr. Trevor Arthur,
Conference Chairman,
Royal Australian Institute of
Parks and Recreation,
1 Roseland Grove,
DONCASTER, VIC. 3108

Dear Mr. Arthur,

Further to our recent telephone conversation, I am pleased to return herewith the completed Speaker's Questionnaire for Mr. Jones for the Keynote Speech on Monday, 29th March, 1993.

The title of Mr. Jones' speech is 'Water: A Global Perspective'.

I look forward to hearing from you if you require any additional information prior to the Conference.

Yours sincerely,

Catherine McDonald

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Bernard Peasley
Michael Tenbuuren

Memorandum

To: MR. TREVOR ARTHUR - RAIPR **Date:** 23-3-93

Re: Conference Papers **From:** Bernard Peasley

Find enclosed the promised Abstract and half page CV for my segment on Monday.

I have also included the first two pages of my draft paper so you can check the format, type face etc.

I will be finalizing the paper tonight and tomorrow and with luck will courier it to you on Thursday.

If you have any problems with the format please contact me.

Bernard Peasley

cmd: ABSTRACT & BRIEF CV
First two pages of paper

Original in mail

IMPROVED IRRIGATION EFFICIENCY THROUGH SYSTEM DESIGN

B.J.Peasley
Engineering Principal, Irrigation Design Consultants

ABSTRACT

The ever increasing cost of water has focused attention on irrigation systems used to water landscapes in parks and gardens. To ensure that water is not wasted, efficiency as well as effectiveness must be the goal of the system designer. This paper examines the fundamental elements of the irrigation design process that directly affect system efficiency, with particular reference to water conservation. Only by addressing the issue of efficiency at the design stage, can an irrigation system effectively service a landscape with the minimum possible volume of water. By reducing the design process to its basic stages and identifying their associated efficiency criteria, this paper formalises a procedure that can be used, both by system designers as well as parks and recreation managers who are in the position of specifying the minimum performance standards for proposed landscape irrigation systems.

PRESENTER

Bernard Peasley is a Mechanical Engineer and a Principal of Irrigation Design Consultants, a Melbourne based, independent consultancy. Bernard has been involved in the landscape irrigation industry since he established the consultancy as a partnership in 1979. At that time it was the first irrigation consultancy, independent of contracting or equipment affiliations, in Eastern Australia.

Bernard is a member of the National Standards Committee of the Irrigation Association of Australia, and has been responsible for the drafting of the Irrigation and Lawn Watering Systems section in the recently revised AS3500.1: Water Supply. He has been chairman of the Backflow Prevention Sub-committee of the NSC since it started.

His areas of expertise are: site analysis; pressurised irrigation system design using sprinklers, sprays or drip; pumping plant design; control system design; documentation; tender evaluation; supervision of works; and contract administration. His most recent work of note was the design of an irrigation system for the new sand profile at the Melbourne Cricket Ground. In May last year he conducted a two day irrigation design workshop for RAIPR members at VCAH Burnley.

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ABSTRACT

The ever increasing cost of water has focused attention on irrigation systems used to water landscapes in parks and gardens. To ensure that water is not wasted, efficiency as well as effectiveness must be the goal of the system designer. This paper examines the fundamental elements of the irrigation design process that directly affect system efficiency, with particular reference to water conservation. Only by addressing the issue of efficiency at the design stage, can an irrigation system effectively service a landscape with the minimum possible volume of water. By reducing the design process to its basic stages and identifying their associated efficiency criteria, this paper formalises a procedure that can be used, both by system designers as well as parks and recreation managers who are in the position of specifying the minimum performance standards for proposed landscape irrigation systems.

INTRODUCTION

The overall efficiency of any irrigation system is a function of the following parameters:

1. Effective use of the water supply available at the site. The irrigation system must be designed around the available volume flowrate and the dynamic pressure at which that flow is delivered to the site.

