

GEOGRAPHY BULLETIN



The
Geography Teachers' Association
of New South Wales Inc.

Volume 42 No 2 2010

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Water For Life Project

...funded this edition of the GTA Bulletin

Dams + Recycling + Desalination + Water Efficiency = Water  life

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GEOGRAPHY BULLETIN

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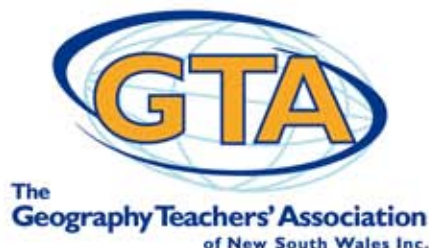
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The Geography Bulletin is a quarterly journal of the Geography Teachers Association of New South Wales. The 'Bulletin' embraces those natural and human phenomena which fashion the character of the Earth's surface. In addition to this it sees Geography as incorporating 'issues' which confront the discipline and its students. The Geography Bulletin is designed to serve teachers and students of Geography. The journal has a particular emphasis on the area of the Pacific basin and its near neighbours and a specific role in providing material to help meet the requirements of the Geography syllabuses. As an evolving journal the Geography Bulletin attempts to satisfy the requirements of a broad readership and in so doing improve its service to teachers. Those individuals wishing to contribute to the publication are directed to the 'Advice to Contributors' on page 42. Articles are submitted to two referees. Any decisions as to the applicability to secondary and/or tertiary education are made by the referees. Authors, it is suggested, should direct articles according to editorial policy.

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Geography Teachers' Association
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Vol 42, No2 2010 – Global Education

EDITOR: Sue Field

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In this special edition of the *Geography Bulletin* we focus on water

The Geography Teachers' Association of NSW (GTA) has had a long involvement with the Water for Life education project. GTA has been a major partner in this education project to develop a teaching program for Stages 4 and 5 Geography. The GTA also managed the Stage 3 HSIE section of the project in conjunction with the Primary HSIE Teachers' Association.

The programs for Stages 4 and 5 Geography can be downloaded from the GTA website at www.gtansw.org.au by going to 'Resources for teaching' and Water for Life. The full set of programs, Stages 3 to 5, is on a CD that has been distributed at the Water for Life workshops. Copies can be obtained by emailing the GTA Office.

The GTA won another Water for Life grant in 2009, to connect teachers with local case studies and fieldwork opportunities for water efficiency. This was achieved through a series of professional development activities in 2009/2010, in the Sydney Water region and more widely through this edition of the *Geography Bulletin*.

The GTA would like to thank all the guest speakers at all the teacher workshops, for their support of the GTA at the workshops and for their contributions to this edition of the *Geography Bulletin*. See separate report on these workshops

Professional development

In the first semester this year, the GTA offered teachers a huge range of workshops. There have been 21 workshops so far covering HSC and SC syllabuses. There have been short afternoon workshops, full day workshops and even a mini-conference. Even though the numbers have been very low at some events, the evaluations have been excellent. Pity more people have not taken advantage of the opportunities available for professional development through the GTA.

In the second semester there were the final two Global Education workshops in July and the Annual Conference in August.

The calendar of events can also be accessed on the GTA website at: www.gtansw.org.au along with registration forms



Presenter Peter Wilcox and participants at the Tamworth workshop.



Sue Field, Editor

Arthur Phillip Awards 2010 – Geography Fieldwork Competition

This year we have made some changes to the Fieldwork Competition:

- In response to feedback, we have extended the time to the 19th November for entries. This allows schools to use research from Term 4 in the competition. As a result, the awards ceremony will now be in February and combined with the HSC Awards ceremony in February 2011.
- We have changed the criteria for some of the categories. Please make sure you are familiar with the criteria.
- We have placed a greater emphasis on the civics and citizenship aspect of research and fieldwork. This award goes across all sections of the competition but it actually requires students to take action – not just talk about what could or should be done.
- Be sure to complete all the paperwork for each entry accurately or the entries will be disqualified. Remember it is only FOUR entries per section and the sections are Stage specific in most cases.
- There is also a new award, which was introduced last year, for teachers that have made an outstanding commitment to the competition by getting their students involved in competition, even if the students are not award-winners.

The information on the competition has been mailed out to all members of GTA. It is on the GTA website and it is in the back of this edition of the Geography Bulletin.

All enquiries should be directed to the GTA Office at: office@gtansw.org.au.

As the person responsible for all the workshops and events for GTA, I would like to thank Sharon McLean, Pam Gregg, Lorraine Chaffer and Paul Alger for their support and assistance. The program could not run without them.

Sue Field

Vice-President (Programs) and Co-editor



REPORT ON WORKSHOPS

Dams + Recycling + Desalination + Water Efficiency = Water  life

At all the workshops an overview of the Water for Life program was provided by either Reid McNamara or Inger Shimell from the Office of Water, Department of Climate Change and Water. The highlight of this presentation was the Progress Report Summary Clip, two-minute flyover movie of the Water for Life program. It is an excellent stimulus for classroom discussion. It can be found on the Water for Life website at www.waterforlife.nsw.gov.au/about/2008_progress_report/movie/

Each workshop had a different set of speakers relevant to the different locations and a local site tour. The site tours were very well received at all locations. The evaluations were very positive at all locations with 90-100% of the teachers indicating these workshops have contributed to their knowledge and professional needs through the handouts, resources and quality presentations.



Coastal Environment Centre (Narrabeen)

This workshop was cancelled due to lack of numbers. However an article by Toni Wilson has been provided for this Bulletin.

Centennial Parklands (Learning Centre)

This workshop was low in numbers but went ahead and those present were very appreciative. There was a great presentation by Dr Kim Jaggar, Principal from Sydney Boys High talking about the water initiatives at his school. Mark Secombe led a most informative site tour around the Centennial Parklands precinct looking at water flows, processes and human impacts.

"Informative day, useful information, great resources and good food."



Sydney Olympic Park (Newington Armory)

This was the first workshop in the series and it was held last year in conjunction with School Certificate marking at Homebush. It was well attended and teachers were treated to a great day at Sydney Olympic Park. There were presentations by Dr Marianne Sheumack on water and waste management at Sydney Olympic Park (see article), Danielle Nash on field based education at Sydney Olympic Park and Dr Swapan Paul on the wetlands project at Sydney Olympic Park. The highlight of the day was the tour of the site, led by David Kirkland with lunch at the Amory Wharf Café on Parramatta River.



"I found it to be very interesting and I learnt a lot, I enjoyed the day immensely, thank you for organising it so well."



Australia's Industry World (Port Kembla)

Despite low numbers this was the best workshop of all. Jason Rosewarn gave an amazing presentation on the use of recycled water at the Port Kembla Coal Terminal (see article). Natasha Flemming (Senior Environment Adviser) led the site tour around Bluescope Steel, with her colleague and they were both very knowledgeable and easy to talk to. We had a fantastic tour and we thank Bluescope Steel for providing our bus and driver free of charge.

"Excellent use of steelworks facilities and personnel."

Dams + Recycling + Desalination + Water Efficiency = Water life

Georges River Environmental Education Centre (Chipping Norton)

This was a well-attended workshop, with a great presentation by Murray Powell on stormwater projects in Sydney (see article). The site tour was around the Georges River area and there was a choice of the site tour or discovering some of the digital resources available on water. The presentation by Norm Foord on water management at New Brighton Golf Course was also very interesting.

Thanks to Sharyn Cullis (see article) and her team for their coordination of the day at the centre. GTA is very grateful for the continuing good relationship between the DET's Environmental Education Centres and the GTA.

"Thorough knowledge of content from all presenters, as well as resources. Thank you."

Centre for Learning Innovation (Strathfield)

This workshop was a special event, with the focus being on discovering all the digital resources available to support the teaching of water in geography classrooms. This session was facilitated by Sally Watts, from the DET. (see article)

"Very informative! Very inspiring to meet people who are so passionate to educate."

Wentworth Falls

Unfortunately this workshop was cancelled due to lack of numbers. There were some great sessions lined up, but we missed out.

For more information on the *Water for Life* education project go to their website at www.waterforlife.nsw.gov.au/education



Water  life
NSW GOVERNMENT

Search

Metropolitan Water Plan

About the Plan | Dams and drought security | Recycling | Desalination | Water efficiency | Rivers and catchments | Education Resource Hub


TOOLS & TIPS | SUPPORT | EVENTS & NETWORKING | RESEARCH

Welcome to the Water Education Resource Hub

This Hub is designed as a 'one-stop-shop' on everything to do with water education for the community. It will be regularly updated and contains a range of useful tools, resources, events and professional learning opportunities.

Anyone from experienced practitioners through to first-timers can use it to **design, run and evaluate** an education project for the community, their work colleagues or friends. It is designed to support you in improving the effectiveness of your projects, increasing the priority of education for your organisation, and accelerating staff development.

Hub highlights

-  **New plan helps spread water conservation message - [more](#)**
-  **Trial of smart meters puts water efficiency at a fingertip - [more](#)**
-  **Case studies on water education projects now available - [more](#)**
-  **Find out about Sydney Water's Speakers Program - [more](#)**

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Water Education Resource Directory

Water for Life Education Program
educating the community and supporting water educators

The site has a wealth of information for schools on: the Metropolitan Water Plan for Sydney, dams, recycling, desalination, water efficiency, rivers and catchments, plus the Education Resource Hub.

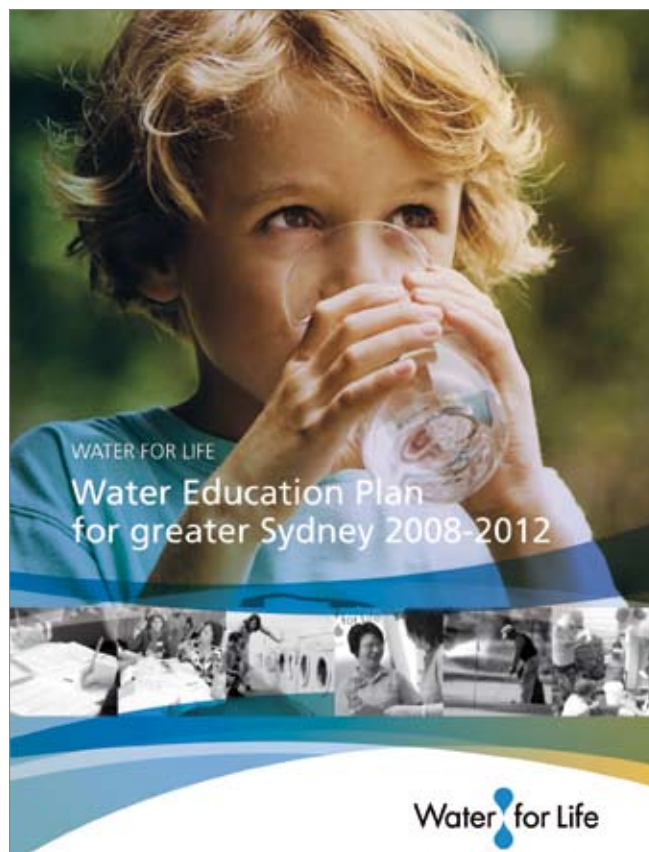
SYDNEY'S WATER FUTURE

Reid McNamara, Manager,
Water for Life Program, Office of Water,
Department of Climate Change and Water

The NSW Government's Metropolitan Water Plan for greater Sydney combines the mix of measures that make sure there is enough water for people and the environment now and in the future.

The Metropolitan Water Plan is supported by the Water for Life Education Program that has been running since 2005. It involves social media campaigns to raise awareness of and provide updates on the range of initiatives being implemented as part of the Metropolitan Water Plan, as well as to reinforce the important role the community plays in helping save water. Activities include partnerships with councils and non-government organisations, such as The Geography Teachers' Association of NSW, to deliver practical education projects, training and support for council education staff and a range of rebates and incentives to encourage the community to play their part in securing our water for life.

There are four main elements that make up the plan: dams, recycling, desalination and water efficiency. This means Greater Sydney's water supply is more diverse, flexible and no longer solely reliant on rainfall. Preparing it for population growth and the potential impacts of climate change and future droughts.



Dams

Sydney's network of eleven major dams will continue to provide most of the water for greater Sydney. The dams also need to be managed to provide the water that is essential to the health of the rivers downstream.

Recycling: making water fit its use

Recycled water and harvested stormwater are suitable for use by industry, councils, in homes for flushing toilets and watering gardens, and to improve the health of our rivers. Recycling is a great way to save valuable drinking-quality water and to provide more water for the environment.

A recycled water treatment plant at St Marys and new residential recycling schemes throughout the city will help us recycle around 70 billion litres a year by 2015.



