NSW Department of Commerce

Nambucca District Water Supply Scheme

Drought Management Plan

Final Report

Water Cycle and Strategic Planning

Report No.: DC03059

Date: November 2004

FOREWORD

This Drought Management Plan has been prepared for the Nambucca Shire Council by Water Services, NSW Department of Commerce. It outlines the drought management process for Nambucca Water Supply Scheme and the drought emergency response strategy together with the management and logistics associated with each emergency response. These measures will ensure that customers will receive at least basic water supply in a drought/emergency situation.

Version	Issued Date	Comments Received
First Draft		
Advanced Draft		
Final Draft	3rd September 2004	20th September 2004
Final Report	20th October 2004	

ACKNOWLEDGEMENTS

This Plan and Response Strategy has been prepared by:

- John Stanmore;
- Roshan Iyadurai; and
- Peter Mackenzie.

NOTE

Under the Public Sector Employment and Management (General) Order of 2nd April 2003 the Department of Public Works and Services (DPWS) was abolished and its branches transferred to the Department of Commerce.

EXECUTIVE SUMMARY

Nambucca Shire has experienced two serious droughts in the last 10 years namely 1994 and 2002. The most recent drought began in August 2002 and extended through to the beginning of March 2003. During this time Nambucca Shire Council (NSC) progressively increased water restrictions from Level 1 to Level 4. Nambucca Shire extracts water from the Bowraville Borefield aquifer, which is located adjacent to and fed by the Nambucca River.

In response to this most recent drought, a drought management plan (DMP), including a drought emergency response strategy (ERS), has been prepared for NSC. This DMP has:

- Examined the antecedent information of previous droughts in the Nambucca Shire in relation to the behaviour of customers during restrictions, and the performance of the storage and the system;
- Examined the long-term climate, streamflow and consumption trends in the Nambucca Shire and how they compare to drought situations;
- Outlined a drought management process for the integration of triggers, restrictions and required actions;
- Listed a number of possible drought emergency response opportunities including both demand and supply-side measures; and
- Provided a Drought ERS so as to guide NSC how best to manage their assets and responses in times of serious drought.

More specifically, this DMP has identified the requirement for:

- A communication strategy to notify customers and public authorities of what actions are required at each level of restrictions;
- Various pre-drought planning measures to be undertaken by NSC including:
  - Preparation of a catchment management plan for protection of emergency sources
  - Securing of licences and approvals so that emergency sources are accessible when needed
  - A long term demand management strategy
  - The installation of monitoring bores

The Drought ERS provides the costs and timing for implementation of the following alternated supply sources in the order of priority listed below:

- Residual Flow Harvesting downstream of existing Borefield but upstream of the confluence of South Creek and Nambucca River;
- Groundwater storage at South Creek
- Kingsworth Storage
- Potential water carting sources

NSC is separately planning to improve the supply security of its water supply scheme in the long term.

Although this DMP outlines the drought management process and emergency response measures, it is important that it be reviewed, at least on a 5-year cycle, to capture the change in the operating environment and at the beginning of a drought as the impact of every drought is likely to be different.

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LIST OF ABBREVIATIONS

AHD	Australian Height Datum
BOM	Bureau of Meteorology
Commerce	NSW Department of Commerce
CS	Communication Strategy
DEUS	NSW Department of Energy, Utilities and Sustainability
DIPNR	NSW Department of Planning, Infrastructure and Natural Resources
DISPLAN	Disaster Plan
DLWC	The former NSW Department of Land and Water Conservation
DMP	Drought Management Plan
DoH	NSW Department of Health
DRP	Demand Reduction Program
EPA	NSW Environment Protection Authority
ERS	Drought Emergency Response Strategy
HWC	Hunter Water Corporation
LRP	Leakage Reduction Program
NSC	Nambucca Shire Council
NDWS	Nambucca District Water Supply
SOI	Southern Osciallation Index
STP	Sewage Treatment Plan
SWL	Aquifer Standing Water Level
UFW	Unaccounted for Water
WMP	Water Management Plan

1 INTRODUCTION

1.1 Location

The Nambucca Shire Council (NSC) governs an area of 149,000 ha on the NSW North Coast and is responsible for delivering water and wastewater services to 13,000 people living within the main urban areas of Nambucca Heads, Macksville, Bowraville and Scotts Head. Figure 1.1 below contains a diagram of Nambucca Shire showing the location of the major urban centres.

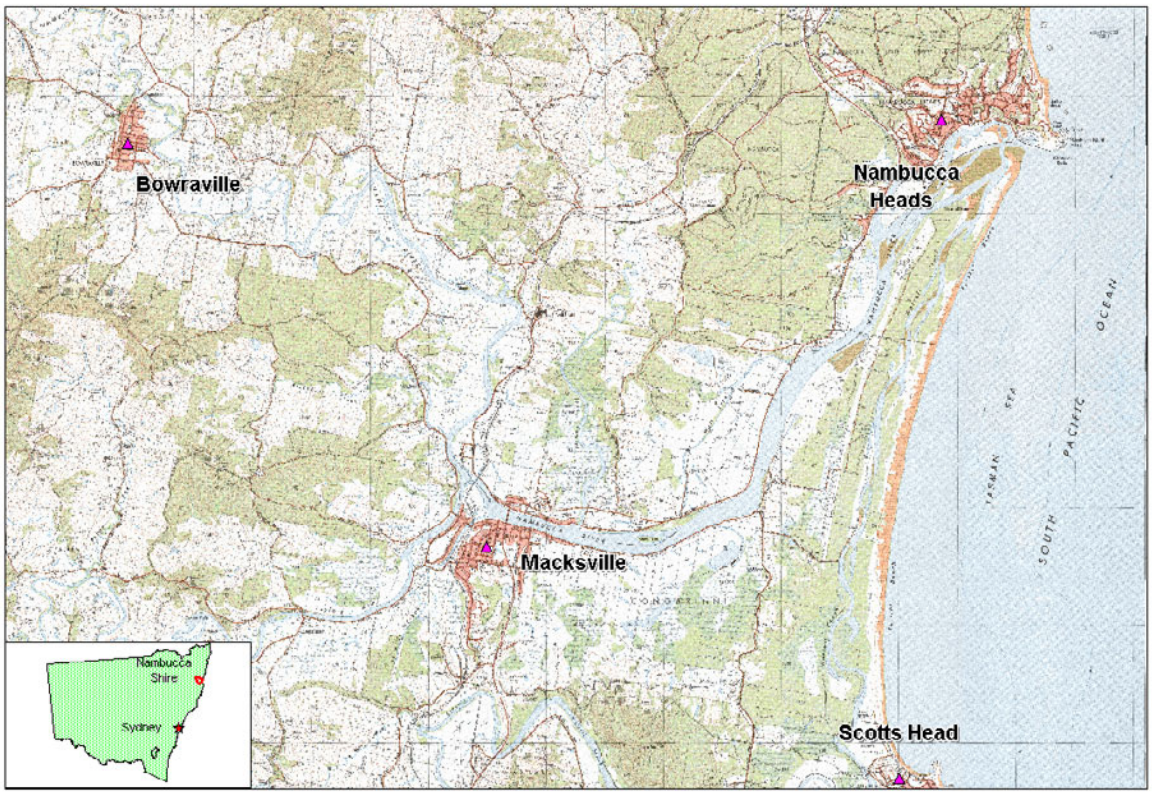


Figure 1.1: Location of Nambucca Shire

The major industries of the area include tourism, agriculture and an abattoir in the northern part of the shire. The demand placed on the water and wastewater infrastructure is highly seasonal due to the large influx of tourists during the holiday periods.

1.2 Plan Context

The draft of this final drought management plan (DMP) and the drought emergency response strategy (ERS) therein were prepared to manage the extended drought of 2002/03. This final DMP and Drought ERS have been amended to take account of the experiences gained and the emergency response measures implemented during the 2002/03 drought. Thus, this is now a plan for managing the future drought events based on existing headwork arrangements.

Although this plan outlines the drought management process and emergency response measures, it is important that it be reviewed, at least on a 5-year cycle, to capture the change in the operating environment and at the beginning of a drought as the impact of every drought is likely to be different.

1.3 Plan Objective

The primary objective of any drought management activity of a local water utility is to provide its customers with access to water to meet the basic requirements of maintaining community health and hygiene during drought. This plan provides the overall process and emergency response measures to achieve this objective. Thus, the specific objectives of this plan are to:

- Outline the recent drought performance for future reference;
- Develop the drought management process and the activities there in; and
- Develop the drought ERS together with the associated logistical, resource and compliance requirements.

1.4 Plan Structure

In developing this plan the Draft Drought Management Guidelines (Ref. 1) were considered and the plan structure encompasses the intent of the Draft Guidelines. Figure 1.2 outlines the structure of this drought management plan. Appendix I shows how the Draft Guidelines have been complied with in the preparation of this plan and where data deficiencies still exist.

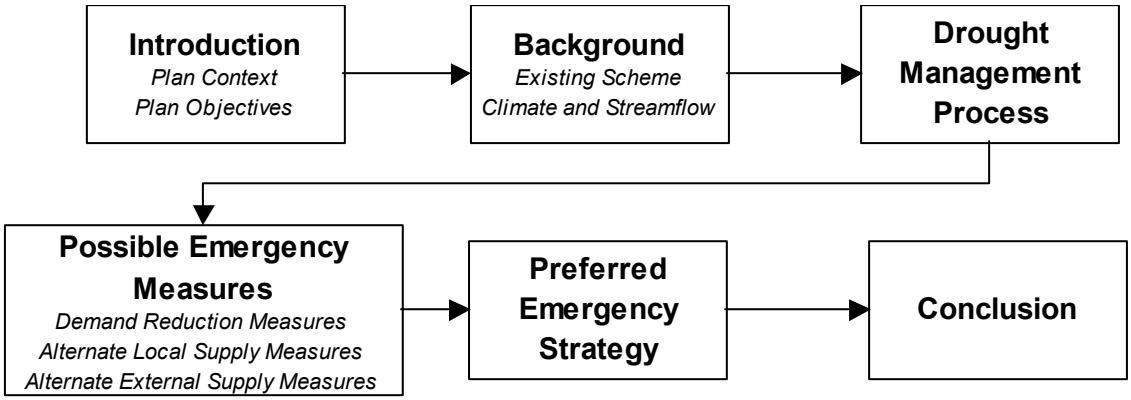


Figure 1.2: NSC Drought Management Plan Structure

2 BACKGROUND

2.1 Existing Scheme

The Nambucca District Water Supply Scheme (NDWSS) has, as its single source, a borefield beside the Nambucca River, approximately 1 km north of Bowraville. This borefield consists of 8 operational bores located on either side of the river on private land. Water is pumped from these bores to a collection tank and following treatment (ie, lime, carbon dioxide and chlorine addition), is pumped to the balance tanks above the Bowraville Racecourse. It then gravitates to all urban areas of the Shire. A schematic diagram of the NDWS is attached in Appendix A.

2.1.1 Capacity of System

Aquifer

The storage capacity of the aquifer from which the bores pump was assessed in December 2002 by Water Studies Pty Ltd as 450 ML with 300 ML available for extraction at 3.25m AHD, if three of the bore pumps were lowered. This lowering was completed in Jan 2003.

In severe drought conditions, the surface flows in the river near the borefield cease and only sub-surface flows occur. The bores draw from this sub-surface stream while the residual flow continues towards the estuary. Hence there is no certainty that the nominated storage is available for extraction.

Bores

The total installed pumping capacity at the borefield is 296 L/s with individual pump capacities ranging from 22 to 56 L/s as follows:

Bore No.	Flow (L/s)
2	31
3	22
4	31
5	27
6	31
7	56
8	42
9	56
Total	**296**

During normal weather conditions, the borefield is capable of pumping a peak daily demand in excess of 13 ML per day. NSC's licence with the Department of Planning and Natural Resources (DIPNR) is for an annual extraction of 3,100 ML. The licence is classified as groundwater extraction and at present has no constraints to access and extraction of water.

2.1.2 System Details

The trunk mains vary in size from dual 450 mm diameter pipes to single 200mm diameter and each urban area is served by individual reservoirs with a total combined storage of 23.8ML. Details of individual reservoirs are as follows and the capacities are in ML:

Balance Tanks	0.45, 1.0
Bowraville	1.3
Midco	1.3
Macksville	1.3, 2.9, 1.8
Scotts Head	1.4
Nambucca Heads	8.0, 1.1, 1.3
Valla Beach	2.0

2.1.3 Water Restiction Policy

The restriction policy employed by NSC at the time of the 2002/03 drought had 5 levels and involved the placing of increasing restrictions on residential, government, commercial and industrial users. The policy adopted since the 2002/03 drought has added an additional level of restrictions to the previous framework and represents a hybrid of the work undertaken at draft stages of this DMP, and the NSW North Coast model for consistent water restrictions across the north coast region. Under the new restriction policy, external residential water use is not completely restricted until the 6th and final restriction level. Appendix B contains the restriction policy that was active during the 2002/03 drought and the current NSC drought restriction policy.

2.2 Climate and Streamflows

2.2.1 Climate

The Nambucca Shire experiences a sub-tropical climate with an average maximum temperature in winter of 19^{o}C and 26^{o}C in summer.

The closest weather station to the borefield is 1.6km to the south at the Bureau of Meteorology (BOM) Bowraville Station (59002). Annual rainfall records are available from this station since 1891. The recorded annual rainfall at this station ranges from 586mm (1902) to 2,553mm (1950) with an average annual rainfall of 1,347mm. Figure 2.1 below shows the long-term record of annual rainfall at this station.

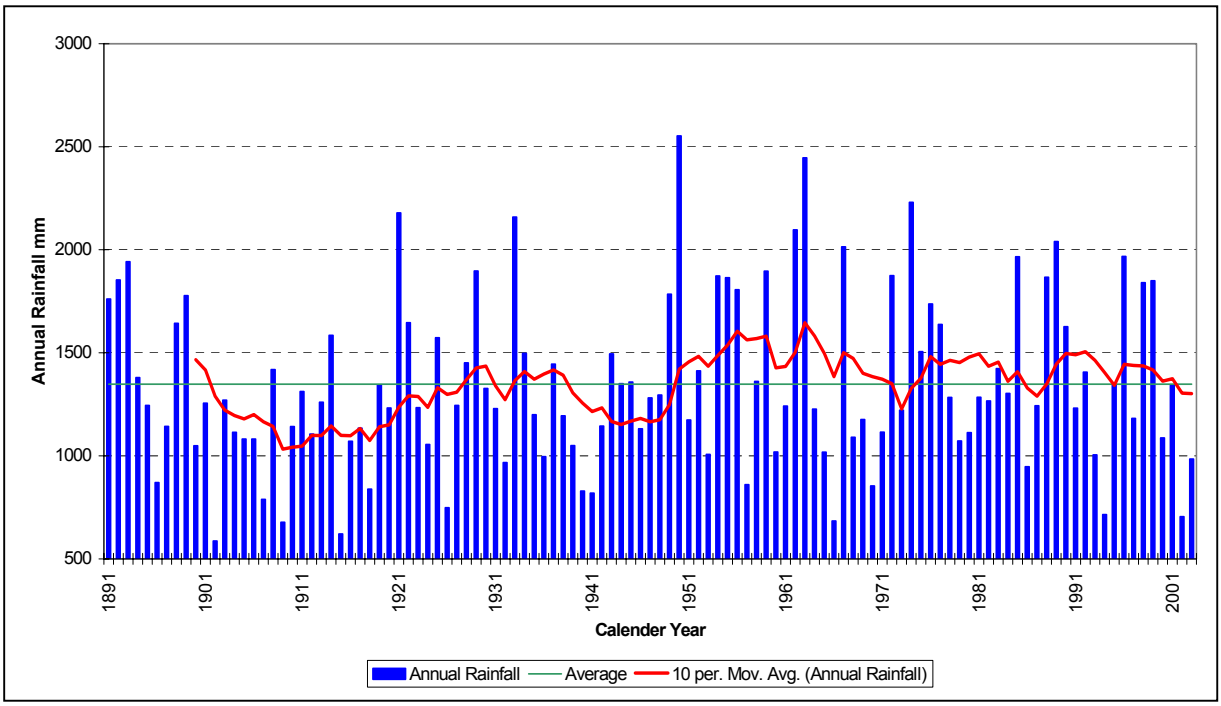


Figure 2.1: Historical Annual Rainfall at Bowraville (Station 59002)

Figure 2.2 shows the average monthly variation of rainfall at this station calculated from the available data.

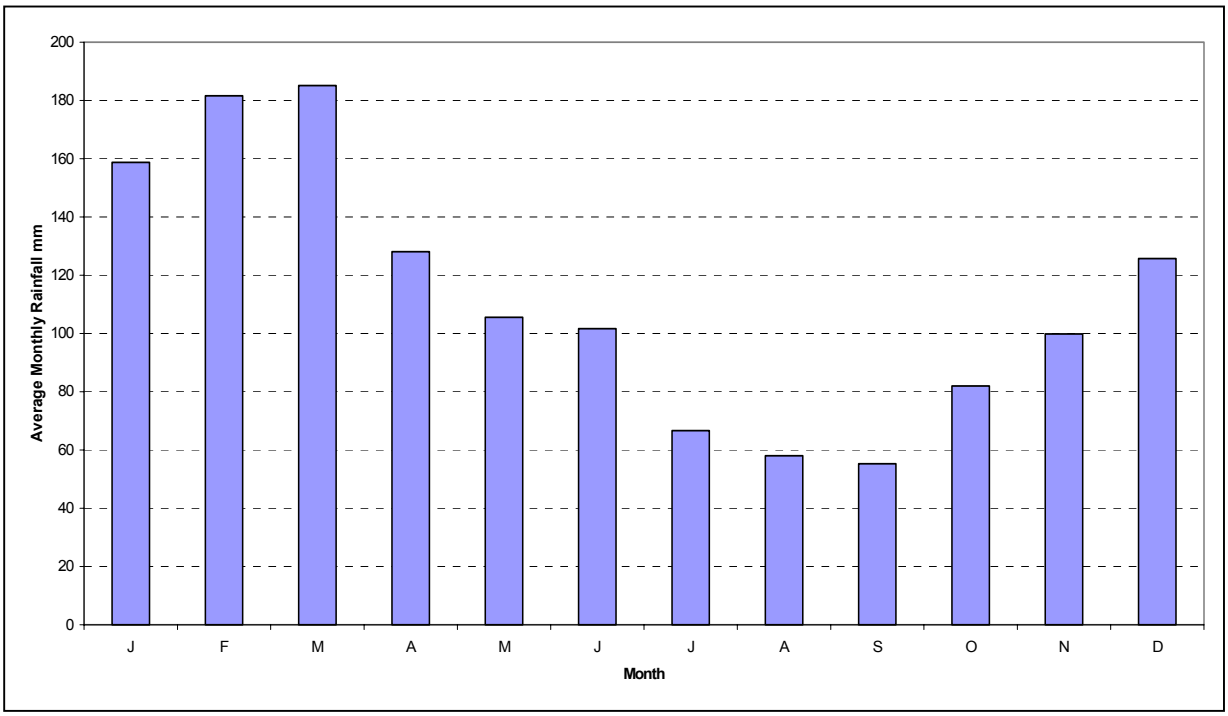


Figure 2.2: Average Monthly Rainfall at Bowraville (Station 59002)

Figure 2.2 shows that the majority of rainfall recorded at this station was in the late summer months, while late winter and early spring is the driest period. The maximum average monthly rainfall is 185mm in March while the minimum average value is 55mm in September.

2.2.2 Streamflow

The Bowraville borefield aquifer is directly fed by the Nambucca River through porous alluvium. No stream gauges are available in Nambucca River upstream of the borefield however DIPNR stream gauge 205006 is located approximately 0.5km downstream of the borefield at the confluence of Nambucca River and South Creek. Figure 2.3 shows the location of this stream gauge in relation to the borefield.

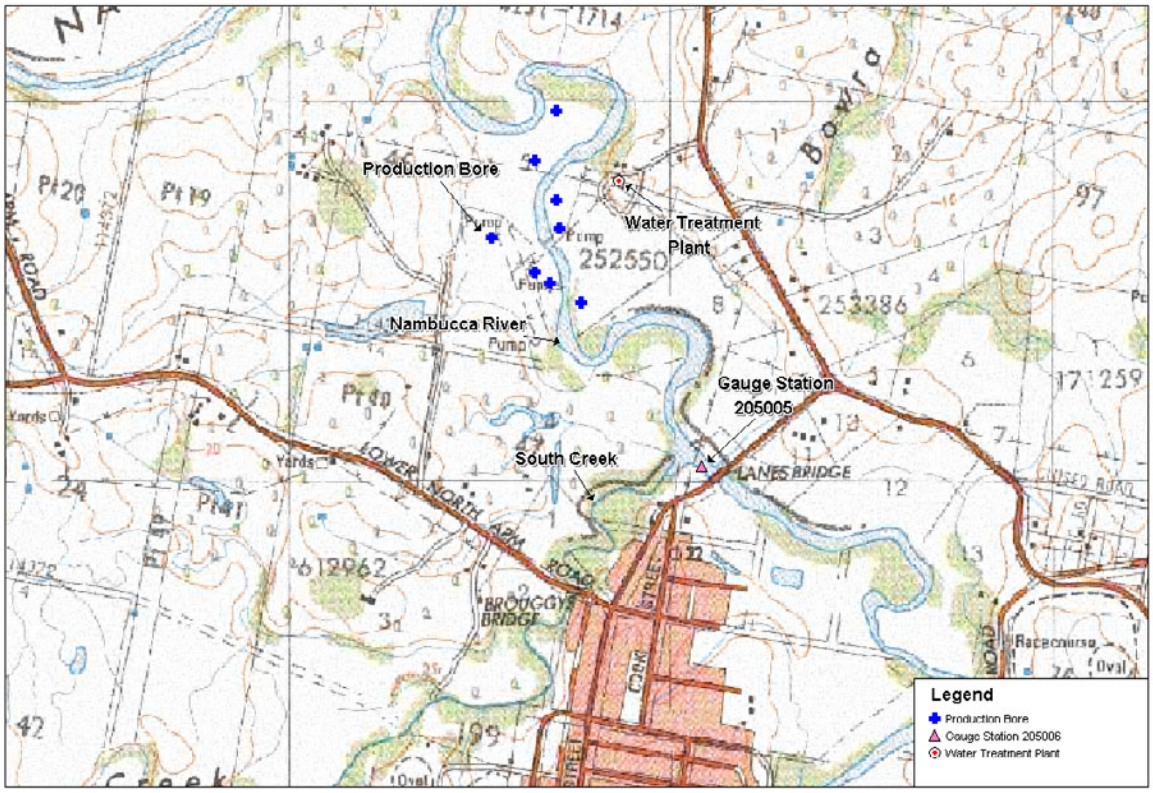
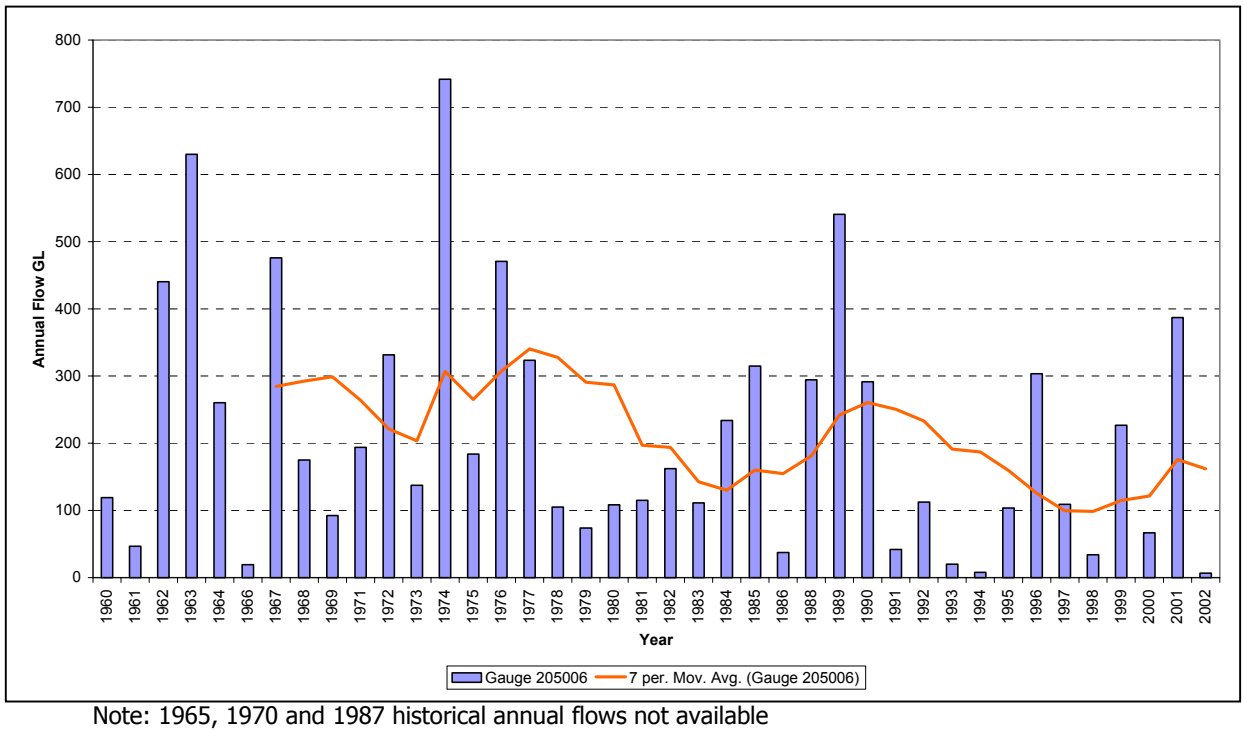


Figure 2.3: Location of Bowraville Borefield and Stream Gauge 205006

Flow recorded at this gauge represents the surface flow from Nambucca River and South Creek and the discharge of subsurface flow through the Bowraville borefield aquifer. DIPNR provided the available daily streamflow from 1959 to the present. Figure 2.4 shows the historic annual streamflow at this gauge. Note that 1965, 1970 and 1987 are missing from Figure 2.4 due to the incomplete data set. DIPNR indicated that the gauge pool control has been washed out several times since 1997, being course sand, and this has resulted in the pool being subject to significant stage fluctuations from tidal activity. DIPNR has edited the data appropriately in an attempt to negate these fluctuations.



