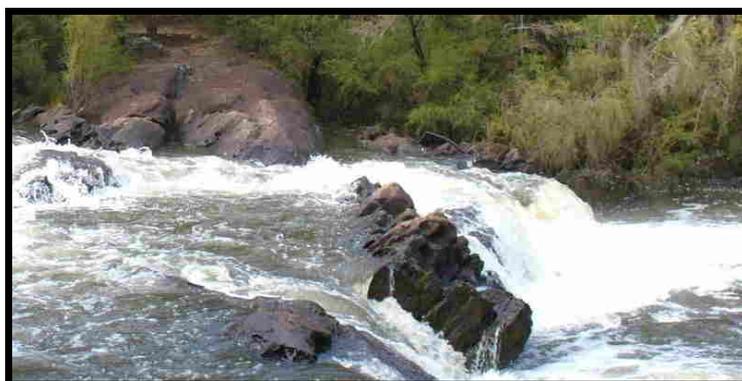
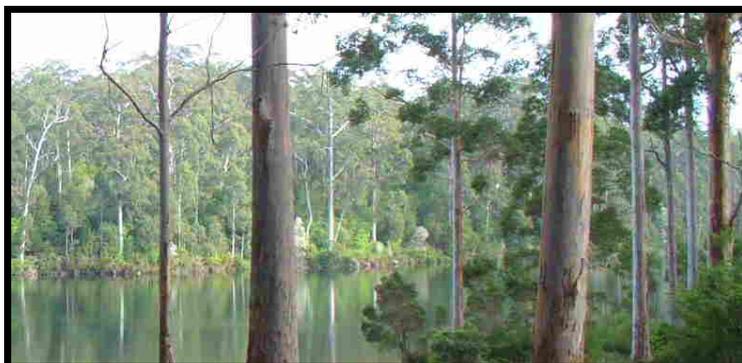


Lefroy Brook – Surface Water Management

Issue Scoping Report



Beckwith Environmental Planning Pty Ltd

Prepared for

Department of Water

Government of Western Australia

February 2007

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The authors would like to thank all of the individuals and organisations who generously agreed to meet and share with us their knowledge and insights on the Lefroy Brook and the surface water management planning process.

The funding and support of the South West Catchments Council and the Perth, Bunbury and Manjimup Offices of the Department of Water are appreciated. We extend a special thank you to Rob Donohue and Katherine Bennett for their assistance with this study.

Sincerely,

A handwritten signature in blue ink that reads "Jo Ann Beckwith". The signature is written in a cursive style and is positioned above a light blue rectangular background.

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Report Authorship

This document is the property of Beckwith Environmental Planning Pty Ltd. The opinions and recommendations in this report are those of the authors and do not necessarily reflect Department of Water policy or positions.

The Department of Water intends to publish a follow-up report that will address issues raised by stakeholders during the scoping exercise and set forth its public involvement process for subsequent stages of the water resource management planning process. Any questions regarding the Department's work in relation to the Lefroy Brook should be directed to Mr. Rob Donohue, Programme Manager, phone (08) 6364 6500 or email robert.donohue@water.wa.gov.au

Executive Summary

Background

Declared in 1959, the Lefroy Brook Catchment includes over 100 licensed private self-supply dams and four Water Corporation dams that provide drinking water to the towns of Manjimup and Pemberton. The Catchment's surface water resources also support a range of ecosystems, water-based recreation, and heritage and tourism activities. Despite a long history of active surface water management, the Lefroy Brook catchment does not have a formal surface water management plan.

With funding from the South West Catchments Council, the Department of Water has commenced development of management plans for selected surface water resources in the South West including the Lefroy Brook. In the upper portion of the Lefroy Brook Catchment, the demand for private water supply is high relative to the size of the resource and preliminary sustainable yield estimates have been reached. Refinement of the sustainable yield estimates is needed to determine the extent to which additional water allocation is possible in a sustainable manner.

Changes in land use patterns (e.g. expansion in commercial tree plantations), requests for additional water allocations to meet self-supply needs, and declining rainfall have provided the impetus for refining the sustainable yield estimates. As the pressures on the surface water resources increase, a more sophisticated approach to water resource management is needed.

As a first stage of the surface water planning process, the Department of Water commissioned an issue scoping exercise to:

- Gain an understanding of and document stakeholder issues and concerns about surface water resource management for the Lefroy Brook and catchment
- Provide guidance in development of a public involvement strategy as a component of the surface water resource planning for the Lefroy Brook

Key Themes

Water Interception by Private Tree Plantations

High rainfall, good land capability and the popularity of managed investment schemes has resulted in significant growth in new private tree plantations in the Lefroy Brook Catchment. The growth in private tree plantations is a contentious issue within the catchment. There is little consensus and considerable polarisation of views. From a surface water perspective, many stakeholders wanted water interception by tree plantations to be taken into account by the Department of Water when modelling water systems and making resource management decisions including water allocations. However, there was not agreement on the exact means for doing so. Many indicated that a better scientific understanding of the water interception issue is needed and supported research in that area. There were also calls for an equitable and clear approach to addressing water interception by tree plantations.

Ecosystem Maintenance

There is strong support for explicit consideration of ecological water requirements as part of surface water management and allocation in the Lefroy Brook Catchment. There is general agreement on the value of gaining a better scientific understanding of the dependent ecological values. There was considerable support for erring on the side of caution in setting ecological water requirements. Some feared the environmental flows would be set too low and were not confident that adaptive management approaches would allow timely adjustments to be made.

Many stakeholders indicated that streamflows are currently meeting the needs of local ecosystems. Some feared that if pressure on local surface water resources increased due to greater consumptive demand or climate change, ecosystem maintenance would receive less management priority than sustaining consumptive uses.

More concern was expressed about water quality and the obstruction to the passage of aquatic life imposed by dams. The practice of flushing private farm dams before the summer rains was identified as creating flow at the wrong time of year with higher levels of nutrient, sediment and salt.

Contribution of Fresh Flows to the Warren River

The Lefroy Brook is ‘fresh’ with salt levels less than the drinking water standard of 500 mg/L TDS. Many stakeholders noted how this contrasted with other parts of the Warren River catchment where salinity levels are well in excess of the drinking water standard. Two distinct views emerged regarding what obligation, if any, the Lefroy Brook water users have to helping address the salinity problems of the Warren River. The dominant view is that water users in the Lefroy Brook Catchment have some duty of care to the Warren River. Most did not see this as a sacrifice, as good resource management in the Lefroy Brook Catchment would result in sustainable fresh flows for the local catchment as well as the Warren River. A few individuals contended that, as there is not a salinity problem in the Lefroy Catchment, concerns about salinity are irrelevant. In their view, the salinity problems of the Warren River system should be solely the concern of those water users in the sub-catchments contributing high salinity levels to the Warren River.

On-Stream Farm Dams

A number of issues emerged in relation to the approval and operation of on-stream farm dams. Some stakeholders feel the approval of water licences for self-supply should be more transparent and must be consistent across applicants. Licensed allocations for self-suppliers often reflect the storage capacity of a reservoir. However, actual use may be greater than the licensed amount due to owners refilling their reservoirs on the shoulder seasons or holding back water by not opening their dam by-pass valves as required. In some years, farmers do not use all the water in their reservoirs. Other years, they may use more water than their storage capacity by allowing it to ‘top up’. Many dam owners view such a practice as an insurance policy against future shortages and just good business sense. Some interviewees (especially self-suppliers) were disdainful of hobby farmers and others who ‘make poor use of water’ by having a ‘duck pond to look at’ rather using the water for ‘production’. They believe that in allocating water, the DoW should view aesthetic water on private properties as a lower priority or value water use.

Recreation and Drinking Water Quality

The *Draft State Water Plan* (2006) encourages the preparation of Drinking Water Source Protection Plans (DWSPP) for all public drinking water sources. The source protection planning process identifies existing and potential threats to a drinking water source and risk management strategies and programs for the ongoing management and protection of a source. This may result in some land use or activity restrictions in order to achieve a safe, good quality drinking water supply. Among the activities of greatest concern are those that result in direct human or animal contact with water.

In the case of Big Brook Dam, recreational activities are actively promoted through the Big Brook Recreational Area managed by the Department of Environment and Conservation (DEC). Recreational activities include - swimming, canoeing, fishing and marroning, picnicking camping, and bushwalking. Some stakeholders, especially those associated with recreational activities such as angling, expressed a fear that permission for recreational activities on and around Big Brook Dam might be withdrawn or severe restrictions put in place if a DWSPP is implemented in the future. There are five stages in development of a Drinking Water Source Protection Plan. The Water Corporation (WC 2004) has completed only the first stage (i.e. initial risk assessment) and there is no timeline for subsequent stages.

State Water Reform Process

At the time of the interviews for this study, the State Government appointed Water Reform Implementation Committee had recently released its *Draft Blueprint for Water reform in Western Australia* (July 2006). Self-suppliers in particular were apprehensive about some aspects of the proposed water reforms. They are generally satisfied with water resource management in the Lefroy Brook Catchment. In their view, if the system is working well, you do not change it as it might not be an improvement and could even be a step backward.

Metering of water use by self-suppliers is generally supported as a means of gathering data on consumptive use. However, self-suppliers are concerned that metering will lead to the introduction of volumetric charges for the use of water. This is strongly opposed by most of the self-suppliers interviewed. Having made substantial investments in their water infrastructure, they view any attempt to charge for the water as unfair.

Warren Water Management Area Advisory Committee

Established as a local water users group in 1963, the Warren Water Management Area Advisory Committee became the first water management committee of its type in Western Australia. Many stakeholders expressed a positive perception of the Advisory Committee's efforts in resolving local water disputes. There was also considerable support for establishing a broader range of stakeholder representation on the Advisory Committee.

Having the Warren Water Management Area Advisory Committee already in place is a significant advantage to the design and implementation of a public engagement strategy for the surface water planning process. A joint planning approach is recommended. The DoW and the Advisory Committee would work together on the design, implementation, and monitoring of the public engagement strategy over the duration of the surface water planning process.

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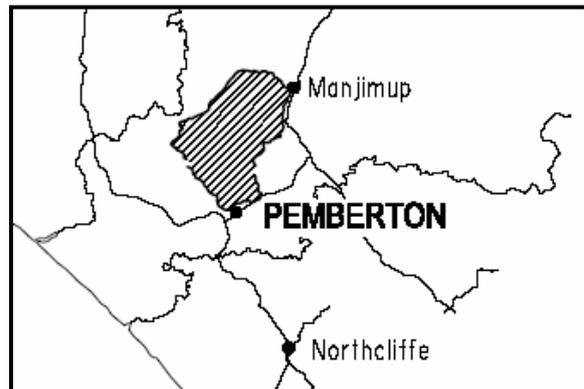
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1 Introduction

1.1 Lefroy Brook and Surface Water Planning

The Lefroy Brook catchment does not have a formal surface water management plan. However, it has a long history of active surface water management. Water licensing was introduced in 1965 and a local water users group was established in 1963. The Warren Water Management Area Advisory Committee was the first water management committee of its type in Western Australia.

The surface water resources of the 358 km² Lefroy Brook catchment support a variety of consumptive and non-consumptive uses. Declared in 1959, the Lefroy Brook Catchment Area includes over 100 licensed private self-supply dams that support the area's irrigated horticulture and viticulture sectors. Four Water Corporation dams supply drinking water to the towns of Manjimup and Pemberton. The surface water resources also support a range of ecosystems and habitats. Situated in 'Tall Timber Country', the catchment offers a range of water-based recreation, heritage and tourism activities.



Water resource managers have used preliminary sustainable yield estimates as the basis for evaluating water license applications in the catchment. In parts of the catchment where the demand for private water supply is high, the preliminary sustainable yield estimates have been reached. Review and refinement of the sustainable yield estimates for the Lefroy Brook catchment is needed to determine the extent to which additional water allocation is possible in a sustainable manner. This is necessary to ensure the surface water resources can continue to support both the natural environment and the many consumptive and non-consumptive uses in the catchment. Changes in land use patterns such as the introduction of commercial tree plantations, requests for additional water allocations and declining rainfall have added to the importance of establishing a formal water management plan for the surface water resources of the Lefroy Brook Catchment.

The Department of Water (DoW) is the State Government agency responsible for water resource planning in Western Australia. The Department has commenced development of management plans for selected surface water resources in the South West including the Lefroy Brook. The South West Catchments Council has provided the Department of Water with funding for the ecological water requirements component of this work. Other surface water resources under investigation are: the Brunswick River, Capel River, Willyabrup Brook, Cowaramup Brook, Margaret River, and Chapman Brook.

The surface water planning process will establish the sustainable water yield and set limits on abstraction. The planning process includes:

- Determining the values associated with water resources including environmental, social and economic values
- Identifying current consumption and predicting future demand for surface water resources

- Gaining an improved understanding of the hydrologic relationships between ground and surface water resources
- Assessing the quantity of water needed to support the natural environment and the amount that can be diverted to consumptive uses

This planning will guide the DoW's approval of future licenses to use water for purposes such as irrigation, industry and the servicing of municipal water supplies. This will protect the resource from over-allocation and allow it to continue to meet multiple uses. It will also protect individual entitlements and the economic viability of licensed users.

1.2 The Lefroy Brook Catchment

The Lefroy Brook Catchment is part of the Warren River Basin. Proclaimed as a catchment area under the *Country Areas Water Supply Act 1947* in 1959, it includes the Big Brook Dam sub-catchment and the Manjimup Dam sub-catchment. The Lefroy Brook Catchment Area covers a 252 square kilometre (km²) area within the Shire of Manjimup. Although the Phillips Creek Dam lies just outside the northern boundary of the proclaimed Lefroy Brook Catchment Area, it is still within the Lefroy Brook catchment (Figure 1).