Figure 1. Find out about how we work to coordinate water education across the greater Sydney region in the Water Education Plan for greater Sydney 2008–2012. The Plan is available online at www.waterforlife.nsw.gov.au

SYDNEY'S WATER FUTURE

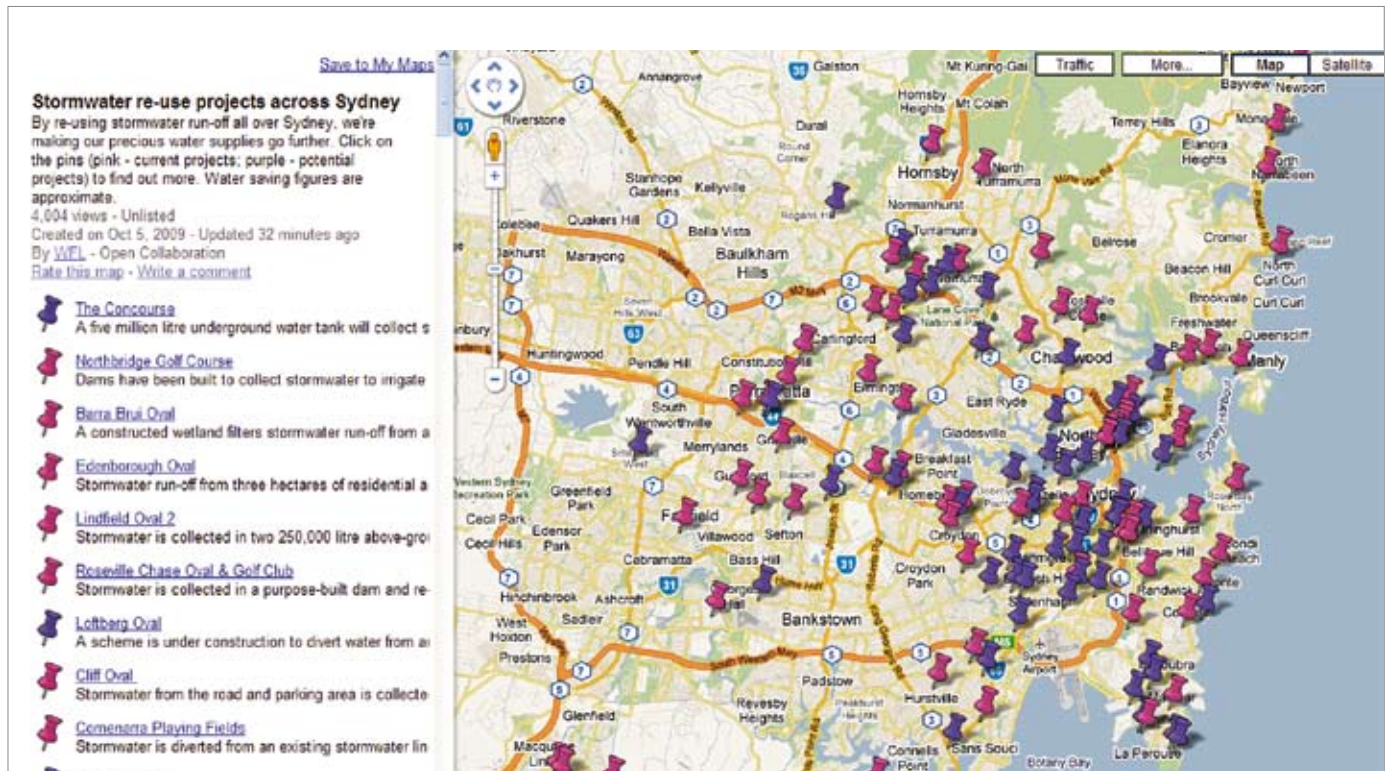


Figure. 2 You can use our interactive map to show your students local stormwater projects. Find the map and other resources at – www.waterforlife.nsw.gov.au

Desalination

Water from the desalination plant is important for the future because it doesn't rely on rainfall. It can provide a guaranteed supplementary water supply that is not affected by climate change and droughts. Everyone benefits from desalination because it allows more water to be left in the dams, which means a more secure water supply.

Sydney's desalination plant can provide up to 250 million litres of water a day using renewable energy – 15% of Sydney's water needs. Once treated, the water from the plant travels through an 18-kilometre pipeline from Kurnell to join the city water supply at Erskineville.

About Water for Life | Dams and drought security | Recycling | Desalination | Water efficiency | Rivers and catchments | Education Resource Hub

Desalination
Providing up to 15% of our water needs

Sydney's rainfall is highly variable and there is the possibility that we could face more droughts in the future. Combined with the general impacts of climate change and a growing population, it makes sense then to balance our dams and water recycling with a source of water that doesn't rely on rain.

Sydney's desalination plant can provide up to 15% of our water. Up to 250 million litres of water from the plant will reach about 1.5 million people as part of all of their water supply.

The desalination plant uses reverse osmosis technology to extract fresh water from the sea-water. Once treated, water from the plant travels through an 18 kilometre pipeline from Kurnell to join the city water supply at Erskineville.

The plant's design allows it to be quickly upgraded to provide up to 500 million litres a day if needed. Meanwhile, its power needs will be fully offset by renewable energy.

More information on desalination can be found in the 2006 Progress Report on the Integrated Water Plan, or you can visit the Sydney Water website where you can find out if your water is coming from the desalination plant, and view short animations of the desalination process.

Desalination is an important, non-rainfall dependent part of the NSW Government's approach to securing Sydney's water supplies, and can provide up to 15% of Sydney's water.

Water efficiency

Water efficiency programs improve the way we use water by installing water efficient equipment and appliances, fixing leaks, educating the community, and modifying industrial processes to use water more efficiently. By being water wise, households, businesses, farms and governments can reduce water wastage, which reduces our reliance on dam supplies and increases the security of Sydney's water supply.

Environmental flows

Dams and reservoirs affect the natural flow of water down rivers and streams. To compensate for this, water is released from the dams to the rivers downstream. These environmental flows improve river health and represent a small percentage of the total water we use each day. In 2010, environmental releases from our dams were improved to better mimic natural flows and restore river health.

Sydney Water – Speakers Program

Sydney Water has a Speakers Program that visits schools. They are available to speak about any of the issues on the Water for Life website.

Contact Michelle Sargent at speakersprogram@sydneywater.com.au or phone 8849 6137

Water Management at Sydney Olympic Park



Dr Marianne Sheumack, Project Manager, Community and Corporate Education,
Sydney Olympic Park Authority

The Sydney 2000 Olympic Games received international recognition in 2001 from Maurice Strong, Chairman of the Earth Council, as “the greenest and most sustainable Games ever”.

The basis for this accolade was successful development of the site and venues in accordance with the principles of ecologically sustainable development (ESD). These principles were embodied in a set of Environmental Guidelines written into Sydney’s bid to host the 2000 Olympic Games. The Guidelines included a commitment to the conservation of water and energy as well as protection of the natural and cultural heritage.

Today Sydney Olympic Park covers 640 hectares of parks, urban development and species habitat. Previous landuse at the site includes the State Abattoirs, the State Brickpit, the Royal Australian Navy Armament Depot and a number of controlled landfills. Creeks and mangrove swamps were also used for the uncontrolled dumping of wastes between the 1950s and 1970s.

Clean up of the site began in the 1980s, but was fast tracked following the success of Sydney’s Olympic bid. As no waste was permitted to leave the site, the remediation process involved consolidation of waste into a number of major landfills, then capture and treatment of the associated leachate. Approximately nine million cubic metres of waste was safely contained in ten landfills and Sydney Olympic Park Authority has the responsibility of monitoring and managing these remediated areas.

The second stage of works involved restoration of the natural ecosystems that once existed in the area. This included:

- recontouring of Haslams Creek to create a more natural meandering shape
- construction of a corridor of freshwater wetlands to store stormwater, create habitat and to mitigate flooding from Haslams Creek, and
- revitalisation of the intertidal wetlands by restoring natural tidal flushing regimes.

Across the site over eight million native trees, shrubs and macrophytes were planted.

Today, Sydney Olympic Park comprises 430 hectares of diverse parklands as exemplified by the mixture of natural and constructed parkland areas and heritage precincts. There are 175 hectares of wetlands and 20 hectares of woodlands. Two endangered ecological communities – Coastal Saltmarsh and a remnant Sydney Turpentine and Ironbark Forest are represented, as well as habitat for the endangered Green and Golden Bell Frog. Over 180 species of birds inhabit the Park including migratory species that fly the East Asian-Australasian Flyway and are protected under the bilateral intergovernmental agreements: Japan-Australia Migratory Bird Agreement, China-Australia Migratory Bird Agreement, and Republic of Korea-Australia Migratory Bird Agreement (JAMBA, CAMBA and ROKAMBA respectively).

Water Management at Sydney Olympic Park

An integrated approach to water management is one of the key components of ESD used throughout the planning, development and operation of Sydney Olympic Park. The aim of this strategy is to conserve valuable drinking water resources as well as protect waterways from stormwater pollution. A holistic approach is taken to managing stormwater, sewage, drinking water and recycled water.

The Water Reclamation and Management Scheme (WRAMS) which was built for the Sydney 2000 Olympic Games, utilises advanced biological technologies to treat sewage. Water reclaimed after the sewage treatment process is then treated by microfiltration, reverse osmosis and chlorination at the Water Treatment Plant to produce high quality recycled water. This plant operates continuously to produce recycled water which is approved for a variety of non-drinking purposes in the Park's venues, commercial premises and parklands as well as residential areas in the nearby suburb of Newington. The quality of this water is of such a standard that it can be used for laundering clothes, washing pets, pool filter backwashing as well as irrigation of vegetable gardens and parks, ornamental fountains, fire fighting, washing cars and toilet flushing.

Recycled water quality is continuously monitored to ensure public health and safety. Since WRAMS commenced operation, it has achieved all mandatory chemical, physical and biological performance standards. The success of WRAMS operation demonstrates that large-scale urban water recycling systems are feasible, safe, reliable and beneficial for both the community and the environment. The environmental benefit stems from both the reduced impact of stormwater run-off on Sydney's waterways and the reduction in discharge of sewage effluent to the ocean.

Stormwater from buildings and roads is harvested through gross pollutant traps into water storage ponds. Passive treatment of the water occurs through settling out of fine sediments and nutrient uptake by macrophyte plantings. This harvested stormwater can be directly reused to irrigate parks, gardens and playing fields and also feeds into the WRAMS water recycling system.

Water demand is reduced through water-wise landscaping practices and night time irrigation, when evaporation rates are low. Most landscape plantings are native species that do not require irrigation once established.

Other examples of water sensitive urban design include the use of permeable pavements in various locations to allow water infiltration to plant roots, the capture and use of rainwater by some venues and the use of water saving devices in high volume usage areas such as ANZ Stadium.

Three different types of water are utilised at Sydney Olympic Park. These are:

- drinking water from the Sydney Water Supply system

- stormwater harvested directly from the freshwater wetlands for irrigation use, and
- recycled water generated by WRAMS.

In the last seven years, Sydney Olympic Park has produced over 4,600 megalitres (ML) of recycled water for non-drinking use for venues, residential and commercial premises as well as irrigation for playing fields and landscape areas. The total water usage by the Authority in the public domain spaces and the Aquatic, Athletic and Archery Centres has been reduced from 602 ML in 2005/2006 to 287 ML in 2007/2008. Over the last two years, less than 2% of the Park's total water consumption has been potable water drawn from the Sydney Water supply.

Recently Sydney Olympic Park Authority released its Master Plan 2030 which sets out the future vision of urban development at the Park. It provides for more than 28,000 extra jobs, 5,000 students and 6,000 new dwellings constructed to house approximately 14,000 new residents. This development is to be accomplished while retaining major event capability for up to 250,000 patrons daily and access to the Parklands. It is envisaged that all new developments in the Park will be required to connect to the Park's WRAMS system. Additional new commercial premises must meet performance criteria relating to energy and environmental efficiency.

Education continues to play a key role in the development of Sydney Olympic Park. Over 28,000 primary and secondary school students participated in education-related programs and activities at the Park in 2008–09.

Sydney Olympic Park offers diverse opportunities for curriculum-based education about water, its uses and management. These school programs involve field-based stage-specific excursions meeting syllabus outcomes within the areas of Geography, Science, Mathematics and Technology and Applied Sciences.

The Authority also conducts various adult education programs. A number of Wetland Education and Training (WET) workshops are offered each year for professionals. The WET Program is designed to facilitate the sharing of scientific research findings and the successful implementation of research in the management of the wetlands at Sydney Olympic Park and elsewhere. As part of the WET Program, teacher professional development workshops are held twice a year. These workshops provide in-depth technical information about intertidal wetlands and are suitable for Geography and Science teachers wishing to gain more expertise in these curriculum areas.

Technical Insight Tours are available for professional groups, university study tours and domestic and international business delegations. These programs are customised to meet the participants' area of interest. Over half of these Technical Insight Tours have focussed on the Park's whole of site water management and initiatives of environmental sustainability.

