

State of Play:

A REVIEW OF RECREATION IN DRINKING WATER CATCHMENTS IN SOUTHWESTERN AUSTRALIA



A research report commissioned for the Western Australian Government
Department of Environment and Conservation and Department of Sport
and Recreation.

By

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LIST OF ABBREVIATIONS AND ACRONYMS

ADWG	Australian Drinking Water Guideline
CALM	Conservation and Land Management
CAWS	Country Areas Water Supply
DEC	Department of Environment and Conservation
DoW	Department of Water
DSR	Department of Sport and Recreation
MWSSD	Metropolitan Water Supply, Sewerage and Drainage
PDWSA	Public Drinking Water Source Area
RPZ	Reservoir Protection Zone
RIWI	Rights in Water Irrigation
VISTAT	Visitors Statistics Database
WA	Western Australia
WAPC	Western Australian Planning Commission
WC	Water Corporation

EXECUTIVE SUMMARY

Introduction

This report was commissioned by DEC and DSR to address divergent views on Policy 13 and provide an independent, balanced analysis of the information available in relation to recreation in drinking water catchments. The report focuses on legislative and management issues associated with a review of public drinking water supply area (PDWSA) zoning in the Southwest¹ of Western Australia. The review of State-wide Policy 13 includes elements relating to exclusion of recreation from PDWSAs as a means for minimising risk to drinking water supply quality. The Department of Environment and Conservation (DEC) and Department of Sport and Recreation (DSR) have concerns in relation to the review in terms of access to public land, how this might function in the current legislative context and how control of access may be subsequently applied in practice. Stated elements of the review relating to public access are considered to contravene some of the core functions of DEC as a manager of public lands for recreational access. See appendix for the terms of reference.

Objectives

This review sought to collate information in terms of:

- the current policy, legislation and practice relating to recreation in water catchments
- the historical and contemporary recreational pursuits occurring in catchments in Southwest Western Australia
- water quality risks associated with various forms of recreation in water catchments;
- the social and economic values of water based recreation in water catchments;

Information was reviewed from a range of sources including WA State Government Agencies; catchment, water storage and supply management organisations, material provided for community forums relating to catchment and PDWSA management, public submissions, technical and consulting reports and academic publications and presentations.

Summary of Issues

The main issues may be summarised as follows:

- Establishing primacy of legislative mandates regarding catchment management areas when overlap of responsibilities occur;
- Establishing primacy of policies issued by the various governing bodies and their relationship to the legislative provisions relating to water catchment area management.

¹ Southwest region is the subject area of this report. The region is one of 9 designated regions of the state of WA and includes the City of Bunbury and Shires of Augusta-Margaret River, Boyup Brook, Bridgetown-Greenbushes, Busselton, Capel, Collie, Dardanup, Donnybrook-Balingup, Harvey, Manjimup and Nannup, covering an area of 23,998 sq kms.

- Co-operation with regard to land-use and water management responsibilities and establishing processes by which appropriate policies and measures relating to such responsibilities can be assessed prior to implementation.
- Maintaining an efficient system of water quality protection while addressing the recreational needs of the public in and around water catchment areas.
- Assessing the level of risk associated with various types of recreation on or near water in relation to water quality; and
- Identifying and recognising socio-cultural and economic values associated with recreation in catchments.

Major Findings

- The legislative provisions governing the management of PDWSAs in WA are dispersed across various state Departments. Overlaps of legislative responsibilities and functional roles of government agencies and lack of clarity regarding primacy in management of PDWSA land and water resources could result in contradictory policies and management regimes.
- There is no published evidence linking recreational land use in PDWSAs to negative impacts on downstream drinking water supply quality.
- A blanket ban of all recreation does not recognise the potential for low risk activity and runs counter to international good practice and an integrated approach to catchment management..
- A range of other threats to water quality occurring in PDWSAs have been identified and include agriculture, urbanization, wildlife, feral and domesticated animals, mining and timber harvesting. Recreation poses a very minor risk relative to these other activities.
- The presence of these other threats in drinking water catchments suggests the significantly higher risk to water quality can be managed without reverting to exclusion.
- Water catchment management practices in other Australian states allows selected recreation in PDWSAs in combination with monitoring and additional water treatment to provide a multiuse management and multiple barrier approach that ensures minimal risk to downstream water quality supply.
- Increasing demand for water based recreation combined with diminishing water availability means single use management may not be feasible or desirable given the potential social and economic costs.

Main Implications

- Lack of policy, legislative and departmental integration will lead to conflicts of interest in applying legislative requirements in a practical management context and mitigate against an integrated approach to total catchment management.
- Total exclusion of the public from PDWSAs or limited managed access in the absence of treatment presents a single barrier that if breached poses a risk to water quality in downstream supply.
- A multiple barrier approach and full treatment of drinking water is standard practice in most Australian states and internationally. Under such a regime, the presence of recreation poses a very low risk such that total exclusion is not necessary.
- There are legal and social justice implications in relation to the public's rights to use and enjoy public lands and waters as well as practical implications related to enforcing exclusion measures in the absence of majority public support.
- As availability of surface water bodies declines and demand for recreation use increases in line with population growth in the Southwest WA, both extractive and non-extractive use of water catchment land and waters will need to be sensitively managed.

Chapter 1

INTRODUCTION AND BACKGROUND

This report presents a review of the relevant literature that relates to DoW's Policy 13. The current policy is due for review in 2008 and this report is intended to inform that process. For the purposes of this report "catchment area" is taken to mean as that referred to in the *Conservation & Land Management Act 1984* (WA) (CALM Act), the *Country Areas Water Supply Act 1947* (WA) (CAWS Act) and the *Metropolitan Water Supply and Sewerage and Drainage Act 1909* (WA) (MWSSD Act) which refers to 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 and includes Public Drinking Water Source Areas (PDWSAs).² See Appendix 1 for the Terms of Reference.

Legislative Context

In December 2007, the *Water & Rivers Commission Act 1995* WA was repealed and the functions of the Water & Rivers Commission and all legislation relating to water resources have been brought under the auspices of a Ministerial Body³, a body-corporate whose oversight lies with the Minister for Water Resources. DoW has extensive powers granted to it by the CAWS Act and the MWSDD Act to proclaim catchment areas and to implement control measures to safeguard water resources. This includes controlling the form and extent of recreation in water catchments through the preparation of Drinking Water Source Protection Plans and the associated gazettal of water catchments to achieve water quality objectives.

However, the wider management function of catchment areas is vested with DEC under powers granted to it by the CALM Act. Questions have arisen over the primacy of legislative provisions relating to the management of water resources. This is especially when the policy and planning objectives for protecting water quality conflict with social and economic objectives for recreation and tourism in public catchment areas. The function of safeguarding water quality and implementing control measures vests with DoW under powers granted to it by the various water resources legislation (see Chapter 2). Water resource areas, like other areas of Crown land (such as land designated for industry) fall within the overall management planning systems and regimes enforced by DEC. These regimes take multiple uses into account including conservation, recreation, timber production and water. Unless there is a systematic process whereby the policies of each Department and associated organs of the state concerned with water & land-use management can be integrated, implementation measures undertaken may be ineffective, duplicating or conflicting.

² PDWSA is a term that collectively applies to drinking water sources protected by the Declaration of Underground Water Pollution Control Areas, and water reserves and catchment areas as defined in the MWSSDA and CAWS Act (Western Australian Planning Commission 2003)

³ Established by *the Water Agencies (Powers) Act 1984* (WA) section 11

The WAPC is the principal body responsible for issuing statements of planning policy. In this regard, the WAPC's Environment and Natural Resources Policy, Public Drinking Water Source Policy and Water Resources Policy (described in Chapter 2) are created under the provisions of the Planning Act⁴ and are the key policies that apply to proclaimed PDWSAs throughout WA. Further, any developments proposed under the provisions of the current *Planning & Development Act 2005* (WA) that relates to the CALM Act must first be approved by DEC, Hence, primacy of the CALM Act can be inferred here insofar as it applies to assessing proposed development applications.

DEC has the overall management function of the State's catchment areas and upholding community values as they relate to recreational access to public lands. Thus this report is contextualised in accordance with DEC and Department of Sports and Recreation's (DSR) requirements and policy objectives. A reflection on the policy debates over the relative importance and the compatibility of protection of water supply and other land uses in catchment areas is made, together with identifying the issues that need to be addressed in current practices as they relate to the management of water-catchment areas in WA.

Water Catchment Management Context

It is recognised that inland water catchments in the Southwest of Western Australia have historically been, and are currently, popular resources for public recreation.^{5,6,7} Recreation includes a broad range of leisure, pastime and entertainment activities ranging from passive through to active pursuits that vary in their character and potential for environmental impacts.^{1,7} The reduction in winter rainfall⁸ and rapidly growing population⁹ in this region have placed increasing pressure on the acquisition and provision of safe drinking water. This has prompted moves to alter management regimes to increase the perceived security and quality of drinking water in the region. Given the growing population, we can assume an corresponding increase in demand for recreation in water catchments in the Southwest of Western Australia, so any changes in access and management could have significant effects.

The DoW has proposed a review of their Policy 13 that affects recreation within PDWSAs in the Southwest region of Western Australia. This region has a range of drinking water source and irrigation dams that currently host varying levels of recreational activity (see Chapter 3 for more detail). The intent of the policy review is to "protect the 'drinking water' environmental value of PDWSAs on Crown Land in the interests of public health" through the prevention of "inappropriate recreational activities".¹⁰ Any review focussing on the objective of protecting the drinking water

⁴ Then known as *Town Planning and Development Act 1928* (WA)

⁵ Advisory Committee on Purity of Water (1977)

⁶ Williamson et al (1990)

⁷ Jennings (2007)

⁸ Hughes (2003)

⁹ Australian Bureau of Statistics (2008)

¹⁰ DoW (2003)

environmental value, without taking into consideration other competing values such as the public's right to use and enjoy public resources may result in a significant reduction in recreational opportunities based in and around dams in the Southwest region of WA.