Upper and Lower catchments

The northern or upper portion of the catchment lies west of the Town of Manjimup. It includes the Scabby Gully, Jarnadup Brook and Archie Ovens tributaries as well as the Lefroy Brook headwaters. The Water Corporation's Manjimup Dam on Scabby Gully and Phillips Creek Dam on Jarnadup Creek supply water to the town of Manjimup. The upper catchment is separated from the lower catchment by a band of managed forest estate.

South of Channybearup Road, the lower catchment includes both the Big Brook and East Brook tributaries of the Lefroy Brook. Secondary tributaries include Four Mile and Five Mile Brook which flow into Big Brook. The Lefroy Brook passes through Pemberton before joining the Warren River. The Town of Pemberton's public water supply is taken from the Water Corporation's Lefroy Brook Weir. It is a pipehead dam on the Lefroy Brook recharged from Big Brook Dam, a storage reservoir upstream. The State trout hatchery is located on Lefroy Brook just below the Weir near Pemberton.

Existing Land Uses

The dominant land use in the catchment is State forest (Figure 2). Vested in the Conservation Commission of Western Australia and managed by the Department of Environment and Conservation (formerly CALM), it makes up 62% of the catchment (Table 1). Managed uses include conservation, recreation, timber production and water catchment protection. Timber production by the Forest Products Commission (FPC) is the dominant commercial activity undertaken in the State forest.

The karri, marri and jarrah forests provide numerous recreation opportunities especially in the lower catchment. The many tracks and trails in the State forest are used for bushwalking, horse riding, firewood collection and off-road vehicle use (WC 2004). Just south of Pemberton, the Gloucester National Park is a popular recreation area which includes the State's most famous karri tree, the 60m high Gloucester Tree. The Cascades, an area of rocky rapids on the Lefroy Brook, is a popular picnicking, fly-fishing and bushwalking area in the National Park.

Figure 1 Map of the Lefroy Brook Catchment Area (Source: WC 2004b)

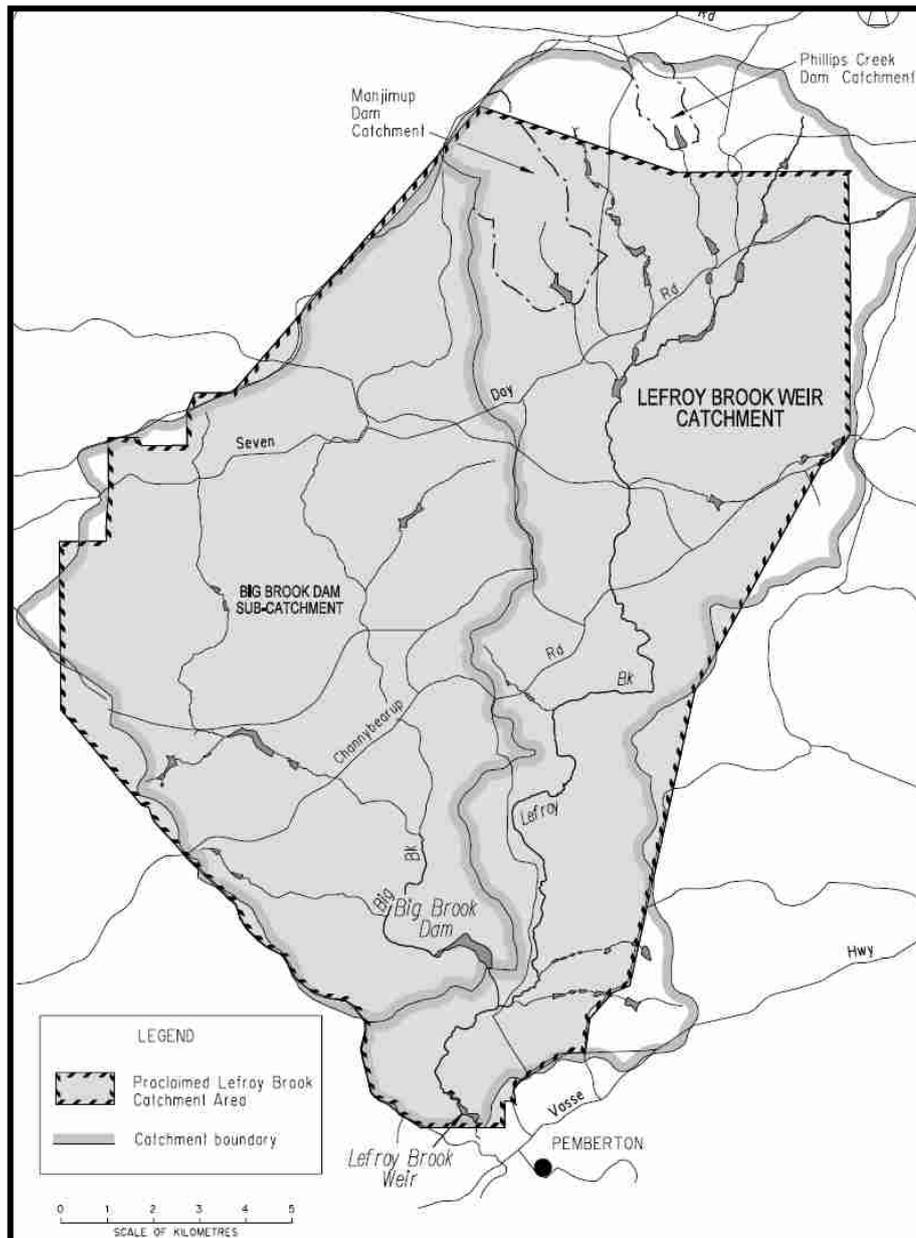


Table 1 Land use in the Lefroy Brook catchment

Type of use	Area	Percent of catchment
State Forest	22,760 ha	62.2 %
Rural Land	12,740 ha	34.8 %
Other Crown Land	1055 ha	2.9 %
Special Rural	65 ha	0.2%
Total	36,620 ha	

Located north of Pemberton, Big Brook Forest was one of the first tourist destinations developed in the karri forest after the Second World War. Centred on the scenic Big Brook Dam, the Forest has grown in popularity over the years (CALM nd). Visitors can swim and fish (trout and marron) in the reservoir or walk and picnic by the water's edge. Western Australia's premiere long-distance walking trail, the Bibbulmun Track, passes through the lower catchment, skirting along Big Brook before passing through Pemberton and Gloucester National Park.

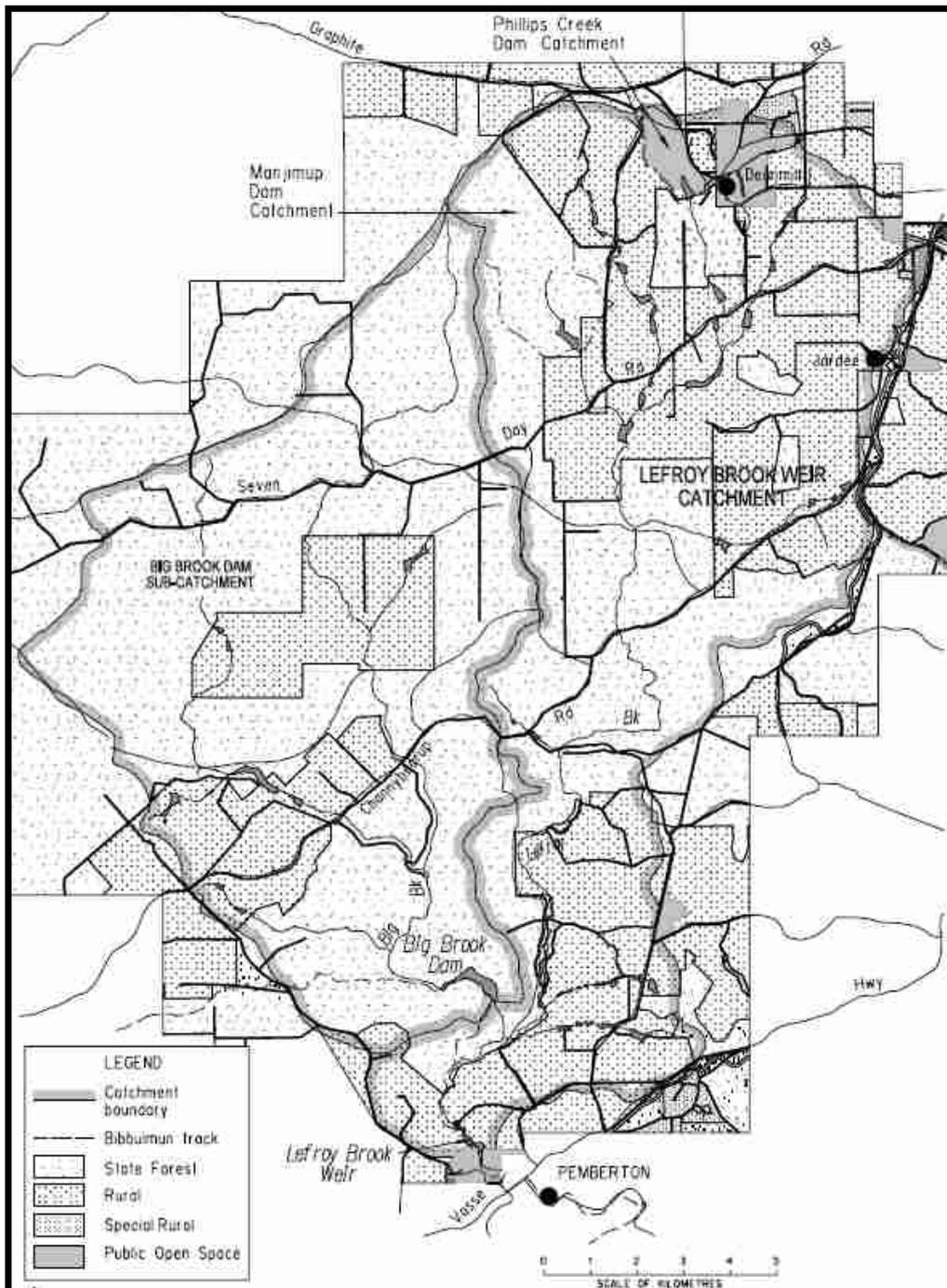


Figure 2 Land uses in the Lefroy Brook Catchment Area (Source: WC 2004b)

Approximately 37% of the catchment is cleared. Most is used for rural land uses including grazing, annual and perennial horticulture, nurseries, small-scale tourist activities and

accommodation, and a small number of industrial businesses (bulk transport and timber treatment). The area has a strong tradition of potato farming although the number of hectares under potato production has declined in recent years. There are numerous orchards and vineyards in the catchment. Avocado orchards are a recent addition as is a truffle farm in the upper catchment. Commercial tree plantations and agroforestry continue to expand. Many rural properties include aquaculture (marron) as a source of supplemental income. A high proportion of the land zoned as Rural is Priority Agriculture in the Shire of Manjimup's Local Planning Strategy (2003).

DoW Monitoring of Flow

Currently the DoW has two operational streamflow gauging stations on the Lefroy. The Rainbow Trail gauging station is 1.5 km upstream of the Lefroy Brook Weir (Pemberton) and commenced operation in 1979. The Cascades gauging station is 3.3 km from the confluence with the Warren River and commenced operation in 1997.

1.3 Issue Scoping

Public involvement is an integral component of water resource management. As a first stage of the surface water planning process, the Department of Water commissioned the issue scoping exercise documented in this report. The objectives of the scoping exercise were to:

- Gain an understanding of and document stakeholder issues and concerns about surface water resource management for the Lefroy Brook and catchment
- Provide guidance in development of a public involvement strategy as a component of the water resource planning for the Lefroy Brook

The scoping exercise involved individual interviews with representatives of a range of stakeholders with an interest in the future of the Lefroy Brook. With the assistance of the DoW's Bunbury and Manjimup Offices, representatives of stakeholder interests in the Lefroy Brook catchment were identified. Prospective interviewees were contacted by telephone and email to request their participation and arrange a convenient date and location for an interview. A brief background document was sent to all study participants in advance of the interviews.

The interviews explored what stakeholders view as the surface water management issues facing the Lefroy Brook Catchment. In total 24 individuals were interviewed (Appendix A). This included representatives of local government, state government agencies, local landholders, environmental organizations, commercial tree plantations and various irrigated agriculture sectors (e.g. potatoes, fruit growers, viticulture).

The key themes arising from the interviews are discussed in subsequent chapters of this report.

2 Water Availability

2.1 Sustainable Yield Estimates

Existing Approach

In the absence of detailed and costly resource investigations and modelling, surface water managers have applied quick and simple methods to estimate the sustainable yield and hence the volume of water potentially available for allocation. The sustainable yield is the quantity of water available for use after water for the environment has been satisfied.

During the interviews, several individuals referred to two approaches used by water resource managers to evaluate the acceptability of surface water licence applications. In the past, a one-in-ten-year drought scenario was used. It was assumed that a farming operation can handle drought conditions in one of every 10 years. Allocation limits were based on the drought year, thus the water needs of consumptive users should be met even in a drought year. In the other nine out of ten years, there would be plenty of water to go round.

That approach has been replaced by what some interviewees referred to as the '60% rule'. The notional sustainable yield is calculated as 60% of the mean annual flow for the period 1975 to 2003. This approach recognises that in areas where the existing level of use of water is low, it is appropriate to make estimates of sustainable yield based on regional models. Even if there are large errors in the estimate of sustainable yield, the level of use is a lot lower than the estimated sustainable yield and so the risk to the environment is low.

The latest version of the model is REG75. The regional water model applies local rainfall and groundcover data to calculate runoff and evapotranspiration rates in the Lefroy Brook catchment. As the level of surface water use increases, so does the rigour required to estimate the sustainable yield. This is why more detailed resource investigations of the Lefroy Brook Catchment are needed at this time.

Some stakeholders commented that the current approach to water allocation in the catchment is working effectively. They cited the low level of conflict among water users in the catchment as evidence the allocation process is working. There was some nervousness expressed about making changes to the existing process.