Note: 1965, 1970 and 1987 historical annual flows not available

Figure 2.4: Annual Historic Flow Records at Gauge 205006

Figure 2.4 shows that apart from annual flows at stream gauge 205006 having great variability, they also exhibit a long-term decreasing trend. Similarly, the frequency of annual flows below 100GL has increased since 1990. The average annual streamflow for the period of record is 211.3 GL.

Table 2.1 below shows the lowest 30 annual gauge readings in the 40 years of records.

Table 2.1: Ranked Annual Flows at Stream Gauge 205006

Rank	Year	Annual Flow GL	Rank	Year	Annual Flow GL	Rank	Year	Annual Flow GL
1	2002	6.9	11	1969	92.5	21	1982	162.3
2	1994	7.8	12	1995	103.6	22	1968	175.0
3	1966	19.3	13	1978	105.1	23	1978	183.8
4	1993	20.1	14	1980	108.3	24	1971	194.1
5	1998	34.2	15	1997	109.0	25	1999	226.7
6	1986	37.3	16	1983	111.4	26	1984	234.0
7	1991	42.0	17	1992	112.5	27	1964	260.3
8	1961	46.7	18	1981	115.0	28	1990	291.6
9	2000	66.7	19	1960	119.1	29	1988	294.3
10	1979	74.0	20	1973	137.6	30	1996	303.3

Table 2.1 shows that four of the five lowest stream flow values on record have occurred since 1993 supporting the observation that the frequency of low annual flows is increasing.

Figure 2.5 below shows the average, 2002 and 1994 monthly flows at the same gauge.

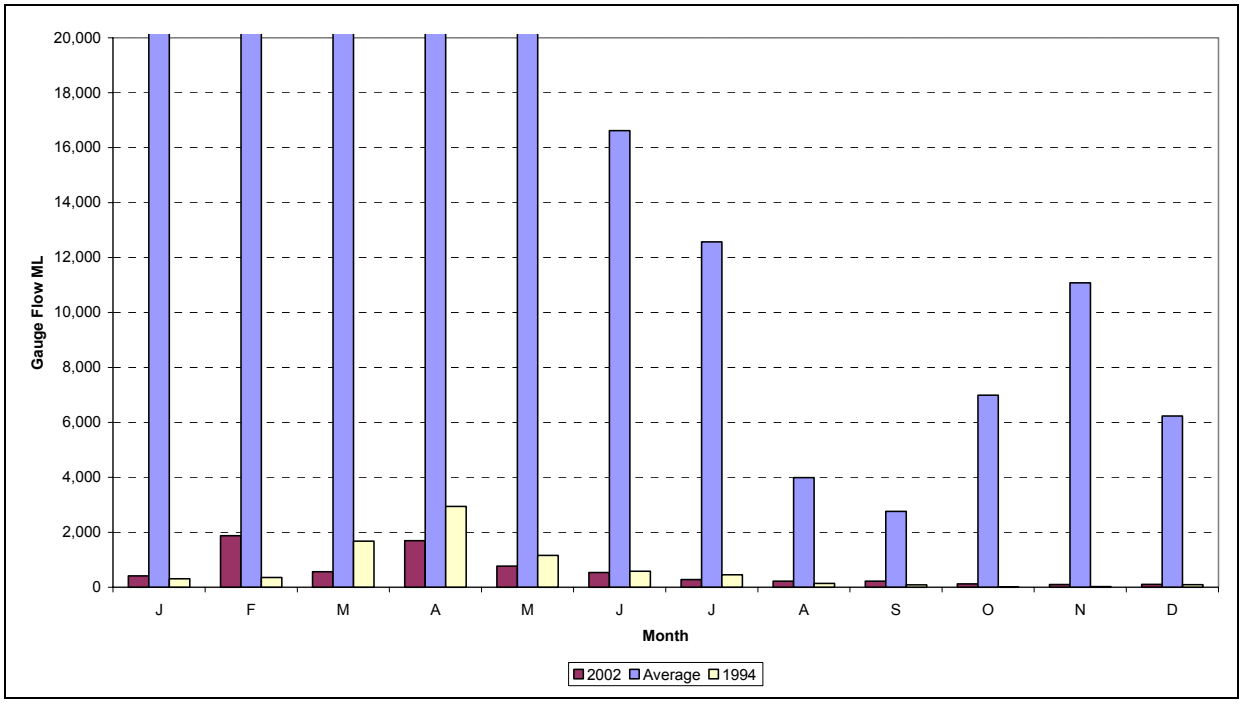


Figure 2.5: Average and Drought Monthly Flows at Stream Gauge 205006

It can be seen in Figure 2.5 that the highest average monthly flows occur during summer and autumn corresponding to high urban water demand periods (see Section 2.3.4), while the lowest average monthly flows are during late winter and early spring. The highest average monthly flow is 37,395 ML in March while the lowest monthly average is 2,765 ML in September. The available data also shows that the high seasonal average monthly streamflow variation is also accompanied by high between-year monthly streamflow variation. This observation is shown in Figure 2.6. Figure 2.6 shows monthly flows for the two years 1971 and 1999 that closest represent the average annual flow for the period of record, which are 194.1 and 226.1 GL respectively. Figure 2.6 also compares the average flows with the flows recorded in the droughts of 2002/03 and 1994/95.

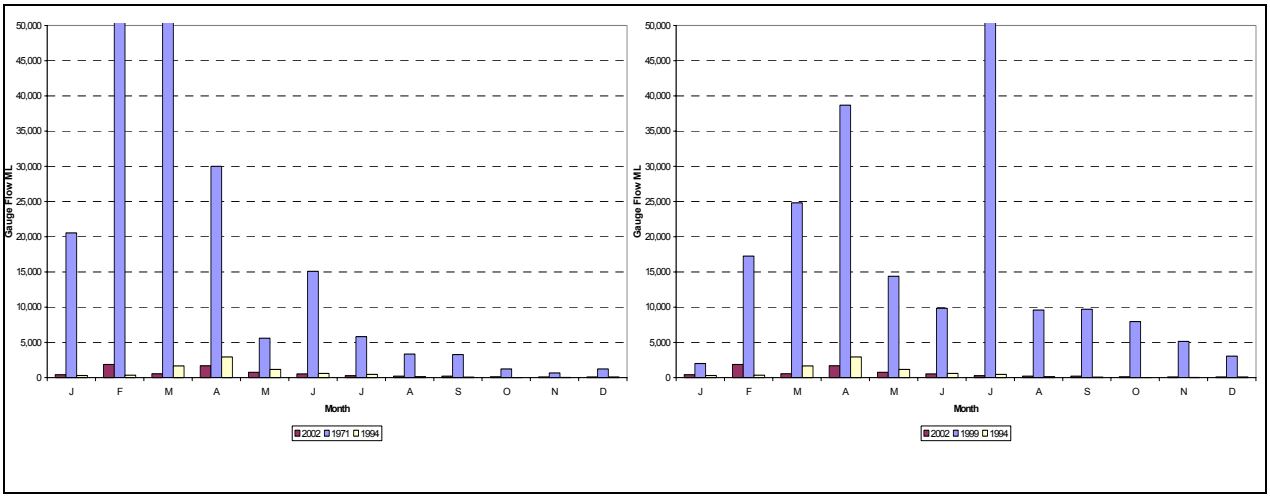


Figure 2.6: Between Year Variability of Monthly Flows at Stream Gauge 205006

2.3 Urban Population and Consumption

2.3.1 Urban Population

Based on the 2001 census figures, the permanent population connected to the water supply system has been estimated at 13,000 people. During peak holiday periods, this population is expected to increase to over 17,000.

Permanent populations for individual towns have been estimated at:

Nambucca Heads (including Valla Beach 1135 and Hyland Park 175)	7,460
Macksville	2,660
Bowraville	960
Scotts Head (including 250 off trunk main)	1,050
Rural Areas	1,110

2.3.2 Normal Urban Consumption

NSC provided annual consumption data from 1977 and peak day demand data from 1989 to date. The Figure 2.7 below shows these data. The figure shows that the highest peak daily demand recorded was 14.9 ML/d in December 1990. Since then, the consumption has dropped with no peak day demands above 10 ML/d until Feb 2002 when 10.6 ML/d was recorded. The figure also shows that the annual consumption has dropped from the high of 3,250 ML in 1991 to a low of 1,687 ML in 1999.

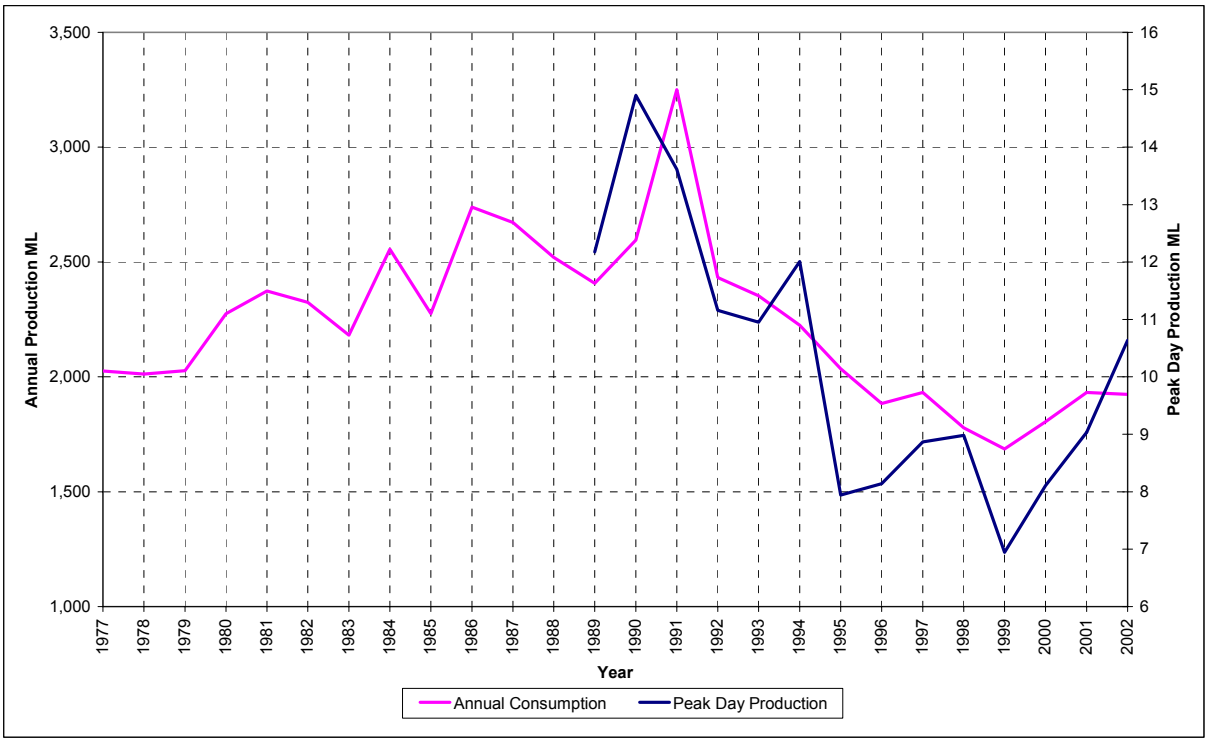


Figure 2.7: Historic Peak Day and Annual Production at Bowraville Headworks

In 1994 NSC introduced a single tariff system comprising of an annual access charge. This pricing system was then augmented in 1996 with the addition of a water rate charge. The impact that the introduction of single and two-part tariff systems had on both peak day and annual consumption is readily noticeable with the sharp drop in consumption. Additionally, consumption decreased significantly in 1999 due to Midco abattoirs closing the majority of their operations. At that time, their consumption accounted for up to 20% of the total Shire use.

2.3.3 Types of Urban Water Customers

To investigate the possibilities for reducing water demand in times of drought, it is necessary to understand customer group consumption. To undertake this customer analysis, metered water consumption was linked to customer category.

These results have been analysed over the 1998-2002 period to determine average annual demand figures for residential, tourist, commercial, industrial, institutional and rural users. Detailed results of this analysis can be seen in Appendix C while a summary of these results have been graphed in Figure 2.8 and tabulated in Table 2.2.

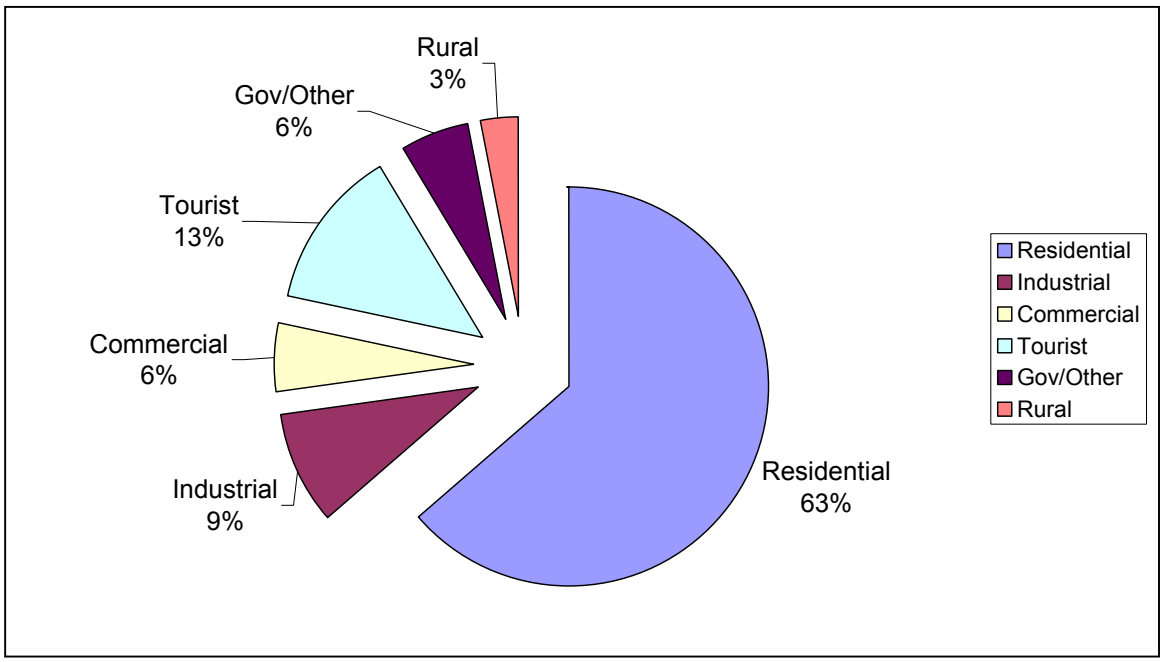


Figure 2.8: NSC Water Demand According to Customer Type

Figure 2.8 shows that residential users account for about 63% of the total consumption in the NDWS. Table 2.2 shows that the average non-residential demand is approximately 1.5 ML/d with the major contributors being the industrial and tourist sector.

Table 2.2: NSC Tabulated Water Demands According to Customer Type

Sector Type	Average (ML/d)*
Residential	2.58
Industrial	0.37
Commercial	0.23
Tourist	0.52
Gov/Other	0.23
Rural	0.12
Total consumption	4.05
Unaccounted for water	0.87
Total Production	*4.92*

Note: * Average was taken from 1997 to present

2.3.4 Seasonal Variation of Urban Demands

Urban demand has a high seasonal component and fluctuates throughout the year. Factors influencing the urban demand within NSC service area include increased domestic outdoor usage during the hot summer months, tourism peaks (summer, Easter and school holidays) and increased rural demand during hotter times.

Figure 2.9 outlines the average monthly demand based on historical data from 1994 onwards, as well as the monthly demands for the 1998 and 2002 financial years. The monthly variation in demands for these two years is representative of the average of the available records for the drought-affected months August to March.

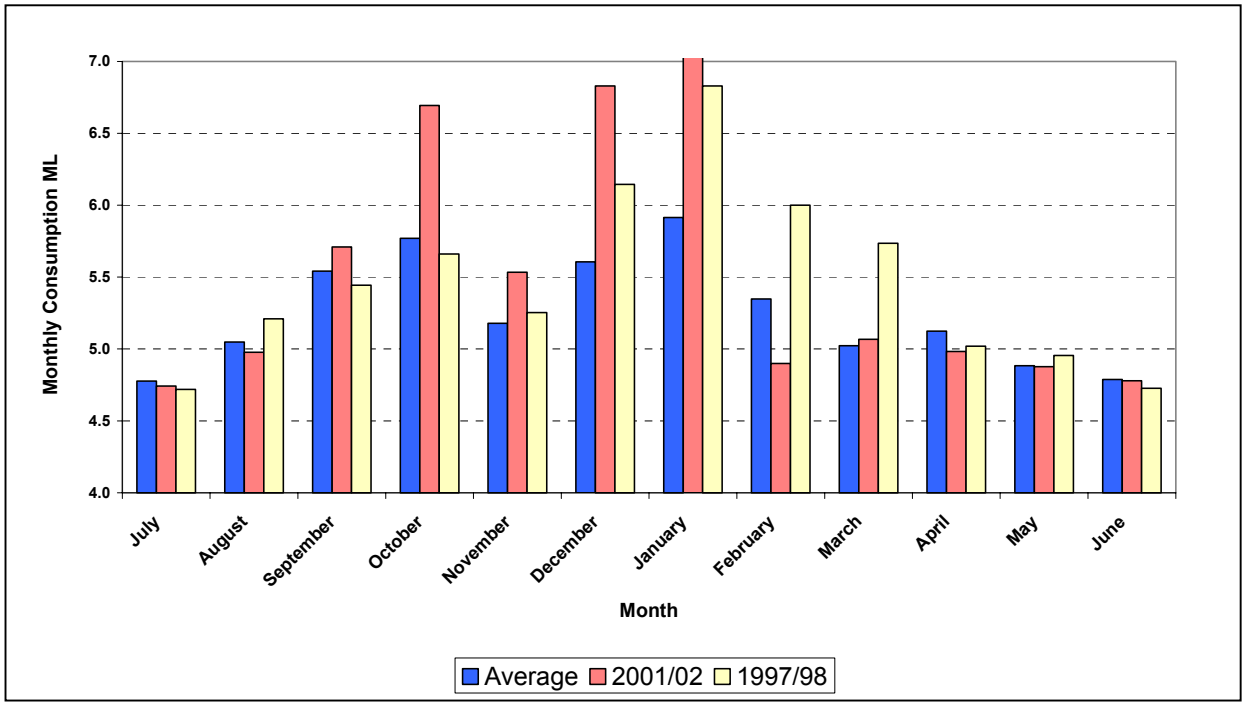


Figure 2.9: Monthly Demand Variation

As expected, the above figure shows that the average monthly demand is highest in summer (5.91 ML/d) and mid spring. This may be due to increased demands resulting from climate and tourism. The above figure also shows that in July average water consumption is the lowest (4.71 ML/d), when both climate impacts and tourism impacts are low.

2.3.5 Treated Effluent Reuse

Currently NSC is reusing 100% of effluent from the Bowraville Sewage Treatment Plant (STP) for fodder production. Analysis indicates that in January 2003, during Level 4 restrictions, average sewer inflows to the Nambucca, Macksville and Scotts Head STPs were approximately 2.9 ML/d. The treated effluent leaving these three STPs could represent a precious source of non-potable water and could be used in the following ways:

- Urban irrigation; and
- Industrial process requirements.

Analysis indicates that an average of 0.31 ML/d of potable water from the water supply scheme is used for irrigation of public parks and garden in NSC. Although the use of potable water for outdoor is banned during water restrictions, the potential to substitute this potable water with treated effluent is an excellent opportunity to maintain the public parks and gardens. NSC should, therefore, investigate the benefit of supplying these areas with treated effluent in the long term.

NSC indicated that opportunities for reusing treated effluent for industrial processes in Nambucca Shire would be limited.

2.4 Drought Performance

2.4.1 Urban Consumption

Nambucca Shire has experienced two serious droughts in the last 10 years namely 1994 and 2002. The most recent drought began in August 2002 and extended through to the beginning of March 2003. During this time NSC progressively increased water restrictions from Level 1 to Level 4. Table 2.3 shows how restrictions reduced average daily demand during this period. The data in Table 2.3 was obtained from NSC pumping records.

Table 2.3: Reduction in Demand During Water Restrictions of 2002/03 Drought

Restriction Level	Restriction Application Date	Period of Restriction	Average Daily Demand ML/d
0	1 Aug	1 Aug – 21 Aug	6.35
1	22 Aug 02	27 Aug – 28 Oct	5.21
2	28 Oct 02	28 Oct- 13 Nov	5.13
3	14 Nov 02	14 Nov-15 Dec	4.36
		16 Dec-1 Jan	4.59
4	2 Jan 03	2 Jan-26 Jan	4.51
		27 Jan- 19 Feb	3.90

Historical unrestricted average demands in summer months have been in the range 5.0 to 7.5 ML/d and in drought conditions it would be expected that unrestricted demands would be towards the high

end of this range. Based on demands recorded during this drought period, it could be said that restrictions clearly have been effective in reducing average demand.

Figure 2.10 compares for the same period the average demand for the period of available records to the demands recorded leading to the drought and drought demands under restrictions. In January 2002 during the summer leading to drought, NSC introduced Level 1 restrictions, however these were lifted in February 2002 after significant rainfall.

