Government of **Western Australia**
Department of **Water**

looking after all our water needs

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DEPARTMENT OF WATER SUBMISSION TO THE LEGISLATIVE COUNCIL'S INQUIRY ON RECREATION ACTIVITIES WITHIN PUBLIC DRINKING WATER SOURCE AREAS

Please accept the attached submission from the Department of Water on the above inquiry.

All stakeholders agree that the provision of safe drinking water and recreation opportunities is important for the physical and mental wellbeing of the community. The degree to which these values can occur at the same location is however not agreed.

The expectation is that this inquiry will allow important facts to be established, thus providing a sound basis to consider how recreation can be supported in public drinking water source areas.

The Department of Water understands that other government agencies are not advocating recreation access to existing drinking water reservoirs, but they are supportive of some passive land-based recreation occurring in the outer catchments. For example, the Department of Sport and Recreation presented their 'Recreation Strategy' to a public forum on 12 November 2009. Their strategy aims to ensure a diverse mix of recreation opportunities for the public. It recommends that land-based recreation is zoned and managed so that it does not pose a risk to drinking water quality, and that water-based recreation is restricted to non-drinking water dams (e.g. irrigation dams and mining voids). The Department of Water supports this approach.

The Department of Water will ensure a planned review of its existing recreation access policy achieves a safe drinking water supply and appropriate recreation opportunities.

Yours sincerely

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Department of Water's submission to the Legislative Council's inquiry on recreation activities within public drinking water source areas

4 December 2009

Introduction

This submission has been prepared in response to the Legislative Council of Western Australia's Standing Committee on Public Administration's advertisement dated 26 September 2009, inviting submissions on the above inquiry.

It is also noted that drinking water legislation and policy has been the focus of two previous Parliamentary Committee reports in 1994 (see Water quality information sheet (WQIS) No. 7) and 2000 (see WQIS No. 8). The findings of those reports have been considered in the preparation of this submission.

The Department of Water (DoW) welcomes the opportunity to provide this submission to help the Committee understand the complex issues that exist. It is expected that many different views will be expressed by stakeholders and that it will be critical for the facts to be established to allow those views to be considered.

The DoW is responsible for managing and protecting the state's water resources. In relation to drinking water the DoW aims to ensure the availability of a 'reliable, safe, good quality drinking water supply to protect public health now and in the future'. This aim is currently achieved through implementation of the *Australian drinking water guidelines 2004* (ADWG), including its preventive risk-based, multiple barrier framework, which has been adopted throughout Australia (see WQIS No. 18). This framework recommends the adoption of 'catchment protection and treatment' measures together for the supply of safe drinking water to consumers.

The first and most important barrier is catchment protection. The achievement of low 'water quality contamination' risk catchments is also important because it sets the scene for lower cost, less complex (and therefore lower risk) treatment plants.

Key issues that need to be considered in response to the inquiries terms of reference include:

- Lessons learned from around the world (e.g. Can we rely on treatment to make water safe to drink? What is recommended by the ADWG?)
- The nature of existing public drinking water source areas (PDWSA) (e.g. Developed versus undeveloped/pristine catchments. Should the primary value of a catchment be for drinking water, the environment and/or recreation?)

- Existing access approvals (e.g. What is currently allowed/restricted under existing legislation and policy? Why is it allowed/restricted? Is the legislation and policy still current for today's technology and needs?)
- The relative risks of different recreation types (e.g. Land-based versus water-based recreation)
- Existing pressures for recreation access and the availability of alternative sites (i.e. How many recreation sites and options already exist? Are they fully utilised? Are there new sites that can be created that are not in a PDWSA?)
- Costs of increased treatment and supply if water quality contamination risks are increased (i.e. What will be the costs to consumers for additional treatment? Will a user pays system be introduced and will this cover the full costs?)
- Costs of increased recreation management policy/plans (What will be the costs for new management plans and active recreation management at new or enhanced sites? Who will be responsible for ongoing management/approvals etc?)
- The community's view (Does the community want more recreation sites? Are they willing to accept the increased risks providing more treatment is added? Are they willing to pay for more treatment? Do they prefer to keep recreation out of PDWSA reservoirs?)

In response to these issues this submission comprises:

1. A summary of the department's position in relation to recreation access to PDWSA;
2. Key findings from the literature, workshops and our own experiences;
3. Key points addressing each of the inquiries five terms of reference;
4. The DoW's response to eleven questions from a private hearing held on the 21 October 2009 (Attachment 1);
5. Frequently asked questions and answers (Attachment 2);
6. A number of water quality information sheets (WQIS) that provide further information on drinking water protection and recreation issues in WA (Attachment 3);
7. An unpublished DoW report: *Drinking water, irrigation and recreational catchments from Perth Hills to South West* (2009) (Attachment 4); and
8. Figures showing public drinking water source areas across the state and in the Perth Hills to South West.

1. A summary of the department's position in relation to recreation access to public drinking water source areas

It is indisputable that physical and mental health benefits can be achieved by increased recreation in the community. However, when considering recreation access to PDWSA key questions that need to be considered are 'what are the public health risks of increased recreation to drinking water quality in these areas?', 'will the community accept those risks?' and, 'does more recreation need to occur in PDWSA or are other more appropriate locations available?'

Although recreation activities have been conclusively shown to have negative impacts on water quality this finding has not prevented recreation from occurring in Western Australia's (WA's) PDWSA. The legislation and policy in WA currently supports 'lower risk' (generally passive land-based) controlled recreation access in the outer catchment of PDWSA. However, it does not support public access to the reservoir and land within 2 km of the

reservoirs high water mark (referred to as the reservoir protection zone – see WQIS No. 26). This 'controlled access' approach to recreation is midway between the 'closed catchment' approach and 'open catchment' approach employed in other parts of Australia and around the world. It has helped WA achieve a reliable, safe, good quality drinking water supply. These surface water catchments form a major component of Perth's Integrated Water Supply Scheme and provide diversity of supply and significant cost benefit offsets against more expensive, higher energy dependent sources of drinking water.

The three basic catchment access approaches (i.e. open, controlled and closed – see WQIS No. 22) reflect the varied decisions by governments in Australia and around the world to the issue of recreation access in drinking water catchments. It is clear that the many factors that need to be considered do not allow for one approach to fit all circumstances. This also means that care must be taken when comparing what happens in WA to other parts of Australia and around the world. For example, current recreation opportunities at some reservoirs are the result of historic access approvals, and/or the multiple land use developments that already existed in those catchments. This means that comparing those sources to WA's PDWSA is not appropriate because we have not historically approved recreation on drinking water reservoirs, and our PDWSA catchments are not developed and mostly occur over high value ecosystems. The pristine (undeveloped) nature of our drinking water catchments is envied by others, both within Australia and internationally. This protection was the intention of government in the early 1900's when it determined that drinking water catchments should be protected through reservation in state forest (see WQIS No. 16).

The focus of information in this submission is on PDWSA from the Perth Hills to South West (i.e. PDWSA from Mundaring to Collie). This area has been the subject of a number of investigations into recreation and drinking water management since 1977 (see WQIS No. 11), and it still remains the focus of most recreation access proposals.

In 2003, the DoW published its *Policy and guidelines for recreation within public drinking water source areas on crown land* (Policy 13) to deal with recreation access proposals in PDWSA. This policy was publicly consulted and was recommended to be reviewed after 5 years. That review was put on hold in 2008 pending the State Government election outcome (which resulted in a change of Government).

> The Department of Water plans to review its recreation access to PDWSA policy. This review would look at low risk recreation opportunities in the outer catchment of PDWSA where no significant increase in water quality contamination and treatment costs are expected. This review would require a public consultation process to ensure all stakeholder views are considered.

2. Key findings from the literature, workshops and our own experiences

The many years of learning and experience by the DoW in catchment protection legislation, policy and implementation has resulted in some key findings. These include:

- The greatest threat to drinking water quality is from microbiological contaminants (pathogens) in the drinking water system (see WQIS No. 23 and DoW's brochure *Risks from pathogenic micro-organisms in public drinking water source areas* for more information on pathogens). This finding is also the first of six guiding principles in the ADWG.

- Drinking water source catchments have many values. Previous Australian and WAn reviews of recreation access to water supply storages (see WQIS No. 11) have highlighted that the primary purpose of urban water storages must always be to provide a reliable, safe water supply. In general, drinking water and conservation/biodiversity values are complimentary, as limiting public access protects both drinking water quality and natural ecosystems.
- The community has an absolute trust in the safety and reliability (24/7 supply) of water delivered to their homes. It should be appreciated that the general public is typically complacent about the safety of their drinking water because WA has not had a major public health drinking water quality incident for more than a century (WQIS No. 16). However, recent survey results (Bruce 2006) show that the community is 'risk averse' in relation to protection of their drinking water source catchments and support continued source protection measures over increased recreation access (see WQIS No. 4). The DoW is planning to repeat this survey to confirm this finding.
- Recreation has been proven to have negative impacts on water quality. These impacts can increase risks to drinking water (see WQIS No. 9, 10, 13 and 21).
- 'Prevention is better than cure.' This is highlighted in the ADWG (see WQIS No. 18), World Health Organisation's *Guidelines for drinking-water quality* (see WQIS No. 19) and previous parliamentary committee reports in 1994 (see WQIS No. 7) and 2000 (see WQIS No. 8).
- A drinking water source protection program must be robust enough to deal with abnormal conditions because existing monitoring systems do not provide protection from rare episodes, and treatment systems do not cope well with sudden change. This is an important point in relation to any proposal that increases risks to a PDWSA because it means that those increased risks can impact on drinking water quality if barriers fail (see WQIS No. 15 for further explanation).
- A 'preventive risk-based assessment' process coupled with a multiple barrier approach is considered to be international best practice for management of drinking water supplies. Reliance on treatment to make drinking water safe is not recommended because treatment can only reduce contaminant levels, not remove contaminants completely.

The Department of Water supports a review of recreation opportunities in the outer catchment of PDWSA, and recommends investigation of new or enhanced recreation sites/activities outside PDWSA.

3. Key points addressing each of the five terms of reference

Term of reference 1

The social, economic and environmental values and costs of recreation access, where possible, to the Perth hills and south west drinking water catchments, including the costs and benefits to public health, water quality, recreation, Indigenous culture and management options.

Potential benefits of increased recreation access to PDWSA include:

- increased number of recreation sites close to major population centres
- increased ability to separate different recreation types and avoid conflicts (due to the greater number of sites available)

- physical (e.g. reduced obesity and risk of heart disease) and mental (e.g. reduced depression) health benefits
- decreased costs on the medical system
- increased revenue for nearby towns through tourism
- social and cultural benefits (e.g. improved sense of community)
- increased appreciation of the environment and potential increase in willingness to protect it.

Potential costs of increased recreational access to PDWSA include:

- increased risk of water quality contamination of the drinking water source. Recreation has been proven to have a negative impact on water quality. WQIS No. 21 provides a summary of the impacts of recreation. WQIS No. 9, 10 and 13 provide summaries of some key documents and reports in the literature dealing with recreation in PDWSA.
- increased maximum risk of contamination in the drinking water supply
- increased risk to public health
- increased reliance on treatment. Treatment is prone to intermittent failure and can only be relied upon to reduce contaminants, not remove them.
- increased cost of water supply (due to increased treatment costs and increased on-ground management costs)
- increased use of chemicals and potential increase in harmful by-products produced
- increased threats to biodiversity and conservation
- potential reductions in the use of existing recreation and tourism sites.

When considering the above costs and benefits of increasing access to PDWSA the following points also need to be borne in mind:

- The public expects a reliable (24/7), safe, good quality drinking water supply to protect public health now and in the future.
- Drinking water source catchments in the Perth Hills to South West are largely native bushland (without substantial urban, rural or commercial land use risks) with high biodiversity ecosystems that are vulnerable to impacts from public access.
- Many existing recreation sites outside PDWSA are not utilised to capacity and their use/management could be enhanced. In addition, a number of new potential recreation opportunities outside of PDWSA have not yet been developed (e.g. Lake Kepwari and Harvey dam).
- Catchment protection and treatment together provide a more reliable and safe drinking water supply to consumers than either can deliver on its own.

<u>Term of reference 2</u>

State, interstate and international legislation, policy and practice for recreation within public drinking water source areas, including information relating to population health benefits and impacts

Legislation in WA:

- The major acts dealing with PDWSA are the *Country Areas Water Supply Act 1947* and *Metropolitan Water Supply, Sewerage and Drainage (MWSSD) Act 1909*. By-laws associated with these acts (*Country Areas Water Supply By-laws 1957* and *Metropolitan Water Supply, Sewerage and Drainage By-laws 1981*) contain a number of restrictions on recreation and public access to drinking water catchments. This

includes provision for a 2 km prohibited zone around a reservoir (under the *MWSSD By-laws*).

- Other legislation, such as the *Conservation and Land Management Regulations 2002*; *Environmental Protection Act 1986* and associated regulations; *Fish Resource Management Regulations 1995*; and *Health Act 1911* and associated regulations also contain provisions to control pollution and/or recreation in PDWSA.
- More information on WA's drinking water protection legislation can be found in WQIS No. 14. Information on the surveillance and enforcement of this legislation can be found in WQIS No. 5.
- The existing legislation is outdated in terms of the matters that are dealt with and penalties that can be applied for a breach of existing by-laws. The review of this legislation should be a priority to bring legislative powers for the protection of PDWSA up to modern standards. Previous work on this matter received strong community support. WQIS No. 33 provides more information on the by-law review.

Policy in WA:

- The major policy for recreation in WA is Policy 13. This policy advises that no recreation access (other than along public roads and some icon well-managed walking and cycling tracks e.g. Bibbulmun Track and Munda Biddi Trail) should occur within reservoir protection zones. Some 'controlled access' for recreation is permitted in the outer catchment. This includes activities such as bushwalking, mountain bike riding, bird watching, orienteering, and barbecue and/or picnicking.
- Policy 13 was developed based on public consultation, the principles of the ADWG, findings of previous parliamentary committees in 1994 and 2000, existing legislation, other state and international practices and risk assessments.
- Copies of Policy 13 have been provided for your information, and WQIS No. 12 provides some background information on this policy.

Practice interstate and internationally:

- Practices vary across Australia and internationally and range from completely closed catchments with no access, to 'controlled access' catchments (no access to the reservoir or designated area around the reservoir but some access to the outer catchment) to open catchments with access provided on and/or around the reservoir and in the catchment. In general, where there is limited development in the catchment and low levels of treatment, there will be restrictions on recreation access (e.g. Melbourne's forested catchments, Canberra's forested catchments). In contrast, catchments where high levels of urban or agricultural development exist and consequently additional treatment is already required, it is more common for greater recreation access to occur (e.g. Brisbane's mixed land use catchments). Greater recreation access is also sometimes permitted when the source is for emergency use only or where it is a pump-back source.
- Many of the examples often cited to support recreation in PDWSA need to be considered in the context that they may reflect very different histories than is the experience in WA. For many cited examples, recreation and development was already in place alongside the use of the water resource for drinking water supply. This meant that the option to keep them separate was not available.
- More information on policy and practice in other states is provided in WQIS No. 29.

Term of reference 3

The range of community views on the value of water and recreation in public drinking water source areas.

- Safe drinking water and recreation opportunities both need to be provided to meet modern community needs.
- The community of WA has a high trust and confidence in its drinking water. They expect it to be safe and available 24/7; now and in the future.
- The integrated water supply system in WA means that many more people benefit from the drinking water captured in a PDWSA (around 2 million people) than would benefit from increased recreation access to PDWSA.
- Results of a 2006 community wide survey (Bruce 2006) looking at the values of Perth Hills and South West dams showed:
    - 68% of respondents thought that drinking water dams should be used for no other purpose. Only 5% supported their use for water-based recreation, and 14% for land-based recreation
    - 83% of respondents preferred to protect drinking water by taking a preventative approach rather than relying on treatment
    - 70% of respondents felt that achieving the lowest possible risk to drinking water should take precedence over all other issues or uses of dams and their water.
    - 67% of respondents preferred to retain the existing policy of keeping recreation and drinking water activities separate.

  A copy of this report has been supplied with this submission and a summary of the report is provided in WQIS No. 4. DoW proposes to repeat the above survey to ensure that it still reflects the community's current views.

Term of reference 4

The costs and benefits of alternative water quality management strategies and treatment for water catchments containing recreation.

- The ADWG recommend the maximum protection of a PDWSA (within the context of what is reasonable given the circumstances) to reduce the pressures on subsequent barriers, and minimise risks to water quality and public health. At the same time recreation opportunities need to be provided, in appropriate locations, to help improve public health.
- In WA, chlorination is generally the only form of treatment used. If recreation access on and around drinking water reservoirs were to increase, more sophisticated and therefore costly treatment would be required. For example, in 2000 consideration was given to allowing recreation on a Californian reservoir and increased treatment costs were modelled. For the scenario of only allowing recreation in a portion of the reservoir treatment costs were found to be an additional $2.6-7.7 million per year. It should be noted that as the treatment plant in this example was already planned to be upgraded to ozone disinfection (regardless of whether recreation was allowed) these costs only related to additional costs associated with increased dosage requirements and capital costs (Beuhler et al. 2000). The DoW is aware from discussions with Water Corporation that depending on the level of access allowed, the costs of higher level treatment across PDWSA in WA could be hundreds of millions of dollars.

- The DoW considers that the following hierarchy should be considered:
    - development of new or enhanced recreation opportunities close to the public (e.g. pools and other recreation infrastructure close to population centres)
    - development of new or enhanced recreation opportunities outside PDWSA (e.g. in irrigation dam catchments or rehabilitated mine voids)
    - a review of proclaimed PDWSA (Perth Hills to South West) to determine if they are all required to meet future water supply needs. If any are not, they could be made available for recreation use.
    - controlled recreation access to the outer catchments only of PDWSA in accordance with existing legislation, revised policy and publicly consulted drinking water source protection plans.
- If a recommendation is made to further consider recreation access to PDWSA reservoirs, the DoW would recommend that increased recreation occurs only on one or two existing PDWSA (rather than increase recreation access and risks to all PDWSA reservoirs), and that existing legislation and policy is strengthened for the remaining PDWSA.

Term of reference 5

Possible recreation sites or opportunities available outside the Perth hills and south west drinking water catchments

The following recreation alternatives (outside PDWSA) are within easy travelling distance from Perth (i.e. 30 minutes to 3 hours), with many along the new Forrest highway:

- 14 National Parks within the Perth Hills to South West study area (e.g. Serpentine National Park, Helena National Park and Wellington National Park)
- the Regional parks of the Darling Range, which cover large areas of the cities of Gosnells, Swan and Armadale and the shires of Serpentine Jarrahdale, Mundaring and Kalamunda
- other DEC managed reserves e.g. Lane Pool Reserve
- irrigation dams (e.g. Waroona, Drakesbrook and Glen Mervyn dams) – these may require proactive management and enhanced facilities to address opportunities for best/fair mix of water-based activities
- rehabilitated and inundated mining voids (e.g. Lake Kepwari, Black diamond)
- dams previously designated for public drinking water supply that are now not required to be used for this purpose (e.g. Harvey Dam, Logue Brook Dam)
- private impoundments (e.g. farm and horticultural impoundments) – these could offer recreation opportunities with economic benefits to land owners
- other recreational water bodies (e.g. Champion Lakes, Lake Leschenaultia, Oakley Dam, Scarp Pool, Minninup Pool)
- 13 recreation sites (picnic areas and rivers) downstream of drinking water supply dams (e.g. at Mundaring Weir, Canning Reservoir, Wungong Reservoir).

The above listed sites do not include many other recreation opportunities that are available outside of the Perth Hills to South West area (e.g. within the Perth Metropolitan area, along the coastline or within estuarine systems).

Further information on recreation opportunities in the Perth Hills to South West is provided in DoW's pamphlet: *Protecting our drinking water catchments: Recreation in the Perth hills and south west*, and WQIS No. 31 and 32.

In conclusion:

The Department of Water:

- Notes that recreation has been conclusively shown to have negative impacts on water quality.
- Notes that government agencies are implementing existing, publicly consulted legislation and policy for recreation access and management in drinking water catchments.
- Notes that many of the risks from recreation activities could be mitigated by additional high level water treatment.
- Encourages new or enhanced recreation opportunities outside public drinking water source areas.
- Recognises that there is potential for recreation opportunities in the outer catchment of public drinking water source areas where no significant increase in water quality contamination and treatment costs are incurred. This potential would be explored through a review of DoW Policy 13, 2003.
- Considers that recreation leading to significant water quality impacts, additional treatment, higher water supply costs and more management costs should be fully assessed against alternatives before a final decision is made.

The Department of Water submits this information in the knowledge that it will be used by the Legislative Council's Standing Committee on Public Administration to address its inquiry into recreation activities within public drinking water source areas, and that it may be made public.

Please do not hesitate to contact the department if more information is required.

John Ruprecht
Director
Water Resource Management Division
Department of Water

References for this submission

Beuhler, MD, Stewart MH and Kostelecky, JD 2000, *Impact of recreation in a drinking water reservoir on treatment requirements,* Water Supply, Volume 18, No.1, pp. 595-598, IWA Publishing, London, UK.

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Bruce, D 2006, South West of WA water catchment management issues, drinking water policy and Logue Brook dam: Community survey results, Prepared for Department of Water, October 2006, available <http://drinkingwater.water.wa.gov.au> then scroll down to Logue Brook dam link web page.

Department of Water and Department of Health 2008, *Risks from pathogenic micro-organisms in public drinking water source areas*, Department of Water, Perth, available <http://drinkingwater.water.wa.gov.au> then scroll down to view our advisory brochures relevant to drinking water link web page.

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Water and Rivers Commission 2003, Statewide Policy No.13: *Policy and guidelines for recreation within public drinking water source areas on crown land*, Water and Rivers Commission, Perth, available <http://drinkingwater.water.wa.gov.au> then scroll down to view our policy link web page.

World Health Organisation 2004, *Guidelines for drinking-water quality*, Volume 1, Recommendations, 3rd edition, World Health Organisation, Geneva, available <www.who.int/water_sanitation_health/dwq/gdwq3rev/en/index.html>.

Attachments to this submission

1. Department of Water's supplementary responses to eleven questions asked in the private hearing held by the Standing Committee on Public Administration at the Legislative Council Committee Office, Perth, WA on 21 October 2009
2. Frequently asked questions about recreation access to public drinking water source areas (PDWSA)
3. Water quality information sheets
4. An unpublished DoW report: *Drinking water, irrigation and recreational catchments from Perth Hills to South West* (2009)

Figures for this submission

1. Public drinking water source areas – WA, Department of Water – Water Resource Management, 2009.
2. Public drinking water source areas – South West, Department of Water – Water Resource Management, 2009.
3. Public drinking water source areas – Reservoir protection zones - Perth Hills to Collie, Department of Water - Resource Management, 2009.

Enclosures provided with this submission

Australian Water Association and American Water Works Association 2008, *Watershed management for drinking water protection*, Australian Water Association and American Water Works Association.

Bruce, D 2006, *South West of WA water catchment management issues, drinking water policy and Logue Brook dam: Community survey results*, Prepared for Department of Water, October 2006, available <http://drinkingwater.water.wa.gov.au> then scroll down to Logue Brook dam link web page.

Documentation and figures provided on 21 October 2009

Documents and reports

Cooperative Research Centre (CRC) for Water Quality and Treatment 2006, *Recreational access to drinking water catchments and storages in Australia*, Research Report 24, CRC for Water Quality and Treatment, available at <www.waterquality.crc.org.au/Publication_OccPpr_ResRpts.htm>.

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Figures

1. Public drinking water source areas – WA, Department of Water – Water Resource Management, 2009.
2. Public drinking water source areas – South West, Department of Water – Water Resource Management, 2009.
3. Public drinking water source areas – Reservoir protection zones - Perth Hills to Collie, Department of Water - Resource Management, 2009.
4. Public drinking water source areas – Reservoir protection zones - Perth Hills to Collie (this figure includes total area and percentage of surface water catchments and reservoir protection zones shown on this map) Department of Water - Resource Management, 2009.
5. Public drinking water source areas – Mundaring to Collie, Department of Water - Resource Management, October 2009.

Attachment 1

Department of Water's supplementary responses to eleven questions asked in the private hearing held by the Standing Committee on Public Administration at the Legislative Council Committee Office, Perth, Western Australia on 21 October 2009

1. We have requested this briefing and I now invite you to make an opening statement.

    - The Department of Water welcomes this inquiry. The issues that will be considered are important from a water quality, public health and economic viewpoint. The inquiry is also timely in relation to new water resource legislation that is being prepared, and a planned 5 year review of the department's 2003 publicly consulted Policy 13 dealing with recreation access to public drinking water source areas.
    - If the history of this matter is an indication of the future, many different views will be expressed. The view that will be the most silent; most important; and most difficult to determine, will be that of the general public. All stakeholders will purport to reflect the views of this stakeholder group.
    - From the department's experience and understanding, simple comparisons within Australia and overseas do not reflect the complexity of matters that need to be considered.
    - The task in front of the Standing Committee on Public Administration will be to: take the different views, experiences and understandings; determine the facts; and make recommendations that consider the circumstances and opportunities that exist in Western Australia.