Port Kembla Coal Terminal – Recycled Water Project

Jason Rosewarn, Facilities Maintenance Engineer, Port Kembla Coal Terminal



Port Kembla Coal Terminal (PKCT) is a key coal exporting facility on Australia's east coast, 72 km south of Sydney. It services two of the nation's richest coal reserves, the Southern and Western coalfields of New South Wales, exporting high quality coking and steaming coal to customers around the world.

Background

Prior to recycled water, Port Kembla Coal Terminal (PKCT) was one of the top 20 water users in the Sydney Metropolitan basin with 95% of drinking water used on site being used for dust suppression.

Recycled water (or tertiary treated effluent) from the adjacent Wollongong Sewage Treatment Plant was determined to be the best and least-risk alternative source of water for this purpose.

The project

A target of 75% reduction in the use of potable (fresh) water per year was set. This equates to a saving of 360 million litres of fresh water per year.

Support and acceptance of all stakeholders including customers, the community and PKCT's employees

was required. The recycled water needed to have no negative environmental or operational impacts, to get acceptance.

Laboratory simulation testing and assessment of water quality application on coal and other bulk products was conducted. As a result, the water quality was approved by all stakeholders, including customers.

Health and hygiene considerations of persons on site were risk assessed within the context of exposure levels and operational tasks conducted on site. PKCT conducted joint risk workshops with stakeholders and as a result, the quality of recycled water was enhanced significantly from the original specifications to meet the appropriate health standards and this was endorsed by the NSW Department of Health.

The quantity had to meet PKCT's daily demand, which is approximately one ML per day.

Right: Main stockyard spray system.

Recycled water is now used to damp down PKCT stockpiles and minimise dust, saving significant amounts of drinking water



PKCT – Recycled Water Project



Left: General washdown using recycled water.



Above: Truck wash using recycled water.

System overview

The NSW South Coast is prone to strong winds, and PKCT have a sophisticated stockpile spray system designed to keep the coal stockpiles moist and prevent dust lift-off in even the strongest winds

An early wind warning system is located at Crookhaven Heads approximately 60km south of the terminal and provides about one hour warning of an approaching southerly wind.

Besides these stockpile sprays, PKCT have other dust suppression sprays, including belt sprays that are located at the transfer point of each belt.

PKCT also have very effective misting sprays that are installed beneath the three, one kilometre long yard-conveyors.

The pumphouse is electronically controlled and the stockpile sprays can be operated on cycles at 15 minute, 1 hour, 2 hour, 3 hour and 6 hour intervals.

The system is automatically overridden to 15 minute intervals if the wind speed is above ten metres per second (36 kilometres per hour, 19.4 Knots or 22 miles per hour).



Above: Electronically controlled pumphouse

Results

The project was delivered safely, on time and on budget and was commissioned in January 2009. The capital cost was \$1.2 million, which was funded by PKCT and supported by the NSW Government's Water Savings Fund.

Recycled water is supplied on site using a combination of existing piping infrastructure, new supply main and an upgraded pumphouse.

PKCT is the first coal terminal in Australia to use tertiary treated effluent, sprayed directly onto stockpiles for dust suppression.

There will be a reduction in effluent outflow to the ocean of one million litres/day from Wollongong's Sewage Treatment Plant.

PKCT has moved from one of the top 20 water users within the Sydney Water catchment area to 148th as at July 2009

PKCT is on target for a 75% reduction in potable (fresh) water use per year which is a saving of 360 million litres of fresh water per year.

NOTE: The average kitchen tap consumes approx eight litres per minute.

A kitchen tap being turned on today, would consume 360 million litres of water, if it is turned off in 85 years time.

PKCT will now be saving that amount of drinking water EVERY YEAR!

For further information about the operations at Port Kembla Coal Terminal please feel free to contact:
Jason Rosewarn, Facilities Maintenance Engineer on 02 4221 1847 or email jason.rosewarn@pkct.com.au .
Website: www.pkct.com.au/communityenvironment.htm.
The Community and Environment section contains downloadable PDFs: Environment Policy, Environmental Assessment Report and Sustainability Report.

Using the Georges River as a Teaching Resource



Sharyn Cullis, Principal, Georges River Environmental Education Centre

In this, one of the driest continents on earth, and increasingly in a global context where drinking water is so scarce, water and river management is a priority.

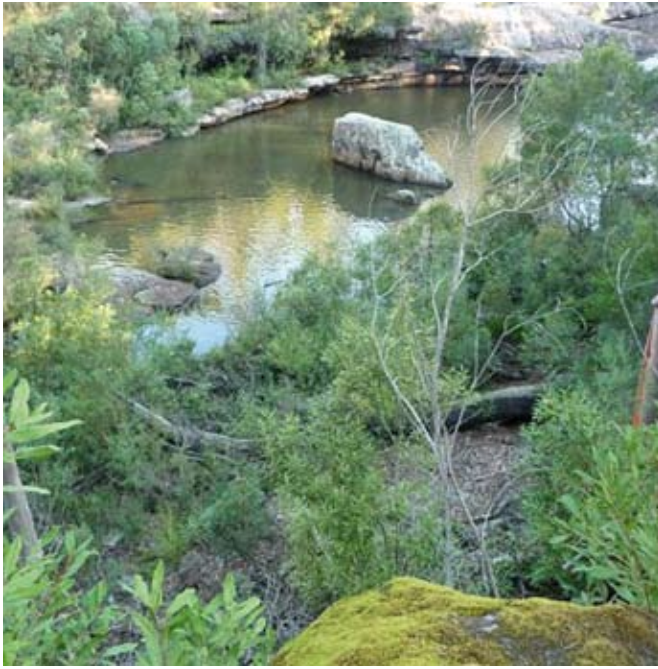
The Georges River is an excellent case study for teaching about ecosystems, river use conflicts and the sustainability of management practices around rivers. For students in urban Sydney, it can be a local case study introducing broader concepts about river use and management. It can be a 'springboard', providing a better understanding and hopefully a greater interest, in river and catchment issues in general.

At the Georges River Environmental Education Centre, teaching programs stress the link between effective catchment and estuary management and the condition of the coast and the ocean. The cumulative impacts of poorly managed urban run-off throughout the 960 sq kms of the Georges River, affects what downstream stakeholders fish, water ski and swim in. For example, a careless chemical spill in the vast and distant industrial and warehousing areas of Wetherill Park, can become part of the cumulative and toxic wastewater cocktail that will affect the ecological quality of the RAMSAR listed bird habitats of Towra Point in Botany Bay, and may even influence, via tides and currents, water quality at the Cronulla beaches. These places are all linked by water!



Source: www.sydney.cma.nsw.gov.au/bbcci/maps.html

Using the Georges River as a Teaching Resource



Since more than a million people live in the Georges River catchment, urban wastewater is recognised as a major management challenge, and a management response is the current emphasis on ‘water sensitive urban design.’

One of the increasingly urgent issues is that around the management of the remaining natural lands. Water quality in the river is a barometer of sustainable land practise, and the fact that almost 50% of the catchment is natural is significant in maintaining water quality. Bushland and swampland have a filtering and flow regulating function.

There are two National Parks: Georges River and Kamai-Botany Bay, in the catchment. Almost 20,000 hectares of the catchment is contained within the Holsworthy Military Training Area. It is mainly high conservation value bushland, and military impacts are surprisingly low impact. However, there is no long-term conservation agreement between the State and the Commonwealth that assures its protection into the future.

Coal mining is emerging as a major threat to the headwaters of the Georges, contained within the O'Hares Creek catchment to the south-east of Appin. It is wholly contained within the 6,000 hectare Dharawal State Conservaton Area. Despite being of national conservation significance, the Bulli Seam Operation is a proposal that will threaten it, with a network of 136 longwall coalmines that will honeycomb beneath at least 40% of it.

Dharawal is a moist landscape, a myriad of swamps and streams, and the major pristine, freshwater source of the Georges. The Environmental Assessment for the project admits mine subsidence causes riverbed and rockbar fracturing and the loss of water, consequently from swamps, pools and streams. Methane gas bubbling can occur in remaining pools. Lost water may resurface further downstream, but then is often very saline and stained with

iron floc. There is a growing community campaign against this proposal.

The Georges River is 93 kilometres in length, and it runs through twelve Local Government Areas, so management responsibility is fragmented. There are also a number of government agencies, with specific responsibilities including the Department of Environment, Climate Change and Water and the Sydney Metropolitan Catchment Management Authority. The Georges River Combined Councils Committee aims to co-ordinated council programs catchment wide. (www.sydney.cma.nsw.gov.au and www.georgesriver.org.au)

It is important to stress the role of individuals, families and communities in sustainability management, as part of active citizenship. Sustainability principles can be reflected in school initiatives for the management of water, and biodiversity in school grounds. Waste reduction, and exercising consumer choice that favours less packaging, for example are more important for longer term sustainability than a focus on recycling.



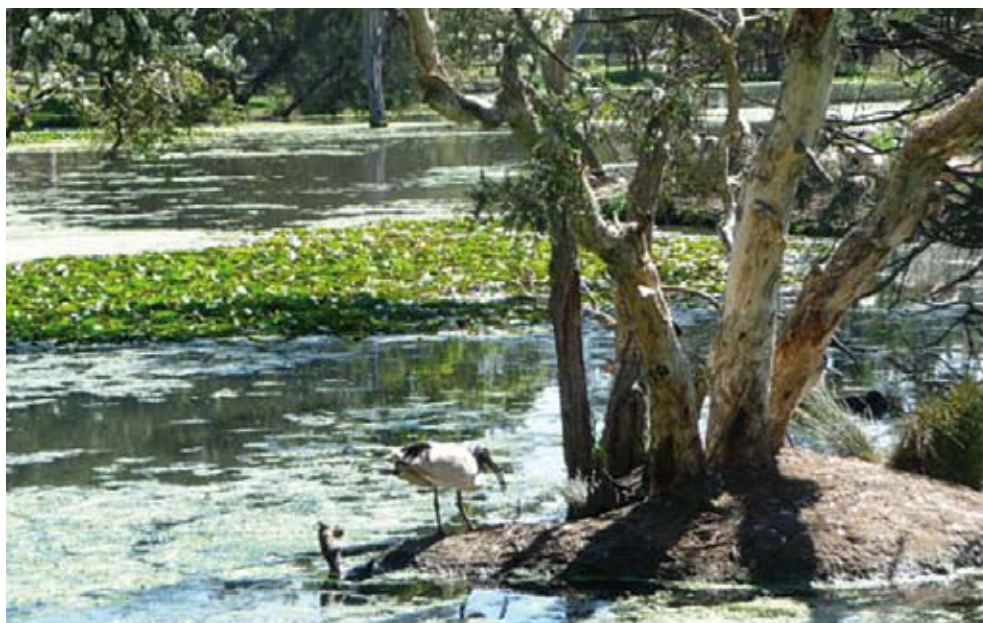
Source: www.sydney.cma.nsw.gov.au/bbcci/images/maps/BBCI_GEORGES_CATCHMENT_LGA_V1.pdf

Teaching about the habitat requirements of estuarine fish like Bream and Flathead works as a way of engaging students with the need to protect and enhance water quality. The life cycle of the Bass is a particularly good way

Using the Georges River as a Teaching Resource

of illustrating the need to pay attention to every part of a river in terms of its health. Bass are born in the sea, and then need to migrate far upstream to fresh headwaters to mature, and then of course return to the sea to breed. They are found in east coast rivers, like the Georges River.

Small fragments of habitat are important, even for endangered species. As an example, the Green and Gold Bell Frog, has been recently heard calling, in and around the swamps and ponds of the Moorebank-Hammondville area, for the first time in many years. Some notable but small reserves providing local students with opportunities to reconnect with nature, and observe wildlife up close include the Cabramatta Creek Flying Fox colony, and the Ibis nesting site at Lake Gillawarna, Milperra. The point is here, not to encourage distant schools to visit these sites, but to encourage schools to seek out similar opportunities within your own river catchments.



Contact your nearest Environmental Education Centre for further information – www.schools.nsw.edu.au/learning/yrk12focusareas/environed/edcontact.php

For more information, look at the Georges River EEC website: www.georgesriv-e.schools.nsw.edu.au or contact Sharon Cullis – sharyn.cullis@det.nsw.edu.au, phone 02 9755 3189 or fax 02 9755 3190.

GEORGESOURCES

The Australian Government's Water Education Toolkit



The Water Education Toolkit provides Australian teachers and schools with access to hundreds of water education materials through one easy to use portal.

Water is a popular subject in the classroom, from science and geography to human resources and cultural studies. The classroom provides a great environment for children and young adults to learn about water issues and incorporate water smart behaviour into their everyday lives.

The Water Education Toolkit brings together more than 650 national, state, territory, regional and urban water education resources into one easily accessible, convenient and comprehensive web portal.

Although this resource is mainly to assist teachers, students will also find it a valuable tool when researching school assignments and seeking additional water information.

Teachers and students will be able to find case studies, lesson and unit plans, visual aids, in-class activities, Indigenous cultural resources, informational resources, games, experiments and more.

