The Department of
Water, Land and
Biodiversity
Conservation

ESTIMATION OF STOCK, DOMESTIC AND OTHER EXEMPT PURPOSE WATER CONSUMPTION IN THE MALLEE PRESCRIBED WELLS AREA

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SUMMARY

This report provides an estimated “snap shot” of the exempt purpose water consumption within the Mallee Prescribed Wells Area (MPWA). It has been estimated from this report that water usage for these purposes is approximately 2% to 4% of the total PAV depending on such factors as the areas climatic conditions and the commercial stock market supply and demand. The 4% (2112 ML) is considered to be on the high side but may be used in times of very hot and dry climatic conditions.

At this point of time the physical features and the demographics do not indicate a large increase in the use of water for the current exempt water use purposes of commercial stock, domestic, town water supply, broad-acre/dryland farming, fire-fighting and road making.

During the 2002/2003 water licensing year with the exemption of two hundreds and a border zone water usage including the estimated exempt use do not take these hundreds or border zones over that years allocated PAV.

Even with the usage at 4% these exempt usage are not of concern under the present departmental formula of allocating PAV’s but the irrigation water usage in two hundreds and border zone (Parilla, Day and border zone 10A) is.

To further quantify this estimate could be collated through water use surveys, selective metering trails and up to date GIS data sets, which would assist in more precise modelling of the area and strategic water resource planning and management.

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INTRODUCTION

With the introduction of water allocation plans (WAPs) prepared under the *Water Resources Act 1997,* a limit on the amount of water that can be taken from the Prescribed Water Resource. A number of the WAP's have exempted certain purpose water consumption based on a number of factors including culture and traditional values during the preparation and consultation process of these WAP's.

Although the reasoning behind the culture and traditional values are well understood especially by the community there is a need to quantify these exemptions in relation to the set limit of water that can be taken and used impacting on the sustainability of the area's water resource.

This report will focus on the Mallee Prescribed Wells Areas (MPWA) with this area shown in figure 1 (marked as Mallee) along with other prescribed water resource areas.