2. Explain the impetus for this Inquiry.

    - The previous government's decision to convert Logue Brook dam from its historic 'irrigation and recreation' use to 'irrigation and drinking water' (thereby excluding recreation on and near the Logue Brook reservoir under existing legislation and policy) acted to raise the issue of 'recreation access to Public Drinking Water Source Areas (PDWSA) (Perth Hills and South West)' to the forefront.
    - The election commitment and decision by the new government to reverse the pervious government's decision on Logue Brook dam acted to foster hope in the recreation community that greater access to drinking water catchments might be achieved.
    - This standing committee is well placed to consider such matters free from stakeholder agendas or bias.

3. What is your perspective on the problem?

    - Recreation has many public health benefits (both physical and mental) and recreational access is supported in appropriate locations.
        i. Many existing recreation dams (e.g. Waroona and Logue Brook) are underutilised, and a number of new recreation dams (e.g. Harvey and Lake Kepwari) are still being developed.

ii. Drinking water sources in the Perth Hills to South West are largely native bushland (undeveloped) catchments with few water quality contamination risks. This means the water quality is good and little treatment is required, which keeps both the costs down and the public health risk to consumers low.

- Recreation has been conclusively shown to have negative impacts on drinking water quality.
    i. Recreation related hazards that increase risks include pathogens (from body contact with water or faeces being washed into waterways), chemicals (from benzene and toluene in boat exhausts) and turbidity (from off road vehicle use).
- Government agencies (i.e. Departments' or Water, Environment and Conservation and Health) are implementing existing publicly consulted legislation and policy for recreation access and management in drinking water catchments.
    i. A 2006 community wide (Perth to Bunbury) survey showed that the general public overwhelmingly supported drinking water protection over recreation access to drinking water catchments.
    ii. Two previous parliamentary enquiries (1994 and 2000) have supported existing legislation and policy approaches.
- Many of the impacts from recreation activities could be mitigated by additional high level water treatment.
    i. If recreation access is increased, effective management (which may include limitations on access) will be required to protect the quality of the recreational experience, water quality and ecosystem.
    ii. Given increased recreation will increase risk levels, more treatment would be needed to meet drinking water quality requirements and protect public health.
- The promotion of new or enhanced recreation opportunities should occur outside PDWSA.
    i. Increased recreation (especially recreation that occurs in or around a reservoir) can significantly increase the likelihood of a drinking water source becoming contaminated.
    ii. Science shows people shed pathogens into water when they bathe, or have body-contact with water. Recreation can also result in chemical contamination and increased turbidity.
    iii. Existing drinking water protection legislation and policy has served Western Australia well for more than 100 years. There have been no major water quality incidents from drinking water catchments since the 1890s when more than 350 people died from the water in the Victoria dam catchment in the Perth Hills.
    iv. Many recreation opportunities exist outside PDWSA that should be prioritised and funded.
- There is potential for additional recreation opportunities in drinking water catchments where no significant increase in water quality contamination and treatment costs are expected to be incurred.
    i. The department supports a review of its recreation in drinking water catchments, policy 13, to consider more low risk recreation

activities away from reservoirs. This policy review should be subject to a public consultation process.

- Recreation proposals in PDWSA that may lead to significant water quality impacts, additional treatment, higher water supply costs and/or more management costs should be assessed against alternatives before a final decision is made.

4. What is current government policy on recreational use of PDWSAs?

    - The department's Policy 13 dealing with recreation access to PDWSA reflects current publicly consulted policy.
    - Controlled access is restricted on the reservoir and within a 2km reservoir protection zone to gazetted roads and icon trails such as the Bibbulmun (walk) Track and Munda Biddi (mountain bike) Trial. Some conditional access is provided in the remaining area of the catchment for recreation such as bushwalking, bird watching, picnicking and camping in designated sites.
    - This 'controlled access' approach is similar to the approach used in major catchments supplying drinking water to Sydney, Canberra and Adelaide, and is midway between the closed catchment approach applied in most of Melbourne's forested catchments and the more open catchment approach practised in Brisbane's mixed land use catchments.
    - This policy is backed by legislation and by-laws administered by the Department of Water (ie. *Metropolitan Water Supply Sewerage and Drainage Act* and *Country Areas Water Supply Act*). It reflects a community consulted process and is supported, in part, by other agency legislation (eg. Department of Health and Department of Environment and Conservation).

5. What types of complaints does the department receive from recreational users about PDWSAs.

    - The type of complaints from recreation groups relate to the limitations of existing legislation and policy that prevent recreation access to some parts of a drinking water catchment (i.e. within reservoir protection zones).
    - Some complaints relate to conditions that are applied to obtain recreation access in the outer catchment.
    - Complaints can also relate to administrative delays in processing applications.

6. To date, how has the Department resolved the competing interest of recreational use of water sources against health imperative?

    - Some recreational opportunities are currently supported in the outer catchment through Policy 13, 2003. This policy was publicly consulted.
    - The department sits on a number of groups that deal with recreation matters in drinking water areas (eg. Trails WA reference panel and Southern Darling Regional Recreation Strategy for Inland Water Bodies and Catchments working group both coordinated by the Department of

Sport and Recreation and the Recreational Freshwater Fisheries stakeholder committee coordinated by the Department of Fisheries).

- Coordination between government agencies and the Water Corporation occurs for the assessment of proposals for recreation access to the outer catchment.
- 'Icon' well-managed trails and associated campsites e.g. the munda biddi trail and bibbulmun track have been supported in drinking water catchments.
- Recreational opportunities in the hills and south-west area outside existing drinking water catchments have been mapped and published, and the maps have been provided free of charge to tourism centres and other such facilities. The maps continue to be in high demand.
- Well developed picnic areas downstream of many dams (ie outside the reservoir protection zones) have been established.

7. What specific primary and subsidiary legislation impedes the recreational use of PDWSAs?

    - The major acts dealing with PDWSA are the *Country Areas Water Supply Act 1947* and *Metropolitan Water Supply, Sewerage and Drainage Act 1909*. By-laws associated with these acts (*Country Areas Water Supply By-laws 1957* and *Metropolitan Water Supply, Sewerage and Drainage By-laws 1981*) contain a number of restrictions on recreation and access to drinking water catchments. This includes provision for a 2 km prohibited zone (under the MWSS&D By-laws).
    - Other legislation, such as the *Conservation and Land Management Regulations 2002, Environmental Protection Act 1986, Fish Resources Management Regulations 1995* and *Health Act 1911* also contain provisions to control pollution and/or recreation in PDWSA.

8. What are the penalties for illegal use?

    - Maximum penalty under MWSS&D by-laws is $200. Legislation reviews have identified the need to increase this penalty.
    - Maximum penalty under CAWS by-laws is $40. Legislation reviews have identified the need to increase this penalty.
    - Penalties under the CALM Regulations relevant to recreation access range from $500 for swimming or bathing in any reservoir or tank used to store drinking water on CALM land to $2000 for organising, promoting or conducting a car rally, mountain bike event or other event involving vehicles on CALM land without a permit.
    - Maximum penalties under the *Fish Resource Management Regulations* are $5000 for a first offence and $10 000 for subsequent offences. Because drinking water catchments are generally not designated fishing zones people can be prosecuted for fishing/marroning in these areas. These are modern penalties that act to deter illegal activity.
    - Defiling or polluting a water supply or catchment area can result in a maximum penalty of $10 000 or 1 year prison under the *Health Act 1911.*

9. How are PDWSAs policed?
    - The Department of Water has delegated surveillance and enforcement functions for Perth Hills and South West catchments to Water Corporation. Water Corporation has dedicated rangers who conduct regular patrols of drinking water catchments. They have the ability to prosecute people who are carrying out unauthorised activities. Many rangers not only have powers under the MWSS&D and CAWS acts but have also obtained powers under other sets of legislation mentioned in question 8 above.
    - During 2008/09 Water Corporation rangers gave out 188 warnings and undertook 263 prosecutions under water legislation and 29 prosecutions under other legislation.
    - The DoW also applies resources to the assessment of proposals and can police issues in drinking water catchments.

10. What particular PDWSAs have been the subject of most complaints by recreational users?
    - Perth Hills and South West drinking water catchments are subject to pressures for increased recreation access. Access to Mundaring, Collie, Harvey and Stirling dams has been sought in the past.

11. How many complaints have you received in the past 2 years?

    - Records of complaints do not exist. The water source protection branch would estimate that no more than 20 complaints related to recreation matters have been considered in the last 2 years. Those complaints mostly relate to administration issues and concern that existing legislation and policy is not relevant to Western Australia's changing needs.
    - Over the last 2 years more than 20 drinking water source protection plans have been prepared by the department (many with recreation issues discussed) and the limited number of submissions received on recreation access issues can be viewed as an indication of broad community support for catchment protection. The department is looking to repeat a 2006 survey, which determined overwhelming community support for catchment protection (in PDWSA) over recreation, to see if the same outcome occurs.

Attachment 2

Department of Water's supplementary responses to eleven questions asked in the private hearing held by the Standing Committee on Public Administration at the Legislative Council Committee Office, Perth, Western Australia on 21 October 2009

1. We have requested this briefing and I now invite you to make an opening statement.

    - The Department of Water welcomes this inquiry. The issues that will be considered are important from a water quality, public health and economic viewpoint. The inquiry is also timely in relation to new water resource legislation that is being prepared, and a planned 5 year review of the department's 2003 publicly consulted Policy 13 dealing with recreation access to public drinking water source areas.
    - If the history of this matter is an indication of the future, many different views will be expressed. The view that will be the most silent; most important; and most difficult to determine, will be that of the general public. All stakeholders will purport to reflect the views of this stakeholder group.
    - From the department's experience and understanding, simple comparisons within Australia and overseas do not reflect the complexity of matters that need to be considered.
    - The task in front of the Standing Committee on Public Administration will be to: take the different views, experiences and understandings; determine the facts; and make recommendations that consider the circumstances and opportunities that exist in Western Australia.

2. Explain the impetus for this Inquiry.

    - The previous government's decision to convert Logue Brook dam from its historic 'irrigation and recreation' use to 'irrigation and drinking water' (thereby excluding recreation on and near the Logue Brook reservoir under existing legislation and policy) acted to raise the issue of 'recreation access to Public Drinking Water Source Areas (PDWSA) (Perth Hills and South West)' to the forefront.
    - The election commitment and decision by the new government to reverse the pervious government's decision on Logue Brook dam acted to foster hope in the recreation community that greater access to drinking water catchments might be achieved.
    - This standing committee is well placed to consider such matters free from stakeholder agendas or bias.

3. What is your perspective on the problem?

    - Recreation has many public health benefits (both physical and mental) and recreational access is supported in appropriate locations.
        i. Many existing recreation dams (e.g. Waroona and Logue Brook) are underutilised, and a number of new recreation dams (e.g. Harvey and Lake Kepwari) are still being developed.

ii. Drinking water sources in the Perth Hills to South West are largely native bushland (undeveloped) catchments with few water quality contamination risks. This means the water quality is good and little treatment is required, which keeps both the costs down and the public health risk to consumers low.

- Recreation has been conclusively shown to have negative impacts on drinking water quality.
    i. Recreation related hazards that increase risks include pathogens (from body contact with water or faeces being washed into waterways), chemicals (from benzene and toluene in boat exhausts) and turbidity (from off road vehicle use).
- Government agencies (i.e. Departments' or Water, Environment and Conservation and Health) are implementing existing publicly consulted legislation and policy for recreation access and management in drinking water catchments.
    i. A 2006 community wide (Perth to Bunbury) survey showed that the general public overwhelmingly supported drinking water protection over recreation access to drinking water catchments.
    ii. Two previous parliamentary enquiries (1994 and 2000) have supported existing legislation and policy approaches.
- Many of the impacts from recreation activities could be mitigated by additional high level water treatment.
    i. If recreation access is increased, effective management (which may include limitations on access) will be required to protect the quality of the recreational experience, water quality and ecosystem.
    ii. Given increased recreation will increase risk levels, more treatment would be needed to meet drinking water quality requirements and protect public health.
- The promotion of new or enhanced recreation opportunities should occur outside PDWSA.
    i. Increased recreation (especially recreation that occurs in or around a reservoir) can significantly increase the likelihood of a drinking water source becoming contaminated.
    ii. Science shows people shed pathogens into water when they bathe, or have body-contact with water. Recreation can also result in chemical contamination and increased turbidity.
    iii. Existing drinking water protection legislation and policy has served Western Australia well for more than 100 years. There have been no major water quality incidents from drinking water catchments since the 1890s when more than 350 people died from the water in the Victoria dam catchment in the Perth Hills.
    iv. Many recreation opportunities exist outside PDWSA that should be prioritised and funded.
- There is potential for additional recreation opportunities in drinking water catchments where no significant increase in water quality contamination and treatment costs are expected to be incurred.
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Attachment 3

Water quality information sheets

List of relevant water quality information sheets

- WQIS No. 3: Irrigation and recreation dams in Western Australia: Results of activity surveys
- WQIS No. 4: Water values and recreation in drinking water catchments: Results of a community survey
- WQIS No. 5: Surveillance and enforcement in our drinking water catchments
- WQIS No. 6: WA's drinking water source protection program
- WQIS No. 7: Select committee report on metropolitan development and groundwater supplies - summary
- WQIS No. 8: *Report of the standing committee on ecologically sustainable development in relation to the quality of Perth's water supply* – summary
- WQIS No. 9: Summary of occasional paper no. 22 – *Effects of recreational activities on source water protection areas*
- WQIS No. 10: Recreational access to drinking water catchments and storages in Australia
- WQIS No. 11: Historical recreation reviews and studies
- WQIS No. 12: Background to Statewide policy No. 13 – *Policy and guidelines for recreation within public drinking water sources areas on crown land* (2003)
- WQIS No. 13: Summary of Watershed management for drinking water protection, chapter 8, *Recreational access to source water reservoirs and catchments*, Australian Water Association and American Waterworks Association, 2008
- WQIS No. 14: WA's legislation for drinking water source protection
- WQIS No. 15: Risk-based management approaches for drinking water catchments
- WQIS No. 16: History of WA's drinking water source protection – more than 100 years of experience
- WQIS No. 17: The Advisory Committee for the Purity of Water – an overview of their role
- WQIS No. 18: *Australian drinking water guidelines* (2004) – an overview
- WQIS No. 19: Summary of World Health Organisation's *Guidelines for drinking water quality*
- WQIS No. 30: Drinking water governance in Western Australia
- WQIS No. 21: Impacts of recreation
- WQIS No. 22: Proposed recreation access and drinking water protection options
- WQIS No. 23: Drinking water catchment protection and pathogen risks
- WQIS No. 24: Case study: The costs of a waterbourne disease outbreak in Walkerton

- WQIS No. 25: List of acronyms
- WQIS No. 26: Reservoir protection zones
- WQIS No. 27: Catchment areas
- WQIS No. 28: Recent disease (microbial pathogen) outbreaks in the drinking water of affluent nations
- WQIS No. 29: Recreational access to drinking water catchments in other Australian capital cities
- WQIS No. 30: Wildfire in drinking water source catchments
- WQIS No. 31: *Protecting our drinking water catchments: recreation in the Perth hills and south west* - a summary
- WQIS No. 32: *Logue Brook Dam visitor facilities and services relocation feasibility study* - summary
- WQIS No. 33: Review of the drinking water source protection by-laws

Government of Western Australia
Department of Water

Looking after all our water needs

Water quality information sheet 3
November 2009

Irrigation and recreation dams in Western Australia: Results of activity surveys

Introduction

Between December 2006 and September 2009 the Department of Water undertook surveys of recreation use at a number of WA's irrigation dams.

These surveys looked at the number of recreational users at each of the dams at a particular time. More specifically, the surveys involved taking photos to provide an indication of the area of water in use, and a count of:

- the number of ski boats on the water
- the number of motor boats and trailers on the banks
- the number of tents/caravans
- the number people kayaking, canoeing, swimming and fishing/marroning
- the number of people mountain bike riding, motor bike riding and horse riding.


Waroona Dam, 30 December 2006

As the aim was to assess maximum usage, surveys were specifically targeted to summer holiday peak periods (e.g. Christmas 2006, New Year 2007), long weekends (e.g. Australia Day 2007, Easter 2007, Anzac Day 2008) and the beginning of marroning/fishing seasons. Surveys were generally undertaken during the late morning/early afternoon when usage was likely to be greater.

Findings

Results from the surveys of Waroona and Logue Brook dams are shown in tables 1 and 2* overleaf. This data provides an indication of the level of usage of these dams and may be useful for determining their potential for further recreational development.


Water skier, Logue Brook Dam

Observations at Harvey Dam and Drakesbrook Dam showed significantly less recreation activity than at Waroona and Logue Brook dams, and these dams should therefore be considered for new recreation opportunities.

* Please note that whilst a pro-forma template was used, surveys were undertaken by various staff members and so no guarantee can be made on the consistency of approach. While all efforts were made to avoid doubling up when counting, there can be no guarantee that some moving boats/vehicles were not counted twice or that every boat/person/vehicle was included within the count, as observations were made from a distance. There were no one-one-one surveys undertaken, or traffic counters used.

Table 1 Recreation visitor use data: Waroona Dam (Lake Navarino)

	2006					2007							2008		2009
	26/12 11:45	*27/12 09:00*	*28/12 10:00*	*29/12 11:00*	*30/12 11:30*	*02/01 10:00*	*19/01 19:30*	*26/01 11:30*	*27/01 14:00*	*28/01 13:00*	*06/04 11:30*	*22/04 12:30*	*12/04 10:20*	*25/04 13:30*	*10/4 11:00*
On dam															
Swimming	**18**	9	10	2	11	0	0	3	11	16	1	4	0	0	5
Canoeing/ kayaking	3	1	**10**	4	2	5	0	6	5	0	1	3	0	1	2
Ski boats	16	15	18	30	**33**	12	1	15	17	15	14	3	0	2	6
On shoreline															
Vehicles	77	85	118	110	126	23	40	115	**173**	115	38	14	10	65	38
Boats (excluding jet skis)	18	15	10	10	43	8	11	16	**54***	18	11	6	6	11	10
Boat trailers	11	8	23	22	50	15	1	8	**64**	24	11	5	5	11	13
Fishing/ marroning	1	0	0	0	3	0	**100**	0	0	2	0	2	0	0	0
Tents/ caravans	96	41	11	43	56	12	30	6	40	30	66	2	0	50	**115**
Mountain bikes	1	0	2	0	0	0	**10**	0	0	0	0	0	2	0	0
Horse riding	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Motor bikes	0	3	1	5	**6**	0	1	1	3	5	0	4	0	0	0

Table 2 Recreation visitor use data: Logue Brook Dam (Lake Brockman)

	2006					2007							2008			2009	
	26/12 13:30	*27/12 10:30*	*28/12 13:00*	*29/12 13:00*	*30/12 13:00*	*02/01 13:00*	*19/01 17:30*	*26/01 9:30*	*27/01 12:00*	*28/01 11:00*	*06/04 11:30*	*22/04 11:00*	*12/04 12:30*	*25/04 14:30*	*26/4 9:30*	*10/4 12:30*	*6/9 8:00*
On dam																	
Swimming	**7**	3	0	0	3	0	0	0	5	0	10	9	0	0	0	0	0
Canoeing/ kayaking	0	0	3	0	2	0	0	0	**4**	3	1	0	3	5	1	0	0
Ski boats	10	13	15	6	25	0	2	0	5	12	21	7	0	0	0	**27**	0
On shoreline																	
Vehicles	41	25	59	36	59	24	27	23	**102**	88	76	22	39	30	40	55	8
Boats (excluding jet skis)	7	11	15	13	**35**	10	3	6	26	28	27	8	13	15	14	18	0
Boat trailers	13	10	18	11	17	6	1	7	13	**33**	15	8	14	9	12	12	0
Fishing/ marroning	0	0	5	0	0	0	**41**	0	5	4	0	0	0	0	0	0	1
Tents/ caravans	3	0	**31**	24	10	15	13	14	30	10	28	0	14	0	22	17	4
Mountain bikes	0	1	0	3	0	0	**2**	0	0	0	0	0	0	0	0	0	5
Horse riding	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Motor bikes	0	1	12	9	4	1	0	1	**16**	**16**	**16**	0	4	0	3	0	4

Notes: Bolded numbers represent maximum counts for that recreation activity.
* DoW received a phone call on this day from a recreation skier saying that he had counted 50 boats and it was as busy as he could ever remember.

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Government of Western Australia
Department of Water

Looking after all our water needs

Water quality information sheet 4
November 2009

Water values and recreation in drinking water catchments: Results of a community survey

Background

In 2006 a proposal was submitted to government to use Logue Brook dam (a recreation and irrigation supply dam) for drinking water supply. Based on current policies this proposal would have meant prohibition of recreation on and within 2 km of the reservoir. As part of the community engagement process a survey was undertaken to gauge the community's views on the proposal itself, and other water management issues such as:

- the relative importance of water as an issue and different water uses
- appropriate uses of water sources
- appropriate activities in drinking water sources and their catchments
- preferred approaches to catchment management and drinking water protection issues.


Logue Brook dam

Results from questions on the above listed issues are relevant to the current review of recreation in drinking water source catchments.

Survey details

- 7000 surveys were sent out and 1017 adequately completed surveys were returned (response rate of 14.5%).
- Recipients were randomly selected from the electoral role.
- The survey area was Perth to Bunbury.
- The survey was designed by an independent research consultant, in conjunction with the Logue Brook dam project steering committee (made up of representatives from Camp Logue Brook, the departments of Environment and Conservation, Fisheries, Health, Sport and Recreation and Water, Harvey Water, recreation representatives, Shire of Harvey, Shire of Waroona and Water Corporation).
- Full details of the survey can be found in:

  Bruce, D 2006, *South West of Western Australia water catchment management issues, drinking water policy and Logue Brook dam: Community survey results*, Prepared for Department of Water, October 2006, available <http://drinkingwater.water.wa.gov.au> then scroll down to Logue Brook dam link web page.

Survey results

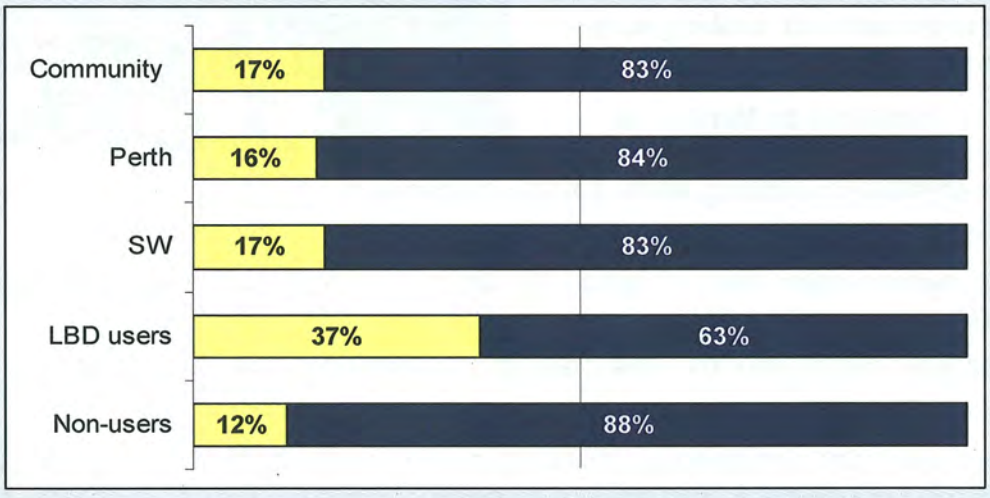
Key findings of survey include:

- Ensuring adequate drinking water supplies was seen as the most important issue (of those listed) in the south west – 96% of respondents saw this issue as being either very important or quite important.
- Household use (including drinking) was seen as the most important use of dams in the south west, and recreation and tourism as the least important use.
- 68% of respondents thought that drinking water dams should be used for no other purpose. Only 5% supported their use for water-based recreation, and 14% for land-based recreation.
- 83% of respondents preferred to protect drinking water by taking a preventative approach rather than relying on treatment
- If recreation was allowed in and around drinking water dams, 82% of the community thought that a 'user pay' principle should apply to meet the costs of any additional treatment.
- 70% of respondents felt that achieving the lowest possible risk to drinking water should take precedence over all other issues or uses of dams and their water.
- 67% of respondents preferred to retain the existing policy of keeping recreation and drinking water activities separate.
- Recreational users of dams generally placed a greater importance on the use of dams for recreation and tourism, and were more prepared to accept a greater risk of contamination and increased treatment costs by allowing recreation than non-users of dams.

Rely on treatment technologies to make our drinking water safe – which is more expensive but allows more potentially contaminating development and recreational activities to occur in our drinking water catchments

Or

Protect our water by avoiding potentially contaminating development or recreational activities in our drinking water catchments



From Bruce (2006)

SW = South West, LBD = Logue Brook dam

The Department of Water is planning to repeat this survey, with removal of reference of Logue Brook dam. This is to ensure respondents are only considering the recreation access and drinking water protection issues.

