JANUARY 2011

Catchment Management Plan

Hunter Water's eight element plan for our catchments

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Message from the Managing Director

The quality of water in our catchments is important to all members of our society. To date, maintenance of healthy catchments has been fundamental to Hunter Water's provision of safe, highly reliable drinking water to the lower Hunter. In addition to the provision of safe drinking water, Hunter Water's catchment management effort achieves multiple benefits such as improved habitat and lifestyle benefits through improved amenity. Managing our catchments well is a key part of creating Sustainable Cities of the Future and hence Hunter Water sees this as 'mission critical'.

Over the last few years Hunter Water has begun the implementation of the *Australian Drinking Water Guidelines Framework for Management of Drinking Water Quality* to effectively manage risks to drinking water quality from catchment to taps. This has provided an opportunity to review our approach to catchment management and renew our strategy in this area. We have used the Framework to develop an overarching action plan to better understand and manage risks, thereby safeguarding water quality and catchment health. At the same time we will continue to leverage our activities to achieve multiple outcomes for the community and environment.

I am pleased to release the first *Hunter Water Catchment Management Plan*, a long term and systematic water quality improvement plan for the drinking water catchments and water sources of the lower Hunter. This plan provides clear priorities to better protect our catchments and ultimately will enable more effective collaboration with all catchment stakeholders.

Please join us in building a sustainable urban water future.

Kevin Young
Managing Director
Hunter Water Corporation

Executive Summary

Water supply businesses are under ever-increasing pressure to ensure that they deliver excellent quality drinking water to their customers. Hunter Water is meeting that expectation using a risk based approach and implementing multiple barrier philosophy to ensure that no contaminants can get through and into the product water. The first of those barriers is the catchment from which the water is drawn.

Protecting our water supplies to ensure we have high quality source water was identified as a priority area from Hunter Water overall corporate risk rating. The Hunter will be home to approximately 160,000 more people by 2031 which will lead to increased development and recreational pressures. Some climate change scenario modelling also indicates that increased storm intensities will affect the quality and quantity of stream flows. This eight element Catchment Management Plan (CMP) aims to identify activities in catchments that can be better controlled to manage this risk to drinking water quality and proactively adapt to impacts brought about by climate change.

A snapshot of water quality in Hunter Water's catchments reveals that water quality varies across sites. It is evident that each catchment has its own risk profile, catchment characteristics and resulting water quality. Individual catchments are described to give an overview of the current understanding of their nature and health. Runoff from urbanised areas into surface water catchments currently poses the greatest risk to source drinking water quality.

To develop this CMP, a wide ranging review of other water authorities, regulations and water quality management guidelines was conducted to benchmark current best practice catchment management. The review revealed that the current Australian and international leaders in catchment management effectively implement eight principles:

1. Identify the top hazards:
After analysing the various methods to identify and rank catchment hazards to water quality around Australia, Hunter Water has partnered with the Sydney Catchment Authority (SCA) to develope the Source Water Improvement Support System (SWISS). The SCA currently use a similar model as the foundation upon which catchment priorities are determined and subsequently funded. It has a scientifically robust, logical and user friendly structure.
Initial tests on the Grahamstown Catchment yielded promising results. Hunter Water aims to have modelled water quality hazards in all catchments and scoped catchment remediation works using this model in time for the next budgeting process.

2. Have effective legislation:
Effective legislation refers not only to the strength and clarity of the rules governing catchment land use, but also their integration into local planning instruments. Hunter Water will seek to clarify the legislation through improvements to the *Hunter Water Regulation 2010* and also endeavour to embed it in local planning instruments within the next two years.

3. Work with stakeholders:
Stakeholders in the management of the *total* water cycle, not only the traditional service components such as water delivery and stormwater, must work together in catchments to improve water quality. Hunter Water will build upon current stakeholder relationships by regularly meeting with catchment stakeholders. We aim to have an initial meeting with all by the end of this financial year (2010-2011).

4. Monitor high risk areas:
Very small numbers of pathogens in treated water can make large numbers of the population sick. It is not possible to reliably monitor treated water for pathogens. A sound understanding of the highest level of risk in the raw water drives the design of the treatment process. It also allows effective targeting of catchment activity impacts. Hunter Water will continue to target samples of runoff from rain events at sites that pose the highest risk in catchments.

5. Foster research:
Our understanding of catchments changes through time as the population grows and science improves. It is essential to be involved in national and local catchment research to have quality information that enables informed decisions. In the next financial year catchment research will be directed by the information requirement for the catchment model. It is envisaged that within two to three years the outcomes of the catchment model will drive research priorities.

The Upper Williams River Catchment

6. Perform proactive surveillance:
Gathering knowledge about catchments is an essential foundation of the risk assessment process. Hunter Water currently employs Rangers to engage in surveillance of the catchments. We plan to implement programmed surveillance of each catchment with simple templates so that catchment condition information can be recorded and shared.

7. Engage the community:
Hunter Water's catchments are approximately 65 per cent privately owned. It follows that land users have arguably the greatest ability to make a difference to water quality in catchments. We have begun to implement methods to inform and engage the community and will develop a Catchment Communication Plan with help from catchment stakeholders.

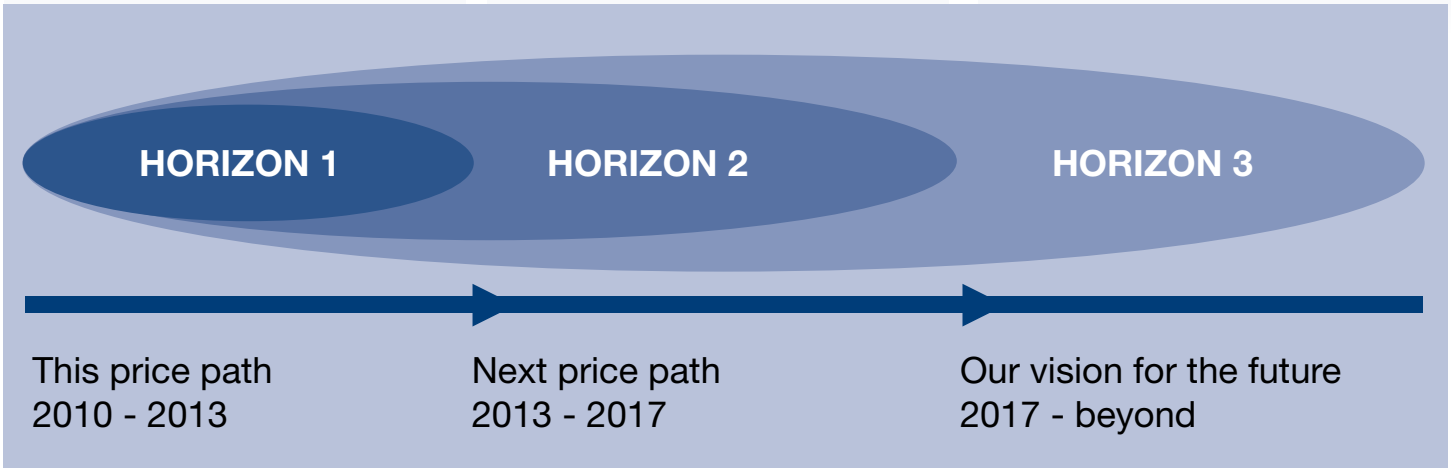
8. Plan for emergencies (fire):
All catchments are vulnerable to unexpected incidents ranging from those with remote possibilities (eg an aircraft crashing) to high (eg vandalism). Hunter Water has a tried and tested Incident Response Plan (IRP) in place. A Bushfire Management Plan that addresses fire preparedness and emergency fire response will be written to complement the IRP.

This plan is a recommendation for substantial change to Hunter Water's catchment responsibilities. Each of the eight elements contain recommendations that may take some time to put into practice. In recognition of this, a scaffold is provided, for each of the eight elements, that promotes future planning in three time horizons:

HORIZON 1
spans this price path (2010-2013) and contains the actions necessary to lay a sound foundation for our vision. The actions of this horizon are pivotal for putting forward the rationale to the Independent Pricing and Regulatory Tribunal (IPART) for expenditure in the budget process.

HORIZON 2
is a crucial period as it builds towards our long term vision for catchment management.

HORIZON 3
contains Hunter Water's broad long term vision for catchment management beyond 2017. This horizon is important as it directs Horizon 1 and 2 actions.



Part 1: Introduction

1.1 DOCUMENT PURPOSE

Protection of our water sources is paramount and a cornerstone of the water management approach adopted by Hunter Water for our catchments. In recognition of this, Hunter Water's *Enterprise Risk Management Process* was applied to the catchment management condition in drinking water catchments. The conclusions from this process were that:

1. There is a risk to water quality in catchments from current land use practices.
2. Planning protocols need to be improved to strengthen consideration of drinking water quality impacts for developments in drinking water catchments.
3. There is no single regulatory authority which currently upholds drinking water quality in catchments. The Hunter Region would benefit from clarifying responsibilities and improving collaboration between agencies to uphold source water quality.

In July 2009, Hunter Water endorsed the development and implementation of a comprehensive *Eight Element Catchment Management Plan* to mitigate the existing and potential risks to the Hunter's drinking water quality. During the past year, the Water Resources Team has begun the implementation of some of these elements and produced this Plan document.

THE HUNTER WATER CATCHMENT MANAGEMENT PLAN (CMP):

- Is a more proactive approach to catchment management, recognising it as an important barrier to water quality risks,
- Supports the strategic objectives from the Hunter Water Strategic Business Plan (especially produce a safe, highly reliable water service and protect people's health and enhance the environment)
- Links with the requirements of the Drinking Water Framework,
- Provides the basis for justification of future expenditure on catchment management initiatives,
- Will be updated and refined as better knowledge and information becomes available.

It is envisaged that the Plan will continue to evolve over time as new information becomes available and understanding of catchments improves. It will be refined and updated after evaluation by other stakeholders and as new recommended practices emerge. The review cycle will be each four years in the lead up to the Hunter Water's pricing submission to the Independent Pricing and Regulatory Tribunal (IPART). In their *Operational Audit 2008-2009 Report to the Minister*, IPART recognised that additional focus is necessary:

"Hunter Water . . . is now in a position to apply the risk based information to develop a Catchment Management Plan to guide its activities and funding priorities"

Hunter Water views the Catchment Management Plan as a catalyst for the collaboration of stakeholders in drinking water catchments. It is recognised that the long term goal of cleaner catchments and better water quality is shared by all and Hunter Water will endeavour to build strong partnerships to keep our catchments clean.

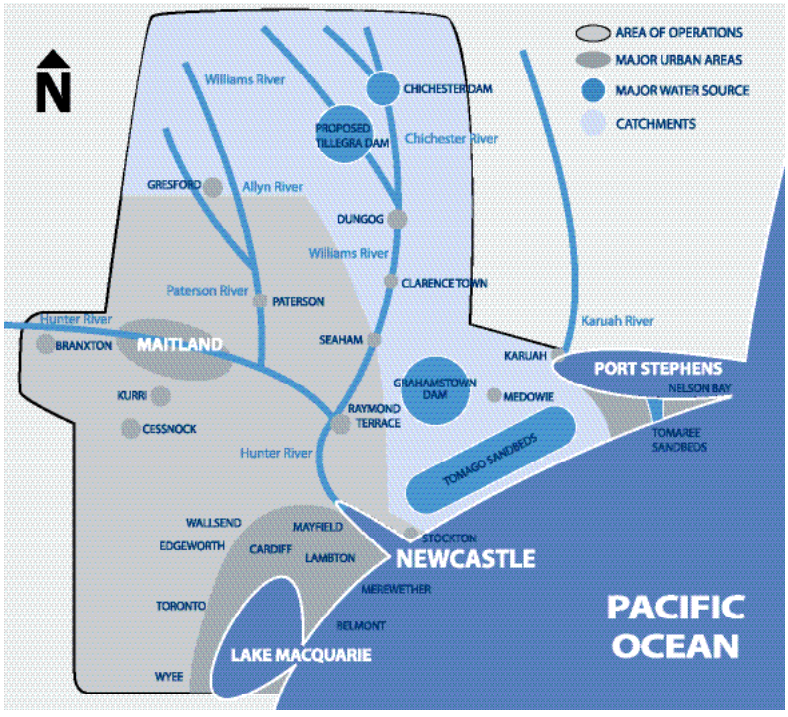


Figure 1: Hunter Water's area of operations (grey) and catchments (light blue)

1.2 OVERVIEW OF HUNTER WATER

Hunter Water is a State Owned Corporation (SOC) providing water and wastewater services for over half a million people in the lower Hunter region. Our primary purpose is to supply reliable and high quality water and wastewater services to the people of the lower Hunter region.

Figure 1 shows a schematic of Hunter Water's area of operations and the drinking water catchments. Hunter Water's area of operations covers 5,400km^2 which includes the local government areas of Dungog, Cessnock, Lake Macquarie, Maitland, Newcastle and Port Stephens and small parts of Singleton. Hunter Water's catchments total an area of 1450km^2.

Hunter Water's operations are regulated by the NSW Government on behalf of the community through a number of regulatory instruments:

- The main regulatory instrument, the Operating Licence, requires Hunter Water to meet Australian Drinking Water Guidelines standards;
- Extraction of water from the Williams River and sandbeds is regulated by the NSW Office of Water (NOW) within DECCW. NOW issue Water Management Licences that require environmental conditions are met.
- The performance of Hunter Water's wastewater system is regulated by DECCW through Environment Protection Licences. The licences stipulate both quality and quantity conditions for discharge from each wastewater treatment works and are reviewed every three years under the legislation.

1.3 THE AUSTRALIAN DRINKING WATER GUIDELINES

Hunter Water has recently adopted the 'catchment to tap' approach that is recommended by the Australian Drinking Water Guidelines (the Guidelines) to manage the risks associated with drinking water quality.

The Guidelines recommend that best practice drinking water quality management is achieved using a multiple barrier process. This approach is based on the premise that no single treatment mechanism is infallible; each 'barrier' reduces risk to water quality incidents when it is applied in a robust manner. Figure 2 demonstrates that as a greater number of robust barriers are implemented, public heath risk is reduced proportionally.

1.4 THE NEED TO MANAGE DRINKING WATER CATCHMENTS

- The Lower Hunter Regional Strategy predicts that an additional 160,000 people will reside in the Hunter by 2031. The Department of Planning has identified that most housing will principally be developed on 'greenfield' sites, some within drinking water catchments. It is recognised that increasing development and land use pressures in the catchment of source waters causes a decline in raw water quality and a resultant increase in risk to the security of drinking water.
- A decrease in the quality of raw water supplied to drinking water treatment plants requires an increase in the treatment infrastructure required (eg ozonation, advanced oxidation processes). The implementation of these advanced treatment methods increases the cost of water to customers.
- Increasingly complex treatment methods require more energy, which has adverse greenhouse gas implications.
- Poor quality source water requires increased chemical dose rates which increases cost to the consumer. Source water with variable quality is also more difficult to treat as chemicals must be adjusted to optimise the treatment process. Rapid change in quality of source water is recognised as a high risk period for water quality incidents.
- Given that Hunter Water applies a multi-barrier approach to managing drinking water quality, the most efficient allocation of resources for catchments and treatment needs to be considered. The costs associated with managing catchments needs to be balanced against the cost of increased treatment. Detailed cost-benefit analysis are currently underway that weigh the cost and benefit of catchment management against treatment (see Wells, in progress). In the interim, Hunter Water recognises that expenditure on both treatment plants and catchment management is necessary.

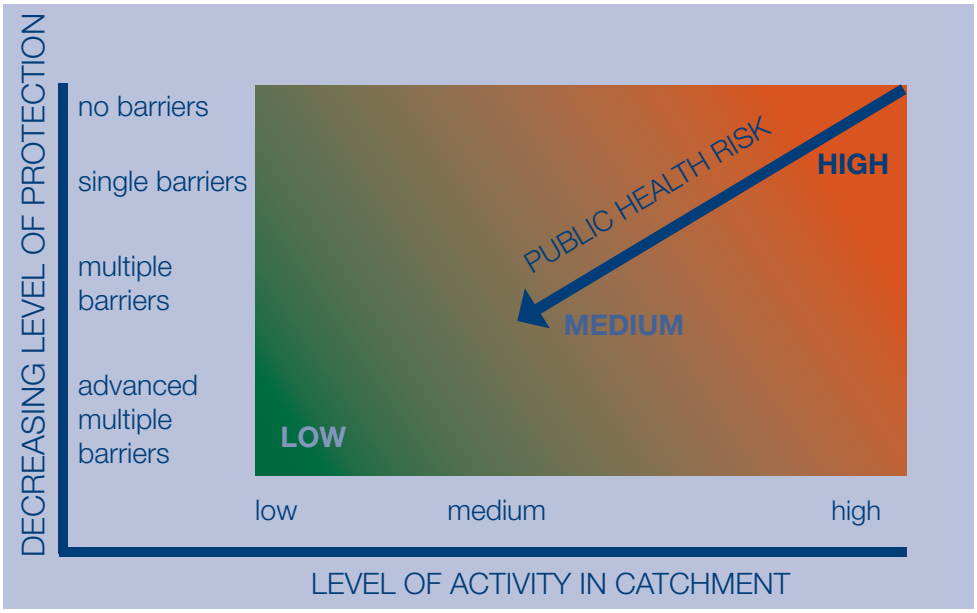


Figure 2: Effect of increasing the number of barriers for protection of drinking water.

1.5 THE STRENGTH OF THE WATER QUALITY BARRIERS IN HUNTER WATER'S CATCHMENTS

The Guidelines recommend strengthening six (arbitrary) barriers for the preservation of quality drinking water. Catchment management and source water protection provide the first barrier and various engineered solutions to reduce the risk of disease are placed downstream of catchments and dams. It should be noted that downstream solutions such as treatment cannot always be relied upon in isolation:

"Preventive measures by their nature should be applied as close to the source as possible, with a focus on prevention in catchments rather than sole reliance on downstream control."[1]

The barriers that reduce the risk of a water quality incident are listed at the top of Figure 3 (below). The various protective measures that underpin them are listed alongside.

The green shading that predominates on the right of the table indicates that barriers are generally robust for Hunter Water's treatment and supply system. In contrast, catchments, and to some extent dams, provide 'developing' protection to drinking water quality. It is evident from the table that we can improve the integrity of our catchments in terms of minimising risks to source water quality.

1.6 CATCHMENT MANAGEMENT AND CLIMATE CHANGE

"According to many experts, water and its availability and quality will be the main pressure on, and issues for, societies and the environment under climate change." - IPCC[2]

There is strong scientific evidence for human induced climate change. It is recognised that Australia - and in particular the water industry - is vulnerable to the impacts of climate change. There are two ways to manage the risk of adverse impact, either:

- attempt to reduce or halt the change (climate change mitigation) or
- live with its effects (climate change adaptation).

