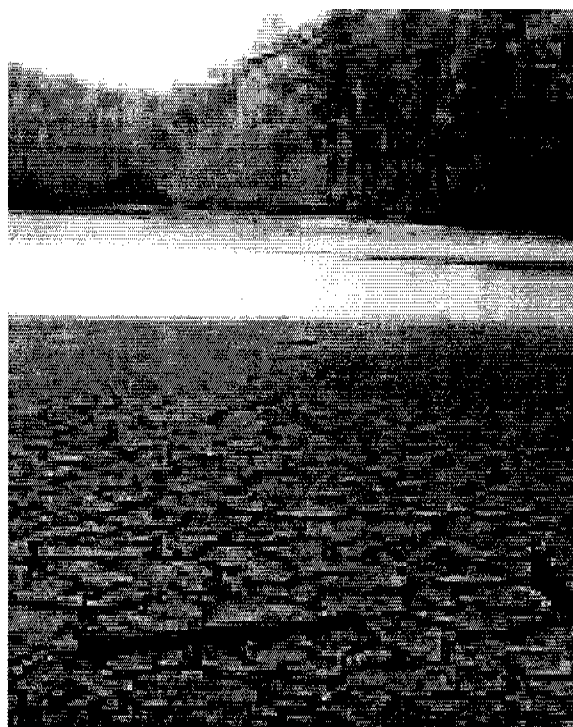


North Coast **WATER**

**NORTH COAST WATER
REGIONAL WATER SUPPLY**

**DROUGHT MANAGEMENT PLAN
2001 - 2003**



NSW DEPARTMENT
OF PUBLIC WORKS
AND SERVICES

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SECTION A

SUMMARY

A1.0 EXECUTIVE SUMMARY

A1.1 Introduction

In March 2001, as a result of record high rainfall in some areas, the Clarence River rose to its highest level in almost 80 years. As the year continued and into early 2002, it became evident that the North Coast of NSW could be moving into one of the driest periods on record.

In response to this situation North Coast Water (NCW), with the support of the Department of Land and Water Conservation (DLWC), decided to accelerate the completion of a planned pipeline connection from the NCW pipe supply network near Coutts Crossing to Karangi dam at Coffs Harbour. This would allow water from the more persistent flows of the Nymboida River to supplement the less persistent flow in the Orara River which is the major water source for the Coffs Harbour area (development is not the issue here).

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The Karangi dam pipeline connection is the first component of the Clarence valley and Coffs Harbour Regional Water Supply (CV&CH RWS) project. The main drought security feature of the project is a 30,000 ML off-stream storage at Shannon Creek. The storage design is underway and the dam is not due for completion until early 2006. The storage is unlikely to be operational before 2007.

Following record low flows in the Nymboida in July and August 2002, some relieving rain in the second half of August?? (18th August on so Ok as written) allowed the Karangi dam to partially recover. However, the North Coast 'dry' has extended into the later half of 2002 and forecasts suggest there may be little relief until March or April next year. The area has been officially drought declared although this is more from an agriculture perspective than an urban water supply perspective.

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The water supply system servicing Coffs Harbour can securely supply about 4,000 ML during a severe drought. The normal annual demand is 5,600 ML. The Coffs Harbour community has been subject to varying levels of water restrictions in 9 out of the last 11 years. Between ??? and ??? level 3 or 4 water restrictions were necessary and many businesses have experienced hardship as a result.

While the Clarence Valley has no major storage at the present time, the more persistent flows in the Nymboida River have prevented the Clarence Valley going onto restrictions other than for ??? weeks in August 2002???. As a result of falling flows in the Nymboida River, the Clarence Valley went onto Level ?? restrictions on ???. This is expected to go to Level ??? on ???. Level 1 started 15th July, level 2 13th August and level 3 may be required around the 26th October. A brief history on past restrictions is as follows:

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2000 – 11th October to 4th November

1994 – 12th November to 3rd December

1976-1985 - every summer due to pipeline capacity from Grafton (Lower Clarence area only)

On 7th August a Regional Drought Task Force (RDTF) was formed to oversee the development and implementation of this Drought Management Plan.

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A1.2 Purpose of the Plan

The purpose of this Drought Management Plan (DMP) is to reduce the potential impacts of drought by identifying principal activities and groups at risk, and developing mitigation actions and programs that alter these vulnerabilities. While the Plan is generally restricted to the communities serviced by NCW and its constituent members, if the drought continues, there is expected to be an extension of the scope to rural villages and possibly separate homesteads.

The Plan is directed at providing those responsible for decision making with an effective and systematic means of assessing the drought conditions and outlook, developing mitigation actions and programs that reduce the risk in advance of drought, and developing response options that minimise economic stress, environmental losses, and social hardships during drought.

The Objectives of the Plan are to:

- collect and analyse drought-related information in a timely and systematic manner
- establish criteria for triggering various mitigation and response activities
- define and establish an organisational structure and delivery system that supports information flow between the parties
- define the roles and responsibilities of the various parties including government agencies with respect to drought
- identify drought-prone areas in the region and vulnerable sectors, individuals, or environments
- identify mitigation actions that can address vulnerabilities and reduce drought impacts
- keep the public informed of current conditions and response actions by providing accurate, timely information to print and electronic media including the web
- to identify and examine the legal and social implications of the Plan
- establish and pursue a strategy to remove obstacles to the equitable allocation of water during shortages and establish requirements or provide incentives to encourage water conservation
- to identify the required resources (human and economic) that the responsible authorities, including government, are willing to commit to the planning and implementation process
- to establish a set of procedures to continually evaluate and exercise the plan and periodically revise the Plan so it will stay responsive to the needs of the Region

A1.3 Content of the Plan

The Plan is divided into four sections.

Section A is a Summary of the drought forecast and drought action plans and program.

Section B provides a detailed background to the drought planning process.

Section C identifies and assesses the drought management opportunities under the headings of Karangi pipeline connection, demand management, management of current sources, and alternative new supplies.

Section D identifies the requirements and risks of delivering the more feasible management opportunities.