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Looking after all our water needs

Water quality information sheet 5
November 2009

Surveillance and enforcement in our drinking water catchments

There are two acts that protect public drinking water source areas (PDWSA), the *Metropolitan Water Supply Sewerage and Drainage Act 1909* and the *Country Areas Water Supply Act 1947*, both managed by the Department of Water. PDWSA are proclaimed under these acts making the relevant by-laws enforceable. By-laws carry penalties for unauthorised activities (refer to WQIS No. 14 for more information).

Illegal activities

Commonly occurring activities posing risks to water quality in the Perth Hills and south-west catchments include:

- rubbish dumping
- vandalism/damage to infrastructure and signs


Abandoned car body

- hunting
- camping and access to water bodies


Dead bird in Harris dam from hunting

- 4WD and off-road bikes access
- fishing and marroning


Rubbish dumping at Canning


Vandalised gate, Lennard 4WD track Collie

Delegation

The Department of Water delegates surveillance and enforcement of most of the Perth Hills and south-west catchments to the Water Corporation. Water Corporation rangers conduct regular patrols of the catchments and their reservoir protection zones. They have the power to prosecute people who are carrying out unauthorised activities.

Working together

Water Corporation not only has powers to prosecute people under the water acts (above) but they also have a range of other powers including:

- Fisheries officer powers
- Department of Environment and Conservation (DEC) ranger powers
- control of off-road vehicles
- ability to issue fines for littering and illegal dumping

Having powers under other acts makes prosecution more efficient and means more significant penalties for offenders.

Rangers regularly conduct joint patrols and liaise with other agency's rangers and the WA Police. For example, on 24th May 2009 Water Corporation, DEC and Shire rangers and the Police conducted surveillance in the Mundaring, Canning and Kangaroo Gully catchments to address the frequent use of these areas for illegal trail bike riding. 77 official warnings were issued as a result of the blitz.

Damage from trail bikes in Mundaring

Trail bike riding in Canning

Snapshot

Water Corporation undertook 254 prosecutions against water acts by-laws in the Perth Hills catchments in 2008/09. They have reported issuing the following warnings and prosecutions for various illegal activities over the past two years:

	Warnings	Prosecutions
	Water Acts	
2008/09	187	254
2007/08	33	192
	Other Acts	
2008/09	0	29
2007/08	22	36

Sign indicating prohibited zone at Mundaring

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Looking after all our water needs

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WA's drinking water source protection program

Introduction

With a continued drying climate and an increasing population, there is growing dependence on WA's water resources. In order to maintain safe, good quality drinking water, we need to continue to manage and protect water resources for current and future generations.

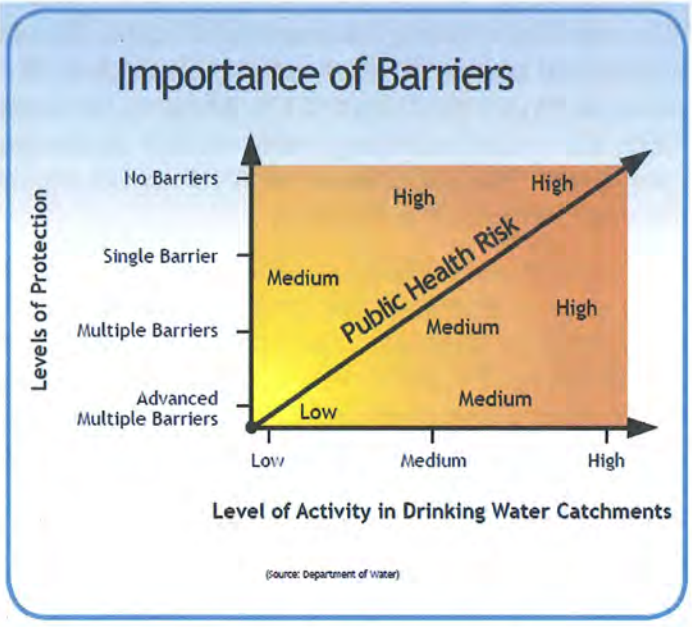
The Department of Water protects this precious resource by enacting legislation, implementing the *Australian drinking water guidelines* (ADWG) and departmental policy and providing strategic input to the land-use planning process.

Legislation

The two most important acts that protect public drinking water source areas (PDWSA) are the *Metropolitan Water Supply Sewerage and Drainage Act 1909* and the *Country Areas Water Supply Act 1947*, both managed by Department of Water. PDWSA are proclaimed under these acts as water reserves, catchment areas or underground water pollution control areas, making the relevant by-laws enforceable. By-laws carry penalties for specific unauthorised activities such as entry into reservoir protection zones. Surveillance and by-law enforcement is generally carried out by the Water Corporation. Other agencies' legislation also has jurisdiction for protecting water quality including the *Environmental Protection Act 1986*, *Conservation and Land Management Act 1984* (Department of Environment and Conservation) and the *Health Act 1911* (Department of Health).

Australian drinking water guidelines

WA's drinking water source protection is strongly influenced by its commitment to implement the ADWG; most specifically the 'catchment to consumer' preventative risk-based, multiple barrier approach. Barriers include catchment protection, reservoir detention, water storage and treatment. It is important to maintain multiple barriers (see diagram).



The guidelines outline 12 elements as part of a framework for protecting PDWSA. Element 2: *Assessment of the drinking water supply system* is implemented through the preparation of drinking water source protection assessments and Element 3: *Preventative measures for drinking water quality management* is addressed via the preparation of drinking water source protection plans.

Department of Water policy

Drinking water source protection plans (DWSPP) have been or are being developed for all drinking water sources around WA. They provide an overview of a water source, its land uses and risks to water quality. DWSPP propose recommendations and strategies to address these risks, and are produced in consultation with stakeholders. Priority areas and protection zones are also determined through the DWSPP process, and provide additional levels of protection to a PDWSA.

Three different ***priority areas*** are identified within PDWSA:

- Priority 1 (P1) areas are managed for risk avoidance
- Priority 2 (P2) areas are operated under the principle of risk minimisation
- Priority 3 (P3) areas are defined for risk management.

Protection zones are defined in the immediate vicinity of water extraction points as these are the most vulnerable areas to contamination. ***Wellhead protection zones*** are declared around bores and are generally circular in shape with a 500m radius in P1 areas and a 300m radius in P2 and P3 areas. ***Reservoir protection zones*** are identified around surface water bodies and generally extend 2km from the high water mark. Wellhead and reservoir protection zones are recognised in legislation and restrictions apply to access and activities.

Land use planning framework

Good land use planning is essential for the protection of water resources and relies on a solid decision-making framework for future developments. State-wide planning policies ensure that planning schemes and strategies identify PDWSA as special control areas, thus ensuring their protection by shaping land-use decisions. For example, State Planning Policy 2.7: *Public drinking water source policy* requires decision making authorities to consult with the Department of Water when making decisions about subdivision or development within a PDWSA.

The Department's Water quality protection note: *Land use compatibility in public drinking water source areas* guides land use planning decision makers on activities that are considered "acceptable", "compatible with conditions" or "incompatible" within each of the priority areas (P1, P2 or P3) according to their level of water quality risk. Statewide policy No.13: *Policy and guidelines for recreation within public drinking water source areas on crown land* provides similar guidance for different recreational activities.

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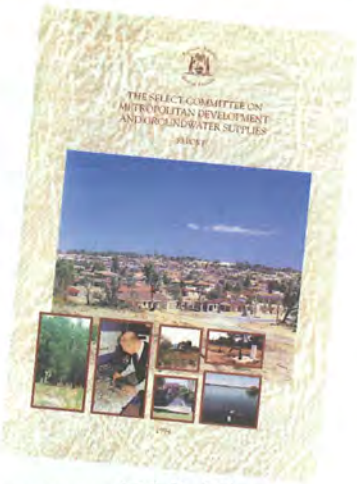
November 2009

Looking after all our water needs

Select committee report on metropolitan development and groundwater supplies - summary

"Sometime after year 2021 when the population [reaches] two million, sources of water will become more expensive, remote and difficult to develop. It is in this context, when Perth's existing sources of water will become even more valuable especially to our children and grandchildren, that the Select Committee has examined the issues relating to development over catchment areas."

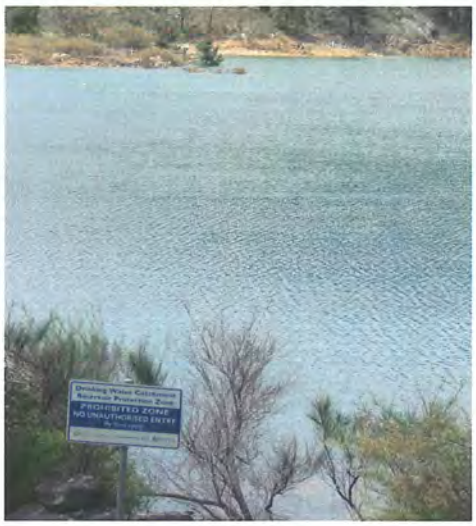


In 1994, the *Select Committee on Metropolitan Development and Groundwater Supplies* was formed due to increasing conflict between land use and groundwater protection. It reported to the Parliament of WA with recommendations on how to manage development and still protect our precious groundwater resources. Whilst the focus of the committee's report is on groundwater, many of the recommendations can be applied to managing surface water catchments. This information sheet summarises the main findings of the Select Committee's report.

International examples

The Committee met with experts from around the world and took an international tour to the UK and the USA. They saw examples of developments made in an ad hoc manner resulting in difficult decisions about development and the protection of water resources. Those cities now spend billions of dollars trying to repair the damage to their drinking water sources. The report states that with foresight, WA has the opportunity to avoid the same costly mistakes made by others.

"Experts around the world have expressed their envy of our relatively pristine water supply and have advised us to protect [it] at all costs."



Protection vs. treatment

The Committee found that cleaning up a drinking water resource costs many times more than establishing a protection program. They stated that the old saying "an ounce of prevention is worth a pound of cure" was very true when it comes to drinking water sources. The report says that government must meet the community's expectation of a high standard of water but also gauge what cost they are willing to pay for that supply. Also, costly treatment for serious contaminants increases the consequences of failure and can create toxic or unpalatable by-products.

"An ounce of prevention is worth a pound of cure."

Extract of recommendations from the select committee report:

3.2	"All government agencies should agree, when considering developments in Priority 1 areas, that protection of the groundwater resource will be given primacy over all other issues."
8.2	"... to give the highest priority to the protection of water supplies for present and future generations on a sustainable basis when considering development on public water supply[ies]. The Committee should adopt the precautionary principle, when considering proposals for developments ..."
14	"... [ensure] the protection of groundwater supplies is not compromised by incremental decision making." For example, a decision to allow one small development in a drinking water catchment might pave the way for other similar approvals and before long the catchment becomes polluted and unusable.
18	"... that the Water Authority, with support from other agencies, continue to maintain a high class water supply to the people of Perth and the option of reducing water quality standards should not be contemplated under any circumstances."
24.1	This recommendation talks about acceptable and unacceptable activities within Priority 1 areas. "Recreation, such as bushwalking and horse riding with limitations on motorcycle riding and other activities involving fuels or chemicals" is listed as an acceptable activity in Priority 1 areas. However it must be remembered that this report is talking about groundwater. The risks to surface water from these types of activities are higher due to the ease in which contaminants can reach the water body (i.e. rainfall washing contaminants into feeder streams and the reservoir).
27	"... Government should take into account the full cost of development over groundwater catchments, including the benefits of development, the availability of land, the treatment costs of water, the possible loss of consumer confidence in the water quality, the possible loss of aquifers as a water supply and the economic, social and environmental problems associated with transportation of water from remote areas."

"Water is indeed our most precious resource. The availability of fresh water is essential to Perth's future and our generation must protect our water resources for future generations."

Citation: Board M (MLA Member for Jandakot and Chairman of the Select Committee) 1994, *The Select Committee on Metropolitan Development and Groundwater Supplies – Report*, Legislative Assembly, Perth, Western Australia. You can obtain a copy of the select committee report from the State Law Publisher phone (08) 9426 0000 or visit www.slp.wa.gov.au.

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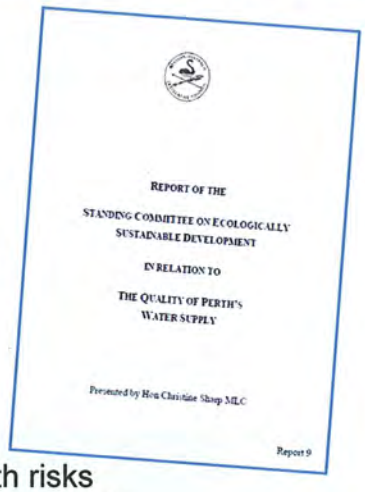
Looking after all our water needs

Report of the standing committee on ecologically sustainable development in relation to the quality of Perth's water supply - summary

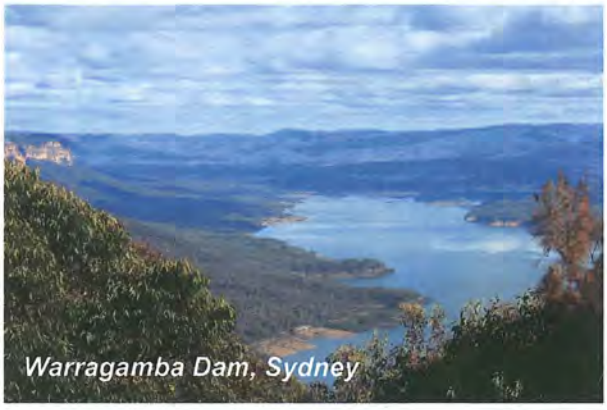

REPORT OF THE
STANDING COMMITTEE ON ECOLOGICALLY SUSTAINABLE DEVELOPMENT
IN RELATION TO
THE QUALITY OF PERTH'S WATER SUPPLY
Presented by Hon Christine Sharp MLC
Report 9

In 1997, a Parliamentary standing committee on ecologically sustainable development was established in Western Australia. After the Sydney water crisis of 1998, the committee's function was amended to include an investigation into the adequacy of current systems of monitoring, preventing contamination, dealing with health risks and general water quality of Perth's drinking water supplies. This information sheet summarises the main findings of their report released in 2000.

> ***"The Committee considers it is necessary to anticipate and prevent harm in water quality management rather than just react to problems after they arise."***

Sydney water crisis

Two pathogens called cryptosporidium and giardia were detected in Sydney's Warragamba Dam in July of 1998, and authorities responded by issuing a 'boil water alert' to consumers. Fortunately, no serious outbreak of disease occurred. However the scare was enough to alert Australians to the dangers of pathogens in drinking water, and a formal inquiry was launched in Sydney, with other states and territories following.


Warragamba Dam, Sydney


Picnickers at Mundaring Weir, Perth

Pressures on our drinking water catchments

The standing committee's report notes that the Water and Rivers Commission (now Department of Water) and the Water Corporation were under increasing pressure to compromise catchment protection by permitting further multiple uses in catchments. This was of concern because full water treatment (just one part of a multiple-barrier system against contamination (see WQIS No. 6 and 18)) was viewed by the Committee as the last resort to protecting water quality. A similar situation still exists in Perth today.

Prevention is the key

The Committee found that the adoption of catchment protection was the major weapon in preventing contamination of water supplies. Recommendation 3 states "that the protection of water quality to meet public health objectives have primacy in the planning of integrated catchment management."

The Committee also considered the following to be key components of ensuring a high quality water supply:

- adequate monitoring system
- measures to prevent contamination
- being able to detect and deal with identified risks
- mechanisms for reporting to Government and consumers.

> ***"... to maintain the quality of Perth's water the first priority should be to protect the water through good land use planning to protect the catchment providing the water ... Using treatment to deal with contamination is a second-best option."***

The report also found that the water catchments feeding Perth's dams are amongst the cleanest in the world. The committee identified that this was due to the foresight of earlier generations in keeping human habitation and development out of these catchments.

> ***"Recommendation 2: That water source protection plans for the Perth metropolitan water supply be completed as a matter of urgency."*** **This recommendation has since been completed by the Department of Water.**

Support for existing approach

The Committee recognised the value of the preventative risk based management approach to drinking water source protection and acknowledged support of the preparation of drinking water source protection plans and the continued implementation of the Australian Drinking Water Guidelines.

Community awareness

The Sydney Water Inquiry found that there was an absence of a public education program in regards to water quality, and stated that the community must have an opportunity to develop an informed understanding of water quality issues and risks to public health. The Committee found that WA was comparatively well-placed due to the establishment of the Advisory Committee for the Purity of Water (see WQIS No. 17) that reports to the Department of Health. They stated that this has enhanced public confidence in the reporting of water quality data.

In summary

The 2000 standing committee report provided a great deal of support for WA's existing framework of legislation, agency cooperation, implementation of the ADWG and development of water source protection plans. The preventative risk based, multiple barrier approach was identified as the best way to protect our drinking water sources. It has done and should continue to be used to protect the public health interests of Perth's water consumers.

Citation: Sharp Hon C (MLC and Chairman of the Standing Committee) 2000, *Report of the Standing Committee on Ecologically Sustainable Development in relation to the quality of Perth's water supply,* Legislative Council, Perth, Western Australia. You can obtain a copy of the standing committee report from the State Law Publisher phone (08) 9426 0000 or visit www.slp.wa.gov.au.

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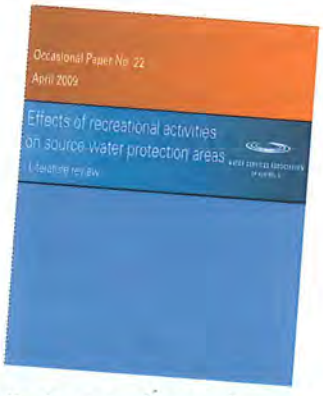
Looking after all our water needs

Summary of occasional paper no. 22 - *Effects of recreational activities on source water protection areas*



> ***"The raison d'etre [reason for being] of the Australian urban water industry is safe and reliable drinking water and it is imperative that all of the potential risks and threats to drinking water quality are viewed in this context."***

Background

In recent times, water authorities all over Australia have been placed under increasing pressure to open drinking water catchments and their water bodies to a wider variety of recreational pursuits than has traditionally been allowed. Hence there has been growing community interest in the effects of recreation on drinking water quality. To help inform both sides of the debate, the Water services association of Australia (WSAA) undertook a literature review on the topic and produced Occasional paper no. 22 in April 2009. This information sheet summarises the main findings of that paper.

Recreational activities pose significant risks to drinking water sources

Recreational access to drinking water catchments causes impacts on soil, flora, fauna and aquatic ecosystems and introduces fire, pests and diseases. The major potential impact is contamination of water supplies with pathogens, from human and animal faecal contamination. Recreation is commonly cited in literature as a possible cause of waterborne disease outbreaks, via the faecal-oral route. There are many mechanisms by which human faeces can enter a drinking water source:

- deliberate defecation into water sources
- accidental defecation (faecal smears from an earlier defecation event or accidental faecal release from flatulence or diahhroea, particularly in children)
- failing septic tanks
- contamination on land washed into rivers and reservoirs by rainfall
- leaking and discharge from sewerage systems

A review of literature revealed that tens of millions of pathogens were likely to be shed on a daily basis where body contact recreation was allowed. Even a single bather was found to shed around a million indicator bacteria per bathing event (Gerba 2000).

Even where people are not allowed direct access to reservoirs, the deposition of faecal contamination in locations other than designated sanitation facilities is inevitable. A detailed study revealed that a proportion of recreators will not follow appropriate sanitary behaviour even with signage and management plans in place (Cilimburg et al. 2000). So the presence of humans in the vicinity of reservoirs will lead to faecal deposition at locations where rain could transport faeces into the reservoir.

Water quality treatment

Current observations show that water treatment does not always remove contaminants even when it is working properly, it only reduces their concentration. Treatment barriers can fail due to a range of natural or human causes resulting in little or no protection to consumers from contamination. Ingestion of just one single pathogen is enough to cause infection. This can lead to illness, hospitalisation and even death.

> ***"As water treatment practices continue to evolve a commonly heard view is that we no longer need buffer zones because we now have the technology to 'engineer out the risks'. Nothing could be further from the truth."***

Nature provides the best water treatment

Natural areas provide many benefits to humans that come from plants, animals and micro-organisms acting together in an ecosystem. These are known as ecosystem services; water filtration is an example of this. When ecosystem services fail, mostly due to many years of human impacts, they are replaced by technological reproductions that are expensive and in some cases inferior to their natural counterparts. The ultimate and most effective barrier to water supply contamination is a pristine water supply catchment.

> ***"Where relatively light drinking water treatment is currently provided, a legacy of the level of protection of the catchments to date, [it] would not be anywhere near capable of mitigating the water quality and health-related impacts likely to be associated with recreational access...in these catchments"***

Multiple barrier approach to drinking water protection

The principle of adopting multiple barriers between contaminants and the consumer is now firmly established and recognised world-wide as best practice for providing safe drinking water supplies. It is also the approach advocated by the *Australian drinking water guidelines* (refer to WQIS No. 18 for more information).

Recent outbreaks of illness and even death through contamination of drinking water supplies have occurred in the USA (Milwaukee, late 1980s – early 1990s), UK (mid-late 1990s), Australia (Sydney, 1998) and Canada (Walkerton, 2000). Following each of these incidents, major changes were made to drinking water regulations and guidelines, and in all cases the multiple barrier approach was promoted.

Once source protection is reduced, contamination risk increases. Water service providers will then need to introduce more barriers to prevent contaminants reaching consumers. As a result of increased recreation, costs will increase (e.g. expensive treatment) and because treatment only reduces contaminants (i.e. does not entirely remove them) there is an increased risk of contaminated water reaching consumers.

Can we compromise?

Compromises, where some level of recreation is provided, are possible but can be difficult to implement in practice. Signs, education and awareness raising are all good ideas, but it only takes a small percentage of users to ignore them for significant impacts to occur. If recreational access is provided, substantial attention needs to focus on management strategies to limit and control the use. Such restrictions are controversial as they run counter to the basic objective of providing public access. However if access is provided, strict limits are needed not only to protect the water resource values, but to protect the ecotourism values to maintain the quality of the recreation experience sought (Newsome et al. 2004 and Manning 2004).

Citation: Krogh M, Davison A, Miller R, O'Connor N, Ferguson C, McClaughlin V and Deere D 2008, *Effects of recreational activities on source water protection areas – Literature review,* Water Services Association of Australia, Melbourne, Australia. You can download Occasional paper no.22 from the Water Services Association of Australia website www.wsaa.asn.au for a cost. Search for product code PP058.

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Looking after all our water needs

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Recreational access to drinking water catchments and storages in Australia

Introduction

The Cooperative Research Centre (CRC) for Water Quality and Treatment published their report 24 – *Recreational access to drinking water catchments and storages in Australia*, in 2006. This information sheet outlines the key findings of this report, the principles that these findings are based on, and how these principles are implemented in Western Australia.

The full CRC report 24 can be accessed at www.waterquality.crc.org.au/Publication_OccPpr_ResRpts.htm, where you scroll down to report number 24.

Key finding 1 - Considerable variation exists across Australia in relation to the levels of recreational access to drinking water source catchments

The spectrum ranges from fully closed catchments, to catchments that allow access for a wide variety of recreational activities. Generally, recreational access is not permitted to permanent supply reservoirs while some form of limited recreation is allowed in outer catchments.

In WA, controlled recreational access is allowed in outer catchments away from reservoir protection zones (or RPZ- which is the area including a reservoir, and within two kilometres of the high water mark surrounding a reservoir).

For further information refer to the Department of Water's Statewide policy 13 – *Policy and guidelines for recreation within public drinking water source areas on crown land.*

Key finding 2 - Recreational access has been conclusively shown to have negative impacts on water quality

This study demonstrates a clear relationship between recreation and water quality. The complexities involved, shortfalls in data, and the present limitations of science in this respect mean that management approaches and decisions need to be made based on principles and probabilities. WA has adopted the principles of the *Australian drinking water guidelines 2004* (ADWG) (see WQIS No. 18). These guidelines recommend a preventative risk-based approach for the protection of drinking water. They also note that pathogens present the greatest risk to the contamination of drinking water (with healthy people, as well as those who are sick, often being the carriers of pathogens).

Key finding 3 - Decision makers often need to consider recreational access in relation to water quality, ecology (biodiversity), security and legal aspects

The state government agencies responsible for decision making in drinking water source catchment and storage areas are the departments of Water (DoW), Environment and

Conservation (DEC) and Health (DoH). These agencies implement legislation and policy. Other agencies and stakeholders also have significant input to and influence on existing drinking water protection and supply in WA. Factors that are considered in decision making for policy and legislation include:

- the provision of safe drinking water now and in the future;
- site compatibility for land uses and recreational activities, and alternative sites that may be available;
- alternative sites for proposed drinking water supply;
- the costs of land and water assets; and
- the costs of high levels of treatment of drinking water prior to supply.