Others want to see further refinement of the modelling to allow detailed assessment of the impact of various land uses on runoff in different parts of the catchment. The impact of commercial blue gum tree plantations on runoff was often mentioned as part of this issue.

According to stakeholders, the northern tributaries comprise the portion of the catchment under greatest pressure. Reduced rainfall, a significant number of self-supply dams and the Water Corporation's Manjimup and Phillips Creek dams were each identified as contributing to the resource reaching its sustainable limit based on the preliminary estimate applied by the Department of Water. Review and refinement of the preliminary sustainable yield estimates was seen as important in determining whether or not the

sustainable limits are actually being reached and whether new allocations are possible in various parts of the catchment.

In the lower catchment, stakeholders expressed less concern about water allocation and sustainable limits. Few felt sustainable limits are being neared and some stated there is plenty of resource for additional self-supply dams in the lower catchment. A number of stakeholders expressed the view that, since relatively little of the catchment is cleared, land uses such as horticulture could not be making a significant impact on the surface water resources. By clearing land, they had increased runoff. One person observed that until his/her relatives cleared their property for agriculture there had not been a stream.

Measuring Consumptive Use

The shortage of information on the level of existing consumptive use by self-suppliers was identified as a major knowledge gap. Acquiring this knowledge was viewed by many stakeholders as a critical part of any review of sustainable yield limits. Though the Department of Water records the amount of water allocated to self-supply dams, it has no mechanism to determine the actual amount of water that is being used by an individual self-supplier. There are over 100 licensed private self-supply dams in the catchment.

Currently water allocation is based on the storage capacity of the individual farm dam. Licence holders are supposed to release any additional water above the allocated volume thereby making water available for the environment and downstream users. During interviews with self-supply dam owners, some admitted that some self-suppliers use more than their allocated volume by topping up on the shoulder seasons. This practice was typically undertaken as a form of insurance against drought conditions.

Some stakeholders claimed there are numerous dams in the catchment that go unused when properties shift out of agriculture to uses such as commercial tree plantations. It was noted that farmers sometimes do not use all of the licensed dams on their property in a given year due to crop rotations. Irrigators only use the dams on or near the fields actually in production that season, while the water stored in the other dams goes unused.

Metering of water use by self-suppliers was generally supported as a means of gathering data on actual consumptive use. However, landowners were concerned that metering would lead to the introduction of volumetric charges for the use of water. This is strongly opposed by most of the self-suppliers interviewed. Pointing to the substantial capital and operating costs borne by farm dam owners, they view charges for water as unfair. Having had to make the investment in water infrastructure, they should not have to pay for the water.

Many of the farm properties have multiple dams including both dams and off-stream dams. Currently only on-stream farm dams need to be licensed. However, several stakeholders noted that similar to on-stream dams, the off-stream dams are intercepting runoff and thus should be part of any database on surface water use in the catchment.

Information Needs

Collectively the stakeholders identified the following information needs in order for the DoW to calculate a more refined estimate of the catchment's sustainable yield:

- Assessment of the amount of surface water runoff associated with different types of land cover (e.g. tree plantations, crop types, etc)
- A projection of future land use patterns in the catchment
- Estimates of future changes in rainfall and climate change impacts (e.g. temperature, evapotranspiration)
- An assessment of ecological water requirements and ecological values
- An understanding of the existing level of consumptive use in the catchment

2.2 Climate Change and Reduced Rainfall

In the South West, the average winter rainfall has decreased by nearly 20% since the mid-1970s. Only a small proportion of rainfall ever becomes stream flow. Thus, even a small decrease in rainfall can result in a significant decrease in streamflows. In some parts of the South West, this has resulted in significantly reduced streamflows (CSIRO 2005). CSIRO climate change models indicate further reductions in annual rainfall and increases in temperature are likely.

Rainfall in the Lefroy Brook catchment is highly seasonal with 73% of annual rainfall occurring between May and September (DoW n.d.). The long-term average annual rainfall for Manjimup is 1019 mm with 80% of rainfall occurring between May and October. Since 1975, Manjimup's annual rainfall has decreased to an average of 935 mm (Water Corporation 2004a). During the same period the average annual rainfall in Pemberton was 1169 mm (Water Corporation 2004b).

The rainfall in the Lefroy Brook catchment has decreased but the area still receives greater rainfall than many other parts of the South West, a point made by many of those interviewed. During stakeholder interviews, the most commonly cited long-term average annual rainfall figure for the catchment was 1000 mm. Some indicated this figure may have decreased to as low as 700 mm in more recent times.

The average long-term annual streamflow at the Cascades gauging station is estimated to be 69.2 GL. DoW monitoring of annual flow at the Cascades gauging station (1997-2004) indicates a decrease in mean annual streamflow from the early 1970s. In the period 1997-2004, the mean annual flow was 50.9 GL with a maximum annual flow of 90.3 GL in 1999 and a minimum annual flow of 22.3 GL in 2001.

Streamflow is highly seasonal with 85% of annual flow occurring between June and October. Streamflow at the Cascades gauging station is continuous from May to November with a median daily flow of 61 ML.

Many of those interviewed indicated they had yet to witness any significant negative impacts from climate change or changes in rainfall. An exception was the impact of reduced rainfall on the Water Corporation's dams in the upper catchment that supply drinking water to the Town of Manjimup (see Municipal Water Supply). However, stakeholders identified the need for potential declines in rainfall and streamflow due to climate change to be taken into account by water resource managers in making water allocation and resource management decisions.

2.3 Dominant Consumptive Uses

Municipal Water Supply

The Water Corporation operates four public water supply dams in the Lefroy Brook Catchment (Table 2).

Table 2 Public water supply dams in the catchment

Name	Dam type	Catchment area	Reservoir storage capacity	Surface water area
Manjimup Dam	17 m high earthfill wall	8 km ²	1,607 ML	26 ha
Phillips Creek Dam	11 m high earthfill wall	2 km ²	269 ML	7 ha
Big Brook Dam	8 m high concrete wall	114 km ²	627 ML	24 ha
Lefroy Brook Weir	4 m high concrete wall	252 km ²	67 ML	N/A

Water supply for the town of Manjimup is sourced from the Water Corporation's Manjimup Dam and Phillips Creek Dam. The Corporation draws water from the Lefroy Brook Weir to supply drinking water to the town of Pemberton following treatment.

Manjimup Town Supply

Constructed in 1967 and raised in 1995, Manjimup Dam is located on Scabby Gully, a tributary of Lefroy Brook in the upper catchment. The smaller Phillips Creek Dam is located on a nearby tributary - Jarnadup Creek. It was constructed in 1936 and raised in 1956. Water from these reservoirs is treated at the dam sites, pumped to a 9000 kilolitre (kL) ground tank in the Manjimup town site, and then pumped into a 1000 kL elevated water tank.

The Water Corporation is licensed to draw 894 mega litres per year (ML/yr) from the Manjimup Dam and Phillips Creek Dam for public water supply purposes. Abstraction in 2002/03 was 762 ML with 518 ML from Manjimup Dam (including 314 ML from Four Mile Brook) and 244 ML from Phillips Creek Dam (Water Corporation 2004a).



Photo: Manjimup Dam (WC 2004a)

Numerous stakeholder representatives commented on the water restrictions imposed on the Town of Manjimup. Many contended that given the high rainfall in the area, there should be no need for water restrictions in Manjimup. Some pointed to poor planning on the part of the Water Corporation as the cause of the problem while others noted the reduced rainfall in recent years.

Although the combined storage capacity of the two reservoirs is more than sufficient to meet the town water supply needs of Manjimup, reduced rainfall has resulted in insufficient runoff in the forested catchment to fill the reservoirs in recent years. Runoff was dramatically reduced in 2001, 2002 and 2004 due to very low rainfall. Both dams have also experienced problems with leaks.

As shown in Table 3, Manjimup Dam has been as low as 29% of capacity in July 2003 and as high as 81% in October 2005 (Water Corporation 200X). Figures for the same period for the much smaller Phillips Creek Dam are provided in Table 4. This included a period in 2004 when the dam was empty to allow repairs and maintenance on the structure.

Table 3 Manjimup Dam storage levels (capacity: 1581 ML)

Date	Quantity Stored (ML)	% of Capacity
July 2003	451	29%
October 2003	1,164	74%
January 2004	996	63%
April 2004	719	45%
July 2004	750	47%
October 2004	979	62%
January 2005	757	48%
April 2005	541	34%
July 2005	787	50%
October 2005	1,283	81%
January 2006	1,146	73%
April 2006	943	60%
July 2006	926	59%

Table 4 Phillips Creek Dam storage levels (capacity: 269 ML)

Date	Quantity Stored (ML)	% of Capacity
July 2003	108	40%
October 2003	103	38%
January 2004	4	1%
April 2004	No data*	
July 2004	24	9%
October 2004	73	27%
January 2005	14	5%
April 2005	182	68%
July 2005	244	91%
October 2005	269	100%
January 2006	178	66%
April 2006	89	33%
July 2006	61	23%

*Dam was empty while repairs/maintenance were done on the structure

A temporary pump-back program was used in 2003 to transfer water from Four Mile Creek to Manjimup Dam. In 2002, the Corporation contracted a nearby landowner to transfer 200 ML of water from a private dam to fill Philips Creek Dam.

In 2003, the Water Corporation conducted non-commercial thinning of 225 hectares (ha) of jarrah and karri regrowth in the Manjimup Dam catchment in an effort to increase runoff. A similar process was conducted in the Phillips Creek Dam Catchment in 2004. The thinning programs are part of the Water Corporation's strategy to help Manjimup's water supply scheme recover from the drought and provide for its long term water supply security.



Photo: Phillips Creek Dam (WC 2004a)

Other elements of the strategy are:

- Possibly raising the Phillips Creek Dam wall by 2 metres
- Seepage recovery pumps installed at Manjimup Dam
- Remedial works at Phillips Creek Dam to reduce losses
- Water restrictions that allow garden sprinklers only twice a week in the Town of Manjimup

The Water Corporation has proposed developing a small pumpback on Record Brook in the Donnelly River catchment as a permanent supplement to the Manjimup Town Water Supply. Up to 260 ML/yr would be pumped along a 9 km pipeline from Record Brook to Manjimup Dam during periods of high stream flow. This option is expected to be required around 2013.

Pemberton Town Supply

Constructed in 1948, the Lefroy Brook Weir is a small pipehead dam located 1.5 km north-west of Pemberton with a 67 ML storage capacity. About 6 km north of Pemberton on Big Brook tributary is the Water Corporation's Big Brook Dam. Constructed in 1986, Big Brook reservoir has a storage capacity of 627 ML. As shown in Table 5, streamflow into Big Brook Dam is not a problem with the reservoir often reaching capacity.

Table 5 Big Brook Dam storage levels (capacity: 627 ML)

Date	Quantity Stored (ML)	% of Capacity
July 2003	656	105%
October 2003	666	106%
January 2004	594	95%
April 2004	445	71%
July 2004	659	105%
October 2004	646	103%
January 2005	493	79%
April 2005	613	98%
July 2005	666	106%
October 2005	668	106%
January 2006	630	100%
April 2006	627	100%
July 2006	668	107%



The Water Corporation is licensed to draw 470 ML/year from Lefroy Brook Weir (photo above) and Big Brook Dam for public water supply purposes. Current abstraction is around 180 ML/year and estimated to increase to 222 ML/year by 2007 (Water Corporation 1999).



During summer, water is released from Big Brook Dam to maintain suitable water levels in the Lefroy Brook Weir (photo) and meet the water requirements of the Pemberton trout hatchery. An estimated 200 ML is annually diverted from the Lefroy Brook Weir through the trout hatchery (WC 2004b).

Population Growth

Manjimup is the most populous town in the Shire and is an important local and regional service centre. Its economy is based on agriculture, horticulture, forestry, timber processing and a tourist service centre. Pemberton, 30 km south west of Manjimup, was developed around the timber industry. More recently, intensive agriculture, tourism and lifestyle residents have grown in importance.

Many stakeholders commented that the Forest Management Plan (2004-2013) and restrictions on native forest logging have had a dampening effect on population growth. In the period 1996-2001, the town of Manjimup grew by less than 1% while Pemberton declined by almost 1% (Table 6).

Table 6 Population figures (DPI 2004)

	Census 1976	Census 1996	Av. annual growth rate (1976-1996)	Census 2001	Av. annual growth rate (1996-2001)
Manjimup	3,893	4,390	0.64%	4,402	0.05%
Pemberton	810	994	1.13%	948	-0.92%

Numerous stakeholders commented that any new residents to the catchment would likely be rural lifestylers. As popular lifestyle enclaves in the Southwest (e.g. Busselton, Margaret-River) become increasingly expensive, they expect the catchment to become increasingly attractive to those seeking lifestyle lots. Some stakeholders predicted some decline in agriculture in the area and an increase in hobby farms. The WAPC (2005) population projections for the Shire indicate no significant growth over the next 15 years (Table 7).

Table 7 Shire of Manjimup projected population growth (WAPC 2005)

Year	Projected Population
2004	10,000
2006	10,000
2011	10,100
2016	10,000
2021	9,900

Agriculture

The Lefroy Brook Catchment is part of the Warren-Blackwood Region. Around Manjimup-Pemberton, there are considerable areas of heavy red loams, or karri loams, which are of significant horticultural value. Almost all the land around Pemberton and towards Manjimup has a high to very high capability for annual and/or perennial horticulture (DPI 2004). Annual and perennial horticulture represents more than half the gross value of agricultural production in the Manjimup Shire (DPI 2004).

Annual horticultural production occurs extensively from Manjimup to Pemberton. An area of exception occurs to the north of Manjimup where poor drainage is a limitation. Perennial horticulture, mainly fruit production and viticulture, is not as extensive as annual horticulture. It was noted that the area under potato production has decreased and the cauliflower industry is gone. There has been an increase in vine plantings in recent years.