A2.0 DROUGHT FORECAST SUMMARY

A2.1 Drought History

The key criteria that have been selected to assess the drought conditions and outlook are:

- historical and current rainfall in the catchment at Nymboida, Dorrigo and Karangi
- historical and current riverflow in the Nymboida River at the Nymboida weir
- current riverflow in the Orara river at Cochrans Pool
- tables of daily average flow exceedance probabilities for the Nymboida and Orara Rivers at the extraction locations
- the current and recent level of storage in Karangi dam
- Bureau of Meteorological data on historical and currently monthly measures of Southern Oscillation Index and current forecast quarterly rainfall probabilities

The information on rainfall and riverflow is being collected on a daily basis and distributed to the drought planning technical team. Current and historical streamflow data is included in *Appendix ???*

Graphs of the Karangi storage level with historical data on restriction levels are distributed weekly. The accumulated data on this and other historical records on water restrictions is in *Appendix ???*

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The Bureau of Meteorology data on historical and recent SOI measures and the current rainfall probability forecasts for October to December 2002 are in *Appendix ???*.

A2.2 Drought Forecast

Rainfall Forecast from National Climate Centre

The current rainfall probability forecast on the Bureau of Meteorology web site indicates that there is a slightly less than 50% chance that rainfall in October to December 2002 will be below the median

Given that forecasting is so imprecise, three different levels of riverflow forecasting are provided.

Riverflow Forecasts Related to Rainfall Forecasts and Past Average Riverflow Trends

The average trend in riverflows in the Nymboida is for a rise in flows at the weir in mid-November to levels of about 200 ML/d with a flattening of the daily flow volumes at this level until about February or March when the whole system is 're-set' by high river flows.

If this were the case following riverflows in the Nymboida River would be expected over the next few months.

Table A1 Nymboida River Prediction 1-Rainfall Probability Based

Month	Oct	Nov	Dec	Jan	Feb	Mar
Predicted Flow at end of Month	84	200	150	200	1000	2000

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Given the forecast by the National Climate Centre there would appear to be about a 50/50 chance that this pattern will occur this year.

Worst Case Scenario Based on Historical Records

Assessment of the historical riverflow records suggest that the current low flows are following a pattern similar to that of the 1915 and 1994 droughts.

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If this was to continue the following riverflows in the Nymboida River would be expected over the next few months.

Table A2 Nymboida River Prediction 2-Repeat of Similar Drought

Month	Oct	Nov	Dec	Jan	Feb	Mar
Predicted Flow at end of Month	60	20	7	2	0.8	??

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This is based on an estimated average daily regression factor of 0.035 ie each day the flow reduces by 3.5% (reasonable pessimistic projection) of the flow occurring on the preceding day.

Worst Case Scenario for Nymboida Riverflows

There is no science in predicting very low streamflows. Given the need to establish an envelope of possibilities, the worst case and highly improbable scenario is that the riverflow continues to fall at the same rate as the average over the preceding 14 days. This is likely to become more accurate the longer the drought continues.

If this were to happen the following riverflows in the Nymboida River would be expected over the next few months.

Table A1 is the more probable prediction based on historical droughts, whereas Table A2 is the improbable worse case based on 3.5% regression, I do not think there is a need for three tables, unless you want a straight line to zero which is as follows

Table A3 Nymboida River Prediction 3-Improbable Worst Case

Month	Oct	Nov	Dec	Jan	Feb	Mar
Predicted Flow at end of Month	72	0	0	0	0	0

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Karangi Dam Level Forecasts

A single worst case scenario has been provided based on target realistic consumption levels. A graph of the predicted storage levels is in *Appendix ???*

Based on this the estimated storage levels at the end of each month, assuming no pumping from the Orara or supply from the Nymboida, are shown in the table below.

Table A4 Karangi Dam Storage Prediction 3-Improbable Worst Case

Month	Oct	Nov	Dec	Jan	Feb	Mar
-------	-----	-----	-----	-----	-----	-----

Percent Full at end of Month	60%	50%	40%	30%	20%	10%
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It should be noted that some water quality problems could be expected below about 25% full.

If Clarence Valley comes on-line end of November when river stops in the worse case scenario the following would happen at 28ML/day

Table A5 Karangi Dam Storage Prediction 3-Improbable Worst Case supplying Region from 1st December

Month	Oct	Nov	Dec	Jan	Feb	Mar
Percent Full at end of Month	60%	50%	35%	20%	5%	0%

A3.0 DROUGHT ACTION SUMMARY

A3.1 Strategic Drought Security

Drought security development for the regional supply has four distinct stages.

Stage 1: Pre-commissioning of the Karangi dam pipeline connection. The connection has a peak capacity of 25 ML/d and is scheduled for completion by 13th November 2002.

Stage 2: Post-commissioning of the Karangi connection and pre-commissioning of the Nymboida pipeline duplication to the Crossover. This will increase the capacity of this pipeline from 39.6 ML/d to about 100 ML/d. Completion of the pipeline is not scheduled until March 2004.

Stage 3: Post-commissioning of the Nymboida pipeline and pre-commissioning of the Shannon Creek storage.

Stage 4: Post-commissioning of the Shannon Creek storage. This is not expected before 2007.

The progressive completion of each phase of the project represents an improvement in the drought security of the whole system.

Karangi Dam Pipeline Connection

During the likely life of the current drought, only Stage 1 is able to provide improved system security. The acceleration of the Karangi pipeline connection in March 2002, was initiated originally to support the drought proofing of the supply to Coffs Harbour. This would have enabled the frequency and severity of the current necessary restrictions to be significantly reduced.

As the drought has deepened and the flows in the Nymboida reached record low levels, the potential for Nymboida River flows to cease has increased.

In the event that this scenario becomes more likely, the major opportunity for drought proofing the regional system is to reduce regional consumption to say 30 ML/d, extract the maximum possible of 40 ML/d from the Nymboida River while flows allow, and store the unused daily portion of 10 ML/d in the Karangi dam. If the Nymboida River does cease to flow, or falls below the minimum level to sustain the Clarence valley, water can be returned to the Clarence valley from Karangi dam.

The sooner the pipeline is completed, the more water can be stored in Karangi dam for possible later return to the Clarence valley. Every three days of storage provides an additional day of full regional supply.

A3.2 Proposed Actions

Proposed drought mitigation actions have been divided into the following strategic areas:

- A. Karangi Pipeline Connection
- B. Demand Management
- C. Management of Current Sources
- D. Development of New Alternative Sources

Table A5 Proposed Drought Mitigation Actions

Month	Karangi Pipeline	Demand Management	Manage Current Source	
OCTOBER 2002				
	Action KPIs: □ Complete pipeline commissioning asap. Target Date is 13 th November	Action DMI:	Action CSI:	
NOVEMBER 2002				
		Action DMI: □ Apply level 4 restrictions in CV and level 6 in CH. Target regional consumption is 30 ML/d; 16ML/d in CV and 14ML/d in CH Trigger: Completion of Karangi pipeline connection and Nymboida River flow < 30ML/d? Date: 13 th November Responsibility: DPWS		
DECEMBER 2002				

JANUARY 2002				

SECTION B **DROUGHT PLANNING**

B1.0 GENERAL

B1.1 Background

Over the last 10-15 years, the two separate areas serviced by the Regional Water Supply, Clarence Valley and Coffs Harbour, have had different experiences in relation to drought.