2. The careful layout of all sprinklers in a geometric pattern that is uniform and suits the site's particular boundary limitations.

3. Exhaustive survey of the uniformities that different sprinklers will display at the preferred geometrical layout. Sprinkler uniformity programs can be used to chose the most uniform sprinkler head at the particular pattern necessary to service the area.

4. Minimization of overspray onto hard paved areas and onto landscaped areas not intended for irrigation.

5. Minimization of runoff by the matching of effective precipitation rate with soil infiltration rate at the point of irrigation.

6. Use of moisture sensing devices to assist in the scheduling of irrigations and to take advantage of any effective rainfall that could reduce the amount of applied irrigation.

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7. Minimization of any evaporation losses that can occur due to high temperatures, high pressures and high angles of trajectories during irrigation cycles.

8. Minimization of deep percolation losses by the careful matching of applied water to the water holding capacity of the soil. Water will be wasted if applied in excess and allowed to percolate below the root zone.

9. Accurate drafting of the irrigation layout plan so that sprinklers can be located precisely as the designer intended. The design process will not have finished until the intent has been successfully communicated to the installer, and a set out procedure provided that will ensure accurate construction.

10. Unambiguous and experienced specification of materials appropriate to perform the system duty without failure. Materials and methods must be robust and practical to ensure leaks never develop that could waste water over extended periods.

11. Accurate installation, adjustment and commissioning to ensure the system achieves its potential efficiency.

12. Intelligent operation of the system to make maximum use of any built in efficiencies of the design.

13. Regular maintenance to ensure that carefully designed, efficient systems remain so.

Items 1 to 10 above relate specifically to the design and specification of an irrigation system. However, Items 11 to 13 are equally important when trying to achieve efficiency. Many factors, beyond the design stage, affect system efficiency drastically, ie:

- system installation and commissioning
    - accurate installation (sprinkler geometric set-out)
    - diligent attention to the adjustment of sprinkler arcs, radii and angle of trajectory to minimise overspray and wind drift
    - careful adjustment of control valves to equalise operating pressures over the whole system
- system operation and irrigation scheduling
    - intelligent adjustment of the controller program to suit the limitations of the soil and the climatic needs of the turf
- system maintenance - regular, critical inspections to ensure:
    - controller time of day is correct
    - all valves are functioning
    - all heads are operating effectively
    - there are no leaks
    - mains pressure is still adequate
    - station watering times and frequency are correct for the soil, season and weather conditions

AMENITY GRASSLANDS FOR DRY TIMES

Dr David E. Aldous *

ABSTRACT

The scarest resource on the Australian continent is water. The need for water conservation will be a recurrent problem for Australia generally, with the State of Victoria, not being exempt. Urban conditions and a poorly distributed rainfall, both seasonally and geographically, makes Victoria's water issue highly complex.

Management of the water resource for amenity grasslands, indeed any turf, for hot weather survival, is not a seasonal practice but rather extends throughout the year. Management strategies to minimise stress will include the selection of low water use grasses and effective management of the cultural practices to promote a healthy, vigorous dryland/low maintenance system that will survive under less favorable environmental conditions.

In view of the many present and potential uses in developing grasses for dry times, opportunities for productive research are very great in the areas of autoecology and physiology of grasslands, particularly in the measurement of plant moisture needs, revegetation research, and the development of superior amenity grasses for harsh environments.

INTRODUCTION

Fully one-third of the earth's land area is arid or semi-arid; much of its soil and water is to saline or alkaline for tradional agricultural production. According to Fitzpatrick and Nix (1970), Australia has the distinction of being the world's most extensively arid continent.

Less than 7 percent of the Australian mainland receives an average annual rainfall exceeding 1,000mm (40"), and 70 percent receives less than 500mm (20"). While drought and limited water supplies indicate a need for water conservation, as well as presenting a recurrent problem for Australia generally, southern Australia and particularly Victoria, are not exempt.