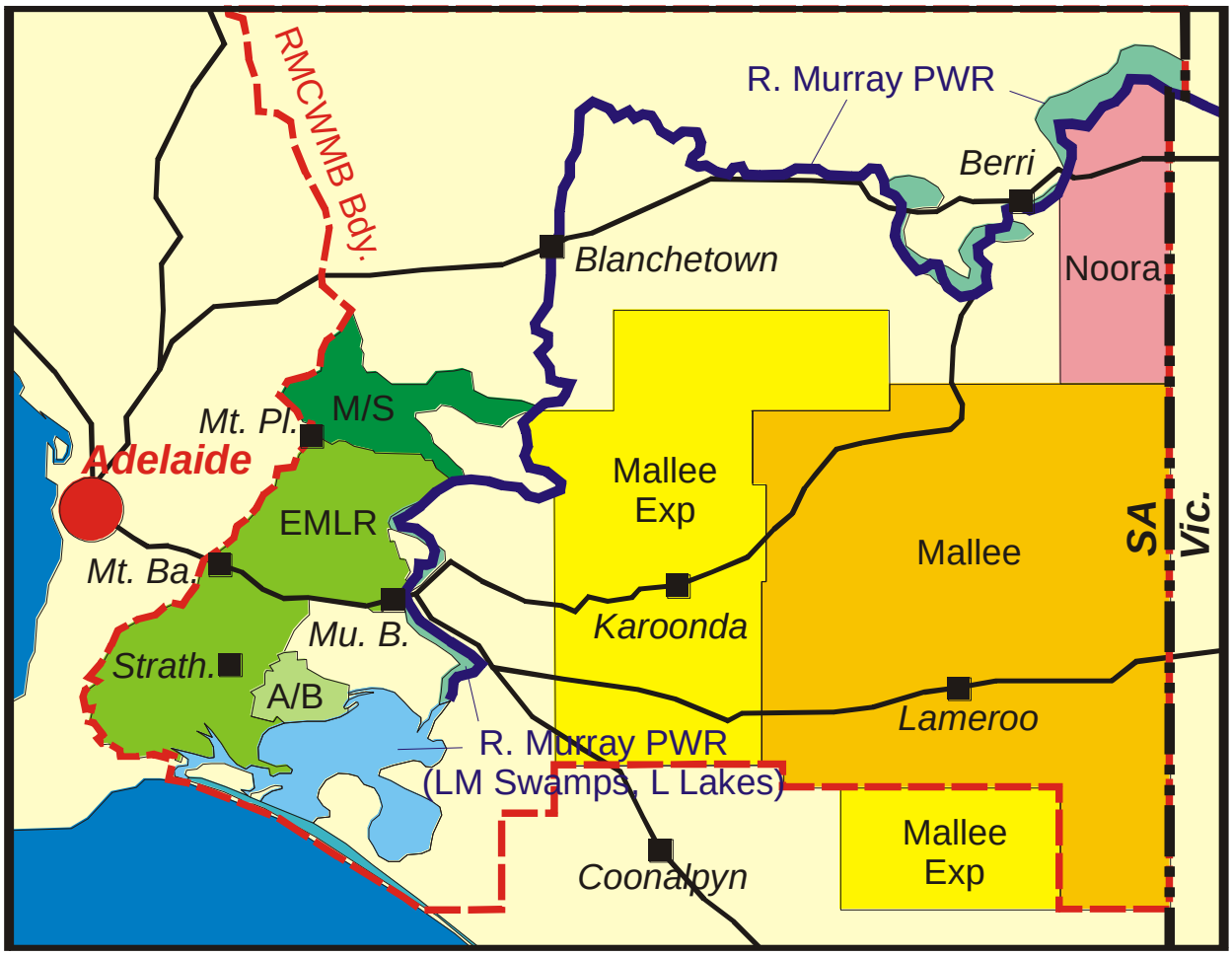

Figure 1 The location of Prescribed Water Resource Areas

The MPWA Water Allocation Plan describes the MPWA as "part of the Murray Basin, a large sedimentary underground water basin covering 300 000 km^2 of South Australia, Victoria and New South Wales. The MPWA covers 8 000 km^2, and most of the area with good quality underground water in the South Australian part of the basin. The area comprised all lands situated within the Hundreds of Chesson, Mindarie, Allen, Kewick, McGorrey, McPherson, Auld, Billiat, Kingsford, Peebinga, Molineux, Cotton, Bews, Parilla, Pinnaroo, Price, Allenby, Day and Quirke" (MWRPC, 2000).

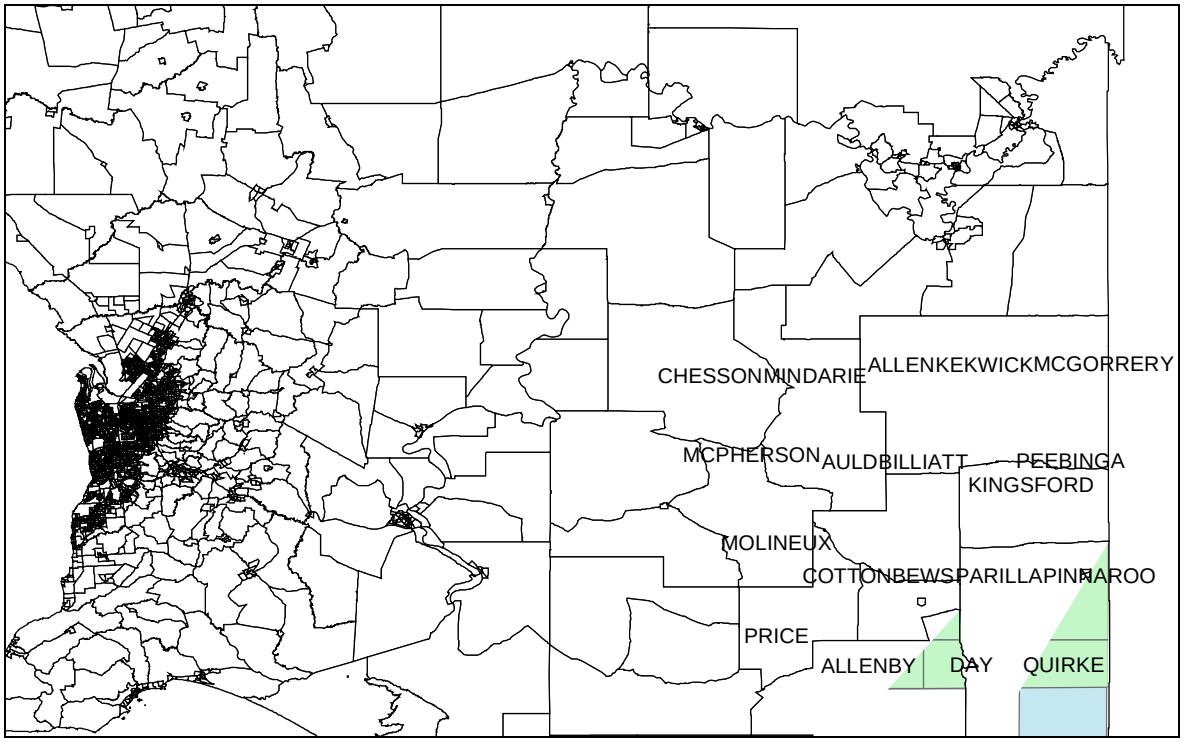

Figure 2 : MPWA hundreds

The MPWA is part of the Murray Mallee and dry land farming is the main industry and therefore the principal land use with 76%. Other land uses include conservation reserves (12%), native vegetation outside of reserves (8%), pastoralism (3%) and horticulture (<1%). Approximately 47 500 ha of land within the Murray Mallee is naturally saline and for this land broadacre cropping is not an option but often the land manager will use these areas for controlled grazing (MMLAPA, 1999).

Horticulture is easiest the biggest water user (28, 760 ML) within the MPWA with land under irrigation in 1991-1992 totalling 737 ha (ABS, 1998) and the 2002/2003 Annual Water Use Report for the MPWA calculating a total area of 5120 ha, nearly a 7 times increase. The underground water resource is the only source of water used for these activities, other activities including domestic requirements, recreational needs, firefighting, road making, stock watering and for spraying of crops where groundwater or recycled water or collected rainwater may be used.

AIM

The aim of this report is to provide, wherever possible, a quantified, documented and auditable estimate for the MPWA, of total extractions of water from the resource for the purpose of:

- Stock usage (excluding intensive farming and dairy usage);
- Domestic usage (excluding rainwater);
- Town water supply (excludes River Murray mains supply);
- Broad-acre/dry-land farming (non-irrigated crop and pasture spraying and associated machinery wash-down, cleaning and associated auxiliary usage)
- Establishments of windbreaks/shelterbelts along fence lines by dry-land farmers (predominantly); and
- Each of the other excempt/non-licensable purposes (fire-fighting, road making, branch broomrape control etc)

These estimates are currently not in the WAP of the prescribed area but there are references to such uses. For example in the MPWA WAP the taking for stock and domestic purposes does not need to be licensed and can be taken in addition to the Permissible Annual Volume (MWAP, 2000).