B1.2 Designing for Drought

The procedures adopted by DPWS for sizing of water supply headworks on a security of supply basis arose from experiences during the severe 1979-1983 drought. Previous methods did not reflect the performance of the system as perceived by the consumer community who tends to view the system's performance in terms of annual water charges and the frequency, duration and severity of restrictions on the use of water.

The key considerations for the procedures were that:

- It is neither practical, economic nor environmentally responsible to provide "restriction free" water supply systems
- A trade-off is necessary between security of supply provided (ie the relative lack of restrictions) and the associated capital and operating costs,
- Adequate storage should be available to allow the operating authority to manage the scheme during drought periods.

B2.0 DROUGHT SECURITY

B2.1 Introduction

Generally, security of supply is perceived by the community to revolve around the duration (no. of months over a period) , frequency (no. of years over a period), and the severity (level) of restrictions that need to be applied to ensure that water demands can be met under the worst expected drought condition.

Most water supplies in country NSW towns are designed on the basis of:

- Restrictions not applied more than 5% of the time (5% rule)
- Restrictions not imposed more often than once every 10 years on average (10% rule)
- System able to supply 80% of normal demand through a repeat of the worst drought on record with the storage drawn down to the level at which restrictions should be applied to satisfy the 5% and 10% rules (205 rule)

This method is demonstrated in the diagram in *Appendix ???*

B2.2 Security of Current Supply

The water supply systems servicing the Clarence Valley and Coffs Harbour currently remain as separate schemes. The Karangi dam pipeline connection is now under construction and is scheduled to be commissioned about 13 November 2002.

Clarence Valley Supply

The supply to the Clarence valley is piped from the headrace for the Nymboida hydro-power station. The peak daily transfer capacity is 39.6 ML/d.

There is no major storage in the system, and security relies on run-of-river flows in the Nymboida River. The period of recorded flows in the Nymboida River is about 95 years (1909). The worst recorded drought was in 1915/16 and the lowest flow of 62 ML/day was recorded during the 1994/95 drought.

Modeling of the 1901/03 drought suggests that the water supply could fail (WRONG - minimum flow was 30ML/day in river less 12.5 ML/day for riparian flow leaves 17.5ML/day for consumption, easily achievable by banning gardening) if a similar drought were to occur in the future. The Clarence Valley supply will not be secured until the Shannon Creek storage is completed.

The Clarence valley has experienced few restrictions on supply over the last 10-15 years up until 1998?? when NCW voluntarily adopted a policy of initiating restrictions based on the level of flow in the Nymboida river. While this provides no drought proofing benefit for the community affected, there is a small increase in flows downstream of the weir due to reduced consumption.

Coffs Harbour Supply

The Coffs Harbour water supply source relies on pumping from the Orara river to the 5,600 ML off-stream Karangi dam storage. The water from the storage is disinfected, treated with lime/CO₂ to stabilise it and then pumped to Red Hill reservoir before distribution to consumers through an extensive reticulation system.

Depending on the volume of stored water in the dam, pumping is permitted when flows exceed nominated environmental flows. These are shown in the following table.

Table B1 Orara River Pumping Conditons

Storage Level	Environmental Flow
Over 85%	>25 ML/day
Between 85% and 65%	>15 ML/day
Less than 65%	>5 ML/day

Based on these levels, the safe yield of the source (using the standard DPWS methodology) has been determined as 4,000 ML/a, well below the average water demand of 5,600 ML/a. This requires that Council impose much more frequent restrictions than usual and there is a higher risk of failure of the supply than would normally be considered acceptable.

A higher level of river environmental flow protection will be required when the connection to the NCW system has been completed. Consent conditions require that once the pipeline connection from the NCW pipe network to Karangi dam is completed, water can be transferred when the flow in the Nymboida exceeds 225ML/d. At the same time minimum environmental flow requirements will be increased.

On completion of the regional Shannon Creek storage, a higher level of protection of environmental flows in the Orara River will be implemented.

B2.3 Security of Completed Regional Water Supply System

The design secure yield of the regional scheme when completed is 22,700 ML/a which is sufficient to meet predicted water demands for the region to at least 2021. Improved water efficiency and use of potential alternate sources such as reclaimed water and desalination could extend this design life well beyond this.

B3.0 DROUGHT PREDICTION

B3.1 Introduction

High annual average annual rainfall on the North Coast means that the area is generally blessed with a plentiful water resource. On the other hand, most coastal NSW rivers experience highly variable flows linked to rainfall patterns. On the North Coast low flows normally occur in the November-December period following the relatively dry spring months. As a result, on the North Coast, many supply systems have not required major storages and thus these supplies rely on run-of-river flows and have been required to extract even during very low flow years.

The increased focus on environmental protection during these low flow periods and the desire to mimic natural flow patterns below extraction points, has resulted in a much higher reliance on stored water.

The size of storage has generally been determined using hydrological modeling techniques. The Regional Water Supply Project has been based on a technique developed by the NSW Department of Public Works that uses the so called '5/10/20 rule outline in section B2.1 of this Plan.

The design safe yield of the regional scheme when completed is 22,700 ML/a which is sufficient to meet predicted water demands for the region to at least 2021. Improved water efficiency and use potential alternate sources could extend this design life well beyond this. While during a average or wet years, Coffs Harbour will source the major share of its water from the Orara River, the modeling demonstrates that in severe droughts only a small proportion of water can be extracted from the Orara River.

If relying on the hydrological analysis for assessing when to apply restrictions during particular drought scenarios, it should be noted that hydrology is not an exact science and necessarily involves some uncertainty. Care needs to be exercised in using the IQQM hydrologic data for any purpose other than its intended use.

B3.2 Drought History

River flow records are available for the Nymboida River over a period of some 93 years (since 1909). Rainfall records have enabled this period to be extended by simulation modeling to include the 1901/02 drought period. The IQQM model

developed by DLWC, has been adopted by DPWS to model daily river flows at the extraction points in both the Nymboida and Orara Rivers.

The most severe droughts have occurred in 1901/02 (simulated), 1915/16, 19????, 1994/95, and 2001/02. These have been graphed and are shown in *Appendix ???*.