Several decades ago it was considered that the benefits of large scale dam construction for suppling urban water needs outweighed their

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environmental impact. Excessive costs and environmental concern have now resulted in the demand that water conservation measures be introduced to defer construction of further dams. Today with the majority of the Victorian population compressed into urban centres, the poorly distributed rainfall, both seasonally and geographically, and increasing competition for the limited amounts of water, makes Victoria's water issues highly complex. There is also an increasing trend toward the use of marginal land and fill areas for home building, industry development and for recreational purposes, all of which will play an increasingly significant role in water demand. Much of these marginal lands, are often further complicated by having saline soils and poorer quality irrigation waters.

AMENITY GRASSLANDS - THE SETTING

The major amenity grasslands located in southern Australia arose because of the co-incidence of summer climatic factors such as high light intensities, high daily temperatures and low rainfall. However since vegetation is the result of the response of plants to many variables of climatic, topography and soil factors, no single factor characterises these regions.

Successful management of amenity grasslands will result from having a good working knowledge of the climate, the grass, the soil, and the cultural practices required to maintain the grass in a manner appropriate to the use for which it is grown. All of these factors, and more, interact to produce the total environment of the grass plant. All climatic factors - temperature, light, water, wind movement and humidity exert direct and interactive will affect the growth response of the grass community.

Climate, especially temperature, is the basic factor that determines the broad adaptation of grasses in Victoria. According to Beard (1973) optimum temperatures for cool season grasses are 15-25C and for warm season grasses 25 to 35C. Younger (1968) has reported that maximum carbohydrate storage for a warm-season grass (Common couch) and a cool season grass (Kentucky bluegrass) occurs at temperatures near the minimum for measurable growth. When these grasses are grown in marginal zones, soil environment and cultural practices become more critical for satisfactory turfgrass growth.

RECOVERABLE AND IRRECOVERABLE WATER RESOURCES

Two basic concepts concern the final destination of Victoria's water resource and how they relate in developing and effectively managing the amenity grasslands. Water that remains on or just below the soil surface is often made use of and is usually recoverable for re-use. However water passing to the air, via the evaporation or transpiration process, or to highly saline bodies, is irrecoverable and is lost from the system. Secondly reducing these recoverable water "losses" and reusing municipal and industrial wastewaters can save water if used locally, whereas reducing irrecoverable water losses can save water in the locality where the reduction is made as well as for the system. Water savings resulting from conservation must be evaluated in light of these two basic concepts.

Water conservation for amenity grasslands can take many forms. Californian research has shown how reductions in irrecoverable and recoverable losses, as well as wastewater re-use have assisted in minimising water use and conserving the water resource (Davenport and Hagan, 1981). These examples have been concerned with improving storage and conveyance by preventing excessive outflows of water to the ocean, or by improving storage capacity and preventing irrecoverable evaporation losses. Another case has been to introduce irrigation systems that reduce recoverable runoff and deep percolation. In these cases irrigation managment needs to reduce recovererable "losses", by recording the water resource by instrumentation and computing services, as well to reduce irrecoverable losses through drip irrigation or reduced irrigation frequency. Cultural and horticultural management practices, such as mulching reduce evaporation, weed control reduces unproductive transpiration loss, changing of cropping patterns can reduce total annual evapotranspiration (ET) and the selection and breeding of crops for low seasonal ET, are all ways to reduce irrecoverable losses. Finally the use of wastewater or recycled water, such as is concerned with agricultural runoff, brackish water for salt-tolerant crops as well as municipal and industrial sources (reclaimed sewerage, food processing effluent and thermally polluted water from power plants) can all be reused to effectively reduce demand for fresh water. Some American states have undertaken institutional action such as pricing water so it more closely reflects its true cost, provided for financial incentives, such as tax credits and have changed the the States water rights laws to enable more efficient state-wide use of water resources.