The catchment is used for pasture to provide feed for sheep, beef and dairy cattle. There is a trend towards diversification and intensification in agriculture rather than expansion of grazing based enterprises.



Many of the stakeholders commented that the catchment has the natural resources (i.e. soils and water) to be a priority horticultural area. However, its ability to compete in the market place is seen as a significant limiting factor. It would determine if agriculture in the catchment remains a viable industry in the longer term.

The majority of those who discussed the future of agriculture in the catchment, believe the current agricultural areas will remain. However, as in the past, some shifts in crops will occur in response to market forces. Some feel that changes in the existing horticulture sector may be painful for some but offer an incentive to explore other markets and for innovation. One example of innovation cited is the research in Japanese Green Tea at the Manjimup Horticulture Research Station. Another is the recent establishment of a hazelnut and truffle farm in the upper catchment.

Some rationalization of the viticulture sector is expected. Consistent with the national trend, there are also predictions of fewer but larger farms. Many expect greater agribusiness investment (corporate farming) in the catchment. The growth in commercial tree plantations and recent upswing in avocado orchards were given as evidence. For some corporate farming represents a loss to the community while others were more accepting of or resigned to the prospect.

Some stakeholders involved in agriculture are quite pessimistic about its future in the catchment. Some stakeholders commented that when trees offer a better return than horticulture, something is wrong.

There was support for retaining high value agricultural land for that purpose through land use planning mechanisms. However, many landowners want to retain the right to subdivide in the future. There is an expectation that the pressure to subdivide agricultural land for lifestyle blocks will increase over time. Parallels were drawn with the history of development in the Margaret River area.

Marron Farming

Marron (*Cherax tenuimanus*) is a large freshwater crayfish native to the permanent rivers in the forested, high rainfall areas in the south west of Western Australia. The farming of marron is popular on many agricultural properties in the Lefroy Brook Catchment where it provides a valuable secondary income. An aquaculture licence is required if the operator intends to sell their product.

Marron are marketed either by individual farmers or by co-operatives. Forest Fresh Marron (Pemberton Aquaculture Producers Pty Ltd) is a cooperative established in 1996 by marron producers. Live marron are brought to the central processing centre in Pemberton where they are graded and prepared for shipment. The marron are DNA tested to ensure wild stock is not being taken illegally.



The import of yabbies (*Cherax destructor albidus*) into Manjimup Shire is prohibited. This is because of the danger of introducing disease into marron stocks and competition for food in water bodies.

Aquaculture enterprises, including marron farms, require careful management of nutrients (feed and waste products) to avoid adverse impacts on downstream water users.

Marron are featured on the menus of many local restaurants. The Marron and Wine Festival is held annually on the Australia Day long weekend as a celebration of Pemberton's forests, food and wine.



2.4 Water Interception and Tree Plantations

Benefit or Threat

The benefits of tree plantations are well known. They eased the pain of phasing out logging of old growth forests, they can protect water quality and are a key in the fight against salinity. More recently, tree plantations have become a mechanism for carbon sequestration in the battle against global warming. Despite these acknowledged benefits, some rural communities view the tree plantation industry as a threat. This is especially the case in agricultural areas, such as parts of the South West, where they have become a competitor for high capability land and water.

In the Lefroy Brook Catchment, the expansion of new private tree plantations is a contentious issue. There is little consensus and considerable polarisation of views. The impact of commercial tree plantations on surface water drew extensive comment during interviews for this study.

High rainfall, good land capability and the popularity of managed investment schemes has resulted in a significant increase in private tree plantations in the Lefroy Brook Catchment. Many of those interviewed commented that the purchasing or leasing of farmland for tree

plantations is increasing in the catchment. With the uncertainty associated with the agriculture sector, tree plantations have become an attractive option for farmers looking to either move out of traditional agriculture or wanting to diversify. Most of the private tree plantations in the catchment are Tasmanian blue gums used to produce wood chips. Individual areas established as plantations range from less than five hectares to 600 hectares, with most greater than 40 hectares.

Water Interception

Tree plantations rely largely on the interception of rainfall for water. From a water management perspective, the primary concern is the impact the additional interception of water by new tree plantations could have on surface water runoff and stream flow. Some expressed fears that additional private tree plantations would result in neighbours not being able to fill their farm dams.

Many stakeholders indicated the interception by tree plantations should be taken into account by the Department of Water when making resource management decisions including water allocations. Some suggested the Department of Water run models regarding various scenarios including the proportion of tree crops covering a catchment to determine possible future cumulative impacts on water quantity. Some went further, making a case for licensing interception as a water use and/or requiring land use approvals. Many of those supportive of licensing interception by tree plantations pointed to examples from other jurisdictions, especially South Africa.

Regulation of Water Interception in South Africa

- In South Africa, all users of water are required to be registered. This includes commercial tree plantations, any diversion of a river or stream, or any storage of water from any source in excess of 10,000 m³ or where the stored water surface exceeds one hectare.
- The use of land for commercial afforestation is a declared streamflow reduction activity under the National Water Act 1998 (Act No. 36 of 1998).
- Any activity may be declared a streamflow reduction activity by the Minister, including ‘cultivation of any particular crop or other vegetation’ (Act No. 36 of 1998).

Currently, the Department of Water is not required to licence water use from tree crops or native vegetation where water is captured from overland flow. Water taken directly from on-stream dams or watercourses and then used for commercial purposes does require a licence in proclaimed areas.

The tree plantation industry wants to be treated equitably as a water user. The observation was made that tree plantations are not the only interceptors of water. If water interception is to be regulated, the plantation industry wants the rules to be equitable and not target one industry. A representative of a tree plantation company noted that the interception issue is a relatively new issue for them but one the industry is taking seriously and working on at both the science and policy levels.

National Water Initiative

A few individuals mentioned the National Water Initiative (NWI) in relation to water interception. Through the NWI, the Federal and State Governments are working together

to set a common path for water resource management in Australia. Western Australia joined the National Water Initiative (NWI) in April 2006.

The NWI states that ‘a number of land use change activities have potential to intercept significant volumes of surface and/or ground water now and in the future’ (Paragraph 55). It lists as ‘examples of such activities that are of concern’: (i) farm dams and bores; (ii) intercepting and storing of overland flows; and (iii) large-scale plantation forestry.

Further,

if these activities are not subject to some form of planning and regulation, they present a risk to the future integrity of water access entitlements and the achievement of environmental objectives for water systems. The intention is therefore to assess the significance of such activities on catchments and aquifers, based on an understanding of the total water cycle, the economic and environmental costs and benefits of the activities of concern, and to apply appropriate planning, management and/or regulatory measures where necessary to protect the integrity of the water access entitlements system and the achievement of environmental objectives (Paragraph 56).

The National Water Initiative and Water Interception

http://www.nwc.gov.au/NWI/docs/iga_national_water_initiative.pdf

Paragraph 57

i) in water systems that are **fully allocated, over allocated, or approaching full allocation**:

a) interception activities that are assessed as being significant should be recorded (for example, through a licensing system);

b) any proposals for additional interception activities above an agreed threshold size, will require a *water access entitlement*:

- the threshold size will be determined for the entire water system covered by a *water plan*, having regard to regional circumstances and taking account of both the positive and negative impacts of water interception on regional (including cross-border) natural resource management outcomes (for example, the control of rising water tables by plantations); and
- the threshold may not apply to activities for restricted purposes, such as contaminated water from intensive livestock operations;

c) a robust compliance monitoring regime will be implemented; and

ii) in water systems that are **not yet fully allocated, or approaching full allocation**:

a) significant interception activities should be identified and estimates made of the amount of water likely to be intercepted by those activities over the life of the relevant water plan;

b) an appropriate threshold level will be calculated of water interception by the significant interception activities that is allowable without a *water access entitlement* across the entire water system covered by the plan:

- this threshold level should be determined as per paragraph 57(i)b) above; and

c) progress of the catchment or aquifer towards either full allocation or the threshold level of interception should be regularly monitored and publicly reported:

- once the threshold level of interception is reached, or the system is approaching full allocation, all additional proposals for significant interception activities will require a *water access entitlement* unless for activities for restricted purposes, such as contaminated water from intensive livestock operations.

The NWI does not prescribe how the management objectives with respect to water interception are to be met. As part of the State's water reform process, several approaches for including water interception in water management are under consideration.

Need for Science

Many stakeholders questioned if there is sufficient scientific understanding of the relationship between water interception by tree plantations and its effect on ground and surface water resources. Gaining this knowledge is viewed as a critical first step to managing water interception. There are concerns that scientific findings from other jurisdictions might not apply to the South West or more specifically the Lefroy Brook Catchment. There is considerable support for developing a scientific understanding based on local conditions and tree species. Along similar lines, some interviewees indicated that blue gums have a higher water uptake than native forest. Others wondered what affect a change in the species of tree in plantations would have on interception. Some would like to know how the interception rates of tree plantations compare to those of other land uses such as native forest, pasture or horticulture. Some questioned whether tree plantations intercept different amounts of water depending upon where they were in their life cycle.

Land Use Planning

While some view the impact of tree plantations as a water resource issue, others perceive it as a land use planning issue, and some as both. From a land use perspective, there were some calls for local government to use land use approval processes to limit or exclude new tree plantations from agricultural areas especially those designated as Priority Agriculture.

Some of the landowners indicated they felt conflicted about the use of land controls on tree plantations. While they want some controls placed on the location of new tree plantations, they did not want to see other farmers lose the option of establishing plantations on their land. They noted that if a farmer gets into financial trouble, tree plantations are a way to retain land holdings while still supplementing a farm income. They noted having a portion of one's land as plantation trees is quite common, especially on land no longer in agricultural production.

If there is one issue on which there is agreement it is the need for a consistent and clear approach to private tree plantations across local and State Government. If there are to be specific water management or land use rules for tree plantations then the industry and others wants them to be well defined. From the plantation sector's perspective, this is important in terms of both business planning and their being able to demonstrate their compliance to the community.

During interviews, some individuals, including the plantation industry representatives, described tree plantations as a 'crop'. Others were adamant that tree plantations are not a form of agriculture and thus not a 'crop'. Although the Shire considers trees a 'crop', for the purposes of the local planning system, all agroforestry and tree plantation proposals require a formal application for Council planning approval (Shire of Manjimup, 2005). No planning application is required for other types of annual or perennial crops.

The Shire of Manjimup released its *Draft Agroforestry and Tree Plantation Local Planning Policy* for public comment in July 2005. To encourage informed debate on the draft policy, the Shire prepared the *Shire of Manjimup Agroforestry and Tree Plantation*

Issues Paper (2005). Local Planning Policy 6.1.40 - Agroforestry and Tree Plantations was adopted by the Shire Council in December 2005.

The Shire's Agroforestry and Tree Plantations policy distinguishes 'agroforestry' from 'tree plantations'. To be considered agroforestry, trees must be in blocks of no more than one hectare, the tree crop cannot cover more than 10% of the total cleared area of the property; and there must be commitment to other forms of commercial agriculture.

Agroforestry and tree plantations are allowed only on land zoned as 'Rural'. Within the 'Rural' zone, some areas are designated 'General Agriculture' while the prime agricultural land is designated 'Priority Agriculture'. Provided the applicant suitably addresses a number of relevant issues (e.g. road impacts, fire management, water quantity, visual impact), the Council will 'actively support agroforestry', 'support tree plantations within areas designated as General Agriculture' and 'consider on its merits' plantation applications within areas designated Priority Agriculture (Shire of Manjimup 2005). Agroforestry or tree plantation applications for areas designated as Priority Agriculture require an impact statement. This is to evaluate the anticipated effects of the proposed tree crop on downstream water quantity of the property immediately downstream of the application site.

The Shire of Manjimup noted that there are many uncertainties associated with tree plantations that make it a challenge for land use planners. For instance, it is difficult to determine the future take-up rate of new tree plantations due to factors such as potential changes in Federal Government tax treatment and market conditions in the agriculture sector. The Council does however expect on-going growth in the number of tree plantations locally at least in the foreseeable future.

Shire representatives expressed concern that measures put in place by local governments might be overturned at the State level. The Administrative Tribunal Act provides applicants the opportunity to appeal to the State Administrative Tribunal against planning decisions made by local government. The Shire would like the State Government to give more guidance to local governments on this issue so they can have a greater level of certainty in their land use policies and plans.

In April 1999, the Western Australian Planning Commission released a draft Farm Forestry Policy (Planning Bulletin No. 31) and adopted it as WAPC policy in April 2000. A revised policy (Planning Bulletin No. 56) was released in 2003. A number of interviewees commented that the Farm Forestry Policy offers little in the way of direction regarding water interception by tree plantations and the effect on surface water.

In August 2006, the Forest Industries Federation of WA released its updated *Code of Practice for Timber Plantations in WA*. The Code is a best practice manual for the establishment and management of hardwood and softwood plantations in WA. The updated Code gives greater emphasis to the issue of water use by tree plantations, including a requirement that trees not be planted across watercourses.

Multiple Issues and Stereotypes

The issue of water interception is just one part of a larger suite of concerns some hold about tree plantations. Non-water related concerns raised during interviews included:

- The 'loss' of good quality agricultural land to tree plantations.

- Replacing agricultural land with tree plantations would result in population decline and the loss of the ‘flow-on’ effects in the local economy generated by traditional farming.
- Impacts of harvest haulage on local traffic and road infrastructure
- Visual impacts of plantations in the landscape, particularly along ‘tourist roads’
- Impacts of aerial spraying
- Fire control

In the Lefroy Brook catchment, tree plantations are grown for commercial gain rather than for environmental management purposes. Some interviewees commented that the tree plantation industry promotes itself as environmentally friendly by pointing to the positive role tree plantations can play in improving water quality and reducing salinity in areas such as the Collie catchment or the Wheatbelt. Many interviewees acknowledged these positives, but felt they did not apply to the Lefroy Catchment. Water quality is of high standard and already protected by the large amount of State Forest. Some felt the plantation industry is overplaying its environmental credentials in some cases. This is seen as contributing to the unease some have towards the industry.