In practice, a combination of substantial cuts to greenhouse emissions and effective adaptation policy will be required to combat climate change. Hunter Water recognises that good environmental stewardship in catchments has broad environmental and social outcomes, including mitigating and managing the impacts of climate change.

1.Opportunities for climate change mitigation in catchments

There has not yet been a unilateral agreement on the depth of cuts in greenhouse gas (GHG) emissions necessary to mitigate the risk of climate change. Despite this, Hunter Water's *GHG and Energy Management Policy* commits to no net annual GHG increase from 2008-2013 and catchment management activities provide a mechanism by which Hunter Water can meet these targets. Vegetation within catchments store significant carbon stocks; maintaining these and pursuing opportunities for carbon sequestration will have dual benefits of mitigation against climate change and improving the quality of water through natural filtration.

Hunter Water has a significant opportunity to leverage catchment management and climate change works

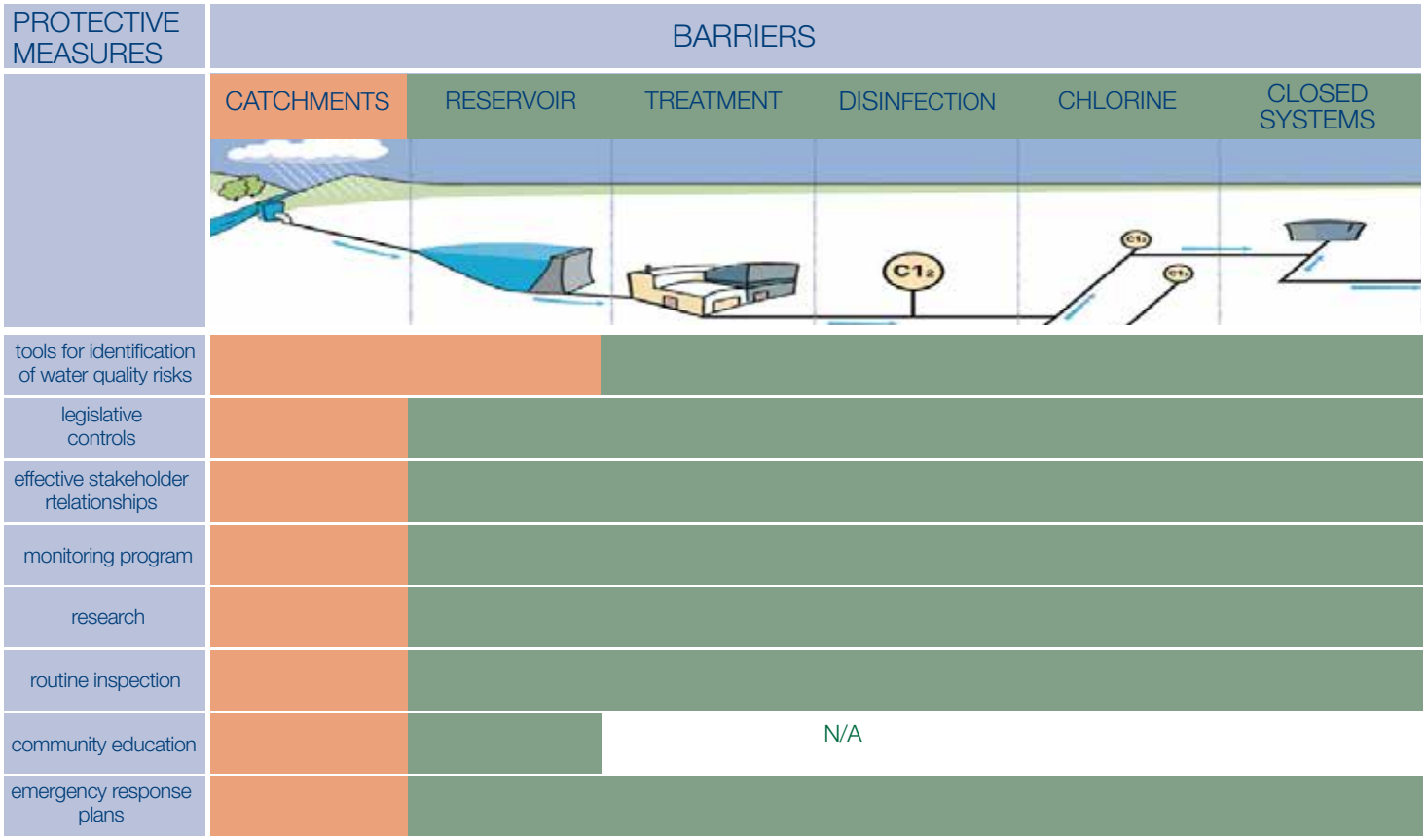


Figure 3: Barriers to protect drinking water quality. Efficacy of each barrier is indicated by green shading (robust), orange (developing)

[1] NHMRC and NRMMC (2004) Australian Drinking Water Guidelines, 2004
[2] Intergovernmental Panel on Climate Change Technical Paper VI - June 2008

as it provides multiple environmental benefits. We have greatest influence over freehold land and on public lands administered by NSW Government agencies, which together cover about one third of the catchment area. Hunter Water has been working with other agencies to develop NSW Government wide objectives, strategies and directions for managing public land to combat climate change[3]. Priority mitigation strategies relevant to Hunter Water's catchments include:

- increasing carbon sequestration capacity, especially on vacant or degraded land and
- reducing greenhouse gas emissions from land management activities.

2. Climate change adaptation in catchments

Management of catchments for water quality and quantity needs to be resilient and responsive to changes to the biophysical environment arising from climate change. Implementing a regularly updated catchment plan that is based on scientific observation allows Hunter Water the ability to respond to environmental change. Effective planning in catchments for water quality in many ways overlaps with planning for climate change adaptation.

- **Adaptation through collaboration and innovation:**

For appropriate planning to occur, there is a need for a collaborative approach across geographical boundaries and levels of government. People must find different solutions through innovative approaches. Hunter Water understands that building and sharing knowledge is cornerstone to effective planning, whether it be land use planning for water quality or climate change.

- **Adaptation to increased storm intensity:**

In its National Climate Change Adaptation Framework[4], COAG recognised that a change in the pattern of Australia's rainfall due to climate change presents one of the most significant challenges to Australian governments. More concentrated rainfall events have human health implications through the increased transport of human disease due to wastewater overflows. Higher peaks can mobilise soils by erosion, thereby reducing water quality and increasing treatment cost. Hunter Water recognises that it has an important role in maintaining the quality of its source water through proactive catchment planning.

- **Adaptation to broad scale changes in vegetation:**

The predicted change in distribution of vegetation communities may have an impact on the natural filtration of water. There is potentially an increased frequency of algal bloom in rivers and dams due to reduced natural nutrient attenuation. Hunter Water's catchments cover a diverse topographic and wide spatial area. The catchments have a diversity of climates and soil landscapes. Catchment activities that improve riparian vegetation may increase the resilience of flora and fauna to climate change by allowing migration of plants and animals to favourable areas.

- **Adaptation to increased bushfire frequency and intensity:**

Under some climate change scenarios, increased bush fire frequency and intensity results in loss of vegetation and subsequent reduction in water quality. More intense fires may reduce the ability to use particular source waters or necessitate additional water treatment capability. Using Hunter Water's Enterprise Risk Management Framework, bushfire preparedness is the priority risk to Hunter Water from climate change. Part 3 of this document outlines how Hunter Water will produce a Bushfire Management Plan that will be updated with reference to climatic conditions.

[3] NSW public land and climate change 2010-2015, NSW Government
[4] Council of Australian Governments National Climate Change Adaptation Framework – endorsed 2007

Part 2: Our drinking water catchments

2.0 INTRODUCTION

Part 2: Our drinking water catchments identifies the broad risks to source water found in our catchments and gives a snapshot of current water source quality. It describes in more detail the catchments and water source from which Hunter Water extracts raw water.

There are currently six legislated catchments from which Hunter Water is licensed to extract. These are defined in the *Hunter Water Regulation 2010*. Hunter Water recently expanded its area of operations to include the Dungog Shire which resulted in an additional catchment, the Paterson and Allyn Rivers, which have not been defined in legislation.

2.1 THE REGION'S HERITAGE

Hunter Water's drinking water catchments link the dunes of Stockton Bight and the World Heritage Barrington Tops. The catchments traverse a mosaic of land use, including agricultural properties, water catchment reserves, national parks, nature reserves, state forests, riparian reserves, roadside reserves, stock routes and other public land. Communities vary from densely populated urban centres to rural communities and indigenous conservation lands.

The drinking water catchments are within the traditional country of four indigenous communities: Worimi, Karuah, Mindaribba and Wanaruah (Figure 4). The landscape contains significant cultural and natural values of importance to the traditional landowners, who have a long history of living in sympathy with the environment. Indigenous knowledge of land management and ecological resilience can play an important role in caring for the catchments.

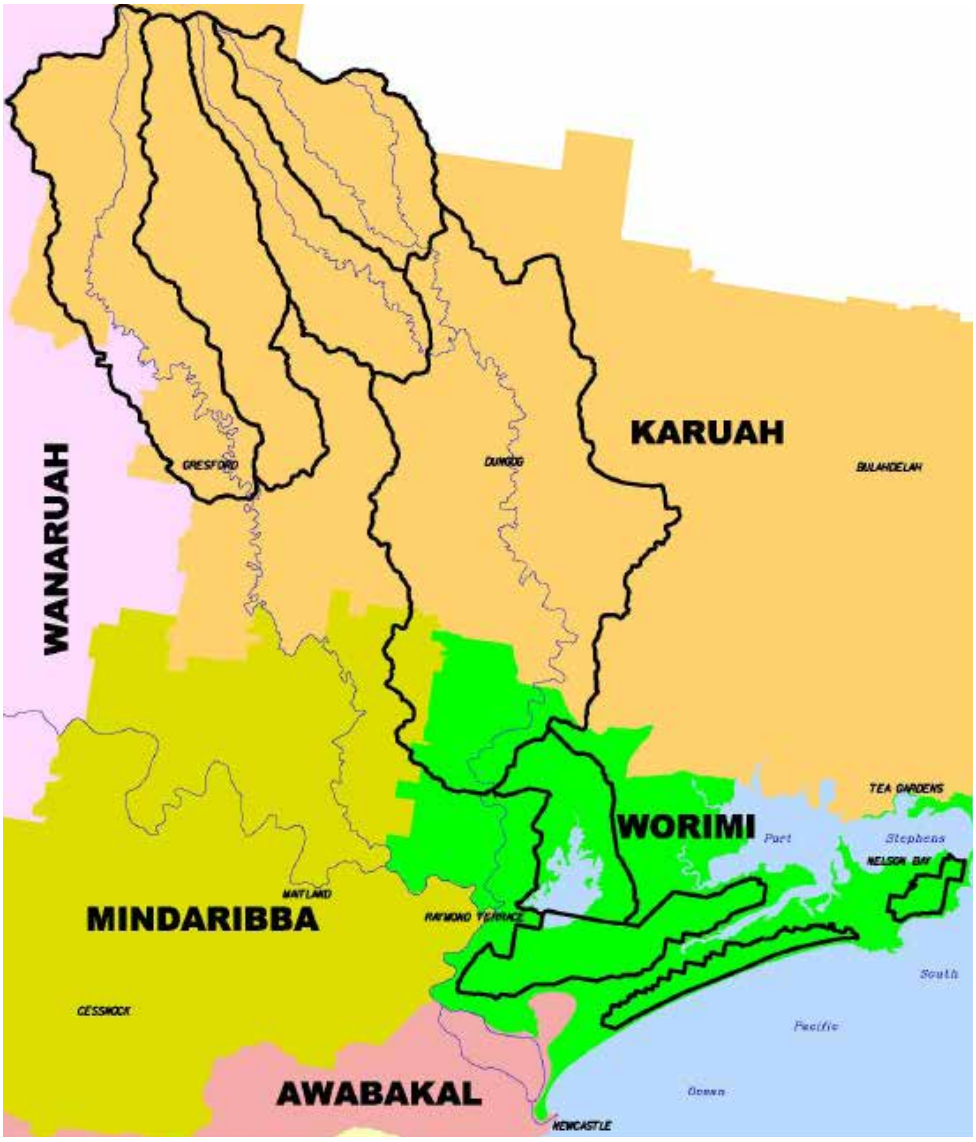


Figure 4: Indigenous communities within the region

2.2 THE BROAD RISKS TO WATER QUALITY IN CATCHMENTS

There are three main types of water contamination:

- **Microbiological** (eg bacteria, viruses and protozoa): these organisms are often found in the faeces of humans and domestic animals. These are the greatest risk to human health.
- **Chemical** (eg fuel, endocrine disrupting chemicals): associated with spills, dumps, agricultural chemicals and sewage.
- **Physical** (eg turbidity): may be caused by erosion along riverbanks and gullies.
- **Figure 5** identifies specific sources of contaminants in Hunter Water's catchments.

Figure 5: The broad water quality risks in Hunter Water's catchments

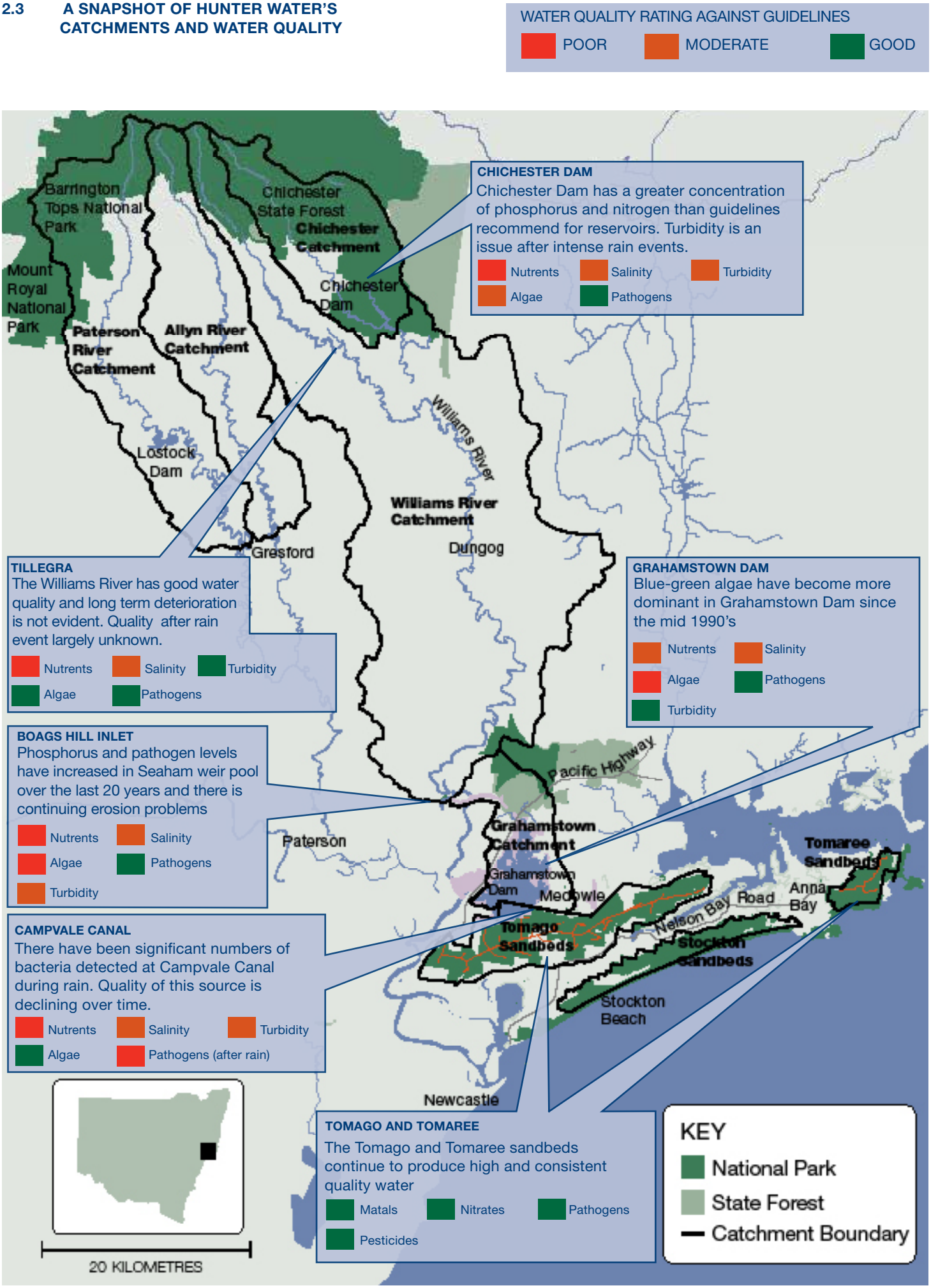


Figure 6: Water quality in Hunter Water's legislated catchments (Source: Hunter Water Biennial Water Quality Reports, 2006 until present)

2.4 THE WILLIAMS RIVER CATCHMENT

CATCHMENT AREA	ANNUAL RAINFALL	AREAS SUPPLIED	LAND USE BREAKDOWN OF CATCHMENT	POPULATION GROWTH FORECAST 2010-2030
974km^2	1152mm (at Dungog)	Water pumped into Grahamstown Dam at Seaham Weir	80% farming and rural, 14% National Park or State Forest, 6% Hunter Water freehold	Current population[5] 2,350 residents. The main population growth will be in uptake of rural residential land – by 2030 the towns of Dungog and Clarencetown may have an additional 250 and 450 of these lots, effectively doubling the population of Clarencetown. A modest increase in urban centre populations only.

Northern reaches

The Williams River has its headwaters emanating from forested and pastoral land approximately 140 kilometres north of Newcastle (Figure 8). The headwaters of the Williams drain the southern Barrington Tops National Park and pastoral hinterland. To the east, the Chichester River also begins in the Barringtons and joins the Williams at Bandon Grove. Land use in the northern reaches is a mixture of National Park, forestry and extensive cattle farming with some irrigated pasture cropping on the river flats.

The Williams continues in a southerly direction through the major townships of Dungog (population 2,100) and Clarence Town (population 1,000). The catchment of this portion of the river is again primarily pastoral, but with pockets of more intensive agriculture (eg poultry and dairy farms) and urban development. There is a sewage treatment plant at Dungog that irrigates effluent onto a dairy farm adjacent to the river and a treatment plant under construction at Clarence Town.

Southern reaches

At Mill Dam Falls (approximately 45 kilometres from Newcastle) the Williams changes from a free flowing river into a modified river weir pool, Seaham Weir pool. The pool is approximately 18 kilometres in length and is effectively free from tidal influence due to the completion of Seaham Weir in 1978. This body of water has a longer retention time than the river above this point and thus may behave similarly to a long reservoir in periods of low river flow. Figure 7 is of Seaham Weir looking south.