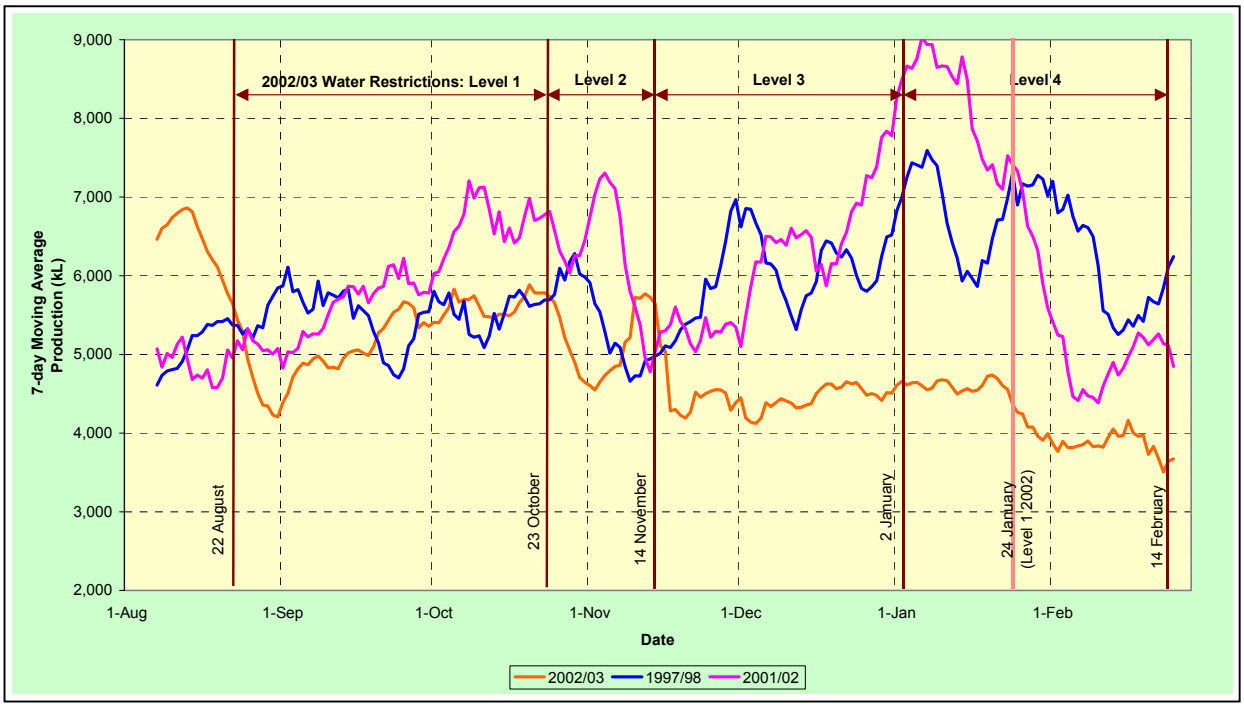


Figure 2.10: Customer Behaviour During Water Restrictions in Nambucca Shire

From Figure 2.10 the following observations can be made:

- Level 1 and Level 2 restrictions achieved a rapid reduction in consumption in the short term however after a period of time the consumption seems to increase, most probably due to customers not being continually aware of the current restriction status;
- Customer consumption response to Level 3 and Level 4 restrictions were relatively "inelastic" as the limits of reduction in residential outdoor use are reached; and
- Level 1 restrictions, when introduced in January 2002, produced a highly "elastic" consumption response from customers.

The above customer responses indicate that the level of 'effectiveness' of a restriction is dependent on the season in which it is imposed. Thus it is important NSC's future restriction policy and the application of the policy takes the seasonal effect into account.

Table 2.4 below shows the estimated residential and non-residential consumption during the 2002/03 drought based on the consumption data from 1 July 2002 to 31 December 2002. Appendix C contains a detailed discussion relating to the assumptions used in this analysis.

Table 2.4: Estimated Reduction in Metered Consumption During 2002/03 Drought

Date	Average Residential Consumption		Average Non-Residential Consumption	Average Unaccounted for water	Total Production	Assumptions
	ML/d	L/p/d	ML/d	ML/d	ML/d	
1 July – 31 Dec	2.74	183	1.58	0.93	5.25	• Average of period • 15,000 population
15 Dec	2.30	153	1.12	0.93	4.35	• 25% reduction in residential demand
19 March	2.18	145	0.79	0.93	3.90	• 50% reduction in non-residential demand

From the above table, it would seem reasonable to assume that level 4 restrictions have reduced residential consumption to approximately 150 L/c/d and have had a significant effect on non-residential consumption in areas where water is normally used externally – golf clubs, bowling clubs open space irrigation etc.

2.4.2 Aquifer Storage Level

Figure 2.11 below shows the average standing water level (SWL) in the aquifer during the 2002/03 drought period along with the estimated aquifer inflow. The aquifer inflow was estimated by constructing a simple water balance model using the change in aquifer storage, NSC extraction and stream flow gauge records as input variables. The model details are in Appendix D.

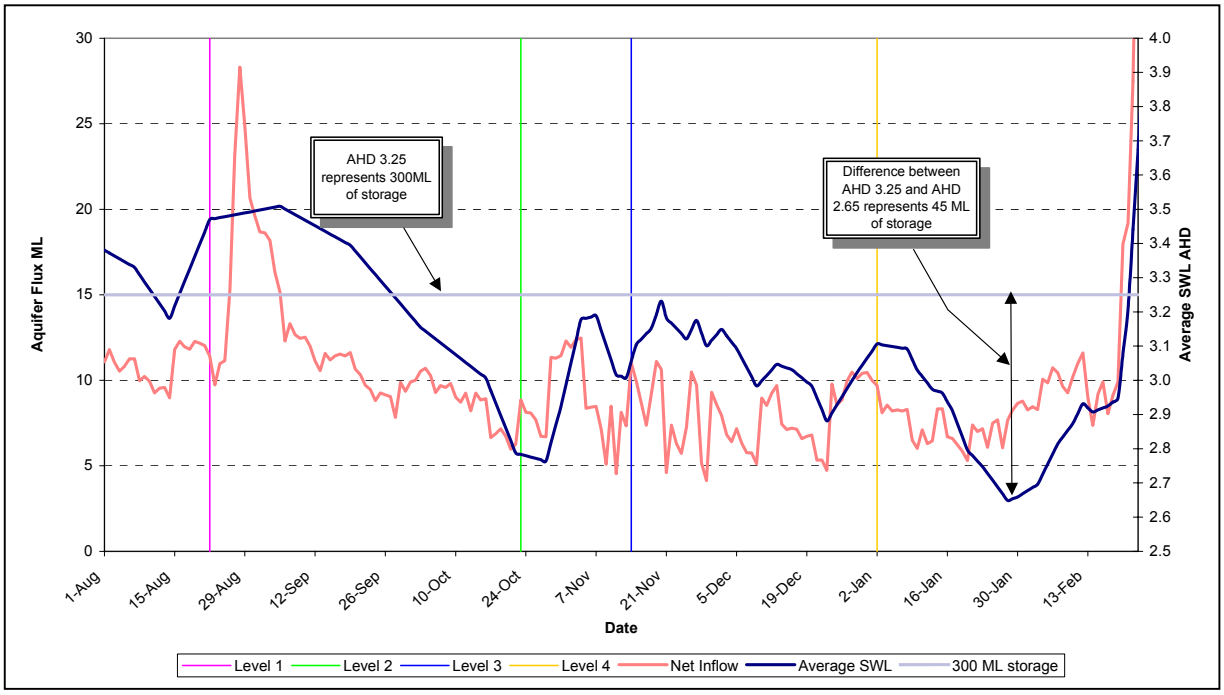


Figure 2.11: SWL Vs Aquifer Inflow During 2002/03 Drought

Figure 2.11 confirms the high connectivity between the aquifer and the surface flows. Figure 2.11 also shows that when flows decrease the rate of depletion of the aquifer storage is extremely high. This confirms that the sub-surface flow is continuously draining to the estuary. Thus it is important that caution is applied when using the aquifer levels as trigger for restriction levels.

Figure 2.12 shows the surface flows recorded at the gauging station together with the flows extracted by NSC for urban use. Although during the drought there were no surface flows past the borefield and in South Creek, Figure 2.12 shows that there was sufficient volume of fresh water available at the gauging station to meet urban demands. This further reaffirms the presence of subsurface flows.

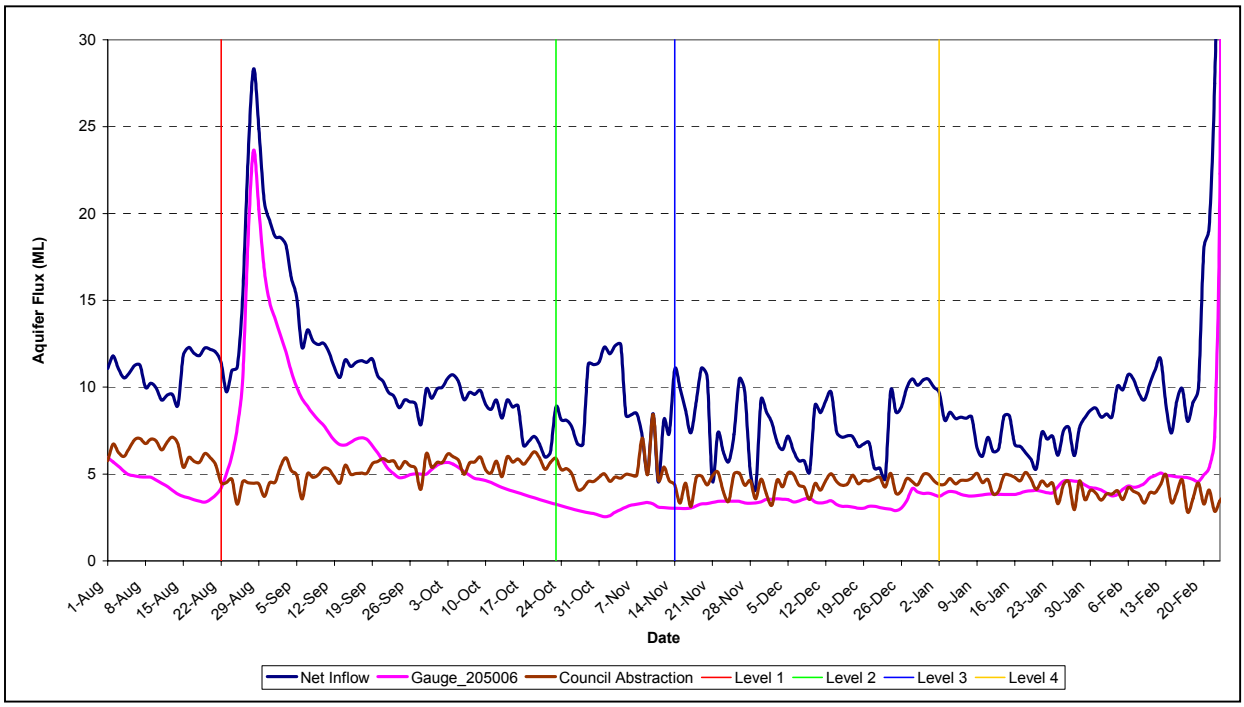


Figure 2.12: Nambucca River NSC Extraction Versus Total Flow at Gauge During 2002/03 Drought

2.4.3 Risks

It has not been possible in the preparation of this DMP to obtain a full understanding of groundwater/surface flow mechanisms in the Nambucca River / South Creek confluence. Records provided by NSC and DIPNR indicate that there is significant subsurface flow into and out of the Bowraville Borefield. As an example of this, between 28/1/03 and 17/2/03, NSC estimated that flow in the Nambucca River, above NSC defined Borefield Location 4, was in the range of 8.0 ML/d to 10.0 ML/d. During this period, NSC was withdrawing from the borefield on average 3.91 ML/d, there was no surface flow at the borefield and groundwater levels increased from RL 2.65 on 28/1/03 to RL 2.9 on 17/2/03. This represents an average increase in storage of 1.05 ML/d. This approximate analysis, which ignores transient effects, indicates that subsurface flow out of the borefield averaged 4.04 ML/d in the period. The flow of about 4.5 ML/d recorded by the gauge seems to confirm this assertion, as NSC also indicated no observable surface flow in South Creek.

Figure 2.13 below shows a cross section of the Bowraville Borefield with standing water levels at various dates. The existence of significant underflow during the 2002/2003 drought is also supported by the slope of the groundwater table through the borefield (1 in 250) coupled with the high transmissivity of the alluvium (1,000 to 15,000 m^2/d reported by Water Studies P/L). It is noted that DIPNR flow records of the October/ November 1994 drought did not indicate similar emerging sub-

surface flows at the Nambucca River Gauge. As mentioned in Section 2.2.2, DIPNR have advised that, in this period, the gauge control was at a higher level on a sand gravel base and therefore sub-surface flow may not have been recorded. The control level is now below tidal influence possibly allowing emergence of sub-surface flow.

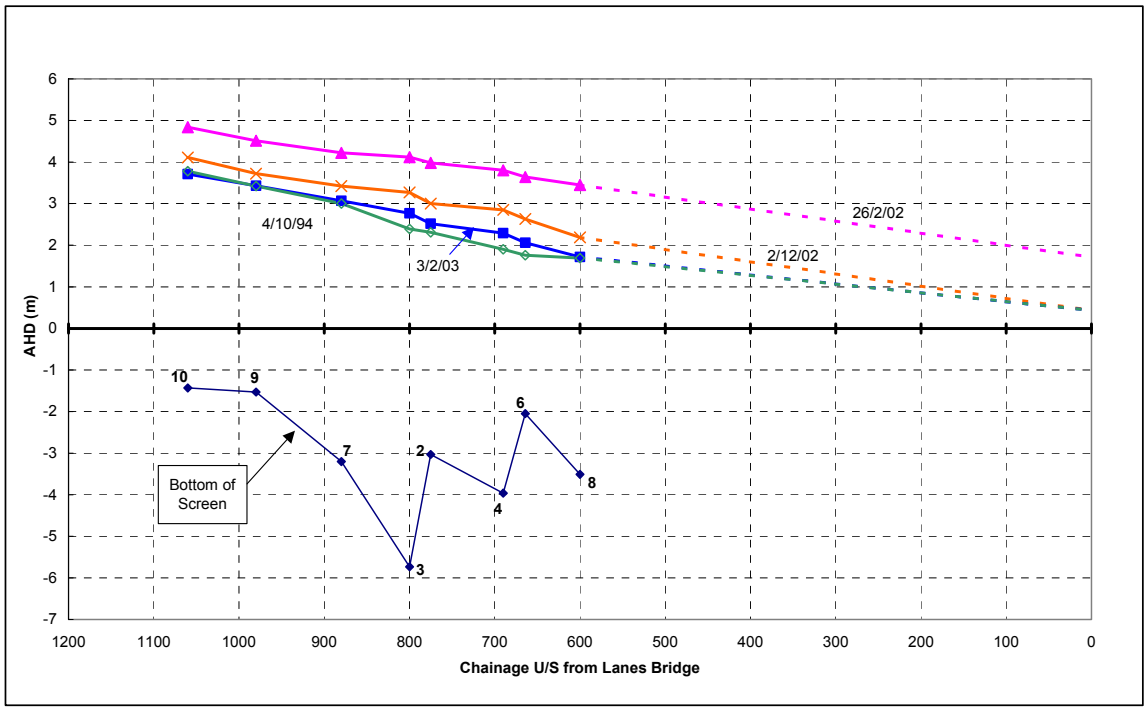


Figure 2.13 Bowraville Borefield Cross Section

Subsurface flow through the borefield of the order of 3 to 5ML/d would be significant in extreme drought conditions. As a consequence the following observation could be made:

- NSC's drought storage assessed at 300 ML would not be secure, as it would have in effect a significant "leak". The reason this was not obvious during the 2002/2003 drought was that there were at all times sufficient inflows into the groundwater storage to keep storage levels high and to mask the leakage out.
- The subsurface flow, which emerges before the DIPNR gauge, coupled with any flow in South Creek, represents a potential emergency water source. Thus NSC should consider using this water with DIPNR concurrence.

It is concluded that NSC was able to maintain supply through careful monitoring of groundwater levels and with progressive imposition of restrictions and with DIPNR regulating irrigation through an extreme drought on record with limited draw down on available groundwater storage. Gaining access to the residual flows would possibly further enhance the security of the existing water supply system.

3 DROUGHT MANAGEMENT PROCESS

Figure 3.1 below shows the overall drought management process for Nambucca water supply scheme.

ACTIONS

ALERT	APPROVALS	SPECIFIC TASKS	COMPLIANCE / MONITORING
➢ Community re: Level 1 ➢ DEUS re: Restriction status	➢	➢ Review and establish emergency Demand Reduction Program (DRP) ➢ Undertake leakage desktop study ➢ Activate Level 1 Communication Strategy (CS) ➢ Rectify minor leakages ➢	➢ Police restriction levels ➢ Issue warning to offenders
➢ Community re: Level 2 ➢ DIPNR re: Rural extractions on Nambucca River and South Creek ➢ DEUS re: Restriction status	➢ NSC re: ratify non-residential customer Water Management Plans (WMP) and Leakage Reduction Program (LRP)	➢ Activate Level 2 CS ➢ Implement Leakage Monitoring Program (minor repairs) ➢ Review drought indicators weekly at BOM Website ➢ Do aerial photo/satellite image to locate water sources ➢ Rectify major leaks	➢ Police restriction levels ➢ Fine offenders
➢ Community re: Level 3 ➢ DEUS re: Restriction status ➢	➢	➢ Source resources for activating residual flow harvesting ➢ Activate Level 3 CS ➢ Review WMP ➢ Review drought indicators weekly	➢ Monitor leakage and ensure that is less than 0.5 ML/d ➢ Police restriction levels ➢ Fine offenders
➢ Community re: Level 4 ➢ DEUS & DIPNR re: Restriction status ➢ DIPNR to restrict rural extractions on Nambucca River and South Creek	➢ DIPNR and Fisheries re: Licence and Permit for residual harvesting ➢ DEUS re: Emergency Works Subsidy ➢ DIPNR re: Extraction licence for South Creek Bores	➢ Activate Level 4 CS ➢ Review drought indicators daily ➢ Investigate South Creek treatment requirements	➢ Increase policing of restriction levels ➢ WMP compliance ➢ Monitor leakage (weekly) and ensure that is less than 0.5ML/d
➢ Community re: Level 5 ➢ DEUS & DIPNR: Restriction status ➢ EPA re: Sewage issues ➢ DoH re: Public health issues including potential grey water reuse ➢ Dept. Education re: Water quality issues	➢ DoH re: Greywater reuse approval requirements	➢ Construct residual flow harvesting works ➢ Plan for implementation of Intensive DRP ➢ Activate Level 5 CS ➢ Review drought indicators daily ➢ Review DRP/WMP for top 20 users ➢ Investigate Kingsworth Storage requirements	➢ Police increased restriction levels ➢ Fine offenders ➢ Monitor leakage (daily) and ensure that is less than 0.5ML/d
➢ DEUS & DIPNR: Restriction status ➢ Local Emergency Management Officier (LEMO): DISPLAN provisions	➢ DEUS re: Emergency works subsidy ➢ DIPNR re: Water carting extraction licence	➢ Commission residual flow harvesting works ➢ Construct South Creek works ➢ Investigate and plan necessary recourses for water carting ➢ Commence Intensive DRP ➢ Review drought indicators daily ➢ Investigate water carting sources	➢ Police restriction levels ➢ Fine offenders ➢ Surprise Inspections ➢ Zone residential meter readings
➢ Community re: Level 6 ➢ LEMO assistance in coordination of resource management	➢ NSC re: DISPLAN declaration and LEMO	➢ Commission South Creek works ➢ Construct Kingsworth Storage infrastructure ➢ Finalise water carting resources ➢ Activate Level 6 CS ➢ Review drought indicators daily ➢ Initiate sewage treatment plant (STP) performance monitoring ➢ Investigate potential odor problem points	➢ WMP compliance for top 20 users ➢ Police restriction levels ➢ Fine offenders ➢ Zone residential meter readings
➢ Request of Minister for Emergency Services to appoint Emergency Coordinator if required	➢ Declare DISPLAN ➢ DISPLAN Coordinator	➢ Commission Kingsworth Storage option ➢ Commence water carting trialing ➢ Review drought indicators daily ➢ Increase STP performance monitoring ➢ Initiate critical odor point monitoring	➢ WMP compliance for top 20 users ➢ Police restriction levels ➢ Fine offenders ➢ Zone residential meter readings
Refer to ERS for Extreme Emergencies			

Figure 3.1: NSC Drought Management Process

Figure 3.2 shows the timing of drought management and emergency response measures together with required NSC actions.

PRE DROUGHT PLANNING / DROUGHT RESTRICTIONS AND TRIGGERS				Department of Infrastructure Planning and Natural Resources Actions	COUNCIL ACTIONS					
					Demand Reduction Program	Locate and Repair Major Leaks	Residual Harvesting	Equip and Connect South Creek Borefield	Pump From Kingsworth Storage	Water Carting
					Establish and maintain emergency demand reduction program if not already implemented	Periodically assess leakage and take action to reduce to below 10% annual production (0.5 ML/d) if not already implemented	Complete investigations and designs Obtain necessary approvals	Complete investigations and designs Obtain necessary approvals	Complete investigations and designs Obtain necessary approvals Establish plan of management	
RESTRICTION LEVEL	TOTAL SUPPLY (ML/d)	TRIGGERS: Average Bore Level AHD m	TRIGGERS: Other							
1	5.0	3.2			Commence	Commence				
2	4.8	3.1				Review Current Situation				
3	4.3	3.0			Increase focus on program	Ensure bakage is less that 0.5 ML/d				
4	3.8	2.9		Stop Irrigation on Nambucca River (upstream of borefield) and South Creek						
5	3.7	2.8					Start Construction			
		2.6			Commence Intense Program		Commission	Start construction		
6	3.0	2.5						Commission	Start Construction	Start Final Planning
	2.9	1.9	South Creek Empty						Commission	Trial 1ML/d
Emergency		0.6	Kingsworth Storage Empty							Commission to 1 ML/d
		0.3								Increase to 2 ML/d
		0.0								Increase to 2.8 ML/d

Figure 3.2 Drought Management and Emergency Response Measures' Timing

Figure 3.3 shows the remaining connected storage and minimum times between each restriction level.

Restriction Level	TARGET SUPPLY					TRIGGERS		EMERGENCY MEASURE						CONNECTED STORAGE				
	Residential		Commercial / Industrial	UFW	Total	Average Bore Level	Other	Demand Manage - ment	UFW Locate & Repair Major Leaks	Harvest Residual Flows	South Creek Borefield	Kingsworth Storage	Water Carting	Nambucca River	South Creek	Kingsworth Dam	Total	Minimum Time
	L/c/d	ML/d	ML/d	ML/d	ML/d	RL AHD m								ML	ML	ML	ML	Days
1				0.9	5.0	3.2								296			296	
2					4.8	3.1			Reduce UFW to 10%					289			289	56
3					4.3	3.0								281			281	
4	150	2.2	1.1	0.5	3.8	2.9								274			274	15
5	150	2.2	1	0.5	3.7	2.8								266			266	21
						2.6		Intense Program		Commission				251			251	11
6	100	1.5	1	0.5	3.0	2.5					Commission			244	56		300	101
	100	1.4	1	0.5	2.9	1.9	South Creek Storage 0 ML					Commission	Trial 1 ML/d	199	0	150	349	150
Extreme Emergency						1.9	Kingsworth Storage 0 ML						Commission 1 ML/d			0		108
						0.6							Increase** to 2 ML/d					
						0.3							Increase** to 2.8 ML/d					

Figure 3.3 Connected Storage and Minimum Waiting Times

4 DROUGHT MANAGEMENT AND EMERGENCY RESPONSE STRATEGY MEASURES

4.1 Drought Management Measures

Drought management measures consist of both demand reduction and the development of alternative supply source opportunities.

4.1.1 Demand Reduction Opportunities

Demand reduction opportunities are considered as preventative measure, as the demand reduction programs assist in reducing demand/consumption both in the short and long terms. In view of the long-term benefits, NSC should actively pursue the following opportunities on a 'business as usual' basis.

Communication

The communication of information between the water utility, relevant public authorities and the community is fundamental to the success of the demand reduction measures and in achieving the targets in this DMP. The two key components of any successful communication strategy are:

- The message being conveyed; and
- The medium used to convey that message.

It is not within the scope of this plan to develop a detailed communication strategy. It is essential, however, that any communication plan should notify customers and public authorities of what actions are required at each level of restrictions. The Workshop undertaken prior to the development of this DMP (see Appendix F) outlined that the communication strategy must also address health warnings, alerting the community of risks relating to restricted flows and be consistent with other water utility messages.

It is understood NSC has an existing communication strategy. It is recommended that this strategy be reviewed and updated taking into account the learnings of the 2002/03 drought event and the suggestion in this DMP.