DoW has taken a "risk avoidance" stance based on the precautionary principle where any level and type of recreation is considered a risk to water quality. Thus, the preferred option for DoW is to create two kilometre buffer zones (Reservoir Protection Zones or RPZs) around PDWSAs, excluding all recreation, to reduce the perceived risk of water contamination from such activities. A significant limitation in this argument is the lack of dedicated research and substantiated evidence regarding how various types of recreation affects water quality generally and as it relates to the Southwest specifically. Exclusion zones will also be applied to irrigation dams, popular with recreationists, acquired whole or declared in part as drinking water sources.

DEC, on the other hand, takes a "risk management" stance, holding the position that recreation activities can be adequately managed within these areas through suitable planning, design and management of recreational activities and sites. This may include allowing selected recreational activities considered to pose very low or no risk to water quality and provision of appropriately designed and sited facilities (such as sealed vault toilets). In addition, DEC suggests that exclusion zones will displace recreation activity and restrict access to the fewer remaining water bodies where activities are allowed. This may lead to illegal entry and irresponsible activities that were previously prevented by the presence of DEC staff and responsible recreational users within the managed areas. Increased concentration of recreational users in fewer water bodies may increase pressure on those areas in terms of environmental impacts and recreational conflict. DEC recognises the systemic nature of risk management and the need for integrated planning, design and management of public lands.

A major concern relates to the potential overlap of responsibilities which may be caused by the current raft of changes and amendments being made to the Water Resources legislation as they relate to the function of managing catchment areas, performed by DoW and DEC. There is currently a lack of clarity in terms of the primacy of management roles with respect to water resources and the subsequent ability of DEC to perform its functions under the CALM Act (see Chapter 2). There is currently no provision in the CALM Act that determines how it relates to the water resources legislation¹¹ and there are no processes in place by which both DoW and DEC could assess proposed management measures jointly. Subsequently, as water is a precious resource, the control measures devised by DoW under the powers granted to it by CAWS and MWSSD Acts have come to be accepted without adequate debate regarding their practicalities in terms of implementation and encroachment on other uses.

¹¹ See Section 4 CALM Act: Relation of this Act to other Acts

In addition to DoW and DEC, mandates of another major state body, the Department for Planning & Infrastructure (DPI), have bearing on issues related to recreation in PDWSAs. DPI undertakes extensive regional planning exercises and prepare long term strategies for each region of Western Australia under powers granted to it by state planning legislation. The DPI has the mandate for planning and oversight of development of all state land under the State Planning Strategy¹². In this regard, the Southwest Country Land Development Program¹³ and Southwest Directions¹⁴ are key documents that are designed to improve the quality of life of people in the South-West region. The Southwest Country Land Development Program refers to the Southwest Water plan, a document which has been released for public comment. It is expected that advice from both DoW and DEC would have been sought in the preparation of such a plan but again, there is lack of clarity as to which body will perform the management function of areas designated as PDWSAs under such plans.

There is also concern in relation to the management responsibilities of DEC on lands subject to the Policy 13 review proposals. Historically, there have been varying levels of recreational activities present in PDWSAs with no reported events of drinking water contamination clearly linked to those activities. Any control measures arising out of legislative changes may necessitate such activities to be transferred to alternative locations despite the historical evidence. Application of legislative powers to establish the RPZs may also provide for stricter control measures that are in excess of those stipulated by management plans put in place by DEC through the powers granted to it by the CALM Act, in terms of management prescriptions for feral animal control, flora harvesting, prescribed burning and recreation management.

¹² Western Australian Planning Commission (1997)

¹³ Western Australian Planning Commission (2006)

¹⁴ South-West Development Commission (2004)

Chapter 2

RELEVANT ACTS AND POLICIES

There is a range of WA State legislation, policies and strategies that relate to the management of PDWSAs and associated activity in those areas. Key sources of legislation and policies include:

- *Conservation and Land Management Act 1984*. (WA)
- *Water Resources Legislation Amendment Act 2007* (WA)
- *Country Areas Water Supply Act 1947*(WA)
- *Metropolitan Water Supply, Sewerage and Drainage Act 1909* (WA)
- *Rights in Water and Irrigation Act 1914* (WA)
- *Water Agencies (Powers) Act 1984* (WA)
- *Water Corporation Act 1995* (WA)
- *Waterways Conservation Act 1976* (WA)
- *Environmental Protection Act 1986* (WA)
- Statement of Planning Policy 2 (Environment and Natural Resources Policy)
- Statement of Planning Policy 2.7.(Public Drinking Water Source Policy)
- Statement of Planning Policy 2.9 (Water Resources Policy)
- State-wide Policy No. 13(DoW 2003)
- Policy Statement No. 56: Risk Management (DEC 2000)
- Policy Statement No. 18: Recreation, Tourism and Visitor Services (DEC 2007)
- Management Plans (DEC) as prepared under the CALM Act
- Public Drinking Water Source Protection Plans (DoW)

Respective government agencies are mandated by different Acts, by-laws and regulations related to the management of PDWSAs and there is potential for overlap of responsibilities unless a collaborative approach is taken. When land and water management responsibilities overlap, the primacy of the roles conferred by legislative provisions that apply to control and conservation must be clearly specified in order to promote the efficient use of resources and expertise of each Department. and to avoid duplication. The general rule for establishing primacy of legislation is that the latter provisions take primacy over the former¹⁵. However it is problematic when laws or parts thereof are amended frequently. The *Interpretation Act 1984* (WA) states that the true spirit, legislative intent and meaning¹⁶ must be established when there are overlaps arising out of legislative provisions and the meaning (of the provision in question) that would promote the

¹⁵ Gifford (1990)

¹⁶ Section 8 *Interpretation Act 1984* (WA)

purpose or object underlying the written law¹⁷ must be adopted. The question of establishing primacy of roles in terms of fulfilling the legislative intent of each source of legislation becomes a matter for the State Government to resolve through collaborative means amongst the Ministers and Departments concerned. The following provides some discussion of the various relevant components of legislation and policies associated with the issue of management and control of recreation in PDWSAs.

Conservation and Land Management Act 1984 (WA) (CALM Act)

The Conservation and Land Management Act 1984 (WA) (CALM Act) is the key source of legislation (in combination with the *Wildlife Conservation Act 1950*) that provides the Minister for the Environment and DEC the powers to manage public land and waters and associated flora and fauna. The primary object of the CALM legislation is to establish state authorities to manage use and protection of certain public lands and waters. The CALM Act applies to state forests, timber reserves, national parks, conservation parks, nature reserves and marine parks and reserves as well as water catchment areas. **“Water catchment area”**¹⁸ is defined as land which is reserved under Part 4 of the *Land Administration Act 1997* for water supply purposes in the care, control and management of the Water Resources Minister under that Act or a catchment area or water reserve as referred to in the *Country Areas Water Supply Act 1947*, the *Metropolitan Water Supply, Sewerage, and Drainage Act 1909*; or the *Water Boards Act 1904*; or an Underground Water Pollution Control Area as referred to in the *Metropolitan Water Supply, Sewerage, and Drainage Act 1909*. Section 54 of the CALM Act provides for the making of management plans and subsection (3)(iii) of that section states that if land includes a water catchment such a plan must be prepared by the Conservation Commission of Western Australia in consultation with the Water Resources Minister.

It should be noted that the earlier reference, of 2000, in the legislation, to “acting jointly” in this Act was amended to read as “in consultation” in this section¹⁹, hence Parliament’s intention for the overall management function to remain with DEC is apparent. The power to make management plans for and management of catchment areas hence vests with DEC and it must do so in consultation with the Minister for Water Resources.

Section 56 of the CALM Act requires DEC to consider fulfilling the demands for recreation by members of the public insofar as they are “consistent with the proper maintenance and restoration of the natural environment...” and hence there is a legal obligation on the part of DEC to consider options that will take into account, recreational needs of the public as long as they do not compromise environmental conservation.

In terms of water management and access, section 33(4) of the CALM Act specifies that the agency is responsible for management of surface waters on land for which a management plan exists, but

¹⁷ Section 18 as above

¹⁸ Section 3: CALM Act

¹⁹ Section 5 *Conservation & Land Management Amendment 2002 (WA)* – Act No. 43 of 2002

without limiting operation of the *Rights in Water and Irrigation Act (1914)* (RIWI Act) . Regulation 81²⁰ and section 55(1a) of the CALM Act specify that state forests and reserves may be managed for the specific purpose of water removal from the reserve or storage of water on the reserve. The RIWI Act makes allowance for the removal of water with appropriate authorisation. This presents an overlap in responsibilities that may require further clarification, for example, in terms of what constitutes proper authorisation for each Act and whether this is interchangeable.

In addition to referencing the RIWI Act, the CALM Act has provisions regarding CAWS Act and the MWSSD Act. According to the CALM Act (sections 54(3), 58) development of management plans for lands that include public water catchments must be consistent with the provisions of the CAWS and MWSSD Acts and prepared in consultation with the relevant water management agencies and utilities (such as DoW and WC) and Section 58 of the CALM Act states that these organisations are to be provided with a copy of any submissions made to draft management plans. By CALM Act sections 97A(6) (for state forest) and 101(1) (for conservation reserves), granting of licences and development of management plans for lands that include public water catchments must also be consistent with both the provisions of the RIWI, CAWS and MWSSD Acts.