MANAGEMENT STRATEGIES FOR MINIMISING WATER USE

Sound strategies, based on good science consist of the following:

* Selection of low water-use turf;

* Effective cultural practices

- Mowing
- Fertilizer application
- Pest and weed control
- Irrigation
- Cultivation

Selection of low water-use turf

The water-use rate is the total amount of water needed for growth plus the quantity lost by transpiration and evaporation from the turf surface and the soil. Management needs to know which turfgrass species and cultivars are low water users and those which are drought resistant. By using appropriate low water-use turfgrasses for moderate to low irrigated grasslands and selecting appropriate drought resistant turfgrasses for non-irrigated grasslands can provide for improved water efficiency. Grasses vary in their tolerances to water deficiencies and their ability to recover quickly (Table 1).

Table 1 : Drought tolerance of turfgrasses

Degree of drought tolerance	Grass species	
Excellent	Kikuyu grass	Pennisetum clandestinum
	Couch grass	Cynodon dactylon
	Redleg grass	Bothriochloa macra
	Kangaroo grass	Themeda triandra
	Wallaby grass	Danthonia spp.
	Weeping ricegrass	Microlaena stipoides
Good	Hard fescue	Festuca ovina
	Tall fescue	Festuca arundinacea
	Red fescue	Festuca rubra
	Perennial rye grass	Lolium perenne
Medium	Kentucky blue grass	Poa pratensis
Fair	Buffalo grass	Stenotaphrum secundatum
Poor	Italian rye grass	Lolium multiflorum
	Creeping bent grass	Agrostis palustris
	Annual blue grass/Winter grass	Poa annua

In general warm-season grasses, such as common couch and kikuyu grass, are more tolerant to drought than the temperate turfgrasses. Further if one compares the evapotranspiration rate (ET) within the cool-season grasses such as kentucky bluegrass and tall fescue growing with adequate water, kentucky bluegrass has a significantly lower water use rate. Beard (1985) has produced the following table to rank turfgrass evapotranspiration rate (ET) (Table 2).

Table 2. Classification of evapotranspirational rates for turfgrasses

Relative Ranking	Evapotranspiration rate[1]	
	mm day	inches/week
Very Low	< 4.0	< 1.0
Low	4.0 to 4.9	1.1 to 1.3
Medium-low	5.0 to 5.9	1.4 to 1.6
Medium	6.0 to 6.9	1.7 to 1.9
Medium-high	7.0 to 7.9	2.0 to 2.2
High	8.0 to 8.9	2.3 to 2.5
Very high	> 9.0	> 2.5

The range in reported summer mean evapotranspiration rates are also summerised by turfgrass species by Beard (1985) in Table 3.

Table 3. Range in summer mean evapotranspirational rates by turfgrass species (after Beard, 1985)

Common Name	Scientific name	Evapotranspiration Summer mean field conditions (mm day)	(in/week)
Tall fescue	Fescue arundinacea	7.2 to 12.6	2.0 to 3.5
Perennial ryegrass	Lolium perenne	6.6 to 11.2	1.6 to 3.1
St. Augustine grass	Stenotaphrum secundatun	6.3 to 9.6	1.7 to 2.6
Seashore paspalum	Paspalum vaginatum	6.2 to 8.1	1.7 to 2.2
Bahia grass	Paspalum notatum	6.2	1.7
Kikuyu grass	Pennisetum clandesimum	5.8 to 9.0	1.6 to 2.5
Creeping bentgrass	Agrostis palustris	5.0 to 9.7	1.3 to 2.7
Blue grama	Bouteloua gracilis	5.7	1.6
Centipede grass	Eromochioa orphiuroides	5.5 to 8.5	1.5 to 2.0
Buffalograss	Buchloa dactyloides	5.3 to 7.3	1.5 to 2.0
Bermudagrass	Cynodon spp.	4.0 to 8.7	1.0 to 2.2
Zoysia grass	Zoysia spp.	4.8 to 7.6	1.3 to 2.1
Kentucky bluegrass	Poa pratensis	4.1 to 6.6	1.1 to 1.8

Beard (1992) also compared the field ET of several warm-season turfgrasses which survived after 158 days of drought stress, yet still maintained a high-quality green turf surface (Table 4).