On average the weir pool is between five and eight metres deep and must be maintained at a specific level to reduce erosion of the river bank and prevent flooding of the surrounding property. Despite these rules, erosion of the riverbank is a significant issue on the weir pool. The worst erosion occurs where banks have largely been cleared for the surrounding cattle pasture and water skiing boats are permitted. The banks of the pool are unfenced in parts, adding to erosion problems and allowing cattle to enter the water.

After rainfall and under higher flows, water is transferred through Balickera Canal to Grahamstown Dam using pumps at Balickera Pump Station (Figure 9). During dry times the majority of flow in the Williams is sourced from the upper catchments and during wet times the lower catchment dominates. Water quality risk assessments for this source indicated that nutrients, turbidity, pesticides, organics and algal toxins were the principal issues for this system.

Figure 7: Seaham Weir looking south

[5] Estimate based on Australian Bureau of Statistics 2006 Census data

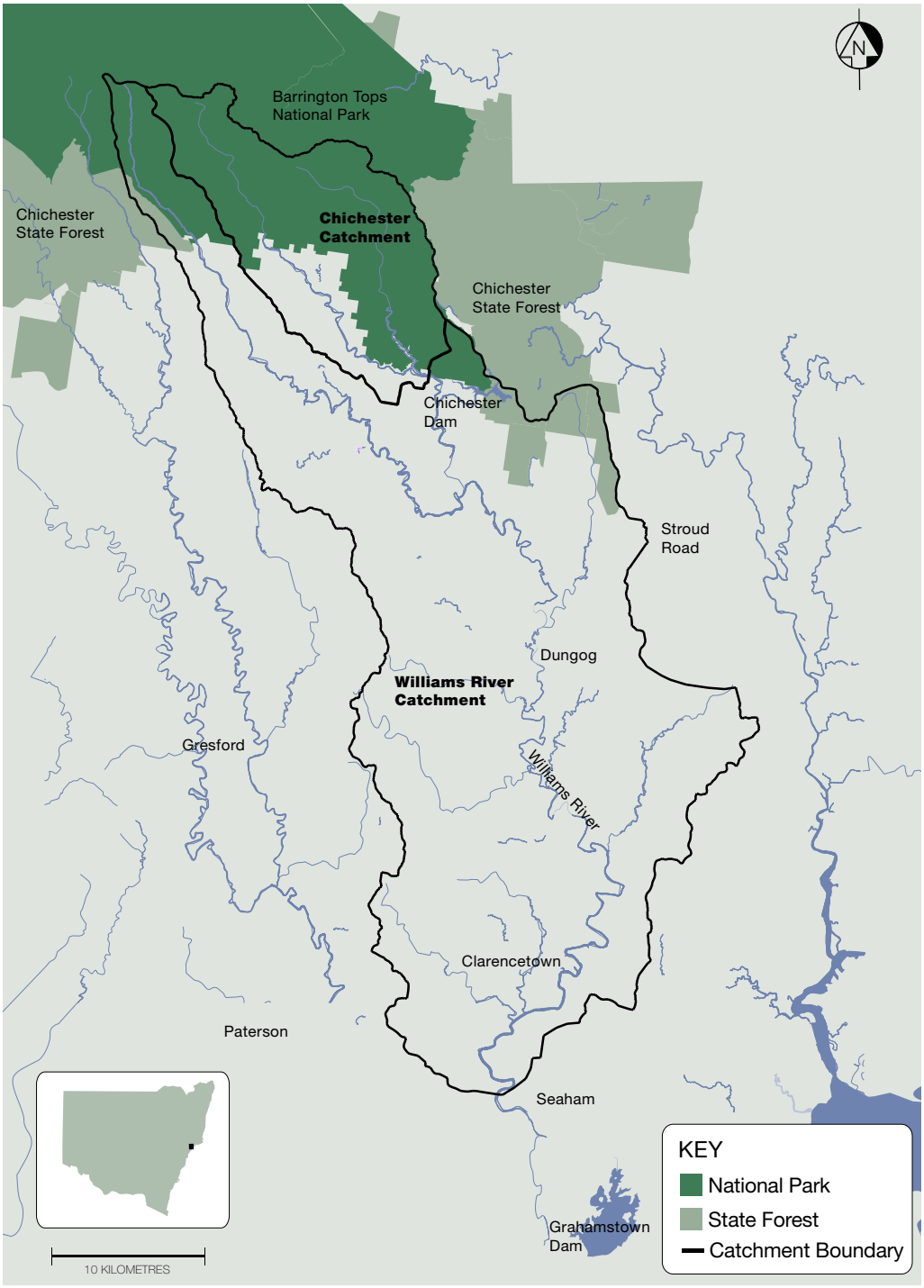


Figure 8: The Williams River Catchment

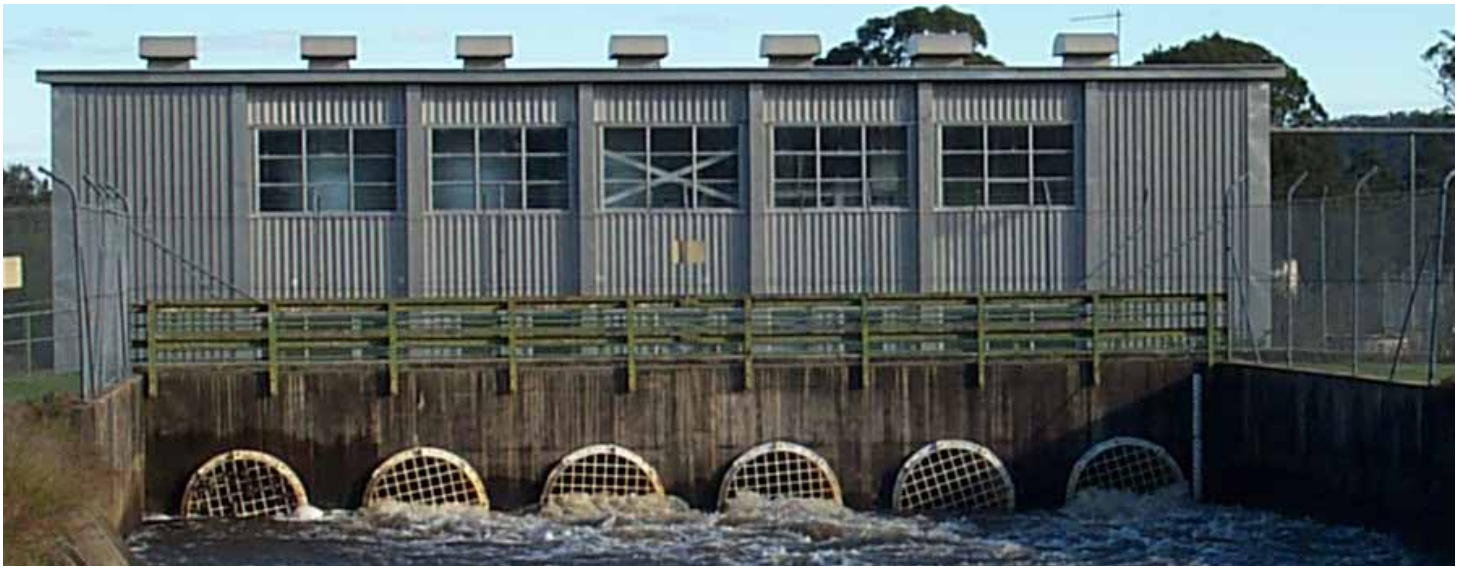


Figure 9: Balickera Pump Station outlet into Grahamstown Dam

CATCHMENT AREA	DAM VOLUME	MAXIMUM DEPTH	SURFACE AREA	ANNUAL RAINFALL	AREAS SUPPLIED	LAND USE BREAKDOWN OF CATCHMENT	POPULATION GROWTH FORECAST 2010-2030
199km^2	21.5GL (1GL = 1 billion litres)	37m	180ha	1300mm (Upper Chichester)	Lower Hunter, approx 35% of volume	76% National Park, 17% rural, 7% Hunter Water freehold (Appendix A shows how this land is managed)	Current population[5] 150 residents, high hobby farm vacancy rate. Negligible population growth until 2030

Chichester Dam is located 80 kilometres north of Newcastle at the south-eastern corner of the World Heritage listed Barrington Tops National Park (Figure 10). Water from Chichester Dam is dosed with chlorine at the dam and then transported via a gravity pipe to Dungog, where it is further treated at the Dungog Water Treatment Plant. Approximately half of the flow from Chichester is supplied to Maitland, Cessnock and Beresfield areas. The balance gravitates further to Newcastle, where it blends with water supplied from Grahamstown Water Treatment Plant. Because water is fed by gravity from Chichester it requires the lowest energy input of all sources. Water supply from Chichester Dam is used as much as possible for this reason.

The dam is fed by the Wangat River to the north and Chichester River to the north-west.

- The Wangat River's catchment is entirely vegetated and pristine. There is very little recreational activity in this catchment because of its difficult terrain. The Wangat catchment has been deemed by expert panel to represent the lowest risk of pollution to drinking water.

- The Chichester River's catchment is partially cleared for agricultural and rural residential land use. Land parcel size is small to medium for a rural area. There has been an increase in holdings of hobby farms and holiday accommodation due to the region's beauty and relative isolation. There is no intensive agriculture in the catchment. Effluent from all properties is treated using septic systems. A large portion of the river is unfenced and hence cattle are free to graze in and around the river.

There is high runoff from the area due to the abundant rainfall and the large catchment area. Hence, the dam is filled quickly following medium to heavy rainfall and there is little time for pathogens or turbidity to settle. There is very little data characterising the water quality after rain events in the Chichester or Wangat Rivers due to the remoteness of the location. Risk assessments for this source indicated that pathogens, phosphorus and turbidity were the principal issues for this system.

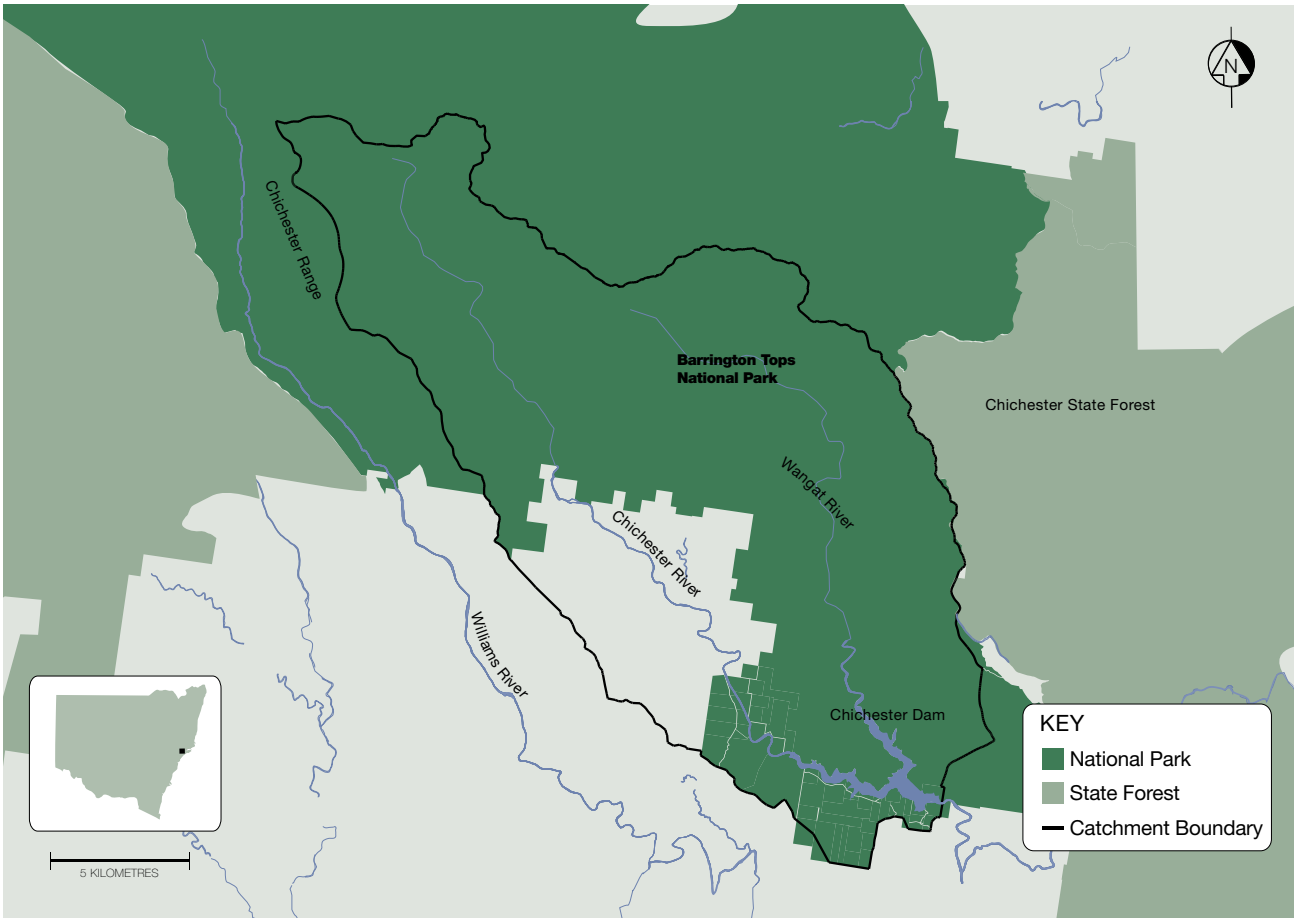


Figure 10: Location and extent of Chichester catchment

[5] Estimate based on Australian Bureau of Statistics 2006 Census data

2.6 GRAHAMSTOWN DAM

CATCHMENT AREA	DAM VOLUME	AVERAGE DEPTH	SURFACE AREA	ANNUAL RAINFALL	AREAS SUPPLIED	LAND USE BREAKDOWN OF CATCHMENT	POPULATION GROWTH FORECAST 2010-2030
115km^2	182GL (billion litres)	9m	2800ha	1125mm (Williamtown)	Lower Hunter, approximately 40% of volume	39% rural, rural residential or urban, 22% State Forest, 39% Hunter Water freehold (Appendix A shows how this land is managed)	Current population[5] 3,900 residents primarily concentrated in the urban area of Medowie (3,600). 2,000 additional dwellings (5,600 more people) in Medowie by 2030

Grahamstown Dam is the Lower Hunter region's major urban water supply dam, supplying 30-75 per cent (40 per cent on an ongoing basis) of our water. The proportion of water supplied is much higher in times of drought. Grahamstown Dam itself is located relatively close to the river at Raymond Terrace (Figure 11).

Transfers from the Williams River

Grahamstown Dam is classified as an off-river storage facility, storing raw water pumped from the Williams River at Seaham Weir (1, Figure 11) through the Balickera Canal (2), raised approximately 15 metres at the Balickera Pumping Station (3) to then flow through the Balickera Canal and Tunnel into the northern end of Grahamstown Dam. On average, 50 per cent of inflow to Grahamstown Dam is pumped from the Williams.

Hunter Water monitors water quality in the Williams River for nutrients before transferring water to Grahamstown Dam. Nutrient levels can be assessed rapidly with a permanently installed online analyser. Like most Australian rivers, the Williams is highly influenced by climatic conditions and is consequently highly variable in flow and water quality. Flow and water quality are assessed against pumping rules to minimise the nutrient load transferred to the dam.

The Grahamstown catchment

Grahamstown Dam's small catchment contributes the remaining inflow. The catchment is primarily located on the northern and eastern shores of the dam.

To the north of the catchment Seven Mile Creek (4) drains small to medium sized farm allotments, a dirt racetrack, large landscaping supply business and a quarry. The water quality from the northern catchment has not been well characterised, but runoff from these land uses typically present some turbidity and nutrient issues. Approximately 75 per cent of total catchment runoff comes from the northern part of the catchment. Runoff from the east comes directly from the urban settlement of Medowie through the Campvale Swamps (5). Water is pumped into the dam via the Campvale Pump Station (6) and finally spills at the Irrawang Spillway (7).

The Medowie catchment is seen as posing the most risk to drinking water quality as it is an urban catchment. It contains all the major risks to drinking water quality and is in close proximity to the offtake for Grahamstown Water Treatment Plant (8).

Water quality risk assessments for Grahamstown indicated that pathogens, turbidity, pesticides, organics and algal toxins, taste & odour compounds were the principal issues for this system.

Grahamstown Dam Catchment

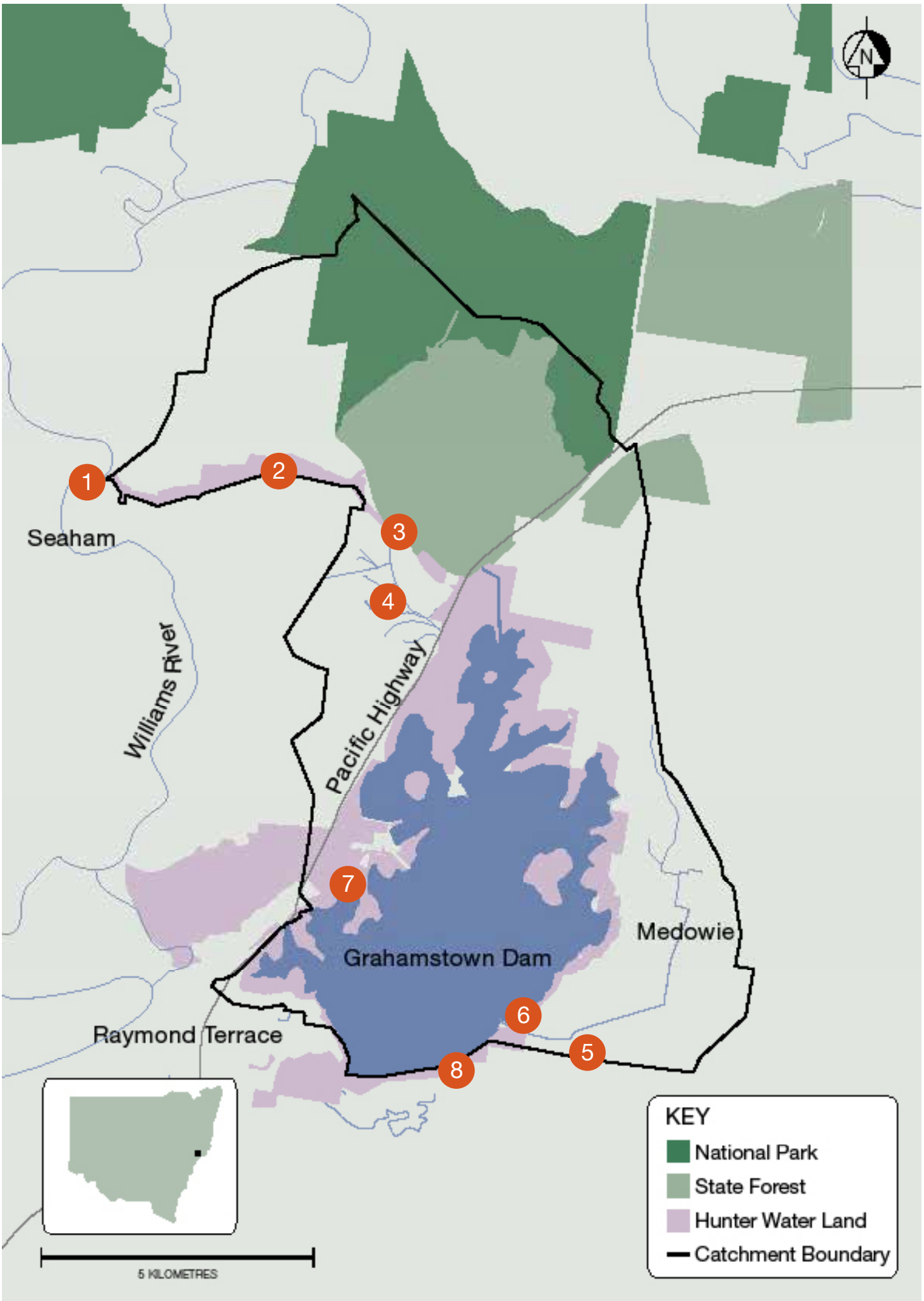


Figure 11: Location and extent of Grahamstown catchment, inflows and outflows

CATCHMENT AREA	ANNUAL RAINFALL	ACCESSIBLE AQUIFER VOLUME	AREAS SUPPLIED	LAND USE BREAKDOWN OF CATCHMENT	POPULATION GROWTH FORECAST 2010-2030
109km^2	1125mm	60GL	Lower Hunter, approximately 20% of volume	44% State Conservation Area, 21% Hunter Water freehold, (Appendix A shows how this land is managed), 21% industrial, 8% Defence (RAAF Base), 3% Bombing Range, 3% rural residential	Current population[5] 1,250 residents. Two large industrial developments to the South and South-West will significantly increase transient population. Average infill and vacant land uptake may increase population to 1,800 by 2030.