B3.3 Riverflow and Storage Behaviour Prediction Methodologies.

There are a range of methodologies for hydrologic prediction modeling. The simplest projects the effects of no pumping to the storage and an estimated net volume reduction per day from the storage. This is a worst case scenario.

Other methods use the actual or generated daily streamflow data from several drought periods to project the possible consequences for the stored water volume of a repeat of the same temporal pattern of low streamflows.

Predictions for run-of-river systems are more problematic, as the averaging effects of a storage are not available in this case. The system fails immediately the flow falls below the minimum demand. Often this part of the streamflow data set is the smallest and the most inaccurate. The best that can be done is to project the worst case scenario based on available data sets where the circumstances best matched those applying to the particular drought period.

B3.5 Predicted Riverflows and Storage Behaviour

Based on the preceding discussion predictive storage behaviour for Karangi dam and riverflows for the Nymboida River are shown in *Appendix ???*

Karangi Dam Storage

At the time of preparing this DMP, Karangi Dam was just over 69% full, and the Orara River was dropping. The current flow was below the environmental flow requirement of 15 ML/d (approximately 10ML/d on 1st Oct 2002) and pumping in to Karangi Dam had ceased. Assuming no substantial rainfall in the catchment occurs and thus no pumping to Karangi dam is possible (Worst Case Scenario), predictions are that the dam could be at 50% capacity by late November, and at 30% capacity around the beginning of February 2003.

I do not now where this should go, but once pipeline is complete and Karangi is full the region will be secure as hydrology shows annual yield increases significantly plus back feed etc. This year would not have been a problem if the Karangi pipeline was finished last November, hence we will be secure while Shannon is being built. Hence this DMP is a one year special.

B3.4 Drought Forecasting

The more difficult element of drought forecasting is determining the likelihood that a particular drought will continue at any particular time of the year. On the North Coast the rainfall pattern gives some predictive certainty however at the boundary between the dry and wet parts of the year there can be a large variance in rainfall probabilities.

There has been demonstrated to be some correlation between the El Nino patterns and rainfall which can be used to also refine probabilities. The current El Nino patterns are shown in *Appendix ???*

SECTION C
DROUGHT MANAGEMENT OPPORTUNITIES

C1.0 INTRODUCTION

C1.1 General

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C1.2 Statutory Approval to Proceed with Actions

Implementation of actions to ensure a water supply to regional consumers will require a range of approvals from key government agencies. Early discussions with agencies is thus essential in the development and prioritisation of drought management opportunities.

The key agencies are likely to be:

1. Department of Land and Water Conservation: on environmental flows, changes to existing water licences, development of new sources etc
2. Fisheries: on riverine activities that could affect fish habitat
3. National Parks and Wildlife Service: on activities that could affect threatened species or Aboriginal heritage
4. Environmental Protection Authority: on activities that could potentially cause pollution problems

C2.0 KARANGI PIPELINE CONNECTION

C2.1 Introduction

As a result of the 2001/2002 drought conditions and the predicted impact on the Coffs Harbour water supply, the decision was made in March 2002 to accelerate construction of the pipeline connecting the NCW trunk mains near Coutts Crossing to Karangi dam.

Since that time, the river flows in the Nymboida River have also fallen significantly with obvious consequences for the Clarence valley supply.

C2.2 Significance of the Karangi Pipeline Connection

The reason for the acceleration was to support connection to the Nymboida River as soon as possible and thus allow water now passing the weir to be diverted and stored in Karangi dam for use in the Coffs Harbour area. If the Nymboida River flow falls below the minimum consumption of the CV(15-20 ML/d), this will also allow return of this water to Clarence valley consumers.

The Karangi pipeline has had no impact on the current restriction policy, however when completed the pipeline will link the Clarence Valley Water Supply to the Coffs Harbour Water Supply increasing security for the region. Completing the pipeline on time remains a high priority.

Currently everything has been done to ensure that the 62 km pipeline is completed by the 25th October 2002. Following review of the options for Coramba bridge crossing, this date now does not appear to be achievable and a mid-November date is the earliest possible completion. Depending on the activities associated with the Orara River bridge crossing at Coramba a later finish may result. This is currently thought to be about 6th December however there are no guarantees of this.

ACTION: DPWS to closely monitor bridge construction progress and river flows in the Nymboida and pursue a completion date as close to 13th November as possible if deemed to be required.

ACTION: DPWS to ensure pipeline contractors do not waste any water in relation to flushing or cleaning of the new main if the Nymboida River is below 40ML/day.

ACTION: DLWC approval to be sought and approved for transfer of water from the Nymboida River to Karangi dam whilst riverflows are below 225ML/day.

ACTION: DLWC approval to be sought and approved for transfer of water from Karangi to Rushforth if required.

ACTION: CHCC and North Coast Water to determine interconnection requirements, lead times etc to allow pumping from Karangi to Rushforth.

C2.3 Communication Issues

There is wide-scale community misunderstanding of the issue of transfer of water to Coffs Harbour during a period when the Clarence valley is on restrictions. A full page advertisement by NCW was published in the Daily Examiner and the Coffs Advocate on 14th September to answer many of the questions being asked by the CV community.

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In order to maximise the advantage of the Karangi pipeline when completed, the CV will immediately (this is not my understanding, restrictions will depend on Karangi level and river levels, may be correct depending on situation) go to Level 4 restrictions and Coffs Harbour to level 6 restrictions (ie no outside sprinklers or hand held hosing). This will enable the maximum amount of Nymboida River water to be stored in the Karangi dam in case the Nymboida River ceases to flow.

There is a need to effectively communicate this situation to the Clarence valley and Coffs Harbour communities. Some form of memorandum may need to be signed as there is significant skepticism within the CV community that return of water from the Karangi dam to Coffs Harbour could ever occur. Similarly it is unlikely that the Coffs Harbour community understand this scenario.

C3.0 DEMAND MANAGEMENT

C3.1 Introduction

????????????????????

C3.2 Water Efficiency Strategy

The Regional Water Efficiency Strategic Plan should not be confused with the Drought management Plan. The RWESP is aimed at achieving long-term permanent reductions in water consumption by all types of consumers.

The desired outcome of the Drought Management Plan is to dramatically reduce water demands or to utilise alternative sources during a short-term crisis (usually caused by drought or some other emergency).

Despite the subtle differences in these separate Plans, there are opportunities in the RWESP that should be explored further as part of the Drought Management Plan.