Restriction Policy and Penalties

As noted in Section 2.1.3, the new water restriction policy adopted by NSC has added an additional level of restrictions to the previous framework and represents a hybrid of the work undertaken at draft stages of this DMP, and the NSW North Coast model for consistent water restrictions across the north coast region. Appendix B contains the current NSC drought restriction policy.

Policing of the restriction levels is important to achieve lower demand targets. NSC currently has a fines system in place for dealing with offenders.

Residential Water Saving Opportunities

Internal Residential Savings During 2002/03 Drought

The reduction of residential demand to 150 L/c/d achieved in the 2002/2003 drought, represents excellent community cooperation in conserving water. Further reduction of internal household water use would be difficult and would require full community understanding that a critical situation had been reached. At 150 L/c/d, internal household water use could be distributed on average as shown in Figure 4.1.

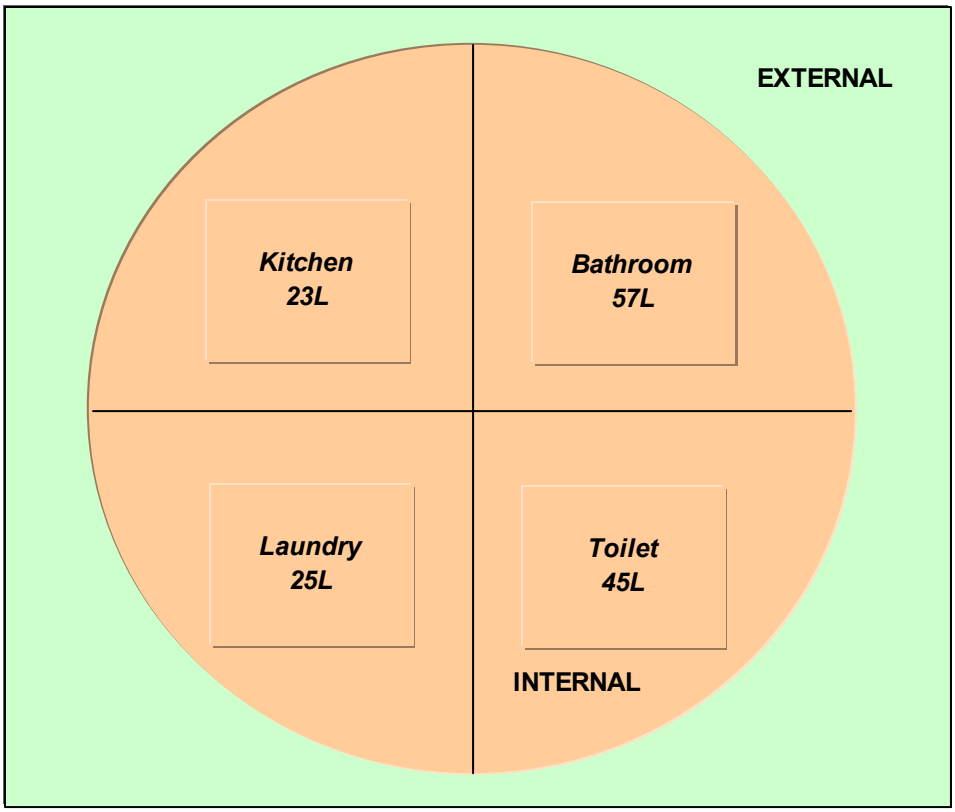


Figure 4.1: Distribution of Internal Household Use

Toilets

Modern toilet suites have a 6/3L dual flush cistern. Earlier toilet suites had 9/4.5L dual flush cisterns or 11L single flush cisterns.

Assuming:

- Distribution of cisterns are

  11L cisterns 50%

  9/4.5L cisterns (AA) 15%

  6/3L cisterns (AAA) 35%

- 1 full flush and 5 half flushes/c/d on average

Water savings of 10 L/c/d could be achieved, if the maximum flush of all earlier types of cisterns was reduced to 7 L. This could be achieved through the use of cistern displacement devices, "water stops" or adjustment to float valves. A somewhat greater saving could be achieved if a significant number of households converted older toilet suites to 6/3L cisterns.

Shower Heads

Modern water efficient shower roses can reduce bathroom water use.

Assuming:

- Present distribution of shower roses are:

  14 L/min (A) 40%

  10 L/min (AA) 45%

  7 L/min (AAA) 15%

- An average shower time of 5 minutes.

Water savings of 11 L/c/d could be achieved, if all 14 L/min shower roses were replaced with a mixture of AA and AAA roses for the same average showering time.

Kitchen, Laundry and Bathroom Taps

If tap aerators were fitted to all kitchen, laundry and bathroom taps, savings of say 5 L/c/d may be achieved.

Summary

Such alteration to fixtures may achieve a total reduction in consumption of the order of 26 L/c/d.

NSC currently does not have powers to make retrofitting water efficient appliances compulsory. However a high level of uptake might be achieved if NSC ran a persuasive publicity campaign offering significant subsidy and organising local plumbers to affect the changeovers.

NSC could also consider additional options to reduce household water use, if target reduction is not being achieved. These options include:

- Significantly increasing the price of water, to further motivate community to use water carefully;
- Reducing supply pressure. This could be achieved by the installation of pressure reducing valves in the reticulation system or by installing flow restrictors in household supply lines; and
- Increasing monitoring of residential consumption, such as reading the household meters every two weeks instead of the current 6 month interval.

Non Residential Water Saving Opportunities

NSC could develop simple checklist type formats of water management plans (WMP) for a variety of typical industrial, commercial, tourist, sporting club etc users and issue to all non-residential users to complete and return to council. These WMPs could require users to segregate their estimated water use into such categories as:

- Process;
- Wash down;
- Food preparation;
- Bathroom/toilet; and
- Laundry.

The WMPs could also require:

- Details, as appropriate, of plumbing fittings e.g. number of toilets, showers;
- Results of an overnight leakage check;
- Occupancy rates of rooms; number of employees etc; and
- Proposals to affect a nominated and substantial reduction in water use.

All WMPs submitted would need to be reviewed and audited by NSC to ensure the plans are comprehensive and optimum water savings have been achieved. Auditing could include random checking to ensure the actions in the plan have been implemented and nominated water saving targets are being achieved. NSC could also consider extending any residential subsidy program to non-residential users with particular attention to large tourist facilities – caravan parks, motels etc. NSC should develop a strategy to deal with non-residential users who were not cooperating with this voluntary approach e.g. install flow restrictors in their service connections. The objective of this strategy would be to constrain non-residential water use to less than 1.0 ML/d during the peak tourist season. Provision of restriction exemption certificates could also be made conditional on consistently achieving targets nominated in the WMP.

Water Saving Program Costs and Logistics

Residential and Non-Residential Water Saving Opportunities - Cost of Implementation

Residential User Costs	
Prepare Program	$20,000
Implement Program ($100/residence)	$600,000
Sub-Total	$620,000
Non-Residential User Costs	
Prepare format for water management plans and issue	$10,000
Review and audit 20 largest users	$20,000
Review plans prepared by other non-residential customers	$5,000
Sub-Total	$35,000

Residential and Non-Residential Water Saving Opportunities - Lead Time for Implementation

A lead-time of the order of 3 months would be necessary assuming NSC already had in place an active demand management program.

It would be necessary for NSC to develop a detailed implementation plan, if emergency demand reduction measures were to be adopted.

It is expected that consumption could be reduced close to 100L/c/d, if most of these techniques were employed. Further, there would be some ongoing benefit towards long-term demand management to the extent that water efficient appliances had been installed. Reduction of residential daily demand from 150 to 100 L/c/d would result in a reduction in daily demand of 0.75 ML/d.

Unaccounted for Water (UFW) and Leakage

Unaccounted for water (UFW) is the difference between the volumes of water produced and recorded at the borefield meter and the total water consumption recorded by all consumer meters. It is made up of leakage from NSC's system of trunk mains, reticulation mains and service connections and accumulative inaccuracies in NSC and consumer meters. Table 4.1 below details UFW in the Nambucca Shire as calculated from NSC records.

Table 4.1 Nambucca Shire Historical Unaccounted for Water (ML)

Year	1997/1998	1998/1999	1999/2000	2000/2001	2001/2002	2002/2003*
Production	1,998	1,581	1,758	1,801	2,031	1,902
Consumption	1,751	1,308	1,442	1,470	1,625	1,563
UFW	248	273	316	331	405	440
%UFW	12	17	18	18	20	18

* 2002/2003 values are 2 x Consumption from 1/7/02 to 31/12/02

NSC's figures of 18% to 20% UFW in recent years are quite high. The 340 ML expected in 2002/2003 is 0.93 ML/d.

NSC provided a copy of a report prepared by Hunter Water Australia (HWA) in 1996 relating to an investigation it carried out into unaccounted for water in the Nambucca District Scheme (Ref. 2). Table 4.2 contains a summary of these results.

Table 4.2: Results from 1996 HWA Unaccounted for Water Test

Area	Leakage L/hr		Properties Served	Leakage L/hr/property
South Macksville	4,623		249	18.6
Scotts Head	6,757		466	14.5
Macksville	4,548		758	6.0
Bowraville	3,655		430	8.5
Nambucca	14,502		2,417	6.0
Trunk Mains	9,853		414	23.8
Total	43,938	1.05 ML/d	4,734	12.8

Whilst HWA reported these night flows as leakage, it is likely that there would have been some small demand at the time measurements were taken and actual leakage would have been slightly less than 1.0 ML/d. This leakage would represent losses from NSC's reticulation system including service connections up to consumers' meters, losses from all consumers' plumbing systems, and possible errors in data collection.

Leakage is largely dependent on pressure and physical condition of pipes and fittings, and is somewhat independent of demand. Thus considering the 1996 HWA survey results and the estimated current UFW figure of 18%, it is possible that total leakage (NSC and consumers systems) could be as high as 1 ML/d. In an emergency situation when NSC is endeavouring to supply 3 ML/d to meet basic customer needs, the need to supply an additional 1 ML/d to overcome leakage would represent a very significant cost and add to supply difficulties.

As part of its general demand management program, NSC should periodically assess leakage from the water reticulation system and take action to reduce water losses to an acceptable level (not more than 10% of annual water production). At the onset of drought NSC should, if necessary, determine the level of leakage and if more than 10% locate and repair all significant leaks.

UFW and Leakage - Cost of Implementation

The indicative cost of undertaking leakage survey and major leak repair work is as follows:

Reservoir drop tests	$20,000
Leak detection survey (specialist firm – 2 men plus equipment for 30 days)	$30,000
Repair Leaks (20 major leaks @$1,000)	$20,000
Total	$70,000

UFW and Leakage - Benefits

If it is found that leakage makes up a major proportion of the unaccounted for water, it should be possible to reduce this figure to less than 10% of average annual consumption or say 200 ML/a. That is an investment of the order of $70,000 has the potential to save up to 140 ML/a or 0.4 ML/d. This saving would continue for some time past the end of the drought period, but would require NSC to periodically carry out leak detection surveys and repair work in the future if it desires to maintain low leakage levels. Additionally, during higher restriction levels NSC could also consider reducing the response time to fix reported leaks.

UFW and Leakage - Lead Times for Implementation

Investigation to better understand the breakdown of the present high level of unaccounted for water including the extent and broad location of leakage problems should be undertaken in the near future. The program outlined above to review the situation as well as locate and repair major leaks could well take a minimum of 3 months.

4.1.2 Local Supply Opportunities

There are a number of local water source supply opportunities available to NSC during emergencies. These opportunities include:

- Residual flow harvesting;
- South Creek Bores;
- Kingsworth Storage;
- Scotts Head Groundwater System;
- Alternative Scotts Head Groundwater Storages; and
- Desalination.

Figure 4.2 below shows the location of these alternate water sources.

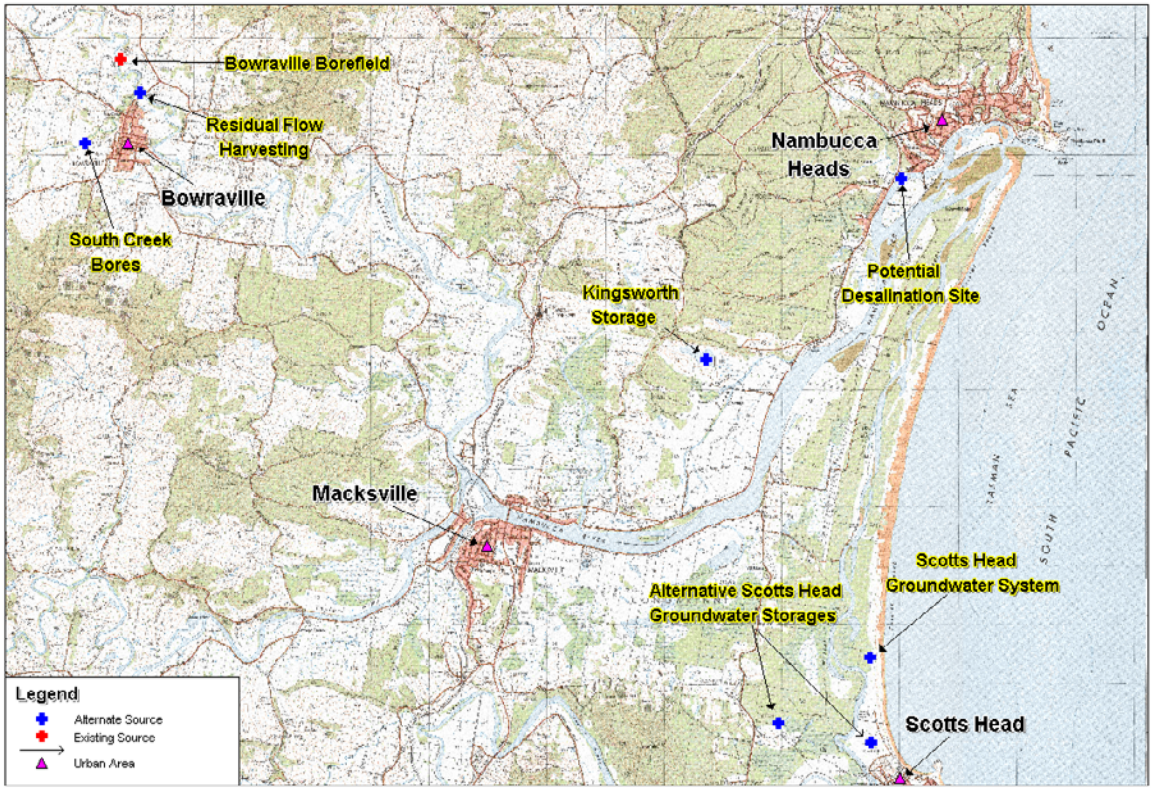


Figure 4.2: Alternate Local Water Source Locations

Residual Flow Harvesting

Description

As indicated in Section 2.4.2, there were significant flows throughout the last drought in the Nambucca River downstream of the Bowraville Borefield. It is likely that most of this water is the emerging subsurface flow that has passed through the borefield. This water could be harvested economically during drought and extreme conditions, with minimal subsurface inflow to the borefield.

To harvest this residual flow, it would be necessary to construct a low temporary weir with sandbags within the Nambucca River reaches, upstream of the DIPNR gauge to create a pumping pool. The weir would also act as a barrier to prevent contamination with saline water at very high tides. The control at the DIPNR stream gauge 205006 just downstream of Lanes Bridge is at AHD 0.43. A hired pump would draw water from the weir pool and pump through an appropriately sized above ground butt-welded polyethylene pipeline to discharge into the balance tank. Alternatively, the water may be discharged at the head of the borefield to improve quality and to minimise net loss of water from the aquifer storage. Correspondence undertaken with NSW Government Agencies indicated their preference for discharging the harvested water into the balance tank to minimise transmission losses and protect the bore water quality (Appendix H). The decision on the preferred discharge location would be made by NSC based on the prevailing water quality and the likely environmental and social impact associated with each discharge location option. Further, although it is proposed to locate the temporary weir approximately 250m upstream of Lanes Bridge, the exact location would depend upon site constraints, river geomorphology and further hydrogeological investigations. The selection of the temporary weir location would be made in consultation with DIPNR and NSW Fisheries' officers.

NSW Fisheries and DIPNR have been consulted regarding this option, with both agencies giving their in-principal support to such an emergency harvesting method. A copy of the correspondence between Commerce and the agencies is included in Appendix H.

In operating the existing borefield, care also needs to be taken to prevent intrusion of saline groundwater into the borefield storage. This can be achieved by ensuring the groundwater level at the most downstream bores (6 and 8) is kept above RL 0.0. As an added precaution two observation bores could be constructed between Bore 8 and Lanes Bridge to monitor water levels and salinity. It should be noted that the option of pumping to the head of the borefield would keep the groundwater table in the borefield at a higher level and improve safety against salt-water intrusion.

The environmental impact of extraction of seepage flows just above the tidal limit would be minimised by monitoring, for example, the interaction of the salt-fresh water interface. An identification of any critical environmental needs and an allocation of a proportion of the seepage flows to meet these needs would then follow.

Cost of Implementation

Capital Costs

Investigate alternate intake systems	$5,000
Pipe line connection (800m of 200mm PE pipe laid above ground)	$40,000
Two observation bores	$6,000
Temporary Weir	$5,000
Install pumps	$10,000
Power Supply	$10,000
Design, supervision etc.	$15,000
Total	$91,000

Daily Costs

Pump (3 ML/d) x 20 m head	$200

Benefit

This will depend on the extent of subsurface flows from Nambucca River at the time existing borefield groundwater levels become critical. During the lowest 60-day flow period of the 2002/2003 drought, it would have been possible to pump 2.9 ML/d on average.

Lead Time

A lead-time of 2 months after obtaining approvals should be adequate. In an emergency situation planning approval could overlap with initiation of design and construction. Lead-time could also be reduced if a hired diesel pump set was used.

South Creek Bores

Description

NSC had developed 2 bores (1 ML/d each) in an alluvial area on South Creek between 1.0 and 1.5 km upstream respectively of Lanes Bridge. It is understood that one bore has high levels of iron and manganese, and the other a high level of iron. NSC's original proposal was to pump from both bores through a new pipeline to join the pipe work associated with Bowraville Borefield.

The former DLWC (now DIPNR) advised that one bore would access a groundwater storage of about 56ML. It could also access run of river flows in South Creek, if there were a strong connection between the groundwater at the bore sites and surface flow in South Creek. NSC engaged consultants to advise on how it should deal with the water quality problems. Review of the consultant's report

indicates that even if the South Creek bore water were blended with existing bore water, the blended water is still likely to cause consumer complaints due to high iron levels.

In view of this, Commerce recommends that NSC establish whether this water could be treated economically with temporary facilities to significantly reduce iron and manganese levels. This would involve taking water samples after pumping from the bores for a reasonable period. For the purposes of this report, Commerce has assumed that simple, temporary treatment facilities involving aeration, oxidation and settlement would be adequate.

Cost of Implementation

It is understood that the present and expected costs to NSC of these works are as follows:

Estimated cost to date	$100,000
Estimated cost to complete	$337,000
Installation of temporary treatment works	$50,000
Total	$487,000

NSC's estimate is based on normal standards for permanent construction. One option would be to construct a temporary above ground polyethylene pipeline. The above costs assumes that the South Creek bore water after aeration and settlement, would be discharged into the common borefield header main.

If NSC had already constructed the pipeline from the DIPNR gauge to the balance tank referred to in the Residual Flow Harvesting option it would only be necessary to connect the South Creek bores to this pipeline. The cost to complete the South Creek option including temporary treatment facilities as an add-on to the residual harvesting infrastructure constructed to temporary standards and making use of bore pumps borrowed from 2 of the existing bores would be as below:

Investigate treatment requirements	$5,000
Construct temporary treatment works	$50,000
Pipeline (1.5 km, 150mm butt-welded PE pipe laid above ground)	$45,000
Install 2 bore pumps (from existing bores)	$10,000
Power Supply	$10,000
Engineering, contingencies	$30,000
Total	$150,000

These costs could be marginally higher, if NSC preferred to use hired bore pumps. This latter approach has been adopted in considering inclusion of the South Creek bores into the emergency strategy.

Benefit

Ability to access groundwater storage of about 56 ML capacity.

Lead Time

A lead-time of 3 months would be adequate for approvals and completion of detailed design and construction. Preliminary design of temporary treatment facilities should be completed before onset of drought.

Kingsworth Storage

Description

Kingsworth Storage is a surface storage with an estimated capacity of 200 ML, located to the east of the Old Coast Road, 2 km North of Macksville. The one water quality test result available indicates that the water could be suitable for connection to the town system after disinfection and treatment to reduce manganese levels (Ref. 3).

It would be necessary to further investigate the size of the storage, water quality, any pollution hazards and the environmental impact of drawing from this storage. It has been assumed that 150 ML would be available in a drought emergency and that a supply rate of 2 ML/d would be appropriate.

If further testing confirms high manganese levels, it would be necessary to investigate whether this could be reduced to acceptable levels with temporary, low cost treatment facilities. It has been assumed this could be done in the costing provided below. If this is not possible it would be more economical to hire a portable treatment plant at a cost of about $70,000/month rather than construct or purchase an orthodox treatment plant for a short-term operation.

To utilize this shallow storage it has been assumed that a hired pump would be set up on the dam embankment with a suction main extended into the storage. Water would be pumped to a tank, where it would be aerated and the sediments settled. Water would then be chlorinated, given 30 minutes detention with chlorine in a second tank and then pumped by a second hired pump-motor set through a 150mm-pipeline connection to NSC's 200mm pipeline serving the Kingsworth Estate. Some adjustments to NSC's reticulation including relocation of existing pressure relief valve (PRV) might be necessary to accommodate this supply. If this option is included in the adopted strategy, NSC should prepare a plan of management for the storage and catchment to protect its value as a water source.

Cost of Implementation (2 ML/d)

Capital Costs

Investigate storage size, water quality, pollution risks	$5,000
Prepare management plan for storage	$5,000
Investigate options for temporary treatment facilities	$5,000
Temporary treatment works	$90,000
Pipework, connection to reticulation – 150ϕ x 400m	$30,000
Install hired pumps	$5,000
Power supply	$20,000
Design, supervision etc.	$40,000
Total	$200,000

Daily Costs

Hire low lift pump (2 ML/d x 10 m head)	$200
Hire high lift pumps (2 ML/d x 70 m head) – 60 days	$300
Total	$500

Benefit

This option would allow 150 ML of water to be supplied over 75 days to supplement existing sources.

Lead Time

A lead-time of 3 months would be adequate for construction activities. Preliminary design of temporary treatment facilities should be completed before onset of drought conditions.

Scotts Head Groundwater System

Description

There is limited potential to extract groundwater from the sand dunes north of the Scotts Head Sewerage treatment works. This is an area some 9 km long by 500 m wide with the ocean on one side and saline Warrell Creek on the other. Figure 4.3 shows the likely groundwater system at Scotts Head.

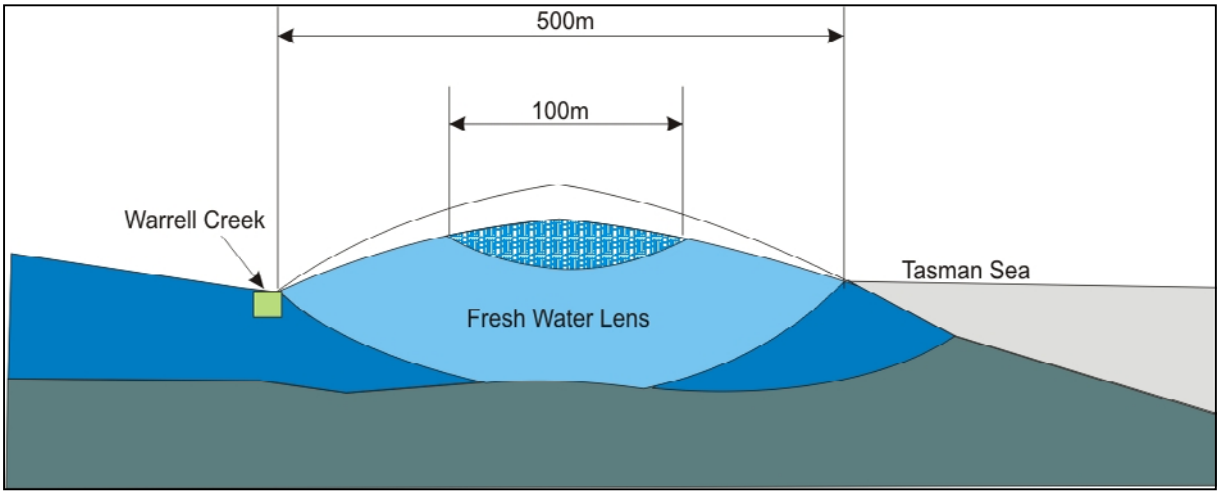


Figure 4.3 Scotts Head Groundwater System

It would be necessary to carry out a hydrogeological evaluation of this source including test boring and water quality testing to establish a suitable source area. It has been assumed that such an area could be located. Storage in a strip 100m wide x 1 km long x 2m average drawdown would be 40 ML assuming 20% specific yield. Recharge during a 3 months period of intense drought could be negligible. A spear point system would be required to extract water from such an aquifer economically.