Funded from the Australian Government's \$12.9 billion Water for the Future initiative, the Water Education Toolkit aims to help raise awareness and understanding in the classroom about all aspects of this vital resource.

You can visit the Water Education Toolkit at: www.environment.gov.au/wet

For more information about the Australian Government's Water for the Future initiative visit: www.environment.gov.au/water

Wow—Look at that stormwater

Murray Powell, President NSW Stormwater Industry Association

During or after a rainstorm, most of us have heard someone say: "Wow, look at that stormwater". Sometimes they are referring to the pollution in it, sometimes it's because of the volume of it and sometimes people are thinking what a waste it is to lose all that great water down the drain.

Stormwater is the water that runs off our rooves and roads, and everywhere else. It picks up the dust, leaves, bird droppings, litter, oils, sediment and everything else that can be washed off our urban environment. This 'polluted' stormwater then goes down our gutters and drains, into our pipes and channels, then eventually reaches our creeks, harbour and beaches.

The result is commonly, unwanted pollution of our waterways, because the stormwater has 'cleaned' our urban environment, and dumped the pollution in our natural environment.

Stormwater can cause another big problem too. Sometimes drains get blocked or there is just too much water to get into our drains, and then it starts flowing overland. Sometimes this can cause unwanted flows going through people's yards or houses. Of course this is called flooding, and it is the result of too much stormwater.

It is the job of Councils to put in drainage, to control flooding.

It is everyone's job to try and stop water pollution. Sometimes Councils install pit traps or gross pollutant traps (GPTs). These can handle varying flow rates and are of varying levels of effectiveness. It's common in most new areas to use a 'treatment train' of stormwater pollution controls. This is a series of solutions in a row, all designed to do their part to stop or capture pollution.

These might include:

1. *preventative measures* such as education, spill control, sweeping up leaves
2. *source control* such as pit traps, street sweeping, porous paving
3. *primary treatment* such as GPTs, litter booms, trashracks
4. *secondary treatment* such as wetlands, basins, grassed swales
5. *reuse* such as stormwater harvesting for irrigation and toilet flushing.



Pollution caught in a gross pollutant trap

The latest trend in stormwater management is called Water Sensitive Urban Design (WSUD). This is an evolution from more end-of-line hard-engineered solutions, to more source control soft-engineered solutions. Examples of this include: raingardens, bio-retention, grassed swales, and infiltration systems. WSUD is all about controlling both the pollution and the quantity issues at source by trying to retain water on site, slow its flow, and keep any pollution on site, and not let it get into the stormwater.

New urban subdivisions are being built with WSUD for stormwater, as part of the water management for the area. Councils and governments are always looking for more sources of water, and stormwater harvesting has now become a common thing.



Stormwater harvesting storage arches being installed at Hornsby in Sydney

You don't need quality drinking water to spray on your gardens and flush your toilets. Sports fields especially, should all be irrigated with stormwater not drinking water, and most Councils are already looking at where they can do this.

Other sources of water include sewer mining, greywater reuse, bores and rainwater tanks. Most new houses all have rainwater tanks these days, and many are looking at greywater reuse (from bath and washing machine). All of these water sources, plus stormwater harvesting and potable (tap) water, are now all considered as water sources. Sydney Water runs campaigns to try and reduce water usage using things such as front-loading washing machines, dual flush toilets and water saving showerheads as part of water saving measures. Together these are known as 'Integrated Water Cycle Management'.

About one metre of rain lands on Sydney every year. If we could trap all of this, we would have four times the water we need. The future of stormwater management is focused on how to do this, and increase our water sustainability.

And at the core of this is STORMWATER. It's gone from being a pest and a polluter, to being an asset and a resource. So next time someone says: "Wow, look at that stormwater", it's likely to be said with a big smile on their face.

Coastal Roadshows

Toni Wilson, Senior Community Educator,
Coastal Environment Centre

give students a heightened level of surf awareness and understanding, knowledge that may save a life.

These dynamic, interactive and engaging presentations are designed to educate students about both the physical environment of the Australian coastline and the behavioural aspects which sadly lead to so much tragedy on our beaches. Importantly, the CEC programs encompass outcomes from the NSW Board of Studies Geography, Science and PD/H/PE syllabuses for Years 7 to 10.

In May this year, CEC Educators embarked on the first Roadshow, visiting schools within the New England and South Coast regions. These visits provided a wonderful opportunity for students to learn about the coast without incurring travelling or accommodation costs. The next stop on the regional tour will be the Central West region of NSW during Term 3, 2010 and continuing on a permanent basis year on year throughout NSW.

Outdoor CEC Ideas For You!

Whether your students participate or not in a Coastal Roadshow, all students need to have the opportunity to actively investigate geographic concepts through fieldwork. If lack of time, increasing costs or travel distance is affecting your students' opportunities, then try getting the CEC to help out in the school grounds.

The following are a few ideas progressing from those with simple equipment, during a geography lesson, to those requiring more detail in planning. The development of field skills and familiarity with field equipment is essential for students to develop their own research action plan and to be involved in inquiry based learning.



*Measuring Air Temperature,
photo courtesy of Toni Wilson, Coastal Environment Centre*

Earlier this year the Coastal Environment Center (CEC) and Surf Educate Australia (SEA) collaborated to design and deliver coastal studies and surf safety presentations to regional students as part of an inaugural "Coast to the Kids" regional educational roadshow.

The award winning CEC, a facility of Pittwater Council based on the northern beaches of Sydney, has an extensive history of providing fieldwork based learning to NSW students, designed to complement and contribute to the knowledge students have acquired in the classroom.

Traditionally, Sydney metropolitan students have visited the CEC and the northern beaches between Dee Why and Narrabeen to participate in hands-on geographical fieldwork including transect studies and field sketches, while observing first hand, the coastal processes and difficulties in managing Collaroy-Narrabeen, one of the most highly developed and at-risk beach systems nationally.

The geographical distance between many regional locations and the Australian coastline, has resulted in fewer students having the opportunity to experience coastal processes first hand. As a result, the CEC sees great value in bringing a coastal presentation to regional NSW schools.

Similarly, the SEA presentation, developed in conjunction with Dr Rob Brander from the University of New South Wales, has been developed to help reduce the tragic drownings that occur, often on unpatrolled beaches. It reviews concepts of wave types and rip cycles, to



*Using Anemometers,
photo courtesy of Toni Wilson, Coastal Environment Centre*



What Is It? Out on the oval or from a safe vantage point, students can draw a fieldsketch of the local area. They can label the natural landforms and built features and refer to the acronym “BOLTS” to complete their sketch. Alternately a plan view of the school grounds could be drawn with the use of a trundle wheel and grid paper.

Where Is It? A class set of compasses are essential for enabling all students to measure wind direction, aspect, orientate a map and navigate a course. Perhaps the previous map could be developed by students into an orienteering course for a younger year?

How Is It? Weather data can be measured and recorded on the oval and compared to different sites around the school. Changes in aspect, light, wind strength and temperature may be reflected in the vegetation type to demonstrate the link between the atmosphere and the biosphere. Durable field equipment such as group sets of anemometers, air or soil thermometers are a valuable investment. Many students will be able to provide their own digital cameras or they may have access to GPS or other field applications.

Why Is It? If your school has a woodland or native area, students could identify the dominant species and record vegetation height, light, soil pH, moisture or temperature and wind speed and compare their primary data to the grassy oval. Perhaps students could predict how the biodiversity would be affected and what parameters would be the best to measure before setting out. Often the greatest benefit may be in the graphing and analysis of their results or in the refining of their field techniques.

Test It! Any local waterways on or within walking distance of your school can be great fieldwork sites. Check out the Waterwatch site for information on what water quality tests to conduct, the procedures, equipment and support available. As students identify catchment stresses, opportunities for real citizenship action can present where students may link up with their Council or a local volunteer group and be involved in riparian revegetation or other projects.

Improve It! Students can be encouraged to be involved in the development and implementation of the School Environmental Management Plan. To do this, students would require an understanding of the school's environmental issues probably by performing waste, water, energy and biodiversity audits. This will lead to an improved understanding of their school's situation and give them ideas about possible solutions and actions including grant funding options. Refer to the CEC and Sustainable Schools NSW for more details and support.

For more details on the CEC's range of geography fieldtrips and how we can deliver your fieldwork outcomes, go to: www.pittwater.nsw.gov.au/cec or contact us on 1300 000 CEC (232), Tel: 02 9970 1679, Email: toni_wilson@pittwater.nsw.gov.au



Top: CEC Field trip and above: CEC/Surf Educate Australia Country Roadshow.
Photos courtesy of Toni Wilson, Coastal Environment Centre

SYDNEY WATER



Major recycled water projects

The information provided here has been taken from the Sydney Water website at:
www.sydneywater.com.au/MajorProjects/

Cooks River Bank Naturalisation

Sydney Water, in partnership with the Sydney Metropolitan Catchment Management Authority, local councils and other land and water managers, is developing a river bank naturalisation project for the Cooks River.

The project covers the area from the freshwater sections at Centenary Drive, Strathfield to the tidal saltwater sections of the river leading into Alexandra Canal at Sydney Airport. The project is focusing on identifying opportunities to naturalise parts of the Cooks River banks.

The Cooks River was originally a natural river. The Cooks River Improvement Act of 1946 led to orderly, concrete panels being built along the 'unruly' natural river banks. This resulted in the loss of the river's natural environment and the creation of the concrete channel we see today. Some sections of the concrete channel are in poor condition and will soon need to be replaced.

This presents an historic opportunity for Sydney Water to look at options for bank naturalisation for these sections. Sydney Water is considering replacing the concrete channel with river banks that are more natural. This will improve the river's health and natural character.

What is river bank naturalisation?

River bank naturalisation can take different forms, but generally involves the removal of some, or all of the steep concrete channel bank and creating a more gently sloping bank. This is stabilised with native plants, trees and rocks.

Naturalisation creates a softer landscape feel and can greatly improve the river bank habitat for native birds and animals.

Wetlands can also be established as part of the naturalisation process. Wetlands have a positive role in improving the river's ecology and health by treating stormwater runoff from streets and industrial areas, before it enters the river.

Cooks River Bank Naturalisation Project Flockhart Park to Beamish Street

Sydney Water would like your feedback on draft naturalisation plans for parts of the Cooks River

Naturalisation involves removing deteriorating concrete banks to create gently sloping banks, stabilised with rocks, plants and trees. This improves the environment for native plants and animals and helps people enjoy the river.

To comment on the draft plans, please complete a survey from the attached box.

If there are none left:

- go to Canterbury Council at 137 Beamish Street, Campsie or Burwood Council at 2 Condor Street, Burwood
- visit www.sydneywater.com.au under 'Major Projects' for an online survey
- call 13 20 92.

Where possible, community feedback will be included in the final project designs. Please return your survey to Sydney Water by 2 February 2009.

www.sydneywater.com.au

SYDNEY WATER – Major recycled water projects

Rosehill-Camellia Recycled Water Project

The Rosehill-Camellia Recycled Water Project will supply high quality recycled water to major industrial and irrigation customers in western Sydney.

A new recycled water plant next to the Fairfield wet weather sewage treatment plant, will initially deliver 4.3 billion litres of recycled water a year via the distribution network by 2011.

Major industrial customers Shell Refining, Visy Paper, Marubeni Australia Power Services LyondellBasell Industries, and Sydney Turf Club – Rosehill Gardens have signed agreements to receive recycled water from the scheme. Agreements are expected to be signed shortly with Boral and James Hardie.

The \$100 million recycled water plant and pipeline system will be built, owned and operated by AquaNet Sydney and Veolia Water Australia. Secondary treated effluent from the Liverpool to Ashfield Pipeline will be extracted and treated by ultrafiltration and reverse osmosis at the new recycled water plant to a high quality suitable for irrigation, use in cooling towers, as manufacturing water and boiler feed.

The scheme has been designed to be expanded to treat a further 3 billion litres a year.

North Head Sewage Treatment Plant

Sydney Water has recently completed \$150 million improvement work at the North Head Sewage Treatment Plant (STP) to ensure reliable plant performance, ongoing protection of water quality and a safer work environment.

This includes the first hydro-electric plant in Australia to generate power from treated sewage. It works by capturing energy from treated wastewater falling down a 60-metre shaft. Thanks to this innovation, as well as cogeneration – where methane produced during sewage treatment is turned into green energy, the STP now generates about 40% of its own power.

The improvements will also ensure the plant continues to perform in line with the environmental protection standards set by the Department of Environment and Climate Change through to 2023.



Sewerfix – Working in a pipe in a low sewage flow.