Table 4 : Comparing the field evapotranspiration rates of warm season turfgrasses (after Beard, 1992).

Comparing Field Evapotranspiration (ET)						
				Mean yearly evaporation rate (mm per day)		
Common and scientific names	No. of cultivars	Location	Duration of study	Min	Max	Mean of all years
Bermuda grass	24	Texas	3 yrs	2.9	6.3	5.2
Zoysia grass	11	Texas	3 yrs	3.8	4.7	4.2
Kentucky bluegrass	20	Nebraska	*	3.9	6.3	5.3
Centipede grass	6	Texas	3 yrs	4.2	4.7	4.5
St. Augustine grass	10	Texas	3 yrs	4.5	5.1	4.7
Tall fescue	6	Nebraska	1 yr	6.2	7.3	6.8
Perennial rye grass	12	Nebraska	2 yrs	6.2	8.0	7.8

* Growth in a growth chamber with non-limiting soil moisture and 95F temperatures

Canberra research (Clark and McIntyre, 1992) have shown a number of fine fescues, dwarf type tall fescues, couchgrass, Australia's native grasses and American buffalograss have shown potential for replacing the current species used in dryland mixes or providing different mixes for various sites and usage. In drier areas, management may well consider adapting Australia's native grasses as alternatives. The concept of the Victorian grassland scene as a pristene, constantly green surface, that requires regular watering, and intensive mowing and fertilizing really belongs to the cultural landscape of another hemisphere. Currently research is being conducted into the establishment of a particular selection of Hume wallaby grass (Danthonia spp.) for planting along roadsides and in other "open space" areas in the Canberra region (Groves and Lodder, 1989), as well as re-establishing the broadleaf component of grasslands.

A critical component of water saving strategies is the selection of slow growing turfgrasses, or those that demonstrate a slow vertical leaf extension rate, in preference to fast growing types (McMaugh, 1992). The small leaf size of grasses is thought to be related to reducted transpiration. Associated internal changes, as the supply of water is reduced include, an increase in cell size and cell wall thickness, development of a dense vascular system, high stomatal density, and proportionally greater development of palliside tissue over spongy mesophyll tissue.

A highly efficient adaptation of grasses is their development of an extensive root system relative to the size of the plant. This not only decreases water loss by exposing only a relatively small part of the plant to the atmosphere, but also has a high capacity for absorbing water from a large volume of soil. Because water in the soil not penetrated by roots is unavailable, those grasses able to produce deeply penetrating and branching root systems use water most effectively and prevent, or at least postpone, possible drought injury. Carrow (1991) has shown that grasses that lack the ability to explore deeper root zones suffer from water stress and demonstrate lower ET values earlier than deep rooted turf. Couch and tall fescue have extensive root systems and have the ability to recover within a 15 day period of being watered. Roots of a few grasses are also adapted for water storage.

In unirrigated regions select drought-resistant turfgrass species and cultivars. Drought resistance is a result of a range of mechanisms that assist grasses to withstand periods of drought. Survival is accomplished by varying degrees of desiccation tolerance (ability to survive low internal tissue water), and desiccation avoidance (continue to grow and remain green during drought) or postponment.

Some grasses survive in part by their capacity to suppress development of competing vegetation, either by releasing chemicals that inhibit germination and growth of competing plants, or the grass may have the ability to monopolize the limited water supply.

Drought resistance in amenity grasses involves other physiological processes different from evapotranspiration. A particular grass species may have excellent drought resistance, but may also have a high evapotranspiration rate when soil moisture is available. This helps to explain why a species that is drought resistant on native sites can use more water in irrigated grasslands.