As stated previously this report wherever possible will provide a quantified analysis of the water use. Although attempts have been made to use quantified data much of the information contains qualitive data due to variables (eg climatic conditions, frequencies and materials used) related to calculating the final water use. It is considered this methodology will provide an estimate mostly on the high side.

This report collates and analysis existing data to determine whether Stock & Domestic water consumption need to be further considered by relevant WAP committees or other stakeholders.

METHODOLOGY

Commercial stock watering

Consumption of water by livestock is subject to considerable variation. It depends on the species, age, condition of the animal, available food, climatic conditions and the quality of the water etc.

Most sources of information for stockwater requirements present average and peak daily consumption rates for various types of stock. For the purpose of this report average daily consumption rates where converted into yearly rates as shown in table 2 for the stock listed in Primary Industries Information Management System (PIIMS). In table 2 the minimum and maximum water requirement from each information sheet is listed with the average water requirement calculated by averaging all relevant information. For example for cattle the lowest average water requirement found on all information collected on stock water requirements was 16 kL/yr and the highest was 25 kL/yr. The average water requirement was found by averaging all yearly water requirements in reference to cattle with similar cattle production as the MPWA sourced in preparing this report.

Table 1 : Average yearly stockwater requirements

Stock Type	Min. Av. yearly water requirement (kL/yr)	Av. yearly water requirement (kL/yr)	Max. Av. yearly water requirement (kL/yr)
Cattle (excluding dairy)	16	20	25
Sheep	2.50	2.78	3.30
Alpaca	1.825	1.825	1.825
Goat	1.825	1.825	1.825

For Alpaca and Goat stock types little information was found regarding stockwater requirements but from the limited data 1.825 kL/yr (4-5 L/day) is considered acceptable. There is insufficient data to allow a minimum and maximum water requirement to be calculated for these animals.

The total stock numbers were determined by obtaining stock numbers by hundreds from PIIMS with the understanding that any published information would respect the relevant privacy issues. The information was supplied by Spatial Information Services of Primary Industries and Resources South Australia (PIRSA) with the principal contact being Mr. John Cock, Project Manager, Corporate Spatial & IT Services, PISRA.

The stock numbers from PIIMS were multiped by the stockwater giving an estimated water use for that stock type as presented in the results section (table 4).

Domestic water usage was calculated by creating a per head of population Geo-database from two departmental GIS datasets (hundreds and population), transferring this information into an Excel spreadsheet and calculating the average water use. The actual volume per person was divided by assuming the water use for all was the same as the water use from the Lameroo and Pinnaroo township for the years of 2002 & 2003 calculating to an water use average of 511 kL/household/year. Water use figures were obtained from SA Water meter readings for the townships with the average for both towns during 2002/03 of 552 kL/household/year and for 2001/02 of 470 kL/household/year. The higher household water usage for the 2002/03 probably reflects Australia's sixth warmest year in 2003 as recorded by the Australian Weather Bureau.

The domestic average was calculated from table 2 :

Table 2 : Average domestic water use based on the township of Pinnaroo and Lameroo water usage

Towns	Water Use		No.of Persons	Dwellings	Raton	Water Use per Dwelling (ML)	Water Use per Dwelling (ML)	Av. Water Use (ML)	Total Av. Water Use (ML)
	03/02	02/01			P:D	02/03	01/02		
Pinnaroo	173.2	145.2	606	297	2.1:1	0.583	0.489	0.536	0.511
Lameroo	134.3	116.4	518	258	2.0:1	0.520	0.451	0.486	

Estimates of Broad-acre/dry-land farming water use for crop spraying, wash down and weed management was taken from work by Mr Tony Meissner (DWLBC) with assistance from Rural Solutions field crop consultant calculated on the dry-land water use on 2003-grain production areas.

Table 3 : Estimates of Broad-acre/dry-land

	Ave Rate of Application			
Region	Area (ha)	Litres per ha	Frequency	Volume (kL)
Western & Eastern Eyre Peninsula	970 200	60	4	232 848
Lower Eyre Peninsula	323 300	60	6	116 388
Yorke Peninsula & Mid North	1 001 050	60	5	300 315
Upper North	444 500	60	4	106 680
Lower North	109 600	60	5	32 880
Kangaroo Is, Fleurieu & Mt. Lofty Ranges	48 950	60	6	17 622
Lower Murray & Southern Mallee	376 300	60	5	112 890
Northern Mallee	235 000	60	4	56 400
Upper South East	212 200	60	5	63 660
Lower South East	71 900	60	6	25 884

Note : Area based on 2003 cropped areas for grain production. Does not include pasture areas that are sprayed which would mainly affect mainly the KI, FP, ML and LSE regions. Frequency of spraying is also an estimate but is considered reasonable by Rural Solutions Field Crop Consultant. It is difficult to estimate how much rainwater is used vs. ground or mains water.