Lane Cove site, part of the STP

Improvements to North Head STP

- The first hydro-electric plant in Australia to generate power from treated sewage
- A recycled water facility that recycles 1.5 million litres of wastewater a day for use at the STP – as a result, 95 per cent of the water used on site is now recycled water
- A cogeneration engine that will reduce carbon emissions by turning methane produced during the treatment process into green energy
- A new biosolid management facility to improve waste handling
- A new odour scrubber to reduce odours during wastewater treatment
- Modifications to the Northside Storage Tunnel pumping station
- Increased performance by minimising grit build-up
- Two new grit tanks and a new grit handling plant to improve removal and cleaning of sand and gravel from wastewater
- Two new primary sedimentation tanks to improve the removal of organic solids, oil and grease from wastewater
- Improvements to the underground screenings handling facility to improve the collection, cleaning and removal of screenings
- New control and monitoring equipment.



Scotts Creek site, part of the STP

SYDNEY WATER – Major recycled water projects



The \$150 million upgrade at North Head sewage treatment plant and hydro plant were completed by the PARR Alliance, comprising Sydney Water, United Group Infrastructure, John Holland, MWH, Worley Parsons and Manidis Roberts.

Overview

North Head Sewage Treatment Plant (STP) is located on the North Head Peninsula at the entrance to Sydney Harbour, near Manly. The 15.9-hectare site is bordered by Sydney Harbour National Park and the Tasman Sea.

North Head STP was commissioned in 1971 and is the second largest ocean STP in Sydney. It provides high rate primary treatment of sewage to a catchment of approximately 416 square kilometres that extends west to Seven Hills, south to Bankstown and north to Ku-ring-gai and Collaroy.

The plant serves a population of over one million people and treats about 300 million litres of flow a day. Treated effluent is discharged through a deepwater ocean outfall.

Vaucluse and Diamond Bay



Sydney Water is working to improve the sewerage systems in Vaucluse and Diamond Bay.

These systems include the three untreated sewage ocean outfalls at Vaucluse and Diamond Bay, and sewage overflows which flow from these areas into Sydney Harbour.

Sydney Water began investigating improvements to the sewerage systems on the Vaucluse Peninsula in the late 1980s. This led to the display of an Environmental Impact Statement in 1993 that examined 18 pipeline and tunnel options. Although Sydney Water received approval to proceed with its preferred scheme, a change in funding priorities resulted in the project being deferred.

Following a review in 2001, Sydney Water decided to restart the project. Extensive community and stakeholder consultation was undertaken between 2001 and 2003. Work has now started.

How does Sydney Water plan to improve the sewerage system?

Sydney Water is working on a two-stage project to improve the sewerage system in Vaucluse and Diamond Bay.

Stage One

Sydney Water will inspect, clean and repair 12 km of high flow public sewer pipes in these areas. This work, known as SewerFix, will reduce overflows from the sewerage system in dry and wet weather. It is part of Sydney Water's \$560 million SewerFix Program to improve the sewerage system and protect public health and the environment.

This SewerFix work will help Sydney Water gather accurate data on how much wastewater flows through the system, as part of investigations to identify the best solution for wastewater discharges from the three ocean outfalls at Vaucluse and Diamond Bay.

Sydney Water will also check for tree root intrusion from private sewers into the public sewer pipes. Property owners will be asked to remove and maintain their private sewers to further decrease and prevent overflows.

Stage One started in March 2010 and should be finished in early 2011.

Stage Two

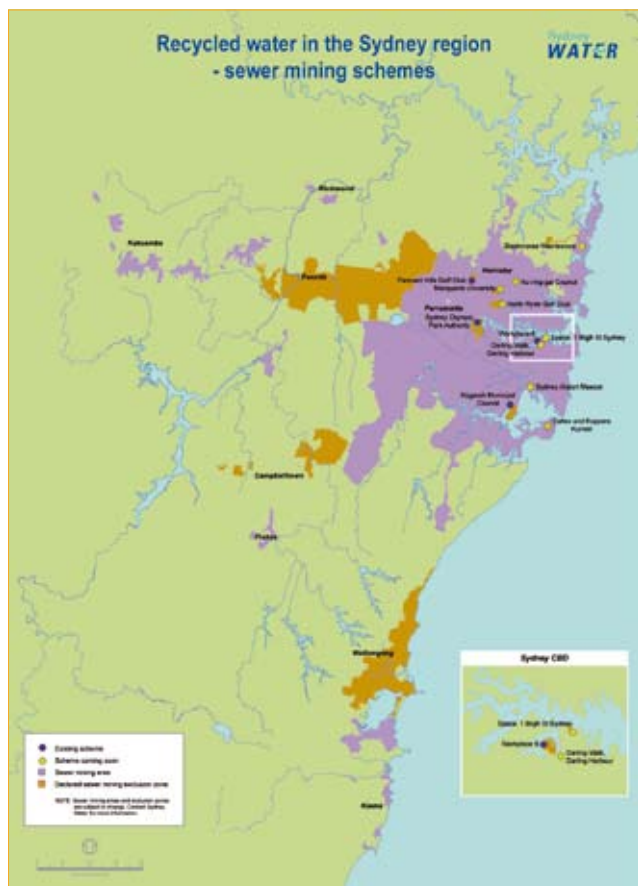
Planning for Stage Two will start after Stage One is complete. Stage Two will use information gathered as a result of Stage One improvements, to identify and implement the best solution for wastewater discharges from the three ocean outfalls at Vaucluse and Diamond Bay.

There will be a number of options to consider, and these will be discussed with the local community and relevant stakeholders during 2011.

*All images and diagrams courtesy of Sydney Water.
Source: www.sydneywater.com.au/MajorProjects/*

RECYCLING WATER IN SYDNEY

– residential projects



Sydney region – Sewer mining schemes. Source: www.waterforlife.nsw.gov.au/

Future Recycled Water Projects

The NSW Government is actively pursuing major large scale recycled water schemes and localised recycling where it is practical and affordable. By 2015 the amount of wastewater recycled in greater Sydney will grow from the current 27 billion to around 70 billion litres a year.

Western Sydney Recycled Water Initiative

As part of the Metropolitan Water Plan a major new recycling project, the Western Sydney Recycled Water Initiative, will provide recycled water via dual reticulation to all 160,000 new homes to be built in new suburbs in Sydney's north west and south west, as well as for agriculture, industry and replicating natural river flows downstream from dams.

The north west will be the first to receive recycled water as there are already three high quality sewage treatment plants in the area. All the wastewater currently being discharged by them will be fully allocated to productive uses, with water quality improvements in the Hawkesbury-Nepean River and its tributaries. The scheme will produce 27 billion litres of recycled water a year by 2015.

The information provided here has been taken from the Water for Life website:
www.waterforlife.nsw.gov.au/recycling/residential

Hoxton Park Recycled Water Scheme

Construction is underway for the Hoxton Park recycled water scheme. The scheme will provide high quality recycled water to the Yarrunga Industrial Area and the Panorama Estate development, as well as about 13,000 homes to be built in Edmondson Park, Middleton Grange and Ingleburn Gardens.

The scheme is expected to be running by 2011, with recycled water flows gradually increasing, as the area develops, to 1.8 billion litres to businesses and homes by 2015.

Ropes Crossing Recycled Water Scheme

Construction of dual reticulation pipelines is continuing as the new development, situated near St Mary's, expands. The Ropes Crossing Recycled Water Scheme will provide recycled water to new homes and for irrigation of local playing fields.

When the scheme is completed, it will provide 1,550 homes with up to 500 million litres of high quality recycled water a year.

The scheme is expected to start operating in 2010.

Localised recycling

In built-up areas of Sydney, new localised recycling schemes are being pursued that include reusing treated wastewater, sewer mining and stormwater harvesting.

'Sewer mining' involves obtaining untreated wastewater directly from the sewerage system. The Government has announced that the private sector and councils will be able to access billions of litres of wastewater generated in Sydney each year for innovative recycling projects. Such initiatives will see providers treating and using or distributing recycled water.

In addition to these recycling initiatives, the Government will change regulations to make it easier to recycle locally and in the home.

Hoxton Park Recycled Water Scheme

The Hoxton Park Recycled Water Scheme in south western Sydney will supply about 900 million litres of recycled water to businesses and about 7,000 homes by 2015. This major recycled water scheme will be commissioned in two stages from 2013 and will eventually

RECYCLING WATER IN SYDNEY – residential projects

serve Edmondson Park, Middleton Grange, Ingleburn Gardens, Yarrunga Industrial Area and Panorama Estate.

Construction of the recycled water pipelines started in May 2008. Much of this work is now complete.

Three new recycled water reservoirs will be built as part of the scheme. Two reservoirs will be located at Edmondson Park, and another at South Hoxton Park.

Special pipes, plumbing and treatment

Sydney Water will provide homes in the area with two water supplies – recycled water and drinking water. This is known as dual reticulation. The recycled water taps, pipes and plumbing will be coloured purple to distinguish recycled water from drinking water. Recycled water will be used for gardens and other outdoor uses, and toilet flushing.

The recycled water for the Hoxton Park area will be treated to a very high standard at a new recycled water plant at Sydney Water's Glenfield Sewage Treatment Plant. It will go through a complex series of treatment processes on top of the usual high level of treatment for wastewater.

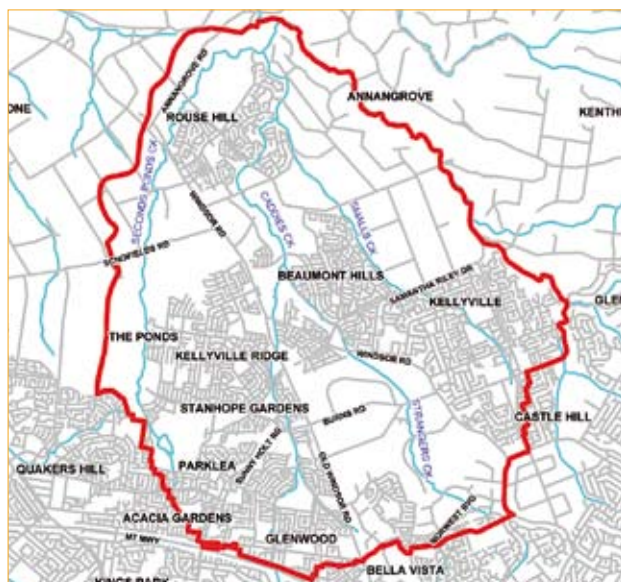
Rouse Hill Recycled Water Scheme

Australia's largest residential recycled water scheme is in the Rouse Hill area in Sydney's north-west.

The scheme started in 2001, and over 19,000 homes are now using up to 1.7 billion litres of recycled water each year for flushing toilets, watering gardens, washing cars and other outdoor uses.

Recycled water is treated wastewater - water that has been used previously in bathrooms, laundries and kitchens, and in businesses. It is treated to a high standard so it is safe to use.

On average the Rouse Hill scheme has reduced demand for drinking water by about 40%.



Rouse Hill development area map. Source: www.waterforlife.nsw.gov.au/



How do I know if I have recycled water?

- You live in one of the suburbs listed above.
- You have a second water meter that is purple or lilac.
- Your garden tap is purple or lilac. It should have this sign on it: 'Recycled water – do not drink.'
- Charges for recycled water are included on your water bill.

Eventually the scheme will serve 36,000 homes. The area includes parts of Acacia Gardens, Beaumont Hills, Castle Hill, Glenwood, Kellyville, Kellyville Ridge, Parklea, Quakers Hill, Stanhope Gardens, The Ponds and, of course, Rouse Hill.

Work to expand the Rouse Hill Recycled Water Plant finished in December 2008. The expansion will allow up to 4.7 billion litres of wastewater to be recycled each year for residential use.

Stormwater and river management

The Rouse Hill Recycled Water Area is part of a coordinated water cycle management program designed to help protect the Hawkesbury Nepean River. This includes not only the recycling of treated wastewater but also pollution reduction in the stormwater system.

Protecting the environment and maximising community benefits are vital components of the project.

METROPOLITAN WATER PLAN

The information provided has been taken from the Water for Life website:
www.waterforlife.nsw.gov.au/about/plan

The 2006 Metropolitan Water Plan is the NSW Government's plan to ensure a sustainable and secure water supply for greater Sydney. The NSW Government is currently updating the plan for the longer term, with the new plan to be released in 2010.

As part of the plan an Independent Review Panel of non government experts has been established to provide expert advice and monitor progress of the plan.

The four major parts of the plan – **dams, recycling, desalination** and **water efficiency** – together with the plan's adaptive approach, prepare greater Sydney for drought, variable rainfall, potential impacts of climate change, and a growing population. The plan secures our water for life, which means water for people and the environment.

Dams

We're making the most of one of the largest per capita storages in the world, for example by installing new pumps to reach deep water in major dams.

Recycling

Large recycling schemes underway and planned will increase water recycling so that it provides 12% of greater Sydney's water needs by 2015 – that's 70 billion litres of water every year.

Desalination

The desalination plant at Kurnell will provide up to 15% of our water needs. The plant is now online and its power needs will be fully offset by renewable energy.

Water efficiency

Our water needs will be reduced by 24% by 2015 through water efficiency initiatives across all sectors, including households, government, business and farms; as well as by building water efficient homes and by fixing and reducing leaks and through continued community education on wise water use.