There are no apparent provisions for the CALM Act in either the CAWS Act or MWSSD Act in relation to surface water management on public lands. This would suggest that DoW may be able to introduce control measures on areas that it declares as catchment areas that may fall outside of management regimes set up by the provisions of the CALM Act. Notwithstanding, Sections 87A(d) and 99 state that “in the case of land in a public water catchment area” powers of DEC are to be applied “consistently with the provisions of CAWS and MWSSD Acts relating to the protection of water quality”. The focus clearly is on water quality insofar as water legislation apply.

The legislative intent of CALM is to provide “for the use, protection and management of certain public lands and waters” and as the long-title of the Act states, provides the powers “to establish authorities to be responsible for such purposes,” whereas the intent of water resources legislation is to control, maintain and safeguard water supplies, as discussed in the next section. It follows that the control measures put in place by DoW must be integrated with the policies and management regimes exercised by DEC for protection and management of State lands and waters.

Water Resources Legislation Amendment Act 2007 (WA)

The *Water Resources Legislation Amendment Act 2007* is the first part of a series of changes being made by the state government in an effort to overhaul legislation for the management of water resources.²¹ The next step is the enactment of the proposed Water Resources Management Bill which is expected to combine the relevant sections of the legislation that apply to management of

²⁰ *Conservation & Land Management Regulation 2002* (WA)

²¹ The other 3 proposed Bills are The Water Services Bill, Water Corporation Amendment Bill and the Water Resources Management Bill which are all said to be in draft stage and would be tabled in Parliament in the near future *Hansard* (LC) 14th May 2008, 2934-2942.

catchment areas so as to avoid duplication and to remove existing overlaps and complexities. It is important that the integration of functions relating to the management of catchment areas be achieved prior to such enactment.

Tabled in Parliament in September 2007, this key piece of legislation, came into effect as of December 2007, repealing the *Waters and Rivers Commission Act 1995* (WA) and amending the following legislation relating to water resources: CAWS Act, MWSSD Act, Rights in Water and Irrigation Act 1914 (WA) (RIWI), the Swan River Trust Act 1988, the Water Agencies (Powers) Act 1984, the Water Corporation Act. All these Acts are under the portfolio of the Minister for Water Resources. The Acts relevant to catchment areas and PDWSAs are explained briefly below, as to how they relate to management and conservation of PDWSAs.

Country Areas Water Supply Act 1947 (WA) (CAWS Act)

The CAWS Act, contains provisions for the construction, maintenance and administration of reticulated supplies of water to country areas and to safeguard water supplies. Boundaries of catchment areas may be declared under this Act which also has provisions for control of potentially polluting activities and regulation of land use. Catchment area as defined and as referred to in the CALM Act is to mean “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...”²².

The Act gives specific powers to constitute and define, alter or extend, unite or abolish boundaries of any catchment area or water reserve as well as the power to divert, intercept and store water.

Part IIA of the CAWS Act relates to “Control of Catchment Areas” but no provisions make reference to the management function. In any event the section applies to such land as described in the Second Schedule (albeit the Minister having the power to change the Schedule) which are:

- the Wellington Dam
- the Harris Dam
- the Mundaring Weir
- Denmark River
- Kent and Warren River Reserves

There are currently no specific provisions in the CAWS Act on how it relates to the CALM Act. This has caused uncertainty in terms of establishing management responsibility in areas historically managed under the CALM Act but subsequently proclaimed as catchment areas under the CAWS Act.

²² Section 5(1) CAWS Act

Metropolitan Water Supply, Sewerage and Drainage Act 1909 (WA) (MWSSD Act)

The MWSSD Act makes provisions for the construction and management of the metropolitan drinking water supply and to establish methods of control of water resources. MWSSD Act gives similar powers as the CAWS Act and additionally the power to declare, extend, reduce, abolish or change the name of an Underground Water Pollution Control Areas as well as Public Drinking Water Source Areas. Where PDWSAs are to be designated under this Act, the approval of both houses of parliament is required before a declaration is made.²³

Boundaries for PDWSAs²⁴ may be declared under this Act together with regulation of land use and minimisation of potentially polluting activities. By-laws introduced in 1981 recognised the Prohibited Zone to protect the immediate vicinity of public water supply. PDWSAs are managed using a three tiered zoning system that includes Priority 1, 2 and 3 areas. Priority 1 areas are managed on a risk avoidance basis through prohibition of activities that pose a risk to water quality. The prohibited zone is a two kilometre buffer from the high water level of a reservoir²⁵. As most activities, including recreation, are considered by DoW as a risk to water quality, they are excluded from priority 1 areas²⁶. Introduction of a Prohibited Zone may include land managed under the CALM Act resulting in the necessity to clarify primacy and associated management responsibilities. While there are no specific provisions in the CALM Act or in the MWSSD Act in relation to land to which both Acts may apply, there are references to allowance for negotiation over altering of management regimes or land uses.

Rights in Water and Irrigation Act 1914 (WA) (RIWI Act)

The long title of the Act relates to “rights in water” and makes provision for the “regulation, management, use and protection of water resources”. Part III refers to “control of water resources” and the object is to make provision for the management of water resources. However section 4(1)(d) refers to such management as assisting “the integration of the management of water resources with the management of other natural resources”. It can be inferred from this section that the legislative intent is for the management of water resources is to be encapsulated in the wider context of the management and conservation of the states natural resources.

Section 26 GK gives the Minister powers to create a water resource management committee to be established for any locality or part of the state to advise and assist the Minister.

Division 3D refers to the making of management plans at either local, sub-regional or regional level to guide the general management of water resources to which it applies and refers to, at Section 26GW(2):

²³ Section 57E(3)(c) MWSSD Act

²⁴ Section 13 MWSSD Act

²⁵ Section 4.2.2.2 MWSSD By-Laws 1981 (WA)

²⁶ Dept. Environment (2004)

- (a) The definition of water resource values, including environmental values and the protection of those values.
- (b) The use of water resources
- (c) The integration of water resources' planning and management with land use planning and management.

Hence the intent is there for water resources management to integrate with the overall management and conservation of the state's natural resources.

Water Agencies (Powers) Act 1984 (WA) (WAP Act)

This Act is primarily relevant as it establishes the Ministerial Body (section 11) through which the Minister for Water Resources may perform the following and specifically defined functions:

Section (9) (1)

- (a) conserving, protecting and managing water resources;
- (b) assessing water resources;
- (c) planning for the use of water resources;
- (d) promoting the efficient use of water resources;
- (e) promoting the efficient provision of water services;
- (f) developing plans for and providing advice on flood management.

The Act does not make provision as to how it relates to other Acts or other relevant state bodies except for the reference to seeking planning approval for schemes planned for land acquired under the Act.

Waterways Conservation Act 1976 (WA)

This Act provides for the conservation and management of "certain waters and of the associated land and environment". Unlike the CAWS and MWSSD Acts, the Act refers to "management areas" and "management programmes" to which it applies. The Act gives powers to declare any area of the state containing one or more rivers, inlets or estuaries to be a management area and to define the boundaries of the waters and associated land comprised in the area or declare any "artificial canal, canal system, lake, lagoon, harbour or embayment connected to a river, inlet or estuary that is in the area to form part of that river, inlet or estuary".²⁷ The Act applies to areas so declared as management areas.

It must be noted that no land shall be included in the management area unless that land is "necessary in order satisfactorily to achieve the control needed for the conservation and management of the waters by reason of the contour of that land or its use, proximity or other relevant circumstance"²⁸.

²⁷ Section 10 Waterways Conservation Act 1976 (WA)

²⁸ Section 10(4) above

The functions of the Minister²⁹ refers to the responsibility for the conservation of the waters and associated land to that portion of the land to which the Act applies. However, the Minister is, to the extent practicable, to “act jointly” with relevant bodies³⁰. The Act also makes reference to obtaining the advice of planning bodies.

Hence there is provision for collaboration in terms of the conservation and management functions referred to in this Act.

Environmental Protection Act 1986 (WA)

This Act ensures that appropriate measures are in place so that development proposals and applications within PDWSAs that might have an environmental impact are assessed effectively prior to approval being granted. It controls the discharge or disruption of water which is likely to cause environmental pollution. These functions vest with DEC and the Act falls under the Portfolio of the Minister for Environment, whereas the CAWS legislation grants similar powers to DoW. It is the reports finding that the controlling of pollution and management responsibilities of water resources and PDWSAs are hence duplicated.

The intent and spirit of water resources legislation clearly focuses on ensuring maintenance, control and safeguarding of water supplies and resources. Legislation intended to provide conservation and environmental protection measures articulate a clear mandate for management responsibilities to be vested in DEC. These responsibilities encompass a wider mandate involving a greater number of stakeholders and their rights; hence the primacy of legislation falling under DEC is significant.

Statement of Planning Policy 2 (Environment and Natural Resources Policy)

Planning Policy 2 applies throughout WA and is issued by the WAPC under the powers granted to it by WA planning legislation. The objectives of this policy are³¹:

- to integrate environment and natural resource management with broader land-use planning and decision-making.
- To protect, conserve and enhance the natural environment; and
- To promote and assist in the wise and sustainable use and management of natural resources.