A frequent comment was that people often associate certain negative perceptions with the private tree plantation industry. They are often characterized as ‘national’ or ‘international’ in scale or as ‘outsiders’ whose headquarters are in metropolitan centres. Their loyalties lie with their shareholders’ interests (i.e. profit), not in the local community and its sustainability. They have no long-term commitment to an area, have little knowledge of local conditions, and do not have the incentive to be good environmental managers. Some commented that tree plantation companies such as Great Southern are diversifying into traditional agricultural crops such as tomatoes, avocados and grapes. This adds to concerns about erosion of the traditional agricultural community based on family farms. Collectively these perceptions form a stereotype that has not helped the plantation industry gain local acceptance.

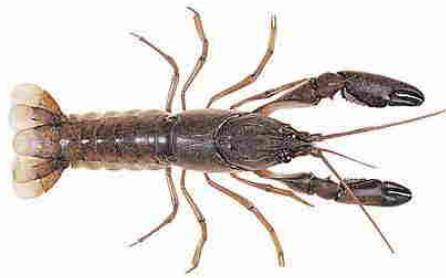
Not all of those interviewed agreed with all or some parts of this stereotype. Some indicated that farming was going through an inevitable evolution with fewer but larger farms whether corporate or family owned. In terms of the use of chemicals, some commented that tree plantations require fewer chemical than many other crops and thus poses less of an environmental risk to water quality. Others indicated that claims tree plantations would undermine local communities were either overstated or in some cases fear mongering. To support their view, several of those interviewed cited the Bureau of Rural Sciences’ report *Socioeconomic Impacts of Plantation Forestry in the Great Southern Region (WA)* (2005).

3 In-Stream Values

3.1 Ecological Values

Surface water licenses were introduced in the Lefroy Brook Catchment in 1965. This was long before the concept of ecological water requirements became an accepted part of water resource management. Many stakeholders mentioned that no specific provisions are made to ensure flow to support dependent ecosystems. Because of the significant rainfall in the catchment, many of those interviewed believe that incidental releases of water from private or public dams satisfy the water needs of downstream ecosystems.

A few stakeholders expressed a concern that if less water is available in the future, either due to increased demand or climate change, the ecology would come out second best to consumptive uses. There is however strong support for explicit consideration of ecological water requirements as part of surface water management and allocation in the Lefroy Brook Catchment. There was general agreement on the need for a better scientific understanding of the dependent ecological values. Many commented that little is known about the aquatic invertebrate and fish populations of the Lefroy Brook.



As part of the Ribbons of Blue Program, water quality testing by Pemberton Primary School and St Joseph's Primary School in 2003 recorded 18 macroinvertebrate species in one sample run in Lefroy Brook. This included Gilgie (photo), a native freshwater crayfish species common in most streams, rivers and irrigation dams in the South West. Marron, the pouched lamprey and Western Pygmy Perch are also native to the Lefroy Brook. Introduced

fish species include brown trout.

Many stakeholders were not overly concerned about the amount of streamflow in relation to ecosystem health. More concern was expressed about water quality and the obstruction to the passage of aquatic life imposed by dams. The practice of emptying dams before the summer rains was identified as a problem. Interviewees commented that flushing dams at that time of year creates flow at the wrong time of year with the flow containing high levels of nutrient, sediment and salt. The low salinity levels of the Lefroy Brook make it a good environment for marron, which are an endemic species.

A number of those interviewed, commented that dams prevented the passage of aquatic life including fish. The pouched or wide-mouthed lamprey (*Geotria australis*) is an endemic species that drew particular mention. The species has evolutionary significance because it is one of only two surviving members of the family Agnatha (i.e. jawless fish). The pouched lamprey is an anadromous species, meaning they need to migrate up rivers from the sea in order to breed in fresh water.

Ecological Flows

Many of those interviewed indicated that stream flows should be monitored. Some feel it will be difficult to define ecological water requirements when there is much uncertainty

about the impacts of climate change. However, this should not deter resource managers from proceeding based on the best available information.

Some stakeholders called for improved catchment modelling and there was support for gaining a better understanding of water use and thus the water available for the environment. One stakeholder representative commented that conditions always change, but the goal of environmental management should be to understand the reasons for the change and then make value judgments about whether the changes are desirable. Then the system needs to adapt to the rate of change desired.

Many stakeholders identified environmental flows as the 'biggest concern' facing the catchment. Flow objectives need to be set for the entire catchment and for each stream. Several of those interviewed noted the need for a consistent approach and rules. To illustrate this, an interviewee described the following scenario. Water is released from a farm dam and then flows downstream to the next farm dam where it is not permitted to flow further downstream. This limited the environmental benefit of the initial upstream release to the stretch of stream between the two farm dams rather than the entire stream. The interviewee commented on the need for a consistent set of rules and that landowners with on-stream farm dams will have to work in unison to ensure stream flows.

Some of those with on-stream farm dams believe that retaining 'unused' water in their reservoirs is more environmentally friendly than releasing it downstream, especially if downstream users did not follow suit. One dam owner asked what was the point if an individual 'did the right thing' and released water from their dams, if there is no guarantee the flow will go beyond the next downstream irrigation dam.

Setting Environmental Objectives

Many viewed the setting of environmental management objectives as important but challenging. There were comments to the effect of needing to set the 'right balance' between consumptive and non-consumptive uses including sustaining ecological values. It was generally accepted that the system is not pristine and attempting to mimic pre-settlement conditions would be unreasonable. A frequent observation was that land uses near the Lefroy Brook system have altered the system including flows. Several horticulturalists noted that land clearing for agriculture allowed greater streamflow than if the area remained forested.

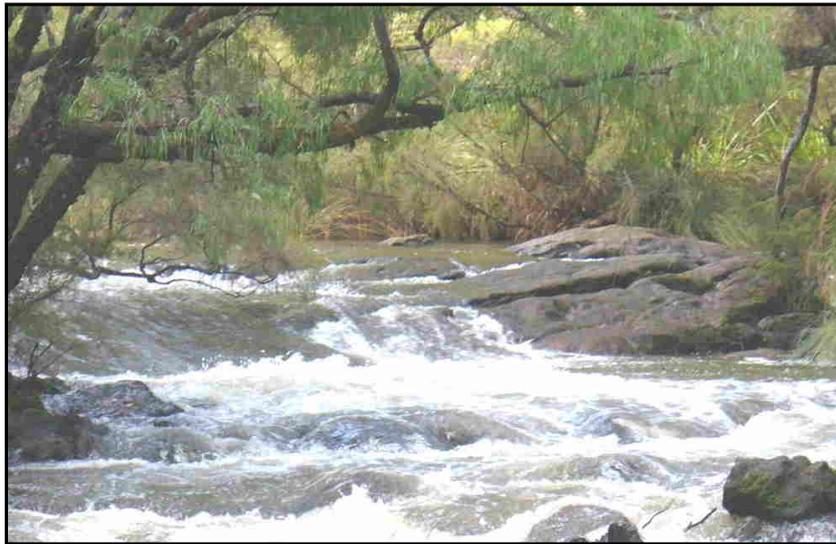
Several approaches to setting ecological flows were identified during the interviews. One approach would use current stream flows as an absolute minimum flow condition in the future. Others argued that if the ecological values in an area are rated as low, then some cut backs or minor downward adjustments to stream flow would be acceptable in a scenario where overall water availability declined.

Another approach supported the current policy of releasing any flows in excess of the licensed allocation for on-stream dams. It was noted that unfortunately the policy is not currently reflected in the behaviour of all on-stream dam owners. It was pointed out that 'just because the water is there [in the pond], doesn't mean it needs to be used'.

In addition to acquiring a better scientific understanding of the ecological values dependent on the surface water resources, it was suggested that the community determine

what it values. Environmental management objectives could then be set to reflect those areas or aspects of the natural environment the community values most.

There was also the suggestion that environmental management efforts be concentrated where they can have the most impact. The parts of the stream environment that are the least degraded or with the highest in-stream social values would be the starting points for management efforts. One stakeholder commented that attempting to restore the ecological values of degraded catchments is a 'waste of time'. Environmental management efforts, at least initially, should focus on those parts of the stream system not substantially degraded. In the longer term, further consideration of environmental flow requirements could be given to other parts of the system.



There was considerable support for erring on the side of caution in setting ecological water requirements. Concerns were expressed about initially setting the environmental flows low and relying on adaptive management to adjust the flows as needed. Some were not confident that adaptive management approaches would identify and respond to changes in a timely fashion.

Riparian Zone Management

Riparian zone management was identified as a component of ecological management. A riparian zone is the area of land immediately adjacent to a body of water (such as a river, creek, lake or pond) that influences or is influenced by the water body. Riparian zones influence both stream ecology and water quality. Riparian zone functions identified by various stakeholders are: providing habitat to both aquatic and terrestrial animals, protecting the stream banks and channel from erosion, filtering runoff from the catchment and removing pollutants, providing recreational and aesthetic values.

Stakeholders defined the actual riparian zone in several ways. For some, the riparian zone only applies to land adjacent to the primary stream course or a major tributary. For others, the concept of a riparian zone applied to all water courses regardless of size. This would include areas below in-stream farm dams even if on very small streams.

Which parties should be responsible for riparian zone management was an issue. Some envisaged community organizations such as the Manjimup Weed Action Group, Landcare, or the Upper Lefroy Catchment Group playing a significant role. There were also

questions regarding from where the funding would come. Other parties identified included DEC, the Shire, private landowners and companies with easements across streams (e.g. Western Power or Telstra).

Problems with weed species including blackberry and wattle were frequently mentioned. There was some criticism of CALM's approach to weed management which one interviewee describing as a 'kill 'em all' approach to spraying weeds.

The quality of riparian zone management by farmers was most often described as 'variable'. Some were deemed effective in their practices but there are still too many cases of either unfenced areas allowing stock to enter the watercourse or the planting of crops right to the water's edge, thereby contributing to erosion. The 20-metre buffer for riparian areas recommended by the Shire is not always implemented. One stakeholder suggested riparian zone management be a condition on water licences.

Some farmers linked riparian zone management to their concerns about remnant vegetation. They feel that the regulations regarding remnant vegetation are too strict in such a highly forested catchment. In their view, remnant vegetation on a farm property is a nuisance or wasted space that could otherwise be productive.

3.2 Recreation, Tourism and Heritage Values

The importance of a healthy river system in maintaining heritage, recreation and tourism values was raised in numerous interviews. With the regional adjustment in the timber sector, tourism has come to play an increasingly important role in the local economy. This includes eco-tours at Big Brook Dam, trout and marron farms, and restaurants and wineries offering local produce.

Bushwalking trails pass through karri forest and along the Lefroy Brook. The 7 km Gloucester-Cascades bushwalk is located in Gloucester National Park and winds along the Lefroy Brook. At the end of the walk are the Cascades, where the Lefroy Brook flows over a series of small rocky shelves. The rocky rapids, are a popular place for a picnic or fly fishing. The privately owned Pemberton Tramway Company operates a tourist railway that passes several times over the Lefroy Brook near the Cascades.



The Rainbow Trail Bushwalk commences near the trout hatchery in Pemberton and follows the Bibbulmun Walking Track to Big Brook Dam. The self-drive Karri Forest Explorer Drive includes Big Brook Dam located in CALM-managed Big Brook Forest. The main feature of this tourist destination is Big Brook Dam. The Water Corporation operated dam was built in 1986 to increase the water supply to Pemberton and the local trout hatchery.



The reservoir and surrounding DEC-managed park is an excellent spot for swimming, fishing, picnics, canoeing, and mountain bike riding. BBQs, change rooms, a 3.4 kilometre walk trail and information boards are provided. Big Brook Dam is a popular spot to catch marron. It is a snare-only area and the marroning season is in January/February. Nearby there is an arboretum with trees from around the world.

The Department of Fisheries operates the trout hatchery in Pemberton. It is located just below the Lefroy Brook Weir and relies on the Brook for its water supply. The hatchery supplies trout to stock rivers in the South West. The Lefroy Brook has a strong reputation for trout fly-fishing.

The Shire of Manjimup’s Municipal Inventory of Heritage Places includes a number of features associated with surface water resources in the Lefroy Brook Catchment (Table 8). Places can only be included on a municipal heritage inventory on the basis of cultural significance which includes aesthetic, historic, social and scientific value. Those in the highest significance category (i.e. A) are to be recognized in the Town Planning Scheme.

Table 8 Municipal Heritage Features

Name of Place	Management Category
Fonty’s Pool	A
Pemberton Swimming Pool	B
Trout Ponds (Pump Hill Rd)	C
The Cascades	NH (Natural heritage)
Arboretum – Big Brook	NH (Natural heritage)

The Pemberton Pool is the old town dam in Pemberton. Located nearby is the Pemberton Camp School, part of the Department of Education and Training Network of Camp Schools.

Fonty's Pool

Location: Seven Day Road, Manjimup

Designer/Builder: Archimede Fontanini, 1925

Registration: National Trust classified, Register of the National Estate, Municipal Inventory

Fonty's Pool is a local landmark built by Italian immigrant Archimede Fontanini, a timber worker and later farmer. The pool started off as a dam across the stream built using a log and earth in the early 1900s. It was popular with locals who brought their children to swim. When Mr Fontanini decided it was time to drain the dam, Manjimup locals formed a committee to convince him to keep the dam and charge an entrance fee. He cemented the dam and Fonty's Pool and gardens was born, and Manjimup had a swimming pool to enjoy. The pool holds 18 million litres of water and covers nearly an acre.