Effective cultural practices

Cultural practices have been grouped into two categories (Watson, 1972): namely

* those deemed essential for development of a turf that will meet established quality and use criteria,

* those deemed of value in combating stress resulting from climate extremes and heavy use.

The first group would include those making more effective use of the cultural practices of mowing, watering, fertilizing, cultivating, as well as plant protection. The second grouping would include such practices as topdressing, improvement of water and air drainage, mulches, soil covers, and soil heating. In both groups the cultural practices work to reduce the evapotranspiration rate of the grass. Both Beard (1985) and Carrow (1991) show clearly that weak thin swards of turf have high ET rates. A healthy dense cover is therefore essential to minimise excessive ET.

Essentially the first group of cultural practices are traditionally concerned basically with the development and maintenance of a green, dense, pest free turf. The intensity of application will vary in accordance with the use and quality level expected of the turfgrass. Situations in which the acceptable level of quality will permit the neglect, reduction, or omission of one of more of the basic cultural practices may cause turf to lose colour, become thin, unthrifty, and weed infested. The withholding of water removes the cooling effects of transpiration and evaporation and an increase in temperature and a decrease in humidity will occur. During a drought, failure of water supply may produce dormancy or, if prolonged, become lethal with the obvious attendant changes in the microclimate.

Mowing

Mowing is a cultural practice that is necessary for turf production and must be keyed to use. Increasing the mowing height of grasses produces a more extensive root system. The additional leaf will also protect the plant and reduce evaporation losses from the soil. When grass is under drought or high temperature stress, severe defoliation may result in dormancy or death of the plant. Mowing should strike a balance between water loss rate reduction and loss of roots.

Temperature is an important determinant of the height at which mowing is tolerated. Cool night temperatures will allow fine-leaved fescues and some bluegrasses to tolerate 1.3 cm (1/2") cutting heights. At higher temperatures they require 2.5 to 5.0 cm (1 to 2") heights to survive. Bentgrasses and couch will tolerate 65 mm (1/4") daily mowing levels under putting green conditions. Infrequent mowing of these species, even at 2.5 cm (1") can result in the loss of turf on a hot day. Tall growing couch will not tolerate mowing below 2.5 cm (1").

Tll fescue and ryegrass, as well as many warm-season roadside grasses, are least tolerant of mowing. Under rough turf cover condtions they may be mown at about 7.5 cm (3") high each time they reach 10 cm (4"), thus removing 1/3 of the leaf area at each mowing.

Frequent mowing at a uniform height results in minimum shock to the plant and maximum density of foliage. As height of cut is lowered, the importance of mowing frequency increases. Mowing frequency should also be kept to a minimum under harsh environments. The more frequently turfgrasses are mown the greater are their water needs.

Grassland mixtures of warm and cool season grasses can be regulated by height of cut and frequency of mowing. Close mowing under hot summer conditions will favor the warm-season grasses (WSG) whilst higher, less frequent mowing favours the cool-season grasses (CSG) especially under the cool to cold Victorian winters when the WSG may become dormant.

Recovery is hastened if grass, mown under severe mowing regimes during hot conditions, is carefully irrigated and lightly fertilized. Applying weed control chemicals under these conditions may well delay grass recovery.

Where grass clippings are removed, extra fertilizer will usually be required to replace the nutrients removed. Thatch should be looked upon basically as a crop residue. Corrective measures, in addition to physically removing thatch, should improve the physical character of the soil as a growing medium. Surface thatch is best removed at the beginning of the growing season, to stimluate live rhizomes and stolons for earlier growth. Water may be required in dry seasons to prevent exposed stolons and rhizomes from drying before the shoot system functions.

Under summer growing conditions it has been found best to increase the cutting height of most grasses some 10 mm above the recommended mowing height. As the weather becomes cooler in the autumn intensively managed turf, such as greens, benefit from a vertical mowing. The cutting height may be made less objectable to the client if the greens are brushed and cross mown during cooler weather to prevent the development of "grain" and to make the greens play faster.