The implementation of this policy “will be through the preparation of strategic plans, regional and statutory schemes, conservation and management strategies, and other relevant plans to achieve the objectives of the policy”.³²

²⁹ Section 11 as above

³⁰ Section 12 as above

³¹ WAPC (2003) Statement of Planning Policy No. 2, *Government Gazette*, WA p2050

³² As above, p 2056

Statement of Planning Policy 2.7 (Public Drinking Water Source Policy)

Planning Policy 2.7 applies to proclaimed PDWSAs throughout WA and is also issued by the WAPC under the powers granted to it by planning legislation and the State Planning Strategy 1997³³ The objective of the policy is to ensure that land-uses and developments within PDWSAs are compatible with the protection and long-term management of water resources. Hence the WAPC is a body whose mandate overarches those of DEC and the DoW, It has the legislative powers to create policy that apply state-wide. Additionally, under the *Land Administration Act 1997* (WA) the Minister for Planning has the powers to reserve land for public interest. Such reserves made for conservation purposes, however, must be declared only with the consent of the Minister responsible for administering the CALM Act.³⁴

According to Planning Policy 2.7 local and regional planning bodies throughout Western Australia must obtain advice from the Department of Water (DoW) for developments intended in or around proclaimed PDWSAs.³⁵ Overall it recognises that land use and development within PDWSAs must at all times be well-matched with the long-term management and protection of water resources for public water supply. It further states that to achieve this aim it is important to ensure integrated decision-making on issues of conservation, land use, water management and water quality and quantity.

Statement of Planning Policy 2.9 (Water Resources)

This policy, is also issued by the WAPC under powers granted to it by planning legislation and hence, like Policies 2 and 2.7, is legally binding. It provides guidance for implementing measures to be undertaken for the protection and management of surface and groundwater catchments, including consideration of availability of water and waterways management, wetlands, waterways, and estuaries and their buffers, and implementation of total water cycle management principles in the land use planning system.³⁶

The policy refers to a range of values - ecological values such as flora, fauna and vegetation and human values such as drinking water, recreation, agriculture and industry, associated with water resources - that must be taken into consideration in planning. It calls for planning policies and strategies to be adequately informed about such values and be subjected to responsible and balanced decision making.

The onus of meeting the community's demands on water resources falls on the government bodies that control, manage and regulate land and water resources and an integrated approach in meeting those needs is called for in the policy, through prioritising and balancing "competing interests" and

³³ WAPC (2000) *State Planning Strategy* Perth, WA, is the key planning strategy document guiding developments in WA

³⁴ *Section 45 Land Administration Act (1997)* (WA)

³⁵ Government of Western Australia, (2003).

³⁶ Western Australia Planning Commission, (2004). *Water Resources Statement of Policy Planning No. 2.9.*

that such an approach must “satisfy the community’s current demands for water resources while seeking long term protection of the environment”.³⁷.

State-wide Policy No. 13

This is a document issued in 2003 by the DoW and not the WAPC. The Water & Rivers Commission (the author of the policy, as it was then known, but now dissolved) by powers granted to it by the *Water & Rivers Commission Act 1995* (WA) (now repealed) has the mandate to “advise the Minister on all aspects of policy in relation to water resources”³⁸ but the Act is silent on the Commission’s own powers as to create and publish policy for state-wide use. Further, instead of granting such powers by the provisions of the Act itself, it clearly spells out that the Commission has water resources conservation, protection and management functions vested in it by the provisions of *CAWS*, the *MWSSD*, *RIWI* and *Waterways Conservation Acts*. Neither of these Acts grants the Commission the mandate to create state-wide policy. On the basis that Policy 13 was not created on the authority of any legal powers granted to the Commission by state legislation or otherwise, it is not legally binding on other governmental agencies and departments, but may be used as a guideline.

Policy 13 states that all activities proposed on Crown land require approval from the land manager, which in most instances will be DEC.³⁹ Policy 13 specifies classification levels, definitions, and a broad framework for public drinking water protection and management. It is through this policy that DoW outlines its primary objective of ensuring quality drinking water and protection of PDWSAs. A three tier-classification system is provided in the policy:

Priority 1 Areas: Generally occur on Crown Land, protected areas and state forest managed by DEC. These areas are demarcated to ensure there is no degradation of the water source and are declared over land where the DoW considers to be prime areas for providing the highest quality public drinking water. Priority 1 areas are dealt by DoW with a “risk avoidance approach”

Priority 2 Areas: These areas ensure that no increased risk of pollution to the water source occur and are declared over land where the DoW considers it necessary to be declared as such when there is low intensity development occurring. Priority 2 areas are dealt by DoW with a “risk minimisation approach”

Priority 3 Areas: these are areas that the DoW considers as requiring to manage risk of pollution to the water source and are declared over land where water supply sources need to co-exist with other land uses such as residential and commercial. Priority 3 areas are dealt by DoW with a “risk management approach”.

³⁷ As above

³⁸ Section 10 *Water & Rivers Commission Act 1995* (WA)

³⁹ Page 7 fn 20 above

As a working document of the DoW, the policy's primary objective is to protect "drinking water sources from contamination through inappropriate recreational activities in the interest of public health" and the policy, not unlike Policies 2, 2.7 and 2.9 of the WAPC, purports to apply itself to all recreational activities and access within areas proclaimed as PDWSAs on Crown land.

Recreation is referred to as "a wide range of leisure, pastime or entertainment pursuits, including bushwalking, orienteering, swimming, boating, fishing, camping, horse-riding and four-wheel driving" and also includes "group outings and commercial activities such as camel trails, llama walks and car rallies".

The policy states that the final approval function for all recreational access lies with DEC and it also states that such access is governed by by-laws under the CAWS and MWSSDA Acts, two acts under the portfolio of the Minister of Water Resources. This statement is consistent with the powers granted to the then Water & Rivers Commission (mentioned earlier), hence Policy 13 itself makes clear that the management and approval functions lie with DEC and that DEC is required to take into consideration the by-laws of CAWS and MWSSD Acts in granting approval for recreation access and carrying out its management functions in catchment areas. DEC in turn, has extensive powers to make policy statements and state-wide plans⁴⁰ to guide it in so doing.

⁴⁰ See for example CALM Act sections 19(1)(c), 33(dd) and 55

RECREATION IN WATER CATCHMENTS

Water catchments have historically comprised an important part of the recreation experience in the Southwest of Western Australia.⁴¹ The conversion of some irrigation supply dams to potable water supply reservoirs and the growth in demand for water based recreation in this region has resulted in crowding and limited access by recreational users. Past management has tended toward a single-purpose approach to water resource allocation. This may be appropriate where water resources are plentiful. However, increasing demand for a decreasing resource⁴² means development for one use will come at the expense of other values.⁴³ Balancing the demands of recreation with maintenance of drinking water supply and quality and land management issues in catchments is a complex task.

Catchment management areas in the South-West of Western Australia's Darling Scarp comprise at least 7,150 square kilometres of various land tenure including state forest, national parks and private land.⁴⁴ Western Australia's public native forests cover much of this area. DEC manages these public lands for many diverse values, as determined by the CALM Act, including nature conservation, recreation, water catchment protection and timber production.⁴⁵

DEC as the statutory body for land management undertakes extensive research in preparing Management Plans for implementation. There are currently six plans covering the Southwest region, two in the drafting process and The Forest Management Plan 2004-2013⁴⁶ which applies to the Swan, Southwest and Warren regions aiming to "... provide opportunities for active and passive recreation and tourism that will meet public demand, so far as is practicable and sustainable, and provide regional economic benefits". Surface water and surrounding land in this area may be proclaimed as water reserves or catchment areas (PDWSAs) by DoW in accordance with the CAWS Act and MWSSD Act.

Areas proclaimed as PDWSAs may subsequently have restrictions on public access and recreational activities. For areas with a history of activities (including recreation, mining and logging) that are subsequently proclaimed as PDWSAs, negotiations may be undertaken with regards to continuation of those activities providing they do not threaten drinking water quality or supply. Acquisition of land for drinking water source protection increases the potential for uncertainty and conflict of interest. This is primarily in terms of establishing primacy where DEC applies the CALM Act to areas proclaimed under water resources management legislation by DoW for drinking water protection. .

⁴¹ Martinick & Associates (1991)

⁴² Dept of Water (2007a)

⁴³ Russell (1988)

⁴⁴ Williamson et al (1990)

⁴⁵ Conservation Commission of WA (2003)

⁴⁶ Conservation Commission of WA (2003) Page 57, section 26

Recreation in Southwest WA Catchments

Water-based tourism, sport, leisure and recreation activities and experiences tend to be popular in industrialised nations⁴⁷ While provision for recreation opportunities are commonly incorporated into management of irrigation storages, there are examples of incorporation of recreation opportunities into drinking water catchment management regimes in Australia. In particular, activities considered to be low risk, such as shoreline activities and un-powered boating have been accepted “without question”. Examples include Lake Wivenhoe northwest of Brisbane, where recreation has been incorporated into the decision making framework (further examples are provided in the national context section of this chapter). PDWSAs are actively promoted as recreational resources in the UK⁴⁸, USA, France and South Africa.⁴⁹ However, activities involving power boats and body contact with water would only be considered in reservoirs with a high standard of water treatment.⁵⁰

The WA Department of Environment⁵¹ (now DEC) provided a list of activities including those potentially allowed in priority one areas for drinking water supply. The following activities were classified as “compatible with conditions” for priority one areas, meaning the activity is not likely to harm the drinking water source given effective environmental management practices are in place.

- Pastoral leases
- Apiaries
- Bed and breakfasts and farm stays, maximum of six guests
- Caretakers dwelling
- Forestry
- Residential occupation
- Mining
- Plantations
- Toilet blocks
- Community education and scientific research centres

Given this varied list, it could be assumed that certain types of recreation may pose a low risk and therefore be allowable.