It appears that the exempt/non-licensable allocation are focussed on protection of infrastructure and/or of human life such as building and maintenance of road infrastructure and fire fighting. As with stock water use the use of the water varies greatly based on circumstances. Councils and Road Transport SA allocate budgets, source funds and react to so called ‘hotspots’ in road making and repairs therefore no fixed amount water is required on an average basis from a particular water resource. Fire fighting is the same with so called ‘wildfires’ varying in intensity, size and threats to infrastructure, crops, live etc. In many cases of the large wildfires water is an ineffective method of controlling the fire but is often used in the cleanup and/or reducing the potential of the fire reinighting. This report does not try to estimate this water use but there is regular use by Councils in road making/repairs and through Country Fire Services (CFS) training. It is also noted that not all water is of a quality suitable for fire fighting (private property are used at various time). Efforts are also made by many CFS unit to conserve water by means of water reuse.

It is estimate that each CFS brigade could use 2,000 litres once per fortnight for training, which calculates to a volume of 52 ML/brigade/year.

An example of a wildfire was the Ngarkat fire dated 26th January 2005. This fire burnt for seven days with the use of three air bombers using a mix of water, foam and retardants over a four-day

period. Although the fire was within the MPWA water for the three air bombers was sourced from near the township of Tininatara, which is outside the MPWA. It has been noted that near Tintinara, water levels in the Murray Group Subsystem are rising in some areas in response to land clearing for agriculture but declining in the areas of high groundwater use (Ife & Skelt).

The smaller Ngarkat fire of October 2004 required no use of water but was contained by use of firebreaks and burning itself out.

At times of wildfires 10,000 litre tankers may be used and planes that use 500 litres every 15 minutes could be used at various times for either directly fighting of the wildfires or so called mopping up activities.

With the consumption use for the purpose of road making there is many variables involved such as road materials used, climatic conditions and if other sources are used such as SA Water supplies or stormwater. This made it difficult to give and quantify estimate on road making for a defined area. The main consumptive users appear to be the relevant District Council, Road Transport SA and private contractors on a project basis. Project basis can range from the construction of main roads to the construction of private road assess (eg into wineries and vegetable packing plants), car parks and on farm dry wether vehicle tracks.

For District Council roads during normal climatic conditions and during full road construction it is estimated that that 6 tankers (5,000L) will be used per day for a period of 3 days per week, which is totalled in the results section on page 15.

RESULTS

Mallee Prescribed Wells Area (MPWA)

Commercial stock

The estimated average stock water use is presented in the Figure 3 below:

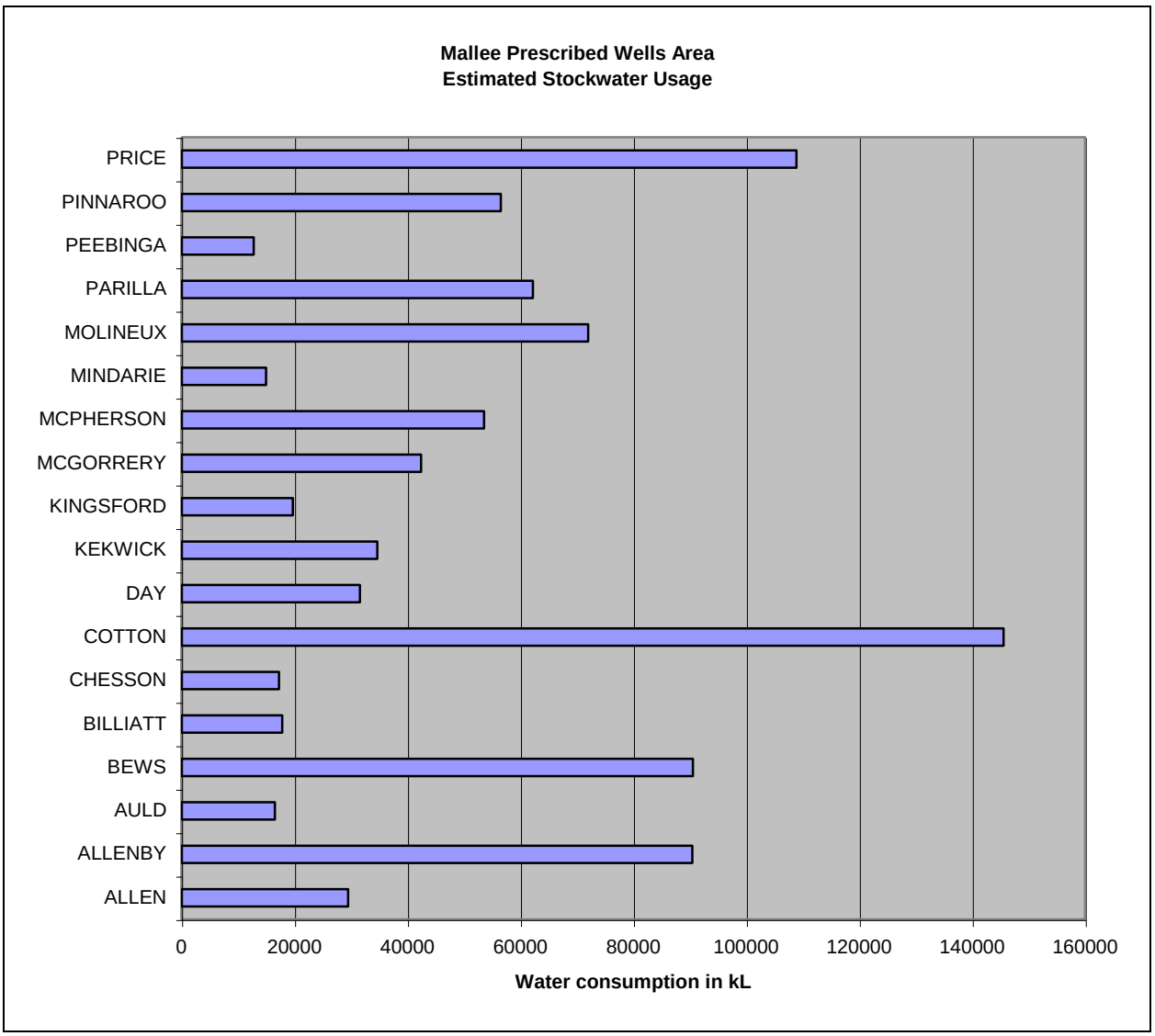

Figure 3 : Average stock water consumption

For the MPWA the overall average consumption is 917,500kL, which is 1.7% of the current MPWA total PVA by itself, is not a significant component of the PAV. When looking at the individual hundreds that the maximum percentage of the current PAV's is the hundred of Allenby with 7.8% and the minimum is the hundred of Billiatt with 0.4% but has large areas of native vegetation. Mindarie is the second lowest with 0.6% with the variance percentage calculated at 4.8% of the listed hundreds as shown in table 4 on the following page.

Table 4 : Commercial stock water use by hundreds

Hundred	Maximum	Average	Minimum	Max PAV %	Av. PAV %	Min PAV %
Allen	35723	29532	8480	1.7	1.4	1.2
Allenby	94974	80008	71950	7.8	6.5	5.8
Auld	19725	16585	14855	1.0	0.9	0.8
Bews	97498	82135	73862	2.3	1.9	1.7
Billiatt	21565	17854	15470	0.4	0.4	0.3
Chesson	20545	17297	15535	1.7	1.5	1.3
Cotton	141867	119512	107475	6.9	5.8	5.1
Day	13530	11398	10250	3.2	2.6	2.2
Kekwick	41680	34688	30400			
Kingsford	23835	19726	17078			
McGorrery	51375	42465	36663			
McPherson	63650	53596	48144	4.1	3.5	3.1
Molineux	85643	72023	64526	5.0	4.2	3.7
Mindarie	18097	14980	12975	0.8	0.6	0.6
Parilla	74757	62239	54588			
Peebinga	15540	12789	10935			
Pinnaroo	68148	56578	49321			
Price	130634	108914	95820	7.0	5.9	5.2
Quirke	0	0	0			
Totals	1100201	917500	807544			

Note: PAV percentage could not be calculated for the Border sharing zones with the available GIS datasets and PIMS information.