Source: http://www.heritage.wa.gov.au/n_yobe.html



Some, particularly those involved in recreation and tourism, believe that water-based recreation and tourism are secondary priorities in decisions regarding water allocation. If stream flow was to decline, they fear that non-consumptive uses would be the losers. While some consumptive users were sympathetic to this position, others believed that in times of shortage, consumptive uses must be given priority.

The future of Big Brook Dam as a recreation and tourism venue was raised as a concern. A few questioned whether in the longer term there would be sufficient water levels in the reservoir for activities such as swimming and canoeing. There were also concerns about how best to balance recreation and drinking water source protection. If a decision was

made in the future to remove recreation from Big Brook Dam, in order to reduce the risk of contamination to this source of drinking water, recreation and tourism sector stakeholders noted this would be a significant loss of a resource.

The lower Warren River was identified as a key recreation area (e.g. trout fishing¹ canoeing) in the South West. Fresh flows from the Lefroy Brook Catchment help offset the more saline flows to the Warren River from higher in the Warren Catchment. Recreation and tourism stakeholders want the recreation value of the fresh flows to the Warren River to be considered when allocation and resource management decisions are made for the Lefroy Brook Catchment.

¹A stakeholder commented that while introduced fish species (e.g. Red Fin Perch) provide recreation value they pose a threat to aquatic biodiversity.

4 Water Quality

4.1 Protecting Drinking Water

Source Protection Plans

The recently released *Draft State Water Plan* encourages the preparation of Drinking Water Source Protection Plans (DWSPP) for all public drinking water sources (2006). DWSPPs are a key component of the 'catchment-to-consumer' protection strategy for Western Australia's drinking water supplies. It identifies existing and potential threats to a drinking water source and provides risk management strategies and programs for the ongoing management and protection of that source. This process can result in some land use/activity restrictions in order to achieve a safe, good quality drinking water supply.

An assessment is the first stage in the production of a Drinking Water Source Protection Plan for a catchment. Table 9 describes the five stages in the development of a DWSPP.

Table 9 Stages in development of a DWSPP (WC 2004b)

Stage	Description
1 Prepare Drinking Water Source Protection Assessment	Assessment document prepared following catchment survey and preliminary information gathering from State and Local Government Agency stakeholders.
2 Conduct stakeholder consultation	Advice sought from key stakeholders using the Assessment as a tool for background information and discussion.
3 Prepare Draft DWSPP	Draft DWSPP developed taking into account inputs from stakeholders and any additional advice received.
4 Release Draft DWSPP for public comment	Draft DWSPP released for a six week public consultation period.
5 Publish DWSPP	Final DWSPP published after considering advice received in submissions on the Draft. Includes recommendations on how to protect the drinking water catchment.

The DoW is responsible for the protection of water sources used for public drinking supply. As the licensed water service provider, the Water Corporation was requested to conduct initial assessments of the risks to water quality in the Manjimup Dam, Phillips Creek, and Lefroy Brook Catchment including the Big Brook Dam sub-catchment (WC 2004a,b).

Manjimup Dam and Phillips Creek Dam

Manjimup Dam Catchment Area and the Phillips Creek Catchment Area were proclaimed in 1968 and 1959 respectively. Catchment Areas are declared to protect public drinking water sources from potential contamination.

Almost all of the 798 ha Manjimup Dam catchment area is State forest (98%). The remaining 2% is unallocated Crown Land. Phillips Creek Dam catchment is covered by two reserves representing about 85% of the 178 ha catchment. The remaining land consists of cleared farmland (9%), other crown land (5%) and timber reserve (1%).

The Water Corporation, in accordance with Australian Drinking Water Guidelines (ADWG), monitors water quality at both sites. Aspects of water quality monitored includes microbiological contamination, health related chemicals and aesthetic chemicals and parameters (WC 2004a).

The raw water from Manjimup Dam and Phillips Creek Dam is disinfected using chlorine gas injection and fluoridated with fluorosilic acid at treatment plants located at the two dam sites. Water from the Manjimup Dam is corrected for pH using caustic soda. Water from Phillips Creek Dam is additionally treated with ultra violet (UV) light technology (WC 2004a).

There are no formal recreation areas within these catchments. Public access and recreation is not encouraged. The Water Corporation's initial assessment of risks to water quality identified swimming, fishing and marroning in the reservoir as the greatest risks to drinking water quality within the Manjimup Dam catchment. The greatest risks to drinking water quality within the Phillips Creek Dam catchment are swimming, fishing and marroning in the reservoir, picnicking and camping, off-road vehicle use and rubbish dumping (WC 2004a). Fishing and marroning are prohibited activities in both reservoirs. The number of people engaging in these prohibited activities is believed to be low.

Lefroy Brook Weir and Big Brook Dam

Raw water samples for the Lefroy Brook Weir and Big Brook Dam reservoirs typically exceed ADWG for colour, turbidity, and iron. High thermotolerant coliform levels are frequent and indicate contamination with faecal matter (WC 2004b). To protect public health, the raw water is treated and disinfected prior to supply as drinking water. The drinking water complies with ADWG microbiological, health and aesthetic requirements.



Despite clear signage prohibiting recreation on or around the Lefroy Brook Weir (photo), some swimming does occur in summer. Fishing and marroning in the Lefroy Brook Weir reservoir and feeder streams occur throughout the year (WC 2004b). The Bibbulmun track passes next to the Weir. The Karri Oak BBQ area is 2 km upstream on the stream bank.

The Big Brook Dam situation is quite different from that of the Manjimup Dam, Phillips Creek Dam or Lefroy Brook Weir. In the case of Big Brook Dam, recreational activities are actively promoted through the DEC-managed Big Brook Recreational Area. Recreational activities include swimming, canoeing, fishing and marroning, picnicking camping, and bushwalking.

Among the activities of greatest concern are those that result in direct human or animal contact with water. These threaten water quality through the potential for Cryptosporidium contamination. This includes activities such as swimming, fishing and canoeing.

However, swimming is an approved use in the recreation area with a beach and other facilities provided at Big Brook Dam reservoir. Approximately 100 people per day swim on summer weekends. Informal non-motorised boating (e.g. canoeing) is an approved activity at Big Brook Dam with medium to high activity levels during summer (WC 2004b).



Fishing for Red Fin Perch occurs year round, while trout and marron fishing is restricted to seasons (typically 8-9 months and 2-5 weeks per year respectively). Trout fishing averages 5 people per day and marroning typically more than 10 people per night, during the season. Four fishing platforms are provided at Big Brook Dam (WC 2004b).

There are many tracks and trails in the State forest which are used for firewood collection, bushwalking, horse riding and off-road vehicle use (WC 2004b).

The Water Corporation's initial assessment of risks to water quality identified land uses and activities considered likely to contaminate the water source with pathogens as a 'high' risk management priority. This includes:

- Recreational activities in and around Lefroy Brook Weir and Big Brook Dam, including:
 - Swimming and boating
 - Fishing and marroning
 - Bushwalking and cycling
 - Picnicking and camping
- Stock grazing in the catchment

The Rainbow Trail runs next to Lefroy Brook and the Big Brook reservoir is a current source of turbidity. There is the potential for direct contamination of the water source from fuel or chemical spills (WC 2004b).

There are five stages in development of a Drinking Water Source Protection Plan (Table 9). To date only the first stage, the initial risk assessment, has been completed. The timeline for subsequent stages is unclear.

Some stakeholders, especially those associated with recreational activities such as angling, expressed a fear that permission for recreational activities on and around Big Brook Dam might be withdrawn or severe restrictions put in place if a DWSPP is implemented. They noted that several Water Corporation reservoirs in the South West (e.g. Logue Brook, Stirling Dam), that had offered recreation opportunities in the past, are now closed to certain recreational activities (e.g. swimming, fishing and marroning) to protect drinking water quality. Several interviewees indicated that the Water Corporation could expect a fight if they were to consider removing existing recreational activities from Big Brook Dam. There was also an interviewee (not a State agency), who indicated they would support removing recreation from Big Brook Dam because of the importance of protecting drinking water quality.



4.2 Nutrients and Chemicals

There were some concerns about the use of fertilizers in farming and tree plantation operations increasing the nutrient load in the Lefroy Brook. Best management practices were suggested as a means of reducing the amount of fertilizer used, thereby, saving farmers money and improving water quality.

A few individuals expressed concerns about aerial spraying of herbicides, pesticides and fungicides. Again best management practices were recommended to minimize the amount of chemical used and to avoid spray drift onto sensitive uses such as marron ponds.

One interviewee credited the reuse of treated wastewater on Pemberton's sporting oval for eliminating algal blooms. In April 2004, the Water Corporation and the Shire of Manjimup signed a five-year agreement to recycle treated wastewater for use on the Pemberton recreation centre's football and soccer ovals². The recycling project is intended to reduce the demand on irrigation supplies from Lefroy Brook and minimise the use of fertiliser on grassed areas at the recreation centre. Pemberton's wastewater goes to a wastewater treatment plant two km south of the town centre.

² An interviewee commented that the sports oval irrigation concept was born from a deep sewerage pond system that was too small and leaking.

4.3 Suspended Sediment

A few stakeholders reported increased levels of suspended sediment in the Lefroy Brook between when crops are harvested and fields reseeded. Riparian zone management and contour planting were suggested as means to reduce erosion.

The practice of flushing farm dams before the winter rains was criticised for degrading water quality. When the stagnant water from the bottom of the dam is flushed, it takes with it the sediment, salt and any contaminants collected in the dam.

4.4 Biologically Available Oxygen

The trout hatchery monitors the Lefroy Brook for oxygen. Riverine fauna and aquaculture (e.g. marron, trout) require flowing water with biologically available oxygen. Irrigation dams prevent water from flowing and reduces the available oxygen. It was recommended that environmental flows between dams be sufficient to keep the water aerated.

4.5 Heavy Metals and Timber Operations

Several stakeholders identified possible heavy metal contamination as a health concern. The attributed source is past and present timber mill operations. The Deanmill Timber Mill (26 km upstream of Lefroy Brook Weir) and the Pemberton Mill were mentioned as locations of concern with respect to arsenic contamination. The State Government was criticised for not doing enough to manage the arsenic risk and not monitoring the water appropriately. These stakeholders believe the State has underestimated the hazard posed by these sites.

In July 2004, sampling at the Deanmill site indicated that arsenic levels were at or below the threshold for drinking water quality and did not pose a health threat. Currently, there is an agreement between WesFarmers and the State Government regarding the Pemberton Mill site cleanup. The State has accepted responsibility for arsenic contamination that occurred when the State owned the operation. WesFarmers has accepted responsibility for the cleanup of PCP contamination that occurred during its timber treatment on the site from 1971-1987.

In a July 2006 media statement, the Department of Environment and Conservation (DEC) announced that the Thompson's Paddock site of the Pemberton Mill 'does not pose a risk to human health or the environment.' Testing of nearby Henley Brook, a tributary of the Lefroy Brook, did not show any traces of arsenic. The site will remain undisturbed to prevent contaminated soil getting into the Brook. WesFarmers will remediate the Thompson's Paddock Waste Ponds. After successful remediation, the State plans to buy the Pond site.

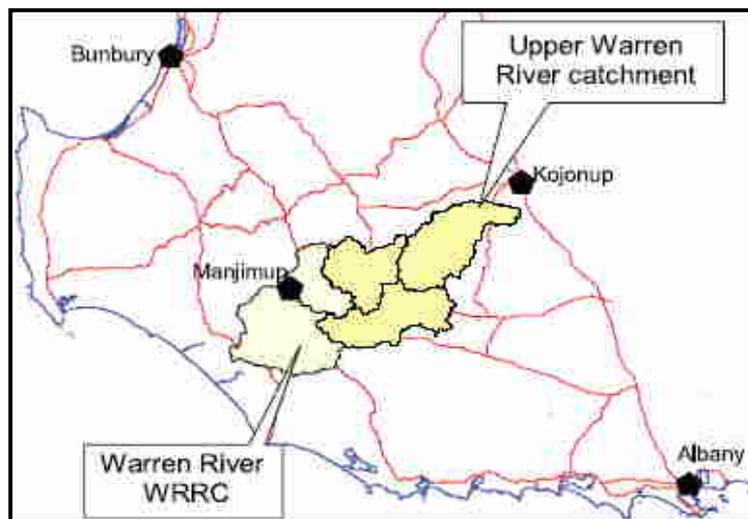
4.6 Salinity

The Lefroy Brook itself is 'fresh' with salt levels less than the drinking water standard of 500 mg/L TDS. Many of those interviewed commented on the high water quality in the catchment especially with respect to salinity. This was often attributed to the amount of forest and limited clearing in the catchment.

The freshness of the Lefroy Brook was contrasted with other parts of the Warren River catchment where salinity levels in the surface water are well in excess of the drinking water standard. Several consumptive users mentioned that they saw themselves as fortunate in terms of water quality but there was a need to remain vigilant to ensure this quality is maintained in the longer term.

Warren River Catchment

The Warren River catchment was designated a 'Recovery Catchment' under the State Government's Salinity Strategy in 2000. The 4000 km² catchment is one of the largest water resources in the south-west. However, salinity levels in the Warren River are well above the 500 mg/L TDS drinking water standard. In the period 1990-2001, the average annual salinity was 895 mg/L TDS. The State Salinity Action Plan set a water quality target of potable water (500 mg/L TDS) for the Warren River by 2030.



Extensive clearing of native vegetation in the upper sections of the catchment during the 1950s and 1960s led to increases in stream salinity in the 1970s. An estimated 60 per cent of the salt load comes from the Perup River and Tone River sub-catchments. In response the State Government introduced clearing control legislation in 1978 and tree planting commenced during the 1990s in the Tone and Perup River sub-catchments.

In 1997, the Warren Recovery Team was formed to facilitate recovery of the water quality. The Recovery Team is a partnership between the community of the Tone River and Perup River subcatchments and key government agencies.