Historically, recreational uses in the Southwest of Western Australia mainly consisted of “passive pursuits”. The primary “passive pursuits” were identified as follows:⁵²

- driving for pleasure
- Tourism
- Barbecues
- Picnics
- Photography
- Nature study

⁴⁷ Jennings, (2007)

⁴⁸ For example see <http://www.anglianwaterleisure.co.uk>

⁴⁹ Ramsar (1998)

⁵⁰ Pigram (2006)

⁵¹ Dept of Environment (2004)

⁵² Advisory Committee on Purity of Water (1977) p2

More active use of water sheds traditionally occupied a smaller number of people. A 1984 list of water based recreational activities in Southwest Western Australia detailed the following pursuits:⁵³

- Fishing
- Swimming
- Casual canoeing
- Power boating
- Waterskiing
- White water racing
- Rowing
- Variety of landscape and wilderness experiences

The report predicted a rapid growth in recreational use of water bodies and the surrounding catchment area in line with a rapid growth in tourism numbers to the region during the late 1980s. A 2001 study⁵⁴ conducted in the *Southern Darling Range* provided a list of thirteen types of recreational activities. The report noted the following activities as being popular in Southwest catchments:

- Picnicking
- ‘designated’ camping
- ‘wild’ camping
- Bushwalking
- Trout fishing
- Marroning
- Flat water canoeing
- White water canoeing
- Four Wheel Driving
- Swimming
- Waterskiing
- Sightseeing
- Rock climbing

This presents a more diverse range of land based and water based recreational pursuits relative to its 1977 equivalent. It demonstrates the growth in variety of activities over the past 30 years. It may also indicate a potential for equally significant change in water catchment recreation activities in the next 30 years.

Logue Brook Dam

Introducing strict management regimes to exclude public access to areas traditionally used for recreation will have significant impacts on recreational opportunities. The acquisition of Logue Brook Dam for drinking water supply provides a recent example of the potential issues associated with such management actions. Logue Brook Dam has recently been classified as a Priority 1 Zone (of the proposed classification levels) resulting in a two kilometre exclusion buffer around the dam as per the requirements of Reservoir Protection Zone (RPZ). As a consequence of this action, recreation will be relocated from Logue Brook Dam to other sites and a figure of more than \$10 million has been set aside as a ‘recreation offset trust’. The offset trust is designed to compensate for relocation of recreational opportunities from Logue Brook Dam. In a response to this proposal DEC and DSR expressed concern with regard to the loss of recreational opportunities and the

⁵³ Martinick & Associates (1984)

⁵⁴ Muench, (2001)

potential concentration of recreational users into fewer sites. In-water based activities such as swimming, waterskiing and some forms of fishing will be particularly disadvantaged. There were also concerns about the quality of alternative recreation opportunities and whether they have been adequately assessed along with the potential loss of economic value of recreation and tourism attached to the dam. The demand for water based recreation in the Southwest region of WA has been ranked between modest and high (mostly high) compared with levels of low to modest (mostly low) in other Australian regions.⁵⁵ The changes in recreational use of water catchments over the past 30 years indicate the increased demand and dynamic nature of recreation use over time in these areas. This would suggest that reducing the number of water bodies available for recreation would increase crowding and limit access.⁵⁶

National Context for Recreation in Catchments

There is significant variation in PDWSA and recreation management across Australia. Some states adopt models with exclusion zones irrespective of the character of the catchment and type of activity. Other states vary their PDWSA management according to the local conditions and uses with recreation activities permitted on drinking water source dams in combination with full treatment.

New South Wales

New South Wales has a similar approach to Western Australia with its PDWSA designated as 'special areas'.⁵⁷ The special areas apply to all drinking water source catchments and include schedule one and schedule two areas associated with land adjacent to water storages. Schedule one areas are equivalent to the WA Priority One RPZ where all public access is prohibited. Schedule one areas extend for a three kilometre radius from the dam wall. Schedule two areas allow restricted activities deemed to be of low risk to water quality. However, the difference in NSW is that orders in relation to the classification of water sources must be made in concurrence with and approval of the Minister for the Environment.⁵⁸

Queensland

Management of public access to drinking water source dams in Queensland varies according to the organisation responsible for storage and the specific PDWSA. In most cases, recreational access to PDWSAs is permitted. For example, North Queensland Water, supplying Townsville, allows land and water based recreation on the Lake Paluma drinking water source dam except for motorised boating. General public access to the Ross River Dam is prohibited but there are guided motorised and non-motorised boating tours available.⁵⁹ Southeast Queensland Water, supplying Brisbane, allows for land and water based recreational use on all of their dams though power boats are not

⁵⁵ Dept of Resources and Energy (1984)

⁵⁶ Western Australian Water Resources Council. (1991)

⁵⁷ Sydney Catchment Authority (2007)

⁵⁸ Section 7, *Water Management Act 2000* (NSW)

⁵⁹ NQ Water (2008a)

permitted on some.⁶⁰ Water from the dams is fully treated prior to supply. Queensland has an overarching *Environmental Protection (Water) Policy 1997* (Qld) that applies to all Queensland waters and designed to achieve the objects of the Environmental Protection Act 1994 (Qld). The policy provides a framework for identifying environmental values for Queensland waters; deciding and stating water quality guidelines and objectives; making consistent and equitable decisions that promote efficient use of resources.⁶¹ This Policy is equivalent to a sub-ordinate legislation or regulation as passed under the *Environmental Protection Act 1994* (Qld). Queensland is a state in which the management and control of water resources and the environment fall under the one Minister: Minister for Natural Resources and Water. As in Victoria (see below), Queensland also adopts an integrated catchment management strategy⁶².

South Australia

South Australia's policy on PDWSA recreation is to restrict public access to water storage reservoirs. This policy undergoes regular review. South Australia's main drinking water sources include the Murray River and the Mt Lofty Ranges Watershed. Water from these sources are captured or pumped into a series of storage reservoirs for full treatment prior to supply. Raw water, or primary, reservoirs are large storages that feed water to the direct supply reservoirs that in turn supply the water treatment plants. The reservoirs function as a barrier between the catchment source and supply.⁶³ The main threats to water quality are considered to be increased agricultural industrial and residential development in the catchment areas.⁶⁴ The establishment of water protection areas in catchments aim to minimise risk to water quality through restriction of high risk development and related activities. Water protection areas are declared legally by the Environment Protection Authority of South Australia which administers and enforces the *Environment Protection Act 1993* (SA). The EPA falls under the auspices of the Minister for Environment and Conservation who is also the responsible Minister for the *Water Resources Act 1997* (SA). However, as in WA there is a separate Minister responsible for water matters who administers other water legislation such as the *Water Conservation Act 1936* (SA).

Tasmania

Tasmanian PDWSA management varies according to the type of source, historical use of the area and the current demand for recreation. For example, of the catchments supplying Hobart, the Lake Fenton Catchment allows limited recreational access. Restrictions include prohibition of direct water contact activities and camping in the catchment area. Some tributaries have public access excluded. However low risk activities such as hiking and picnicking are allowed where appropriate toilets facilities have been provided.⁶⁵ On the other hand, the upper reaches of the Derwent River are also used as a drinking water source for Hobart. The Derwent River hosts a broad range of recreational activities and the management authority relies on public education and vigilance in

⁶⁰ SEQ Water (2008)

⁶¹ Section 6 (a)(b) and (c): *Environmental Protection (Water) Policy 1997* (Qld)

⁶² <http://www.nrw.qld.gov.au/education/teachers/water/background.html> accessed on 19 June 2008

⁶³ SA Water (2003)

⁶⁴ Environmental Protection Authority, SA (no date)

⁶⁵ Hobart Water (2000)

removal of risks such as litter to minimise risks to water quality.⁶⁶ Mt Wellington also serves as a drinking water catchment for Hobart. In this instance, management “...recognise[s] the value of the Park as both a tourism resource and as a recreational area for nearby populations.”⁶⁷ The Mt Wellington Catchment falls into a range of tenures but has been divided into management zones including: Springs Zone, Pinnacle Zone, Recreation Zone, Natural Zone, Remote Zone and the Restricted Zone. There are two restricted Zones covering the majority of the drinking water catchments of the Knights Creek reservoir, the Humphrey Rivulet weir, and the Limekiln Gully reservoir below existing tracks. Appropriate recreation is allowed in other areas but contact with water bodies and streams is prevented where possible.

As has been recently passed in WA, Tasmania has also tabled a Water Legislation Amendment Bill in Parliament which will, when enacted, see changes to the current Water Management Act 1999 (Tas). The Minister for Primary Industries and Water administers water legislation and the Minister for the Environment, Parks, Heritage and the Arts is responsible for the Environmental Management and Pollution Control Act 1994 (Tas).

Victoria

Victorian PDWSAs are managed under a varied system of restricted and open public access. Drinking water is mainly supplied by three metropolitan water companies in Melbourne and 15 water authorities in regional cities and towns. The drinking water suppliers are regulated by the Department of Human Services, the Department of Sustainability and Environment, and the Office of the Regulator-General. In terms of public access to catchment areas, there are two types of drinking water supply catchment. Catchments that are owned or managed by the local community under many titles are ‘open’ catchments with unrestricted public access. Victorian PDWSAs may also be ‘closed’ catchments with public access restricted. Closed catchments are those that are managed by a single land manager. For example, 85 percent of Melbourne’s drinking water supply comes from publicly owned and government managed ‘closed’ catchments where public access is prohibited in sensitive areas. This water has minimal treatment prior to downstream supply. The remaining 15 percent comes from ‘open’ catchments where public access is allowed and the water is fully treated.⁶⁸ The circumstances under which catchments are open or closed are a product of historical use.

A separate Catchment and Land Protection Act 1998 (Vic) aims to achieve an integrated system of catchment management, dividing Victoria into ten catchment regions and granting autonomy to regional authorities. Victoria has several other key pieces of legislation governing water resources – Water (Resource Management) Act 2005 (Vic), Water (Governance) Act 2006 (Vic) as well as the Conservation of Forests & Lands Act 1987 (Vic).