Protecting the environment is also an extremely important aspect of the Metropolitan Water Plan. Healthy rivers and catchments are essential for recreational use, for business and for tourism. The focus is on environmental flows and the NSW Government has also established an Office of the Hawkesbury-Nepean to improve the health of the Hawkesbury-Nepean River System.

The plan also includes reforms to create a competitive and dynamic water industry, by encouraging the participation of the private sector in the water industry. Should Sydney experience another drought, the plan includes a number of drought response measures such as accessing groundwater reserves and implementing water restrictions, which are being reviewed as part of the updated plan.

The plan is based on the findings of independent experts. In addition to the commitment to undertake a four yearly major review of the plan, implementation is monitored every year through the preparation of annual progress reports, the latest of which is the 2008 Progress Report.

There is a Progress Report Summary Clip on the Metropolitan Water Plan, on the Water for Life website at: www.waterforlife.nsw.gov.au/about/2008_progress_report/movie/

It is a two-minute flyover movie of the Water for Life program. It is an excellent stimulus for classroom discussion.



GET INVOLVED –

how can you make a difference?

The information provided has been taken from the Sydney Water website:
www.sydney.com.au/Education/SecondaryTeachers/Getinvolved

Sydney's water environment needs your help. Your small actions can lead to big improvements in the water environment.

Find out how you can get involved and help make a difference by being water wise and improving water quality.

Get involved in your home



From turning the tap off while brushing your teeth, to being careful about what goes down the drain, there are many ways you can use water wisely around your home.

Sydney Water also offers programs to help households use water efficiently.

Get involved around your home and in your garden



There are many ways you can use water wisely outdoors and in your garden. Sydney Water offers several programs to help you use water more efficiently.

Get involved at school



You can help your school reduce water use, save money and manage water resources efficiently.

Get involved in the community to help local waterways

Streamwatch



Sydney Water's Streamwatch Program involves schools and community groups monitoring their local waterways and taking action to improve water quality.

Clean Up Australia Day



Every year thousands of Australians help clean up their environment on Clean Up Australia Day. Local waterways are often a focus for this special day.

Landcare and Bushcare



Landcare and Bushcare volunteer groups care for local parks, bushland, creeks, rivers and beaches.

Local councils



Many local councils run environmental centres and special environmental programs for schools.

Catchment Management Authorities (CMA)



CMAs' community programs offer a range of activities that give communities an opportunity to help improve their local environment.

To find out more on any of these projects and ideas, go to the website: www.sydneywater.com.au/Education/SecondaryTeachers/Getinvolved/

WATER RELATED DISASTERS

and Sustainable Management

Dr Susan Bliss, Director
Global Education NSW

Bonn Recommendations for Action (2001):
'Water management arrangements should take account of climate variability and expand the capacity to identify trends, manage risks and adapt to hazards such as floods and droughts. Anticipation and prevention are more effective and less expensive than having to react to emergencies. Early warning systems should become an integral part of water resources development and planning.'

World Summit on Sustainable Development, Plan of Implementation (2002):
'...combat desertification and mitigate the effects of drought and floods through such measures as improved use of climate and weather information and forecasts, early warning systems, land and natural resource management, agricultural practices and ecosystem conservation particularly in African nations as one of the tools for poverty eradication.'

Introduction

The World Disaster Report, noted that over the past 20 years, deaths resulting from water related disasters (e.g. floods, landslides, storm surges, tsunamis and droughts) accounted for 83.7% of total disaster related fatalities in Asia compared to 12.4% in America, 2.7% in Africa, 0.7% in Europe and 0.5% in Oceania. The greatest impact on people and properties from water related disasters, occurred in developing countries causing serious disruption to the functioning of communities and widespread human, material, economic and environmental losses.

An example of a water related disaster was the catastrophic tsunami in the Indian Ocean on 26 December 2004 which struck twelve coastal countries resulting in around 300,000 deaths and severe economic losses. In 2005 in response to this major water related disaster the Inter Academy Panel on International Issues (IAP) launched the 'Natural Disaster Mitigation' Initiative.



Woman after the 2004 Indonesian tsunami
Source: www.ausaid.gov.au/publications/focus/tsunami/focus_tsunami.pdf

Though water related disasters are increasing every year, the number of fatalities has declined due to improved understanding of the causes and impacts of disasters, more sophisticated monitoring systems and improved forecasting capabilities. For instance in Bangladesh the number of fatalities due to similar magnitude cyclones decreased from 300,000 people in 1970 to 5,000 people in 2007. Consequently it is important policy makers and managers include disaster risk management into policies at the local, national and global scales for sustainable development.

Questions such as how water related disasters will change in the context of global warming, and how humans can adapt to this change or mitigate such situations, are waiting to be explored and solved.

Global trends in water related disasters

'Trends in natural disasters show they are continuously increasing in most regions of the world. Among all observed natural and anthropogenic adversities, water related disasters are undoubtedly the most recurrent and pose major impediments to the achievement of human security and sustainable socioeconomic development, as recently witnessed with the disasters caused by the Indian Ocean tsunami in 2004, Hurricane Katrina in 2005, Cyclone Sidr in 2007, Cyclone Nargis in 2008, and many others. During the period 2000 to 2006, a total of 2,163 water related disasters were reported globally in the Emergency Disasters Database (EM-DAT), killing more than 290,000 people, affecting more than 1.5 billion people, and inflicting more than US\$422 billion of damage.' (The United Nations World Water Development Report 3: Water in a Changing World, 2009).

Water Related Disasters and Sustainable Management

Analysis of one thousand most fatal natural disasters across the world showed 90% were water related between 1900 and 2009. Floods accounted for 29.8% of the total number of natural disasters – claiming 18.5% of total casualties and 48% of total number of affected people.

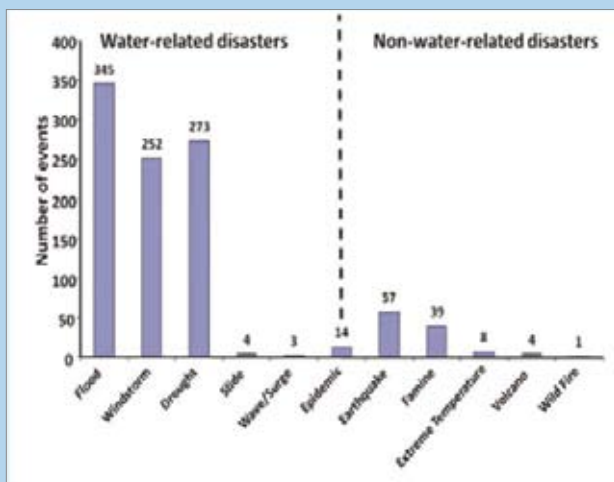
Aimed to reduce the adverse impacts of water related disasters, decision makers need to adopt policies in water hazard mitigation with a better understanding of disaster vulnerability.

Table: Global scale – frequency of recorded natural disasters between 1900 and 2006

	1900-2006	Number of Disasters	(%)	Number killed	(%)	Total affected	(%)	Real Damage	(%)
Water-related Disasters	Flood	3,050	29.8	6,899,095	18.5	3,027,693,701	48.3	342,968,287	25.9
	Windstorm	2,758	26.9	10,008,806	3.2	752,843,507	12.0	536,432,227	40.5
	Drought	836	8.2	1,208,806	26.8	2,239,624,826	35.7	61,262,901	4.6
	Slides	508	5.0	55,980	0.2	10,206,768	0.2	3,487,457	0.3
	Wave/Surge	52	0.5	295,813	0.8	2,596,663	0.0	7,850,747	0.6
Non Water-related Disasters	Epidemic	1,035	10.1	9,528,995	25.6	40,156,618	0.6	4,737	0.0
	Wild Fire	312	3.0	2,710	0.0	4,019,267	0.1	29,574,293	2.2
	Extreme Temperature	322	3.1	69,138	0.2	11,466,747	0.2	21,843,847	1.6
	Volcano	193	1.9	95,917	0.3	4,907,517	0.1	3,842,646	0.3
	Insect Infestation	83	0.8	0	0.0	2,200	0.0	230,125	0.0
	Famine	76	0.7	7,158,229	19.2	70,996,301	1.1	93,449	0.0
	Earthquake	1,025	10.0	1,963,172	5.3	104,038,367	1.7	317,580,870	24.0
	Total	10,250	100.0	37,286,332	100.0	6,268,551,482	100.0	1,325,171,586	100.0

Source: www.unwater.org/downloads/181793E.pdf

Column graph: Global scale – annual total and cumulative number of natural disaster events between 1900 and 2006



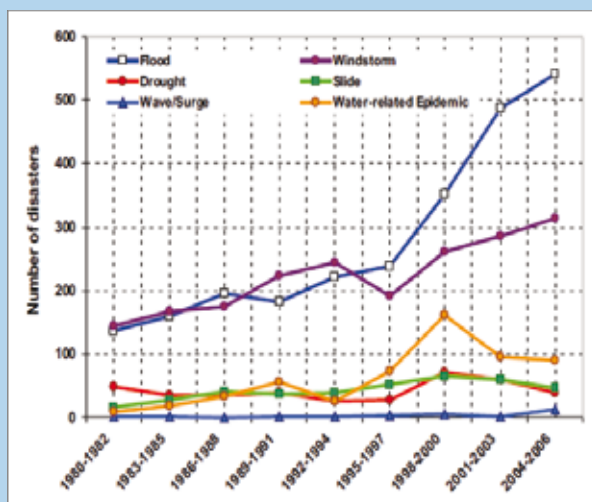
Source: www.unwater.org/downloads/181793E.pdf

News: 2010 Queensland floods break records

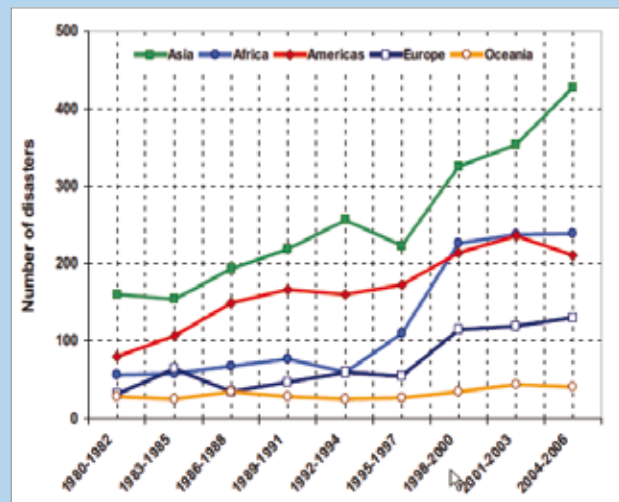
The weather system drowning Queensland broke a record set 54 years ago. The record was for the largest area of land saturated by heavy rain. The Bureau of Meteorology stated rain, flooded an area of Queensland larger than Victoria, and gave central Australia its best rainfall since 2001.

The massive flood across western Queensland caused millions of dollars of damage, but also resulted in the emergence of new vegetation, waterbirds colonising lakes that had been empty for years, and native mammals began breeding.

Line graphs: Water related disaster events 1980 to 2006
Global scale



Regional scale



Asia is the region most vulnerable to water related disasters, accounting for more than 45% of fatalities and more than 90% of the people affected by disasters. However, the recorded number of fatalities was highest in Africa, accounting for more than 46% of the world total.

Source: www.unwater.org/downloads/181793E.pdf

Water Related Disasters and Sustainable Management

Table: Countries most affected by water related disasters (1900-2005) sorted by number of people killed and affected

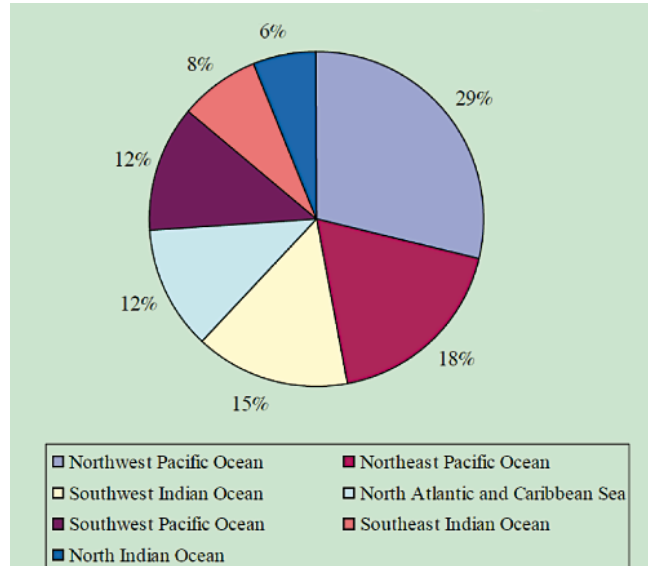
Country	Date	Killed	Country	Date	People Affected
China P Rep	Jul 1931	3,700,000	China P Rep	6 Aug 1998	238,973,000
China P Rep	Jul 1959	2,000,000	China P Rep	18 May 1991	210,232,227
China P Rep	Jul 1939	500,000	China P Rep	Jun 2002	190,035,257
Indian Ocean	Dec 2004	250,000	China P Rep	Jul 1996	154,634,000
China P Rep	1935	142,000	China P Rep	23 Jun 2003	150,146,000
China P Rep	1911	100,000	India	7 Jul 1993	128,000,000
China P Rep	Jul 1949	57,000	China P Rep	May 1995	114,470,249
Guatemala	Oct 1949	40,000	China P Rep	Jun 1999	101,024,000
China P Rep	Aug 1954	30,000	China P Rep	14 Jul 1989	100,010,000
Venezuela	19 Dec 1999	30,000	China P Rep	Jun 1994	78,974,400
Bangladesh	Jul 1974	28,700	Indian Ocean	Dec 2004	5,000,000

Source: www.fao.org/tsunami/stories/spotlight1005.htm

Tropical cyclones and water related disasters

Tropical cyclones are low pressure systems that develop over warm ocean waters. The world experiences 90 tropical cyclones annually (including typhoons and hurricanes). Most are located in the northwest Pacific Ocean (29%) followed by the northeast Pacific Ocean (18%).