5 Resource Management Issues

5.1 Fresh Flows to the Warren River

The Lefroy Brook contributes fresh water to the Warren River. Many stakeholders noted that the fresh flows from the Lefroy Brook are important in diluting the saline water from higher in the Warren River Catchment.

Two distinct views emerge regarding what obligation, if any, the Lefroy Brook water users have to helping address the salinity problems of the Warren River. The dominant view is that water users in the Lefroy Brook Catchment have some duty of care to the Warren River. Most did not see this as a sacrifice as good resource management in the Lefroy Brook Catchment would result in sustainable fresh flows for the local catchment as well as the Warren River.

A few interviewees indicated that as there is not a salinity problem in the Lefroy Catchment concerns about salinity are irrelevant. In their view, the salinity problems of the Warren River system should be solely the concern of those water users in the sub-catchments contributing high salinity levels to the Warren River. To do otherwise would be a 'subsidization of unsustainable practices in the higher Warren Catchment'.

5.2 On-Stream Farm Dams

The following issues were raised in relation to the licensing of private on-stream dams:

- A few individuals in the community refuse to licence their on-stream farm dams.
- The perception that once a license is issued, it is not reviewed and thus operates under a 'first in, best dressed' ethos. Overtime, the licensed allocation and actual use differ.
- All licence applicants should be required to follow the same approval process.
- It was suggested that once a private dam and reservoir has been constructed, the licensed allocation should be for the life of the dam. This would ensure the landowner is able to get a return on the large capital expenditure attached to dam infrastructure.
- Licensed allocations for self-suppliers often reflect the storage capacity of a reservoir. However, actual use may be greater than the licensed amount as a result of owners refilling their dams on the shoulder seasons or holding back water by not opening the by-pass valves.
- In some years, farmers do not use all the water in their reservoirs. Other years, they may use more water than the storage capacity of their dam by allowing it to 'top up'. Many dam owners view such a practice as an insurance policy against future shortages and just good business sense.
- Some interviewees were disdainful of hobby farmers and others who 'make poor use of water' by having a 'duck pond to look at' rather using the water for 'production'. They believe that in allocating water, the DoW should view aesthetic water on private properties as lower priority or value water use.

5.3 State Water Reforms

At the time of the interviews for this study, the State Government appointed Water Reform Implementation Committee³ had just released its *Draft Blueprint for Water reform in Western Australia* (July 2006).

Some non-government stakeholders commented that many in the catchment had been ‘bowled over’ by the proposed water reforms. Even those familiar with water resource management issues (e.g. Warren Advisory Committee) were struggling to absorb all the new information and potential implications. There were predictions that water users would struggle with some of the new concepts. Some commented that some in the community do not understand how water management currently functions, ‘so the changes are likely to be even more of a mystery’.

Some self-suppliers in particular were apprehensive about some aspects of the proposed water reforms. They are generally satisfied with the current water management arrangements in the Lefroy Brook Catchment. In their view, if the system is working well, you do not change it as it might not be an improvement and could be a step backward.

During the interviews, certain of the proposed water reforms received more comment than other reforms. Water metering, water charges, and water trading were the most often discussed.

Water Metering

You ‘can’t manage unless you meter’ was a frequent comment. Measuring water use was viewed as an important component of the water allocation process. Some contended that accounting for water use should extend beyond on-stream dams to all use of surface water in the catchment. Some dam owners were concerned about the funding of metering equipment. It would be too expensive for farmers unless they could pass the cost on somehow.

Creating a sound database of water use was seen as the primary value of water metering. But many were suspicious that metering was the tip of the iceberg. They suspected a more far-reaching Government agenda involving volumetric charges for their use of water. Most self-suppliers were strongly against such a concept. They felt it would prevent them from being competitive in the market place. As a business, they would need to pass along the water costs to their customers. They noted that they had borne the cost of constructing and operating the water supply infrastructure on their properties and thus should not be charged for its use. Some were concerned that water charges would be inequitable by favouring Perth or urban residents over rural water users. Some landowners indicated they would be prepared to pay a licensing fee for their dams but wanted assurance the funds would provide some resource management benefit.

Some felt that independent reading of water meters should occur (e.g. an NRM group) but others indicated that the dam owners could undertake that task and avoid the additional expense to the State Government.

³ The Water Reform Implementation Committee held a Water Reform Workshop in Manjimup to invite community feedback on the draft water reforms.

Water Trading

A limited amount of informal water trading occurs in the catchment between neighbours. It is part of being 'neighbourly'. One individual commented, 'The worst thing that can happen is for two neighbours to start fighting [over water] because it gives the DoW a reason to get involved.'

Many were aware of the concept of water trading but saw limited potential in the Lefroy Brook Catchment. Two main reasons were given. The first is that water is not in short supply, other than at the Water Corporation's Manjimup and Phillips Creek dams. Thus, there would be little demand to stimulate trading. The second was the lack of a centralised irrigation distribution system. This raised questions regarding how water would be moved to where it would be needed. A few envisioned a web of poly piping transferring traded water across properties.

While most were not opposed to the concept of water trading, a number of issues and concerns were raised. A few stakeholders opposed 'making water a commodity' through water trading. By giving the water formal monetary value, it will reinforce the concept of people 'owning' rather than having the right to use water.

Farmers highlighted the need for clear rules for water trading, so that informed decisions can be made. Many asked questions regarding how a water market would be established and if this would involve recouping 'unused water'. There was also concern about who would supervise the trades. One suggestion was a water board or water bank to oversee trades.

Water Use Efficiency

Although few stakeholders discussed water use efficiency in-depth, the following comments were made during the interviews:

- Some identified water use efficiency initiatives such as the State Government sponsored WaterWise on the Farm program as a positive step.
- The use of treated wastewater on the Pemberton sports oval was given as an example of efficient use of water.
- Several stakeholders commented that any new residential subdivisions should adopt a smart water system. Such systems emphasise a holistic water cycle management approach including an emphasis on effective stormwater management.
- There are still too many in the community without the correct ethos towards water. 'The community needs to face the fact that water is a precious commodity in WA. Not to be wasted or used lightly even when there is an apparent abundance'.
- A stakeholder commented that what are sometimes called water restrictions (e.g. twice a week watering of lawns and gardens) should be relabelled as simply good water practice. Calling good water use practices 'restrictions' implies the consumer is 'going without'.
- Some commented that efficient water use should be a priority in all communities. There is a perception that households in metropolitan areas such as Perth are wasteful in their water use.

6 Public Engagement

6.1 Public Engagement Themes

Public engagement themes frequently raised during the scoping study included:

- The importance of consulting with the community before water resource management decisions are made. As one person put it, ‘No one wants Government coming in with the whole plan and bowling the community over’.
- The comments of some interviewees reflected a saying in the field of conflict resolution – ‘Sometimes you need to go slow to go fast’. Community members need time to consider and adapt to new information, concepts and potential changes. Go too fast and the process will be ineffective and may need repeating or result in conflict. Thus, if there is a need for change to water resource management in the catchment, this should be examined with the community in a step-by-step manner following a clear process with clear expectations. The recent State Government water reform process was cited as an example of a process in which too many new concepts were presented too quickly and with insufficient detail for the community to determine their acceptability and potential ramifications.
- Many of those interviewed are generally satisfied with the current approach to water resource management in the catchment. Some are leery of any proposal to significantly change a system they believe is working effectively. They note that any change brings its own risks and uncertainties and thus change for change’s sake is not desirable. The gains must outweigh the risks if a change is to be adopted.
- Some stakeholders currently not represented on the Warren Water Management Area Advisory Committee, including some from outside the local area (e.g. recreational angling), want mechanisms for their participation in the water resource management process.
- The value of relationship building to water resource management was highlighted. In addition to technical proficiency, Department of Water staff members should have a strong appreciation of the local community, its dynamics and the pressures facing water users such as irrigators. One irrigator commented that simply ‘having a lot of initials after one’s name’ does not mean a water resource manager understands the decision-making context.
- Some believe the Department does not have enough visibility in the community and that landowners only see a staff member when there is a problem (i.e. contact occurs in a negative context). Some lamented that the old extension model used by State Government agencies (e.g. field days, frequent face-to-face contact) has given way to less personal approaches reliant on technology such as the internet. Some viewed the new ways as a barrier to the development of working relationships between the Department of Water and water users.
- The Warren Water Management Area Advisory Committee’s working agreement with the Department of Water sets forth a number of Department responsibilities

toward stakeholders. These include actions such as the documenting of licensing procedures and widening the Committee's membership to provide greater public opportunity for representation (DoE 2006). The stakeholder interviews revealed significant support for more transparent water allocation processes and broader stakeholder representation on the Advisory Committee.

- Many of those interviewed were unaware of the broad range of public engagement techniques that could be applied. Appendix B provides a brief overview of some of the most frequently used public engagement techniques.

6.2 Public Engagement Principles

When developing its public engagement program, the Department of Water is encouraged to keep the following public engagement principles in mind:

- All members of the community are potential stakeholders. Different sectors of the community will want varying degrees of engagement (i.e. involvement) in the water resource planning process. Some may want regular updates on the progress of the planning process or will be happy knowing that others are actively engaged. Others, including the majority of those interviewed for the issue scoping study, are seeking a higher level of involvement. They want greater hands-on involvement in the planning process; beyond the provision of information. For this reason, a strategy typically includes a variety of activities geared to different stakeholders/interests and levels or degrees of involvement in the planning process.
- A public involvement strategy must be realistic. The strategy should take into account the resources available, including monetary support, time and skilled personnel. It is critical that, whatever the final design of its public involvement strategy, the Department be in a position to deliver on its commitments. Too often, well intentioned but inadequately resourced public involvement programmes have proven costly to government agencies in terms of loss of stakeholder trust.
- The issue scoping exercise forms one component of the Department's public involvement strategy. It is important that the agency build on the momentum of this initial work with stakeholders. When a planning process involves a protracted timeline of several years, it can be a challenge to maintain stakeholder interest. The Department is encouraged to look across the various stages of its timeline and seek out meaningful opportunities for dialogue and collaboration with stakeholder interests. The DoW's tentative timeline for the surface water planning process is shown in Table 10.
- Any public involvement strategy should be periodically reviewed and modified to reflect changes in circumstances and new information. Ongoing monitoring allows adjustments to occur in a timely and effective fashion. The issue scoping report is a snapshot of a particular point in time. As additional information emerges over time, stakeholder and agency perspectives may change on some issues and new issues will likely emerge. Additional stakeholders may also make themselves known.

Table 10 Tentative⁴ DoW timeline

Activity	Year 1	Year 2	Year 3	Year 4
Stage 1 Issue scoping Survey of consumptive use Gather data on Aboriginal cultural/social values				
Stage 2 Develop hydraulic model Assess river hydrology Assess riverine ecology Develop flow model Develop digitised map of river hydrology and flow Report on social/cultural values of the Lefroy Brook				
Stage 3 Determine ecological water requirements Develop alternatives to address water resource management issues				
Stage 4 Evaluate alternative allocation scenarios (economic, social, ecological) Determine water provisions and preferred resource management measures				
Stage 5 Prepare draft water resource management plan				

⁴ A refined planning timeline will be developed by the DoW at the end of Stage 1.

6.3 Level of Public Engagement

Any public engagement process should reflect a set of objectives. What is the engagement process intended to achieve? What level(s) of engagement is desired by the agency or expected by the community?

The levels of public engagement can be conceptualised as a ladder. At the bottom of the ladder is one-way communication where the objective is for the resource agency (i.e. the DoW) to inform, persuade or educate the public. Above that is two-way communication in the form of consultation in which stakeholders provide feedback on ideas presented by the agency. Joint planning is a higher form of two-way communication. The resource agency takes the lead in defining the problem but works in a collaborative manner with the community in finding an acceptable solution. It applies a more collaborative style than consultation. Higher still is delegated authority. The resource agency identifies and presents a problem to the community, defines the limits, and asks the community to make a series of decisions resulting in a plan the resource agency will then accept. In the case of water resource management, a public engagement program may include various levels of public engagement.

Experience in the field of natural resource management has demonstrated that collaborative approaches such as joint planning can build social capital and produce agreements that are more likely to be workable and implemented (Susskind, Levy, & Thomas-Larner 2000). Such approaches recognize the need to ground decision-making in good science while at the same time being aware that technical factors are only one consideration in natural resource management. Collaborative approaches can aid in building a 'sense of shared ownership and responsibility for natural resources' by empowering those impacted by the decisions. Such approaches also 'recognize that government as a partner can provide unique resources, incentives, and opportunities important to collective efforts' (Wondolleck & Yaffee 2000).

For collaborative approaches to be effective, the following conditions must exist: mutual understanding of the interests of each party, a degree of trust, willingness to seek mutual gain solutions, and repeated interactions among the parties (Hadlock & Beckwith 2002). In the case of the Lefroy Brook Catchment, water resource managers already have a mechanism in place to facilitate joint planning – the Warren Water Management Area Advisory Committee.

6.4 Warren Water Management Area Advisory Committee

By the mid-1900s, the Warren and Donnelly River areas had developed a history of disputes over surface water due to 'landowners relying on run of the river for water supplies rather than constructing storages' (DoE 2006). In response, an Advisory Committee was established in 1963 to advise the Minister for Water Supplies (now the Minister for Water Resources) on 'matters affecting irrigation by settlers in the area' (DoE 2006).

The Committee recommended that a system for controlling water use be implemented and licensing was introduced in 1965. The Committee was the first of its kind in Western

Australia and continues to advise the Department of Water on surface water management issues. The Warren Water Management Area Advisory Committee currently operates under a working agreement with the Department of Water (DoE 2006). There are five members and a Chairperson from the Department of Water. The Department also provides an executive officer.

Over its long history, local irrigators have dominated the composition of the Committee. A valued role of the Advisory Committee is its intervention in local water disputes over irrigation. Non-committee members interviewed for this study made favourable comments about the Committee's efforts in this regard. Specific instances in which one or more Committee member had successfully intervened in a water dispute between neighbours were described.