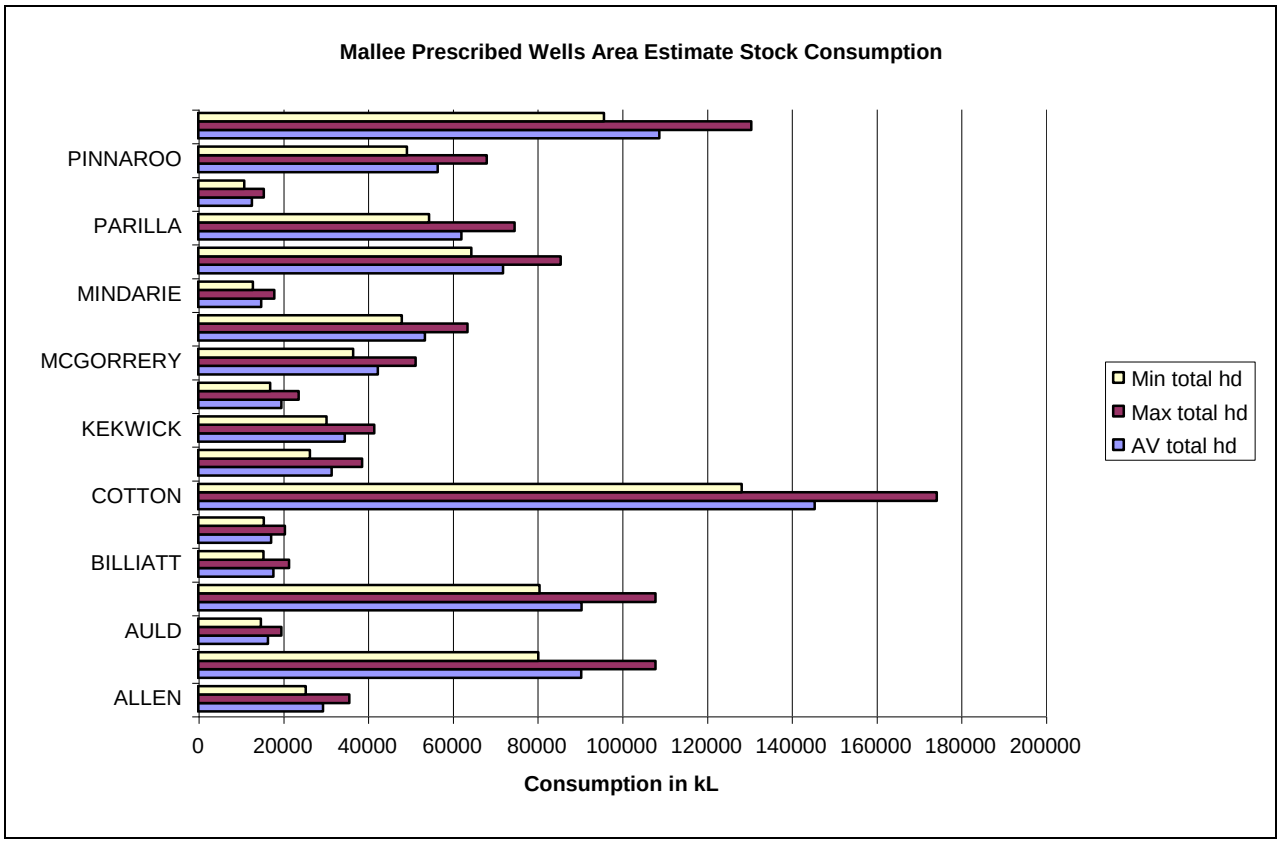

Figure 4 : Stock water use by Hundreds PAV

Domestic Usage

Table 5 : Domestic Water Use

	Based on Pinnaroo and Lameroo 2001/02/03 SA Water township water use					
	High water Use (kL)	av. Water use (kL)	Low water Use (kL)	Current PAV (ML)	% of PAV (high)	% of PAV (av)
Allen	61905	54238	47893	2072	3.0	2.6
Allenby	31664	27744	24698	1392	2.3	2.0
Auld	53782	47121	41608	1912	2.8	2.5
Bews	34.82	29949	26445	4755	0.7	0.6
Billiat	52271	45798	40439	2241	2.3	2.0
Chesson	56240	49275	43510	1176	4.8	4.2
Cotton	51832	45412	40099	2520	2.0	1.8
Day	65458	57351	50641	1192	5.5	4.8
Kekwick	61901	54234	47889			
Kingsford	48631	42608	37623			
McGorrey	61946	54274	47924			
McPherson	54979	48170	42534	1544	3.6	3.1
Mindarie	53212	46621	41167	2313	2.3	2.0
Molineux	55933	49006	43272	1720	3.2	2.8
Parilla	74589	65351	57705			
Peebinga	49859	43684	38573			
Pinnaroo	76324	66871	59048			
Price	69049	60497	53419	1856	3.7	3.2
Quirke	90973	79706	70381			
Totals	1104740	967918	854877			

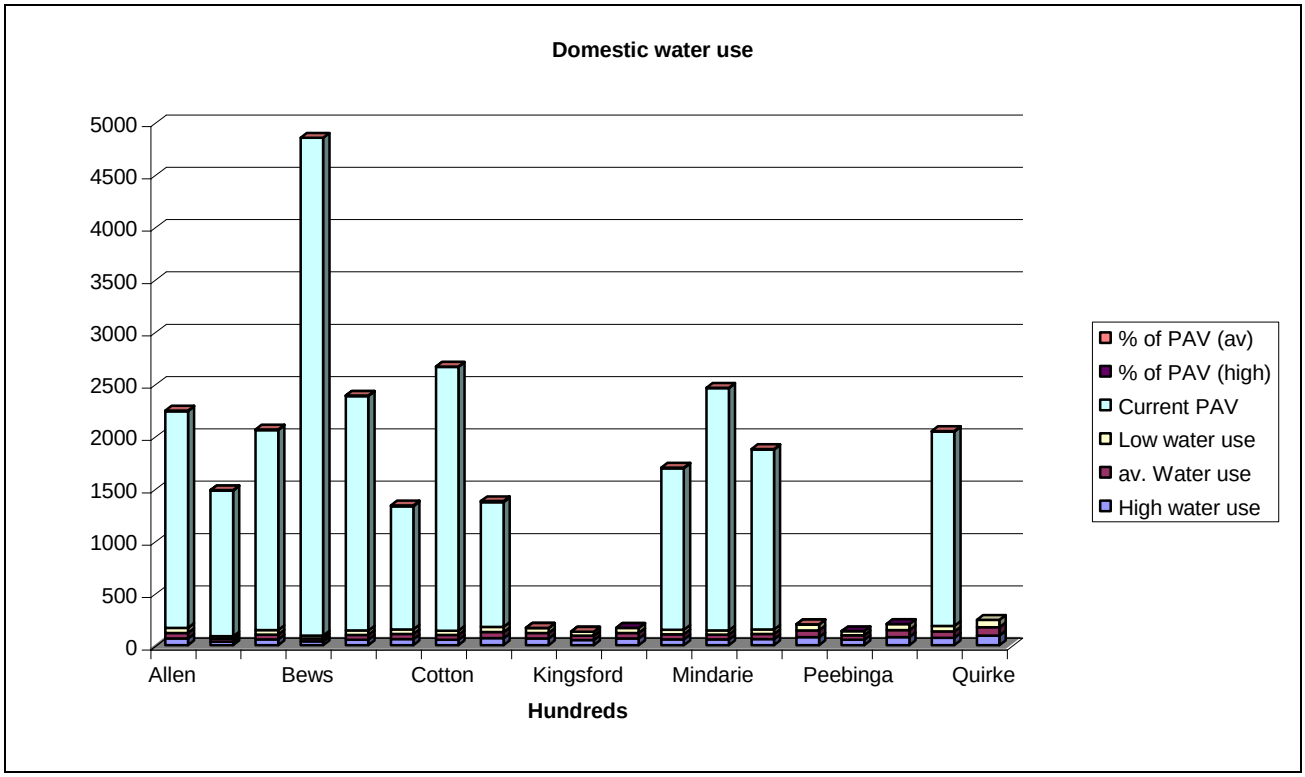

Figure 5 : Domestic water use by Hundreds PAV

Table 6 : Ratio of persons per dwellings

HUNDRED	Ratio
ALLEN	2.7
ALLENBY	2.4
AULD	2.3
BEWS	2.4
BILLIATT	2.6
CHESSON	2
COTTON	2.3
DAY	2.4
KEKWICK	2.7
KINGSFORD	2.6
MCGORRERY	2.7
MCPHERSON	2.0
MINDARIE	2.4
MOLINEUX	2.3
PARILLA	2.2
PEEBINGA	2.6
PINNAROO	2.1
PRICE	2.3
QUIRKE	2.1