It is likely that the groundwater would require treatment to meet NSW Health guidelines. It has been assumed that chlorination, aeration and settlement would be able to reduce iron levels and remove CO_2 for an emergency supply.

Cost of Implementation

Capital Costs

Hydrogeological investigation, test bores	$20,000
Install 10 spear points	$5,000
1 km suction main	$50,000
Low lift pump station	$5,000
Chlorination Plant	$5,000
40 kL tank, aerator	$20,000
High lift pump station	$5,000
Rising main 100 ϕ x 3km (2km above ground)	$100,000
Engineering contingencies 30%	$63,000
Total	$273,000

Daily Costs

Hire of pumps	$150

Benefit

A supplementary supply of 1 ML/d delivered to Scotts Head for a period of 40 days. A larger supply might be possible by extending the borefield area. However the supply would have high risks and be difficult to convey to demand centres. The proposal costed above is considered adequate for this study.

Lead Time

A minimum lead-time of 6 months would be required to investigate, design and construct these works.

4.2 Emergency Response Measures

Emergency response measures are needed when all demand reduction and alternative supply source opportunity measures have been exhausted. The emergency response measures are highly costly and hence should be triggered as the last resort. The emergency response measures aim to:

- Maintain, as a minimum, the health, safety and hygiene of the community by ensuring sufficient water is available for potable needs and to convey the raw sewage from premises; and
- To operate sewage treatment plants to ensure safe and sustainable discharge of the treated effluent.

The emergency response measures developed during the 2002/03 drought identified and evaluated the following emergency response measures for Nambucca Water Supply Scheme:

- Marginal groundwater resources in Gumma/Scotts Head area;
- Desalination of sea/brackish water;
- Water carting and unloading into reservoirs; and
- The combined distribution of bottled water to premises and supply of sea/brackish water into the water supply system for non-potable use.

These emergency response measures together with the associated costs and logistics are discussed in Appendix G.

4.3 Comparison of Measures

Table 4.3 below shows an economic, logistic and volumetric capacity comparison of the drought management and emergency response measures outlined in Sections 4.1 and Section 4.2 respectively.

Table 4.4 shows the social, environmental and risk factors associated with each measure.

Table 4.3: Emergency Measure Comparison

	Measures	Capital Cost	Daily Cost	Capacity	Storage	Minimum. Supply Availability	Lead Time	Cost Comparison # (Cap cost/# days +daily cost)/ML n =		
		$'000	$	ML/d	ML	Days	Month	10 days	20 days	30 days
Drought Management	Demand Management	685		0.75		N/A	3**	$91,300	$45,700	$30,450
	Reduction of Leakage	70		0.4		N/A	3**	$17,500	$8,750	$5,800
	Residual Harvesting	91	200	3.0		Possible for drought duration at > 90% capacity	2	$3,200 assuming 3ML/d available	$1,700 assuming 3ML/d available	$1,200 assuming 3ML/d available
	South Creek	150		2.0	56	28	3	$7,500	$3,750	$2,500
	Kingsworth Storage	200	500	2.0	150	75	3	$10,250	$5,250	$3,600
	Scotts Head Groundwater	273		1.0	40	40	6	$27,450	$13,800	$9,250
Emergency Response	Desalination	2,780	2,500	2.5		Unlimited	6	$280,500	$141,500	$95,200
	Water Carting to Reservoirs	80	11,950	1.0		Unlimited	3	$19,950	$15,950	$14,600
	Delivered Bottled Water to Houses for drinking and Brackish water into system for non-potable use	219	14,400	3.0		Unlimited	3	$36,300	$25,350	$21,700

\# There would be continuing benefit from the installation of water efficient appliances. There would be benefit for some years for repairs of leaks. It is necessary to periodically repeat this exercise to maintain low leakage rates. Desalination as an emergency response measure would be beneficial if it could be incorporated into a long-term augmentation program.

** At the onset of drought, if not already implemented as a preventative measure in NSC's water management practice.

Table 4.4: Emergency Measure Social, Environmental and Risk Factors

Emergency Measure	Social Factors	Environmental Factors	Risk Factors	Action to Manage Risk
Demand Management*	Severe restrictions on normal household water use	Reduces extraction from Nambucca River and any additional sources tapped	A significant proportion of households do not follow guidelines	Implement a comprehensive communication and (if necessary) enforcement program
Reduction of Leakage		Reduces extraction from Nambucca River and any additional sources tapped	It may not be possible to locate and repair leaks totaling 0.4 ML/d	Carry out reservoir drop tests at early date to quantify leakage by reservoir zone
Residual Harvesting		Reduces fresh water inflow to Nambucca River estuary.	Uncertainty as to amount of underflow. Proportion of salt water upstream	Improved groundwater/streamflow modeling would reduce uncertainty
South Creek	Quality of reticulated water will degrade unless Iron and Manganese reduced to low levels	Reduces South Creek drought inflows into Nambucca River estuary. May affect stock and domestic supplies drawing from South Creek	Storage volume of 56 ML might not be realized. Water might prove difficult to treat (remove Fe and Mn). May adversely affect Nambucca River and groundwater.	Hydrogeologist to reassess storage on completion of bores. Expert assessment of water treatment requirements
Kingsworth Storage		Not known	Water quality and treatability. Storage volume Pollution hazards	Carry out thorough investigation into suitability of storage for potable water source. Develop management for the storage and catchment.
Scotts Head Groundwater		Draw down of water table in sand dunes could affect vegetation Need to include Aboriginal land concerns in investigations	Poor water quality Risk of salt water intrusion	Carry out hydrogeological survey and test boring well ahead of need to implement this option
Water Carting to Reservoirs		Increased traffic (66 truck loads/d)	Neighboring council might not co-operate	Involve agencies at early stage of negotiations
Desalination		Brine disposal Energy availability Noise	Foreign exchange rate fluctuations Local availability of expertise to operate plant	Involve agencies at early stage Need to link to long term supply solution
Delivered Bottled Water to Houses for drinking and brackish water into system for non-potable use	Inferior quality water for laundry and bathing. Risk of corrosion to household fittings	Performance of sewage treatment plants could degrade until processes stabilize. Increased local traffic (20 delivery trucks)	Source of moderate salinity water might not be found	Carry out investigation into source options well ahead of need to implement this option

* Reduce household consumption from 150L/c/d to 100L/c/d

5 PREFERRED EMERGENCY STRATEGY

The drought management measures in Section 4 can be used to assemble alternate strategies for NSC's consideration. The starting point for all strategies is that they would be implemented only after NSC has progressively introduced restriction levels 1 to 5 and has achieved a high level of demand management, that is, residential consumption down to 150 L/c/d and leakage reduction. It is recommended that demand management and leakage reduction measures be implemented immediately as preventative measures as part of NSC water management practice. These measures would aid NSC's ability to manage drought scenarios with greater flexibility and preparedness. The implementation of these measures would display best management practice and in the event of drought, it is expected that drought assistance would be well supported and readily available.

In considering the social and environmental impact of the options available, NSC and government agencies should keep in mind that the probability of having to activate any emergency option is low and if this were necessary it would be highly probable that the duration of application would be short if past rainfall and streamflow patterns were to repeat in the future. It would be possible to quantify these probabilities with more detailed analyses.

In the event that the average bore level fell to RL 2.6 (level 4 restrictions) and was not remaining stable, the least cost initial response measure for NSC would be to pump back a proportion of surface flows in the Nambucca River to the existing balance tank (Residual Flow Harvesting). This returns some of the seepage flow that has passed through the borefield and captures part of any subsurface flows in South Creek.

The next most cost effective response measure for NSC to implement would be the connection of the South Creek bores to the pipeline constructed under the residual harvesting measure. The reasoning behind the recommendation to proceed with this measure before utilising the aquifer storage in South Creek is as follows. In critical drought conditions the basic strategy must be to conserve storage and harvest run of river flows where ever and when ever possible. Once lost, such flows are discharged to the estuary system forever and future flows are uncertain. If the storage at the South Creek Borefield were emptied before some of the seepage flows from the Bowraville Borefield were harvested, storage would be lost from both the South Creek borefield and the Bowraville Borefield and surface flows at the stream gauge would be lost to the system.

Initial construction of Residual Harvesting measures would preserve storage in South Creek alluvium for as long as possible, it would allow harvesting of a proportion of any minor mid drought flows in South Creek and it would reduce seepage losses from the Nambucca River alluvium. Operation of this option could be modified to ensure identified environmental objectives were met.

In parallel with implementing these emergency measures, NSC, having previously determined the extent of system leakage, should take steps, if necessary, to reduce water losses to less than 0.5 ML/d (Leakage Reduction).

If drought conditions continue and South Creek groundwater storage were emptied, NSC should construct the Kingsworth Storage transfer and treatment system and draw this storage down.

It is most unlikely that further emergency measures would be necessary. The steps taken to date would allow NSC to maintain supply through a much more sever drought than the 2002/2003 event. This can be illustrated by the approximate analysis set out below.

Critical period in 2002/03 drought:

(Bowraville Borefield storage from full to maximum drawdown)

28/9/02 – 29/1/03 = 122 days

For this period:

Water Production	+590 ML	= 4.84 ML/d
Drawdown in groundwater storage	-45 ML	= -0.37 ML/d
Total Streamflow measured at gauge	+452 ML	= 3.70 ML/d
Net Inflow into groundwater storage	997 ML	= 8.17 ML/d

Assume worst drought

Net inflow into groundwater storage is 50% of 2002/03 drought:

Net inflow into aquifer	+4.09 ML/d

Streamflow gauge is 50% of recorded 2002/03 drought

Streamflow	1.85 ML/d

- Allow for 50% of stream harvesting for environmental flows

Environmental flows	-0.92 ML/d
Available water	3.17 ML/d

- Assume demand at same average level as 2002/03 drought

Average demand	-4.46 ML/d
Average rate of aquifer depletion	-1.29 ML/d

- Available storage, allow:

Bowraville Borefield	150 ML
South Creek Groundwater	56 ML
Kingsworth Storage	150 ML
Total	356 ML

- Therefore, time to empty South Creek and Kingsworth and leave 150 ML in Bowraville Borefield:

Time	206/1.29	= 160 days

The four demand reduction and alternate source measures, that is, Demand Reduction, Residual Harvesting, South Creek and Kingsworth Storage, would have allowed NSC to maintain supply through a drought which lasted 30% longer than the 2002/2003 event and in which streamflows were 50% of those that occurred in 2002/2003. NSC could do this while making reasonable provision for environmental flows and retaining 150 ML storage at the end of the drought.

In the extreme unlikely event that the drought had not broken in the time it took to empty Kingsworth storage, it would be necessary to significantly reduce consumption to 100 L/c/d and prepare for water cartage. This would involve a major communication program with consumers including strong encouragement for all householders to install water efficient appliances and drastically cut back on all household water use. All industrial/commercial/tourist businesses would be required to produce and adhere to approved Water Management Plans.

The source of water for cartage would depend on the state of regional streams and the supply systems of neighbouring councils. Extreme emergency response options would remain if sources for cartage were exhausted. Possible extreme emergency response options would include development of Scotts Head groundwater, supply of potable water in household containers in conjunction with the use of non-potable water in NSC's reticulation system and finally the purchase and installation of a package desalination plant. The likelihood, however, of requiring such emergency response measures is so remote that they would be out of place in a realistic emergency plan.

6 CONCLUSIONS

A drought management process, including a drought management strategy and emergency response strategy (ERS), has been prepared for NSC. This Drought Management Plan (DMP) has:

- Examined the antecedent information of previous droughts in the Nambucca Shire in relation to the behaviour of customers during restrictions, and the performance of the storage and the system;
- Examined the long-term climate, streamflow and consumption trends in the Nambucca Shire and how they compare to drought situations;
- Outlined a drought management process for the integration of triggers, restrictions and required actions;
- Listed a number of possible drought management opportunities including both demand and supply-side measures and developed a drought management strategy;
- Recommended that demand management and leakage reduction measures be implemented immediately as preventative measures as part of NSC water management practice.
- Provided a Drought Emergency Response Strategy (DERS) so as to guide NSC how best to manage their assets and responses in times of extreme drought conditions.

More specifically, this DMP has identified the requirement for:

- A communication strategy to notify customers and public authorities of what actions are required at each level of restrictions;
- Various pre-drought planning measures to be undertaken by NSC including:
  - Preparation of a catchment management plan for protection of drought management sources;
  - Securing of licences and approvals so that drought management sources are accessible when needed;
  - A long term demand management strategy;
  - The installation of monitoring bores.

The Drought management strategy and emergency response strategy provides the costs and timing for implementation of the following alternated supply sources in the order of priority listed below:

- Residual Flow Harvesting upstream of the confluence of South Creek and Nambucca River;
- Groundwater storage at South Creek;
- Kingsworth Storage; and
- Potential water carting sources.

NSC is separately planning to improve the supply security of its water supply scheme in the long term.

Although this DMP outlines the drought management process, the drought management and emergency response measures, it is important that it be reviewed, at least on a 5-year cycle, to capture the change in the operating environment and at the beginning of a drought as the impact of every drought is likely to be different.

7 REFERENCES

1. DLWC, 2002. *Draft Guidelines for Drought Management Plans*, NSW Department of Land and Water Conservation, October, 2002.
2. Hunter Water Corporation, 1996. *Final Report for Nambucca Shire Council Into Unaccouted for Water*.
3. Coffs Harbour City Council, 2003. *Envrionmental Laboratory Analytical Report – Kingsworth Dam Water Sample*, February 2003.

APPENDICES

Appendix A – System Maps

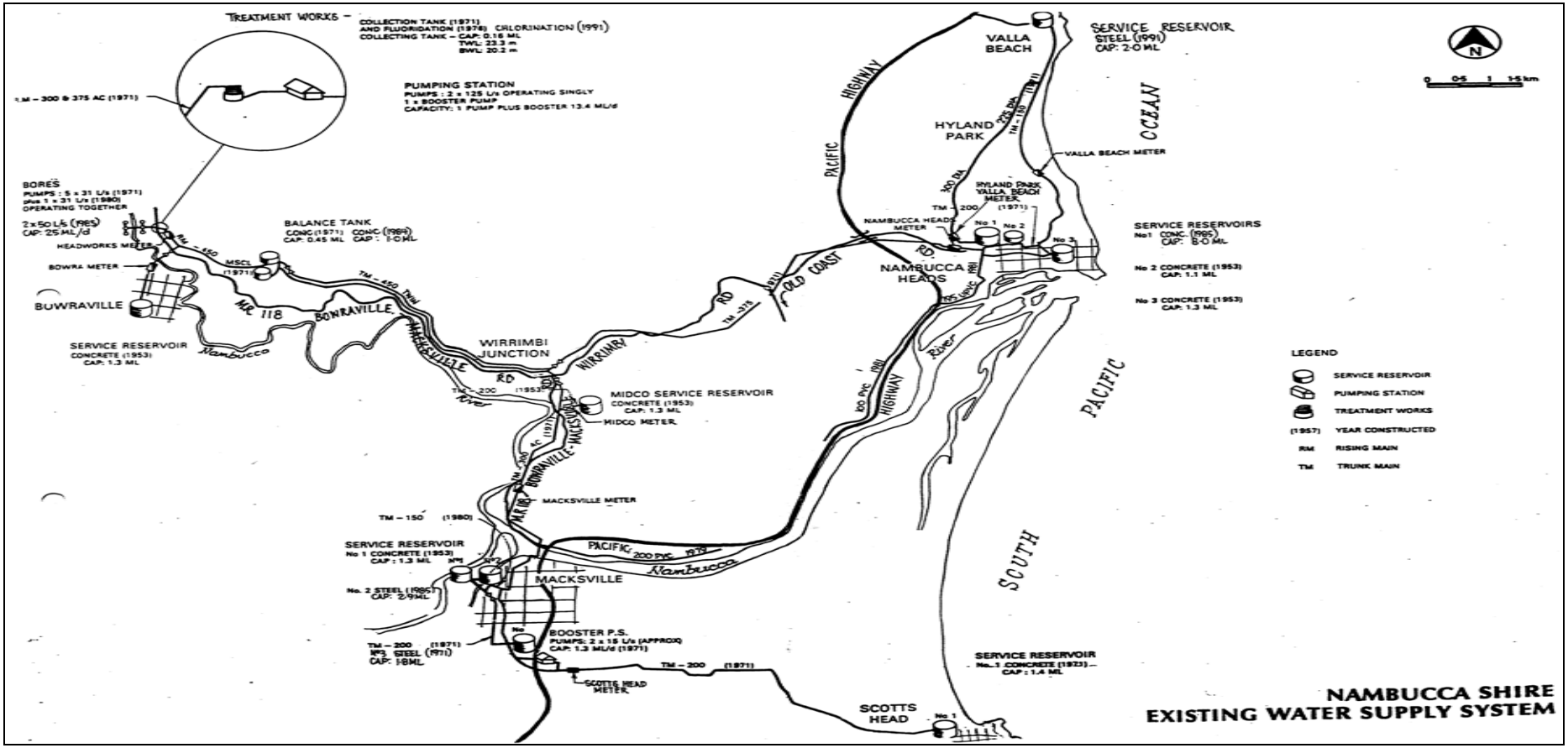


Figure A1: Nambucca Shire Water Supply Schematic

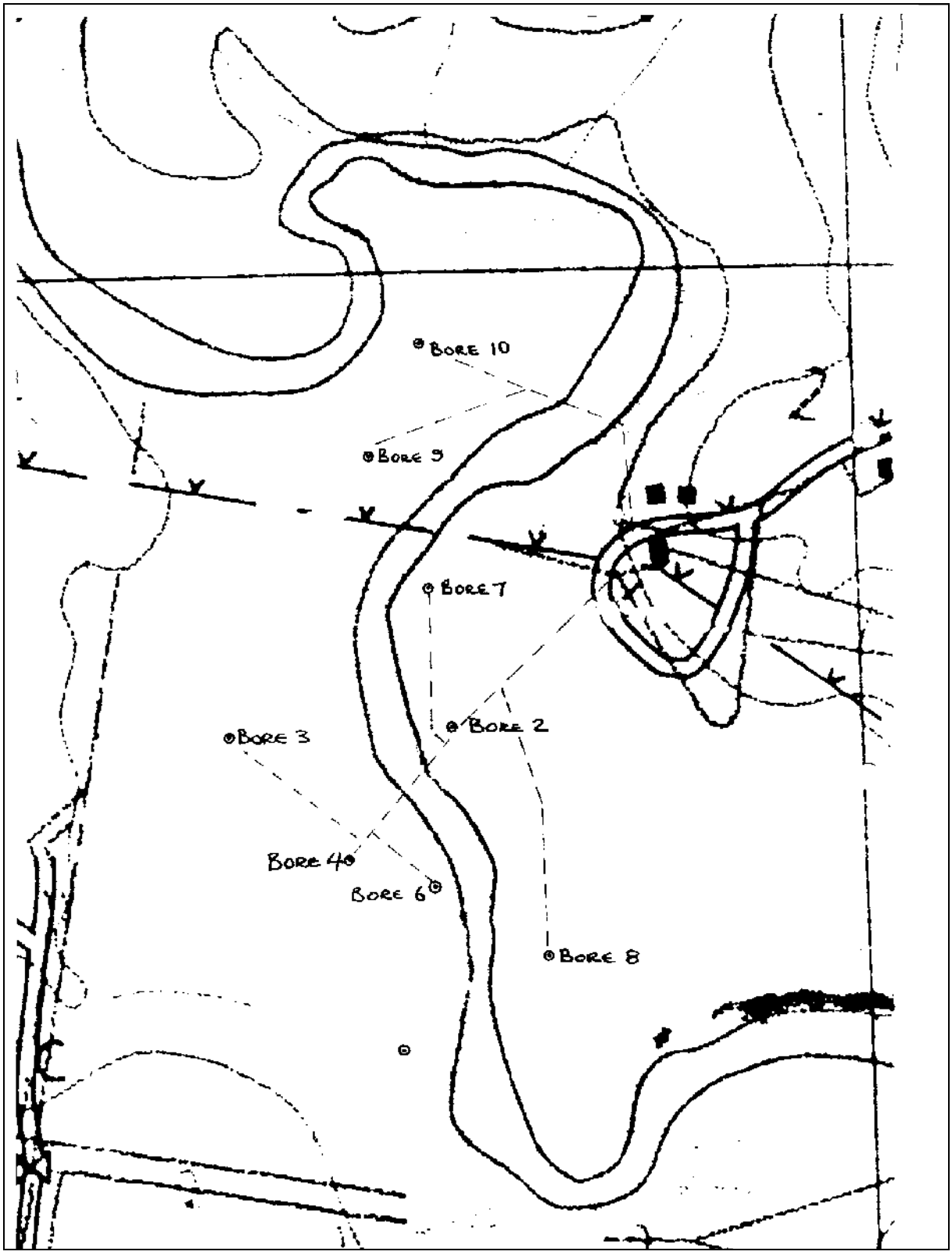


Figure A2: Bowraville Borefield Schematic

Appendix B – Water Resitiction Policy

NAMBUCCA SHIRE COUNCIL

WATER RESTRICTION LEVELS

GENERAL DOMESTIC

Type of Consumer	*Level 1 Restriction*	*Level 2 Restriction*	*Level 3 Restriction*	*Level 4 Restriction*	*Level 5 Restriction*	*Level 6 Restriction*
Gardens	Sprinklers, sprays, fixed hoses (unattended), banned between 8am and 4pm.	Sprinklers, sprays, fixed hoses (unattended), banned. Single hand held hose per property between 6pm and 8pm on 'odds and even' basis.	Sprinklers, sprays, fixed hoses (unattended), banned. Single hand held hose per property between 6pm and 7pm on 'odds and even' basis.	Sprinklers, sprays, fixed hoses (unattended), banned. Single hand held hose per property between 6pm & 6.30pm on 'odds and even' basis.	Sprinklers, sprays, fixed hoses (unattended) and hand held hoses banned. Buckets only.	All external use banned Reused water only
Washing motor vehicles	No restriction	Buckets only	Buckets only	Buckets only	Banned	Banned
Boats and Motor washing	No restriction	Maximum 5 mins (after use)	Maximum 5 mins (after use)	Maximum 5 mins (after use)	Banned	Banned
Swimming pools	No restriction	Filling banned, topping up with hand held hose max 2 hrs/day	Filling banned, topping up with hand held hose max 2 hrs/day	Filling banned, topping up with hand held hose max 1 hrs/day	Banned	Banned
Outdoor Showers	No restriction	No restriction	No restriction	No restriction	Banned	Banned
Washing paved areas, driveways, houses & roofs	No restriction	2 hrs per day between 6pm & 8pm 'odd and even' days matching house numbers	1 hr per day between 6pm & 7pm 'odd and even' days matching house numbers	Buckets only	Banned	Banned
Animal Washing	No restriction	No restriction	No restriction	No restriction	Buckets Only	Banned

COMMERCIAL/INDUSTRIAL

Non-residential gardens	Sprinklers 1hr/day 5am – 8am *	Hand held hose 1hr/day 7am – 8am	Hand held hose ½ hr/day 7am – 7.30am	Hand held hose ½ hr/day 7am – 7.30am	Banned	Banned
Boats and Motor washing - Commercial	No restriction	Maximum 5 mins (after use)	Maximum 5 mins (after use)	Maximum 5 mins (after use)	Banned	Banned
Sport grounds	Sprinklers 1hr/day *	Hand held hose 1hr/day 5pm – 6pm	Hand held hose ½ hr/day 5pm – 5.30pm	Hand held hose ½ hr/day 5pm – 5.30pm	Banned	Banned
Outdoor Showers	No restriction	No restriction	No restriction	No restriction	Banned	Banned
Nurseries, commercial gardens	No restriction	2hrs/day *	2hrs/day *	2hrs/day *	Hand held hose 2 hrs/day *	One hand held hose ½ hr/day *
Bowling greens, turf cricket wickets	No restriction	2hrs/day *	2hrs/day *	2hrs/day *	Hand held hose 2 hrs/day *	Banned
Golf Courses	No fairway watering	2hrs/day * No fairway watering	2hrs/day * No fairway watering	2hrs/day * No fairway watering	Hand held hose 2hrs/day * No fairway watering	Banned
Washing motor vehicles (commercial)	No restriction	No restriction	No restriction	No restriction	Buckets only	Banned
Washing of buses, taxis, ambulances & food transport	No restriction	No restriction	No restriction	No restriction	Hand held hose 1 hr/day*	Banned except where required by law
Washing of garbage trucks & street sweepers	No restriction	No restriction	No restriction	No restriction	Hand held hose 1 hr/day*	Banned except where required by law
Brick cleaning, carpet cleaning, car detailing & underboring	No restriction	No restriction	No restriction	No restriction	Hand held hose 2 hrs/day*	Banned
Swimming Pools – Commercial	No restriction	No restriction	No restriction	No restriction	Filling banned, topping up with hand held hose max 1hr/day	Banned
Building Construction	No restriction	No restriction	No restriction	No restriction	Hand held hose 2 hrs/day*	Council permit only
Paved public areas	No restriction	2hrs/day*	2 hrs/day*	2 hrs/day*	Buckets only except where required by law	Banned except where required by law
Water cartage – town supply	No restriction	No restriction	No restriction	No restriction	Internal domestic use only with Council permit	Internal domestic use only with Council permit
Auto flush toilets	No restriction	No restriction	No restriction	No restriction	Banned	Banned
Road construction	No restriction	Banned	Banned	Banned	Banned	Banned
Industrial/business/ commercial operations	No restriction	No restriction	No restriction	No restriction	Council permit only for 'wet' industries	Council permit only - all
Pressure cleaning – commercial	No restriction	No restriction	No restriction	No restriction	Hand held hose 2hrs/day*	Banned
Public Toilets – cleaning	No restriction	No restriction	No restriction	No restriction	Hand held hose 2 hrs/day*	Buckets only except where required by law
Animal washing	No restriction	No restriction	No restriction	No restriction	Buckets Only	Banned

Definitions:

- ♦ Fixed hoses include sprinklers, sprays, irrigation systems and unattended hoses.
- ♦ Buckets relate to buckets, watering cans or the like filled directly from a tap not via a hose.
- ♦ Motor vehicles include cars, utilities, trucks, motor bikes, trailers, caravans & the like.
- ♦ Boats include all forms of marine craft and also refers to washing and flushing motors.
- ♦ 'Odds and evens' relates to the street number matching the day of the month (ie water usage is permitted in properties with an even number on even days of the month, odd numbers on odd days)

* Apply to Council for times

Appendix C – Derivation of 2002/03 Consumptions

Table C.1 below shows the customer category consumption from 1997 to 2002. These values were analysed from the NSC rates database.