The Tomago Sandbeds lie parallel to the coast between Newcastle and Port Stephens, beginning at Tomago and extending north-east for 25 kilometres to Lemon Tree Passage (Figure 12).

Below the Sandbeds is an aquifer (or underground water source) consisting of an impervious clay and rock layer underneath fine sand. The sand is on average 20 metres deep, but reaches a depth of 50 metres in places.

Rain water lands directly on the sand surface to replenish the aquifer. Whist some is lost to plants and evaporation, the fine sand particles slow the passage of water as it generally moves in a southerly direction. The water table is approximately 4.8 metres above sea level when full and 1.8 metres above sea level when empty.

Extraction of water from the aquifer

From approximately Lemon Tree Passage west to Tomago, there is a network of more than 500 individual bores covering 100km^2. After conventional treatment at Grahamstown Water Treatment Plant, water from the western Tomago Sandbeds is piped to consumers in Newcastle and the lower Hunter regions.

To the east of Lemon Tree Passage, a smaller volume of water is extracted and treated by the Lemon Tree Passage Water Treatment Plant and piped to Karuah, Lemon Tree Passage and Tanilba Bay.

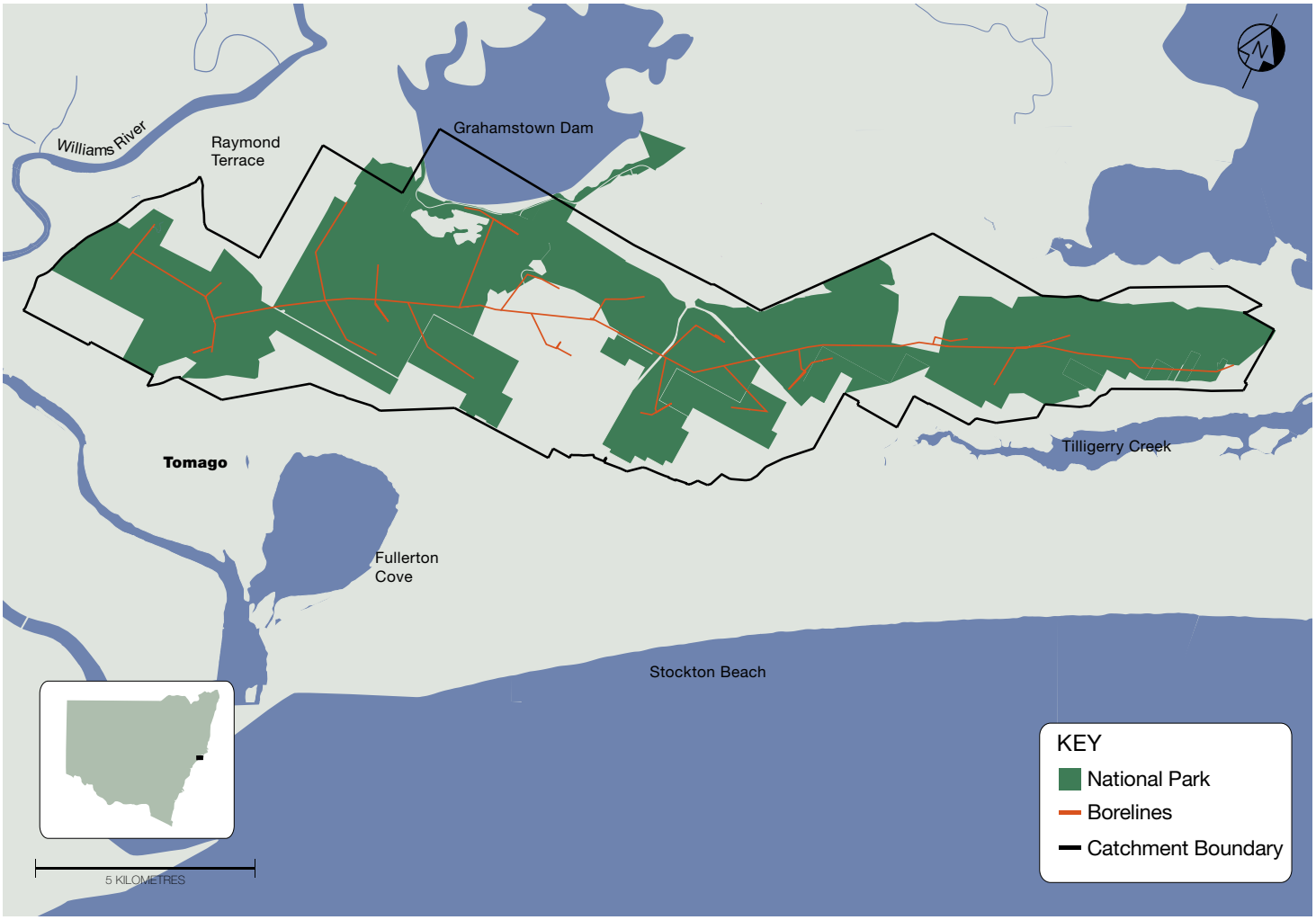


Figure 12: Location and extent of Tomago Sandbeds

[5] Estimate based on Australian Bureau of Statistics 2006 Census data

The importance of the sandbeds to the supply system

The sandbeds are strategically important for both ongoing and backup water supply. The ongoing supply from the sandbeds reduces the load on surface water sources and thereby allows greater overall yield from the total water supply system. The large storage volume can be used as a reserve supply during drought and is available as a backup supply in the event of water quality issues in the surface storages.

Water quality and catchment health

Water from the Tomago aquifer is of reliable quality. This has been the result of both favourable natural conditions and forward-looking land zoning. Sand itself is a good filter of contaminants and therefore pollutants do not travel quickly and are normally inactivated. In addition, most of land in the catchment areas has historically been zoned a water reserve which preserves drinking water quality.

To date, the most significant issue to water quality has been managing the area's grey sands which contain iron and arsenic minerals. These can oxidise on exposure to air (eg during mining activities) liberating dissolved forms of these metals to the groundwater. Some areas of the sandbeds are naturally very high in dissolved minerals and other areas may have been contaminated by past mining activities. High mineral levels at some sites have caused the inactivation of some bores.

Although industry at Tomago is not new, there has been increasing pressure from industrial land uses in and around the sandbeds due to a demand for industrial land close to Newcastle:

- Tomago Aluminium, which produces airborne fluoride as a by-product of the refinery process, has expanded.
- Other potentially polluting industries (eg a lead battery smelting facility) have been approved adjacent to the sandbeds.
- Large manufacturing plants are being built on the outskirts of the catchment with significant areas of hard surface.
- The Defence RAAF base has expanded over the aquifer which brings with it risks of fuel contamination.

It is becoming increasingly important to work with land use planners and industry in this area to protect the sandbeds as a natural resource.

Grahamstown Dam, Tomago Sandbeds in the distance

CATCHMENT AREA	ANNUAL RAINFALL	ACCESSIBLE AQUIFER VOLUME	AREAS SUPPLIED	LAND USE BREAKDOWN OF CATCHMENT	POPULATION FORECAST 2010-2030
16km^2	1350mm (Nelson Bay)	16GL (billion litres)	Tomaree Peninsula, 100% of supply	88% National Park, 11% rural residential or urban	Current population[5] of Shoal Bay 1,900 residents, approximately half houses vacant during census indicates primarily a holiday area. Caravan parks contribute one third of the current population. Small population growth until 2030.

The Tomaree Sandbeds are so named because they lie on the end of the Tomaree Peninsula approximately 50 kilometers northeast of Newcastle. On the outskirts of the sandbeds are the growing towns of Anna, Nelson, Fingal and Shoal Bays (Figure 13). The sandbeds are primarily covered by Tomaree National Park in which recreation is permitted.

There are 21 bores in total that extract from the sandbeds and then to two nearby water treatment plants. Treatment at both plants is simple because the quality of water extracted is very good. The groundwater is first aerated to remove dissolved minerals, pH neutralised, chlorinated and then fluoridated.

Due to the minimal level of treatment and limited ability for the Peninsula to use alternative water sources, it is important to ensure that these sandbeds are effectively managed to avoid contamination.

Future issues for consideration in this catchment are the increase in aquifer recharge works in Shoal Bay (to the NE of the catchment) and the proximity of some bores to a swamp at Shoal Bay. Water quality risk assessment of this sources indicated that pathogens were the principal issues for this system.

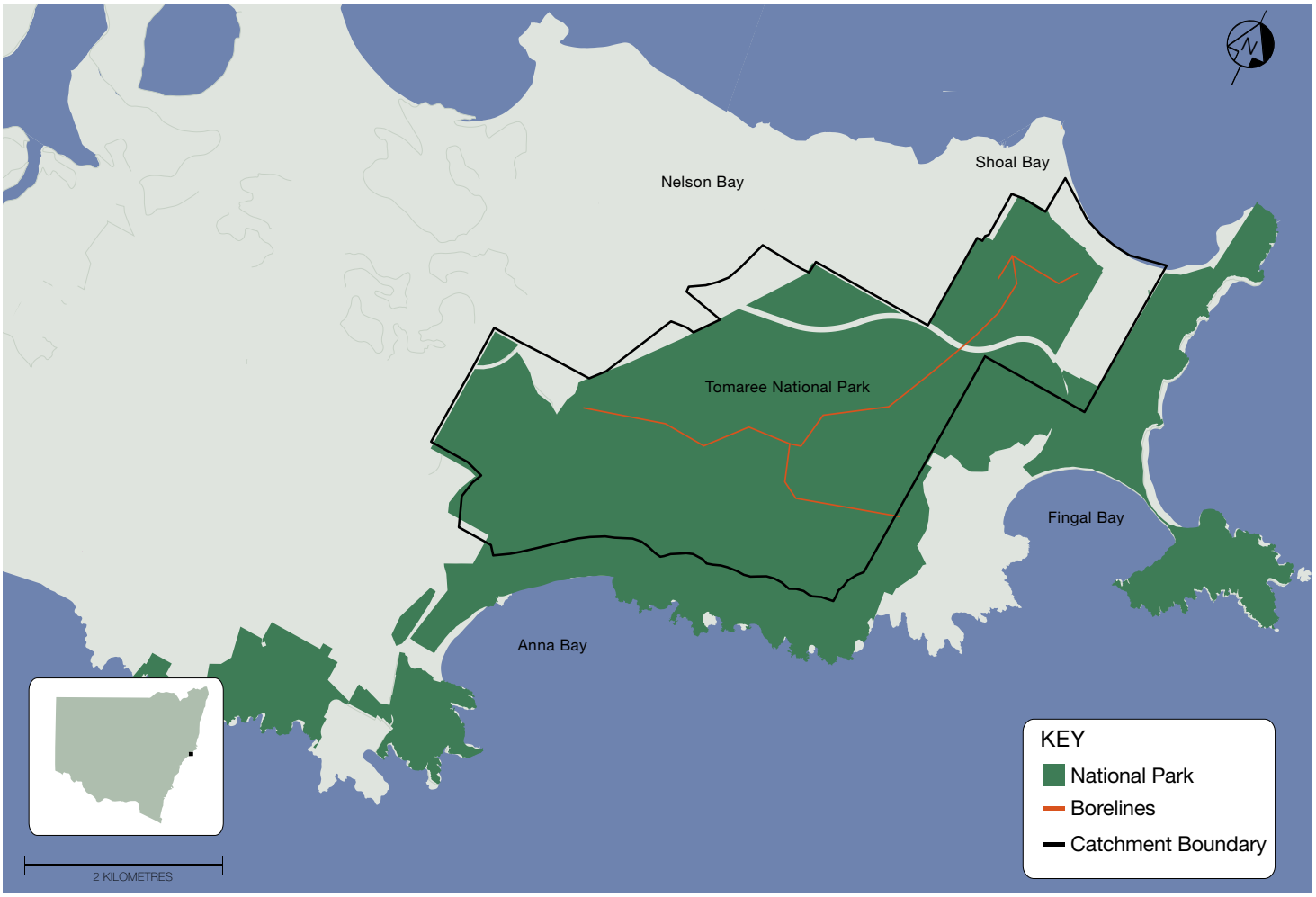


Figure 13: Location and extent of the Nelson Bay Sandbeds

CATCHMENT AREA	ANNUAL RAINFALL	ACCESSIBLE AQUIFER VOLUME	AREAS SUPPLIED	LAND USE BREAKDOWN OF CATCHMENT	POPULATION FORECAST 2010-2030
391km^2	1350mm (Nelson Bay)	1GL	Water reserve only	71% National Park, 17% Worimi lands, 12% freehold (sand extraction)	Current population[5] unidentified, but small (<50 residents). Negligible population growth until 2030.

The water source at North Stockton is found within an unconfined sand aquifer which runs from Fullerton Cove in the west to Anna Bay in the east (Figure 14). It is bounded by the Pacific Ocean to the south and by Tilligerry Creek to the north. The sand system that stores the water consists of a series of sand hills running roughly parallel to the coast. These sandbeds are approximately 8,000 years old, which is much younger than Tomago Sandbeds which are 30,000 years old. The water in the aquifer is slightly salty because of the geologically young sands originating from the ocean. The water would not taste salty, however, as it is below our taste detection limit.

Hunter Water currently does not extract water from this aquifer, but plans are in place to do so in the event of a water shortage. Bores would be sunk along the length of the aquifer and water extracted piped to the Grahamstown Water Treatment Plant. A significant area of this catchment has an active or inactive sand mine due to the abundance of high quality sand. Pollution from mining is the only significant land use risk.

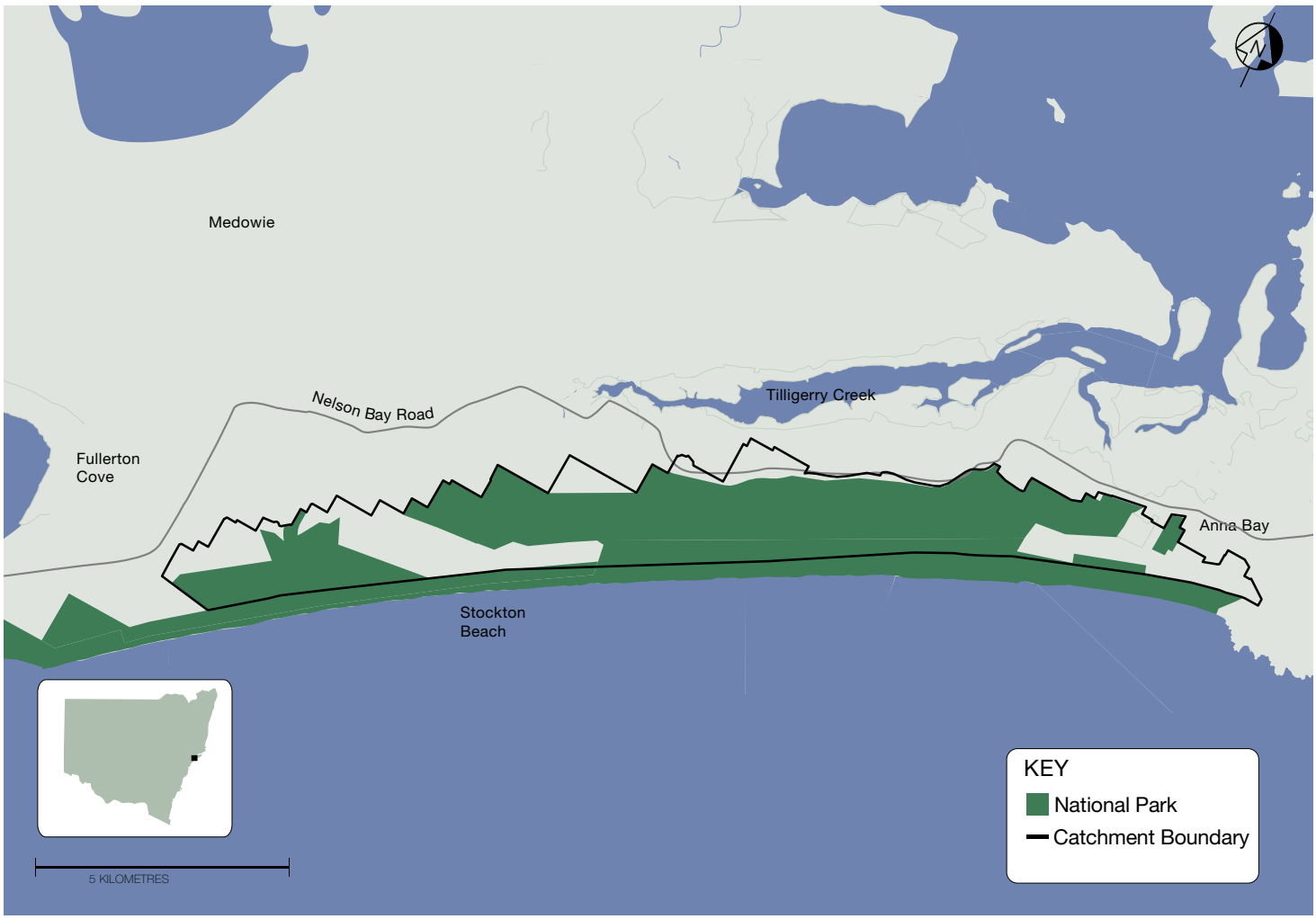


Figure 14: The Stockton Sandbeds aquifer reserve.