Several individuals noted that there are times when it is more effective for a non-government Committee member (i.e. a 'neighbour') to help facilitate resolution of a local water dispute rather than bringing in the Department of Water or another State agency. However, it is important that the disputing parties understand that the regulatory agency will intervene if a solution is not negotiated. This allows creation of a good cop, bad cop dynamic and provides an incentive for the parties to find a mutually agreeable outcome.

There are also cases in which such a 'neighbour to neighbour' approach would be ineffective and the Department must take the lead in resolving a dispute. Interviewees commented that the characteristics of the dispute dictate which approach will be effective. To collaborate effectively in ensuring water use compliance, a strong working relationship between the Department and the Advisory Committee members is considered essential.

A number of Committee members noted that its level of activity has vacillated over the years. There have been times of great activity and times of inactivity. Some of the inactivity was attributed to the water resource management agency of the day not being as supportive of the Committee's efforts as it might have. However, Committee members indicated that the Advisory Committee is currently vital and has a strong working relationship with the Department of Water. Several individuals noted that the Department of Environment/Department of Water officers who have been working with the Committee over the past couple of years have helped revitalise the Committee through their efforts and positive attitude toward the Committee and its role.

In the past, the Committee has had representatives of particular interests not represented on the Committee attend some of its meetings. Looking to the future, some suggested the Committee evolve toward a Whicher Water Resource Management Committee model with a broader range of stakeholders represented as opposed to primarily irrigators.

Several commented on their desire for the Committee to become a statutory body, thereby giving it more authority and formal status. It was noted that if the Committee took on a more substantial role in local water resource management, issues of accountability and resources would need addressing.

In 2005/2006, the Committee reviewed its objectives and relationship with the Department of Water (then the Department of Environment) with the aim of improving the level of surface water management. This process produced the *Warren Water Management Area Advisory Committee Working Agreement (2006-2010)* (DoE 2006). The Agreement sets

forth the Committee's objectives, the respective roles of the Committee and the Department of Water, the Department's responsibilities to stakeholders and the Committee's five-year work plan.

The Committee's mission is 'the promotion of responsible management of surface water to the Department [of Water] and stakeholders within the Warren and Donnelly River Catchments.' The Advisory Committee's objectives are:

- To share/allocate water fairly while ensuring its long-term sustainability
- To encourage sound dam construction techniques
- To be responsive to stakeholders
- To be representative of community interests
- To consider and advise on the environmental consequences of surface water allocations (DoE 2006)

The advisory role of the Committee includes the following duties:

- Provide advice on specific license applications
- Provide advice on surface water management and allocation policies
- Assist with the development of management plans
- Comment upon the suitability of the committee membership and areas of interest to the committee and provide advice to the Department
- Liaise with licensees and interest groups to improve awareness and obtain local input
- Liaise with licensees to resolve conflicts over water use
- Assist with the preparation of information pamphlets (DoE 2006)

Having a longstanding and respected local group such as the Warren Water Management Area Advisory Committee already in place is a significant advantage to the development of a public engagement strategy to complement the DoW's surface water planning process.

Further expansion of the Committee's membership to embrace a broader range of interests (e.g. tree plantations, Indigenous community) would enhance its value. However, even if additional stakeholder interests are added to the Committee, it would be important for the public engagement strategy to include elements that extend beyond the Committee. The DoW is already working closely with the Advisory Committee in relation to water resource management in the catchment. We would encourage a joint planning approach to the design, implementation, and monitoring of the public engagement strategy for the Lefroy Brook studies. In addition to participating in the design and implementation of the engagement strategy, the Advisory Committee might also undertake tasks such as reviewing the terms of reference and methodology for specific DoW studies and the review of draft study reports.

In our experience, a frequent weakness of such Committees is insufficient attention to the flow of information from the community to the Committee and from the Committee back to the community. When these linkages are not strong, despite the best of intentions, this

can result in the community effectively being disenfranchised rather than instilling a sense of community ownership of both the problems and the solutions. The DoW and the Advisory Committee are encouraged to ensure that sufficient energy and resources are devoted to these linkages. Effort should also be invested in establishing or strengthening relationships with other stakeholders with complementary objectives (e.g. Upper Lefroy Catchment Group).

6.5 Seek Opportunities by Stage

Each stage in the surface water planning process (Table 10) has the potential to generate opportunities for engagement with stakeholders. The exact nature of the opportunities will become clearer as the DoW study progresses and the products of the various planning stages become more defined. Because of the evolving nature of the planning process and outcomes, the potential opportunities for engagement should be reviewed at each stage in the process. This will allow the best fit to be achieved between the planning stage and the public engagement activities.

In designing public engagement activities, for each stage in the surface water planning process the following questions might be asked:

- What are the objectives and major outputs of this stage of the water resource management process?
- What interests in the community are potentially directly or indirectly affected by the outcomes?
- Will the study involve local knowledge as a source of data?
- Are there contentious or potentially contentious issues associated with this stage?
- What is the level of stakeholder interest in the activities in this stage of the study?
- What is the level of community understanding of the issues addressed in this stage of the process?
- What are the public engagement objectives for this stage (e.g., education, provision of information, obtaining local knowledge, gaining feedback on options, review of a study design, etc)?
- Given the available resources, what public engagement techniques (e.g. seminars, open houses, workshops, media, website based content, etc) can most effectively and efficiently achieve these objectives?

At each stage it is important that engagement activities are focussed on key issues of importance to the participants. Too often those hosting public engagement activities attempt to do too much at one go and end up covering important issues in a superficial and unsatisfying manner for participants. During activities such as workshops, it is better to focus in greater depth on a smaller number of issues or single issue of importance.

6.6 Options for Providing Information

Providing the community with information is an important component of any public involvement programme. Information needs to be presented in a timely fashion and in a form (e.g. level of technical language, volume) that complements its intended audience.

A wide range of information mechanisms can be used to effectively present information to stakeholders and the local community. It is often desirable to use a combination of

mechanisms. Some information mechanisms could be put in place by the end of Stage 1 (Table 10) and function over the course of the 4-year water resource planning process. The following are a variety of options that might be considered by the DoW:

- A DoW webpage dedicated to the project
- Newspaper and radio articles/stories
- A periodic newsletter
- Creation of a public involvement database
- Information displays

Dedicated webpage

Increasingly community members look to websites for both general background and detailed information on topics of interest. The DoW's already has a website and this could play an important role in communicating with the public regarding the Lefroy Brook management process. A separate page(s) could be designed for the surface water management projects being undertaken in the South West including the Lefroy Brook project.

The content of the webpage might include:

- Information on the need for surface water management planning
- The steps in the planning process
- Background on each of the surface water sources highlighting key issues
- Summaries of key outcomes and progress reports
- Links to technical reports pertaining to the study
- Identification of ways the public can contribute to the study (e.g. up coming events, register for a newsletter)
- A mechanism for readers to make comment (e.g. email, comment forms, discussion threads)
- Contact information for the study, including the name of an individual to contact. It is important that this person is knowledgeable about the project and thus able to answer most questions that members of the public may ask.

An interactive website could both provide and gather information about the study. The website would require periodic updating to provide the most current information about the project. The interactive elements of the website such as discussion threads would require daily administration.

One of the key challenges in making a website effective is creating awareness of its existence. The website could be promoted through other public information sources including newspaper articles and newsletters. Related interests, such as the South West Catchments Council, might be willing to provide information about the DoW planning process and links to the project pages on their websites.

However, the DoW cannot rely on the public accessing a website for information about the Lefroy Brook project. Additional mechanisms (e.g. media) are needed to ensure the community is aware of the planning process, its outputs and the opportunities for their input.

Media

Local newspapers and radio provide inexpensive and effective means for reaching the broader community with information about the Lefroy Brook study. The DoW could provide the local media outlets with media releases and/or feature articles at various stages of the study to keep the general community informed of outcomes, key choices, and the status of the study. Specific stakeholder interests often have their own communication mechanisms to serve their particular audiences. These often provide another way of getting messages out to a broader audience within a particular sector (e.g. horticulturalists, tree plantation owners).

Newsletter

The DoW could periodically publish a project newsletter at key milestones in the project. The initial newsletter might focus on the need for the planning process and the Stage 1 outcomes (Table 10) and provide contact details and a project timeline. It could also reflect on issues raised in the issue scoping exercise.

The newsletter could play an important role in keeping the community abreast of the status of the planning process. The first edition of the newsletter could be distributed extensively to households throughout the catchment. Community members could then elect to continue receiving the newsletter by joining a mailing list. The newsletter might be published on a quarterly basis.

Public involvement database

A mailing list/database of interested parties is a valuable asset. Such a database would contain contact information for people and organisations interested in some level of involvement in the study, even if simply being kept informed. Once registered on the database, participants would receive regular updates (e.g. the newsletter) and be notified of upcoming events in which they could participate.

Opportunities to register on the database could be promoted through the website and newsletter. Information collected from those registering on the database might include:

- Name
- Email address (or mailing address)
- Affiliation
- Issues of particular interest
- Types of activities in which they would consider participating

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Appendix A – Interviewed Stakeholders

Name	Affiliation
<i>State Government</i>	
Tony Church	Department of Fisheries
Kesi Kesavan	Department of Agriculture
Peter Bealty	Forest Products Commission
Tom Busher	South West Development Commission
Peter Buckley	Water Corporation
Michelle Thorpe	Water Corporation
Steve DeMunck	Dept. of Environment/Dept. of Water, Warren Advisory Committee
Wayne Tingey	Department of Water, Warren Advisory Committee
Michael Schramm	Department of Planning and Infrastructure
John Gillard	Department of Conservation and Land Management
Roger Hearn	Department of Conservation and Land Management
<i>Local Government</i>	
Steven Thompson	Shire of Manjimup
Keith Liddelow	Shire of Manjimup, Warren Advisory Committee
<i>Non-Government</i>	
Richard Briedahl	WA Plantation Resources
Grant Johnson	WA Plantation Resources
Neil Pemberton-Ovens	Warren Catchments Council, Manjimup Land Conservation District Committee
Gary Bendotti	WA Potato Growers Association, farmer
Diane Fry	WA Fruit Growers Association, Warren Advisory Committee, farmer
Frank Prokop	RecFishWest
Kane Moyle	RecFishWest
Lee Fontanini	Upper Lefroy Catchment Group, Manjimup Weed Action Group
Andy Russell	Ribbons of Blue project, Pemberton Hydro Energy Group, Pemberton Hiking and Canoeing
Vivienne Karahoutis	Wagelup Aboriginal Corporation
<i>Warren Advisory Committee Members (not included above)</i>	
John Omodei	
Bob Pessotto	
Tony Ryan	

Appendix B – Overview of Public Engagement Techniques

Technique	Description and use	Advantages	Limitations
Leaflets/ Brochures	Used to convey information. Care should be taken in distribution.	Can reach a wide audience, or be targeted.	Information may not be understood or misinterpreted.
Newsletters	May involve a series of publications. Care should be taken in distribution.	Ongoing contact, flexible format, can address changing needs and audiences.	Not everyone will read a newsletter.
Unstaffed Exhibits or Displays	Set up in public areas to convey information.	Can be viewed at a convenient time and at leisure. Graphics can help visualize proposals.	Information may not be understood or be misinterpreted.
Local Newspaper Article	Conveys information about a proposal.	Potentially inexpensive form of publicity. Means of reaching a local audience.	Circulation may be limited.
Site Visits	Provides first hand experience of an activity and related issues.	Issues brought to life through real examples.	Difficult to identify a site that replicates all issues.
Staffed Exhibits or Displays	Set up in public areas to convey information. Staff available.	Can be viewed at a convenient time and at leisure. Groups can be targeted. Graphics can help visualize proposals.	Requires a major commitment of staff time.
Staffed telephone lines	Can phone to obtain information, ask questions or make comments about proposals or issues	Easy for people to participate and provide comments. Promotes a feeling of accessibility.	May not be as good as face-to-face discussions. Staff may not have knowledge to respond to all questions.
Internet	Used to provide information or invite feedback. On-line forums and discussion groups can be set up.	Convenient method for those with internet access.	Not all parties will have access to the Internet.
Public Meetings	Used to exchange information and views.	Can meet with other stakeholders. Demonstrates proponent is willing to meet with other interested parties.	Can be complex, unpredictable and intimidating. May be hijacked by interest groups or individuals. Little discussion.
Interviews, Surveys and Questionnaires	Used for obtaining information and opinions. May be self-administered, conducted face-to-face, by post or telephone.	Can identify existing knowledge and concerns.	Response rate can be poor. Responses may not be representative and opinions change.
Workshops	Used to provide background information, discuss issues in detail and solve problems.	Provides an open exchange of ideas. Can deal with complex issues and consider issues in-depth. Can be targeted.	Only a small number of individuals can participate. Full range of interests not represented.
Open-House	Location provided for people to visit, learn about a proposal and provide feedback.	Can be visited at a convenient time and at leisure.	Preparation for and staffing of the open house may require considerable time and money.

Technique	Description and use	Advantages	Limitations
Community Advisory or Liaison Groups	People representing particular interests or areas of expertise (e.g. community leaders) meet to discuss issues.	Can consider issues in detail and highlight the decision-making process and complexities involved.	Not all interests may be represented. Requires on-going commitment from participants.
Citizen Juries	Group of citizens brought together to consider an issue. Evidence received from expert witnesses. Report produced, setting out the views of the jury.	Can consider issues in detail and in a relatively short period of time.	Not all interests may be represented. Limited time may be available for participants to fully consider information received.
Visioning	Used to develop a shared vision of the future.	Develops a common view of future needs.	Lack of control over outcome. Needs to be used early in the decision-making process.

Source: Institute of Environmental Management and Assessment (1999)