On average there is a ratio of 2.4 persons per dwelling. There was an average ratio of 1 : 2.1 for the Lameroo and Pinnaroo townships. Based on the average water use the dwellings equates to 1.8% of the total PAV, by itself, not significant.

Town Water Supply

All town water supplies of concern within the MPWA have been accounted for within the minor towns being addressed for within the domestic section through GIS data sets.

Broad-acre/dry-land farming

This calculated to an estimated usage of 1.7 ML/year based on the northern and southern Mallee grain production 2003 figures created by Mr Tony Meissner. It is believed that the water usage would also cover washdown etc.

Excempt/non-licensable purposes

Fire Fighting

It is estimated that each CFS brigade could use 2,000 litres once per fortnight for training, which calculates to a volume of 52 ML/brigade/year. But as mentioned previously most of this water is used in a conservative manner wherever possible and more realistic water use would be less than 5 ML/brigade/year for the brigades using bore water. Therefore for the MPWA water estimated is 50 ML/year especially in times of water restrictions would be less than 1% of the allocation (say 520 ML)

At times of wildfires 10,000 litre tankers may be used and planes that use 500 litres every 15 minutes could be used at various times for either directly fighting of the wildfires or so called mopping up activities.

It is noted that during the large Ngarkat fire water was sourced from outside the MPWA for a wildfire inside the area calculated to a very rough volume estimate of 0.3 ML for the planes and 0.5 ML for the units say a rough total volume of say 1 ML.

Road Making

For District Council infrastructure road maintenance during normal climatic conditions and during full road construction it is estimated that that 6 tankers (5,000L) will be used per day for a period of 3 days per week. This equates to 4.68 ML per year. There are three councils associated with the MPWA but each council have land outside of the MPWA therefore it is considered that 4.68 ML/year is the best estimate based on comments from the District Council of Loxton Waikerie.

DISCUSSION

Although this report has tried to quantify water usage in the MPWA, the table below by necessity only represents a best estimate of the water use during a hot year with the high use representing a extreme hot year similar to the 2002/03 licensing year and the low use similar to 2001/02 licensing year.

Table 7 : Estimation of MPWA exempt water usage

Water Use Purpose	High Use (ML)	Low Use (ML)
Commercial Stock	1100	808
Domestic	1104	854
Board acre / dryland farming	2	2
Fire fighting	1	0
Road making	5	2
Total	2212	1666

These estimates represent between 4% and 3% of the current total PAV for the MPWA.

An exhaustive discussion regarding assumptions and variables is not justified, however, the current demographics of the MPWA are believed to remain constant. Horticulture industries continue to provide employment and compensate for decreasing dryland agriculture employment (District Council of Southern Mallee and the Murray Mallee Local Action Plan). There has been a recorded water usage for the MPWA of 30191.8 ML some 57% of the total PAV for 2002/03 licensing year in the Annual Water Use Report for 2002/03. Adding in the estimated stock, domestic and other exempt uses of high water use of 2212 ML this would take the usage to 61% of the total PAV.

When breaking the usage down by hundreds there are three hundreds, border zone 10A, Day & Parilla that have usage over their allocated PAV's as shown by the table 8 but exempt water usage does not bring the other hundreds over their 2002/03 PAV.

Table 8 : Water Usage above the PAV for 02/03

Hundred	**Allocation (ML) 02/03**	**Water use 02/03 (ML)**	**Domestic Water use – low (ML)**	**Stock Water use – low (ML)**
10A	*9199.52*	*10748.88*	135.87	86.61
Day	*1198.96*	*1316.38*	50.64	10.25
Parilla	*3863.80*	*8894.81*	46.16	43.67

Note : Italics is information sourced from MPWA, Annual Water Use Report 2002/2003

From table 8 it is estimated that in border zone 10A is using approximately 119% whilst Day is 115% and Parilla is 232% above the allocated PAV.

CONCLUSIONS & RECOMMENDATIONS

It is considered the estimates of the exempt purposes are likely to be on the high side but not unreasonably so. The general conclusion is that this usage is not significant enough to impact on the total PAV of the MPWA. Across the area excessive water usage, relative to the PAV, is taking place within the hundreds of Parilla, Day and the Border Zone 10A.