ACTION: All major water users to be targeted for carrying out water audits and/or provision of advice on possible savings and implications of the drought.

C3.3 Restrictions Policy

Current Demand Patterns

A clear understanding of current demand patterns across the various consumer sectors is required so that restrictions may be applied fairly and uniformly. Community understanding and acceptance of the restrictions will lead to lower demand and a lower requirement for policing.

ACTION: Obtain further data on different consumer types across the region such as minimum demand requirements and alternative drought response mechanisms, eg if, how and when to remove stock from the supply system.

Need for a Common Policy

There are currently separate restrictions policies for the CV and CH areas of the supply region. This is largely historical, and has not caused many problems so far. This will change with the completion of the Karangi pipeline connection and other components of the regional water supply project. The pipeline is due for completion in mid-November 2002.

In the CV area delegated authority has been granted by NCW for the Chairman and General Manager to change the restrictions as necessary to achieve the objectives of the restrictions policy. The Draft Restrictions policy has been included in *Appendix ???*.

There is no provision for a higher level of restriction than Level 4 in the CV which is similar to Level 6 in CH. CH have a provision within Level 6 for *no outside watering*. This must be addressed as part of developing a common restrictions policy

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ACTION: Develop a common water use restrictions policy for the whole region as soon as possible. The policy must include details on the mechanisms for triggering the different levels of restrictions in all regional areas.

The reason for this action is to demonstrate equity among all regional consumers to improve acceptance of the need to comply.

ACTION: Implement a program to advertise the common policy so all regional consumers clearly understand the requirements at each level.

The reason for this action is to establish a common understanding of the various restriction levels across the region. This should assist to reduce the policing effort.

In-House Water Restrictions

No measures currently exist for restrictions of a severity greater than Level 6 (CH) or Level 7. By the time Level 6 is enforced, all outside use of water will be prohibited, and business and trade activities will be severely curtailed. (Sugar Mill, Abatoirs and Fish Co-Ops would still be going)

If further savings are required, these will have to come from domestic, in-house use, and this can best be achieved by imposing a rationing system allowing a predetermined per capita consumption per day (See DLWC Drought Management Strategy Paper). Meters would have to be read fortnightly, at a minimum, and punitive rates would have to be applied to over consumption. There are administrative problems with this approach—how do you determine how many people are in a house, for example—but it has the merit of being flexible. The per capita allowance can easily be varied to suit changing circumstances.

It is thought that daily consumption for Coffs Harbour City could be reduced to around 7 ML by this method. Projections for the CV have not yet been made. (Would be about the same if industries and stock removed)

ACTION: Establish a regional restrictions policy to reduce in-house water use ie Level 7 (CH) restrictions. This should target a particular level of consumption yet to be established for the two major demand centres.

C3.4 Restrictions Implementation

Coffs Harbour Area

Coffs Harbour City Council (CHCC) first imposed water restrictions on 13th October 2001, when Karangi Dam was 82% full. Water restrictions were progressively increased to Level 5 restrictions on 31 January 2002, when the dam was 48% full. These restrictions limited the outside use of water to watering cans or buckets only. The average weekly consumption was down to 13.7 ML/d, for a residential population of approximately 56,000 people, including commercial and industrial use.

The drought was partially broken in February 2002 and this allowed Council to fill the dam to 93% by mid May 2002. The drought has since intensified and Karangi Dam is now down to 69% (1st October 2002). CH is currently on Level 4 restrictions.

Based on experience in previous droughts the following actions are recommended:

ACTION: Introduce *Level 5 Restrictions(CH)* when Karangi Dam capacity falls to 55%. This is anticipated *early November* but will depend on the current situation in regard to water consumption and existing and predicted weather conditions.

ACTION: Introduce *Level 6 Restrictions(CH)* when Karangi Dam capacity falls to 35%. This is anticipated to be in *mid-January 2003*. The benefit from the completion of the Karangi pipeline will need to be factored into this decision. With Karangi pipeline in place this would not be until end of February 2003 if no water has to come back to Clarence Valley.

Clarence Valley Area

The Clarence Valley is currently on Level 2 restrictions with the Nymboida flow at 140ML/d. Level 3 restrictions are expected around 26th October.

Assuming the Karangi pipeline is completed about mid-November 2002, the following actions are proposed for implementation of restrictions

ACTION: Implement level 4 modified restrictions (Clarence Valley) when flow in the Nymboida falls to 60 ML/d. Level 5 implemented at say 40ML/day similar to CH level 5. (see revised restriction summary)

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ACTION: Implement level 6 restrictions regionally similar to Coffs (NCW) when the pipeline is completed and Karangi dam falls to 35% (or the flow in the Nymboida falls to 25 ML/d.

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Region-Wide Restrictions

ACTION: Introduce equivalent *Level 7(CH) restrictions to reduce in-house water use*, when Karangi Dam falls to 20%. This is anticipated to be around the *end of February 2003*. The benefit from the completion of the Karangi pipeline will need to be factored into any decision on this.

Policing Restrictions

A key to the success of any restrictions policy is a commitment to policing

ACTION: Develop a resourcing plan to ensure policing at a level that will support achievement of the aims of the restrictions policy. This may require a training program for meter readers and for resources involved in processing fines etc.

C3.5 Communications Plan

The history of water shortages across the region has created large differences in consumer knowledge about restrictions between the CV and CH areas.

The success of the restrictions policy will depend on two issues. The success of the Task Force in communicating the seriousness of the drought situation as the drought deepens and the resources committed to policing the restrictions.

ACTION: Engage a communications specialist to assist with the development and distribution of the communications plan. It is desirable that the communications specialist be locally based and have a good knowledge of the area.

ACTION: Develop and implement a public communications plan. This plan is to be aimed at making the public much more aware of the potentially very serious situation that could arise if there is no rainfall. This would be achieved through a publicity campaign, using press, radio and television, setting out present predictions for water availability in the short and medium terms. Information on the expected increasing severity of restrictions in Levels 5 and 6, and predicted dates when these levels might be introduced. The increasingly severe restrictions beyond Level 6 should be foreshadowed, and the likely date of implementation indicated.

The public should be invited to help delay the onset of more severe restrictions by voluntarily reducing consumption. They should be reminded of available assistance to install dual flush toilets, AAA showerheads and the like.

The cooperation of business needs to be obtained. It would be helpful to hold discussions with, say, the Chamber of Commerce, Trade Organisations and different facets of the Tourist Industry, in order that they understand the implications for them of more severe restrictions. At the time of writing this report contact had been made with the major resorts in the CH area and a date for discussions is to be set.