⁶⁶ Hobart Water (2007)

⁶⁷ Hobart Water (2003) p v

⁶⁸ Government of Victoria (2000).

International Examples of Recreation Management in Drinking Water Catchments

International practice in drinking water catchment management commonly includes or even encourages recreation in drinking water source dams in combination with full water treatment. Below are some relevant examples of recreation management in drinking water catchments from UK and Canada.

United Kingdom

Recreation in PDWSAs is actively promoted in the United Kingdom as part of government regulatory requirements. The United Kingdom currently practices multiple use land and water management, having evolved from a paradigm of single use focus. This change came with a recognition of the various statutory responsibilities of the different government land management agencies with overlapping areas of responsibility. Interestingly, forestry, protected area management and farm land managers were the first to move toward multiple management while water supply companies resisted the change based on the need to provide safe drinking water. This stance was challenged in a number of ways. There were orchestrated mass trespasses of hikers onto catchment lands with the objective of testing the case in court. National Parks authorities challenged the water management regime by pointing to better practices in the US. Development of new reservoirs provided the opportunity to write multiple use requirements into the planning permissions from the 1970s onwards.

Possibly of equal importance was the argument that the population had a safe drinking water supply as it consisted of fully treating water from the river Thames. Full treatment was necessary given the poor quality of Thames raw water. Therefore, recreation could take place at no further cost or risk to water quality. Currently, the UK privatised water supply industry is heavily regulated. Regulation includes a requirement for the provision and promotion of recreational opportunities on their reservoirs. The recognition of the multiple values associated with surface water bodies combined with the high demand but shortage of supply essentially resulted in a multiple management approach to PDWSAs. With or without the presence of recreation, health requirements necessitated the full treatment of drinking water to ensure a safe, good quality supply.⁶⁹

The UK example perhaps is a function of larger population and greater demands on limited land resources. However, Western Australia faces a growing population and shrinking availability of surface water for both consumption and recreation. One of the key aspects of this story seems to be

⁶⁹ Chard (2008)

a recognition of the varying values land is managed for by different government agencies responsibly for overlapping areas of responsibility. Given the much higher risks to water quality posed by expanding urban and industrial areas, mining and timber production and agriculture, ensuring the supply of safe good quality drinking water would seem to eventually require full treatment. Given this, as with the UK example, recreation would pose little risk to drinking water quality.

Canada

Canadian drinking water sources include rivers, lakes and ground water. Water is usually drawn from the raw source (such as a river or lake) and pumped to a storage reservoir for subsequent treatment. The rivers and lakes are subject to other uses including recreation and transport. Water catchments (or water sheds) generally include agriculture, industry and mining related activities as well as recreation. Subsequently, management of Canadian water sheds is based on a multi-use approach that acknowledges the multiple values associated with surface water bodies.

Canada bases its drinking water quality management on a multi-barrier approach defined as “an integrated system of procedures, processes and tools that collectively prevent or reduce the contamination of drinking water from source to tap in order to reduce risks to public health.”⁷⁰ According to Health Canada, it has been demonstrated that the most effective way to manage drinking water systems is to implement a multi-barrier approach with the key element being water treatment. This enables multiple use of water catchments and surface water bodies while ensuring minimal risk to drinking water quality.

⁷⁰ Federal-Provincial-Territorial Committee on Drinking Water (2004)

RECREATION AND WATER QUALITY

There is a wide variation in Australian jurisdictions to allowing for recreation on or near domestic water supplies and management of water quality. In some Australian states, the long established practice has been to close drinking water sources to public access where feasible. However, increased public demand, accessibility and encroachment of urban settlements into and around even remote catchments in Australia have made enforcement of total exclusion unviable.⁷¹ In many cases, drinking water catchments host agricultural, industrial and mining activities and urban areas that pose a potentially higher risk to water quality than recreation and cannot be easily excluded. In such cases, additional treatment of the water is required.⁷²

Recreation and Drinking Water Quality

There is a lack of substantiated evidence regarding specific links between varying forms of recreation and water quality in drinking water catchments. This may be partly owing to the difficulties in demonstrating casual links. The WA Department of Health⁷³ recently stated,

“it is not possible to link a type of and level of recreational activity to a quantified level of water quality impact.”

This is primarily due to the site specific character of impacts, complexity, time and expense required rendering studies of this nature impractical. Instances of drinking water contamination have commonly been linked to wild or domestic animals or the presence of human dwellings in catchments.

In the current debate, the evidence presented in an attempt to demonstrate the link between recreation and drinking water quality does not appear to be directly relevant. Most cited examples of water borne disease outbreaks relate to recreationists falling ill after swallowing contaminated water at the source, mainly in swimming pools, fountains and spas. Instances where downstream consumers are exposed to contaminated drinking water are most often traced to downstream plumbing and distribution system problems. A study⁷⁴ of the health consequences of body contact recreation in drinking water reservoirs noted that

“... the source of pathogens for the outbreaks associated with the natural recreational settings may have been from animal sources.” (pp. 86)

⁷¹ Pigram (2006) pp. 182-183

⁷² Webber et al (1982)

⁷³ WA Dept of Health. (2007)

⁷⁴ Stewart et al (2002)

Of the remaining contamination events cited, most were examples exclusively from swimming pools (recreationists swallowing pool water) and are not relevant to the catchment management context.

Evidence Presented by the CRC for Water Quality and Treatment

In support of exclusion of recreation from PDWSAs, the CRC for Water Quality and Treatment observed ⁷⁵ that there had been “many outbreaks of waterborne disease” where people have drunk water used by recreationists. An information brochure supplied to a community forum on recreational access to water highlighted the dangers of such access to water quality and spread of waterborne disease. However, the examples linked to recreational use of water cited in the brochure refer mainly to swimming pools, spas and decorative fountains, not public drinking water supply areas. References cited as evidence included Lemmon et al (1996) reporting on outbreaks of cryptosporidiosis linked to an indoor swimming pool. The work by Hoeba et al (2004) reported on a norovirus outbreak amongst school children playing in a recreational water fountain. In each case it was the recreationists swallowing water while recreating, not consumers drinking contaminated water downstream. The cited US Centres for Disease Control (CDC) examples of community water supply contamination in 1995-96 trace 70% of cases to problems with downstream plumbing and water distribution systems. The remaining 30% “were caused by problems at water treatment plants”. ⁷⁶ Other CDC reported cases of illness from water contamination were associated with “hot tubs and lakes”.

Interestingly, the “famous Sydney Water Incident” cited by the CRC for Water Quality and Treatment was not in any way associated with recreational activities. It was eventually determined that the most probable source of *Giardia* and *Cryptosporidium* contamination in the Sydney drinking water supply were poorly maintained sewerage treatment plants and urban septic tanks in the catchment area. These were found to have discharged poorly treated or untreated sewerage after a significant rain event. Other possible sources included: cattle, residential development, feral and native wildlife, agriculture and related activities and mining activities.⁷⁷ In most cases of water quality contamination, such as this one, no single management action could have prevented the occurrence.⁷⁸

Hammit and Cole (1998) observed that many studies of recreation impacts on water quality are site specific and mainly relate to sewerage flow rates into streams and lakes from campsites with inadequate or non-existent human waste facilities. They also noted there are many contradictory studies on recreation impacts on water quality. Consequently, catchment management action relies on expert opinion and modelling based on scientific inference leading to considerable margins of error in assessing risk.⁷⁹

⁷⁵ CRC for Water Quality and Treatment (2006)

⁷⁶ CDC (1998)

⁷⁷ Stein, 2000

⁷⁸ Hruday & Hruday (2004)

⁷⁹ Miller et al (2006)

The Advisory Committee on Purity of Drinking Water (1997, p13) compiled the following list of activities, potential risks and some management suggestions in Western Australian catchments:

Recreation Activity	Potential Risk/Management action suggested
Horse riding	Excretion of Coliform bacteria and Salmonella pose a contamination risk if allowed in or near water bodies and running streams
Four Wheel Drive vehicles	Increased turbidity in streams, should not be permitted off road in water sheds
Motorcycles	Nuisance value to other catchment users, damage to soft terrain. Certain portions of water sheds could be made available to organised trail-riding events contingent on monitoring
Picnicking	Low risk given provision of suitable toilet facilities.
Fishing	Use of bait and “unfortunate personal habits” pose a considerable health risk.
Canoeing	None noted as it was a “relatively new custom”
Swimming	“Physical (and possibly psychological) effects” are undesirable. Should remain prohibited in reservoirs.
Power boats	Erosion of bank and shore areas, disturb fish and bird breeding areas, oil leakage and exhaust fumes. Should not be permitted on reservoirs.

Adapted from Advisory Committee on Purity of Water (1977) pp. 8-14

Given the lack of specific hard data linking recreational pursuits to water quality, one approach⁸⁰ recommended evaluations be based on whether any given activity poses a high or low risk to the safety and quality of water. It is interesting to note that the 1977 review found certain “passive activities” posed a low risk while other activities were high risk or not popular enough to be considered. A more recent report noted that where various types of recreation activities were carried out on water bodies, reduced water quality was mainly related to boating activities and pollution from accommodation facilities.⁸¹ This suggests certain types of activity present a higher risk to water quality while others present a low risk.

⁸⁰ Western Australia Water Resources Council. (1993)

⁸¹ Hadwen et al (2006)

In relation to this, DoW's Policy 13 document noted that recreation in water catchments may be allowed given.⁸²

“Controlled access for certain types of recreation activities within PDWSAs (such as picnic areas or designated walk trails) with appropriate management measures including rubbish disposal facilities and signs promoting public awareness of water quality issues, would reduce the potential for contamination, and be considered to provide an acceptable level of risk.”