Key finding 4 - A joint approach is recommended to protect the biodiversity (ecology) of a drinking water source catchment as well as the quality of water and security of supply

The protection of both biodiversity and drinking water are highly compatible environmental values. There tend to be information gaps, both for biodiversity conservation and drinking water protection. Generally, it is difficult and costly to fill these information gaps. The *precautionary principle* has long been used for biodiversity conservation when there are information gaps, and can equally be used to protect water quality and the security of supply.

Key finding 5 - Water treatment barriers are not absolute

Treatment was the cornerstone of drinking water protection in developed nations for most of the 21st century. This changed around the world, when it was recognised that treatment is not fail-safe. Greater protection of public health is achieved by a combination of catchment protection and treatment.

Key finding 6 - Public policy for drinking water protection endorses 'catchment protection' as the most important barrier in a drinking water protection program

Protecting catchments to the highest degree practicable will minimise risks to water quality, as well as maximise the protection of public health, and reduce the costs of treatment.

WA's drinking water protection program has been guided by two parliamentary committee reviews in 1994 and 2004 (see WQIS No. 7 and 8). Key conclusions of these reviews were that "an ounce of prevention is worth a pound of cure" (Parliamentary Select Committee 1994); and "the first priority should be to protect the water through good land use planning" (Standing Committee on Ecologically Sustainable Development 2000).

Key finding 7 - Security of drinking water supply and associated assets, including risks associated with wildfires and arson

A critical issue throughout Australia is the increased risk of wildfire due to a number of factors including recreational access. Picnicking and camping increase the risk of accidental wildfire. Additionally, the risk of arson is increased when there is ease of access to catchments. Australian water utilities need to consider the threats posed by deliberate damaging, or interfering with, water supply infrastructure. As such, the security of water supply infrastructure needs to be considered as part of the overall question of recreational access to drinking water catchments and storage areas.

Government of Western Australia
Department of Water

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Looking after all our water needs

Historical recreation reviews and studies

Introduction

The Department of Water's Statewide Policy 13: *Policy and guidelines for recreation within public drinking water source areas on crown land* (2003) provides guidance on the acceptability of various recreational activities within drinking water source catchments. The development of this policy drew on the findings of a number of previous reviews and studies, which are summarised below.

Recreation access reviews

ACPoW working group review

In 1977, the Advisory Committee for Purity of Water (ACPoW) established a working group to examine the issue of recreation in water catchments between the Helena and Collie rivers.

A wide range of recreational activities (in particular 'passive recreation' e.g. sightseeing, picnicking, photography and nature study) were found to occur. Some environmental damage to vegetation, soils and water quality was noted during the study, and there appeared to be a general lack of understanding amongst the public on the extent of water supply catchments and the potential risks of their actions to water quality.

The working group recommended better signage, increased surveillance and implementation of a public education program. They also provided guidance on types of activities that should be discouraged in certain areas and recommended a zoning approach for designating acceptable activities. This included a recommendation for a 2 km prohibited zone around reservoirs for domestic water supply, where public access is excluded (with the exception of designated roads).

Picnic facilities downstream of South Dandalup dam

AWRC review and workshop

In 1980 the Australian Water Resources Council (AWRC) established a working group to examine recreational use of urban water supply dams. Their findings were compiled into a report released in 1984. The AWRC then held a workshop to develop guidelines for use by management authorities. These guidelines recommended that consideration should be given to recreational access to maximise the community benefit of water resources, but that the primary purpose of urban water storages must always be to provide a safe and

potable water supply. The guidelines also provided advice on the appropriateness of recreation as a secondary use of a water supply dam for a range of circumstances.

WAWRC review

In 1983, the Western Australian Water Resources Council (WAWRC) developed a working group to examine the issue of increased demand for recreation on and within the catchments of water supply reservoirs (both drinking water and irrigation supply) and develop guidelines that could be applied in WA. Similar to the AWRC review, their report (released in 1985) highlighted that recreation needed to be recognised as an important use of reservoirs, but at the same time should be permitted only to the extent that is does not interfere with the primary objective of a reservoir. On water supply reservoirs where chlorination is the only form of treatment, it was recommended that no water-based recreation (including swimming, wading, boating, fishing) should take place. However, on irrigation reservoirs it was recommended that few constraints need apply. The guidelines recommended that reservoirs and their catchments be classified as one of four classes and provided guidance on the potential acceptability of activities within each class.

Recreation needs and opportunities studies

WAWRC study

This study (released in 1987) examined current recreation opportunities in the area from Perth to Bunbury and identified sites where recreation could be enhanced. A number of reservoirs, streams, wetlands and estuaries were identified as providing or having the potential to provide significant water-based or water-orientated recreation opportunities.

WG Martinick and Associates study

This study (released in 1995) investigated the current and likely future demand for recreation in all regions of WA and assessed whether water bodies would be likely to meet that demand. Findings included:

Canoeing, Lane Pool Reserve

- In all regions there is likely to be an increase in the number of recreationalists.
- Most waterbodies are currently under-utilised by recreationalists and offer room for further expansion of use.
- The Perth and South West regions were identified as the areas with the greatest pressures and therefore requiring the highest level of planning attention.

Water Corporation studies

In 1997, Water Corporation documented current and historically approved recreational activities in Perth metropolitan drinking water catchments. A range of different recreation activities were identified as being approved in the catchments, including car rallies, bushwalking, camping, orienteering and rogaining. A further study undertaken by consultants for Water Corporation aimed to determine the frequency of activities, and their current and potential impact. High risk activities included car rallies and camping, while lower risk activities included bushwalking, formal walk trails and club-based orienteering and rogaining.

Government of Western Australia
Department of Water

Looking after all our water needs

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Background to Statewide policy No. 13 - *Policy and guidelines for recreation within public drinking water source areas on crown land* (2003)

Introduction

The protection of drinking water source catchments is the responsibility of the Department of Water. The aim of the drinking water source protection program is to help ensure the availability of a reliable, safe, good quality, drinking water supply to consumers now and in the future. This responsibility and aim are consistent with the *Australian drinking water guidelines* (ADWG) 2004 catchment to consumer framework.

Within the ADWG framework the protection of drinking water sources is recognised as the first and most important barrier. Maintaining the quality of water at the source has the advantages of maximising the protection of public health and reducing the costs of water supply systems.

Policy 13 was prepared by the Department of Water to help protect the quality of water in public drinking water source areas (PDWSA) from the negative impacts of recreation. It implements existing legislation and water resource policy. Policy 13 was publicly consulted and published in 2003 and is subject to a 5 year review period. Government has recently determined that the issue of recreation in drinking water catchments is significant enough to warrant a parliamentary committee review, proposed to be completed in July 2010.

Statewide policy 13 - key points

1. Pressure for recreation access to the natural environment (including PDWSA) continues to increase with Perth's population increase. Along with this increasing pressure is an expanding list of recreation types.
2. 'Controlled access' to drinking water sources (with appropriate management measures) can provide an acceptable level of risk. Table 1 (Compatibility of land based recreational activities) and Table 2 (Compatibility of water based recreational activities) of policy 13 indicate what recreational activities can be undertaken. Contamination risks are decreased by limiting the recreational access to PDWSA.
3. Studies and reports into recreation and drinking water source protection issues considered during the preparation of policy 13 included:
    - 1977 Advisory Committee for the Purity of Water report *Study of catchments and recreation in Western Australia*.
    - 1980 Australian Water Resources Council (AWRC) working group formed to investigate recreational use of urban water storages and catchments.

- 1984 AWRC report from the working group titled *Recreational use of urban storages and catchments*.
- 1984 AWRC workshop that established draft guidelines for water authorities for recreation in catchments. The guidelines were eventually published in the 1987 report *Desirable guidelines for the recreational use of urban water storage and their catchments*.
- 1985 Western Australian Water Resources Council guidelines as outlined in their report titled *Recreation on reservoirs and catchments in Western Australia*. These guidelines were based on the AWRC draft guidelines.
- 1987 WAWRC report *Recreational opportunities of rivers and wetlands in the Perth to Bunbury region* prepared as part of the process in developing the draft allocation plan for the region in 1991 *Safeguarding our water resources: Perth-Bunbury draft regional allocation plan*
- 1994 Select Committee report on Metropolitan Development and Groundwater Supplies
- 1995 WAWRC working group investigation to review the supply and demand for terrestrial based water-based recreation in Western Australia.
- 1997 Water Corporation project with the objective to "list the recreational activities in Perth Metropolitan drinking water catchments managed by the Water Corporation which have current approval in the form of an agreement or have been approved in the past ten years by the Water Corporation or its predecessors".
- 2000 Standing Committee on Ecologically Sustainable Development in relation to the Quality of Perth's Water Supply recommendations

4. Areas close to collection points for drinking water sources (e.g. reservoirs and production bores) need special protection. If contamination incidents occur close to water sources or extraction points there is little time to respond.
5. On ground liaison and cooperation between different management authorities and public awareness are important factors for the success of policy 13 in protecting water quality.

Conclusions

1. Many factors considered in the setting of existing legislation and policy will be reconsidered by the Standing Committee on Public Administration inquiry into recreation activities within PDWSA.
2. From a 2006 community survey looking at water values and recreation in drinking water catchments (see WQIS No. 4) it is clear that recreational access to drinking water source catchments is still a high priority to recreation groups, but a low priority for the wider community.
3. The benefits of recreation to improve public health and good water quality to keep the public healthy is agreed by all stakeholders.
4. It will be governments role to consider the findings of the Standing Committee report. Government's ultimate decision of how best to deal with recreation access to drinking water source catchments in WA will then need to be reflected in the legislation and policy of key government agencies such as the Department of Water, Department of Health, Department of Environment and Conservation and Department of Sport and Recreation.
5. For an update of the parliamentary committee review process you can visit www.parliament.wa.gov.au or contact the Department of Water via email at drinkingwater@water.wa.gov.au.

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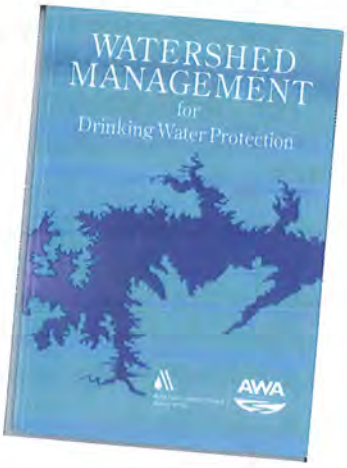
Summary of Watershed management for drinking water protection, chapter 8, *Recreational access to source water reservoirs and catchments* Australian Water Association and American Waterworks Association, 2008 (Michael A. Anderson, Rachael Miller, Perri Standish-Lee)



This publication is an international guide for catchment management and protection. Topics covered are based on the recommendations of delegates at the March 2005 joint catchment management seminar/workshop in Hawaii.

Australian drinking water guidelines

The *Australian drinking water guidelines* (ADWG) and its preventative risk-based, multiple-barrier framework, guides drinking water protection in Western Australia. The ADWG emphasise the need to avoid waterborne disease outbreaks through the '*protection of catchments from human and animal waste as a priority*'.

Summary of recreational activities findings

> ***"Treatment barriers, which have been known to fail, only reduce contaminant concentrations, so residual risk persists"***

Recreational activities in drinking water catchments can have direct and indirect impacts on water quality, safety and supply security of the source water, putting higher expectation on downstream water quality protection barriers, such as water treatment.

Permitting recreational access can be contrary to source water protection. It weakens the first barrier, the catchment, by reducing the ability of the catchment to mitigate risk, as well as contributing more risk, necessitating higher levels of treatment to compensate for potentially poorer source water quality.

> ***"if alternative areas can be provided for the activity, then these can be pursued."***

Recreational access in catchments varies across Australia, closed catchments; controlled; access; and open access catchment exist. In most cases, recreation access in not permitted on direct supply sources, but is allowed on pump-back or emergency sources. Some form of land-based recreation is often permitted in areas some distance from the reservoir or off take.

Water-based recreation

> ***"Recreational activity has been conclusively shown to have negative impacts on drinking water quality"***

Recreational activities that involve direct body contact with water, such as swimming, are of great

concern to water resource managers. While studies demonstrating degradation of water quality in source water reservoirs as a direct result of body contact recreation are limited, substantial microbial contamination has been found in many recreational waters that result in large numbers of annual outbreaks of diseases within the recreational community. Outbreaks occurred in fresh water, for example lakes and rivers, as well as treated waters such as swimming pools.

> ***"...such activities* [body-contact recreation] *were recognised to increase the overall risk of infection relative to the baseline of no body-contact recreation"***

Because of its resistance to chlorine disinfection, *Cryptosporidium* is the pathogen of greatest concern. The large percentage of outbreaks due to *Cryptosporidium* in treated water underscores the resistance of this organism to conventional treatment. This has implications for water treatment options, as body-contact recreational use can result in microbial contamination of source water supplies with organisms that resist conventional treatment. Body contact recreational use can also result in increased illness, especially in the recreational community by a wide range of pathogenic organisms, including *E. coli* and *Shigella sonnei.*

Two-stroke outboard motors can release significant amounts of fuel into the water body in the unburnt fuel passing through the engine to the exhaust. Benzene, toluene and xylene (known carcinogens) have been found in lakes and reservoirs because of recreational motorised watercraft. Inputs from motor operation, spills during refuelling and leaks on boats and fuel storage facilities all contribute to contamination.

Land-based recreation

It has been shown that activities within the catchment can potentially degrade water quality. Animal waste, such as from dogs and horses, even away from the reservoir or rivers can be flushed into the receiving water body during periods of rainfall causing runoff.

> ***"The complex interrelationships that characterise watershed* [catchment] *processes make it difficult to provide a quantitative estimate of the extent of impact given an anticipated or measured quantity of recreational access"***

Sanitary facilities can leak and release microbial contaminants to the surface and subsurface that may find their way into the water supply.

Even when sanitary facilities are fully functional and pet waste is eliminated, hiking, biking, and other land-based activities can result in accelerated erosion of soil within the catchment, introducing nutrients, pathogens and sediment to the source water supply. Sediment in particular can reduce the effectiveness of downstream chlorination.

> ***"Moreover, uncertainties are always attached to predictive tools or models. The result of this is irreducible uncertainty is that decisions must be made based on principles and probabilities (risk assessment)"***

Best Practice

Best practice in the management of recreation in water supply reservoirs is to err on the side of caution. Recreational use without a rigorous risk assessment is not recommended.

In view of strong public and political pressure for recreational access, water resource managers must be willing to stand firm to ensure that water quality is not comprised.

Australian Water Association and American Waterworks Association 2008, *Watershed management for drinking water protection*, Australian Water Association, Australia.

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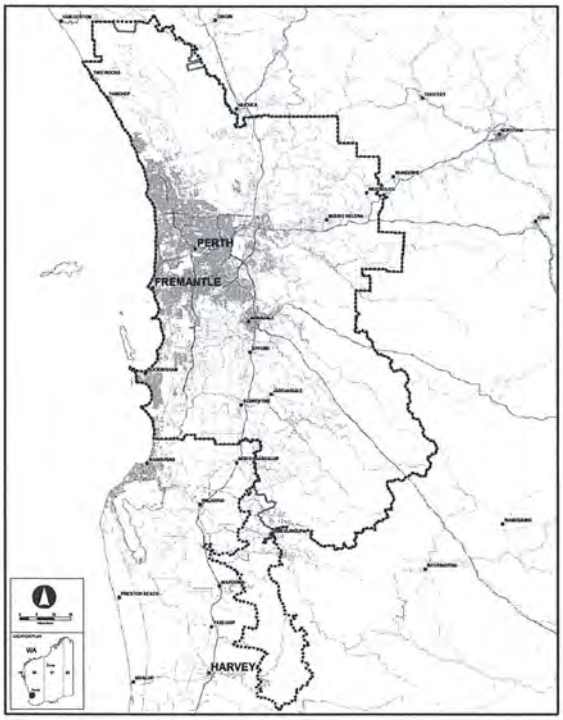
WA's legislation for drinking water source protection

Introduction

The two most important acts that protect public drinking water source areas (PDWSA) in WA are the *Metropolitan Water Supply Sewerage and Drainage (MWSSD) Act 1909* and the *Country Areas Water Supply (CAWS) Act 1947*, both managed by the Department of Water. PDWSA are proclaimed under these acts as water reserves, catchment areas or underground water pollution control areas, making the relevant by-laws enforceable. By-laws carry penalties for specific unauthorised activities such as entry into reservoir protection zones. Surveillance and by-law enforcement is generally carried out by the Water Corporation under delegation from the Department of Water (see WQIS No. 5).

Metropolitan Water Supply Sewerage and Drainage Act 1909

PDWSA's that are located within the Metropolitan Water Supply, Sewerage and Drainage Area (see map below), are proclaimed under the *MWSSD Act 1909.* The Act provides for the proclamation of PDWSA as catchment areas, water reserves or underground water pollution control areas. The *MWSSD By-laws 1981* provides detail on prohibited activities within metropolitan PDWSA, including certain recreational pursuits (see table below). The maximum penalty for an offence under these by-laws is only $200. This penalty is not a strong deterrent and needs to be updated.



By-law	Prohibited activity
4.3.2	Bodily contact with any stream, reservoir, aqueduct or other water works in a catchment area
4.3.3	Boating, without written permission from the department
4.3.4	Camping, shooting or fishing without written permission from the department
4.3.6	Unauthorised access to a RPZ
4.3.7	Establishment of a picnic area in a catchment area or water reserve without written permission from the department
4.5.1	Domestic animals to enter or remain in a catchment area
4.5.3	Horse riding without written permission from the department unless on a public road
4.7.2	Driving on a road that is not graded, gravelled, sealed primed or other prepared surface in a catchment area without written approval from the department
4.7.3	Conducting a vehicle rally/race in a catchment area without written approval from the dept

Country Areas Water Supply Act 1947

All PDWSA in WA outside the Metropolitan Water Supply, Sewerage and Drainage Area (see map overleaf) are proclaimed under the *CAWS Act 1947*. The Act provides for the proclamation of PDWSA as catchment areas or water reserves. This Act and associated *CAWS By-laws 1957* are outdated and require amendments to ensure the ongoing protection of PDWSA. The *CAWS By-laws 1957* provides limited detail on prohibited or restricted activities. Some restrictions on recreational pursuits are included (see table below). The maximum penalty for an offence under these by-laws is only $40. This penalty is not a strong deterrent and needs to be updated.

By-law	Prohibited or restricted activity
31	Bathing prohibited except in approved places
35	Hunting, shooting and fishing restricted in a catchment area
36	Camping and picnicking restricted

Other legislation

Much of the land within a PDWSA is managed by the Department of Environment and Conservation (DEC). Hence there are several sections under the *Conservation and Land Management Regulations 2002,* administered by DEC, which are applicable to recreational pursuits within a PDWSA (see table below).

Section	Prohibited activity	Conditions	Max penalty
9	Fishing in a prohibited area	Area prohibited under section 5	$1000
12	Possession of firearms, spears, restricted devices etc. on CALM land		$1000
23(2)	Swimming or bathing in any reservoir or tank used to store drinking water on CALM land		$500
51	Use of vehicles on CALM land except on public roads or designated areas (except bicycles)		$1000
52	Off-road vehicles on CALM land	Definition of off-road vehicle given under *Control of Vehicles Act 1978*	$1000
53	Organise, promote or conduct a car rally, mountain bike event or other event involving vehicles on CALM land without a permit		$2000
66	Camping on CALM land except in a camping area or on a vessel moored or anchored		$500

There is also an abundance of legislation relating to the protection of drinking water quality. This includes the *Environmental Protection Act 1986* and associated regulations, administered by DEC; the *Health Act 1911* and associated regulations, administered by the Department of Health; and the *Fish Resources Management Regulations 1995*, administered by the Department of Fisheries. The penalties under these pieces of legislation range from $5000 to $1 000 000.

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Risk-based management approaches for drinking water catchments

The *Australian drinking water guidelines* (ADWG)* recommend that a preventive risk-based management approach is used for the protection of drinking water sources "to maintain the supply of water at the highest practicable quality". Strategies should be devised and applied to not only minimise risk of contamination, but to prevent such risk from occurring. The focus of preventive risk-based management is to prevent or avoid unnecessary risks before adopting the normal risk management process that relies on risk minimisation and management measures to offset risks that have been allowed to occur. The significant public health consequences of getting the risk balance wrong in a drinking water catchment as well as the public's absolute trust in the safety of the water delivered to their homes were significant factors leading to the above ADWG recommendations.

Table 1 summarises three management approaches to public access in drinking water catchments. The protected (closed) catchments approach is used for some catchments supplying Melbourne, controlled access catchments reflect the current Western Australian approach, and Brisbane's drinking water is sourced from catchments where open (little or no restrictions) access is allowed. Where access is not allowed a preventive approach is applied; where access is allowed a risk management approach is used.

Table 1 Public access to drinking water catchments under different catchment management approaches

	Protected (closed) Catchment	Controlled Access Catchment	Open Access Catchment
Access to reservoir	✗	✗	✓
Access to land around the reservoir	✗	✗	✓
Access to the outer catchment	✗	✓	✓

Table 2 (overleaf) illustrates the difference between preventive risk management and normal risk management using the three potential approaches to drinking water catchment management summarised in Table 1. It demonstrates that the type of catchment and risk management approach used influences

- the contamination exposure (risk levels) in the catchment and at the tap
- whether additional treatment barriers are required to meet the ADWG
- the level of risk the public could be exposed to should treatment barriers fail.

Both a normal risk management and a preventive risk management approach can deliver an acceptable level of risk provided treatment barriers are operational at all times.

However, experiences around the developed world show that most drinking water contamination incidents occur at times when treatment fails. This is often due to a set of circumstances occurring together that overwhelm normally reliable treatment barriers. Under such a scenario, the management approach delivering the lowest level of risk in the catchment (i.e. a protected or controlled access catchment) will provide the better quality drinking water to consumers.

Table 2 Risk exposures of three drinking water catchment risk management approaches

Type of Catchment	Hypothetical Contamination Risk Exposure in Risk Units (RU)	Treatment A (RU) - reduces risk by 75%	Treatment B (RU) - required if > ADWG Value 4 RU*	Risk Units after Treatment	Risk Units (if treatment barriers fail)
Protected (closed) catchment (uses preventive risk management approach)	6	1.5	Not required (RU below ADWG value after Treatment A)	1.5	Up to 6
Controlled access catchment (restricts recreational access; uses preventive risk management approach)	12	3	Not required (RU below ADWG value after Treatment A)	3	Up to 12
Open catchment (uses normal risk management approach)	24	6	3	3	Up to 24

***Note**: A notional ADWG value of 4 risk units (RU) is applied to help demonstrate the difference between preventive risk management and normal risk management approaches.

Table 2 demonstrates that when a normal risk management approach is applied the end-users (the public, the consumers) are experiencing a higher level of contamination risk should increased access to a drinking water catchment and treatment failure coincide. Prevention provides the greatest certainty for safe dinking water, the lowest costs and the lowest risk levels.

When deciding on which catchment management approach is best for Western Australia, consideration should be given to the public's expectation of a consistently safe drinking water supply, how this is best achieved, and the additional treatment and management costs that will be incurred if more recreational access to drinking water catchments is supported.

* National Health and Medical Research Council (NHMRC) & Natural Resource Management Ministerial Council (NRMMC) 2004, National Water Quality Management Strategy: *Australian drinking water guidelines,* Australian Government, Canberra, available <www.nhmrc.gov.au/publications/synopses/eh19syn.htm>.

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History of drinking water source protection in WA - more than 100 years of experience

Groundwater was the only source of water for the Swan River Colony from the time of settlement in 1829 until the establishment of the first water storage, Munday Brook, in 1891 (Carew-Hopkins, 1996). Historically septic waste was often disposed of in recharge areas and by 1874 it was becoming apparent that there was a link between land use practice and groundwater quality. The need for integration between land and water management had now been established.

Unfortunately, between 1895 and 1898, 367 residents died from typhoid which was largely from contaminated water at Victoria Reservoir. This resulted in corrective action being taken in catchment protection and management. It was achieved through diversion of the contaminated waters (contamination from sawmill and sanitation from the 200 people who lived within the catchment) and no further illness or deaths were recorded (Carew-Hopkins, 1996).

Typhoid

In 1892, three cases and one death from the disease occurred at one of the timber mills in the catchment. The incidence of typhoid was increasing rapidly in Perth:

Year	Cases	Deaths
1895	566	70
1896	663	89
1897	1408	134
1898	800	74
1899	200	19
1900	410	39

In March 1897 the first irrefutable proof of the health risks from the water was provided when a water sample was shown to contain typhoid, colon and pseudo bacilli.

In the development of new dams, consideration from the typhoid incident was taken into account and catchment areas were protected through reservation in state forest (Carew-Hopkins, 1996).

Legislation dating back to 1909 was created in order to better protect Perth's water resources.

Over the years, reviews of recreational access to public drinking water source areas has been conducted, and as a result there has been an improved understanding of the potential impacts human access may have on water supply. Reviews of recreation in WA have also been undertaken which highlight the importance of recreation and provide recommendations for enhancing opportunities outside drinking water areas.

Legislation and policy that is currently applied to recreational access in drinking water source catchments is currently being reviewed by the Standing Committee on Public Administration. The parliamentary committee is due to report its findings by July 2010.