Pie graph: Proportion distribution of tropical cyclone in the world (1968–2003)



Source: www.interacademies.net/Object.File/Master/10/292/Natural%20Disaster%20Mitigation%20-%20A%20Scientific%20and%20Practical%20Approach%20natdismitdec09.pdf

World Meteorological Organisation (WMO) statistics show tropical cyclones, associated with storm surges and torrential rains, are the most destructive hazards in terms of deaths and material losses. For example, a strong storm surge in Bangladesh in 1970 drowned 300,000 people. Also a storm surge near Chittagong, Bangladesh in 1991 caused 10 million disaster victims, 140,000 deaths and over \$3 billion in economic losses. When Tropical storm 'Bilis' blew into China in 2006, 31.94 million people were affected, 843 killed, 208 missing and 3.37 million were relocated. The economic loss reached 34.83 billion RMB.

News: 1931 Central China floods

In Central China in 1931 a series of floods occurred. They were considered the deadliest natural disaster ever recorded, and certainly the deadliest of the 20th century in China. Chinese sources indicated the death toll of the Yangtze River floods at 145,000 and affecting 28.5 million people, while western sources place the death toll from the floods at between 3.7 and 4 million people.



Cyclone Nargis: These houses are right at the water's edge, with open sea behind them. When the water came it covered the roofs of these houses. Photograph by Marianne Jago, AusAID. Source: www.flickr.com/photos/ausaid_photolibrary/3963694747/

According to Webster (2005), the percentages of hurricanes/ typhoons above category 4 in the West Pacific, East Pacific, South Indian Ocean, Southwest Pacific, North Atlantic and North Indian Ocean have increased from 25%, 25%, 18%, 12%, 20% and 8% in 1975-1989 to 41%, 35%, 34%, 28%, 25% and 25% in 1990-2004. This resulted in an increase of 16%, 10%, 16%, 16%, 5% and 17%. According to the Third Assessment Report on Global Climate Change there are indications this increase will continue. It is

Water Related Disasters and Sustainable Management



Hurricane Nargis hit Burma in May 2008, resulting in over 130,000 fatalities. Life returns to normal in Bogale town in the Irrawaddy Delta six weeks after Cyclone Nargis, with houses under repair and small roadside stalls re-opening. However, drainage ditches remain clogged with debris from the cyclone and stagnant pools of water pose an on-going health threat. AusAID provided \$2.5 million to the World Health Organisation (WHO) following Cyclone Nargis to combat disease in the dengue and malaria-prone Irrawaddy Delta. Photograph by Neryl Lewis, RRT. Source: www.flickr.com/photos/ausaid_photolibrary/3405959168/in/set-72157623544486040/

expected in the future, tropical cyclones will increase in intensity, although there are uncertainties regarding the overall frequency of tropical cyclones in a warming world.

In an attempt to reduce the impacts of cyclones and storm surges, surveillance systems have developed disaster prediction technology aimed to provide early warnings. In Cuba and Bangladesh this technology has had a positive impact on disaster mitigation.

Risk, Hazard and Vulnerability

A person's vulnerability to water related disasters/hazards is determined by physical, social, economic, and environmental factors as well as effective government planning and emergency management.

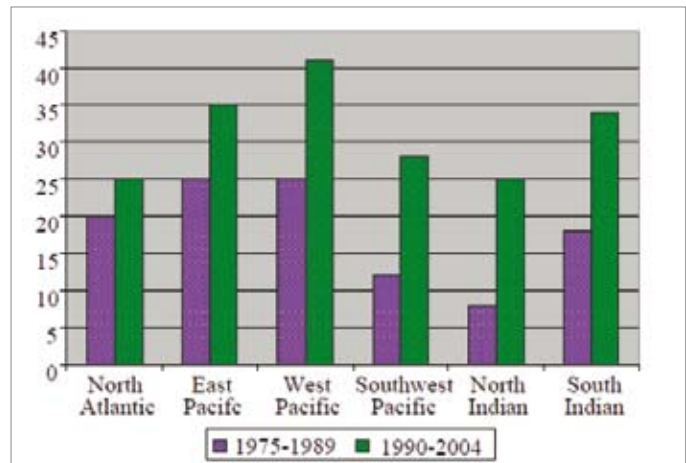
Management of water related disaster risks focuses on the reduction of hazards and vulnerabilities.

$$\text{Risk} = \text{Hazard} \times \text{Vulnerability}$$

In the equation:

- Risk is the probability of harmful consequences, or expected human injury, environmental damage, loss of life, property and livelihood, resulting from interactions between natural or human hazards and vulnerable conditions
- Hazards are natural or human induced damaging events (e.g. floods, cyclones and tsunamis) that can cause a disaster
- Vulnerability is the degree to which a society is susceptible to the impact of hazards (e.g. developing countries, women)

Column graph: Increased percentage of Category 4–5 hurricanes



Source: Webster P. J. et al., *Changes in Tropical Cyclone Number, Duration and Intensity in a Warming Environment*, Science, 309, 1844 (2005)

News: 2005 Hurricane Katrina

On 26 August 2005, a category 5 Hurricane Katrina from the Caribbean landed southeast of Florida. Seven states of the United States suffered from floods. At least 1,836 people lost their lives in the hurricane and in the subsequent floods, making it the deadliest US hurricane since the 1928 Okeechobee hurricane. Total property damage was \$81 billion

The hurricane protection failures in New Orleans prompted a lawsuit against the US Army Corps of Engineers (USACE) the builders of the levee system as mandated in the Flood Control Act of 1965. Five years later, thousands of displaced residents in Mississippi and Louisiana are still living in trailers.

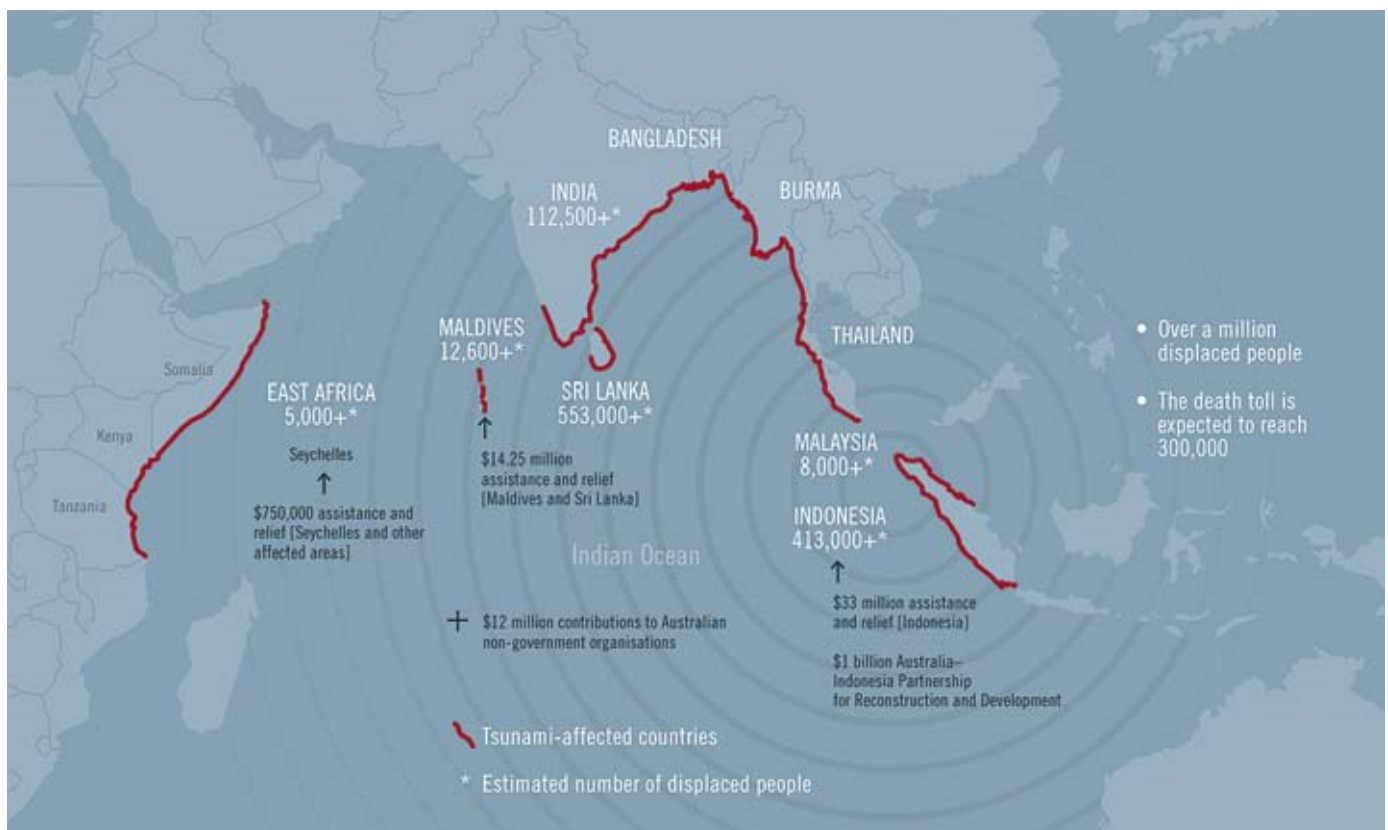
Today, the reason why most water related disasters cause fewer casualties (*reduced risk*) is because people living in disaster-prone areas have learned to cope with floods, by either reducing the *hazard* or its *vulnerability*. However, the victims of the Indonesian tsunami in 2005 were unaware of the warning signals, such as the receding sea, and therefore had not learnt to cope with this *tsunami-disaster*. They were consequently unprepared and therefore *vulnerable*. With an unpredictable *tsunami-hazard*, little can be done to block the waves, but integrated coastal area management (ICAM) aims to diminish the impact of the waves and an early warning system could reduce *vulnerability*. Today national and local governments and supporting organisations are more aware of the *hazard* and its *risks* to *vulnerable* people living in low lying coastal areas.

Water Related Disasters and Sustainable Management

Geofacts: Tsunami

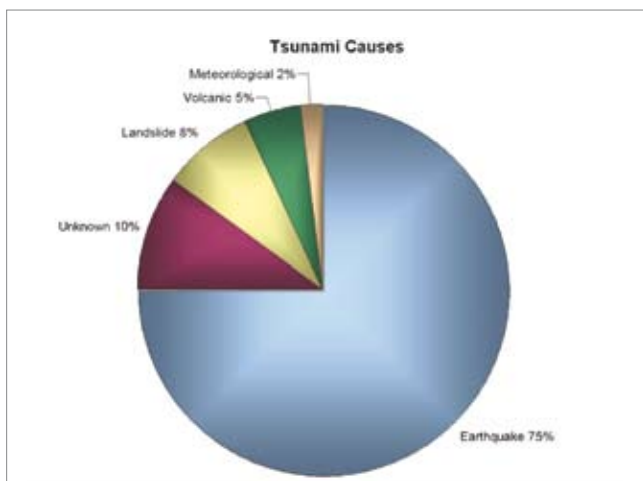
Tsunami means sea wave with ultra-large wave length and cycle induced by vibrations from undersea movement such as an earthquake. Tsunamis are not new. For example an earthquake tsunami occurred in the sea near the Jamaican Royal Port on 7 June 1692, causing 3000 deaths. A tsunami was triggered by the eruption of Krakatoa a volcano in Indonesian on 26 August 1883. The 42 metre high tsunami wave attacked the sea coast, caused 30,000 deaths and destroyed 295 villages and small towns.