2.10 THE PATERSON AND ALLYN RIVERS

CATCHMENT AREA	ANNUAL RAINFALL	AREAS SUPPLIED	LAND USE BREAKDOWN OF CATCHMENT	POPULATION FORECAST 2010-2030
Paterson River - 277 km^2 Allyn River - 367 km^2	850mm (Gresford), 955mm (Lostock)	Gresford (population ~400), 100% of supply	82% agriculture (dairying, beef cattle poultry, timber), 18% National Park	Current population[5] 450 residents. Negligible population growth until 2030.

On 1 July 2008, Hunter Water took over the water and wastewater networks operated by the Dungog Shire Council (DSC). This included the water supply system to the township of Gresford (Figure 15). Bulk water for this system is sourced from the Paterson and Allyn Rivers according to the availability and quality of water. The Allyn River water is the primary source of the two rivers (approximately 75 per cent of volume). Raw water is pumped to a micro-filtration plant where the water is filtered and chlorinated. DSC administers the Paterson and Allyn rivers catchment and Hunter Water is responsible for the potable water supply.

Allyn and Paterson Catchments

The Paterson and Allyn rivers rise in Barrington Tops National Park and Chichester State Forest and flow in a south-easterly direction. The headwaters of these rivers are both in excellent condition.

The geological features of both catchments are predominately Carboniferous/Devonian sediments with some tertiary basalt, which can contribute geologically sourced phosphorus to the rivers. The upper reaches of the Paterson River contain basalt soils and the lower reaches have rich alluvial soils. The soils of the Allyn River catchment are moderately erodible and prone to mass movement on the steeper slopes contributing to increased river turbidity at times. Lockstock Dam is located on the Paterson River near the township of Lockstock and algal growth within the dam can impact downstream water quality. The dominant non agricultural land use in the catchment is timber production and the major agricultural industries are dairying, beef cattle and poultry production.

Water quality hazard and risk assessments for these sources indicated that pathogens, turbidity, pesticides, organics and algal toxins, taste and odour compounds were the principal issues for this system.

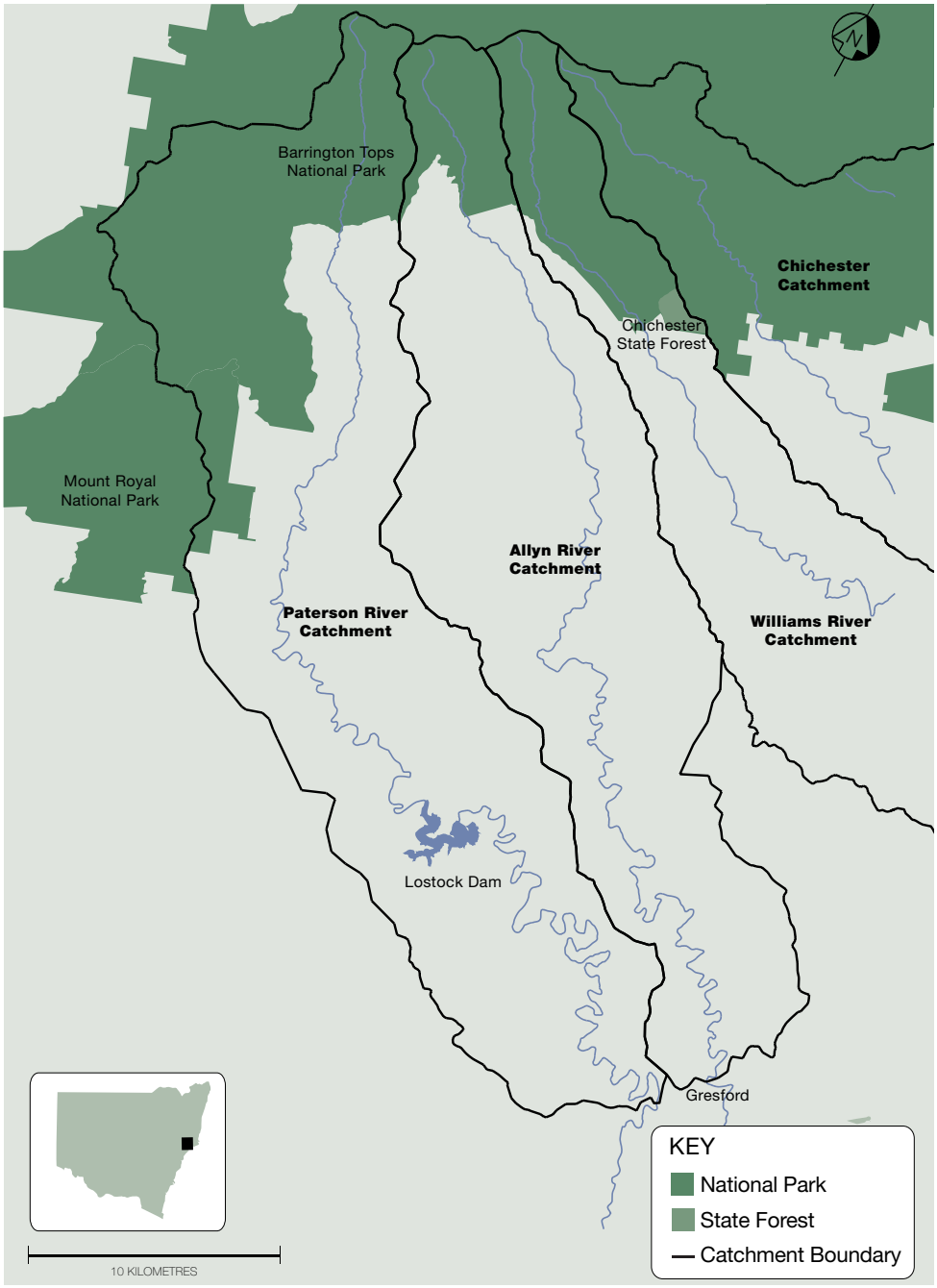


Figure 15: The Paterson and Allyn Catchments

Part 3: The eight element strategic plan

3.0 INTRODUCTION

There is a large body of literature on how to best manage catchments for drinking water quality. A critical review of the accepted best practice documents highlighted eight elements for effective catchment management (Table 1).

Figure 16 demonstrates the connections between the elements. Two elements underpin all others: 'identify the top hazards' and 'work with stakeholders'. This is because knowing the risks in catchments necessarily precedes effective management and successful management of catchments is not possible alone.

Hunter Water intends to implement each of these elements to minimise water quality risks. **Part 3: The eight element plan** discusses the current condition of each element in turn and provides a vision for the future of each element.

		ELEMENT	QUESTION	ANSWER
1.		Identify the top hazards	How should effort be focused to improve the drinking water catchments?	A catchment model will be used to identify from where pollutants originate, highest risk areas will then be prioritised.
2.		Have effective legislation	How should land use activities be guided in catchments?	Legislation will be strengthened and embedded into local planning instruments.
3.		Work with stakeholders	How can the workload be shared?	Current stakeholder relationships will be built upon.
4.		Monitor high risk areas	How can the water quality risks and improvements be quantified?	A Source Water Monitoring Program will be developed to review the current monitoring program.
5.		Foster research	How can expertise about the drinking water catchments be built?	Assembly of local knowledge will be promoted, directed by requirements from the catchment model.
6.		Perform proactive surveillance	How can changes in catchments be better communicated?	A programmed surveillance program will be implemented.
7.		Engage the community	How can land users and developers be informed about their effects on water quality?	A Catchment Communication Plan will explain the best methods for community engagement.
8.		Plan for emergencies (fire)	How can the risk of uncontrolled bushfire be minimised?	A Bushfire Management Plan will be written to address risk before, during and after a fire.

Table 1: The eight elements for effective catchment management

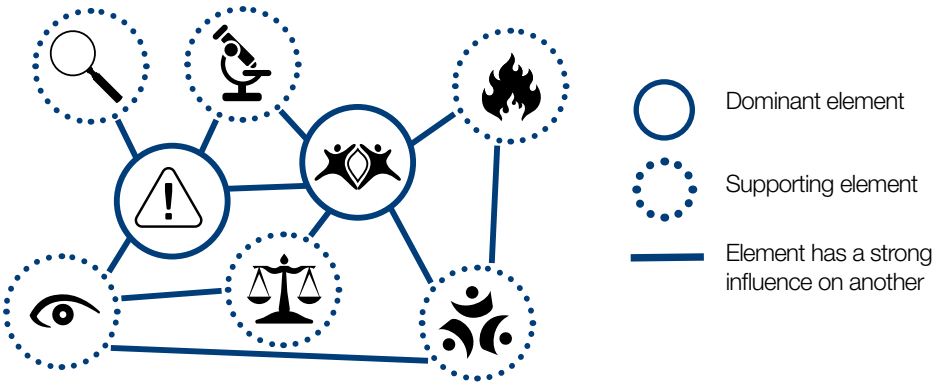


Figure 16: An influence diagram demonstrating the connections between each element.

3.1 ELEMENT 1: IDENTIFY THE TOP HAZARDS

PURPOSE
To provide a robust, repeatable and consistent assessment of hazards based on land management practices so that rectification efforts are addressed in priority order and are cost effective.

PRÉCIS
There is a large diversity of potential risks to water quality in catchments. How should septic overflow in the Williams catchment be ranked against the presence of cattle in the river in the Chichester catchment? A repeatable and transparent way of assessing these scenarios is required. Hunter Water is working in close collaboration with the Sydney Catchment Authority to develop a Source Water Improvement Support System (SWISS) model for our catchments.

3.1.1 Previous hazard ranking in catchments

In the Operational Audit 2008/2009 Report to the Minister, IPART recognised the improvements made to Hunter Water's catchment performance and reporting. IPART specifically referenced Hunter Water's completion of a water quality risk assessment to identify, assess and address (if necessary) the largest risks to water quality from the 'catchment to the tap'. The process followed the framework that is set down in the Guidelines; firstly an expert panel of Hunter Water staff was convened, then risks were identified and finally ranked using Hunter Water's corporate risk rating tables. The expert panel then either accepted that the risk was controlled adequately or provided comment on how the risk should be reduced.

When addressing catchment risks, the panel determined that two of the largest risks to water quality were from increasing urbanisation in catchments and some farming practices. Table 1 summarises the risk assessment findings.

The expert panel did not accept that the current risk to water quality in catchments was adequately controlled but recognised that these risks could not be controlled using a single engineered approach. A more comprehensive catchment management plan was required.

3.1.2 A new system for ranking catchment risks

Around Australia, water authorities and catchment management bodies employ a diversity of methods to identify and rank catchment risks. Most authorities view the identification of the level of risk and the location of these problems as the foundation data upon which to build a catchment management plan. Hunter Water and a consultant separately reviewed the methods for determining catchment risks throughout Australia and concluded that many authorities were moving towards semi-quantitative models to identify risk and direct catchment effort. Some of the tools for catchment management reviewed included:

- The eWater Catchment Modelling Toolkit,
- The University of Western Australia's storage and aquatic systems models,
- The Restoration Prioritisation Tool (RPT) used by some Catchment Management Authorities
- The Sydney Catchment Authority's Source Water Improvement Support System (SWISS)

Hunter Water chose to pursue implementation of the SCA SWISS because:

1. SCA has a strong track record in catchment management planning which includes development and implementation of the Source Water Improvement Support System (SWISS) for prioritisation of works. This model provides the rationale for catchment expenditure in excess of $21 million per year;

2. The system is currently embedded in SCA's catchment management policy, demonstrating its functionality;

RISK	POTENTIAL THREAT	POTENTIAL SCENARIO	CONSEQUENCE	LIKELIHOOD	INHERENT[3] RISK LEVEL
Increasing urbanisation (including sewer overflow and increased stormwater discharge)	Increased number of pathogens[1] and chemical pollutants[2]	• Pathogens/toxins in catchments bypass treatment process and enter the Hunter's drinking water. • Increased algal productivity and results in taste and odour or toxic compounds produced.	Extreme	C (1 in 5 years)	very high
Some farming practices (e.g. cattle in rivers)	Increased pathogens[1] and chemical pollutants[2] and erosion from clearing	• Pathogens/toxins in catchments bypass treatment process and enter the Hunter's drinking water. • Decrease in quality and clarity of water supplied to reservoirs. Increased turbidity may make water more difficult to treat for pathogens.	Extreme	C (1 in 5 years)	very high

Table 2: Inherent risk levels to Hunter Water's drinking water quality from unmanaged catchments (summarised from Hunter Water Risk Assessment 2009)

1 including Cryptosporidium, Giardia, faecal indicator organisms and associated pathogenic bacteria and viruses
2 including nitrogen, phosphorus, organics, heavy metal, pesticides
3 inherent risk is defined as risk that remains when current control measures are in place

3. It is built on a platform that is scientifically robust, easily updated and takes a logical approach to decision making;

4. It has a practical output that will be able to be used in decision making by specialists and non-specialists alike;

5. IPART are familiar with the model and their support will be needed if catchment protection is to receive increased funding in future.

Hunter Water has partnered with the SCA for access to this model and we have begun a demonstration run of the SWISS on the Grahamstown Catchment.

3.1.3 Overview of the model

The SWISS model graphically identifies the catchment areas that pose greatest risk from pathogens (disease causing organisms), suspended solids and nutrients (nitrogen and phosphorus). The model has a relatively simple structure in comparison with other quantitative catchment models throughout Australia and globally. However, many of the more complex quantitative models have to be run by specialists. The power of SWISS lies in its ability to be built, run and analysed by catchment managers.

In essence, the SWISS model inputs various spatial GIS data 'layers' that can be continuous (e.g. rainfall) or point source (e.g. intensive animal sheds). The model then uses weightings (determined from expert panel workshops) to multiply the importance of each layer to determine the areas with greatest contribution to nutrient, turbidity and pathogen risk in catchments (Figure 17). There are various inbuilt scripts to calculate parameters such as number of pathogens from livestock and alike. The output is a ranking of activities and associated areas in the catchment that pose the greatest hazard to drinking water quality.

Catchment risks may then be ranked according to a prioritisation process which factors in practical aspects such as the cost of reducing each hazard, the likely effectiveness of remediation works and the level of confidence in the data.

Each component of the SWISS is transparent and able to be modified independently to incorporate improvements in inputs and assessment methods. The model can also be used to predict the effects of land use changes by running scenarios. This is a powerful exploratory tool and could be used when considering broad catchment planning decisions in the future.

Over the past five years of development at the SCA, the accuracy of the model has been reviewed using the following methods:

- Comparison with monitored data revealed sensible results;
- Expert panels agreed with the outputs;
- Public consultation on methods was favourable (2007);
- Presentation to the international 'Water Down Under' conference (2008) was positive;
- Public consultation on results in 2009 has verified that the model is producing sensible results.

As a consequence, the level of confidence that Hunter Water has in the model methodology is high.

3.1.4 Results of Hunter Water SWISS demonstration run

The following maps demonstrate an example of the SWISS model output. Figures 18-20 show the first model run for nitrogen, phosphorus and pathogen risk from grazing in the Grahamstown catchment.

The output is built from 9 sets of data or 'layers' such as rainfall, slope, erosivity of soils, groundcover, distance from streams and density of farm animals. Layers are weighted according to best scientific understanding and overlayed upon each other. Red areas represent a high risk and blue are lower risk to the raw water source.

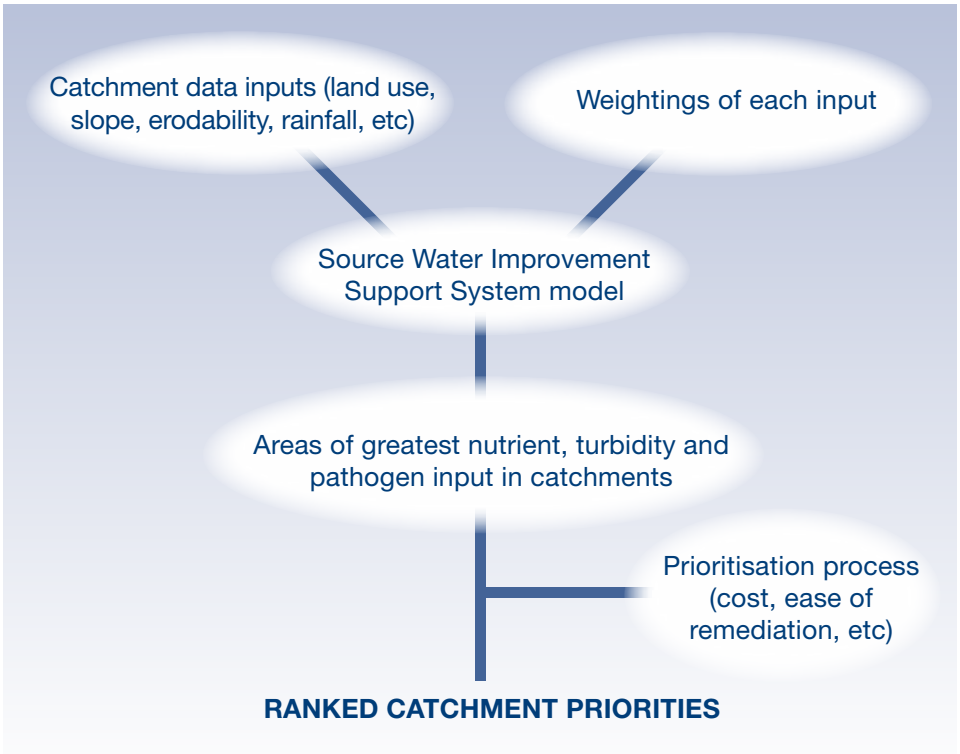
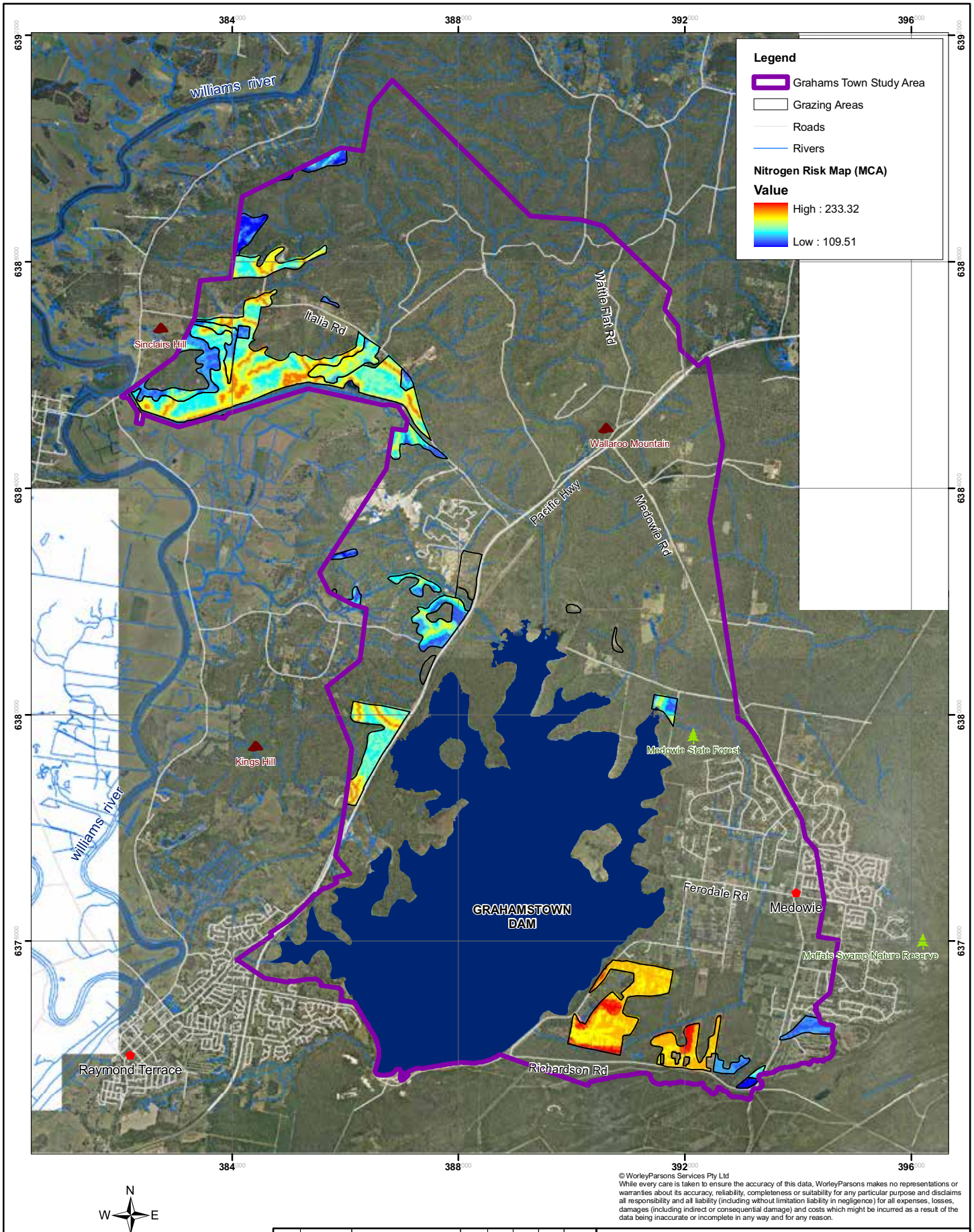