Table C.1: Annual Demands (ML)

Sector Type	1997/ 1998	1998/ 1999	1999/ 2000	2000/ 2001	2001/ 2002	2002/ 2003*
Residential	920	841.7	878.6	932.7	1068.9	984.8
Industrial	407.0	88.9	182.7	135.3	134.4	131.2
Commercial	80.1	79.6	72.2	77.6	86.0	105.9
Tourist	201.2	174.0	185.2	189.6	198.3	208.2
Gov/Other	86.1	78.9	81.1	90.2	86.1	84.8
Rural	55.1	44.0	40.9	43.5	50.1	46.0
Non Classified	0.3	0.2	0.4	0.3	0.4	0.3
Total consumption	1,749.7	1,307.2	1,441.0	1,469.1	1,624.1	1,561.4
Unaccounted for water	247.5	273.1	315.7	330.7	405.2	339.6
Total Production	*1,997*	*1,580*	*1,757*	*1,800*	*2,029*	*1,901*

- 2002/2003 values are 2 x Consumption from 1/7/02 to 31/12/02

Table C.1 above indicates that restrictions in 2002 might not have had much impact on water consumption for sectors other than residential. Consumption data from 1 July 2002 to 31 Dec 2002 was examined in more detail to estimate the effect of restrictions on residential water consumption. In this assessment it has been assumed that un-accounted for water remains constant at 2002/2003 levels i.e. 339.6/365=0.93 ML/d.

For the 6 month period 1/7/2002 – 31/12/2002:

Average residential consumption	2.74 ML/d = 183 L/c/d (15,000 residential population)
Average non residential consumption	1.58 ML/d
Average unaccounted for water	0.93 ML/d
Average total production	5.25 ML/d

By 15.12.02 production had dropped to 4.35 ML/d.

If a 25% reduction in non-residential consumption had been achieved, the above figures would become:

Average residential consumption	2.30 ML/d = 153 L/c/d
Average non-residential consumption	1.12
Average unaccounted for water	0.93
Average total production	4.35

In Feb 2003, under level 4 restrictions before the drought broke, water production had dropped and remained steady at 3.9 ML/d over a 2-week period. With a fall in tourist activity and pressure to conserve water in all sectors, it was assumed that non-residential water consumption had been reduced to 50% below average. The figures would then become:

Average residential consumption	2.18 = 145L/c/d
Average non residential consumption	0.79
Average unaccounted for water	0.93
Average total production	3.90

Appendix D – Minimum Inflow Details

A simple water balance model was used to estimate the sub-surface flow entering the Bowraville Borefield Aquifer. Figure D.1 below shows a schematic of the borefield with the major system flows.

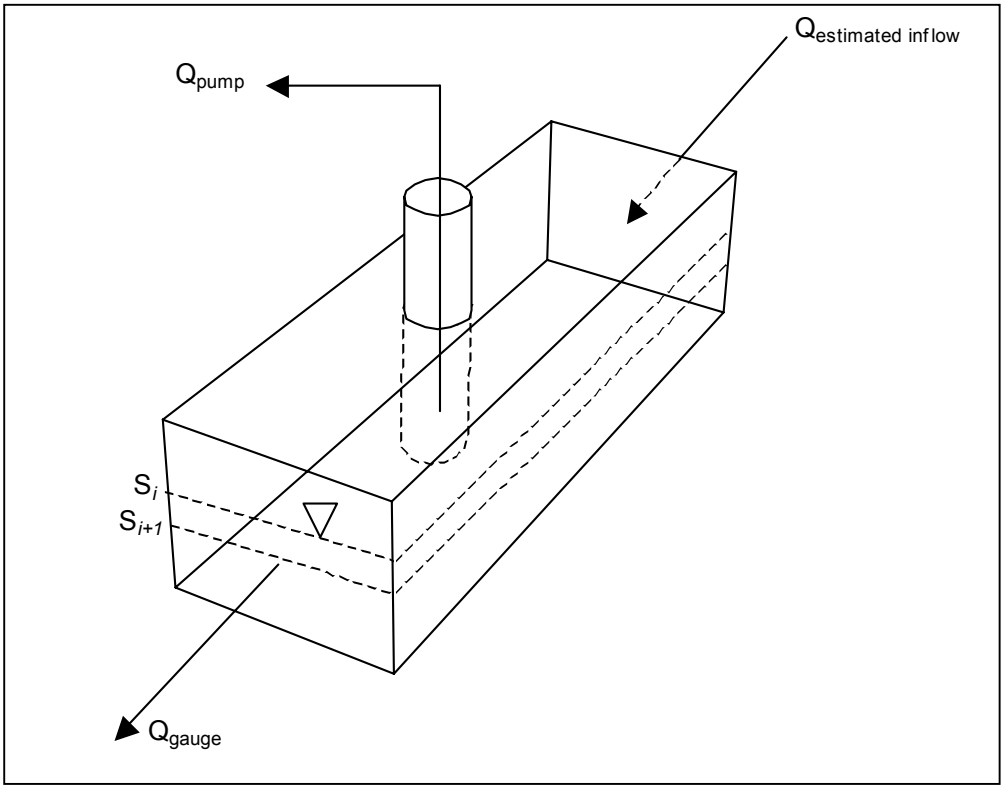


Figure D.1: Bowraville Borefield System Flows

An estimate of the sub-surface aquifer inflow was estimated using the following equation:

$$Q_{IN} = Q_{OUT} + \Delta STORAGE$$
$$= Q_{GAUGE} + Q_{PUMP} + \Delta S$$
$$= Q_G + Q_P + SA \times \Delta H \times S_y$$

where Q_{GAUGE} is the recorded daily flow at stream gauge 205006;

Q_{PUMP} is the recorded daily production values at the Bowraville Borefield;

SA is the estimated surface area of the aquifer (50 Ha);

ΔH is the change in average recorded SWL at the borefield; and

S_y is the specific yield of the aquifer (0.15).

The following assumptions were used so as to make an estimate of the sub-surface aquifer inflow:

- The aquifer is a simple rectangular prism;
- Vertical flows in the aquifer are ignored; and
- At times of drought, surface flows at stream gauge 205006 are fed entirely by aquifer sub-surface discharge.

Based on the above methodology, the minimum net subsurface inflow to the Bowraville borefield and the minimum flow at the Nambucca River Gauge during the 2002/2003 drought event (after irrigation bans) for time periods from 10 to 90 days has been plotted in Figure D.2.

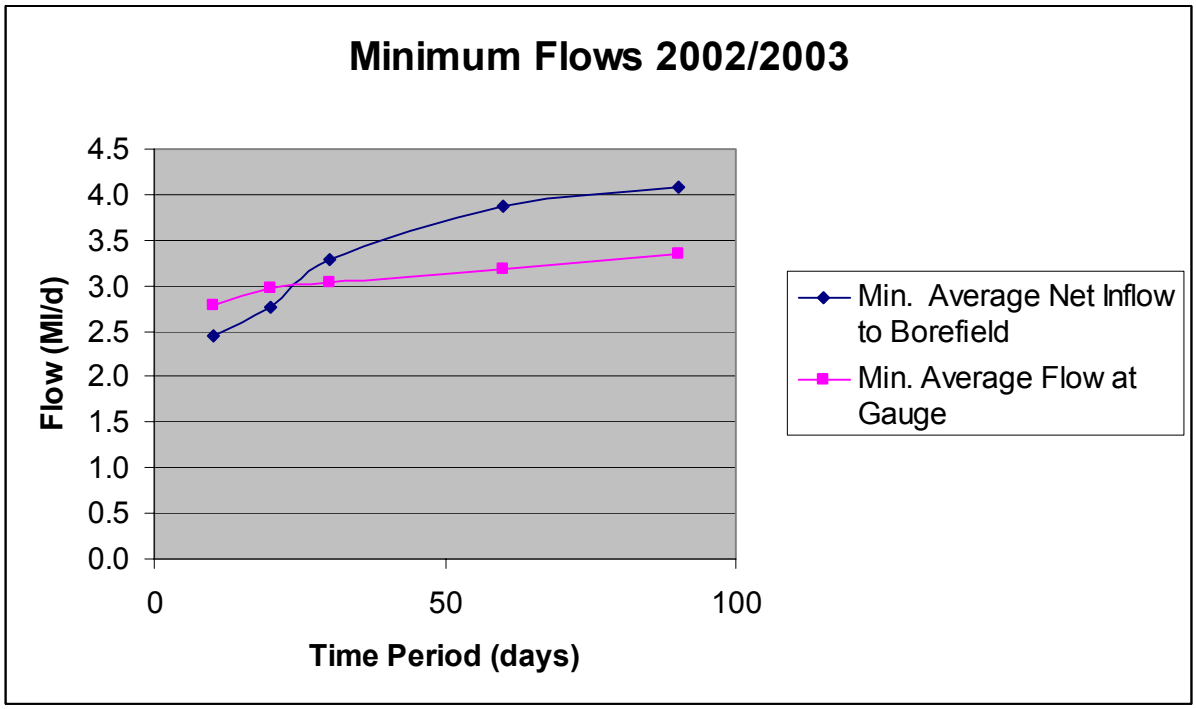


Figure D.2: Minimum Cumulative Inflows to Bowraville Borefield

Based on the minimum river gauge flows and net aquifer infows, minimum times to drawdown the storage at each restriction level were calculated. Table D1 below shows these values.

Table D1: Minimum Time Values Between Restriction Levels

Restriction levels		Average Bore Levels		Change in Storage			Average demand	Assumed Minimum		Total Available Flow	Required from Storage	Minimum time to drawdown storage
Start	Finish	Start	Finish	Borefield	Other	Total		Net inflow to borefield	Residual Harvest			
		AHD	AHD	ML	ML	ML	ML/d	ML/d	ML/d	ML/d	ML/d	Days
Level 1	Level 4	3.2	2.9	22.5		22.5	4.4	4.0	0.0	4.0	0.4	**56**
Level 4	level 5	2.9	2.8	7.5		7.5	3.8	3.3	0.0	3.3	0.5	**15**
Level 5	Level 5a	2.8	2.6	15.0		15.0	3.7	3.0	0.0	3.0	0.7	**21**
Level 5a	Level 6	2.6	2.5	7.5		7.5	3.7	1.5	1.5	3.0	0.7	**11**
Level 6	Level 6a	2.5	1.9	45.0	56.0	101.0	3.0	1.0	1.0	2.0	1.0	**101**
Level 6a	Emergency	1.9	1.9	0.0	150	150.0	3.0	1.0	1.0	2.0	1.0	**150**
E1	E2	1.9	0.6	97.5		97.5	2.9	1.0	1.0	2.0	0.9	**108**
E2	E3	0.6	0.6	0.0		0.0	2.9	1.0	1.0	2.0	0.9	**0**

Appendix E – Drought Management and Emergency Measure Lead Times

APPENDIX E - NAMBUCCA SHIRE COUNCIL SUMMARISED DROUGHT MANAGEMENT PROGRAMS

OPTION 1 - INTENSE DEMAND MANAGEMENT

No.	TASK	LEAD TIME (months) 1 2 3 4 5 6	COST ALLOWANCE $	SERVICE BY COUNCIL	SERVICE BY EXTERNAL	COMMENT
	Residential Users					
1	Prepare program for installation of efficient appliances, cistern displacement devices, household leakage repairs, publicity re critical situation		20 000	Y		
2	Implement program		600 000		Y	
	Industrial, Commercial, Tourist Users					
3	Prepare format for water management plans and request all users to complete plans		10 000		Y	
4	Review plans prepared by 20 largest water users and follow up with water audits		20 000		Y	
5	Review plans prepared by other significant users - negotiate revised targets if appropriate		5 000	Y		
	TOTAL		655 000			

OPTION 2 - LEAKAGE REDUCTION

No.	TASK	LEAD TIME (months) 1 2 3	COST ALLOWANCE $	SERVICE BY COUNCIL	SERVICE BY EXTERNAL	COMMENT
1	Reservoir drop tests		20 000		Y	Specialist consultant recommended
2	Leak detection surveys		30 000		Y	Specialist consultant recommended
3	Repair leaks		20 000	Y		
	TOTAL		70 000			

OPTION 3 - RESIDUAL HARVESTING

No.	TASK	PRE DROUGHT PLANNING (months) 1 2 3	CONSTRUCTION LEAD TIME (months) 1 2	COST ALLOWANCE $	SERVICE BY COUNCIL	SERVICE BY EXTERNAL	COMMENT
1	Investigate alternate intake systems			5 000	Y	Y	Specialist advice recommended
2	Approval of regulators to proposal						DIPNR EPA
3	Construct intake works, pipeline			45 000	Y		
4	Install hired pump			10 000	Y		
5	Power supply			10 000		Y	
6	Design ,supervision			15 000	Y		
	TOTAL			85 000			

OPTION 4 - SOUTH CREEK BORES

No.	TASK	PRE DROUGHT PLANNING (months) 1 2 3	CONSTRUCTION LEAD TIME (months) 1 2	COST ALLOWANCE $	SERVICE BY COUNCIL	SERVICE BY EXTERNAL	COMMENT
1	Investigate treatment requirements for return to Nambucca River bed			5 000			Specialist consultant recommended
2	Approval of regulators to proposal						DIPNR EPA
3	Construct temporary treatment works, pipeline			95 000			
4	Install 2 bore pumps			10 000			Investigate economics of using 2 pumps from Nambucca R. Borefield
5	Power supply			10 000			
6	Design, supervision			30 000			
	TOTAL			150 000			

OPTION 5 - KINGSWORTH STORAGE

No.	TASK	PRE DROUGHT PLANNING (months) 1 2 3	Construction LEAD TIME (months) 1 2	COST ALLOWANCE $	SERVICE BY COUNCIL	SERVICE BY EXTERNAL	COMMENT
1	Investigate size, water quality, pollution risks			5 000	Y	Y	
2	Prepare management plan for storage and catchment			5 000	Y		
3	Investigate options for temporary treatment facilities			5 000		Y	Specialist consultant recommended
4	Construct intake, temporary treatment works pumping stations,pipeline connection			120 000	Y	Y	
5	Install hired pumps			5 000	Y		
6	Power supply			20 000		Y	
7	Design, supervision			40 000	Y	Y	Specialist consultant assistance
	TOTAL			200 000			

OPTION 6 - WATER CARTING

No.	TASK	LEAD TIME (months) 1 2 3	COST ALLOWANCE $	SERVICE BY COUNCIL	SERVICE BY EXTERNAL	COMMENT
1	Identify preferred source		5 000	Y	Y	DEUS assist
2	Arrange approvals		5 000			DIPNR
3	Apply government assistance		2 000			DEUS
4	Construct loading, unloading facilities		40 000	Y		
5	Arrange hire water carts		5 000	Y		
6	power supply at unloading station		10 000		Y	
7	design, supervision		13 000	Y		
	TOTAL		80 000			

Appendix F – Workshop Notes

NAMBUCCA DISTRICT WATER SUPPLY

EMERGENCY WORKSHOP OUTCOMES

6 March 2003

1. DOMESTIC USAGE

SCENARIO: Drought is prolonged and a significant reduction in consumption is required.

For this initial scenario the workshop dealt only with the need to reduce domestic consumption, different users would require different management responses.

Participants at the workshop discussed the need to move from consumption of 200 litres per person per day to 100 litres per person per day.

It was generally agreed that 150 litres per person per day was achievable through the implementation of Community Awareness programs. An analysis of consumption figures during the drought indicated that the Nambucca district consumption was actually already as low as 150 under level 4 (no external town water use) restrictions. To then reach 100 litres per person per day would require expenditure on a specific water efficiency program and an additional role of compliance.

REDUCING CONSUMPTION TO 150 LITRES PER PERSON PER DAY

Discussions were held over whether the change in consumption could proceed from 200 directly to 100 litres per person per day. It was the general agreement that from 200 to 150 litres would be a relatively easy process through the use of:

- Level 4 restrictions – no outside use of water
- Shower & toilet system retrofit programs
- Ethos of care in water consumption is created.

It was noted that NSC had already achieved 150 litres per person per day during recent level 4 restrictions without the second dot point.

Other opportunities identified for potentially reducing consumption below this figure included:

- Offering incentives for reducing consumption
- Offering specific quantified examples to the community of how much water can be saved eg. by simple things like no tap running when brushing teeth.

At a point where there is an identified need to reduce consumption down to as low as 100 litres per person per day, the above could be continued, but in addition other forms of monitoring/compliance would be required, and a fundamental change of usage behaviour would be essential. This may require an extension to the aforementioned retrofit program, to examine specific internal household usage patterns and commencement of a comprehensive communications program.

It was generally agreed that to ensure targeted outcomes are achieved, you need to take community with you, highlighting why reductions in consumption are so important.

Additional important messages that could be linked to an awareness program included:

- River stress linked with Ground Water
- Fishing industry + other impacts + relationships

Education was identified as the most important tool available to reduce consumption to at least 150 litres per person per day or below.

Riparian right water users not connected to the town supply were also identified as an unexplored user that should be considered.

In general, it was agreed that essential messages to be communicated must include:

- Clear goals for continuity of supply
- Concern over environmental issues, with messages that link things like how much water in river vs impacts on fisheries
- Clarification of the degree of threat to the community as a whole eg. potential job losses etc.

It was recognised that a good communication strategy was important to achieving a reduction in consumption of water at critical periods. As an example, in the past a letter was sent from the Mayor to every resident at level 4 restrictions and this achieved the biggest reduction in consumption during the crisis.

ROLE OF INFRASTRUCTURE

It was agreed that at some point to significantly reduce consumption, a process of changing hardware may be quickly required. For example, implementation of a shower and toilet retrofit program may need to occur very quickly, if not already dealt with.

Consideration of lead times that would allow for infrastructure change would also be required. Some discussion ensued on what triggers for infrastructure would be required and how this should be linked to the communication strategy.

In addition it was agreed that education needs to be placed within a longer term framework than just the emergency situation facing Nambucca Shire Council, as it has a significant role outside of the emergency scenarios. This included an ongoing program to promote what Council and others are doing to reduce consumption.

Additional possible initiatives also included the use of rainwater tanks and other efforts for domestic premises.

REDUCING CONSUMPTION TO 100 LITRES PER PERSON PER DAY

In the instance where the supply of water required stricter responses and consumption needed to approach 100 litres, the following potential solutions were initially considered:

- Cut off water at different times (raises health and other issues)
- Flow restrictions so that pressure is reduced (raises operational issues)
- Increase price of water and target education on how use water (raises equity issues)

It was agreed that personal letters to every resident from the Mayor should be issued early.

To ensure that people are seriously reducing consumption it was felt that at some point that reading of meters (say weekly or fortnightly) might be required, using a team of meter readers (monitoring of water use/restrictions can really only deal with outside consumption, inside needs meter reading).

It was agreed that reading meters every two weeks may be a possibility, however resource requirements would be significant. For example Coffs Harbour has considered this possibility and determined that 20 readers would be required for Coffs Harbour. Alternative solutions could include:

- Ring resident + surprise inspections (cheaper)
- Telemeter meters
- Flow restrictors on everyone

Other issues/opportunities raised included:

- *Fine levels*
- *Health/equity/legal/resourcing implications of flow restrictors*
- Peer pressure from children-(need to consider use at Schools)
- *Declaration of number of people in household or estimate number of people*
- Anomaly process
- On – spot fines
- What about rewards !! (best users in town)
- A competition
- Award prizes.
- Link to Communication Strategy.

It was generally agreed that the local water utility could manage a scenario of this type, with some assistance from external agencies where required.

2. INDUSTRY USAGE

SCENARIO: There is a role for industry within the scenario of diminishing water availability. Current restrictions do stop certain activities though there was a question of appropriateness of these current arrangements. The workshop was asked to identify and highlight the issues around the restriction of industry and consequent impacts. Some of the issues/opportunities raised included:

- Employment
- Managing usage rather than hard cut offs
- Education, documenting successes and achievements
- Audits of use + exploring opportunities for re- use
- Highlight achievements of other areas
- Ask/require industry to do water management plans (WMP's)
- Require a written plan to reduce consumption by 20% (California example)
- Audit on urinals – auto flush ban them.
- Target large and / or inefficient users
- Negotiate compliance with WMP's
- Link WMP actions to domestic where possible
- Ban all outside use (not found to be very useful in Coffs)
- Issue all users with meters eg all builders – (Administration would be huge)
- Not good to ban any industry (potentially revisit existing arrangements)
- Question of whether WMP's are voluntary and whether they should be promoted more.

TOURISM

- Read meters x litres per room
- Ban spas. Coins for showers
- Laundry done outside Shire?