This indicates a recognition that the risk from recreation activity varies depending on the type of activity, where it occurs and the management actions in place. This point is highlighted in another DoW report detailing various types of activities and whether they could be allowed in P1 PDWSAs.⁸³ Many of the listed activities noted have been allowed on a conditional basis. Again, this demonstrates recognition that particular types of recreational activity are associated with varying levels of water quality risk. Conditions on which recreation may be allowed include “historical and traditional uses” (p21) while another specifies carrying out water quality assessments for given recreational activity to ensure minimal risk. This suggests a management approach based on selective exclusion of high risk activities rather than a blanket ban on all activities. The documents produced by the DoW also demonstrate an avenue for allowing recreation in PDWSAs deemed to be low or zero risk.

An earlier statement by the Department of Resources and Energy appears to support this with the view that:

“...no amount of properly planned recreation can generate enough contamination of reservoir water to pose any technical difficulties in treatment.”⁸⁴

In other words, while there may be high or low risk of contamination from recreation in drinking water sources, measures can be put in place to ensure that risk is not passed downstream to users. Such an approach could form part of a multiple barrier management regime, preferable to singular management actions such as total exclusion of public access. However, the costs of installation and management of additional treatment to ensure maintenance of water quality downstream would need to be factored in.

Risk Management and Risk Avoidance in Catchments

Risk management is an approach that recognises and accepts a given level of risk and actions are taken to minimise that risk. Risk avoidance is a stance where *all* possible threats are removed in an attempt to negate risk. These two stances are evident in the debate relating to whether recreation

⁸² Department of Water (2003) pp. 11

⁸³ Dept of Water (2007c)

⁸⁴ Dept of Resources and Energy. (1984).

and drinking water supply dams are compatible. Allowing certain types of low risk recreation and/or putting in place mitigating management actions (such as additional treatment and filtration) represents a risk management approach. Excluding all recreational and other unauthorised access to drinking water dams represents a risk avoidance approach. Risk management of recreation in and around water catchments is a widely accepted practice at the international level.⁸⁵ Such a regime could foster a supportive recreational community that would be more open to a positive communication and education campaign aimed at responsible use in defined areas and/or at given times (i.e. spatial and temporal constraints). There is considerable evidence from work in the UK and USA to support the view that properly planned and managed recreation in water catchments can be acceptable on public health grounds. Appendix 2 provides a potential framework for recreation management in PDWSAs.

The uncertainty regarding the link between water quality and recreation may form the basis for a risk avoidance approach. This could be perceived as a premise to adopt the precautionary principle and exclude recreation to avoid risk. However, total exclusion of public access through legislation does not guarantee compliance on the part of the public. A total exclusion regime will thus only be as effective as the enforcement on the ground. Construction of physical barriers such as security fencing can be prohibitively expensive. This is particularly so in catchment areas with variable topography, soil types and numerous stream crossings.⁸⁶ Provision of staff to patrol and enforce exclusion zones may also have limited success given the size of the proposed area and the ability to monitor the large areas proposed. Thus the adoption of total recreational exclusion as a risk avoidance approach may provide a false sense of security as it is a single barrier approach to catchment management.

A multiple barrier approach is a form of preventative management strategy which involves putting together protective measures so that in the event that one protective measure/barrier fails, other barriers should be sufficient to compensate.⁸⁷ This approach is preferable to reliance on a single barrier that may be breached, leaving downstream drinking water quality exposed to contamination. Multiple barriers in drinking water catchments may consist of a combination of regulations, physical barriers, water filtration and treatment processes that together enhance the security of water quality. Should one barrier fail, water quality is maintained for downstream users by the presence of other barriers. The Multiple barrier approach to catchment management is advocated for water supply areas where recreational access is permitted or desired.⁸⁸

Comparing Costs of Risk Management and Risk Avoidance in Catchments

Owing to the wide range of possibilities, it is difficult to cite costs in relation to management of recreation in catchments combined with additional treatment versus exclusion of recreation. The

⁸⁵ Pigram (2006)

⁸⁶ Long & Robley (2004); Karori Wildlife Sanctuary Trust (2003)

⁸⁷ Dept of Environment. (2004)

⁸⁸ Patterson (1977).

primary cost of allowing recreation in PDWSAs could include installation of additional water treatment infrastructure. The cost of this would depend on the capacity of the facility, the type of treatment and whether a new facility is built or an existing one is upgraded. Water treatment facilities can range in cost from \$10-15 million up to several hundred million dollars.⁸⁹ Other costs could include installation of appropriate recreational facilities and amenities such as toilets and sealed roads; water quality monitoring and policing of activities.

Exclusion of public access from PDWSAs may also incur considerable costs depending on what management action is taken to ensure exclusion. A significant cost could include construction of human proof fencing and staffing costs for enforcement of the exclusion zone. Fencing in catchment areas can be costly owing to the highly variable topography, existence of streams, steep, potentially soft terrain and close proximity of trees. Costs can vary from a few thousand dollars per hectare of land fenced in relatively flat, open terrain up to tens of thousands of dollars per hectare for fences in more variable terrain. There is also a requirement for ongoing maintenance costs that largely consist of labour costs as regular (usually weekly) inspection of fencing is necessary. Common maintenance costs also include damage from falling tree branches, vandalism, wear and tear (corrosion) and subsidence creating holes under the fence.⁹⁰ Additional costs might include funds for relocation of recreational opportunities and lost revenue from removal of recreationists from a region. Further costs may be incurred in areas with higher densities of recreationists due to relocation and where additional management measures are required to minimise impacts and risk.

⁸⁹ Government of Western Australia (2008) State Budget; NQ Water (2008b); SA Water (2008)

⁹⁰ Long & Robley (2004); Karori Wildlife Sanctuary (2003)

Chapter 5

SOCIAL VALUES

Surface water bodies play an important role in the recreation and lifestyle of many communities⁹¹. Water bodies and the associated activities hold certain social values for users. These may be insitu or relate to social water requirements. In situ social values are based on the aesthetic and biophysical characteristics of a given location from which visitors draw value through scenic appreciation, a sense of experiencing nature or wilderness, education and research. The unique characteristics of a given surface water body may also function as a focus for tourism, encouraging visitors to the region with associated socio-economic benefits. Social requirements relate to the availability of surface water for activities such as boating and fishing. Water bodies that afford adequate volumes of water during summer months for recreational use are particularly valued in the drying Southwest of Western Australia.⁴⁸

Social values of water bodies in the Southwest of Western Australia tend to be specific to particular water bodies and adjacent areas and can include:⁹²

- Aesthetic values
- Heritage values (indigenous and non-indigenous)
- Socio-cultural values
- Intrinsic and extrinsic values
- Recreational values
- Educational values
- Research/scientific values
- Tourism values

The unique biophysical character of respective surface water bodies across the Southwest hold values that cannot be satisfactorily substituted once access is restricted. For example, study of social values in the Blackwood groundwater area⁹³ found case study sites to hold unique aesthetic characteristics, unique current use and traditions of use and unique cultural heritage that could not be replaced or substituted through access to alternative sites.

Recreation in natural areas such as water catchments and dams can provide social benefits through improved health, quality of life and stronger community networks.⁹⁴ Research at Deakin University indicated people engaged in nature recreation develop or reinforce positive social networks and/or improve personal wellbeing. The study found that there was a reduction in anti-social behaviour

⁹¹ Hadwen et al (2006)

⁹² Beckwith Environmental Planning (2007)

⁹³ Dept of Water (2007b)

⁹⁴ Western Australian Water Resources Council. (1991).

such as aggression, crime and violence when people are exposed to nature contact regularly. Previous studies have found a range of social and public health benefits associated with natural area recreation.⁹⁵

It is evident from studies of catchment and dam use in Southwest Western Australia, that particular sites tend to be dominated by repeat visitors for specific recreational purposes.⁹⁶ There is a wide body of literature highlighting the relationship between repeated recreation in a location, attachment to place and development of social networks. Past research has highlighted the link between recreation in natural areas and reinforcement of social networks.⁹⁷ Repeated recreational activity at a specific location results in attachment to that location in conjunction with development of strong social networks and a sense of wellbeing.⁹⁸ The high repeat visitation rate evident at dams and water ways are a function of these natural amenities being used as recreational outlets in the absence of alternative natural and built amenities. Denial of access may result in significantly reduced opportunities for recreation in some communities. The repetition of an activity at a specific location has also been strongly linked to social wellbeing through development of networks with a strong attachment to that place.⁹⁹ In other words, recreational sites, such as dams, with a tradition of use are not substitutable. Exclusion from existing sites and relocation of users to new sites as determined by managers will likely result in significant reduction of the quality of experience and decline of associated social networks.¹⁰⁰

⁹⁵ Sharp (2005)

⁹⁶ Muench (2001); Dept. Cons. and Land Management (1990)

⁹⁷ Shafer, E. & Mietz, J. (1967); Eisenhauer, B. et al (2000); Fakeye, P. & Crompton, J. (1991)

⁹⁸ Kyle et al (2004); Jorgensen & Stedman (2005); Bricker & Kerstetter (2002)

⁹⁹ Hughes (2004)

¹⁰⁰ Dept of Water (2007b)

Chapter 6

ECONOMIC VALUES

The economic value of recreation and tourism in catchments in the Southwest region of Western Australia has resulted in a wide variation in estimates.¹⁰¹ This is because of the variety of methods of economic valuation and the intangible (non-market) components of recreation value.¹⁰² The literature presents a generally sceptical view of recreation value estimates owing to the lack of reliable data such as visitor numbers and expenditure at the regional level. These uncertainties are highlighted in visitor estimates relating to Logue Brook Dam where estimates were based on assumptions and secondary data. In addition, there appeared to be significant discrepancies between reported visitation numbers to the dam. DEC reported an estimate of 16,000 visitors per year while a consulting report to the DoW reported 32,000 per year. Another study¹⁰³ provided estimates of 200,000 visitors to Wellington Dam and the Collie River in the year 1999. DEC provided a considerably lower estimate of around 26,000 visitors for the 2006/07 period. This either demonstrates a severe decline in visitation or an error in one of the estimates. Interestingly, the author providing the larger estimate did not indicate where or how this figure was sourced. The ability to provide reliable and objective valuations of recreational use of water catchments would enable a more balanced approach to the allocation and management of PDWSAs.¹⁰⁴ The apparent lack of reliable economic valuation of recreation in catchments creates difficulties in arriving at appropriate management decisions.