A combined waterwise promotion with surrounding Councils is being carried out through two TV stations at present. A number of activities are proposed as part of Water Week commencing 20th October 2002.

C3.6 Systems Management

System management requirements include minimising all leakage's and flushing whilst also ensuring that all reservoirs are as full as possible just prior to and after the Nymboida stops flowing.

ACTION Ensure that the system is running at optimum capacity as the flow in the Nymboida River gets below 20ML/day.

A specific action that could be carried out at Karangi dam is to upgrade the pump which returns seepage water to the dam, to minimise loss in this way. The amount of water saved is not great, but there is a symbolic value in doing this and, over a year, it would extend the use of Karangi by up to a week at restricted consumption figures.

ACTION: Investigate the pump upgrade and report on feasibility.

C4.0 MANAGEMENT OF CURRENT SOURCES

C4.1 General

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C4.2 River Management

The Nymboida River has excellent data compared to most rivers in Australia, however recorded data began in 1909, representing just under 100 years of data. 100 years of data is good in Australia, however in Europe where they would have 800

years or more of indicative data records are currently being broken with flooding. Therefore The Nymboida River may stop flowing although never recorded before.

1. **Other upstream users** – It is unknown how much impact upstream users including riparian had on the lowest flow recorded in 1994 as against 1915, however it would be expected that this would be increasing as population and pump technology has increased. DLWC needs to determine stop pumping levels as the river falls. It is not expected that these users will have a major impact on the town water supply until the river gets down to say 30ML/day. **ACTION** would be required at around this level.
2. **Weir Operation** – The current pipe beneath the weir is 300mm in diameter and allows around 45 ML/day to pass the weir if not blocked by any river material. The current license requirement is 12 ML/day, hence the pipeline needs to be restricted to ensure full water supply capacity. At current consumption levels of less than 20ML/day the pipe will need to be blocked at the 60ML/day level. A polyurethane plug has been priced at \$1,200 and will take 3-4 weeks to deliver. **ACTION** order plug around one month prior to 60 ML/day river flow is attained. Get DLWC approval to temporarily plug pipeline (note environmental flows will still be maintained by water going over weir rather than under it). Install plug when flows get below 60ML/day.
3. **Tunnel Inlets** – The tunnel inlet levels have been checked and the full 214ML weir storage is available and possible to gravity feed into the water supply. **ACTION** Check tunnel inlets for blockages as water level drops below weir.
4. **Penstocks/Hydro** – Need to ensure integrity of the structure to minimise any risk of failure during drought conditions and minimise leakage. **ACTION** Contact Country Energy to provide additional effort over next two-three months to minimise leaks and risk of failure.
5. **Monitoring** – As there is no regulation of the river flows upstream the water supply is dependent upon the natural river flows. Flows are monitored constantly by automated equipment. I also monitor the river levels daily and report them via the Daily Examiner. Predictions are also made on possible future flows. See attached graph in Appendix A. DLWC has recently checked gauge and recalibrated the height/flow curve on the 5th September. **ACTION** Continue monitoring and updating of graph and predictions including associated action list. Arrange for DLWC to confirm gauge accuracy at low levels especially below 100.
6. **Relaxation of Environmental Flows** – This offers benefits of being able to access water in the rivers for a longer period.
Orara River
Currently flows in the Orara prevent access under licencing rule as the storage is > 65% full. If this was relaxed an additional 5-10 ML/d could be stored. There are political and environmental factors associated with this alternative

ACTION: Approach DLWC to determine their position on relaxation of EF at Cochrans Pool in the Orara River.

C4.3 Water Quality Management

1. **River Water Quality** – Algae is currently monitored weekly and is currently clear. Discussions with Bill Ho (DLWC) indicate that only treatment possible due to not having filtration in place is to alum dose at either and/or the weir pool and the 100Ml reservoir using motorised boat to minimise nitrate levels and reduce algae numbers.

ACTION Check alum source and availability and continue monitoring weekly unless increases occur.

2. **Stored Water Quality** – There is a possibility that as the level of Karangi dam draws down water quality may deteriorate. Water quality was worse when the storage was drawn down recently to 48% full but not significantly. The response of the stored water quality as the storage falls lower is difficult to predict.

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C4.4 ??????????????

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C5.0 ALTERNATIVE NEW SOURCES

C5.1 General

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C5.2 Most Feasible Options

Alternative sources may be required if the Nymboida River stops flowing for two weeks before the Karangi pipeline is completed or Karangi drops to 20%. The more feasible options available include:-

Groundwater – Grafton once relied on groundwater from wells in the Fischer Park area, Yamba and Iluka have individual spear points and Yamba also had an original supply from ground water. **Groundwater is a serious emergency alternative.** Water quality issues would be manageable, however the capacity and availability needs to be identified as well as practicality of getting something in place promptly.

ACTION: Engage DPWS to manage a scoping study to include viability and lead times (Note CHCC already has scoping study on groundwater sources in Coffs area). A sub-consultant Don Wooley has been engaged to carry out the study.

Upstream natural weir pools of Nymboida River – It may be possible to pump/siphon water from upstream pools to maintain the weir pool storage at Nymboida. This has implications for Freshwater Cod and requires input from Fisheries to assess the viability of the option.

ACTION: Commission DPWS to manage the investigation of the feasibility and yield of this alternative. A sub-consultant Bill Patterson has been engaged to examine the upstream pool network and the feasible water transfers systems between pools.

Woolgoolga Storage (200 ML) could be recommissioned to supply, say, 1 ML/d. It will be necessary to install suitable treatment of the water, to avoid the complaints and subsequent failure of the attempt to use it during the 1994 drought. Hunter Water carried out tests on water quality, and investigated treatment options at that time. Their recommended option was not adopted then, perhaps leading to the ultimate failure of the attempt to use the dam.

Hunter Water should be invited to review their test results—probably re-do them—and make updated recommendations for treatment. The issues of taste and odour would have to be addressed in any recommendations. It is possible that Hunter Water could supply, at short notice, a suitable package treatment plant for this location.

Hunter Water has been approached, and they are available and willing to carry out such a consultancy, as soon as they are commissioned.

ACTION: Hunter Water be commissioned to carry out such a consultancy *immediately Level 6 Restrictions are introduced.*

It is further recommended that the measures identified by Hunter Water to treat the water from Woolgoolga Dam be in place, ready to work, by the time water rationing might be implemented. That is, there would be, under the present predictions, a period of about six weeks only, between early-January and the end of February, for Hunter Water to investigate and report and for their recommendations to be put in place. This may prove to be a tight timetable.