Figure 17: How the SWISS ranks catchment hazard priorities



Rev	Date	Revision Description	ORIG	CHK	ENG	QA	APPD
A	28/06/2010	Issued for squad check	EY	RB			

WorleyParsons resources & energy

HUNTER WATER

HUNTER WATER CORPORATION

GRAHAMS TOWN CATCHMENT AREA

Grazing Module
Nitrogen Risk Map

Project No: 301010-00649 | Figure: 00649_GrM_Nitrogen_Risk_Map.mxd

Compiled by GEOMATICS SOUTHERN OPERATIONS

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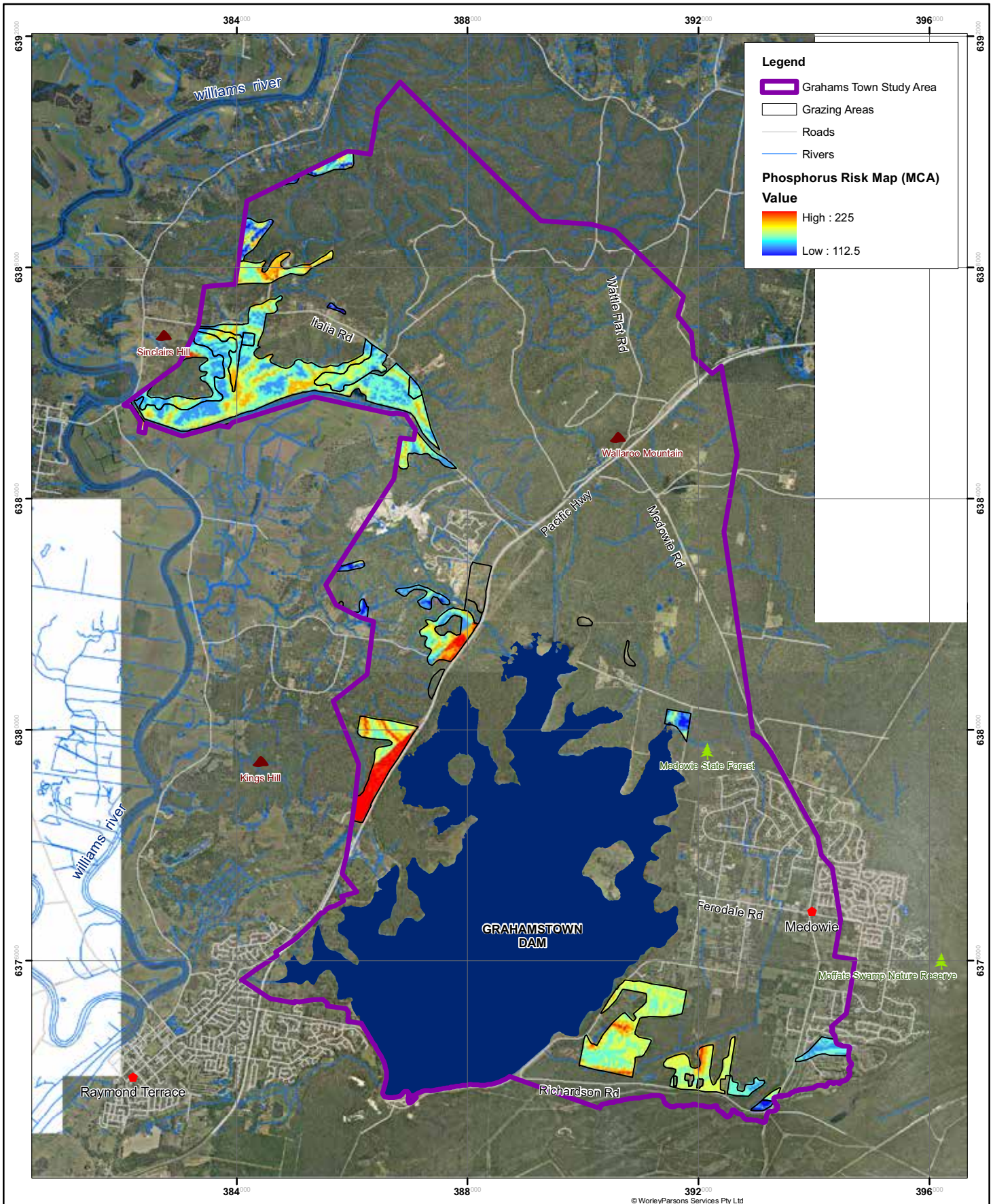
Figure 18: Highest risk of nitrogen input from grazing in the Grahamstown Catchment



SCALE-1:60,000 (at A3)

Map Grid of Australia (Zone 56)
Geocentric Datum of Australia 1994

Rev	Date	Revision Description	ORIG	CHK	ENG	QA	APPD
A	28/06/2010	Issued for squad check	EY	RB			

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HUNTER WATER

HUNTER WATER CORPORATION

GRAHAMS TOWN CATCHMENT AREA

Grazing Module
Phosphorus Risk Map

Project No: 301010-00649 | Figure: 00649_GrM_Phosphorus_Risk_Map.mxd

Compiled by GEOMATICS SOUTHERN OPERATIONS

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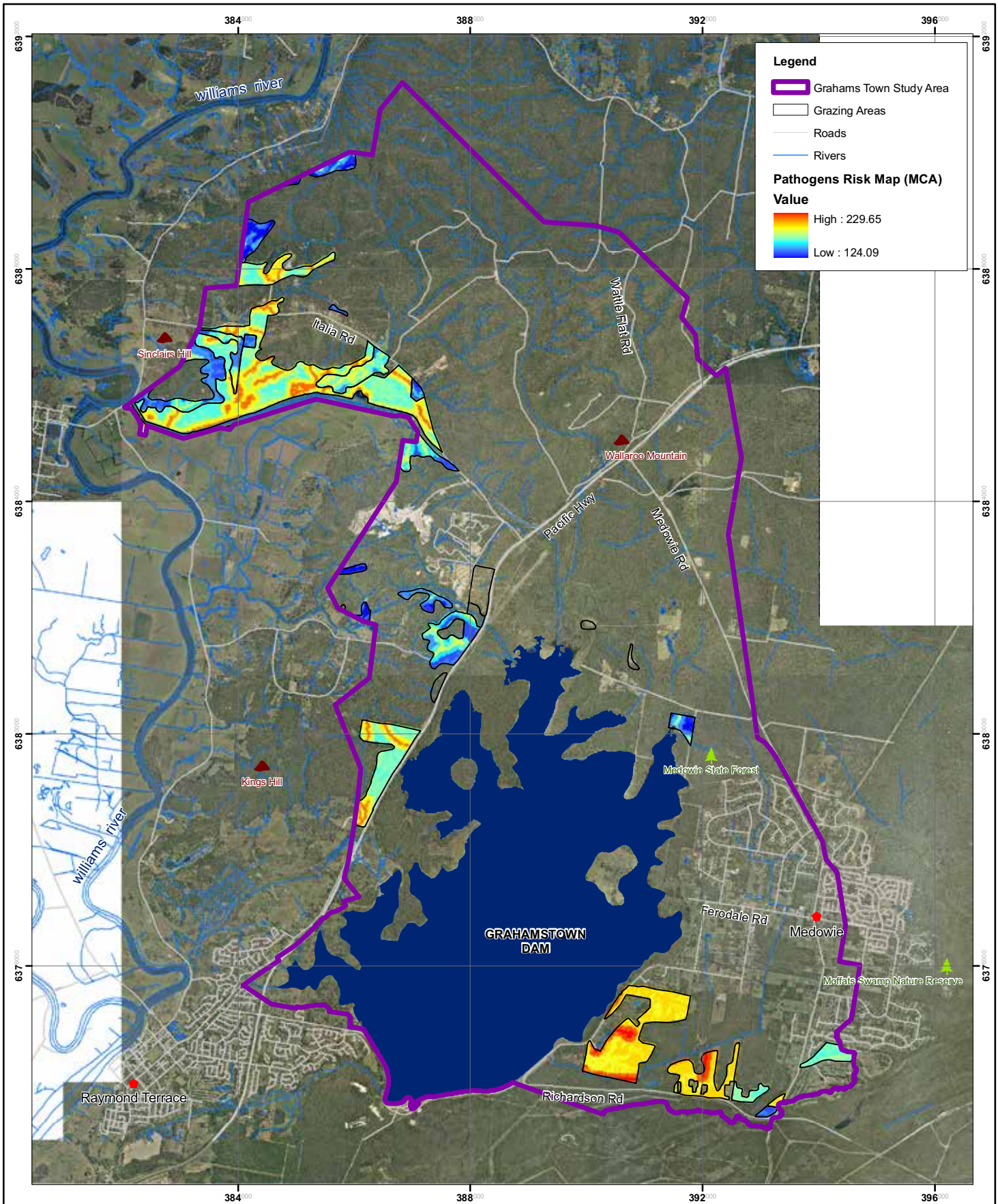
Figure 19: Highest risk of phosphorus input from grazing in the Grahamstown Catchment



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Map Grid of Australia (Zone 56)
Geocentric Datum of Australia 1994

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A	28/06/2010	Issued for squad check	EY	RB			

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GRAHAMS TOWN CATCHMENT AREA
Grazing Module
Pathogens Risk Map

Project No: 301010-00649 | Figure: 00649_GrM_Pathogens_Risk_Map.mxd

Compiled by GEOMATICS SOUTHERN OPERATIONS

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Figure 20: Highest risk of pathogen input from grazing in the Grahamstown Catchment

Using this model it is possible to begin analysis of the areas that pose the greatest risk to drinking water quality. For example, in Figures 18-20 the grazing areas that are the highest risk to water quality from nitrogen, phosphorus and pathogens are shown in red. It can be seen that the south-east corner might be more effectively targeted for nutrient and pathogen reduction measures from grazing above other parts of the catchment.

Ultimately, there will be another seven 'modules' (such as Impact of roads and Stormwater runoff) overlayed upon the catchment maps. The final output will then be broken up into smaller drainage units that can be colour coded to represent risk and help prioritise catchment remediation works.

3.1.5 HUNTER WATER'S VISION TO ADDRESS CATCHMENT RISKS USING THE SWISS

The top catchment priorities are ranked using SWISS and funding to address catchment priorities is requested in the next price submission.	Priority high risk areas are sequentially addressed with on ground work, the model is refined and rerun.	The SWISS catchment model becomes an industry leading package and is integrated into many land use change decision making processes.

Part 4: The action plan 2010-2013 explains in more detail how Hunter Water will move towards this vision.

3.2 ELEMENT 2: HAVE EFFECTIVE LEGISLATION

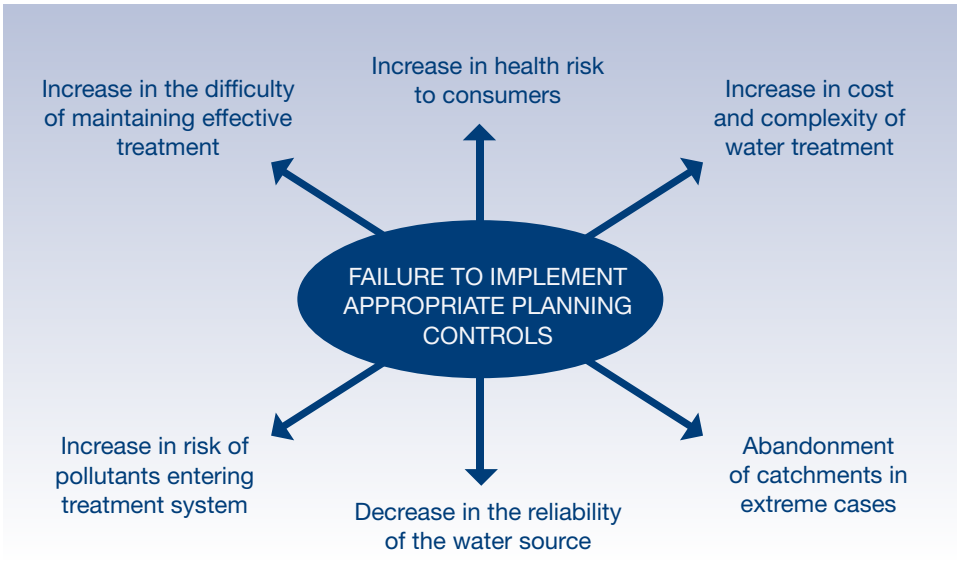
PURPOSE
To strengthen the legislation within the drinking water catchment areas whereby new or proposed activities on land can be managed with a focus on water quality protection.

PRÉCIS
A catchment's water quality and land use are inextricably linked. There are some legislative controls which apply to catchments that require drinking water quality to be considered as a primary concern. Hunter Water will strengthen the legislation and ensure that it is well integrated into local and regional planning instruments.

3.2.1 Current status of land use planning and development control in catchments

The quality and quantity of source water is largely dependent upon the activities that occur in the catchment. Land use planning legislation that ensures developments consider the quality and quantity of water are essential to maintain or improve raw drinking water quality.

Poor development choices in drinking water catchments can have the following impacts on drinking water quality [6]:



[6] Hurlimann, Ford (Feb 2010) Development control within catchments, Water magazine, AWA

The current legislative mechanisms for land use planning in Hunter Water's drinking water catchments are:

1. The Hunter Water Regulation 2010:

- This legislation defines six catchment areas in the Lower Hunter Region from which Hunter Water draws drinking water supplies.
- It addresses potential threats to drinking water quality from catchment activities such as agriculture, extractive industries, sewage disposal, water-based recreational activities, and management of waste and pollutants.
- The regulation is currently not well integrated into local and regional planning instruments and regional awareness of the principles of the regulation could be improved.

2. Dungog and Port Stephens Local Environment Plans (LEPs)

- The primary purpose of LEPs is to segregate incompatible land uses that are thought to be incompatible. They formalise which development is allowable in which areas and are administered by local councils.
- Dungog and Port Stephens are the only councils in Hunter Water's catchments and are presently remaking their LEPs, applying a Standard Template as stipulated by the NSW Department of Planning. The Port Stephens and Dungog LEP will be remade by mid 2011. The LEPs do not currently reference drinking water catchments and this is an opportune time for change to these documents.

3. The Williams River Regional Environmental Plan (REP)

- The aim of this plan is 'to protect and improve the environmental quality of the Williams River catchment through the management and use of the catchment's resources in an ecologically sustainable manner'.
- It legislates that all development must consider the Williams River Best Practice Notes for land use, published in 2005. To this end, it is important to promote the intent of this planning instrument as it has the capacity to improve water quality in the Williams Catchment.

3.2.2 GUIDANCE FOR MINIMUM WATER QUALITY FROM DEVELOPMENTS

The *Hunter Water Regulation 2010* requires developments to not pollute drinking water catchments. Currently, when developments such as subdivisions in catchments are assessed, council often seeks advice from Hunter Water for the level of stormwater treatment that s considered necessary. Hunter Water would be well placed to assist Dungog and Port Stephens Councils in developing a policy to advise the minimum storm water treatment necessary for developments within catchments.

3.2.3 RECENT IMPROVEMENT TO PLANNING CONTROLS

During the past year, the three legislative instruments and processes have been (or are being) improved in the following ways:

- **The Hunter Water Regulation 2010 has been remade to include detailed maps of catchments.** Prior to 2010, planning bodies were unsure about the bounds of the legislated drinking water catchment areas and therefore sometimes approved incompatible land uses in catchments.
- **Hunter Water has the power to enforce contraventions of the Regulation in the new remake.** Hunter Water has previously had provisions under the *Hunter Water Act 1991* to issue infringement notices but these were not defined in legislation until now.
- **Hunter Water has established regular training for council planners ensuring appropriate referral of DA's to Hunter Water for comment on water quality impacts.** The high turnover in some council planning staff has meant that Development Applications that should consider their effect on catchments do not always do so. Regular contact with councils should increase the appropriateness and number of referrals to Hunter Water for comment. Councils have shown a willingness to cooperate if Hunter Water responds in a timely manner.
- **Hunter Water has established training for Hunter Water staff** to ensure appropriate and timely responses to referrals from planning bodies.
- **A new internal process for assessment of Development Assessment referrals** under the Hunter Water Regulation will likely lead to improved turnaround times and response rate. Hunter Water has targeted 100% response rate to externally reinforce the importance of the Regulation to Hunter Water.
- **Inclusion of a reference to the Regulation in the new Port Stephens and Dungog Council Local Environment Plans.** Councils have agreed in principle to place the Hunter Water Regulation requirements on all Section 149 certificates issued within drinking water catchments. This move will ensure that planners and developers alike are aware that their land falls within a legislated drinking water catchment.