An economic valuation of the southern forests region in the Southwest of Western Australia found a direct tourism expenditure attributable to the “natural attractions” of \$61.9 million¹⁰⁵. While this value was associated with natural attractions in general, the Southern Forests region includes significant water bodies and rivers that maintain their flow during summer, including the Blackwood, Donnelly, Shannon and Warren rivers. Rivers with adequate summer flows have particular social use value in the generally dry Southwest of Western Australia. This is especially in relation to unpowered boating (kayaking, canoeing) and fishing activities as well as insitu values associated with aesthetics. These water bodies thus form an integral part of the Southern forests experience and could therefore be closely associated with tourism and recreation in the region. The estimated direct expenditure associated with “natural attractions” could provide an indication of the value of water oriented recreation and tourism in the Southern Forests region.

¹⁰¹ Western Australia Water Resources Council. (1993)

¹⁰² Dyack, et al (2007)

¹⁰³ Menzies and Doupe (2000)

¹⁰⁴ Loomis (2000)

¹⁰⁵ Carlsen and Wood (2004)

Notwithstanding the lack of adequate data, attempts at putting a dollar value specifically on catchment dam recreation have been made. For example, the exclusion of recreation from Logue Brook Dam included a proposed \$10 million of funds for relocation costs. This appears to be a value for relocation or rebuilding of infrastructure and amenities at alternative locations. It does not factor in economic values of recreation and tourism activities in the region resulting from the presence of the dam. A study measuring the economic value of recreation at Wellington Dam¹⁰⁶ measured a visitor direct expenditure figure of \$5.7 million per year associated with recreationists in the reserve area. The direct visitor expenditure represents a value over and above the value of assets and amenities. Furthermore, economic value could be extrapolated from the direct expenditure of visitors to include induced economic benefits to the region. This indicates two points:

1. recreation and tourism activity focussed on catchment dams bring significant economic benefits to the given region; and
2. valuing catchment dam recreation solely on the cost of relocating or rebuilding infrastructure and amenities will underestimate economic value.

It is therefore important to recognise that the economic value of recreation in catchments includes both the physical infrastructure and amenities as well as the expenditure of recreationists in the region and any subsequently induced economic benefits.

¹⁰⁶ Mqhum (2007)

CONCLUSION

Recreation and Water Quality

There is no published evidence linking recreation to negative impacts on downstream drinking water supply quality. All examples cited, in the argument for exclusion of recreation from P1 PDWSAs in WA, relate to recreationists falling ill after swallowing contaminated water in swimming pools and natural surface water bodies or relate to problems with downstream plumbing and distribution systems. Contamination in natural surface water bodies (lakes, dams) are most likely to be linked to the presence of native and feral animals, residential areas and associated sewerage, agricultural activity, mining and industrial activity in the catchment area. Recreation poses a very minor risk relative to these other activities.

Catchment Management

DEC, as the land management agency adopts a “risk management” stance whereas DoW adopts a “risk avoidance” strategy, in their approaches to land and water resources management. This has come about as a result of lack of adequate processes by which the related plans and policies of different government agencies may be assessed in an integrated manner, and with a view to achieving complementary, streamlined and efficient outcomes.

Multiple barriers are preferable to single barriers in management of drinking water supply and quality. This reduces risk to downstream water quality through the presence of back up systems should one barrier fail. Total exclusion of recreation from PDWSAs alone does not remove risk to water quality as it relies on a single barrier based on public compliance and enforcement capability. In circumstances where minimal treatment of water is in place and the exclusion barrier is breached, there is no safeguard in case of water contamination resulting from the breach. The international standard practice is to allow selected recreation in PDWSAs in combination with monitoring and additional water treatment to provide a multiple barrier approach.

Recreation Management

Increasing demand for water based recreation combined with diminishing water availability means single use management may not be feasible. Excluding all recreation activity from PDWSAs does not factor in, social and economic values associated with catchments and water bodies. Relocation of recreation from P1 PDWSAs and concentration to fewer alternative sites will result in degradation of the recreation experience and decay of social networks associated with use of the PDWSA. It will also potentially increase negative environmental and social impacts on remaining water bodies available for recreation through illegal use and higher intensities of use.

The most recent research into the WA community's needs and demands on water resources was done over 10 years ago.¹⁰⁷ Given the noted changes in use and demand over the past 30 years, another study would be necessary to gain an understanding of the current situation. Unless such an evaluation is made and competing interests identified, the objective of meeting the community's demands in land-use planning, while balancing environmental protection will be difficult.

Legislation

There are provisions in the relevant water management Acts and policies for negotiation in relation to allowing certain land uses to continue in declared PDWSA priority 1 areas where risk to water quality is deemed acceptable. This suggests an approach based on recognition that different types of recreation activity pose varying levels of risk to water quality. Exceptions to banning of activity in PDWSAs, including mining and logging, suggests the significantly higher risk to water quality posed by such activities can be managed. A blanket ban of all recreation does not recognise the potential for low risk activity and runs counter to international good practice and an integrated approach to total catchment management..

There are adequate legislative provisions governing the management of PDWSAs in WA and they are dispersed, with administration falling across various state Departments. The mandate to develop and issue policy with regard to conservation and land management vests with DEC, however the overall planning function of Crown Lands in regard to land-use vests with the Department for Planning and Infrastructure with the proviso that any proposed developments relating to the CALM Act must be consented to by DEC. DEC in turn has the overall management function in regard to permitting uses only insofar as they are consistent with the conservation of the environment. DEC also has the mandate to enforce the regulations made under the CALM Act and so are charged with the policing function of Crown lands.

In carrying out its functions DEC has to make provision for the management of PDWSAs, whose control legally falls under DoW. In essence, DEC must take into consideration the CAWS and MWSSD Act provisions in observing the control measures stipulated by DoW under these. An anomaly has arisen as DoW itself is not required to have concurrence with DEC in devising these stipulations. To complicate matters further, a raft of legislation is currently being drafted by DoW for the management of water resources. Whether or not PDWSAs are encapsulated within the overall management mandate of DEC under the CALM Act remains to be seen.

Development of an operational process with the function of assessing all relevant state policies and regulations to identify areas of overlap and duplication could facilitate efficiency and ensure the objects of the CALM Act are fruitfully achieved. Ideally the process could take into consideration

¹⁰⁷ Water Corporation (1997) (cited in Statewide Policy 13)

the rights, values and expectations of the public in how they use and access resources vis-à-vis practical implications of enforcing rules and regulations. For example, NSW, Victoria and Queensland have developed an integrated approach to managing the environment of which water resources is a part. Separate legislation for catchment management, in addition to the proposed Water Resources Management Bill (as is the case in the state of Victoria) can function to remove doubt as to the authority and relevance of bodies implementing appropriate catchment management regimes.

Closing Comments

The available literature supports the view that proper planning and management for recreational development in water catchments is critical particularly in the context of Southwest of Western Australia. The demand for recreational use of water sources has increased. Hence, the need for the implementation of effective management strategies for Western Australian waters and water systems.¹⁰⁸ It is apparent that any management approach, from total exclusion through to managed use has a level of associated risk to water quality.³⁸

To improve water security and ensure water quality, a multiple barrier approach to water management appears to be the option with least risk associated with it.. While this may involve considerable initial costs, additional treatment barriers will significantly reduce risk to downstream water quality irrespective of the management approach to recreation. Recognition of and allowance for recreation activities that pose a low risk to water quality will enable a more considered and socially responsible approach to PDWSA management. Appendix 2 illustrates a potential framework for recreation management in catchments aimed at minimising risk to water quality.

¹⁰⁸ Government of Western Australia. (2007) *State Water Plan*

Appendix 1: Terms of Reference

The core components of the review and analysis of the literature included the following:

- a) the historical and contemporary recreational pursuits occurring in major water catchments in the Southwest of Western Australia, including
 - the extent and scope of recreational pursuits in SW water catchments;
 - changes in spatial, seasonal demand and use patterns (if data exists)
- b) the social and economic values of water based recreation (in-stream and off-stream) in water catchments;
- c) the current policy and practice relating to recreation in water catchment
 - with WA
 - other Australian states and internationallyIncluding
 - details on the supervision/management/policing issues raised from current practice;
 - a comparative analysis of the advantages and disadvantages of policy implementations across Australia;
- d) scientific research completed on:
 - the water quality risks associated with various forms of in-stream and off-stream recreation in water catchments;
 - incidents of water contamination arising from recreation, and
 - the social/wellness impacts/cost by not having places to recreate for the community;
- e) economic analysis:
 - cost benefit analysis of cost of recreation exclusion versus tertiary treatment;
 - an estimation of the economic value of recreation and tourism in SW catchments

Appendix 2: Possible Framework for Recreation Management in PDWSAs

Following is a suggested management regime for recreation access to PDWSAs based on recreation type and risk to water quality. This combines international practice with recognition of drinking water quality risk management protocols common in Australia.

Water Quality Risk Level	High	Restrict	Exclude
	Low	Permitted	Monitor
		Land Based	Water Based

Recreation Type

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