C5.3 Less Feasible Options

Ashby Storage (may be as small as 100 ML) is also available on the Lower Clarence that used to supply the sugar mill. Water Treatment would be required, pipework is in place although only 150 mm into reticulation system with only minor work being required.

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ACTION: Engage DPWS to complete a scoping study on level of treatment required, lead times etc if storage size warrants the effort.

Desalination is not practicable at this stage due to the high capital cost and long lead times. Other options have been pursued such as mobile plants including Navy Ships with nothing being large enough to assist in a meaningful way.

Desalination should not be discarded as an option for specific sites, e.g. hospitals and resorts etc.

ACTION: Contact manufacturers/suppliers of desalination plant to find out such things as availability at short notice, capacity of units, cost etc. etc. A successful desalination installation allows a vital location to be disconnected from the public

supply system, and to operate normally while severe restrictions may be in place all around it.

It may be practicable to shandy the Nymboida River supply with water from the Clarence River at Grafton for all use except drinking – utilise bottled water for drinking. This would be a last resort alternative due to effort required to clean the reticulation system afterwards to restore potable supply.

Additional Storage (Rushforth) – It is possible to get an additional 30-40 ML stored in the 100 ML reservoir by raising the overflow pipe and operating the storage at almost failure levels just prior to river not meeting consumer demands. May also be options for additional temporary storage's to be built in the immediate vicinity and utilise pumps to transfer water into the 100 ML as required. This option is only useful if connection to Karangi is not available prior to the Nymboida River getting below 10 ML/day.

ACTION Determine method to raise or block overflow pipe including lead times etc.

Cloud Seeding – this technology has been used successfully by the Tasmanian Hydro-Electric Authority for many years to improve the rainfall yield from clouds over hydro-power dam catchments. Given that the NCW system uses pumping to off-stream storages rather than on-stream storages, the feasibility of this alternative is difficult to predict.

ACTION: Make contact with *Tasmanian Hydro-Electric Authority's* experienced cloud seeding experts to establish the feasibility and possible benefits and costs of cloud seeding in this case.

C5.4 Least Feasible Options

Additional Storage (Consumers) – In a river flow situation such as ours it would be possible to get every consumer to store as much water as possible just prior to the river not meeting demands. As above this option is only useful if connection to Karangi is not available prior to the Nymboida River getting below 10 ML/day.

Grey water Re-use may be possible on a small scale to keep gardens alive but as above does not reduce potable consumption levels during periods of heavy restrictions it is unlikely to be of benefit.

Effluent Re-use is not practicable to any major extent as dual reticulation is not available and would only be available for non-potable use which will be severely restricted by this stage. Possible uses include road construction or irrigating sport fields which will have no benefit re drought management of town water supply.

C5.5 Conclusions

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SECTION D
DROUGHT PLAN DELIVERY

D1.0 INTRODUCTION

D1.1 General

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D1.2 Leadership

A Regional Drought Task Force has been established under the chairmanship of NCW. The Task Force includes a team of technical people and high level representatives from each local government council, DLWC and the regional coordinator from Premiers. As the drought deepens this may require the addition of other key agencies with approval responsibilities.

The purpose of the Regional Drought Task Forces is to:

- Supervise and coordinate development of the DMP
- Coordinate DMP actions, implement mitigation and response programs and make recommendations to the state level Drought Task Force.

has been created to react promptly to situations as they may occur. This team and North Coast Water will keep in contact with state government and their Drought Task Force to ensure that this study is relevant and includes all possible alternatives including importing water from other areas.

ACTION Forward copies of draft drought management plan to all technical members of task force and state task force for comment.

D1.3 Organisational Structure

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D2.0 RISK ASSESSMENT

D2.1 Risk Identification and Analysis

In order to support the smooth implementation of the plan, it is desirable that a risk assessment be carried out that examines the potential for issues to derail the effectiveness of the DMP.

| This needs to be done when the basis of the plan has been established and should involve key team members.

An important issue is the protection of the security of supply which may arise if restrictions become extremely harsh. Activities that may threaten this security include:

- theft of water
- removal of the Nymboida weir plug to ensure environmental flows
- blockage of the tunnel inlets at Nymboida
- sabotage of upstream pumps/syphons etc to protect the environment

ACTION: Identify areas of potential risk to the security of the supply and develop systems to protect against and minimise the risk.

D2.2 Risk Assessment

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D2.3 Risk Mitigation Strategies

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D3.0 RESOURCING PLAN

D3.1 Roles and Responsibilities

The organisation chart for the development and implementation of the DMP is included in Appendix ??

The roles and responsibilities of the various members of the team are:

Task Force Executive

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Task Force Technical Support

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Restrictions Implementation Team

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Public Communications Group

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D3.2 Procuring Additional Resources

Depending on the progress of the drought, additional resources can be expected to be required for the following:

- policing restrictions – meter readers etc
- communications – practitioners skilled in written and electronic media
- groundwater implementation or other source development activity – project managers, designers, suppliers and contractors
- ???????
- ???????

D4.0 COMMUNICATIONS PLAN

D4.1 General

Management of communications in situations such as these is often crucial to the success of development and delivery of the DMP.

D4.2 Key Stakeholders

Social, economic and environmental values clash as competition for scarce water resources intensifies. It is essential that all groups that have a stake in drought planning be identified and their interests clearly established.

A preliminary assessment has identified the following key stakeholder groups:

- Urban residential consumers
- Industrial consumers
- Commercial consumers incl. tourism interests etc
- Rural residential consumers not connected to the current supply
- Rural consumers who currently rely on rainwater tanks, groundwater or minor surface water sources
- Environmental groups
- Government agencies
- Business groups
- Community groups such as ratepayer and progress associations
- Electronic and written media
- ???????
- ???????

It is desirable that these groups be involved early and continuously in order that there be fair representation and effective drought management planning. These groups are likely to impede progress in the development of plans if they are not included in the process.

ACTION: Determine key stakeholders and establish a process to support their input into the drought planning process.

D4.3 Team Structure and Communications

Appendix ??? includes the organisation chart for the Drought Management Team and the standard communication paths to assist clarification of the roles and responsibilities of the various members.

D4.4 Community Communication Plan

At this stage communication has been directed at the restrictions and general drought conditions, media contacts have been re-established and have been kept informed of the current conditions.

A full-page advertisement has been included in all local papers re the Karangi Pipeline and the regional significance of Karangi Storage.