Carew-Hopkins, D 1996 *Protection of Groundwater.* In Bartlett, R.H., Gardner A. and Humphries B. ed. Water Resources Law and Management in Western Australia, The Centre for Commercial and Resources Law, Perth, WA, pp. 236-246.

Timeline

1874	The link between land use practice and groundwater quality was established
1895 – 1898	Typhoid in Victoria Reservoir results in 367 deaths
1909	*Metropolitan Water Supply, Sewerage and Drainage Act 1909* (WA) (see WQIS No. 14)
1925	Advisory Committee for the Purity of Water (ACPoW) was established (see WQIS No. 17)
1947	*Country Areas Water Supply Act 1947* (WA) (see WQIS No. 14)
1957	*Country Areas Water Supply By-laws 1957* (WA) (see WQIS No. 14)
1977	ACPoW report on recreation in catchments (see WQIS No. 11)
1980	Australian Water Resources Council (AWRC) working group formed to investigate recreational use of urban water storages and catchments
1981	*Metropolitan Water Supply, Sewerage and Drainage By-laws 1981* (WA) (see WQIS No. 14)
1984	AWRC report released and workshop held to develop guidelines for the management of recreation in catchments (see WQIS No. 11)
1985	Western Australian Water Resources Council (WAWRC) outline their guidelines for recreation in catchments (see WQIS No. 11)
1987	AWRC publish the guidelines from 1984 workshop (see WQIS No. 11)
1987	WAWRC report on recreational opportunities of rivers and wetlands for Perth (see WQIS No. 11)
1994	Select Committee reports on Metropolitan development and groundwater supplies (see WQIS No. 7)
1995	WAWRC working group investigates the supply and demand for terrestrial based and water-based recreation in WA (see WQIS No. 11)
1996	Drinking water framework first discussed in the *Australian drinking water guidelines* (ADWG)
1998	Pathogen contamination in Sydney's water supply leads to a boil water alert
2000	Standing Committee review in relation to the quality of Perth's water supply (see WQIS No. 8)
2003	Statewide policy No.13: *Policy and guidelines for recreation within public drinking water source areas on crown land* published (see WQIS No. 12)
2003	State planning policy No. 2.7 – *Public drinking water source policy* published
2004	ADWG framework updated (see WQIS No. 18)
2004/5	The option of developing drinking water source protection assessments was introduced consistent with element 2 of the ADWG.
2006	Cooperative Research Centre for water quality and treatment research report 24: *Recreational access to drinking water catchments and storages in Australia* published (see WQIS No. 10)
2006	State planning policy No. 2.9 – *Water Resources* published
2007	Water Services Association of Australia Occasional paper 22: *Effects of recreational activities on source water protection areas – literature review* published (see WQIS No. 9)
2009	Standing Committee on Public Administration began a review of recreation access to public drinking water source areas

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Looking after all our water needs

The Advisory Committee for the Purity of Water - an overview of their role

Introduction

The Advisory Committee for the Purity of Water (ACPoW) was originally established in 1925 to address drinking water quality issues and to provide a link between the water and health agencies of the time. From the first meetings, the ACPoW identified the importance of secure catchment areas and adequate chemical treatment processes and so sought representation from the agriculture, conservation and land management and chemistry agencies of the time.

In response to the water industry reform of 1995, the Terms of Reference of the committee were amended and a number of additional members were invited to join to better reflect the water industry in Western Australia.

Current members of the full ACPoW are Department of Health, Department of Water, Department of Agriculture and Food, Department of Environment and Conservation, Chemistry Centre WA, Economic Regulation Authority, Western Australian Local Government Association, Water Corporation, Aqwest, Busselton Water Board and Parsons Brinckerhoff.

With the implementation of the 1996 and 2004 *Australian drinking water guidelines*, the ACPoW created two specialist sub-committees with specific focus on source protection and catchment management; and drinking water sampling and results monitoring. The sub-committees provide additional expertise to review, monitor and advise the full committee on any issue effecting drinking water supplies within the State from catchment to consumer.

The ACPoW continues to evolve, reflecting the diverse and complex issues associated with the provision of drinking water in a changing environment. However, its primary role of ensuring that Western Australians have access to safe drinking water which they can trust, remains unchanged.

What is the role of each Committee?

The role of the ACPoW is to provide unbiased health related advice associated with the provision of drinking water, to the Ministers for Health and Water. The ACPoW determines the water quality compliance requirements for all water providers across the State. The Minister for Health has the lead responsibility with respect to issues of health, however it is customary for both Ministers to jointly accept the recommendations of the ACPoW. Members are at liberty to discuss matters openly and frankly. Issues that may be commercial and in confidence are dealt with accordingly.

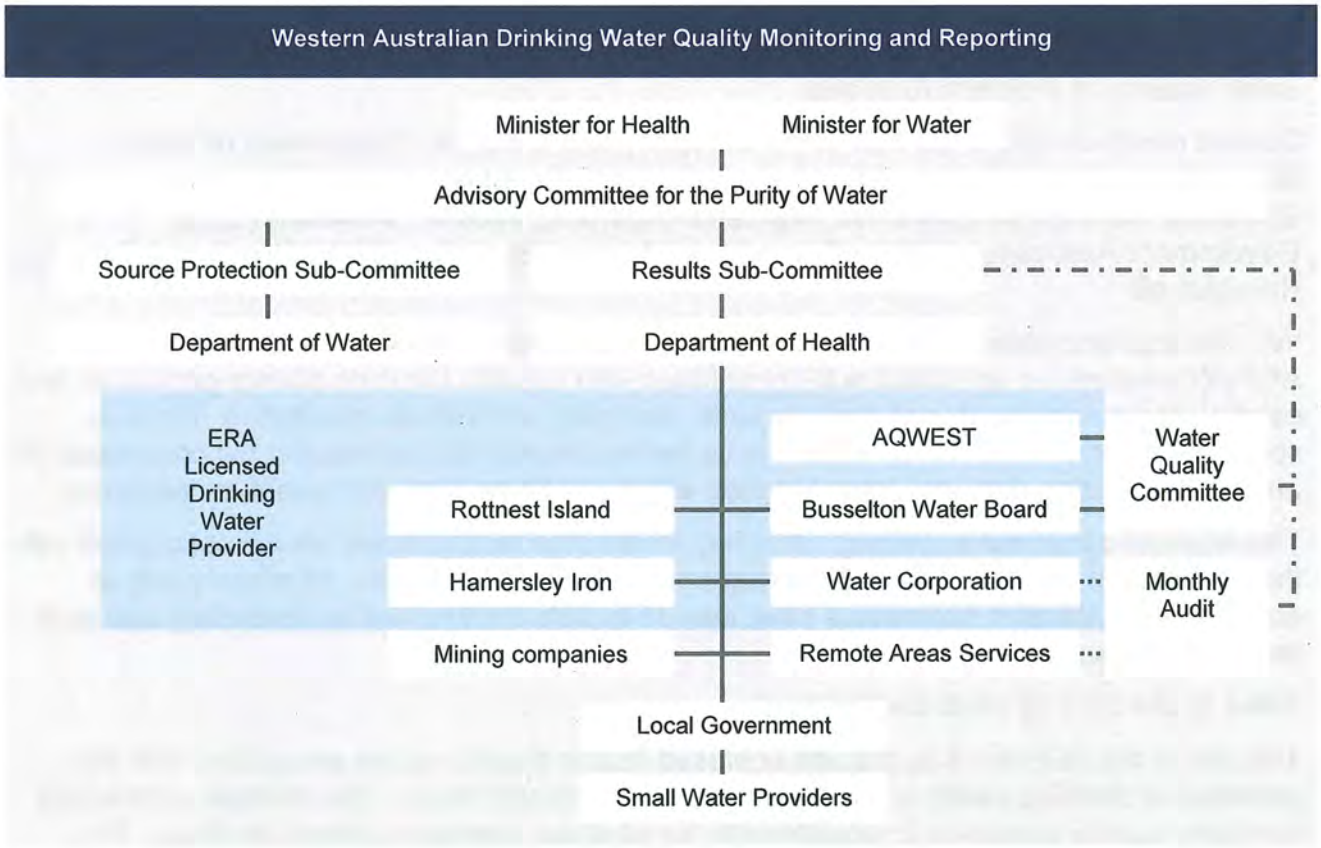
The Results sub-committee and the Source Protection sub-committee have been established to provide specialised support for their respective areas of interest. To ensure close liaison the Chair from each sub-committee is a member of the full committee and the

secretariat attends all meetings. The ACPoW members may attend sub-committee meetings at any time.

How is WA's drinking water regulated and where does the ACPoW fit in?

Regulation of the Western Australian drinking water industry is divided into licensed and non-licensed providers and the ACPoW is an integral part of the monitoring framework. The Economic Regulation Authority licenses larger providers such as the Water Corporation, AqWest and Busselton Water Board. As part of the license arrangement each licensed water provider is required to establish a Memorandum of Understanding for drinking water quality with the Department of Health (one aspect of the MoU process is shown below in the monthly audit and water quality committees). All other non-licensed water providers such as caravan parks, road-houses, farm stays, small communities, minesites, etc. are monitored directly by the Department of Health through either Local Government environmental health officers or by direct reporting (e.g. minesites and the Remote Area Essential Service Program).

The ACPoW through both sub-committees reviews all drinking water monitoring and catchment activities undertaken throughout the State. Combining this information with scientific and industry knowledge, the committee is able to identify longer term interagency trends and anomalies that may impact upon the public health of Western Australians.



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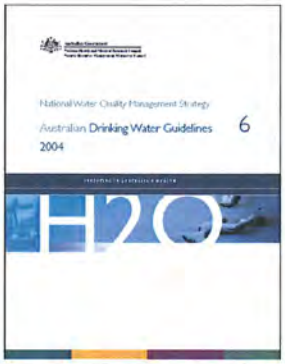
Australian drinking water guidelines (2004) - an overview



Introduction

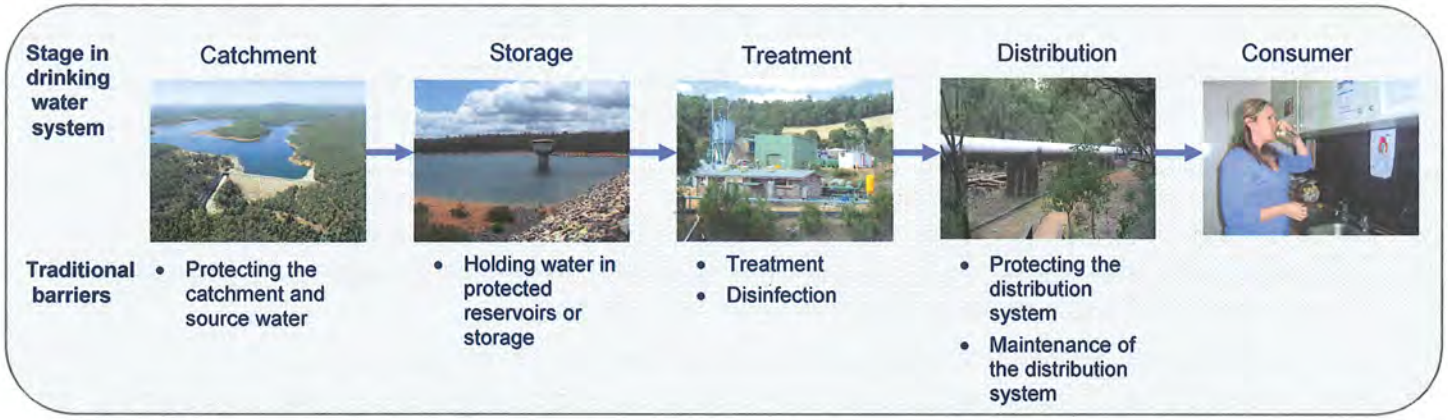
National guidelines for drinking water were first published in 1972. These guidelines have since undergone a number of reviews, with the latest version produced in 2004. The *Australian drinking water guidelines* (ADWG) aim to provide information on appropriate management of drinking water supplies and acceptable water quality for human consumption. The best available scientific information was considered during their development and they provide an authoritative view on what constitutes safe, good quality drinking water; how it can be achieved; and how it can be assured. Although the guidelines are not mandatory, the government of Western Australia has made a commitment to support these guidelines.

Guiding principles

The ADWG describe six fundamental principles that are vital for ensuring safe drinking water. Included in these principles is "The greatest risks to consumers of drinking water are pathogenic microorganisms." (p. 1–1) and "The drinking water system must have, and continuously maintain, robust, multiple barriers..."(p. 1–2).

Catchment to consumer and multiple-barrier approach

The ADWG highlight the need to understand the entire drinking water system, from the catchment to the consumer. Hazards may occur or be introduced in each stage of the drinking water system and therefore it is important to have a good understanding of the system and the potential risks to water quality at each stage.



The ADWG note that the "multiple barrier approach is universally recognised as the foundation for safe drinking water" (p. 1–2) and recommend that this approach be applied. Multiple barriers are defined in the ADWG as the "use of more than one preventive measure as a barrier against hazards" (p. 15–41). No single barrier is able to be effective against all sources of contamination at all times and so the advantage of this approach is

that if one barrier fails, other barriers should be sufficient to compensate. Therefore, the likelihood of contamination reaching a consumer's tap is minimised. The number and type of barriers required is recommended to be determined on a source by source basis by hazard identification and risk-based assessment. Traditional barriers used for protecting drinking water are shown in the diagram above. The first of these barriers, protecting the catchment and source waters, is recognised in the ADWG as being the most effective barrier for drinking water protection. Suggested preventive measures related to surface water catchment management and source protection include exclusion or limitations of uses (e.g. restrictions of human access and agriculture); protection of waterways; and use of planning and environmental regulations to regulate development.

> ***"Preventive measures by their nature should be applied as close to the source as possible, with a focus on prevention in catchments rather than sole reliance on downstream control." (p. 3–8)***
>
> ***"Prevention of contamination provides greater surety than removal of contaminants by treatment, so the most effective barrier is protection of source water to the maximum degree practical." (p. 1–2)***

12 element framework

The ADWG contains a framework, consisting of 12 elements which are considered to be best practice for the management of drinking water. This framework incorporates a preventive risk-based approach. This approach is recommended for the protection of public health, as it provides the most effective means of assuring safe drinking water.

> ***"Water suppliers should adopt a preventive risk management approach, as stipulated in the ADWG, to maintain the supply of water at the highest practicable quality." (p. 1–6)***

Guideline values

> ***"The guideline values should never be seen as a licence to degrade the quality of a drinking water supply to that level." (p. 1–6)***

For contaminants of concern, the ADWG provides health- and/or aesthetic-related guideline values. Health-related values are concentrations or measures of a water quality characteristic that, based on present knowledge, do not result in a significant risk to the health of the consumer over a lifetime of consumption. Aesthetic-related values are concentrations or measures of a water quality characteristic associated with the acceptability of water to the consumer e.g. its appearance, taste and odour.

Guideline values are provided for a range of physical (e.g. salinity, pH), chemical (e.g. nutrients, hydrocarbons), radiological and microbiological (pathogens) contaminants.

Protozoan pathogens (such as *Cryptosporidium* and *Giardia*) and viruses (such as hepatitis and adenovirus) do not have a guideline value set. *Escherichia coli* or thermotolerant coliforms are recommended to be used as indicators of pathogen contamination. The guidelines state that *"Escherichia coli* (or thermotolerant coliforms) should not be detected in a minimum 100 mL sample of drinking water." (p. 12–7).

In order to reduce the risk of *Cryptosporidium* and *Giardia* contamination it is recommended that catchments be protected from human and domestic animal wastes as a priority. In WA, this has been implemented through controls on potentially contaminating land uses and activities within drinking water catchments.

Citation: National Health and Medical Research Council and Natural Resource Management Ministerial Council 2004, National Water Quality Management Strategy: *Australian drinking water guidelines*, Australian Government, Canberra, available <www.nhmrc.gov.au/publications/synopses/eh19syn.htm>.

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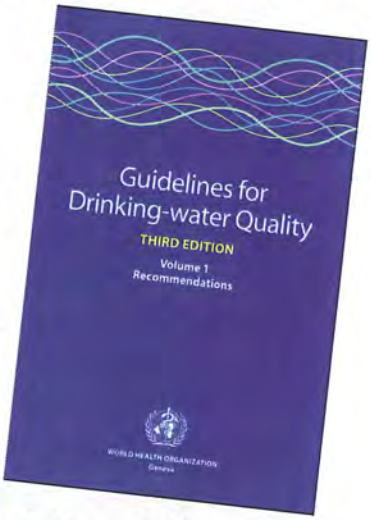
Looking after all our water needs

Summary of World Health Organisation's *Guidelines for drinking water quality*



> *"Access to safe drinking-water is essential to health, a basic human right and a component of effective policy for health protection."*

The World Health Organisation (WHO) is responsible for directing and coordinating health issues within the United Nations system. In 2004, the third edition of *Guidelines for drinking-water quality* was published by the WHO, which further develops concepts, approaches and information in previous editions (since 1983) and includes new information. The guidelines are addressed primarily to water and health regulators to assist in the development of national standards. Australia has considered them in the development of the *Australian drinking water guidelines* (see WQIS No. 18). Volume 1 of the WHO guidelines "explains requirements to ensure drinking-water safety, including minimum procedures and specific guideline values, and how those requirements are intended to be used". This information sheet summarises Volume 1 of the WHO guidelines.

Framework for safe drinking water

The guidelines outline a preventative management framework for safe drinking-water that comprises five key components:

- "health-based targets based on an evaluation of health concerns (chapter 3)
- system assessment to determine whether the drinking-water supply (from source through treatment to the point of consumption) as a whole can deliver water that meets the health-based targets (section 4.1)
- operational monitoring of the control measures in the drinking-water supply that are of particular importance in securing drinking-water safety (section 4.2)
- management plans documenting the system assessment and monitoring plans and describing actions to be taken in normal operation and incident conditions, including upgrade and improvement, documentation and communication (sections 4.4 – 4.6)
- a system of independent surveillance that verifies that the above are operating properly (chapter 5)."

Microbial contamination

> *"Experience has shown that microbial hazards* [pathogens] *continue to be the primary concern in both developing and developed countries." "The potential health consequences ... are such that its control must always be of paramount importance and must never be compromised."*

WHO identifies the greatest, most common and widespread health risk associated with drinking water is consumption of water that is contaminated with human and animal excreta. Excreta contains pathogens (bacteria, viruses and parasites) which can cause human health impacts such as illness, disease and even death if consumed. Breakdown in water supply safety may lead to large-scale contamination and disease outbreaks in communities. The guidelines

provide information on pathogens that are of relevance for drinking-water supply management. There are fact sheets on each type of pathogen, describing their health impacts, persistence in water supplies, relative resistance to treatment and infectivity rates. They outline how health-based targets for pathogens should be set, and describe a risk assessment approach for managing them. Methods of detection, treatment options and reporting information are also covered in the guidelines.

> *"The preferred strategy is a management approach that places the primary emphasis on preventing or reducing reliance on treatment processes for removal or pathogens."*

Chemical contamination

Health concerns associated with chemical constituents of drinking-water differ from those of microbial contamination, and usually arise from health impacts after prolonged exposure. Also, water with chemical contamination is often rejected by consumers because of unacceptable taste, odour or appearance. The guidelines provide fact sheets on a myriad of chemicals, their effects on human health and acceptability of water to the consumer, techniques for detection, chemical effects on water supply infrastructure such as pipes, and treatment options. They also provide guidance on levels of chemicals acceptable for human health to aid water management authorities to set limits for their own supplies.

Risk assessment approach

> *"Risk assessment ... aim: To identify all possible hazards associated with drinking-water that would have an adverse public health consequence, as well as their pathways from source(s) to consumer(s)"*

The guidelines describe a risk assessment approach for managing drinking-water supplies. "Risk assessment commences with problem formulation to identify all possible hazards and their pathways from source(s) to recipient(s)." The WHO recommends that stakeholder support and participation should occur in the risk assessment process through providing "a transparent procedure and active risk communication at each stage".

Roles and responsibilities

"Preventative management is the preferred approach to drinking-water safety and should take account of the characteristics of the drinking-water supply from catchment and source to its use by consumers". WHO state that preventative management often falls outside the direct responsibility of water suppliers, so it is essential that a multiple-agency collaborative approach is taken to managing drinking water. The following roles and responsibilities all need to play a part in drinking-water safety:

- surveillance and quality control
- public health authorities
- local authorities
- water resource management
- drinking-water supply agencies
- community management
- water vendors
- individual consumers
- certification agencies
- plumbing

Citation: World Health Organisation 2004, *Guidelines for drinking-water quality, 3rd edition, Volume 1 – Recommendations,* World Health Organisation, Geneva Switzerland.

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Looking after all our water needs

Drinking water governance in Western Australia

Department of Water

The Department of Water manages Western Australia's precious water resources to meet the needs of our community now and in the future. The department's responsibilities include development of legislation, policy, water quality guidance documents and drinking water source protection plans. The department is also responsible for the identification and proclamation of public drinking water source areas (PDWSA).

State Water Quality Management Strategy

The *State water quality management strategy* (SWQMS) ensures that an administrative structure for water quality management is established in Western Australia. State water quality management strategy No 1, *framework for implementation*, is the first document of the SWQMS series.

Advisory Committee for the Purity of Water

The Advisory Committee for the Purity of Water (ACPoW) is a non-statutory independent body that advises the Minister for Health and the Minister for Water on issues associated with protecting public drinking water. ACPoW is chaired by the Department of Health and includes representatives of key government agencies and water service providers.

Western Australian Planning Commission

The Western Australian Planning Commission (WAPC) is the statutory authority with statewide responsibilities for strategic urban, rural and regional land use planning and land development matters. The WAPC also prepares land use and water management strategies.

Department of Planning

The Department of Planning is responsible for land use planning and development in Western Australia. Statement of planning policy 2.7: *Public drinking water source policy* provides guidance for land use planning in PDWSA; it protects and manages PDWSA from incompatible land uses and pollution in order to maintain the quality of the drinking water.

Department of Health

The Department of Health WA (DoH) ensures safe drinking water is provided to consumers. The DoH regulates drinking water, and reviews, interprets and applies the recommendation contained in the *Australian drinking water guidelines 2004* which are published by the National Health and Medical Research Council.

Economic Regulation Authority

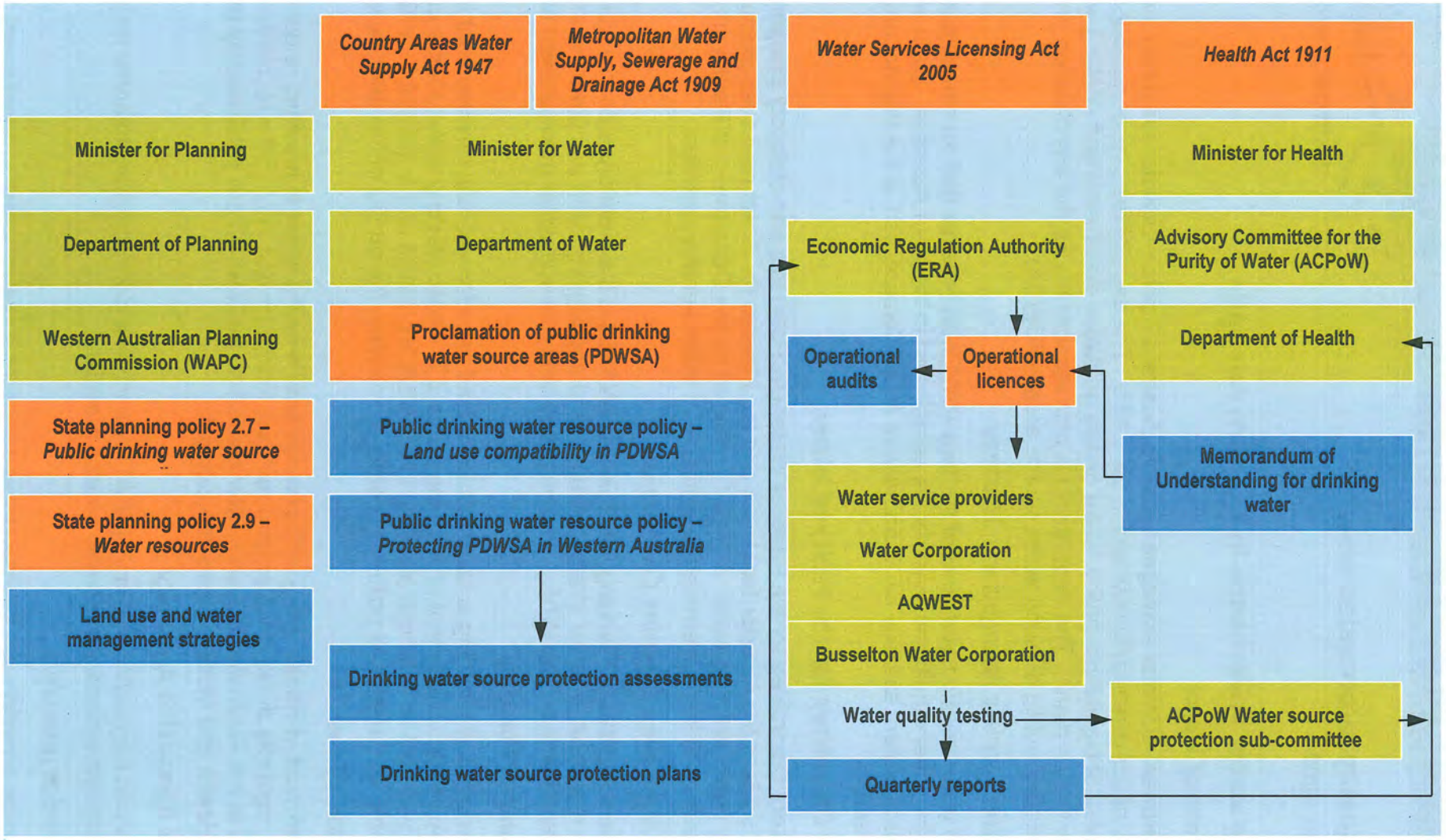
The Economic Regulation Authority (ERA) is an independent statutory authority responsible for licensing and monitoring of water service providers.