3.2.4 HUNTER WATER'S VISION FOR LEGISLATIVE CONTROL IN CATCHMENTS

This price path 2010 - 2013	Next price path 2013 - 2017	Our vision for the future 2017 - beyond
The Hunter Water Regulation 2010 becomes embedded in planning instruments and source water quality is regularly considered in planning decisions.	Hunter Water, councils and Dept of Planning work closely in local and regional land use assessment processes, including implementation of best practice stormwater treatment requirements.	Integration of legislation into local and regional planning instruments means significant land use changes always apply best practice assessment tools to minimise the impact on receiving water.

Part 4: The action plan 2010-2013 explains in more detail how Hunter Water will move towards this vision.

3.3 ELEMENT 3: WORKING EFFECTIVELY WITH STAKEHOLDERS

PURPOSE

To promote partnerships across stakeholder groups for more effective management of drinking water catchments.

PRÉCIS

Hunter Water's drinking water catchments are managed by a number of agencies. It is impossible to manage raw water quality without leveraging their help and effective collaboration is necessary. A stakeholder map will be produced and regular meetings scheduled as the first steps towards better collaboration.

3.3.1 The benefits of a collaborative approach

It is widely accepted that the critical environmental issues facing society are so intertwined that a collaborative approach to solving these problems is needed [7]. There is a groundswell of support for integrating across traditional water service areas (e.g. flood prone area management, wastewater treatment, non-point source pollution control) and to cooperate across levels of government (local, state, federal).

This approach includes consideration of the total water cycle, and not just the traditional service components such as water delivery and stormwater alleviation. Communities that have implemented this approach have demonstrated marked improvements in social, environmental and financial outcomes [8].

[7] US EPA 1997 State-wide Watershed Management Facilitation, Office of Water, US EPA Washington
[8] Ulson et al., Transitioning to water sensitive cities, International Water Centre, Brisbane

3.3.2 THE MAIN STAKEHOLDERS IN HUNTER WATER'S CATCHMENTS

BODY	RESPONSIBILITIES
Indigenous groups	• Custodians of large tracts of Stockton Sandbeds. • As traditional land owners, land and water condition is integral to cultural beliefs.
NSW Office of Water	• The primary regulatory body governing river system health and water sharing between resource use and the environment. • Administer Hunter Water's licenses to extract raw water • Have limited responsibility to determine the appropriateness of many developments or land use practices.
DECC	• Have a regulatory responsibility to control the discharge of pollutants to waters throughout drinking water catchments. • Are rolling out a Monitoring, Evaluation and Reporting (MER) program to provide land use and land management data to the public • Regulate the use of chemicals and pesticides • Do not have a planning role for management of diffuse pollution sources in catchments.
DECC (NSW National Parks)	• National Parks estate is managed to preserve environmental condition and therefore help preserve water quality. • There is significant areas of National Parks in several of Hunter Water's catchments
Hunter – Central Rivers CMA	• A 10-year Catchment Action Plan (CAP) has been formulated to improve the health of 37000km^2 of catchments within the responsibility of the Hunter CMA. Hunter Water's drinking water catchments are a fraction of this, totaling an area of 1450km^2. • Facilitate grants to individuals and organsations working towards targets in the CAP (such as tree planting, riverbank stabilization). • The CAP is not legislated and, although maintenance of water quality is a cornerstone of the Plan, it focuses on water for ecological processes above water quality for drinking purposes.
Department of Planning	• Administers the Williams River Regional Environmental Plan which was formulated to manage water quality in the Williams Catchment. • Planning's Lower Hunter Regional Strategy commits to implementing "LEPs that protect drinking water catchments, in particular the vulnerable aquifers of Tomago, Tomaree and Stockton." • On ground implementation of these plans is divested to councils.
Port Stephens and Dungog Shire Councils	• Have significant power to influence the nature of development and therefore runoff water quality through adherence to applicable acts, regulations and environmental planning instruments. • Define specific environmental protection zones that are appropriate around source waters. • Have significant powers to influence development, but have had limited guidance on maintenance of water quality in catchments to date.
Industrial landholders (e.g. Tomago Aluminium and RAAF)	• Own extensive tracts of land in the catchments • Own tracts of high quality, high environmental value land. • Are bound by conditions of consent and state/federal laws to limit pollution. Have the capacity to significantly influence quality of land under ownership.
Hunter Water	• Manage the Hunter Water (Special Areas) Regulation which aims to maintain drinking water quality in catchments. • Own and maintain significant tracts of land in catchments. • Have committed to implementing the Australian Drinking Water Guidelines which put a large emphasis on the protection of source waters.

Table 3: Major stakeholders in managing drinking water quality in the catchments

Freudenberg (1999) [9] recommends the construction of a comprehensive 'stakeholder map' with consideration of stakeholders as varied as government organisations, industry representatives, consumer groups, recreational groups, non-government organisation, residents and traditional owners. The paper argues that there is a great deal of expertise and goodwill in catchments outside of authorities and that inclusion of a broader range of stakeholders ultimately leads to better decision making. It suggests that this information can be collected through workshops or surveys. It is noted that a detailed map can take a considerable time to construct.

3.3.3 Current stakeholder relationships

Hunter Water's specific relationships in catchments have been built over many years. We are currently represented on the following diverse range of committees in catchments:

- National Parks and the NSW Department of Defence: Current quarterly meeting to discuss land use issues. A MoU is under negotiation to delineate responsibilities.
- Lower Hunter and Port Stephens Bushfire Management Committee: Meet quarterly, almost $100 000 was spent on fire trails and clearing last financial year [10].
- Feral animal control committee: Aim to control feral animals. Annual meeting.
- Port Stephens Council Koala committee: Quarterly, supporting the Port Stephens Koala Plan of Management.
- Medowie flood management committee: Aim to resolve flooding issues in Medowie.
- Ranger patrols and presence builds land owner relationships.
- Regional weeds committee: Aim to identify and eradicate problem weed areas. Hunter Water spent $18,000 on weeds removal in catchments last financial year.
- Grahamstown Dam Recreational Plan of Management Committee: Aim to manage recreation in Grahamstown Dam.
- Hunter Central Coast Illegal Dumping Group: Aim to identify and combat illegal dumping. Meet quarterly.
- Hunter Illegal Trail Bike Riding Group: Aim to identify and combat areas of illegal trail bike use. Meet quarterly.
- Landcare and Tocal Field Days sponsorship: Yearly grants, $15,000 for small Landcare grants and $10,000 for the Field Days.

3.3.4 Recent improvements in relationships with stakeholders

- **The Hunter Water Catchment Committee:** Hunter Water convenes a quarterly internal Catchment Committee with a diversity of planners and operational staff in attendance. This committee has been operational for 18 months with positive feedback. The committee is a knowledge centre and promotes discussion of:
    - Developments and development applications in catchments to be discussed;
    - Rangers to give an 'on ground' perspective of the catchments;
    - Land use changes to be analysed;
    - Hunter Water's own catchment obligations to be discussed.
- **Building partnerships with local councils:** Hunter Water recently organised a Water Sensitive Cities forum to which various council representatives were invited. An expert was asked to attend from Melbourne Water, who are often seen as national leaders in total catchment management. There was broad agreement reached that the Hunter needs to champion water sensitive urban design and another meeting was agreed upon to discuss how we might make this a reality.
- **Partnering with Landcare and Hunter Councils Environment division to apply for federal funding for our catchments:** Hunter Water and other catchment stakeholders collaborated to apply for a federal government grant to improve the Williams River in 2009. Although the funding opportunity did not arise, Hunter Water's willingness to seek external funding for catchment activities was received positively in the region.
- **Collaboration with NSW Office of Water:** Hunter Water has regular meetings with NOW and has recently given tours of catchments, dams and treatment plants. Such interaction will likely translate to a better understanding of the water supply system and build relationships in the long term.

[9] Freudenberg, 1999. Tools for understanding the socioeconomic and political settings for environmental decision making. In TOOLS TO AID ENVIRONMENTAL DECISION MAKING, New York.

[10] Source: Hunter Water Annual Operating Licence Report: The Catchment Report 2008-2009

3.3.5 RECOMMENDED FUTURE COLLABORATION WITH CATCHMENT ORGANISATIONS

Discussions held between a broad range of stakeholders reveals the connections that can be leveraged in catchments and promotes drinking water catchment issues.	Stakeholder connections are enhanced and Hunter Water begins to influence land use activities in catchments.	Drinking water catchments are considered in all aspects of town planning, from local scale land use planning to regional master planning.

"Part 4: The action plan 2010-2013" explains in more detail how Hunter Water will move towards this vision.

3.4 ELEMENT 4: ENSURING OUR SOURCE WATER QUALITY MONITORING PROGRAM IS ALIGNED WITH RISKS

PURPOSE
To ensure that Hunter Water's monitoring program effectively detects changes in source water quality.

PRÉCIS
Unfortunately scientific tests alone cannot prove that drinking water is safe due to the very small samples that are taken. Instead, monitoring of the highest catchment risks tells Hunter Water about the level of treatment necessary to reduce the risk to an acceptable level. A water quality monitoring program has been implemented that reflects the risks as we understand them. The results will feed essential information back into the risk assessment process.

3.4.1 The outcomes of a well designed monitoring program

Drinking water is continually treated and distributed to customers and there is no way of recalling a contaminated product. It is not possible to test each batch of water for all possible disease causing organisms or toxins. Sampling programs can only examine a minute fraction of the product. Often the time taken to receive the results of a test is a few days, after which time the water has usually reached consumers. As monitoring programs are expensive, it is important to understand the highest risk areas of catchments and align the monitoring program appropriately.

A greater certainty of effective treatment can be assured if the 'worst case' source water is known in advance.

A well designed monitoring program provides the following essential information

- Provides a baseline and flow event record for analysis of risk through time
- Reveals seasonal or natural trends that could impact on the treatment process
- Determines the impact of different land uses over time
- Allows early detection of possible contaminants
- Tracks the perceived high risk areas of the catchment to better quantify inherent risk
- Assists catchment managers to identify emerging issues in the catchment
- Allows reporting on performance against water quality criteria
- Allows performance of improvement actions to be quantified

The value of monitoring is not easily quantified in dollar terms. The information gleaned from the monitoring program will inform future risk management plans.

3.4.2 Current Status

Hunter Water spends approximately $500 000 per year on water quality monitoring in catchments at 10 surface water sites and approximately 70 groundwater locations. At some sites the monitoring program has been in place for several decades and others have been added as our understanding of the catchments has changed.

Two scientists are employed by Hunter Water to oversee the monitoring program. The current monitoring program provides a sound baseline analysis of trends, but as the focus on catchments increases the monitoring program should be formally reviewed. A key finding of the *Hunter Water Biennial Water Quality Report 2009/2010* was also that a Source Water Monitoring Program should be written. Our highest priority moving forward is to better characterise the water quality after rainfall as this water poses the greatest risk.

3.4.3 Recent improvements to the monitoring program

It is becoming increasingly evident that the Medowie sub catchment presents risks to drinking water quality above others. The reasons for this high risk rating essentially arise due to increasing urbanisation of this catchment, its proximity to Grahamstown Dam and the operational requirement to pump all water from this catchment into the Dam.

It is known that most toxins are mobilised during and after rain events . To better align with this risk, Hunter Water has implemented two event based monitoring samplers in this catchment (provided). The samplers are simultaneously triggered by a rising water level following rain in the canal. They extract samples at a predetermined volume and frequency which are later analysed for nutrients, pathogens, turbidity and other chemicals.

During the previous year, we have initiated the following targeted sampling programs:

1. **Broad suite pathogen and nutrient sampling:** preliminary results from sampling indicate Campvale Canal transports moderate to high pathogen loads after heavy rain. The numbers of faecal indicator bacteria are typical of a mixed urban/rural source and represent a very high risk to drinking water quality. To better determine the source of the bacteria faecal sterol analysis has been commissioned.

2. **Faecal sterol analysis:** Newcastle University is spearheading the development and use of faecal sterol analysis techniques. Faecal sterols occur in all faeces, and each animal (including humans) has a unique 'fingerprint' of sterols. By analysing the sterol signature in water, we can infer from where the bacteria originate. This monitoring program will significantly inform the management plan for the catchment. We have currently achieved a dry weather baseline for sterols and now require analysis of rainfall events.

3. **Reinstatement of phosphorous pumping rules from the Williams River:** Increasing the amount phosphorous in a river or reservoir (eutrophication) has been shown to proportionally increase the biomass of algae . We have recently fixed the real time phosphorus analyser on the Williams River and reinstated rules that aim to limit the phosphorus pumped from the Williams River thereby reducing the risk of an algal bloom in Grahamstown Dam.

3.4.4 RECOMMENDED FUTURE ACTIONS TO IMPROVE THE MONITORING PROGRAM

This price path 2010 - 2013	Next price path 2013 - 2017	Our vision for the future 2017 - beyond
A peer reviewed Source Water Monitoring Plan is complete that optimises data collection and aligns monitoring with high risk areas.	The Source Water Monitoring Program is fully implemented with the appropriate mix of regular and event sampling, data is easily stored and retrieved using GIS based technology.	Catchment data collection is routinely reviewed to analyse highest risks and data storage is spatially reverenced and easily extracted by all stakeholders.

"Part 4: The action plan 2010-2013" explains in more detail how Hunter Water will move towards this vision.

3.5 ELEMENT 5: FOSTERING RESEARCH PROGRAMS IN OUR CATCHMENTS

PURPOSE
To better pursue collaborative funding opportunities for targeted local catchment research.

PRÉCIS
Better information leads to better decisions. Hunter Water will foster the strong ties with universities and other research bodies to understand how the catchments function. Hunter Water's R&D program will guide the research.

3.5.1 Current catchment research: Grahamstown Adaptive Management Study

Grahamstown Dam is an important water source for the Hunter as it supplies 40% of our water supply on an ongoing basis. Monitoring of Grahamstown demonstrated that there have been increasing numbers of blue-green algae (cyanobacteria) in Grahamstown over the past 15 years. The increasing number of blooms of cyanobacteria can be seen in Figure 22.

Cyanobacteria have the capacity to cause an objectionable change in taste and odour of the raw water or produce other damaging toxins which may be difficult to treat. An increasing number and bloom frequency of these algae is often a sign that nutrients are increasing in a waterway.[11]
In 2008, Hunter Water has committed $580 000 to the Grahamstown Adaptive Management Study (GAMS) which aims to

> "provide information on how water quality in Grahamstown Dam is managed to maintain yield at satisfactory levels whilst providing a low, or managed, likelihood of development of problematic algal blooms."

GAMS is broken down into the following separate studies of water quality:

- **A three-yearly benthic macrophyte (water plant) survey** - it is known that water plants take up significant amounts of nutrients and therefore their role in the dam's ecology is operationally important.
- **Investigations into the contribution of sediments to Dam nutrients and ongoing seasonal investigations into the cause of algal blooms** – The University of Technology Sydney has been commissioned to investigate the interaction between nutrients in the sediment and water column and the amount of algae that grow as a result.
- **Investigations into the biological control of algae** – fish and planktonic organisms that have a role in controlling algae will also be examined.

This study is now partially completed. When complete, it will provide a better insight into the ecology of Grahamstown Dam and will allow more informed strategic planning and operational decisions.

3.5.2 Research and Development at Hunter Water

According to Hunter Water's Research and Development (R&D) Strategy, **water quality and public health** and **system modelling** are two key focus areas for future research. These focus areas include activities such as:

- Looking at the impacts of recreation on drinking water bodies;
- Better understanding how nutrients, pathogens and/or suspended solids enter our source waters;
- Obtaining improved data for the decision support tool (i.e. the SWISS) which enables better identification and prioritisation of catchment work.

As there are many opportunities for leveraging grant funds in catchments, an important part of fostering research is liaising with other catchment stakeholders and identifying appropriate grant opportunities for a better research outcome.

GRAHAMSTOWN RESERVOIR CYNOBACTERIAL LEVELS
Southern Monitoring Site off Schroder Pump Station

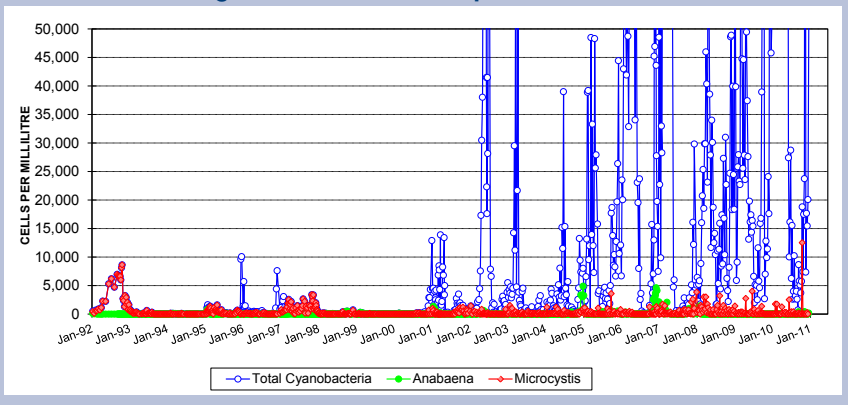


Figure 22: Cyanobacterial numbers in Grahamstown Dam 1992 -2007

[11] Smith et al (1999) Eutrophication: impacts of excess nutrient inputs on freshwater, marine, and terrestrial ecosystems, Env. Pollution

3.5.2 Hunter Water's vision for catchment research

Research of identified knowledge gaps in catchments is promoted, particularly at the University of Newcastle, focusing on informing the Source Water Improvement Support System.	Specific funding is allocated to identified areas of need; the outcomes begin to inform management decisions. Catchment research is fostered at Newcastle University.	Collaborative and leveraged funding opportunities are leveraged; drinking water catchment research is a scientific focus at Newcastle University.

"Part 4: The action plan 2010-2013" explains in more detail how Hunter Water will move towards this vision.

3.6 ELEMENT 6: PERFORM PROACTIVE SURVEILLANCE

OBJECTIVE
To perform regular, documented surveillance of catchments, ultimately improving the quality of catchment risk assessments.

PRÉCIS
Hunter Water presently has rangers who are active in catchments and therefore provide 'informal' surveillance services. Surveillance will be formalised to meet the requirements of the Framework for the Management of Drinking Water Quality. Regular, programmed and proactive surveillance will feed back into policy and risk assessment outcomes.