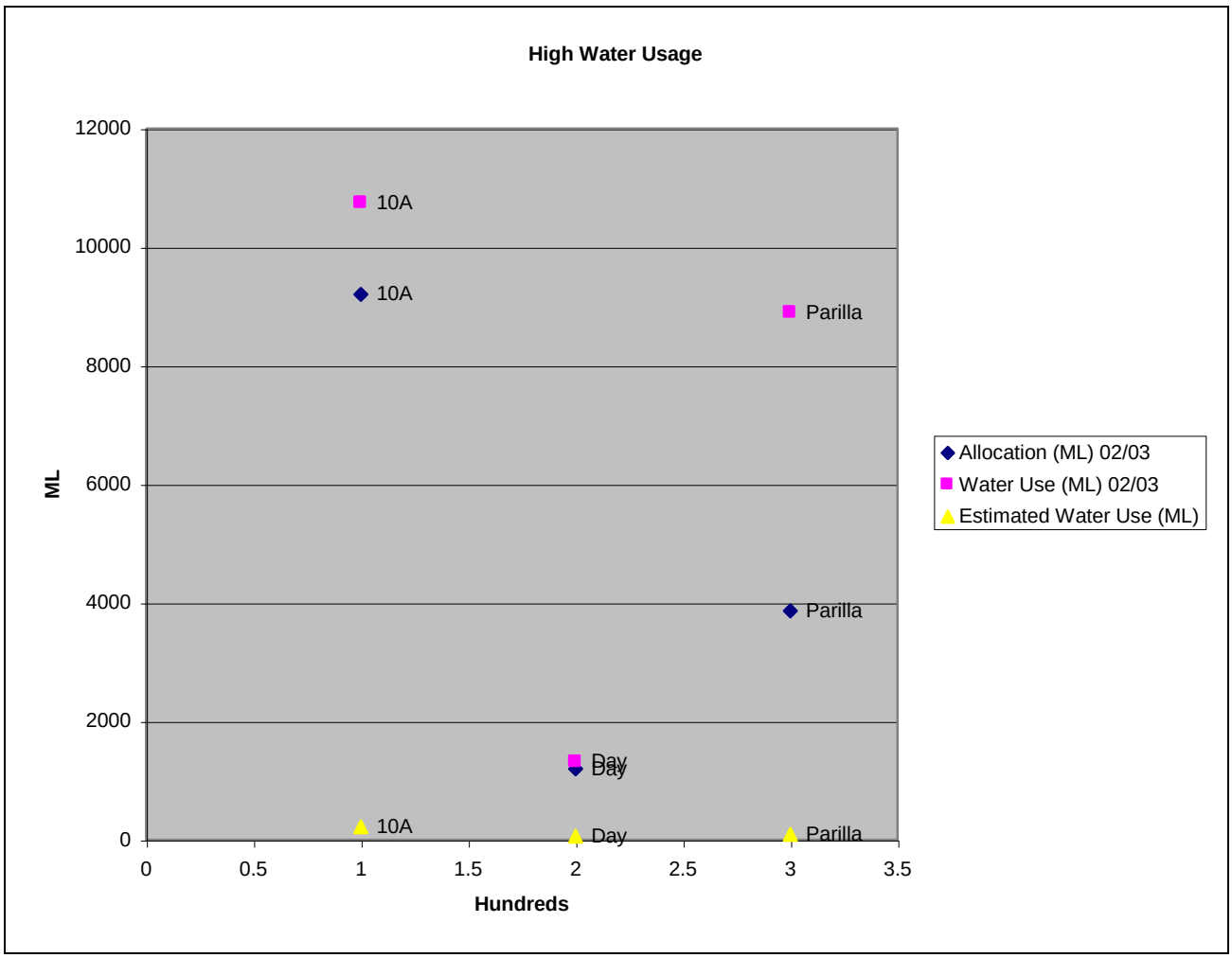

Figure 6 : High Water Use

The water extraction for Exempt purpose water extraction would range from 1% to 4% within a water-licensing year for the total MPWA depending on a number of factors within that year such as climatic conditions. This percentage (i.e. range of percentage conclusions are due to varying characteristics) is higher or lower for individual hundreds but due to the physical features and demographics of the region this not deemed to be of concern at this point of time.

It is believed that a trigger for reassessment of this recommendation would be if the regions population densities and therefore water consumptions showed an increase within the area or hundred which was using close to it's allocated PAV.

It is also understood that more accurate information could be collated through water use survey's, selective metering trails and comparing the GIS information but at this point of time would be a low priority due to reasoning that this type of usage is not above 20%. The department usually operates with a 30% safety factor when dealing with PAV's.

Having said this it would be appropriate to further quantify stock and domestic water use when modelling water use or implementing strategic water resource management within the MPWA especially in the high water use hundreds such as Parilla, Day and border zone 10A.

GLOSSARY

Border Zone a section of the 20 km strip on the South Australian side of the South-Australia Victoria border in which the *Groundwater (border Agreement) Act 1985* applies.

SI UNITS COMMONLY USED WITHIN TEXT

kL	Kilolitre
ML	Mega litre

ABBREVIATIONS COMMONLY USED WITHIN TEXT

Mallee Prescribed Wells Area (MPWA) the area first proclaimed in August 1983 under the provisions of the *Water Resources Act, 1976* comprising of all lands situated the Hundreds of Chesson, Mindarie, Allen, Kekwick, McGorrey, McPherson, Auld, Billiat, Kingsford, Peebinga, Molineux, Cotton, Bews, Parilla, Pinnaroo, Price, Allenby, Day and Quirke.

Permissible Annual Volume (PAV) the total volume of water that can be taken annually for licensed purposes from the Murray Group limestone aquifer. A PAV can apply to part of the Murray Group limestone aquifer within a Hundred or a border zone or to the Murray Group limestone aquifer with the Mallee Prescribed wells Area as a whole.

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