Water service providers

Water service providers are licensed by government to deliver water to consumers. They include the Water Corporation, Aqwest, Busselton and a few other smaller providers.

Figure 1 Overview of governance arrangements for drinking water protection in Western Australia

The diagram was adapted from the *Australian Government National Water Commission* websitet - www.nwc.gov.au/www/html/2266-drinking-water-management.asp?intSiteID=1.



Other agencies with legislation available for the protection of drinking water include the Department of Environment and Conservation and the Environmental Protection Authority. The Department of Water is the agency with primary responsibility for drinking water protection in public drinking water source areas.

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Looking after all our water needs

Impacts of recreation

Introduction

> ***"Negative impacts on wilderness are an inevitable consequence of recreation" (Leung and Marion 2000)***
>
> ***"Recreational access has been conclusively shown to have negative impacts on drinking water quality." (CRC for Water Quality and Treatment 2006)***

Both water-based recreation (e.g. swimming, boating, fishing, marroning and water-skiing) and land-based recreation (e.g. walking, mountain biking, picnicking, camping, 4WDing and horse-riding) can have impacts on soil, vegetation, wildlife and water quality (see Table 1). Impacts on water quality can occur through the introduction of contaminants such as pathogens, nutrients, chemicals (e.g. hydrocarbons) and sediment. In addition, recreation access can also lead to an increased risk of wildfire, which has the potential to cause significant degradation of water quality.

Table 1: Common impacts of recreation on natural ecosystems (modified from Hill and Pickering 2009)

Soil	Vegetation	Wildlife	Water
• Soil compaction • Increased soil penetration resistance • Loss of organic litter • Loss of soil (erosion) • Reduction in moisture and microbial activity	• Reduced height and vigour • Loss of ground cover • Loss of fragile species • Loss of trees/shrubs • Increase in resistant species • Introduction and spread of exotic plant species (weeds) • Introduction and spread of fungal pathogens • Exposed roots • Tree trunk damage	• Habitat alteration • Loss of habitats • Introduction and spread of exotic animals • Wildlife harassment • Modification of wildlife behaviour • Displacement from food, water and shelter • Reduced health and fitness • Reduced reproduction • Increased mortality • Compositional change	• Introduction of exotic species • Increased turbidity • Increased input of nutrients • Increased levels of pathogens • Degraded water quality • Reduced health of aquatic ecosystems • Compositional change • Excessive algal growth • Introduction of chemicals, such as hydrocarbons

Introduction of chemicals

Recreation can lead to the introduction of chemicals such as hydrocarbons. Hydrocarbons (e.g. fuels and oils) affect the aesthetic appeal of drinking water due to their taste and odour. Some can cause a range of serious health impacts, and potentially harmful chemical by-products may be formed when they are combined with chlorine in the water-treatment process. Recreation can introduce hydrocarbons into drinking water sources through leaks and spills of fuel or oil from vehicles (e.g. cars, motorbikes) or motorboats. Two-stroke engines on motorboats release fuel into the water due to the way they operate, and refuelling and breakdowns present an additional risk of hydrocarbon contamination. A literature review by Mosisch and Arthington (2004) noted that various studies have detected hydrocarbons in water resources and attributed their presence to motorboat use.

Introduction of pathogens

One of the most significant risks of recreation access to drinking water quality is the introduction of human pathogens. Pathogens are types of micro-organisms (including bacteria, protozoa and viruses) that are capable of causing diseases. Consumption of water containing pathogens can cause illness (e.g. gastroenteritis, hepatitis) and even death. Introduction of pathogens from recreation can be through:

- direct release into the reservoir from pathogen shedding; or deliberate or accidental faecal release during body-contact recreation (see Box 1)
- deposition of faeces onto land by humans (e.g. where toilet facilities are not provided or not utilised) or animals (such as horses or dogs). Pathogens can then be washed into feeder streams or reservoirs by rainfall.
- poor operation and maintenance of toilet facilities e.g. failing septic tanks.

Box 1: Body-contact recreation and pathogen loading - what do we know?

People carry and shed pathogens

Gerba (2000) undertook a review of the literature and estimated that:

- Each bather sheds an average of 0.14 g of faeces
- 10-40% of the population is likely to be shedding pathogens at one time.
- For average case conditions a median of 14 000 protozoa and 14 million enteric viruses will be shed per person whilst bathing
- Accidental faecal releases can lead to significant additional shedding of pathogens into the water.

Body-contact recreation leads to increased pathogen concentrations in water

This has been documented through a number of recent studies of bather shedding. For example, Elmir et al. (2007) found that concentrations of the bacteria *Staphylococcus aureus* and enterococci increased by 1-2 orders of magnitude after 10 participants immersed themselves in the water.

Computer modelling undertaken for a Canadian drinking water reservoir also suggested that there will be increased numbers of pathogens such as *Cryptosporidium* (Anderson et al. 1998; Stewart et al. 2002) and an increased risk of waterborne illness for downstream consumers (Stewart et al. 2002) if body contact recreation were permitted.

Pathogen shedding from bathers can lead to waterborne disease outbreaks

There are many documented cases where people have become ill simply by ingesting small amounts of the water they are recreating in. Craun et al. (2003) investigated 104 outbreaks from recreation waters in the US between 1991-1998. For the 40 outbreaks where the source of contamination was known, the bathers themselves were found to be an important source of pathogen contamination (60% of causes linked to the bathers). Poor maintenance, inadequate treatment or operation was also frequently reported (37.5% of causes).

Elevated pathogen concentrations have been found in water resources nearby to recreation areas where other land use activities are limited (e.g. McDonald et al. 2008; Flack et al. 1988; Carter et al. 2009). McDonald et al. (2008) measured pathogen concentrations in rivers of a remote and 'pristine' area of Scotland. Concentrations were higher in areas where camping occurred; in summer compared to winter; and on weekend and long weekend days compared to weekdays.

Increased erosion and turbidity

Many recreation activities (e.g. walking, mountain biking, horse riding, 4WDing, picnicking and camping) have the potential to cause soil erosion. Erosion can result in greater amounts of soil particles entering a drinking water reservoir, thereby causing increased turbidity. Turbidity affects the aesthetic appeal of water by causing it to appear 'muddy' or 'milky'. High levels of turbidity also makes pathogen detection and removal from water more difficult and unreliable. Pathogens have a tendency to absorb onto particles in the water and can be shielded from disinfection. Soil and plant particles will also consume disinfectant as a result of chemical reactions between particles and disinfectant. This increases the amount of disinfectant required for adequate treatment.

As noted in Table 1, recreation can also cause soil compaction and increased soil penetration resistance (results in water flowing over the surface more quickly instead of infiltrating), and loss of vegetation. This exacerbates erosion problems. Soil compaction,

loss of vegetation and erosion as a result of recreation has been documented in a range of studies. For example:


Erosion from 4WD activity

- Smith and Newsome (2002) found significantly increased soil penetration resistance and vegetation loss at campsites and nearby river access points in a south west Western Australian (WA) national park
- Taylor (1988) found decreased vegetation density and coverage, increased soil compaction and an increase in erosion indicators at recreation sites in Colorado compared to control sites
- Moncrieff (2000) examined a number of WA recreation sites and found that almost all sites suffered from varying degrees of degradation, with impacts including soil compaction and erosion from picnic sites and tracks.
- Mende and Newsome (2006) examined 10 walk trails in a south coast WA national park. Erosion (ranging from 5 cm to greater than 20 cm of topsoil) was the most commonly noted impact on the trails. Other impacts noted were trail proliferation, exposed tree roots and increased trail width.

Water-based activities around the reservoir (e.g. boating, fishing and swimming) can cause loss of riparian vegetation and erosion from people walking on the banks and launching boats. For example, an investigation of the impacts of boating at Brown Lake, Queensland noted that "sites along its shoreline where boats are launched have become increasingly degraded, especially by the removal/destruction of both littoral and riparian vegetation, resulting in open, destabilised stretches of sand along the shore" (Mosisch and Arthington 2004).

Increased nutrient concentrations

High concentrations of nutrients (such as nitrogen and phosphorus) in drinking water reservoirs can lead to algae and/or cyanobacteria blooms. Some species are toxic to humans so can cause health concerns. Other problems associated with blooms include odour, and increased treatment times and costs. Some nutrients, such as nitrate, are also toxic to humans at high concentrations. Increases in nutrient concentrations can occur from:


Rubbish left behind by recreators

- human or animal faeces
- use of live baits for fishing
- inappropriate disposal of rubbish
- use of detergents when camping.

Increased risk of wildfire

Wildfire can have significant impacts on water quality, as has been demonstrated by observations and monitoring undertaken during and after major wildfires in drinking water catchments in New South Wales, Australian Capital Territory, north east Victoria and WA. These studies have found that when storm events follow major wildfires, significant erosion of sediment and attached nutrients can occur from burnt hillslopes and be washed into the drinking water source (NEW 2003; White et al. 2006; Wilkinson et al. 2007). Water quality issues associated with erosion of sediment included high levels of turbidity, manganese, iron and nutrients in water supplies. For example, the post-fire pulse of turbidity in Bendora Dam (ACT) was nearly 30 times greater than any previously recorded turbidity and the magnitude iron and manganese exceeded all

previous peaks by factors of three and five respectively (White et al. 2006). Fires can also cause disruptions to the water supply system, e.g. an inability for drinking water treatment plants to cope with high turbidity levels has led to water restrictions (NEW 2003; White et al. 2006) and boil water alerts (NEW 2003) being issued.


Turbid runoff following fires in Mundaring catchment area (2005)

Provision of access to catchments for recreation activity not only increases the risk of escaped campfires, it also provide greater opportunity for the deliberate lighting of fires. Causes of wildfires on Department of Environment and Conservation managed land in WA have been documented for the past ten years. Over this time, an average of 22 fires (4% of the total number) are started each year as a result of recreator's campfires. An average of 241 fires (45% of the total number) have been deliberately lit.

For more information on wildfire, see WQIS No. 30: *Wildfire in drinking water source catchments.*

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Proposed recreation access and drinking water protection options

The Department of Water had reviewed four alternative approaches that provide different levels of recreation access and different levels of drinking water protection.

1. Operate separate recreation catchments/reservoirs and drinking water source catchments/reservoirs. This reflects a closed recreation access approach in a drinking water source catchment.

2a. Operate 'controlled access' catchments with closed reservoir protection zones (RPZ) and limited recreation access to the outer catchments. (This occurs now in Western Australia.)

2b. Operate 'controlled access' catchments with limited recreation access to RPZ and the outer catchment.

3. Operate open access catchments that provide high levels of recreation access in RPZ and the outer catchment.

Western Australia currently operates under option 2a and this approach has served us well. In 1994, the report of the Select Committee on Metropolitan development and groundwater supplies noted that experts from around the world expressed their envy of Western Australia's relatively pristine water supply and advised that we should protect it at all costs. The high quality of this source water was achieved by maintaining a high level of protection in undeveloped catchments for more than a century. In 2000, the *Report of the Standing Committee on ecologically sustainable development in relation to the quality of Perth's water supply* noted that it was imperative to protect drinking water sources.

> ***"A common thread running through much evidence reviewed by the committee is that to maintain the quality of Perth's water the first priority should be to protect the water through good land use planning to protect the catchment providing the water, whether surface or groundwater. Using treatment to deal with contamination is a second-best option. The committee found support for adopting catchment protection as the major weapon in preventing contamination of water supplies."***
>
> (Report of the standing committee on ecologically sustainable development in relation to the quality of Perth's water supply 2000)

The Department of Water supports the continued application of option 2a in legislation and recreation policy in PDWSA. The indisputable benefits of recreation should be achieved by enhancing existing irrigation and recreation catchment reservoirs (for example Waroona Brook and Logue Brook) as well as creating new recreation opportunities at Harvey Dam (which is in the process of being deproclaimed as a drinking water source catchment).

Table 1 (overleaf) characterises the four approaches described above.

Table 1 Strategic options for drinking water source catchment protection

	Type	Option	Drinking water risk objective	Catchment risks with basic treatment	Catchment risks with intensive treatment
1	**Protected catchment**	• Drinking water source only • Closed drinking water source catchment (recreation to occur at alternative recreation catchments)	To keep drinking water source catchments separate from recreation catchments **RISK AVOIDANCE**	Maximum risk – **Low** Residual risk – **Low**	**Intensive treatment not required due to low risk in catchment**
2a	**Controlled access catchment**	• No access to RPZ • Restricted access to outer catchment	To protect reservoir by avoiding risk in RPZ and minimise risk in the outer catchment **RISK AVOIDANCE** and **RISK MINIMISATION**	Maximum risk – **Low** Residual risk – **Low**	**Intensive treatment not required due to low risks in catchment**
2b	**Controlled access catchment**	• Restricted access to RPZ • Restricted access to outer catchment	**RISK MINIMISATION** and **RISK MANAGEMENT**	Maximum risk – **High** Residual risk – **High**	Maximum risk – **High** Residual risk – **Low** (due to treatment)
3	**Open access catchment**	Recreation can occur in RPZ and the outer catchment	**RISK MANAGEMENT**	Maximum risk – **High** Residual risk – **High**	Maximum risk – **High** Residual risk – **Low** (due to treatment)

Assumption of the table above

↓ Recreation = ↓ contaminant loads and ↓ risk of contamination of drinking water in catchment and at consumers tap
↑ Recreation = ↑ contaminant loads and ↑ risk of contamination of drinking water in the catchment and at consumers tap if treatment fails
↑ Recreation = ↑ barriers/treatment ↑ cost of barriers/treatment and ↑ cost of supply

National Water Quality Management Strategy, *Australian drinking water guidelines* (2004)
These guidelines noted that risk should be assessed at two levels:
• **maximum risk** in the absence of preventive measures
• **residual risk** after consideration of existing preventive measures.
Assessing maximum risk is useful for identifying high priority risks, determining where attention should be focused and preparing for emergencies.
Residual risk provides an indication of the need for additional preventive measures.

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Looking after all our water needs

Drinking water catchment protection and pathogen risks

How do we keep our drinking water safe and protect public health?

Drinking water is kept safe through a combination of catchment protection and treatment. The aim is to ensure water is safe for human consumption, pleasant to drink and reasonably priced. No single barrier (e.g. reliance on treatment) is considered sufficient to deliver safe, good quality drinking water. The primary focus should be on preventing the water from becoming contaminated. Protecting the catchment of surface water sources, and recharge area of groundwater, is recognised as the most important barrier in ensuring a safe drinking water supply is available to consumers (NHMRC & NRMMC 2004).

What are pathogens?

Pathogens are organisms that cause illness in people and animals. Pathogens include bacteria (*Salmonella*, *Escherichia coli, Cholera*), protozoa (*Cryptosporidium*, *Giardia),* viruses (*Hepatitis)* and parasitic worms.

Do people carry them?

Yes, people can carry pathogens without their knowledge. Some people may be carriers of pathogens, but never exhibit any symptoms of illness. Pathogens can be transferred from person to person by the faecal-oral route, usually as a result of poor hygiene practices, or by ingesting contaminated food or water.

Where do pathogens come from?

Pathogens can be found naturally in water in the environment, be carried by people and animals and also result from a range of normal human activities. For example, inadequately treated sewerage, animal wastes from agriculture and the shedding of organisms from the human or animal body in contact with water, can contaminate water with micro-organisms (including pathogenic micro-organisms).

Did you know?

- a person can shed a median of 14 000 protozoa and 14 million viruses into water during contact?
- each adult bather sheds a range of 0.1 – 0.0001 g of faeces and a child a range of 0.01 to 10 g of faeces into the water during contact?

(Gerba 2000)

Can they survive in the environment?

Yes, the survival of pathogens is dependent on several factors, including temperature, pH, solar radiation, media (i.e. soil, water, faeces), nutrient levels, competing micro-organisms and the availability of a carrier. Research has shown that *Escherichia coli* bacteria can survive months in water bodies. Viruses and protozoa can also survive for long periods in water. Unlike chemical contamination, low numbers of pathogens can quickly multiply to large numbers in the right conditions.

Why do we need to restrict human activity in and around reservoirs?

Reservoirs are a key component of drinking water catchments. Wherever possible, a best practice approach is proposed for reservoirs to prevent the risk of physical, chemical and biological (pathogen) contamination. This best practice approach is already applied in many of the drinking water sources in Western Australia (e.g. Serpentine and Canning dams) and results in land use development and activities, including human activity, being restricted to protect water quality and ultimately public health.

Direct human and domestic animal contact with a waterbody may pose an immediate threat of pathogen contamination. Recreational use such as swimming, fishing and canoeing can lead to the transfer of pathogens into the waterbody. The smallest amount of faecal material on or from the human and animal body could contain pathogens that may contaminate a drinking water source. Faecal material may also enter the reservoir through defecation within the catchment and subsequent overland flow into the reservoir after rainfall.

"The greatest risks to consumers of drinking water are pathogenic microorganisms."

"Protection of water sources and treatment are of paramount importance and must never be compromised."

(NHMRC & NRMMC 2004)

It should be appreciated that from a preventive risk assessment viewpoint, wherever possible 'risk avoidance' is the safest response to pathogen contamination threats to deal with potentially severe/tragic public health consequences.

Will water treatment alone prevent contaminated water from reaching the community?

Reliance on water treatment alone is not recommended. Drinking water is expected to meet the health and aesthetic criteria of the *Australian drinking water guidelines* (NHMRC & NRMMC 2004). These guidelines recommend a preventive risk-based approach to ensure safe drinking water is delivered to consumers. The guidelines also recognise that no single barrier will be effective against all sources of contamination. A combination of catchment protection and treatment, continuous monitoring of barriers (e.g. chlorine analyser) and regular water-quality analysis have ensured the supply of a reliable, safe, good-quality drinking water supply to Western Australians for more than 100 years.

"Pathogen-free water is attainable by selection of high-quality uncontaminated sources of water, by efficient treatment and disinfection of water known to be contaminated with human or animal faeces, and by ensuring that such water remains free from contamination during distribution to the users. Such a policy creates multiple barriers to the transmission of infection"

(WHO 1993, cited in Productivity Commission 2000)

"Preventing contamination as close as possible to the source water and prior to final stage disinfection is seen as a desirable strategy."

(Productivity Commission 2000)

"Fully protected catchments had by far the highest water quality even during rain events (equivalent to over 99.9 % pathogen reduction compared to unprotected), demonstrating the value of catchment protection and access exclusion policies."

(CRC for Water Quality and Treatment 2004)

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Looking after all our water needs

Case study: the costs of a waterborne disease outbreak in Walkerton

Introduction

In May 2000, a moderately prosperous rural community in Ontario, Canada experienced an outbreak of waterborne disease through the public water supply system. The outbreak caused seven fatalities and illness in over 2 300 others (approximately 50 per cent of the resident population). The reported illnesses included 27 cases of kidney disease caused by the outbreak, mostly among children aged one to four, with potential lifelong medical implications.

The estimated economic and social costs to the town of Walkerton could be valued at about $155 million. The estimated expenditure of the Ontario government in response to the outbreak was likely to be several hundred million dollars.

Background

The contamination of the public water supply was most likely caused by pathogens from cattle manure washed from an adjacent farm into the water supply bore field by heavy rain. The bores were not properly sealed to prevent the inflow of contaminated surface water. One bore drew water down from nearby contaminated surface water ponds. The risk of pathogen contamination of the water supply had been identified 22 years earlier.

The Walkerton Inquiry found the failure of the public water supply system happened at many levels, including:

- negligence and a lack of training for plant operators;
- ineffective regulatory oversight of the water supply system;
- inadequate catchment protection, water treatment and monitoring of barriers for contamination risks;
- poor system management.

"Like many others in Walkerton, Bruce Davidson still hasn't turned on his taps. Five months after the boil-water advisory was issued, the warning is still in effect.

This means that Davidson must wash his vegetables with bottled water. His two children take their baths at their grandmother's house in a neighbouring town. Trips to the water distribution centre have become a routine part of his day."

The National
16 October, 2000

Economic costs of the outbreak

Direct costs to Walkerton households included:

- travel for treatment
- medication
- boiling and collecting bottled water
- wasted contaminated food
- veterinary costs
- transporting children to school/daycare facilities outside town
- damaged clothing from superchlorinated water after the outbreak
- travel for supplies, services (e.g. shower or do the laundry).

Costs to the town of Walkerton included:

- lost productivity
- restaurants closures
- lost accommodation bookings
- lost business for stores and services
- drop in real estate values.

The tangible economic cost of the outbreak on the Walkerton community was estimated at over $65 million.

The total expenditures of the Ontario government directly arising from the Walkerton outbreak has likely been several hundred million dollars, covering costs ranging from decontaminating the water supply system and leasing a temporary water treatment system to settling a class-action law suit.

Summary of estimated costs to Walkerton

Category	Cost estimate ($ million)
Households	$6.9
Household property values	$1.1
Walkerton business losses	$1.5
Lost productivity	$1.2
Drinking water	$4.2
Medical and hospital related costs	$6.6
Investigation and inquiry costs	$14.5
Water testing and system repairs	$9.9
Other costs to the area	$6.5
Private legal expenses	$1.0
Other agency costs	$11.1
Total	**$64.5**

Social costs of the outbreak

The statistical value of lives lost and the illness suffered has been estimated at approximately $91 million. The average duration of hospitalisation was 13 days for adults and 15 days for children.

"The public strongly favours source protection as a key component of our water system.

No other aspect of the task of ensuring drinking water safety received as much attention during the town hall meetings held across Ontario"

Justice O'Connor
Walkerton Inquiry

Long-term social impacts included:

- distrust of water service providers, local officials and public institutions
- negative treatment of Walkerton residents by neighbouring communities
- residents suffering enduring illness following the outbreak
- Walkerton has become an icon for disastrous failure of public institutions.

Recommendations of the Walkerton Inquiry

In his report on the Walkerton Inquiry, Justice O'Connor recommended a multi-barrier approach to managing drinking water. The report identified protecting the source of the drinking water as the first barrier to the contamination of drinking water, and recommended a catchment-based approach to protect water sources.

"In a multiple-barrier system for providing safe drinking water, the first barrier involves selecting and protecting reliable, high-quality drinking water sources."

Justice O'Connor
Walkerton Inquiry

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LIST OF ACRONYMS

ACRONYM	DEFINITION
ADWG	Australian drinking water guidelines
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management council of Australia and New Zealand
DWSC	Drinking water source catchment
DWSPA	Drinking water source protection assessment
DWSPP	Drinking water source protection plan
HAZMAT	Hazardous material
LUCT	Land use compatibility table
NHMRC	National Health and Medical Research Council
PDWSA	Public drinking water source area
P1	Priority 1 A P1 area – has the fundamental water quality objective of risk avoidance
P2	Priority 2 A P2 area – has the fundamental water quality objective of risk minimisation
P3	Priority 3 A P3 area – has the fundamental water quality objective of risk management
RPZ	Reservoir protection zone
UWPCA	Underground water pollution control area
WHO	World Health Organisation
WHPZ	Wellhead protection zone
WQIS	Water quality information sheet
WQPN	Water quality protection note

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Reservoir protection zones

What is an RPZ?

Reservoir protection zones (RPZ) are identified around surface water bodies used for supplying drinking water. They generally extend 2km from the high water mark of the reservoir or dam, but only extend upstream of the dam wall. RPZ are legally recognised under the *Metropolitan Water Supply Sewerage and Drainage Act 1909* and are also applied as policy to country sources. Restrictions apply to access and activities within RPZ.

Why do we need RPZ?

When undesirable land uses and activities (such as industry, housing or swimming) occur in or right next to a drinking water source, contaminants can easily enter the water. This reduces the quality of the water which can then affect public health. RPZ help to avoid contamination by preventing these types of activities.

Multiple barrier approach

Disease-causing microorganisms (pathogens) are the greatest health risk associated with drinking water because they can cause illness, hospitalisation and even death. Some pathogens are resistant to disinfection, so drinking water safety cannot totally rely on a single contamination barrier such as chlorination. RPZ provide an additional protective barrier against contamination. This approach is consistent with the preventive risk-based, multiple barrier approach for protecting drinking water quality which is outlined in the *Australian drinking water guidelines 2004* (see WQIS No. 18).