Irrigation practices

Careful irrigation is the most important means of maintaining turfgrass under critically dry periods as water transpired by the leaves serves as a temperature regulator. Of all the cultural practices, irrigation probably exerts the greatest influence on the turfgrass microclimate. With correct irrigation system design, installation and use, water use can be reduced from 35 to 45 percent. To reduce evapotranspiration losses, consider irrigating when air temperatures and wind speeds are lowest.

When irrigating turf it is preferable to apply water infrequently and deeply. Light applications encourage shallow root systems and are often inefficient as more moisture is lost through evaporation. Different grasses, growing under similiar summer conditions, may require similiar amounts of water but at different intervals. Bentgrass grown under Melbourne's summer conditions can require 35-45 mm per week ap-

plied over 2-3 applications, whereas the extensive root system of couch grass would require a similiar amounts but only every 7-10 days (Neylon, 1987).

The community may also have to accept a more dormant turf when grass is placed under stressed conditions. Decidious trees drop their leaves during drought. Why not accept a golden brown turf during drier times? Often unirrigated turf in a brown dormant state may be in a better condition for recovery than an inadequately watered turf area.

Often turf areas are amongst the first areas to be restricted in water use during drought. Management should consider seriously the use of recycled and grey water as an alternative water source for these areas. Recycled water is currently abundant constant supply, available at a relatively low cost and will help to preserve our high quality water resources for human consumption.

Fertilizer practices

Sound fertilization programs are conducive to survival under hot weather since they help to establish healthy turf. Inadequate amounts, improperly balanced ratios, and incorrent timing of application can contribute to poor turfgrass performance. High nitrogen levels usually increase leaf extension rates and higher ET, as well as reduce root depth. Few studies have been conducted on the effects of P and K , and their interactions, in optimising growth rate, and subsequently optimising ET, in turfgrasses.

As a general rule, fertilizers need to be first applied shortly before or at the beginning of the growing season of the grass involved. Rate of growth, colour and recovery from traffic wear will provide guidelines for further applications. Under hot summer conditions the nitrogen component of a fertilizer should be eliminated. Soft lush green grass can be more susceptible to disease and increased water use as a result of the stimulation of new leaf growth. Use only light, infrequent nitogen applications if the grounds are in play or you wish to stimulate recovery from heavy use.

Fertilization of the native grasses is based on a different concept of management from that for the more aggressive turfgrasses. Many are poor competitors are intolerant of shade. Fertilizer applications should be made when competing weeds will not benefit more than the native grasses. Very little work has been carried out with fertilizer application of native grasses, although it is known such grasses have low maintenance requirments and can establish without nutrient addition. Grassy, annual weeds are the more serious competitors because they grow more rapidly if excess moisture becomes available.

Tolerance of native grasses to herbicides is becoming better documented. Grasses that are damaged by herbicides that reduce root depth can be devastating to all grasses as their tolerance to drought is based on the ability of 2.5 to 5.0 cms (1-2") of top growth to support 60 cm to 1.2 m (2 to 4 ft) of root depth.

Damage can also occur from fertilizer applications containing salt. Where soils have a high salt content, as they often do in dry or semi-arid areas, fertilizers with a a high salt index may damage amenity grasses by raising the salt content of the soil. Organic or low-salt

index fertilizers should be considered as organic fertilizers of limited solubility and low osmotic value cause little salt damage. The nutrients are more slowly available because the organic nitrogen compounds must be oxidized before they can be taken up by the grass.

Cultivation

Cultural practices enhance the roots system's ability to absorb water. Coring, slicing, and other practices that open the soil will permit movement of water, air and fertilizer into the root zone. Such practices will assist in drying the surface if it is excessively moist and, if dry, can provide a trap for moisture. Thus many turf areas in subhumid and semi-arid areas are cored in late autumn to trap additional moisture. Thatch can also restrict water penetration. Regular de-thatching can maintain water infiltration. Soil compaction in amenity areas can also restrict water penetration and lead to run-off and water wastage. The practices of mole ploughing and hollow tyning can break the compacted layers, aerate the soil profile and improve water penetration.