Future communication will reinforce restrictions and possible impacts on various consumer types.

ACTION Develop a communication strategy including consideration of the following;

- Continue with regular columns including Whizzy and Water Watch
- Development of a dedicated web-site or use of the NCW or CV&CH RWS sites as apart of the communications strategy. The site could include information on the drought planning process, a copy of the plan, and current climate and water supply data.
- Level 3 restriction promotion when Nymboida approaches 115ML/day
- Major letter-box drop similar to Gold Coast Flyer.
- Level 4 restriction promotion when Nymboida approaches 60ML/day
- Approach major industries such as Sugar Mill, Abattoir, Fish Co-Ops, Tourist Industry and NSW Agriculture re possible closure as Nymboida passes 40ML/day or Karangi is connected and passes 20%.
- Major press conference re drought situation.
- Level 5, 6 and 7 restrictions.

D4.5 Reporting

The RDTF will report to the state level DTF on the status of drought monitoring, drought conditions and the status of the DMP development and implementation.

The frequency of reporting will be as required by the state DTF. In the absence of any other advice the frequency of reporting will be:

APPENDIX A

**RESTRICTIONS POLICY – COFFS HARBOUR
OCTOBER 2002**

APPENDIX B

**RESTRICTIONS POLICY – CLARENCE VALLEY
OCTOBER 2002**

**NORTH COAST WATER (Regional Water Supply)
LEVELS OF WATER RESTRICTIONS - CLARENCE VALLEY**

NYMBOIDA RIVER FLOWS³	95%ile or 225 Megalitres per day	98%ile or 170 Megalitres per day	99%ile or 115 Megalitres per day	100%ile or 60 Megalitres per day
LEVEL OF RESTRICTIONS	1	2	3	4
Gardens	No fixed hoses or sprinklers except between the hours of 7-8 am and 7-9 pm.	Hand held hoses only between the hours of 7-8 am and 7-9 pm.	Hand held hoses only between the hours of 8-9 pm.	Reused water only
Sports Grounds	No restrictions	No irrigation between the hours of 11 am to 2 pm	No irrigation between the hours of 11am to 2 pm	Council Approval required ⁵
Swimming Pools	No restrictions	Emptying and re-filling of pools BANNED , topping up allowed between 7-8 am and 7-9 pm.	Emptying and re-filling of pools BANNED , topping up allowed between 8-9pm.	Emptying and re-filling and topping up of pools BANNED
Washing Driveways and Paved Areas ¹	No restrictions	Buckets Only	Buckets Only	BANNED
Washing of Motor Vehicles	Buckets Only, Hose Rinse.	Buckets Only	Buckets Only	BANNED
Water Cartage	No restrictions	No restrictions	For internal domestic use only	For internal domestic use only
Continuous Flush Urinals ²	No restrictions	No restrictions	Council Approval required ⁵	BANNED
Road Construction	No restrictions	No restrictions	Council Approval required ⁵	BANNED
Industrial, Commercial ⁴	No restrictions	No restrictions	Council Approval	Council Approval

and Nurseries			required ⁵	required ⁵
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Notes:

1 - Washing driveways and paved areas is generally not recommended and the use of dry methods such as brooms is preferred or high pressure cleaning tools which use less water.

2 - Continuous flush urinals waste water and money and it is generally more economic to install movement sensors to automatically flush toilets after and during use, while not wasting water during long periods of no use. Check with Council to calculate a payback period for conversion of your existing urinal or methods to reduce the amount of flushing in your toilet at home.

3 - To prevent introduction and removal of restrictions on a daily basis the river levels must be less than those stated for a continuous period of 7 days before restrictions are imposed and higher than those stated for 7 days before removing the restriction.

4 - Commercial use is defined as businesses that indirectly use water such as motels, hotels, shops, new pool installations and Council owned and operated swimming pools.

5 - Where Council approval is required this shall be the Council responsible for reticulation in that area. The relevant Councils are Grafton City Council for Grafton City consumers including Clarence and South Grafton Industrial area ; Pristine Waters Shire for Waterview, Eatonsville and Coutts Crossing; Copmanhurst Council for Copmanhurst village; and Lower Clarence County Council for all remaining areas including Junction Hill, Southgate, Swan Creek, Ulmarra, Tucabia and Maclean Shire.

APPENDIX C

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APPENDIX D

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APPENDIX E

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NCW Regional Drought Management Plan 2001-2003

Restrictions

Current Policies

Clarence Valley

<u>1 – 225ML/day</u>	<u>2- 170 ML/day</u>	<u>3 – 115 ML/day</u>	<u>4 – 60ML/day</u>
<u>Fixed Sprinklers 3 hours per day</u>	<u>Hand Held Hoses 3 hours per day</u>	<u>Hand Held Hoses 1 hour per day</u>	<u>Greywater only</u>

CHCC

<u>1 – 85%</u>	<u>2 – 80%</u>	<u>3 – 75%</u>	<u>4 – 70%</u>	<u>5 – 55%</u>	<u>6 – 35%</u>
<u>Fixed Sprinklers 1 hour per day</u>	<u>Fixed banned, hand held 24hrs</u>	<u>Hand Held 1 hour per day alternate days</u>	<u>Hand Held ½ hour per day alternate days</u>	<u>Buckets Only</u>	<u>Greywater only</u>

PROPOSED CHCC stay the same except level 7 with CV being as follows (Note with Nymboida on line Karangi will not fall to above levels as quickly)

<u>1 – 225 ML/day</u>	<u>2- 170 ML/day</u>	<u>3 – 115 ML/day</u>	<u>4 – 60ML/day</u>	<u>5 – 40ML/day</u>	<u>6 – <30ML/day and Karangi 35%</u>	<u>7 – <40ML/day and Karangi 20%</u>
<u>Fixed Sprinklers 3 hours per day</u>	<u>Hand Held Hoses 3 hours per day</u>	<u>Hand Held 1 hour per day</u>	<u>Hand Held ½ hour per day alternate days</u>	<u>Buckets Only</u>	<u>Greywater only</u>	<u>Internal and Industrial restrictions</u>

This will bring CV into similar restrictions to that of CHCC in a uniform logical manner without effectively jumping from level 3 to 6 under the current policy

Assuming Karangi pipeline connected end of November and has 10ML/day supply dates would happen as follows

CV – Level 3 21-26th October 2002

CV – Level 4 7th November to December

CHCC – Level 5 November 2002

CV – Level 5 18th November to January

Region - Level 6 March 2003