Other Issues

- Re-use from industries
- Batching Plants need to be considered
- Rural Fire Service – need special consideration
- Health Care Nursing Homes – hard to touch
- Dialysis needs special consideration
- Ban topping tourist pools ?? – maybe use other sources
- Some industries may have to eventually shut down

3. EMERGENCY SITUATION

SCENARIO: The potable reticulated water supply system has failed. There is now a need to limit consumption to 20 Litres/person/day.

Note: Some discussion was held regarding the need to stage down to 50 l/p/d before reducing to 100 l/p/d. Generally this would require an extension of the previous scenario to reduce to 100 l/p/d, with extremely strict enforcement and an extensive communications strategy. This scenario was not developed further.

Under the 20 L/p/d scenario a psychological profile of users will be essential.

POTENTIAL SOURCES

- Bellingen first?? – closest (though probably in a similar boat to Nambucca)
- Question of whether Taree would be the best option – distance to cart (need to source from as close as you can get). Also need to explore Macleay (Kempsey) and Hastings options.

Bottled Water –

- Question of obtaining supply and minimising profiteering
- Source for bottles and water needs to be identified
- Mobile bottling plant may be an option

Desalination -

- Cost approximately $1.15M
- Lead 4 – 6 months maybe (minimum of 2 months + connected.)

Unlikely to be a viable option in an emergency unless extensive lead times are available.

Other Sources

Anywhere else Sydney?

Hunter?

Local - Kingston Estate Dam – requires further investigation

BRINGING IT IN

- Road – Milk tankers – may be difficult to source in a drought when others may already be using
- Rail – difficulties sanitising?
- Army Bladders – semi or rail – difficult and limited capacity
- Wine bladders – big. maybe jerry cans on semi trailers
- Bottled water
- Use local resources as much as you can, then State and Federal resources
- Include local emergency mgt officer

DISTRIBUTION

- Bottled water may be first preference – Bring in already bottled
- Tankers or storage tanks around town – people come to it.

  Issues/options may include

  1. Rationing
     - black market
     - double dipping

  2. Drop off bottled water to each house? - resourcing
  3. How manage it (Odds and evens every second day?)

PRIMARY ISSUES TO CONSIDER IN AN EMERGENCY

- Need to identify and plan for all costs upfront.
- Hospitals – possibly install own treatment works, need a WMP
- Schools – Bring own water or supply school?
- Nursing Homes
- Dialysis - maybe evacuate in emergency
- Aged population – carrying/collecting water
- Rural population not on TWS
- Babies on formulae
- Young
- Mental Health eg Alzheimer's
- Rural fire fighting
- Communication and Education
- Sewerage System
  - Blockages
  - Treating
  - Flushing - 100l/p/day is probably required, needs to be checked

- Personal Hygiene – disease spread
- Subsidies – state/federal/other?, particularly for things like freighting
- Policing issues
- Ability of local authority to manage – this will be beyond local management – a significant co-ordinated response will be required
- Local Council can distribute
- Non-potable in system – need to be communicating with Health + Rural Fire etc. Non potable in reticulated system with delivered potable appears to be likely option, however raises health issues. May need to colour the reticulated non-potable, big communications issue.
- This constitutes a natural disaster – needs to be included as one of the scenarios in DISPLAN.
- When Town Water Supply failure is imminent, needs to trigger this response.
- Voluntary evacuation may need to be considered? Issues that come up may include employment, looting, security – this was not considered a good idea
- Need to maintain quality of life

PACKAGED WATER OPTION

This option was considered further as it was considered likely to be the most viable. This option would require a significant coordinated response, and would require assistance beyond the local water utility.

Major issues/questions requiring resolution include:

- Who is supply agency (source finder) – possibly DLWC?
- Who is Combat Agency or Controller – need Incident Management trained organisation – possibly SES or police.
- Who transports? – unclear, probably need agency assistance
- Who distributes? – probably Council to manage with assistance from SES, RFS
- Who manages compliance? – Police for theft, Council for distribution, need a rigorous checklist method, education and communication, and an anomaly process
- Need to consider health and the elderly – how do they to get into the house – need a team of volunteers?

Question: What if we shut the mains off and have no form of reticulated water supply? How then do people deal with own waste? – This is NOT an acceptable scenario.

NON POTABLE WATER

What standard of non- potable water is appropriate?

1. Standard least likely to make ill ingesting or skin contact (less than drinking water standard
2. Need to be able to return system from non- potable to potable safely

The best option for non-potable in the reticulated system in Nambucca was considered to be brackish water. Micro biologically would need to disinfect. Chemically should be OK. Main issues identified for use of non-potable (brackish) water in reticulated system:

- Turn off hot H2O system and dishwashers
- Put a dye in water so not potable (flurosene) Make it blue like kero?
- Odour complaints?
- Corrosion problems
- Can sewerage treatment system handle it – need a phase in over 20 – 40 days.

LEAD TIMES for EMERGENCY PLANNING

Need to consider things like:

- Sewerage system – converting non- potable
- Gearing up to bottled water
- Infrastructure for non- potable water
- Community understanding

It was generally agreed that a significant coordinate response would be required to manage this scenario, and the local water utility would need to hand over management of the situation to an external agency with a highly developed incident management system.

SUMMARY STRATEGY

LITRES/PERSON/DAY	MECHANICS	TRIGGERS	LEAD TIME
200	Education, restrictions	to be determined	to be determined
150	Internal usage, education	Existing restrictions	
100	Compliance	Upping education	Communication
		Penalties (More intensity of 150)	
50	More of 100 intensity		
20	Evacuation or	Bottled water (collected or delivered)	

Note: It was agreed that for any scenario where reductions in domestic consumption below 150 l/p/d are required, professional communicators would be required to develop education programs + a communication strategy

Appendix G – Emergency Response Strategy Supply Opportunities

Emergency response measures are needed when all demand reduction and alternative supply source opportunity measures have been exhausted. The emergency response measures are highly costly and hence should be triggered as the last resort. The emergency response measures aim to:

- Maintain, as a minimum, the health, safety and hygiene of the community by ensuring sufficient water is available for potable needs and to convey the raw sewage from premises; and
- To operate the sewage treatment plants to ensure safe and sustainable discharge of the treated effluent.

The emergency response measures fall into two categories:

- Alternate emergency *local* supply opportunities; and
- Alternate emergency *external* supply opportunities.

The alternate emergency *local* supply opportunities include:

- Marginal groundwater resources in Gumma/Scotts Head area; and
- Desalination of sea/brackish water.

The alternate emergency *external* supply opportunities include:

- Water carting and unloading into reservoirs; and
- The combined distribution of bottled water to premises and supply of sea/brackish water into the water supply system for non-potable use.

These emergency response measures together with the associated costs and logistics are discussed below.

Alternate Emergency Local Supply Opportunities

Alternative Groundwater Supplies in the Scotts Head Area

Description

It may be possible to develop small groundwater supplies in the following areas:

- The northern corner of the Scotts Head village. It is understood that the former village supply drew water from this area; and
- Between Scotts Head and Gumma Road.

The Scotts Head location has a limited catchment and there are already private bores in use. The Gumma Road area has very low relief and would store little water above sea level. As a consequence low drought yields would be expected. In both areas there would be a high risk of saline intrusion and pollution. These sources could be considered as a separate supply to Scotts Head in the unlikely event that water cartage to the rest of the scheme proved necessary.

Desalination

Description

A final emergency supply option would be desalination of brackish water. The Department of Commerce investigated this option in developing a drought management plan for Eurobodalla Shire Council. A skid mounted 2.5 ML/d desalination unit can be imported for about $2.0m with delivery from 12 to 14 weeks. The unit could be sited on the Nambucca River estuary at an environmentally suitable location that would minimise cost of intake and brine disposal lines, power supply and connection to water supply trunk main.

The option costed below is for a 2.5 ML/d supply for blending with a residual supply from Bowraville borefield of 0.5 ML/d. The option of a small desalination plant (say 0.5 ML/d) as an ultimate source for carting potable water is not considered a realistic scenario.

Cost of Implementation

Capital Costs	
Supply of 2.5 ML/d desalination plant	$2,000,000
Power Supply	$100,000
River Intake	$20,000
Pipeline connection	$50,000
Low lift pumps / switchgear	$20,000
High lift pumps / switchgear	$40,000
Brine disposal line	$200,000
Land acquisition, access	$100,000
Engineering contingencies 30%	$160,000
Total	$2,700,000
Daily Costs	
Allow $1.00/kL	$2,500

Lead Time

While suppliers offer 3 months delivery and commissioning, it would be prudent for NSC to commence investigation into plant location, brine disposal issues etc at least 6 months before placing the order.

Alternate Emergency External Supply Opportunities

Water Carting to Reservoirs

Description

The Brochure in Appendix J prepared by the former DLWC outlines the procedure NSC should follow in applying for financial assistance towards the cost of water carting. The Government will meet all costs in excess of a base cost / litre (presently $1.86/L) incurred by NSC in water carting.

NSC would be responsible for determining the water source and determining the transport arrangements (the number and size of trucks and the loading and unloading points), while DEUS would review this planning before granting subsidy.

As set out in the Brochure, DEUS will subsidise the minimum amount required for essential domestic, industrial and institutional purposes. In the case of Nambucca District, NSC could seek to have subsidy provided towards the cost of water it has been providing under Level 6 restrictions. NSC could phase in water carting as storage at the Bowraville borefield approached a critical level.

There are several advantages to phasing in cartage:

- NSC does not know with certainty the storage volume at the borefield and when salt-water intrusion might occur. It must leave a reasonable safety margin when it begins carting.
- The logistics of carting can be refined as supply is increased from 1 to 2 ML/d and finally 2.8 ML/d over say a 2-month period if this proves necessary.
- Leaving a small residential storage would also provide security in the event of some major problem developing with cartage arrangements.

At the workshop held at Macksville on the 6th March 2003, consideration was given to an emergency supply of 50 L/c/d. As determined at the workshop such a restricted supply would be extremely difficult to administer and would have major adverse effects on industry, tourism and quality of life of residents. In view of the government policy outlined above, such a scenario has not been developed in this report.

Source

The source of water for cartage will depend on the flows within local rivers and storage levels of town water supplies operated by neighbouring councils at the time Nambucca Shire WS is approaching failure. The town supplies that would be first considered are:

- Bellingen
- Kempsey
- Coffs Harbour

NSC could negotiate directly with the councils. If unreasonable difficulties were encountered, NSC could seek to have the Minister for Energy and Utilities use his powers under the Local Government Act to instruct the councils to act in the required manner.

The river source that would most likely be suitable would be the Macleay River upstream of Kempsey. The DIPNR Minister could, on application, grant NSC authority to pump from the Macleay River.

Transport

Water carts used in road construction works vary from 10 to 20 kL capacity.

Adopt 15 kL average.

Assume carting from Kempsey to Macksville 66 km.

Transport times are as follows:

Cycle load	10min
Kempsey – Macksville	60min
Unload	10min
Macksville - Kempsey	50min
	130min

Allow 5 trips per day (on road 11.5 hours /day)

One 15 kL truck will cart 75 kL /day

To cart 1 ML/d – 14 trucks/ 1 shift, 7 trucks/ 2 shifts

2 ML/d – 27 trucks/ 1 shift, 14 trucks/ 2 shifts

Hire of 7 to 14 water carts under drought conditions could be difficult. Interstate hire might be necessary. Tankers normally used to carry other liquids could be used if water quality could be guaranteed. Other options such as use of butyl bags in trucks fitted with suitable baffles could be investigated if necessary.

Loading

With 27 trucks making 5 trips / day 135 loading / unloading operations in a 12 hour day.

i.e. @ 5.33 minute intervals to load 15 kL water in 10min. requires supply rate of 25 L/s.

This would require say 3 specially constructed standpipes located close to a service reservoir where such high draw- off rates could be tolerated.

Unloading

To allow rapid unloading it would be necessary to have a system which allowed water carts to discharge at a high rate into a temporary ground level storage from which water could be pumped into an adjacent service reservoir.

Cost of Implementation

Loading and unloading arrangements would depend on the water source. Possible examples include:

- From Bellingen or Coffs Harbour transfer into Nambucca Heads Reservoir;
- From Kempsey transfer into Macksville Reservoir and install temporary booster to pump to Nambucca Heads; and
- From Macleay River transfer into Bowraville borefield balance tank for blending and chlorination before distribution.

Indicative costs for carting from Kempsey

Capital Costs

Identify preferred source	$5,000	
Arrange approvals	$5,000	
Apply for government subsidy	$2,000	
Loading facilities		
Large ϕ stand pipes – cut in, valves etc.	$20,000	
Unloading facilities		
30kL tank, trough, pipework	$15,000	
Installed hired pump, pipework to reservoir	$5,000	
Arrange hire water carts	$5,000	
Power supply	$10,000	
Design, supervision etc.	$13,000	
Total	$80,000	

Daily Costs

Hire transfer pumps (50L/s x 20m)	$250	
1 ML/d – 14 trucks x 12hrs x $70/hr	$11,700	= $11.70/kL
Subsidy		= $9.84/kL
Cost to NSC		= $1.86/kL

Lead time

The steps NSC has to follow to obtain government subsidy towards the cost of cartage are shown in Figure G1 below.

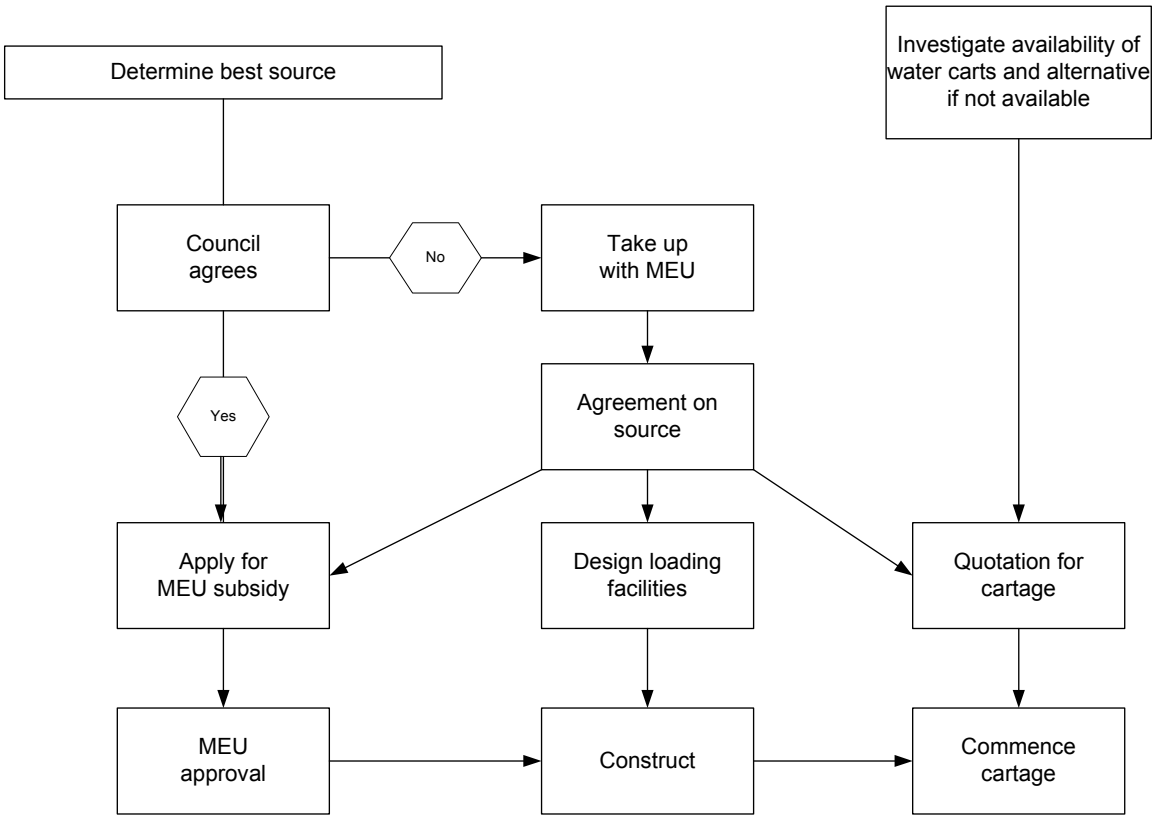


Figure G1: Steps Required to Secure Government Subsidy

NSC should commence this process some 3 months before it considers cartage could become necessary.

Resources

- Planning

  One contract engineer / technical officer for one month (cumulative time) to assist with all planning activities, design of facilities, investigating transport arrangements etc.

- Cartage

  Supervision that loading and unloading are done carefully to protect installations and water quality, to tally truckloads and to pump water from temporary ground storage into service reservoir.

  Say one NSC operator at each end at all times

  12 hour days – 6 hour shifts.

  4 additional personnel

Delivered Bottled Water to Houses for Essential Cooking and Drinking Only

Description

Where emergency potable supplies are very limited but non potable supplies are available, an extreme emergency option would be for NSC to use its reticulation system to distribute non potable water and to deliver by road limited potable water to each household for essential cooking and drinking purposes. It would be desirable if the non-potable supply was suitable for laundry washing, kitchen washing up, bathing and toilet flushing and could be made reasonably safe for inadvertent drinking by children after chlorination. It would be essential that the sewage treatment plants could tolerate the non-potable source given a reasonable transition period with a diminishing proportion of potable water. It would also be essential that the non-potable supply should have a high degree of reliability as it is vital to the protection of public health that the sewerage system should continue to function.

Saline groundwater with salinity up to 5,000 mg/L could meet this specification. With such a non-potable supply, an allowance of 7.5 L/c/d of bottled potable water would be adequate.

If such a source cannot be located it would be necessary to utilise highly saline water from the Nambucca River estuary. In this case a larger allowance of bottled potable water would be required to allow limited washing (clothes and body) in low salinity and low hardness water – allow 20 L/c/d. This case has not been examined in detail.

Low Salinity Non-Potable Source

As a theoretical exercise it could be assumed that a 2 ML/d borefield could access saline groundwater in the Nambucca River alluvium in the vicinity of Lanes Bridge. It would be necessary to construct a pipeline connection to the proposed South Creek borefield rising main.

Distribution of Bottled Water

Considering residential use only, a supply of 7.5 L/c/d for drinking, cooking, teeth cleaning etc. would require delivery each day of 112.5 kL of potable water. There are several options for this supply:

- Deliver commercially bottled water to homes

  There are many firms delivering bottled spring water. Practice is to deliver in 15 L containers from trucks equipped with racks that can hold up to 300 bottles. Price per bottle in Sydney is of the order of $8.50. It is assumed that a commercial operator would transport bottles in bulk (semi-trailer or rail) to Macksville and then re-load onto smaller flat top delivery trucks equipped with racks. Each house would require about 1.25 bottles per day on average. Cost therefore would be in the order of $10/house/day. And for some 6,000 houses, $60,000 per day.

  If delivery of 1 bottle a day took 3 minutes / house, each truck with 300 bottles would have a cycle time of the order:

Load	30 min	
Depot to Suburb	30 min	
Deliver	300 min	
Return	30 min	
Lunch	30 min	
	420 min	= 7 hours

To deliver 7,500 bottles would require 25 trucks working 1 shift per day.

The costs and logistics of this operation make it clearly impracticable.

- Set up "bottling plant" at Bowraville

NSC would fill bottles with water drawn from residual storage left for this purpose in the Bowraville borefield. This would require NSC to purchase some 12,000 bottles and hire and equip 25 flat top trucks with racks. NSC would have to design and construct a system for cleaning, disinfecting and filling 7,500 bottles in say 10 hours i.e. 750 bottles an hour.

This also appears impracticable.

- Refillable bottles kept at household

NSC to provide each house with say 2 X 50 litre plastic water containers with bottom taps. NSC to refill and seal these containers kept at house entrances from water carts equipped with pumps and hoses. NSC would fill water carts from residual storage left for this purpose in the Nambucca River borefield.

Allowing 10min / house and working on 2 houses at a time, a 15 kL water cart could provide 100 litres to 150 houses in about 12.5 hours plus 1 hour to travel to and from the borefield. Therefore NSC would require 8 water carts working double shifts and 7 days per week.

This appears the most practicable option for delivering potable water to each house.

Cost of Implementation of Refillable Bottles at Household

Capital Costs

Non-potable supply

Site investigation	$20,000
Construct 2 production bores	$40,000
Power supply	$5,000
Pipeline connection to existing borefield	$30,000
Engineering contingencies 30%	$28,000
Sub-total	$123,000

Potable supply

12.000 x 50L containers	$60,000
Loading arrangement at borefield	$20,000
Water cart equipment 8 x 2,000	$16,000
Sub-total	$96,000
Total	$219,000

Daily Costs

Water cart hire	
8 trucks x $70/hr x 14hrs	$7,840
4 operators/truck – 32 operators x $200	$6,400
2 bore pumps (1 ML/d x 20m)	$200
Total	$14,400

Lead Time

A minimum lead-time of 3 months would be required.

Appendix H – Agency Correspondence

NSW Department of Infrastructure, Planning and Natural Resources

Department of Sustainable
Natural Resources

Department of Commerce
Integrated Urban Infrastructure and Planning Group
Level 13 McKell Building
2-24 Rawson Place
SYDNEY NSW 2000

Attention: Roshan Iyadurai

Re: Nambucca Emergency Drought Strategy – Draft 2

Dear Mr Iyadurai

Thank you for the opportunity to comment on the draft of the Emergency Drought Strategy for Nambucca Shire Council. DIPNR has several concerns with the draft Strategy, outlined below.

It is recognised that a very short-term strategy is required should a drought similar to last year's recur in the near future. It should be stressed, however, that any such strategy is indeed short-term, and that a longer-term water supply solution should be explored as soon as possible. Any such solution should focus on off-stream works and the harvesting of high river flows, so that the natural low flows can be restored as much as is possible. The Department looks forward to working with DoC and Council on any proposal.

Generally, new in-stream structures are contrary to Government policy, and any such structure on a major river such as the Nambucca requires consultation with, and possible approval from, NSW Fisheries. I would urge you and Council to contact NSW Fisheries regarding the temporary weir proposed in the draft Strategy.

It was unclear from the draft strategy the actual nature of the proposed weir, whether it is removable, and how far into the river bed it will extend. Although not entirely comfortable with the concept, and subject to NSW Fisheries concurrence, DIPNR may be willing to accept the short-term proposal if the weir can be installed only in emergency circumstances, and removed once the emergency has passed, with minimal impact on stream structure. In addition, DIPNR will require Council to monitor the movement of the salt water interface during these emergency times, and have developed a contingency plan should significant movement be detected.

The Department is concerned about the proposed recirculation of water through the Nambucca borefield. It appears the main motivation for recirculation is to use the Nambucca aquifer to improve water quality, namely possible contaminated stormwater runoff from Bowraville (unlikely in an emergency drought situation). This runs contrary to the Government's *NSW Groundwater Quality Protection Policy* (NSW Government 1999). It is also seen as an unnecessary cost to the strategy. The natural filtration provided by the short distance between the discharge point and the borefield extraction points would be very minimal, with very short travel times. This view is supported by evidence of very high transmissivities as shown by the disappearance of the river at the head of the borefield during drought periods, and the very fast rebound of the water table within the bores once pumping has ceased. In addition, direct supplementation of the temporary weir water to Council's header main (ie no recirculation) could result in reduced borefield pumping, leaving a higher water table within the borefield, thereby reducing the risk of saltwater intrusion.

The proposed discharge of water from the South Creek bores to the Nambucca borefield is also a major concern to the Department. Possible contamination a fresh groundwater resource with iron and manganese again runs contrary to the *NSW Groundwater Quality Protection Policy*. The Strategy

contends that discharge to the Nambucca borefield is preferred to direct supplementation of the South Creek groundwater to Council's header main because "any treatment malfunction would lead to increased levels of iron and manganese in the Council's system. DIPNR considers the addition of high levels of iron and manganese to a system that can be flushed is preferable to their addition to the fresh groundwater, and any consequent environmental and water supply impacts.

It should be noted that the documented storage volume of 56ML for the South Creek alluvium was determined as the approximate volume of water available for drawdown from the first production bore installed. This volume did not include any calculations from the second production bore installed or any groundwater through flow from up-gradient alluvium. As such, there is potentially further water available in this area than accounted for in the option.