Control of major pests

Rabbits and hares can destroy irrigated turf by grazing and persistant burrowing. Poison baits or fumigants are usually recommended for their removal, although the legal aspects should be cleared with the local government authority. Insect pests of turf commonly found in semi-arid areas, or during hot summers, include grasshoppers, crickets and various scarab grubs of the pasture cockshafer and black beetle. Control is easy with chemicals, except when they are migrating or concentrated in turf areas. Hot, dry summers also favour the development of sucking insects, including aphids, couch mite and scale, and may require unusual control measures if resistant to common insecticides. Several species of sucking flies are also known to attack native grasses and may move to the cultivated grasses.

Endophyte infected cultivars of perennial ryegrass, tall fescue and chewings fescue in New Zealand, as well as in the United States, have been found to benefit turf growing under a stressed environment. Perhaps the most striking advantage of having endophyte infected turf is its resistance against insect attack (Davies, 1991). Harris (1991) also mentions improved cultivar persistance to summer drought stress and a greater resistance to the invasion of summer weeds, in New Jersey turfgrass trials of fine fescue and perennial ryegrass.

Other cultural practices used to alleviate stress in turf may include wind breaks and bio-degradable covers to assist in seed germination and development. Both practices will protect the plant against desiccation and high temperature stress. Wind reduction is an effective agent in temperature reduction in the turfgrass microclimate. Duff and Beard (1966) reported a 13F temperature reduction in turf with a wind movement of 4mph as compared to no air movement. At seed sowing and early seedling development surface covers and mulches substatially alter the microclimate by insulating the grass against widely fluctuating temperatures and further protect against desiccation.

FUTURE RESEARCH DIRECTIONS FOR AMENITY GRASSLAND RESEARCH

In view of the many present and potential uses and values in developing grasses for drier climes, a sound knowledge base is needed to allow effective management of the wider amenity grassland communities, to develop superior species for a wide variety of uses, and to successfully propagate in a wide range of ecological situations.

Perhaps the most important research should be undertaken in the following categories:

Synecology of grassland communities

Considerable information is available on the characteristics and functioning of amenity grassland communities, particularly those concerned with the management of the grass as a forage resource. However, much additional information is needed to provide satisfactory answers to a number of practical questions in realtion to their other functions: what amenity grasses are satisfactory for harsh environments? How can other undesirable grasses and broadleaf weeds be controlled? What is the best mix of amenity grasses for achieving particular management objectives? What are the effects of high temperatures, or other climatic variables, on the sustainability of amenity grasses?

Autoecology and physiology

The total knowledge available for individual amenity grasses for dry times is rather meagre. In addition, numerous physiological studies have been made on both cool and warm season grasses, especially in the areas of nutrition, response to mowing and irrigation, but few studies have reflected on the optimum and tolerable ranges of moisture for many amenity grasses to survive harsh times.

Revegetation

Much research has been undertaken in the rehabilitation of depleted grassland and bushland areas, but there is a need to develop reliable guides for equipment and methods for seeding, the best season, local adaptation of species, and the subsequent management of seeded areas. It is apparent that much more information is needed to allow establishment and maintenance of amenity grasses in a wider variety of situations in Victoria, such as road cuttings and fills, areas disturbed by mining operations, and other depleted areas where soil fertility and stabilization are serious problems.

Development of superior dryland amenity grasses

Scarely any work has been done on genetic improvement of amenity grasses for dry areas, or more specifically the summer dormancy of the cooler season grasses. However preliminary investigations have revealed considerable variation among natural populations in regard to such characterisitics as germination and growth habits, growth rate and productivity, drought, fire and cold tolerance. Once we understand the significance of local and geographic variations, management can use this knowledge to assure good adaption in seeding and planting regimes.

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