Reservoirs themselves are another barrier against contaminants that may be present in feeder streams and overland flows from the wider catchment. They provide detention time where contaminants are removed from the water by natural means such as dilution, filtration, sedimentation and sunlight. RPZ help to protect a reservoir so it is able to maintain optimum conditions for reducing contaminants.

History

The last water quality incident in WA occurred between 1895 and 1898 when 367 people died from typhoid after drinking contaminated water from the Victoria reservoir. This was found to be linked to a sawmill and septic tanks in the catchment. Catchment protection was implemented and no further illness or death was reported. Subsequent drinking water catchment areas were protected by reservation in state forest (Bartlett et al. 1996).

RPZ have been central to the provision of safe drinking water since they were recommended by the Government's Advisory Committee for the Purity of Water in 1977. The RPZ approach was based on an assessment of recreational activities in surface water catchments. RPZ were adopted in WA legislation in 1981 under the *Metropolitan Water Supply and Sewerage and Drainage By-laws* 1981.

Typical RPZ sign

How are RPZ identified?

RPZ are identified through publicly consulted drinking water source protection plans (DWSPP) prepared by the Department of Water. They are generally set at 2km from the high water mark of the reservoir/dam unless a different distance is determined through the consultation process of the relevant DWSPP.

How are RPZ applied / enforced?

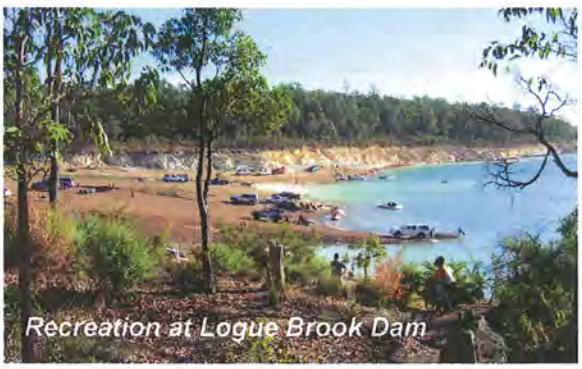
RPZ are applied through land use planning controls (such as limiting certain types of developments under town planning schemes), policies, signs, information brochures and physical barriers (such as gates).

The Department of Water generally delegates surveillance and enforcement of RPZ to the Water Corporation. Penalties apply for non-compliance under the by-laws mentioned previously. Water Corporation rangers regularly patrol the RPZ and have the ability to issue fines and prosecute those who are undertaking illegal activities.

What am I allowed to do in a RPZ?

Generally, public access is not allowed in RPZ, except on designated public roads and established icon trails (such as the Bibbulmun walking track and Munda Biddi cycle trail). The Department of Water's Statewide policy 13: *Policy and guidelines for recreation within public drinking water source areas on crown land* outlines the types of activities that are supported outside the RPZ (i.e. in the outer catchment of a PDWSA). A copy of this policy can be found on our website.

Many drinking water reservoirs have recreation facilities available downstream of the dam wall, such as BBQ and picnic areas. Other recreational activities, such as fishing, boating and camping, and associated facilities are also provided at some non-drinking water catchments such as Harvey dam, Logue Brook dam and Waroona dam. Activities in these areas do not pose a threat to drinking water quality because they are outside of drinking water catchments.


Recreation at Logue Brook Dam

Do other states in Australia have RPZ?

Most of Melbourne's catchments are completely closed (i.e. no access allowed at all). Warragamba dam (supplies drinking water to Sydney) has a 3km exclusion zone, imposed as a result of a water quality scare in 1998 which saw 'boil water alerts' issued to 3 million people due to contamination by pathogens. Some of NSW's other catchments have no access to the entire catchment apart from walking trails.

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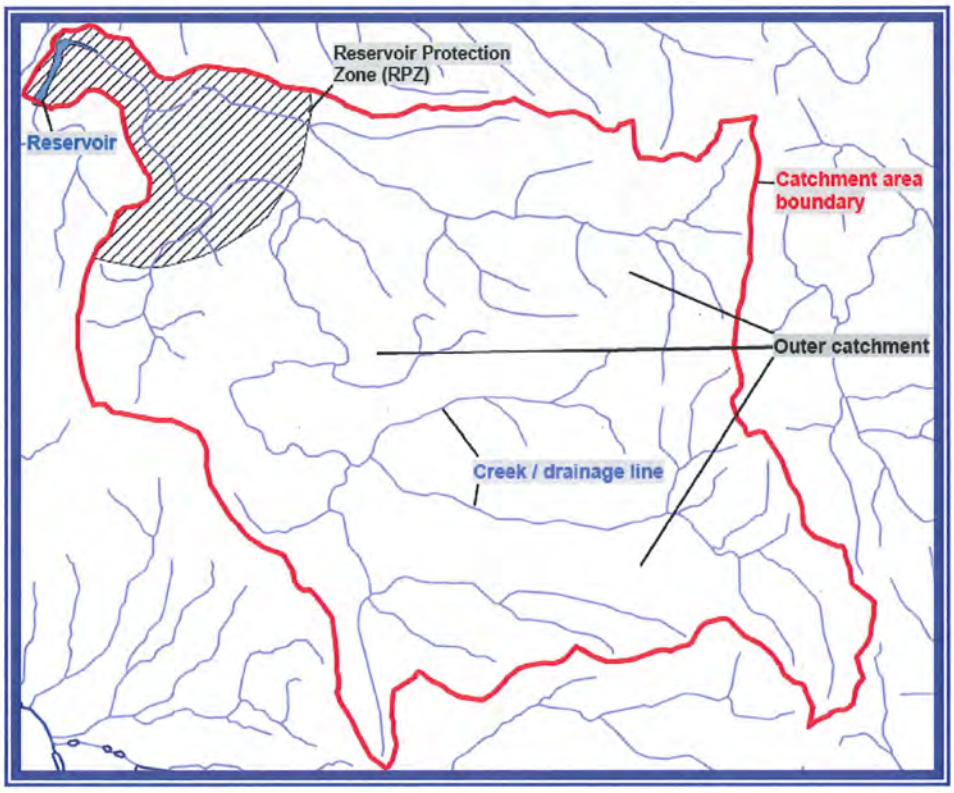
Looking after all our water needs

Catchment areas

What is a catchment area?

A catchment is an area of land where water drains downhill into a waterbody such as a lake, river, reservoir or aquifer. It may also be referred to as a catchment area, a drainage basin or a watershed for surface water, or a recharge area for groundwater aquifers.

The boundary or edge of a catchment has the highest elevation, while the receiving body such as a reservoir is at the lowest elevation point of the catchment.



Under the *Country Areas Water Supply Act 1947** and the *Metropolitan Water Supply, Sewerage, and Drainage Act 1909** a catchment area is defined as:

> "all land over, through, or under which any water flows, runs or percolates directly or indirectly into any reservoir erected or used in connection with any water works" or "water supply".

Catchment areas are proclaimed under both Acts to protect surface water sources used for public drinking water supplies. Water reserves can also be proclaimed.

In general, water reserves are proclaimed to protect groundwater sources; however, on occasion water reserves have been proclaimed over surface water catchments that have been identified as potential future drinking water sources (e.g. the Donnelly River and Warren River water reserves).

Reservoir protection zones

Reservoir Protection Zones (RPZ) are applied within proclaimed catchment areas. They consist of the reservoir and that part of its catchment that lies upstream of the dam wall and within 2 kilometres of the top water level of the waterbody. The RPZ includes the waterbody itself, but does not extend outside the catchment boundary or down-stream of the dam wall. It covers that part of the catchment area which is most vulnerable to contamination.

The objective of a RPZ is to prevent land uses and activities occurring close to or on the reservoir that present an immediate risk to water quality and subsequently to public health. Please refer to WQIS No. 26 for further details on RPZ.

Outer catchment

The term 'outer catchment' refers to the land that extends from the edge of the RPZ to the boundary of the catchment area. In most catchments this area is considerably larger than the RPZ.

What happens to existing or future activities and land uses when a catchment area or water reserve is proclaimed?

Land uses and activities that have been legally established prior to proclamation of a catchment area can continue at their presently approved level, provided they operate lawfully. Where necessary, negotiations may be arranged with landowners and managers to implement environmental management practices that minimise risks to water sources. Proposed future land uses and activities are required to meet the provisions of State planning policy 2.7*: Public drinking water source policy*** and development approval, if granted, may be subject to conditions.

* Acts of the Parliament of Western Australia and subsidiary legislation are available from the State Law Publisher <http://www.slp.wa.gov.au/legislation/statutes.nsf/default.html>.

** Western Australian Planning Commission 2003, Statement of planning policy No. 2.7*: Public drinking water source policy*, Government of Western Australia, Perth, available <www.wapc.wa.gov.au> select < Publications < State planning policies.

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Recent disease (microbial pathogen) outbreaks in the drinking water of affluent nations

Acknowledgement

This information sheet is based on the authoritative work of Hrudey, SE and Hrudey, EJ 2004, *Safe drinking water: Lessons from recent outbreaks in affluent nations*, IWA Publishing, Cornwall, UK.

This book aims to improve understanding and raise awareness, of the factors commonly causing drinking water transmitted disease outbreaks. It follows a case history approach, with detailed analysis of the failures underlying these outbreaks – as documented by public inquiry and in investigation reports, surveillance databases, open literature etc. The book 'converts hindsight into foresight' to inform drinking water and health professionals – including operators, managers, engineers, chemists, microbiologists and regulators; as well as academics and undergraduates of these professions.
(Extract from IWA Publishing)

Introduction

Public drinking water systems that supply good quality, safe water are a critical foundation for public health. Sometimes the inherent safety of drinking water supply systems in affluent nations may be taken for granted, and lead to reductions in the barriers of protection, or the resources needed to ensure their safety.

Drinking water is very safe for most residents of affluent nations, however in recent decades there have been many cases of disease (microbial pathogen) outbreaks occurring in the drinking water of these nations. Analysis of these cases shows that these outbreaks were generally preventable.

The main origin of waterborne diseases is faecal contamination, which can originate from humans or animals, with human wastes preventing the highest risks. The risk of disease outbreaks is considerably reduced when high levels of sanitation and waste management are in place.

Multiple barriers for the protection of drinking water

Affluent nations generally have multiple barriers in place to protect their drinking water systems. The first barrier, and ideal situation, is catchment protection in order to ensure that high quality raw water enters storage areas. Once human development encroaches on a catchment there tends to be a greater range and magnitude of water quality problems. This will often mean that higher levels of treatment are needed, in order to ensure the supply of high quality, safe drinking water. Extreme weather events and natural disasters may cause failure in several of these protective barriers, and result in disease outbreaks occurring in drinking water.

Raw water is monitored during storage in order to determine the optimal treatment regime for the supply of safe drinking water. Typically in affluent nations, drinking water treatment comprises clarification (coagulation, flocculation and sedimentation) and filtration, followed by chlorination as a means of disinfection. Filtration is a key part of treatment, given that the clarification process tends to cause faecal material to clump (into fine particles) in water. Some microbial pathogens (e.g. *Cryptosporidium*) are resistant to chlorination, however they can be dealt with by alternative disinfection such as ultraviolet radiation.

Overview - including lessons learned

Recurring themes of the 70 case studies in Hrudey, SE and Hrudey, EJ (2004):

- *Microbial pathogens pose the greatest risk to drinking water safety.*
- *Robust, effective multiple barriers to drinking water contamination are needed.*
- *Drinking water professionals must be capable and responsive, as well as accountable to drinking water consumers and regulators/governments.*
- *Ensuring safety is an exercise in risk management, and in the face of uncertainty a precautionary approach is needed.*

Examples of disease outbreaks in affluent nations

Country	Location	Date	Contaminant(s)	Details	Estimated impacts
Australia	Sydney[1]	July 1998	*Cryptosporidium* & *Giardia*	Boil water alert (BWA) issued	>$100million
Canada	Walkerton, Ontario[1]	May 2000	*Escherichia coli* & *Campylobacter jejuni* in a groundwater bore	Inadequate disinfection, delayed BWA	7 deaths, 2300 ill, Royal commission inquiry, >$200 million
	North Battleford, Saskatchewan[1]	March 2001	*Cryptosporidium parvum* in river water	Sewage contamination, poorly filtered	5800 – 7100 ill
England	Clitheroe, Lancashire[1]	March 2000	*Cryptosporidium parvum*	Inadequate treatment, BWA	58 ill
	Northhampton[2]	June 2008	*Cryptosporidium parvum*	BWA	No report
Finland	Heinavesi[1]	March 1998	Norwalk-like virus	Inadequate treatment	1700 – 3100 ill
Italy	Matera resort[1]	March 1998	Norwalk-like virus	Irrigation cross-contamination	22 – 344 ill
Ireland	Galway[2]	March 2007	*Cryptosporidium*	BWA	"Many ill"
	Belfast[1]	2000 - 01	*Cryptosporidium*	3 outbreaks	437 ill
New Zealand	Hawkes Bay school[1]	2001	*Campylobacter jejuni* in spring water; cattle	Disinfection failed	95 – 185 ill
Scotland	Glasgow[2]	August 2002	*Cryptosporidium* in reservoir	BWA	No report
USA	Gloucester, Massachusetts[2]	September 2009	Coliforms	BWA	No report
	Aurora, Illinois[2]	February 2004	Faecal coliforms	BWA	No report
Wales	North Wales[2]	2005	*Cryptosporidium*	Inadequate treatment, BWA	231 ill

Sources: [1]Hrudey & Hrudey (2004); [2] Internet search October 2009

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Looking after all our water needs

Recreational access to drinking water catchments in other Australian capital cities

Introduction

Access to drinking water catchments for recreational pursuits is similar throughout Australia if consideration is given to the nature and purpose of the individual reservoirs. Specifically, it is common to allow some water based recreation if the source is a pump back, has a substantial distance to travel before uptake, is for irrigation or is for emergency backup purposes. Similarly, it is common to allow passive land based recreation such as picnicking at designated sites and vehicle access on public roads. In this regard the current policy for recreational access in WA reflects the common trend seen throughout Australia.

> ***"In most cases, recreational access is not permitted on permanent water supply storages although some form of limited recreational activity is permitted in parts of the catchment lands"*** (CRC for Water Quality and Treatment 2006)

Sydney

Drinking water catchments for Sydney are managed by the Sydney Catchment Authority (SCA). All catchments managed by the SCA have a prohibited area extending 3km from the reservoir or in some cases covering the entire catchment. These areas are termed 'schedule one areas' and all access, except specified walking corridors, is prohibited. The rest of the catchment is termed 'schedule two areas' and some passive recreational pursuits such as picnicking and bushwalking are allowed. There is some fishing and non-powered boating permitted on back up sources, such as Tallowa Dam.

Melbourne

Drinking water catchments for Melbourne are managed by Melbourne Water. Around 80% of Melbourne's drinking water comes from 157,000 hectares of forest in the Yarra Ranges, which has been closed to the public for over 100 years. Only one reservoir, Sugarloaf, is open to recreational pursuits such as shore-based fishing, sailing and bushwalking. These activities occur in restricted areas. Sugarloaf Reservoir is an off-stream storage for water pumped from the Yarra River (a mixed land use catchment). In other cases, passive recreational facilities are provided downstream of a reservoir.

Adelaide

Drinking water catchments for Adelaide are managed by South Australia Water. Most of Adelaide's comes from reservoirs within the Mount Lofty Ranges catchment. This is supplemented with water from the River Murray and two other reservoirs closer to Adelaide. Most reservoirs have facilities for picnicking below the dam wall. Recreation is not allowed on reservoirs, with the exception of the South Para reservoir, where fishing is allowed. South Para is the second largest reservoir in South Australia. These activities are confined to certain areas and within certain times.

Brisbane

Drinking water catchments for Brisbane are managed by Seqwater. The majority of Brisbane's water supply comes from the Wivenhoe, Somerset and North Pine Dams. Water from the Somerset Dam is released into Wivenhoe Dam, which in turn supplements the natural flow of the Brisbane River and maintains an adequate supply of water to the Mount Crosby pumping station located 132km downstream. Much of the land within the drinking water catchments is privately owned. All dams provide access for a range of permit based recreational pursuits such as powered and non-powered boating, camping and fishing. Many locations also have a range of day-use facilities such as BBQ's, picnic areas and walking trails. Notably, Seqwater have temporarily closed Hinze Dam due to an *E. coli* outbreak (October 2009) and are currently reviewing their recreational policy for drinking water reservoirs.

> ***"Seqwater has developed a draft Recreational Management Framework to guide future recreation activities. The framework was released for public comment in September with submissions closing on 5 October 2009"*** (Seqwater website)

Darwin

Drinking water catchments for Darwin are managed by Power and Water Corporation. Darwin's water supply is a combination of groundwater and surface water. There are two reservoirs, Darwin River Dam and Manton Dam. Both dams have closed catchments and hence there are no land-based recreational pursuits. Manton Dam is a backup source and water-based recreational pursuits are allowed. However, if this source is required for future supply the water-based recreation will need to cease.

Canberra

Drinking water catchments for Canberra are managed by ActewAGL. The majority of Canberra's water supply comes from three dams built along the Cotter River, which are part of the Namadgi National Park. In some parts of the catchment passive land-based recreational pursuits such as bushwalking, picnicking and cycling are allowed. A fourth dam, Googong, was developed on the Queanbeyan River (a mixed land use catchment) as a back-up supply. This dam allows land-based recreational pursuits in the outer catchment and water-based recreational pursuits such as sailing, canoeing and fishing on the dam. The storage capacity of this reservoir and associated catchment area is at least double the size of the other sources.

Hobart

Drinking water catchments for Hobart are managed by Southern Water. Hobart's water supply is obtained from three dams, Mount Wellington, Derwent River and Lake Fenton. These dams have some land-based recreational pursuits. Activities such as dog walking, horse riding and trail bikes are restricted to certain areas. Contact with the water is generally not permitted.

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Wildfire in drinking water source catchments

Introduction

Wildfire is an integral part of the Australian landscape. However, wildfires can cause major challenges when they occur in drinking water source catchments. Formerly pristine catchments with a high quality drinking water supply can be quickly degraded following a wildfire. Impacts include erosion of sediment, higher turbidity and increased concentrations of nutrients and other chemicals. The magnitude of these impacts is influenced by factors such as fire size, intensity (rate of heat released) and severity (amount of fuel consumed); environmental factors such as slope and soil type; and weather conditions following the fires (heavy rainfall following a wildfire is the primary driver for transportation of contaminants into water sources).

Findings from recent wildfires in Australian drinking water source catchments

Recent wildfires include:

- fires in New South Wales (NSW) in December 2001/January 2002
- fires in the Australian Capital Territory (ACT) in January 2003
- fires in north east Victoria in January 2003
- fires in Western Australia (WA) in January 2005.

Mundaring fires, WA, 2005

Over 28 000 hectares of bushland were burnt during fires in January 2005. The area burnt included large parts of the Mundaring, Kangaroo Gully and Victoria catchment areas and small areas of Canning and Lower Helena catchment areas. The fires resulted in significant vegetation loss in the catchments, which was expected to cause an increase in turbidity in runoff and within drinking water reservoirs following winter rainfall. At the time, the Mundaring Weir was the only source of drinking water for the city of Kalgoorlie and many wheatbelt towns and so protection of this source was particularly important. In an effort to control turbidity in this source various erosion control structures were installed and coagulant was added to the Darken River. Monitoring showed that runoff volumes and turbidity levels in runoff were increased as a result of the fires (see photo). However, due to the measures taken, there was a negligible increase in turbidity in the Mundaring Weir.

(Water Corporation 2005)

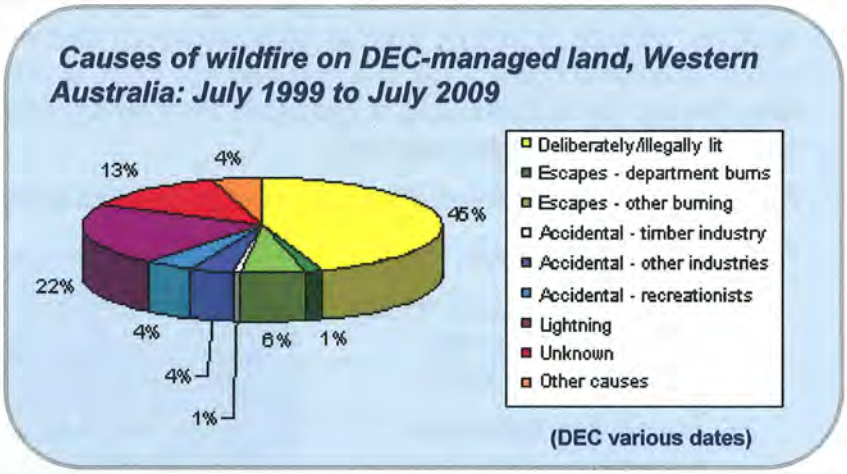
Impacts noted from observations and monitoring include:

1. Significant changes to the landscape and catchment condition, such as extensive destruction of vegetation in the catchments and increased water repellency of soils.
2. Significant erosion of sediment and attached nutrients from burnt hillslopes when storm events followed major wildfires. For example, four months after the fires in NSW, large quantities of topsoil had been eroded from burnt hillslopes and transported into streams. Sediment delivery to streams in 2002 was around six-times the pre-fire mean-annual rate in the fully burnt Little River catchment, and three-times the pre-fire mean-annual rate in the partially burnt lower Nattai River catchment (Wilkinson et al. 2007).
3. Water quality degradation in drinking water reservoirs and feeder streams, including increased levels of turbidity, manganese, iron and nutrients. For example:

- The post-fire pulse of turbidity in Bendora Dam (ACT) was nearly 30 times greater than any previously recorded turbidity event, and the magnitude of iron and manganese peaks exceeded all previous peaks by factors of three and five respectively (White et al. 2006).
- Sediment and nutrient yields to Lake Burragorang (NSW) in post-fire runoff events were one to two orders of magnitude larger than in pre-fire conditions (Wilkinson et al. 2007).
- Erosion, landslides and flooding in the Buckland River catchment (Victoria) following the fires resulted in turbidity levels of up to 120 000 NTU in the Buckland River (compared to normal turbidity levels of 1-2 NTU), and up to 71,000 NTU in the upper Ovens River (North East Water 2003).

4. Disruptions to water supply. For example, an inability for drinking water treatment plants to cope with high turbidity levels led to water restrictions and boil water alerts for towns following the 2003 Victorian fires; and following fires in the ACT, one of Canberra's main water supply dams was switched off due to water quality issues, requiring an emergency source to be utilised and water restrictions to be implemented.

Causes of wildfire



There are a range of potential causes of wildfire, both natural and human-induced. Causes of wildfire on Department of Environment and Conservation (DEC)-managed land in WA have been documented for the past ten years. Over this time lightning accounted for 22% of fire causes, while 45% (an average of 241 fires/year) have been deliberately lit. Other human causes include escapes (7%), and accidental fires from industries (5%) and recreationalists (4%). This information demonstrates that humans (either through negligence or deliberate actions) are the principal cause of wildfires in WA.

Management of wildfire risks

Measures that have been implemented in WA that assist in reducing the risk of wildfire in drinking water source catchments include:

- reduction in fuel loads through prescribed burning
- implementation of other wildfire control measures e.g. fire breaks and fire bans
- restrictions to human access in vulnerable areas e.g. to reservoir protection zones (area within 2 km of the high water mark of a reservoir). This not only reduces the risk of accidental fires (e.g. from campfires) but also reduces the opportunity for the deliberate lighting of fires.

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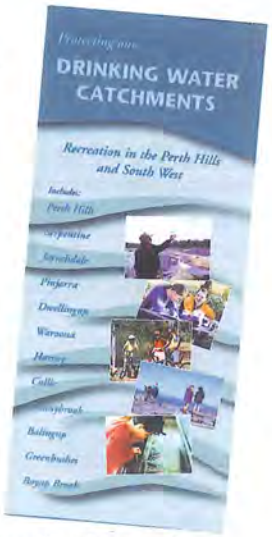
Water quality information sheet 31
November 2009

Looking after all our water needs

Protecting our drinking water catchments: recreation in the Perth hills and south west - a summary



This pamphlet (2004) provides a map and guide to recreation and associated facilities in the Perth hills and south-west of Western Australia. It indicates permitted recreational activities, roads, tracks, facilities, catchment areas and reservoir protection zones (RPZ).

Drinking water catchments

Our drinking water catchments traverse the suburbs of Perth, jarrah and marri forests, banksia woodlands, pine plantations and rural areas. As water drains through the catchments it can pick up bacteria and other microbes, soil, litter and chemicals such as spilt fuel.

"Respecting the constraints on what you can do in and around a drinking water catchment helps to protect the quality of our drinking water"

Protecting our catchments is an important way to ensure the water we receive in our home is safe to drink. When walking, cycling or driving through catchments, visitors are asked to stay on existing roads and tracks to help prevent soil erosion and damage to wildlife habitat.