The conditions of any approval of an Emergency Drought Strategy will include the requirement to produce a formal demand management strategy. Obviously, the Emergency Drought Strategy would not be activated until level 4 restrictions were in place. In addition, approval conditions will include requirements to monitor salt water intrusion down gradient of the borefield, surface water flows above and below the borefield, surface and groundwater quality, groundwater levels, and to meter extraction from each individual bore.

If you wish to discuss the Department's concerns further, or to canvass any alternative options for the Emergency Drought Strategy, please contact Vanessa O'Keefe (A/Manager Resource Knowledge) in the Grafton office on 6640 2191.

Yours sincerely

Des Schroder
Regional Director
North Coast Region

18 July 2003

cc. Mr Tony Pedlow
Water and Sewerage Manager
Nambucca Shire Council
PO Box 177
MACKSVILLE NSW 2447

cc. Mr Glenn George-Radford
Urban Water Engineer
Department of Energy and Utilities
PO Box 582
COFFS HARBOUR NSW 2450

Department of
Infrastructure, Planning and Natural Resources

Locked Bag 10
Grafton NSW 2460
Telephone: 6640 2191
Facsimile: 6640 2185

Urban Services Planner
Sustainable Water Solutions
NSW Department of Commerce
McKell Building
2-24 Rawson Place
Sydney NSW 2000

Attention: Roshan Iyadurai
Senior Urban Services Planner
Sustainable Water Solutions

Dear Roshan

Nambucca District Water Supply

I refer to your letters dated 27th October, 29th October 2003, regarding Council's final draft Drought Management Strategy and 9th December 2003, regarding possible access conditions for an off-river storage.

Draft Drought Management Strategy

We are pleased to note your confirmation (letter dated 27th October) that the Drought Management Strategy is only intended as a short term strategy until longer term solutions to water security during drought periods is in place. Subject to the matters listed below, the Department endorses the strategy.

One outstanding concern regarding this Strategy relates to the monitoring of salt water interface during emergency. This monitoring needs to be clearly linked to the strategy to ensure that monitoring frequency is linked to groundwater levels and the increased likelihood that there may be salt-water intrusion during an extreme drought. Clearly if a problem is identified through this monitoring, Council's use of the aquifer would need to be modified.

The groundwater licences for Nambucca District Water Supply will need to be modified to include the Drought Management Strategy. I have asked our licensing unit to advise me of an approximate time frame for these changes.

When, the Emergency Drought Management Strategy reaches the stage where the temporary weir needs to be constructed, the Department will need to issue a

temporary permit to allow extraction from the river behind this weir. Monitoring of groundwater and surface water levels should ensure that there is no delay in the issuing of this permit when required.

A permit is not required by Council for the construction of this weir under the Rivers and Foreshores Improvement Act. However, the Department is concerned about possible detrimental impacts of this work on the stablility of the river. A meeting between Peter Corlis of the Department (6653 0115) and Council to identify the likely site of the weir and discuss an appropriate design should ensure that our concerns are addressed and expediate the granting of the surface water permit when required.

Indicative operating rules for an off-stream storage

I confirm that the indicative operating rules for filling an off-stream storage for Nambucca District Water Supply outlined in a letter from Des Schroder dated 25 September 1998 largely reflect current policy. Additional limitations relating to daily extraction limits (eg. 20% instantaneous flow) may also be required.

These rules will need to be refined in light of ecological assessments associated with the formal planning for such a storage.

Modelling conducted as part of a secure yield assessment for such a storage should be done on a daily time step (rather than the monthly time step used in the original analysis). This is needed to better capture the variability in flows and hence Council's requirements and the management regime now used for unregulated rivers.

Should you wish to discuss these comments further, please contact Jeanine Murray, Manager Resource Knowledge on 6640 2191.

Yours sincerely

Des Schroder
Regional Director
North Coast Region

NSW Fisheries

14 November 2003
Our Ref: MJR-Nam/water supply

Mr Roshan Lyadurai
Department of Commerce
Level 13 Mckell Building
2-24 Rawson Place
SYDNEY NSW 2000

Dear Roshan,

RE: Nambucca Water Supply - Emergency Drought Management Strategy and Works

I refer to your letter of the 27 August and following up site inspections with Mr Tony Pedlow (Nambucca Shire Council) concerning the development of an Emergency Drought Management Strategy for Nambucca Shire Council's water supply.

Under the provisions of the *Fisheries Management Act 1994* (the Act) NSW Fisheries has management responsibility for the protection and conservation of fish and fish habitats. Further, NSW Fisheries is an "approval body" for works that require one or more of the following approvals under the *Fisheries Management Act* 1994:

- Approval to cut, remove, damage or destroy marine vegetation;
- Approval to carry out works for dredging and reclamation within any waters;
- Approval to block the free passage of fish;
- Approval for the use of explosives or electrical devices; and
- Approval to undertake aquaculture activities.

NSW Fisheries has reviewed the information provided in light of these provisions and the policies that underpin them and provides the following comments for yours and Councils consideration.

1. NSW Fisheries gives its in principle support for the 'Water Supply - Emergency Drought Strategy', and acknowledges the need for a strategy that includes a range of options that will secure satisfactory water supply to the towns and residents of Nambucca Shire.

2. Option 3 as detailed in the Emergency Drought Strategy – Draft 2, will require approval under section 200 of the Fisheries Management Act.

3. Option 3 should be seen as a last resort. Options 1 and 2 should be implemented to the fullest extent possible before proceeding to Option 3.

4. Before approval can be given for the works the following information will need to be provided:

   - Permit application form with all information requirements addressed
   - Permit application fee ($200)
   - A 'work method statement' detailing the proposed works (ie detailed design of structure and proposed location) and how the proposed works will be undertaken (ie access roads, work platforms sediment erosion control, etc)

RICHMOND FISHERIES OFFICE
5 Regatta Avenue ~ PO Box 154 BALLINA NSW 2478
Telephone: (02) 6686 2018 Facsimile: (02) 6686 8907
ABN 56 287 047 871

5. It is recommended that Council compile the information and submit the permit application form only when it is deemed necessary. This will avoid unnecessary costs and doubling up of administrative handling.

If you require further information or have any queries please feel free to contact me on (02) 6686 2018.

Yours sincerely,

Marcus Riches
Senior Conservation Manager (North Region)
NSW Fisheries

CC Tony Pedlow (Nambucca Shire Council)

NSW Department of
Commerce

McKell Building
2-24 Rawson Place
Sydney NSW 2000

Telephone 02 9372 7871
Facsimile 02 9372 7872

TTY 1300 301 181
ABN 54 625 095 406
www.commerce.nsw.gov.au

27 October 2003

Mr Des Shroder
Regional Director
North Coast Region

Dear Mr. Shroder,

Nambucca Water Supply Scheme Emergency Drought Strategy - Draft 2

Thankyou for your letter of 18th July 2003 detailing your department's comments on the draft of the Nambucca Water Supply Scheme – Emergency Drought Strategy. The concerns raised in your letter were discussed at a meeting on 6/8/2003 with your department representative Mr Jeremy Black, Nambucca Shire Council's Water and Sewerage Manager Mr Tony Pedlow and Ministry of Energy & Utilities Regional CTWSS program coordinator Mr Glenn George Radford. The outcomes of this meeting are summarised below for each concern raised in your letter.

a) *Drought Strategy should be very short-term and a long-term water supply strategy should be explored as soon as possible.*

This emergency drought strategy is a short-term strategy to manage the water supply scheme during emergencies such as drought. The measures nominated in the strategy are triggered when the existing supply source is nearing depletion and there is high level of restrictions on water use. As explained at the meeting, Council and the Ministry are in the process of commissioning a separate study, which will evaluate long-term solutions for the water supply, including off-stream storage, among other options.

b) *Contact NSW Fisheries regarding the proposed temporary weir.*

The Department of Commerce has spoken to NSW Fisheries and has written a letter on 27/9/2003 requesting approval for the proposed concept and for a work permit. Verbal advice is that a temporary permit would be issued to Council after a site visit.

c) *Actual nature of the proposed weir.*

As explained at the meeting, the proposed weir will be constructed with sandbags within the Nambucca River, upstream of the confluence with South Creek. There will be some excavation of the riverbed say to a depth of up to 1 metre to place the sand bags. The purpose of this sandbag weir is to create sufficient pumping pool for the pumps. The sandbag weir will be removed once surface flows return to Nambucca River.

d) *Monitoring of the salt water interface during emergency*

As indicated at the meeting, Council will be separately investigating the installation of monitoring bores and would also be developing the bore monitoring program and the contingency plan to deal with salt-water intrusion.

e) *Proposed recirculation of water from the weir through Nambucca borefield.*

As indicated at the meeting, since the temporary weir is upstream of the confluence with South Creek, the harvested water is unlikely to contain any runoff from Bowraville Township. The recirculation to the head of the borefield has two main benefits. Firstly, it maintains a steady water level within the Bowraville town water aquifer and secondly, the sand will act as a natural filter (as at present) to screen iron and particles. However, as agreed at the meeting if the water quality tests show that the water quality is poor, Council will not recirculate the water to the head of the borefield but will feed directly to the water supply headworks for treatment.

f) *"Proposed discharge of water from South Creek bores to Nambucca borefield is also a major concern..."*

As indicated at the meeting, the South Creek bore water will be treated separately within a treatment plant and the treated water will be pumped directly into the water supply system. The sludge/waste from the treatment plant will be managed in Council's sewage treatment plant.

g) *Storage volume of second bore in South Creek not accounted for in the calculations.*

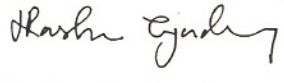
It was agreed that Council would forward the drillers report separately for Department of Infrastructure Planning and Natural Resources (DIPNR) review. Water available from this bore will be managed in a similar manner to bore Number 1 water.

h) *"Condition of any approval...production of formal demand management strategy."*

At the meeting it was clarified that DIPNR's requirement is not a demand management strategy but a formal restriction policy. Council already has a restriction policy and is in the process of reviewing the common residential restriction policy for North Coast water supplies.

The Department of Commerce has, based on review comments from Council and MEU, amended the Emergency Drought Response Strategy (ERS) and also produced the Drought Management Plan (DMP). The final drafts of the ERS and DMP are attached for your review.
The Department of Commerce is also seeking DIPNR's approval, in principle, for the ERS and DMP. We would also appreciate it, if DIPNR could indicate any requirement for license / permits / approvals for any measures listed in the ERS and an approximate length of time for their issue.
If you need any clarification, please contact Tony Pedlow or myself on 0409785013.

Yours Sincerely



Roshan Iyadurai
Senior Urban Services Planner
Sustainable Water Solutions

Appendix I – Draft DLWC Drought Management Plan Guideline Compliance

Item		Compliance			Comments
		N/A	Y	N	
A) Data					
	1. Identification of:				
	a) Communities with Local Water Utility services.	☐	☑	☐	
	b) Communities with private water services (i.e. Aboriginal Communities)	☑	☐	☐	
	c) Communities with no water services that may seek Local Water Utility assistance.	☑	☐	☐	
	d) Properties (eg. Farms) that may seek Local Water Utility water.	☐	☑	☐	
	2. Identification of requirements and current water supply status for all communities and properties identified in 1.	☐	☑	☐	
	3. Normal and minimum potable water requirements for all schemes identified in 1. Show as a graph, as figures will vary throughout the year.	☐	☑	☐	
	4. Normal and minimum raw (non-potable) water requirements for all schemes identified in 1. Show as a graph as figures will vary throughout the year.	☐	☐	☑	Bowraville STP reuses 100% of effluent however demand for effluent was not provided.
	5. Identification of water dependant industry / businesses associated with the schemes identified in 1.	☐	☑	☐	Midco is the obvious inclusion.

Item		Compliance			Comments
		N/A	Y	N	
	6. Identify any fire fighting requirements.	☐	☑	☐	Standard design values assumed.
	7. Identify opportunities for recycled water use.	☐	☐	☑	Long term opportunities identified but drought opportunities were limited.
	8. A map of communities and properties referred to in 1.	☐	☑	☐	
	9. A description of all water supply schemes referred to in 1. (including schematic diagrams).	☐	☑	☐	
	10. Storage volumes and surface areas for dams and weirs. "Height/Storage Volume" and " Height/Surface Area" curves should be included.	☐	☐	☑	An estimate made. Aquifer storage is not well understood. Hydrogeological modelling required.
	11. Historical performance of rivers/dams/weirs/bores in previous droughts. Show graphically and compare to current drought.	☐	☑	☐	
	12. Average annual rainfall / forecasting. Show on a graph.	☐	☐	☑	Historical provided. No forecasting undertaken.
	13. Evaporation rates. Show on a graph.	☑	☐	☐	
B) Planning					
	14. Level of prediction and intervention i.e. Trigger points.	☐	☑	☐	
	15. Restriction strategy and policies for special demand management and other management options.	☐	☑	☐	

Item		Compliance			Comments
		N/A	Y	N	
	16. Enforcement of restrictions i.e. Identification of legislative instruments and methods for enforcement.	☐	☑	☐	
	17. Impact of imposing restrictions on demands, river flows, volumes of stored water, water tables, etc. Show graphically.	☐	☑	☐	
	18. Impact of extraction on downstream stakeholders. Local Water Utility to work in partnership with downstream users and communities. (Water Sharing Committees, Water Management Committees, State Water, Irrigators, etc.)	☐	☑	☐	NSW Fisheries contacted. Legislative requirements outlined. No downstream extraction occurring.
	19. Impact of reduced flows in watercourses. Local Water Utility to work in partnership with upstream and downstream users and communities. (Water Sharing Committees, Water Management Committees, State Water, Irrigators, etc)	☐	☑	☐	
	20. Availability of alternative water sources such as bores, private supplies, farm bores and other Local Water Utility schemes.	☐	☑	☐	
	21. Issues relating to cartage to remote locations such as mining areas.	☐	☑	☐	
	22. Identify Legislation, Local Laws and Council Policies that might impact on the contingency arrangements, particularly DIPNR and Fisheries.	☐	☑	☐	
	23. Identify human resource requirements.	☐	☑	☐	
	24. Identify costs of options.	☐	☑	☐	

Item		Compliance			Comments
		N/A	Y	N	
	25. Prepare a media strategy. This should cover television, radio and newspapers. It should also give consideration to signage on roads leading to areas where restrictions are in place, at railway stations and airports.	☑	☐	☐	Not part of brief. The essential elements of a communication strategy were included.
	26. Establish a list of appropriate contact persons.	☐	☑	☐	
C) Monitoring					
	27. Monitoring demands.	☐	☑	☐	
	28. Monitoring flow in streams.	☐	☑	☐	
	29. Monitoring water level in bores and dams.	☐	☑	☐	
	30. Monitoring the EC, Alkalinity and Algae levels in the water sources. Seek technical advice on treatment necessary. Identify contacts and document.	☑	☐	☐	To be undertaken by NSC
D) Consultation					
	31. Public consultation (Need to address the social and economic impacts. Need to address the effectiveness of restrictions, etc)	☑	☐	☐	To be undertaken by NSC
	32. Consultation with appropriate NSW Government Agencies (DIPNR, EPA, Health, etc).	☑	☐	☐	To be undertaken by NSC
E) Review					
	33. Throughout and at the end of the drought, the local water utility should record significant events as they occur and ensure that they are available for the	☑	☐	☐	To be undertaken by NSC

Item		Compliance			Comments
		N/A	Y	N	
	next drought.				

Appendix J – Drought Relief for Country Towns

Drought relief for country towns

Buckenbowra River, Eurobodalla Shire

A guide to assistance available from the New South Wales Government to local water utilities

LAND & WATER CONSERVATION

Introduction

In New South Wales, local water utilities are responsible for water supply to country towns and villages.

Local water utilities have the responsibility to manage their water supplies and where necessary, impose restrictions to maintain essential demand and avoid the need for cartage of water.

When country town and village supplies are threatened by drought or blue-green algae outbreaks, the New South Wales Government will help local water utilities maintain a basic supply to their consumers. The Department of Land and Water Conservation (DLWC) will provide technical assistance and aid to councils in applying for financial assistance from the Government.

This brochure describes the types of assistance available and the procedures that should be followed when local water utilities seek help.

Groundtank, White Cliffs

The Government may also help to provide water to drought-affected primary producers, who should approach the Department of Agriculture for advice.

Types of assistance available

Technical or financial assistance may be provided to assist in the preparation of drought management plans, manage depleted supplies, to implement emergency capital works or to cart water, depending on the particular situation.

A subsidy of up to 50% of the cost (to a maximum of $5000 per local water utility) may be made available by the Minister for Land and Water Conservation to assist with preparing Drought Management Plans.

Emergency capital works may be recommended as the best solution to the council's water supply problem; these might include emergency bore supplies, temporary or permanent connection to another source or water supply scheme, or the development of new water sources.

The Department of Land and Water Conservation can provide technical assistance in relation to drought management planning. The Government may also offer to reduce the cost of design and construction of approved works to the local water utility, through financial assistance, under the Country Towns Water Supply and Sewage Program. This assistance can be up to 50% of the cost.

Where water cartage is recommended as the most economical measure to adopt, the Minister for Land and Water Conservation may pay a subsidy for the quantity required to be carted for essential purposes. The quantity will be subject to cartage allowances and cartage methods described in this brochure and agreed with the DLWC.

Initial assessment - technical report

If the security of a town water supply appears to be threatened, the local water utility should request advice from the Regional Director of the DLWC. DLWC Regional staff will make a site inspection, if appropriate, and arrange for the preparation of a technical report that includes the following:

- ✓ The name of the community and its location relative to the nearest town
- ✓ A contingency plan for the current drought (Drought Management Plan)
- ✓ An indication of the earliest data failure could occur
- ✓ A brief description of the existing water supply, stating whether or not it is reticulated, and information on whether the town is sewered, unsewered, or uses septic tanks
- ✓ Details of normal and current water consumption and of restrictions imposed by council
- ✓ The number of residents requiring a supply, the number of occupied dwellings and quantitative description of any other consumer types to be provided for, eg. industries or businesses that need water to protect public health and meet essential needs
- ✓ The minimum essential quantity of water required by the community
- ✓ A description of the existing source, and an analysis of its security
- ✓ Potential for works to secure the supply against future droughts
- ✓ An analysis of the cost of various feasible means of safeguarding the supply, including cartage

This report will provide the local water utility with the information required to support claims for assistance with capital works or water cartage.

South Torrens Bore, Tibooburra

Water cartage

Government assistance towards the cost of water cartage is available from the Minister for Land and Water Conservation but is subject to quantities and cartage arrangements being agreed with the DLWC.

If water cartage is the only economic solution, the council should prepare an application to the Minister for Land and Water Conservation for financial assistance. This should be undertaken in consultation with the Regional Director of DLWC, who can advise on the best cartage arrangements.

If water is to be transported by road, the local water utility is to seek quotations from contractors if its own equipment is inadequate, unavailable, or is more costly to employ.

The application to the Minister for Land and Water Conservation should contain the following:

- ✓ A copy of the technical report
- ✓ Details of any consideration given to, or steps taken towards, establishing an emergency supply from another source
- ✓ The location of the new source of water to be used, the method of cartage proposed, the number of loads and frequency
- ✓ The cost of purchase and transportation of water
- ✓ Copies of all correspondence with transport contracts on the subject of cartage

The local water utility should make its application to the Minister for Land and Water Conservation Parliament House, Sydney and provide copies to the Regional Director and the General Manager, Town Water Treatment and Recycling, DLWC.

The local water utility is responsible for town water services and should proceed with cartage arrangements as soon as necessary, and must meet all costs pending the determination of subsidy by the Minister for Land and Water Conservation.

The subsidy will only apply to the minimum quantity required for essential domestic, commercial, industrial and institutional purposes in urban areas, calculated according to the guidelines set out later in this brochure and endorsed by the General Manager, Town Water Treatment and Recycling, DLWC.

The local water utility would be expected to supply a sufficient quantity to meet the reasonable needs for their communities. The actual amount to be carted may be greater than that attracting subsidy.

The subsidy is reviewed annually, usually in September. As at February 2001 the Minister for Land and Water Conservation may meet all freight charges in excess of $1.86 per kilolitre to supply towns with a reticulated supply, or $3.73 per kilolitre for those without a reticulated supply.

Financial assistance is not available for hiring or operating temporary pumps or pipelines, nor for costs of management measures.

Guidelines for determining minimum requirements

The basis of subsidy for water cartage is the minimum amount calculated as follows (all quantities are given in litres per day per person):

Residences

	WC not connected to septic tank	Septic tank	Sewered
Coast & Tablelands:			
Unreticulated supply	60	75	-
Reticulated supply	65	80	95
Western Areas:			
Unreticulated supply	80	100	-
Reticulated supply	85	105	130

Schools

Add the appropriate allowance for each person not included in the resident population

	WC not connected to septic tank	Septic tank	Sewered
Coast & Tablelands:	5	17	37
Western Areas:	10	22	42

Hospitals and public institutions

Add 330 litres for each patient for hospitals, and 154 litres per person for other institutions such as nursing homes.

Other

Commercial premises, shops, clubs, public toilets, etc require an allowance for residential and health related needs, with each affected scheme being assessed on the individual circumstances.

Factors to consider are:

- ✓ That public health is of permanent concern
- ✓ The number of non-residents
- ✓ The services provided by the local water utility, and the number of people who need to use those services
- ✓ Requirements for essential activities such as cleaning and washing in food preparation and services areas
- ✓ People should not be counted twice

Isolated Western Division villages (Population under 300 people)

Add 55 litres for each permanent resident.

Emergency capital works

If emergency capital works are identified as the best means of maintaining essential supplies of water, the local water utility may apply for financial assistance. The application should be prepared in consultation with the Regional Director of DLWC and then forwarded to the Minister for Land and Water Conservation. It should contain the following:

- ✓ A copy of the technical report
- ✓ A full description of the proposed works, starting their location, whether or not they are permanent, and the quantity, quality and security of supply they will provide
- ✓ Estimate of the capital cost of the works
- ✓ Envisaged dates of commencement and completion

The Minister for Land and Water Conservation will consider the application and determine the extent to which Government assistance is available.

Financial assistance will not extend to the operating costs of the works, nor to the costs of managing supplies (such as the policing of rationing and waste). These are the normal responsibilities of local water utilities.

Further information can be obtained from DLWC Regional staff responsible for Water Treatment and Recycling matters:

Ian BURTON Local Government Programs Manager. Noel Park House 155-157 Marius St. TAMWORTH 2340
Ph: 02 6764 5917 Fax: 02 6764 5982 Mobile: 0427 818 827

Siva VARATHAN Local Government Programs Manager. 209 Cobra St. PO Box 717 Dubbo 2830
Ph: 02 6841 7420 Fax: 02 6884 0096 Mobile: 0417 409 342

Peter WALKER Manager, Resource Access and Compliance. 45 Wingewarra St. DUBBO 2830
Ph: 02 6883 3067 Fax: 02 6883 3099

John BOURKE Local Government Programs Manager. 464 King St. NEWCASTLE WEST 2309
Ph: 02 4929 9805 Fax: 02 4929 65306 Mobile: 0413 018 644

Andris RUBENIS. Water Supply, Sewerage & Drainage Manager. Chelmsford Pl. LEETON 2705
Ph: 02 6953 0729 Fax: 02 6953 4468 Mobile: 0428 602 234

Gary MARSHALL Urban Water Manager. 24 Gordon St. PO Box 582 COFFS HARBOUR 2450
Ph: 02 6653 0150 Fax: 02 6652 3936 Mobile: 0412 137 387

Chris HENNESSY Urban Water Manager. Suite 3, The Plaza PO Box 664 ALSTONVILLE 2477
Ph: 02 6627 0113 Fax: 02 6628 6011

Warwick BROWN Local Government Programs Manager . NSW Government Office 512 Dean St. PO Box 829 ALBURY 2640
Ph: 02 6043 0105 Fax: 02 6043 4223 Mobile: 0408 629 373

Paul LEE Team Leader Water and Sewage, Sydney / South Coast Region. Level 3, 84 Crown St. PO Box 867
WOLLONGONG EAST 2500. Ph: 02 4224 9623 Fax: 02 4224 9650 Mobile: 0413 457 652