3.6.1 Why surveillance, and how much is enough?

To understand a catchment area "regular documented inspections to monitor catchment conditions and land use changes" should be undertaken . The very action of being seen proactively patrolling the catchment sends a positive signal to the land owners that the utility does care about land management and is interested in their activities.

In conversations with other water and catchment management authorities and from the literature, catchment knowledge is often identified as one of the single greatest barriers to waterborne disease. Catchment knowledge is vital because the application of the risk assessment process is entirely reliant on the understanding of the water supply system from catchment to tap. Inspection of catchments is the key activity that will increase an organisation's knowledge and understanding of its catchment area.

The frequency of surveillance is dependant upon the risk in a catchment. As Hunter Water's catchments can be described as partly or fully developed, current best practise is a minimum of 3-5 days per week of surveillance.

In addition to traditional surveillance, aerial and satellite imagery can also be useful to detect changes in land use. Satellite imagery especially can be used to assess changes in land use such as amount of vegetation clearing or to assess the effects of bushfire.

3.6.2 Surveillance currently conducted in catchments and best practice

Hunter Water currently has three full time Rangers who are based in the field and thus are regularly engaged in surveillance of the catchments. Between these staff there would be in excess of 5 days spent on informal surveillance.

Current best practice surveillance in catchments involves not only monitoring catchments but also recording observations. Specific items to observe are shown in Appendix B. In brief, records should be kept of the following:

- General land use activities and land use changes,
- Checking for unusual, unapproved or unlawful activities,
- Inspections following incidents (fires, heavy rain, spills),
- Proactive management of catchments to predict risks and hazards.

It is important that this information is recorded and used in strategic planning decision making. For this to occur, a template or simple checklist must be generated so that surveillance can be standardised across catchments and time.

3.6.3 Recent improvements to surveillance techniques

Appendix C shows a template developed within the last year for the Williamtown RAAF base. It sets out the inspection frequency, what to inspect and the considerations for each site. The aim of developing the template was to standardise inspections and make them routine.

One Ranger and Trade Waste Inspector attend the site to check certain waste water and environmental sites, fill out the sheets and file them electronically. Positive feedback of the template system has referenced:

- the ability to print the last inspection to determine if problems have been rectified;
- the capacity for any person to follow the routine, freeing up personnel;
- the ease with which the template is completed.

This surveillance pro forma could be used as a basis for the development of catchment specific surveillance templates.

3.6.4 HUNTER WATER'S VISION FOR CATCHMENT SURVEILLANCE

HORIZON 1	HORIZON 2	HORIZON 3
Formalised surveillance begins supported by a record keeping system that allows dissemination of information and actions.	Surveillance becomes routine and embedded into staff duties. Procedures are automatic and information is easily available.	Regular and documented surveillance is routinely performed in catchments informing operational and planning arms of Hunter Water.
This price path 2010 - 2013	Next price path 2013 - 2017	Our vision for the future 2017 - beyond

"Part 4: The action plan 2010-2013" explains in more detail how Hunter Water will move towards this vision.

Figure 21: Developments such as this erosion risk above Chichester Dam will be detected by surveillance

3.7 ELEMENT 7: ENGAGE THE COMMUNITY

OBJECTIVE
To inform, connect with and empower the community to make a positive change in catchments.

PRÉCIS
Supportive and constructive behaviours by land and water users within catchments are crucial to the success for catchment management. As we achieve success through catchment management initiatives, we will better communicate and engage the community to build upon success.

3.7.1 Why communicate about drinking water catchments

Community involvement and awareness are foundation concepts in the Framework for Management of Drinking Water Quality in the Guidelines. This is because catchment land users and customers have arguably the greatest influence on drinking water quality in these areas. Approximately 65% of Hunter Water's catchments are in private ownership. Through education and empowerment, positive changes in routines and actions of private landholders can have a large effect on the runoff from their properties. It follows that effective communication is one of the most important mechanisms for better catchment management.

3.7.2 CURRENT LEVEL OF COMMUNITY ENGAGEMENT WITH CATCHMENTS

Hunter Water currently employs some effective mechanisms to communicate catchment information:

- **Signage:** There is currently some effective signage in the catchments. Examples of these are along the Pacific Highway in the Grahamstown Catchment informing motorists that they are in a drinking water catchment and to report chemical spills. Signage such as this does more than mitigate the risk of chemical spill; it also draws awareness of the catchment boundary and reinforces the notion that Hunter Water is an effective environmental steward. Hunter Water is at present identifying and cataloguing all signage in catchments. Catchment signage placement and condition will be noted so that we can maximise the impact of this medium.

- **Website:** The website currently has detailed information on the drinking water catchments. This is presented in an accessible and easily interpreted way so that people seeking information about catchments can find it. As there have been some changes to our catchments, the website needs updating in this respect.

- **Supporting the Household Chemical Cleanout scheme in Dungog (Appendix D):** Dumping of large volumes of chemicals could cause a serious problem in catchments. Hunter Water demonstrates good environmental stewardship and reduces the risk of chemicals entering the drinking water supply by supporting this scheme in catchments.

- **3.7.3 RECENT EXAMPLES OF COMMUNICATION ABOUT CATCHMENTS**

In the last year, Hunter Water has increased communication regarding the Hunter's drinking water catchments. The projects implemented included:

- A **newspaper** advertisement in The Land with free DVD offer **(Appendix E)**

- **Posters** of catchments were developed to use at public events **(Appendix F)**

- A **poster** illustrating drinking water catchment locations was developed to be used at Tocal **(Appendix G)**

- A series of **articles** in the customer newsletter ('THINK about your DRINK) discussing catchments and how to keep them clean was initiated. **(Appendix H)**

It is important to build upon the success of these projects by developing a strategic plan for communication in catchments. This plan will ideally use survey techniques to identify the most effective methods of communication to land users and customers.

3.7.4 HUNTER WATER'S VISION TO ENGAGE THE COMMUNITY

HORIZON 1	HORIZON 2	HORIZON 3
Catchment signage and effective media opportunities are identified; opportunities to promote catchment management information are supported.	Catchment signage and effective media opportunities are resourced; community becomes more connected with drinking water catchments.	The community is empowered to make positive change to their activities in catchments and is supportive of Hunter Water's catchment initiatives.
This price path 2010 - 2013	Next price path 2013 - 2017	Our vision for the future 2017 - beyond

"Part 4: The action plan 2010-2013" explains in more detail how Hunter Water will move towards this vision.

3.8 ELEMENT 8: PLAN FOR EMERGENCIES (FIRE)

OBJECTIVE
To mitigate the risk of uncontrolled bushfire causing injury, damage or loss of supply.

PRÉCIS
All catchments are vulnerable to unexpected incidents ranging from those with remote possibilities (e.g. an aircraft crashing) to high (e.g. vandalism, which is endemic). Hunter Water has a tried and tested Incident Response Plan in place. An appendix to the Response Plan to specifically address Bushfire emergencies is recommended.

3.8.1 THE STRENGTH OF HUNTER WATER'S INCIDENT MANAGEMENT PLAN

Hunter Water currently has a robust and tested Incident Management Plan as recommended by the Guidelines. The plan gives explicit directions and a chain of command should an emergency arise. There are frequent desk and mock incidents to assess the response adequacy. It was tested during the Newcastle storms of June 2007 and proved to be a sound policy document.

3.8.2 THE NEED TO ADDRESS WILDFIRE RISK

One common threat that is not specifically addressed is the risk of fire. The profound effect of bushfire was brought to the fore in February 2009 when Melbourne's Black Saturday bushfires caused huge human, environmental and financial costs for Victoria. In many articles produced after the incident the importance of preparedness for such a disaster was stressed.

The importance of a Bushfire Management Plan (BMP) that stated a water authority's guiding policy before, during and after fire is considered industry best practice. A 2009 Water Services Association of Australia conference concluded that three themes need be addressed with regard bushfire risk management:

- **Preparation** – working with catchment management authorities and fire agencies on preparation activities such as contingency planning and critical asset protection.
- **Incident management** – maintaining an incident management structure that is well drilled on the implementation of contingency plans/ management of assets.
- **Recovery** – working with catchment management authorities and fire agencies on prioritising recovery works that will minimise the impacts on water quality and assets.

Hunter Water will prepare a document with the above structure that aims to mitigate the risk of uncontrolled wildfire to life and property by January 2011.

3.8.3 HUNTER WATER'S VISION FOR BUSHFIRE PREPAREDNESS

HORIZON 1	HORIZON 2	HORIZON 3
A complete BMP that considers catchment stakeholders and other fire plans.	The BMP is accepted and endorsed by all parties in the region, mock incidents being run.	The BMP is integrated into all other regional bushfire plans, other stakeholders are engaged in modifying its structure and it is methodically tested.
This price path 2010 - 2013	Next price path 2013 - 2017	Our vision for the future 2017 - beyond

Appendix A:
Items to observe during inspection and surveillance programs

ITEMS TO OBSERVE	POINTS TO NOTE	FOLLOW-UP-ACTION
Access roads	Condition	Arrange remedial action if necessary.
Signage	Inspect and ensure the performance of signage in relation to the effect on visitor behaviour. Identify damaged signs and replacement trends/ details	Post signage required to increase effectiveness (e.g., restrict access) and replace as necessary
Erosion	Location and severity	Arrange remedial action: short term reosion control measures; long term- rehabilitation
Declared weeds	Type, location and severity	Arrange for eradication
Feral animal activity	Type, location and severity	Arrange for eradication program
Evidence of illegal activities (e.g., entry to restricted areas, swimming, fishing)	Location and severity	Arrange a specific surveilance patrol to target illegal activity
Dumping rubbish/ chemicals	Type, location and quantity	Arrange removal, advise other agencies
New land development including rate of growth	Location, impact on water quality, compatability with planning controls	If not compatable advise planning agency, appeal development approval, check for compliance with any specail conditions required as a condition of the approval
Livestock activity	Location especially in relation to streams, reservoirs, well heads	Fencing and revegetation of streams and waterways to prevent stock access and creation of vegetated stream banks
Activities by other agencies (e.g., Forestry Department , local shire or country council)	Assess impact, monitor compliance with agreed standards	Arrange remedial action where required and where applicable arrange approvals process for future activities
Hazardous sites	Location, type, assess hazard	arrange protective meqasures
Approved recreational events	Attend event and ensure compliance with event approval conditions, assess impact	Assess impact and arrange remedial action if required
Post wildfire	Inspect the burnt area and fire trails used, upgraded and installed. Inspect and map fire trails installed/ upgraded. Where available obtain fire intensiaty maps from fire authority. Liaise/ advise on the r3ehabilitation required from the fire.	Investigate potential for erosion problems resulting from the fire and associated activities. Monitor turbidity in problem areas, sample for nutrients in first heavy rains after the fire to monitor nutrient release. Arrange restoration/ rehabilitations as required. Install erosion control measures on fire trails such as drains, booms, and sediment traps

From Watershed Management for Drinking Water Protection, AWA, St Leonards

Appendix B:
Chemical cleanout at Dungog, 2010

Appendix C:
The Land newspaper advertisement – catchments

A MESSAGE FROM HUNTER WATER

DO YOU LIVE IN A DRINKING WATER CATCHMENT?

WHAT IS A CATCHMENT?

A catchment is an area where water is collected by the natural landscape. In a catchment, all rain and run-off water eventually flows to a creek, river, ocean or into the groundwater system.

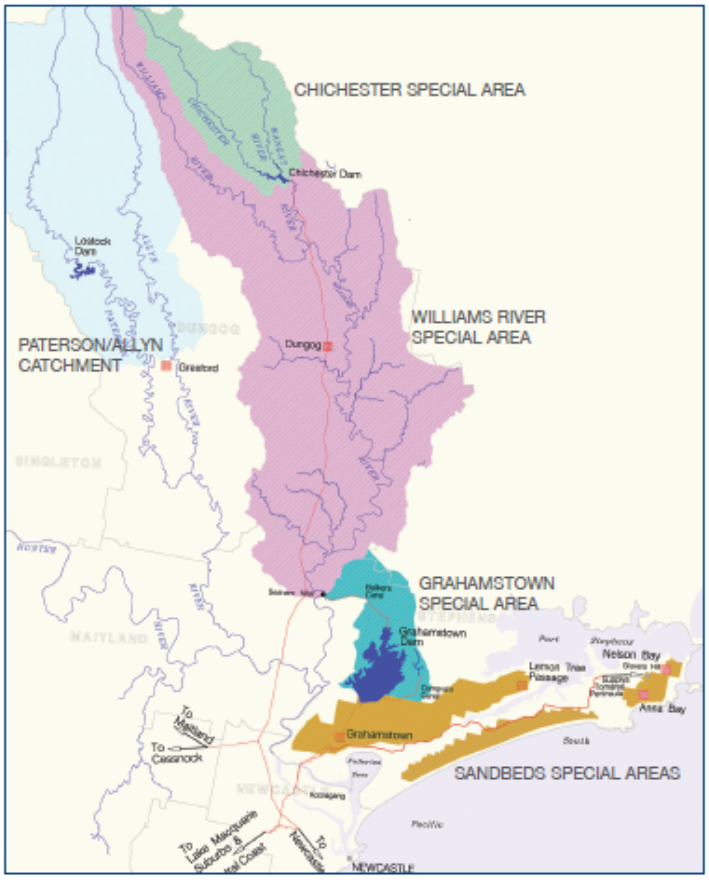
The Lower Hunter's drinking water catchments cover an area of more than 2000km^2, supplying water to over half a million people.

WHAT ARE SPECIAL AREAS?

The Hunter Water Special Areas are the Hunter's drinking water catchments (see shaded areas of map) and are governed by NSW legislation.

These areas range from native forests, agricultural lands, residential neighbourhoods to sand dunes.

Special Areas are vital to protect our drinking water because they help filter out nutrients and unsafe substances before the water reaches our reservoirs.

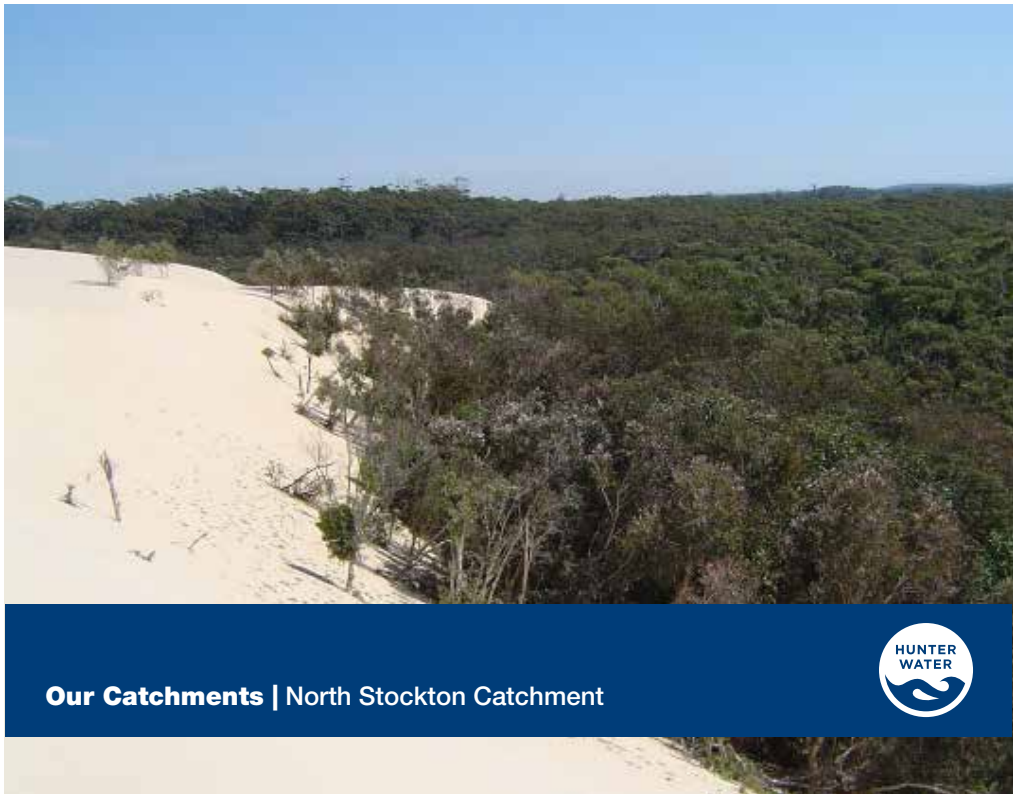


Map of Hunter Water Drinking Water Catchments

YOU CAN HELP HUNTER WATER TO PROTECT OUR WATER QUALITY. HUNTER WATER HAS PRODUCED A DVD OF ONE HUNTER FAMILY'S QUEST TO FARM SUSTAINABLY AND IMPROVE WATER QUALITY.

FOR A FREE COPY OF THE DVD, 'STRIKING THE BALANCE', PLEASE CONTACT AXEL HANSON AT AXEL.HANSON@HUNTERWATER.COM.AU OR TELEPHONE 02 4979 9499.

Appendix D:
Posters of catchments for use at public events



Appendix E:
Graphic used to illustrate drinking water catchments

Appendix F:
Article in customer newsletter

Think About Your Drink

Where does your drinking water come from?

Hunter Water supplies drinking water to over half a million people throughout Newcastle and the Hunter. Not everyone knows that our drinking water comes from rivers, dams and groundwater sources. This is the second in a series of five short articles explaining where your drinking water comes from and how you can help us look after it.

The Tomago Sandbeds:

The Tomago Sandbeds is an underground water source that provides about 20% of the lower Hunter's drinking water. The Sandbeds are parallel to the coast between Newcastle and Port Stephens, starting at Tomago and extending north-east for 25 kilometres to Lemon Tree Passage. All of the water stored in the ground comes from rain that fell on the Sandbeds.

Water from the Sandbeds has been supplied through drinking water pipes since 1939. A network of bores covering about 100 square kilometres pumps water from the ground. Groundwater is treated to a high quality for customers at a large water treatment plant at Tomago and a smaller plant at Lemon Tree Passage.

Most of the Tomago Sandbeds catchment is protected by a State Conservation Area but parts of the area are developed with houses and industry.

The Sandbeds are an important hidden water source. The water is of consistent quality which means it can be used to keep up supply if there is ever a problem with the water in Grahamstown Dam, such as an algae bloom.

You can help maintain the quality of drinking water in the Sandbeds by protecting the local environment. In particular, you can help by:

- Not dumping rubbish or chemicals near the Sandbeds;
- Reporting any spill or environmental concern to Hunter Water;
- Respecting the rules of the State Conservation Area.
- Respecting the environment in and around the Sandbeds because it is the best filter for drinking water.

Hunter Water believes that if we know where our water comes from we can all take better care for it.

Please call Hunter Water on 1300 657 657 or visit our website if you would like to know more about where your water comes from.