Reservoir protection zones

"By protecting our catchments we will ensure the availability of safe, clean drinking water for now and into the future"

Near a drinking water reservoir, the risk of bacteria and other microbes, chemicals and soil particles entering the water is very high. Public access to RPZ is usually not allowed as the risk to the drinking water is too high. There are exceptions due to existing established walk tracks and cycles trails. Examples include the Bibbulmun Track within the Mundaring Weir RPZ, and the Munda Biddi and Carinyah bike trails within the Canning River RPZ. The use of these walk tracks and cycle trails is allowed but visitors are asked to stay on the paths. Further details about RPZ are provided in WQIS No. 26.

Beyond drinking water catchments

Some catchments have facilities, including picnic areas and toilets, located below the dam walls of our drinking water reservoirs. Since these facilities are located downstream from the reservoir they are outside the drinking water catchment. Visitors can visit regional parks, national parks and irrigation reservoirs where water-based activities are welcome. Details are provided in the pamphlet.

"Many drinking water reservoirs have recreation facilities below the dam wall, outside the catchments"

Table 1 (overleaf) is an updated version of the original table provided in the 2004 pamphlet. It should be noted that this table only encompasses the Perth hills to south west area and so does not include many additional recreational opportunities available within the Perth metropolitan area, along the coastline and within estuarine systems.

Table 1 Recreation and facilities guide in the Perth Hills to South West

	Barbeques	Picnic tables	Walk trail(s)	Cycling trail(s)	Lookout	Public toilets	Disabled access	Restaurant/ café	Boat ramp	Boating - fuel powered	Boating - other (e.g. canoeing)	Fishing*	Marroning (snare only)*	Swimming	Water skiing	Camping	Caravan sites
Irrigation and recreation dams																	
Glen Mervyn Dam	✓	✓	✓			✓			✓	✓	✓	✓	✓	✓	✓		
Harvey Dam	✓	✓	✓		✓	✓	✓				✓	✓	✓	✓			
Lake Brockman (Logue Brook Dam)	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Lake Leschenaultia	✓	✓	✓	✓		✓	✓	✓			✓			✓		✓	
Lake Kepwari	✓	✓	✓			✓			✓	✓	✓			✓	✓		
Lake Moyanup (Drakesbrook Weir)	✓	✓	✓			✓				✓	✓	✓	✓	✓			
Lake Navarino (Waroona Dam)	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Oakley Dam	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓			
Stockton Lake	✓	✓	✓			✓			✓	✓	✓			✓	✓	✓	
Potential future drinking water dams																	
Wellington Reservoir	✓	✓	✓	✓	✓	✓		✓			✓	✓	✓	✓		✓	
Drinking water dams*																	
Bickley Reservoir	✓	✓	✓			✓			The Department of Water's Statewide policy No. 13 - *Policy and guidelines for recreation within public drinking water source areas on crown land* (2003) is a publicly consulted policy created to guide recreation within the state's drinking water catchments. This policy reflects existing legislation, which does not support recreation on drinking water reservoirs or within 2 km of the reservoir's high water mark. In the remaining area of the catchment controlled access for recreation purposes (such as bushwalking, mountain biking, bird watching, orienteering, and bbq/picnic areas) is supported by policy 13. The legislation and policy currently related to recreation access to drinking water catchments is currently being reviewed by the Standing Committee on Public Administration. This parliamentary committee is due to report by July 2010.									
Canning Reservoir	✓	✓	✓		✓	✓	✓										
Churchman Brook Reservoir	✓	✓	✓			✓	✓										
Harris Reservoir	✓	✓	✓		✓	✓											
Mundaring Weir	✓	✓	✓		✓	✓	✓										
Mungalup Reservoir			✓														
North Dandalup Reservoir	✓	✓	✓		✓	✓											
Padbury Reservoir	✓	✓	✓			✓											
Serpentine Pipehead	✓	✓	✓		✓	✓											
Serpentine Reservoir	✓	✓	✓		✓	✓	✓	✓									
South Dandalup Reservoir	✓	✓	✓		✓	✓	✓										
Stirling Reservoir	✓	✓	✓		✓	✓	✓										
Victoria Reservoir	✓	✓	✓		✓	✓	✓										
Wungong Reservoir	✓	✓	✓		✓	✓	✓										
National, regional and conservation parks**																	
Avon Valley NP	✓	✓	✓			✓					✓					✓	
Beela (formerly Mundaring) NP	✓	✓	✓	✓	✓	✓										✓	
Canning NP			✓	✓													
Greenmount NP			✓														
Helena NP		✓	✓			✓										✓	✓
John Forest NP	✓	✓	✓	✓	✓	✓	✓	✓									
Kalamunda NP		✓	✓														
Lesmurdie Falls NP		✓	✓		✓	✓											
Pickering Brook NP			✓	✓													
Regional Parks of the Darling Range	✓	✓	✓	✓		✓	✓										
Serpentine NP	✓	✓	✓			✓	✓										
Walyunga NP	✓	✓	✓			✓	✓				✓						
Wandoo NP	✓	✓	✓			✓											
Wellington NP	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓		✓	✓
Other recreation areas																	
Hoffman Mill recreation site	✓	✓	✓			✓	✓									✓	✓
Lane Pool Reserve (Dwellingup)	✓	✓	✓	✓		✓	✓				✓	✓		✓		✓	✓
Minninup Pool (Collie)		✓	✓			✓	✓				✓	✓	✓	✓			
Wright's Bridge (Balingup)	✓	✓				✓	✓				✓	✓		✓		✓	✓

* require a licence from Department of Fisheries – (08) 9482 7333

** facilities provided below the dam wall

*** refer to Department of Environment and Conservation's *National, marine and regional parks in Western Australia* pamphlet for more information.

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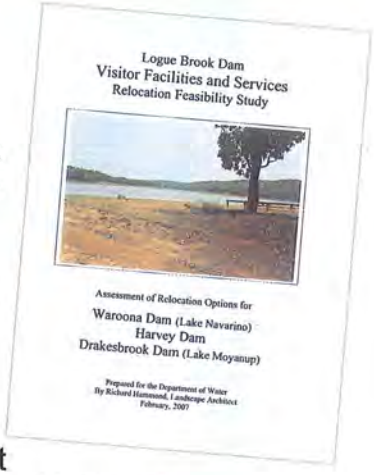
Water quality information sheet 32
November 2009

Looking after all our water needs

Logue Brook Dam visitor facilities and services relocation feasibility study - summary



This report was prepared by Richard Hammond, Landscape Architect for the Department of Water in 2007 when it was proposed to change the primary purpose of Logue Brook Dam from 'irrigation and recreation' to 'irrigation and drinking water supply'. If this change had taken place recreation on and immediately around Logue Brook Dam would have been prohibited in order to meet stringent public health requirements for public drinking water sources.

The study determined the feasibility, physical capability and potential for relocating established recreation facilities and activities at Logue Brook Dam (Lake Brockman) to other sites in the Southern Darling Range, specifically Waroona Dam (Lake Navarino), Drakesbrook Dam (Lake Moyanup) and Harvey Dam. It did not consider water quality or quantity issues.

These dams are strategically located in close proximity to the Murray River and Lane Poole Reserve to the east and numerous other rivers and reservoirs in the Darling Range to the north and south. Excellent road access to Logue Brook, Waroona, Harvey and Drakesbrook dams from the population centres of the coastal urban zone ensures that visitors from Perth, Rockingham, Bunbury, Collie and Mandurah can visit the area within a two-hour drive.

Existing recreation opportunities

The study identified the type, quantity and quality of recreation at Logue Brook Dam. It considered existing visitor sites and facilities, including land and water based activities that would be affected if Logue Brook catchment were closed to visitor access.

Relocating existing recreation facilities

> "Creative planning solutions and active management of the limited resources available for recreation are essential."

The study determined if established visitor facilities, services and experiences could be transferred to other dams. It assessed the potential for relocation in terms of a direct transfer of recreation activities, facilities and opportunities through the creation of new sites or enhancement of established facilities and sites.

Key factors considered included physical characteristics, proximity to infrastructure, aesthetic appeal and conflict potential. It identified generic and use-specific 'suitability factors' as a basis for selection of sites suitable for development of visitor facilities and services that support recreational activities. User profiles and demand indicators were identified and site selection suitability factors were considered in the study.

Conclusion

It can be concluded from Table 1 (overleaf) that the potential exists to develop and expand all types of recreation facilities and activities at 'irrigation and recreation' sites.

Table 1 *Established and potential recreation facilities and activities*

(Note: This assessment is based on physical assessment criteria only and does not consider water quality or availability.) (Est=established, Pot=potential)

	Logue Brook Dam			Harvey Dam			Waroona Dam			Drakesbrook Dam		
	Est	Pot	Conclusions	Est	Pot	Conclusions	Est	Pot	Conclusions	Est	Pot	Conclusions
Land-based facilities												
Caravan park/resort	✓	X	Brockman Holiday Park to be relocated	X	✓	**Highly Suitable** for full service facility	✓	✓	**Highly suitable** for new or expanded full service facility	X	X	**Not Suitable**
Camping	✓	X	Brockman Holiday park to be relocated	X	✓	Two sites **Suitable or Highly Suitable** for camping facilities	✓	✓	Two sites **Suitable or Highly Suitable** - new or expanded.	X	X	**Not Suitable**
Day use sites	✓	X	Four sites to be relocated	✓	✓	Four sites **Highly Suitable** for day use development	✓	✓	Six sites **Highly Suitable** for day use development	✓	✓	One existing site **Highly Suitable** for expansion
Land-based activities												
Cycling	✓	✓	Limited catchment access to cyclists	X	✓	Development of cycle trails **Highly Suitable**	✓	✓	Development of cycle trails **Highly Suitable**	X	✓	Development of cycle trails **Highly Suitable**
Bushwalking	✓	✓	Limited catchment access to hikers	X	✓	Development of walking tracks **Highly Suitable**	✓	✓	Development of walking tracks **Highly Suitable**	X	✓	Development of walking tracks **Highly Suitable**
Water-based facilities												
Boat launch ramp	✓	X	One formal, one informal ramp to be relocated	✓	✓	Expansion of existing formal ramp **Highly Suitable**	✓	✓	Three informal ramps, expansion **Suitable**	✓	✓	Natural informal ramp **Suitable**
Water-based activities												
Power boating and water skiing	✓	X	Power boating and skiing to be relocated	X	✓	Western sector of surface water **Suitable**	✓	✓	Zoned use areas **Limited Suitability** for expanded use	X	X	**Not Suitable**
Sailing, canoeing and kayaking	✓	X	All surface activity to be relocated	✓	✓	Central and eastern sectors **Highly Suitable**	✓	✓	Zoned use areas **Highly Suitable**	✓	✓	**Highly Suitable**
Fishing and marroning	✓	X	Fishing and marroning to be relocated	✓	✓	**Limited Suitability** for expanded use	✓	✓	**Limited Suitability** for expanded use	✓	✓	**Limited Suitability** for expanded use
Swimming	✓	X	Swimming to be relocated	✓	✓	**Highly Suitable** for water play/swimming	✓	✓	**Highly Suitable**	✓	✓	**Highly Suitable**

Citation: Hamond, R 2007, *Logue Brook Dam visitor facilities and services relocation feasibility study: Assessment of relocation options for Waroona Dam (Lake Navarino), Harvey Dam, Drakesbrook Dam (Lake Moyanup)*, Department of Water (unpublished). You can download this report from the Department of Water website at www.water.wa.gov.au/firstdowPublic/DocViewer?id=38051.

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Water quality information sheet 33
December 2009

Looking after all our water needs

Review of the drinking water source protection by-laws

Introduction

The objective of the *Metropolitan Water Supply, Sewerage and Drainage (MWSS&D) Act By-laws 1981* and *Country Areas Water Supply (CAWS) Act By-laws 1957* is to prevent contamination of water in areas that are used for public water supply. The by-laws apply in catchment areas (CA), water reserves (WR) and underground water pollution control areas (UWPCA) that have been proclaimed under the *MWSS&D Act 1909* or *CAWS Act 1947*. Collectively these proclaimed areas are called public drinking water source areas (PDWSA). More information on drinking water source protection legislation is provided in WQIS No. 14.

It is recognised that the current by-laws for protecting drinking water quality (and public health) are outdated (e.g. penalties are disproportionately low) and inconsistent (e.g. the *MWSS&D Act By-laws* are currently much stronger than the *CAWS Act By-laws*). This was confirmed in a select committee report on metropolitan development and groundwater in 1994, and again in a standing committee report on ecologically sustainable development in relation to the quality of Perth's water supply in 2000. Both of these reports recommended that the by-laws be updated.

Key actions undertaken to date are summarised in Table 1, and further information is provided below.

Table 1 Key actions undertaken on the by-law review

Date	Action
1999	Desktop case studies completed
2001	*Proposed by-laws for the protection of public drinking water source areas – draft* published
2002	Case study workshops completed
2005	Workshop held with Water Corporation
2005	*Enhancement of the Metropolitan Water Supply, Sewerage and Drainage By-laws 1981 and Country Areas Water Supply By-laws 1957 – draft* prepared and comments sought from relevant government agencies
2006	Comments on 2005 report provided by the State Solicitors office
2008	Comments on 2005 report provided by the Parliamentary Council
2009	Draft discussion paper in preparation

2001 report

Proposed by-laws for the protection of public drinking water source areas – draft was developed to "facilitate further consultation with government agencies, landowners, community groups and industry groups affected by the proposed by-law reform." It provided background information on the protection of PDWSA, the reasons why reform of

the by-laws is necessary, an overview of proposed changes to the by-laws, information on how proposed by-laws would be implemented and a proposed consultative process.

Case studies

In 1999 desktop case studies were undertaken for three PDWSA (Newman WR, Bolgart WR and Harding Dam CA). In 2002, case study workshops were held for five PDWSA (Esperance WR, Gwelup UWPCA, Leonora WR, Lower Helena CA and Ten Mile Brook CA). These case studies aimed to trial the proposed by-laws against the existing and proposed land uses and activities within representative PDWSA. PDWSA were chosen to encompass different land uses (e.g. broadacre agriculture, intensive agriculture, urban, mining, recreation and tourism), different water source types (i.e. groundwater and surface water) and other factors (e.g. Water Corporation and non-Water Corporation service provider). Case study workshops involved representative stakeholders (including landowners, industry groups, local government authorities and State government agencies) for each case study area.

Workshop participants supported protection of water quality for public drinking water supplies and the response to the by-law review was generally positive. Additional by-law amendments recommended at the workshops included increased penalties, the potential for powers to be delegated to other agencies, the ability to seize equipment for unauthorised activities and use of an independent tribunal for appeals rather than referring appeals to the Minister.

Water Corporation workshop

In August 2005, a workshop was held with Water Corporation staff to benefit from their experience and knowledge of surveillance and enforcement processes. The purpose of this workshop was to provide an overview of the by-law review, resolve issues raised by Water Corporation and discuss specific high priority by-laws.

2005 report

Enhancement of the Metropolitan Water Supply, Sewerage and Drainage By-laws 1981 and Country Areas Water Supply By-laws 1957 – draft provided updated discussion and proposed enhancements to the parts of the by-laws which regulate activities in PDWSA. Preparation of this document considered previous information, and aimed to limit duplication of proposed by-laws with powers already provided under the *Environmental Protection Act 1986* and *Environmental Protection Regulations 2000*. Key objectives for the by-law review stated in this document included:

- consistency between the MWSS&D and CAWS by-laws
- statutory recognition of priority areas and protection zones
- increased penalties for offences
- increased powers of authorised persons
- ability to provide Infringement Notices for offences.

Comments were sought from key stakeholders, including other government agencies and water service providers.

Discussion paper (2009/10)

A discussion paper, which considers all of the above sources of information is currently in preparation. This paper will aim to establish support for a modern set of by-laws or regulations to ensure the availability of a reliable, safe, good quality drinking water supply to consumers now and in the future.

Attachment 4

Drinking water, irrigation and recreational catchments from Perth Hills to South West

Please refer to the unpublished report: *Drinking water, irrigation and recreational catchments from Perth Hills to South West* (Department of Water 2009) provided with this submission.

Figure 1

Public drinking water source areas - Western Australia

Department of Water - Water Resource Management

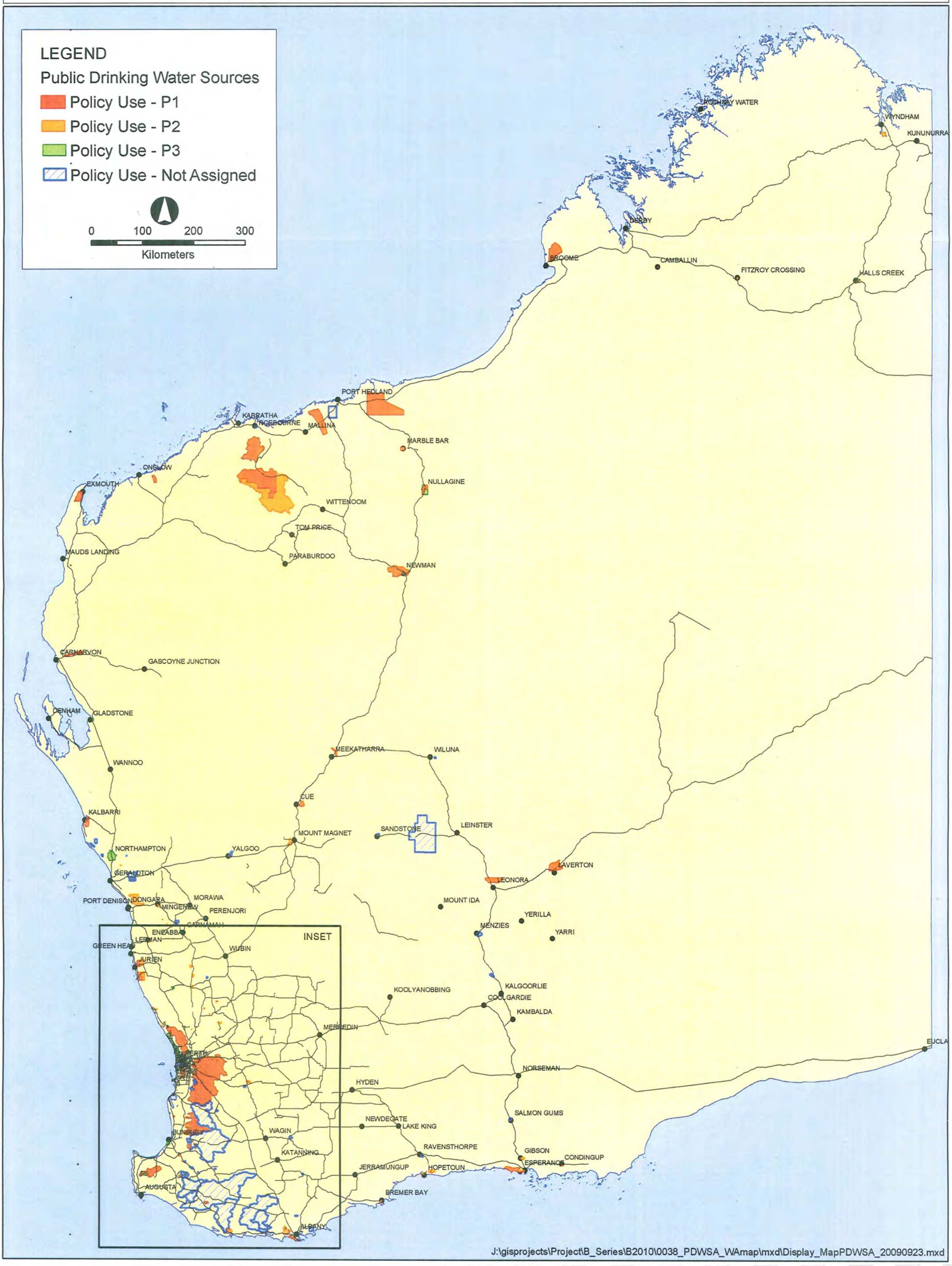
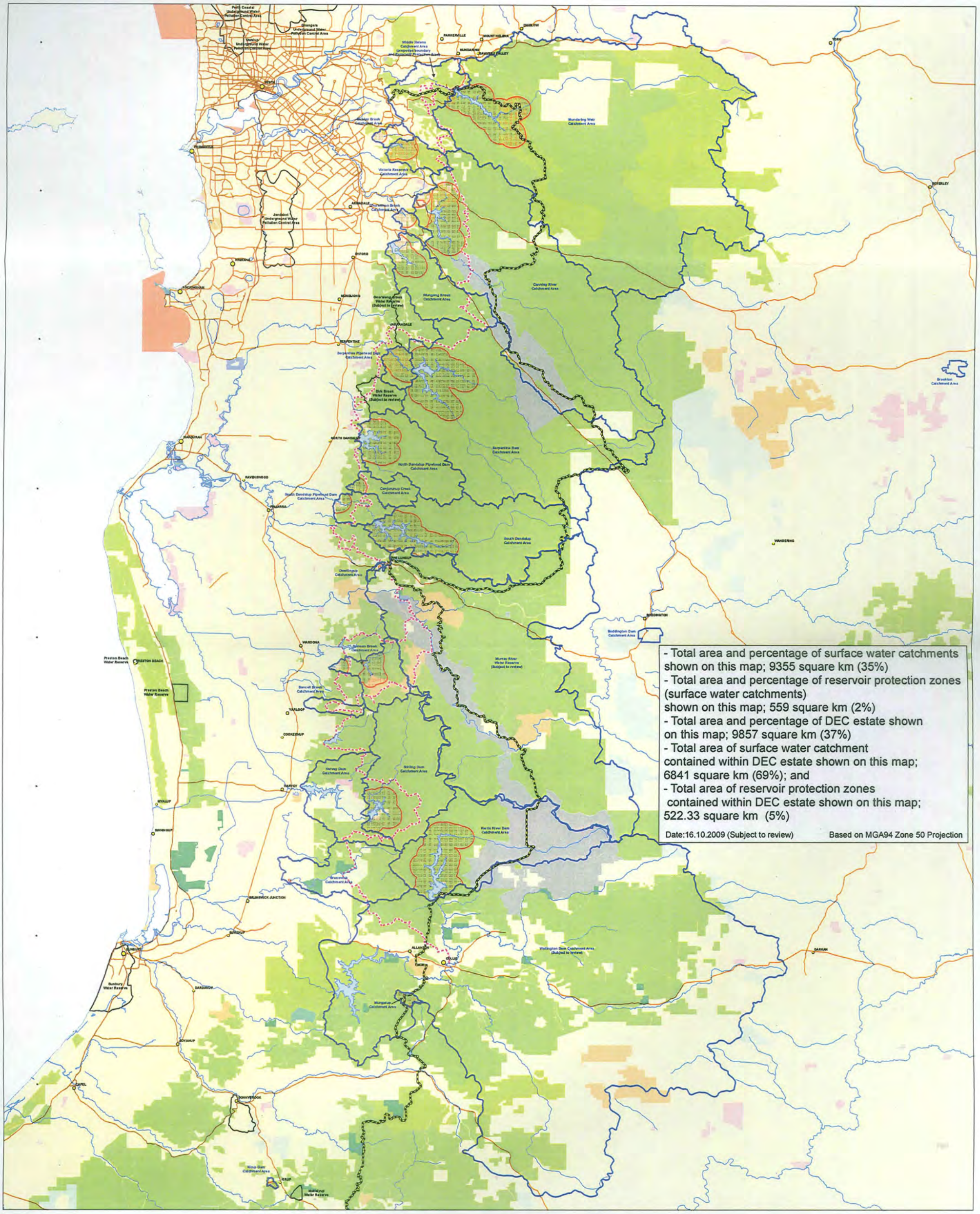


Figure 2

Public drinking water source areas - South West

Department of Water - Water Resource Management

Figure 3 PUBLIC DRINKING WATER SOURCE AREAS
Reservoir Protection Zones - Perth Hills to Collie



SOURCES

DoW acknowledges the following datasets and their Custodians in the production of this map:

Dataset Name - GUSTODIAN ACRONYM - Metadata Date
PDWSA -DOW - January 2008
Reservoir Protection Zones - DOW - January 2008
DEC Estates - DEC - June 2007

LOCALITY MAP

5 0 5 10 15 20
Kilometres

N

Public Drinking Water Source Area
- Catchment Area (Surface Water)
- Groundwater Area
- Reservoir Protection Zone
- Bibbulmun Walk Trail
- Munda Biddi Cycle Trail

DEC Estates
- 5(1)(g) Reserve
- 5(1)(h) Reserve
- CALM Exec Body
- CALM Exec Body Freehold
- Conservation Park
- Former Leasehold
- Marine Park
- Miscellaneous Reserve
- National Park
- Nature Reserve
- State Forest
- Timber Reserve

Datum and Projection Information
Vertical Datum:
Australian Height Datum (AHD)
Horizontal Datum:
Geocentric Datum of Australia (GDA 94)
Projection:
Map Grid of Australia (MGA 94) Zone 50

Project Information
Requestee: Kathryn Buehrig
Map Author: Melanie Webb
Task ID: B2010
Filename J:\gisprojects\Project\B_Series\B2010\0055\SW_RPZmap_15102009_2.mxd
Date:15/10/2009

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