Map: Coastal areas affected by the Indonesian tsunami 2004



Source: www.aid.gov.au/publications/focus/tsunami/focus_tsunami.pdf

Pie graph: Causes of tsunamis



Source: www.ga.gov.au/hazards/tsunami/gallery.jsp?id=GA9549



A fishing boat stranded after the Indonesian tsunami 2004. The fishing industry which was devastated by the tsunami has been rebuilt. Photograph courtesy of AusAID. Source: www.flickr.com/photos/ausaid_photolibrary/4207497277/in/set-72157623544486040/

Water Related Disasters and Sustainable Management

Poverty and water related disasters

Poverty and disaster *vulnerability* are mutually reinforcing. Factors such as low income, poor housing, and lack of social security, public services and insurance force the poor to behave in ways that expose them to greater *risk*. They are also less able to anticipate, survive and recover from the effects of water related disasters such as massive floods caused by a cyclone or a tsunami. From 1975 to 2000, over 90% of all deaths from natural disasters were attributed to water related disasters, and people who belonged to the low-income category accounted for 50% of those killed in floods.

Poverty and disaster *vulnerability* form a 'negative feedback' cycle. For example if a water related disaster strikes, the level of poverty in the community increases, leading to increased *vulnerability* and disaster *risk*. As the impacts of water related disasters tend to fall disproportionately on the poor, poverty is a key dimension of disaster risk management.

Gender issues

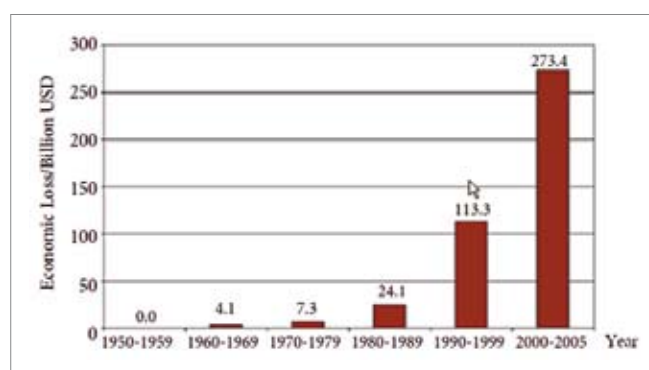
The elderly, disabled, children and women are particularly *vulnerable* to water related disasters. Women die disproportionately in water related disasters, if they do not receive timely warnings or other information about *hazards* and *risks*, or are prevented from acting on them. Their mobility in disasters may be restricted by culture or socio-economic constraints. Gender-biased attitudes and stereotypes can extend the time for a woman's recovery, especially if a woman does not seek or does not receive timely care for physical and mental trauma experienced in disasters (United Nations, 2001).

The need to stimulate community involvement and empowerment of women at all stages of water related disaster management programs is integral to reducing community *vulnerability* to the disaster.

Economic aspects of water related disasters

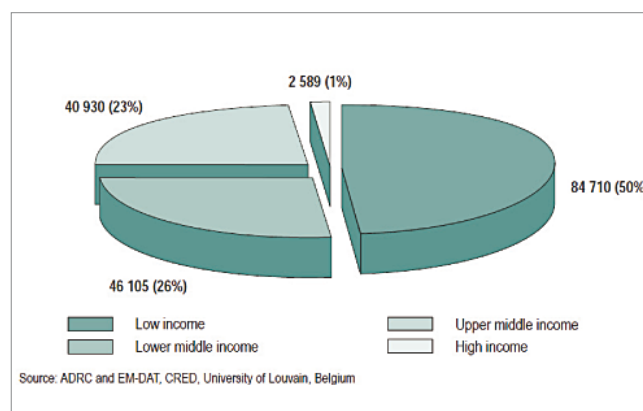
The number of major water related disasters and damages increased over the last decade - a trend likely to continue unless action is taken to mitigate their impacts.

Column graph: Economic loss caused by tropical cyclone every ten years in the world (1950–2005)



Source: Munich Re NatCatSERVICE

Pie graph: Number of people killed in floods by income class, 1975–2001



Poor women at risk. Banda Aceh, Indonesia, 2005. A female survivor of the Indian Ocean tsunami searches in vain for something worth keeping. In some villages up to 80 per cent of those who died were women. AusAID has funded several programs to help relieve financial and social burdens on female survivors and to protect them from discrimination and violence. Photograph courtesy of Caritas. Source: www.ausaid.gov.au/publications/focus/may07/focus_may07_5.pdf

Risk sharing and risk transfer at national, community and household levels can help reduce losses, improve resilience and contribute to expeditious recovery. Insurance helps spread the risk of disasters across society and can improve the situation of individuals by compensation. For example, in Mozambique insurance companies and banks are active participants in the national disaster management system.

The amount of catastrophe insurance purchased in the world insurance markets increased 34% from 1997 to 2000. Most of the insurance claimed for water related disasters was by developed countries. For example the United States, United Kingdom and Japan accounted for 55% of the total claims. Asia, which represented half of all the damages and two-thirds of all the casualties, owned only 8% of the insurance coverage for catastrophes purchased in the world market. The remainder of the costs fell either to the government or victims, with some limited relief from international aid agencies.

Water Related Disasters and Sustainable Management

Sustainable management

Sustainable cooperative plans between international organisations, government institutions, private organisations, civil societies and stakeholders are required to reduce the risk, vulnerable societies face from water related hazards. Today most communities are provided with the mechanisms and tools to cope with water related hazards. Low-cost solutions used at the village level enable local communities to foresee and prepare for a coming flood, cyclone, tsunami or storm surge. The African Centre of Meteorological Application for Development (ACMAD) takes advantage of human resources at the village level to reduce risk. For example communication methods include wind-up radios which transmit a forecasted hazard to the village. Local authorities also use high technology (data display and exchange using the Internet) and basic technology (poster display) to inform communities about the potential impacts of droughts or floods. This technology has aided farmers to reduce the impact of water related hazards in Africa.

Earth Observation (EO) technologies utilise information from space and airborne systems through sensors and has been an advantage for predicting water related hazards and helping with disaster relief. Examples of EO include the thousands of data buoys operating in the world's oceans, hundreds of thousands of land-based environment monitoring stations, tens of thousands of observations by radio and aircraft, and over 50 environmental satellites orbiting the globe.

The present era of globalisation has helped increase awareness that water related hazards can happen in any society and that preventative disaster mitigation is preferable to loss of lives and properties. Research found for every \$1 spent on preventative disaster mitigation it resulted in an \$8 reduction in losses (Abramovitz, 2001). Since 2001, the UN International Day for Disaster Reduction (IDDR) is observed, as a vehicle to promote a global culture that supports the reduction of natural disasters, including disaster prevention, mitigation and preparedness.

Confronting global warming requires international cooperation and the involvement of all stakeholders at the local, national, regional and global scales.



The island of Kiribati is particularly vulnerable to sea level rise. AusAID is helping the people of Kiribati prepare for the effects of climate change. Photograph by Jodi Gatfield, AusAID Source: www.ausaid.gov.au/publications/focus/oct09/FocusOct09.pdf

References

- Associated Programme on Flood Management (APFM) – www.wmo.ch/apfm/; www.wmo.ch; www.gwpforum.org
- Centre for Research on the Epidemiology of Disasters (CRED), Catholic University of Louvain, Belgium – www.cred.be
- Dialogue on Water and Climate – www.wac.ihe.nl/home.html
- Floods Australia – www.bom.gov.au/lam/climate/levelthree/c20thc/flood.htm
- International Year of Fresh Water – www.wateryear2003.org/
- Natural Hazards Center and HazLit – www.colorado.edu/hazards/
- Pan-American Health Organization (PAHO) – Disasters and Humanitarian Assistance – www.paho.org/disasters
- Reliefweb – www.reliefweb.int
- UNESCO Water Portal – www.unesco.org/water/
- UN Water Assessment Program – www.unwater.org/downloads/181793E.pdf
- Water Media Network – www.worldbank.org/wbi/sdwatermedianetwork/index.html
- Water related disaster websites – www.unisdr.org/eng/public_aware/world_camp/2003/english/4_Websites_eng.pdf
- World Water Assessment Program – www.unesco.org/water/wwap/facts_figures/managing_risks.shtml
- World Water Council – www.worldwatercouncil.org



Source: www.ga.gov.au/hazards/gallery.jsp?id=GA9549

Digital resources for Geography

Sally Watts, Chief Learning Design Officer (HSIE), Learning Design and Services,
Centre for Learning Innovation, NSW Department of Education and Training

Pauline Sheppard, Senior Curriculum Adviser HSIE 7-12,
Curriculum Support Directorate, NSW Department of Education and Training

Opportunities to use computers and the Internet in schools are increasing rapidly so it's becoming more practically possible for teachers and students to take advantage of the online digital resources that are available.

The online digital resources described here, have been produced by The Centre for Learning Innovation and Curriculum K-12 Directorate of the NSW Department of Education and Training. All projects have been developed as a response to the needs of teachers and with their ongoing input into reference groups. The resources are rigorously tested for standards of interoperability and accessibility to ensure they will work for teachers and students. Copyright is fully cleared for those resources that are available over the Internet. Others are cleared only for use within the DET network. While all resources are applicable to NSW Syllabuses, more flexibility is being built into new resources with a view to being useful nationally.

The choices and purposes for using digital resources will vary, for example the About fieldwork resource may be used prior to a fieldwork activity, in order to provide background for what students will observe and do there, including the data collection, saving time during the visit. Other resources may be used as an introduction or for independent self-paced work.

There is a range of types of resource, some covering complete syllabus topics and others focusing on parts of topics. Where they are student targeted, teacher notes are usually included. Teachers can select the parts of the resources and the ways to use them as relevant to their programs and the hardware available to them. This may include laptops, computer labs, IWBs or projectors for teacher directed, student directed, individual or group work.

The future of digital resources may include more virtual tours, games and simulations, and virtual worlds that allow interaction between students as new capabilities and opportunities emerge. More possibilities are opening up for use of mobile devices such as smart phones to allow students to access, capture and exchange media, information and communications.

The challenge is in the way teachers and students use these opportunities to enhance what they do in the teaching and learning process.

Following is a list of geography resources created by DET and accessible through the DET Teaching and Learning Exchange (TaLe) at www.tale.edu.au. Resources created by other organisations are also searchable through TaLe. The Parent and Community section provides public access and the Secondary or Primary sections require DET login. Some are also available for purchase.

about fieldwork

NEW SOUTH WALES
DEPARTMENT
OF EDUCATION
AND TRAINING

starting out

- direction
- distance
- topography
- clouds
- rainfall
- air
- humidity
- wind
- vegetation
- soil
- water
- location
- observation
- interviews
- surveys
- what next?

Text version | Accessibility | Technical requirements | Help | Teacher notes | Copyright

Digital resources for Geography

Resources

About fieldwork Stages 4–6

Information about a selection of fieldwork tools, what they are used for and how they are used. Students can become familiar with the use of fieldwork tools and select the ones they need before undertaking studies in the field. Available to all on TaLe through 'Parents and Community' or through 'Secondary' DET.

How eco-friendly are you? Stage 4

This resource is an overview of global geographical issues such as climate change. It includes a 'think globally, act locally' approach, interactive Flash activities, animations, literacy and problem-solving tasks and quizzes. Available through TaLe to DET only and for public purchase at: www.cli.nsw.edu.au/shop/shop.htm or Direct Mail Sales 02 9715 8222



Change the world Stage 4

This resource explores the factors that influence people's quality of life throughout the world. It includes an interactive mapping tool using data, links to animated maps, a quality of life survey tool, activities on global citizenship based on the Millennium Development Goals. Available through TaLe to DET only and for public purchase at: www.cli.nsw.edu.au/shop/shop.htm or Direct Mail Sales 02 9715 8222

Going global Stage 4

This resource explores the changing nature of the world with an emphasis on the impacts of globalisation. It includes a global bingo game, an interactive diagram of the global connections found in a typical Australian home, and video clips with related questions and activities. Available through TaLe to DET only and for public purchase at: www.cli.nsw.edu.au/shop/shop.htm or Direct Mail Sales 02 9715 8222

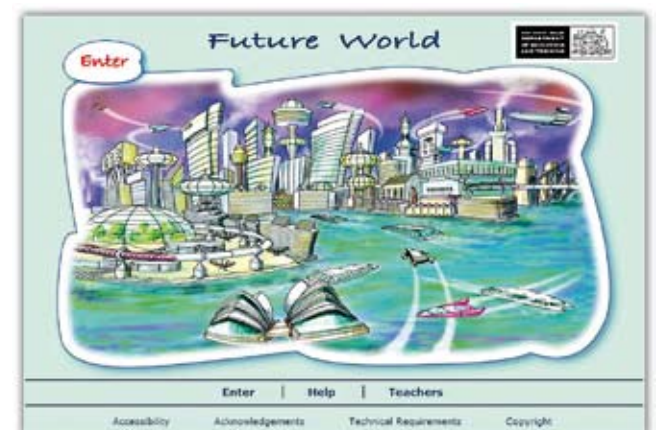
About GIS Stages 4–5

An introduction to the use of Geographic Information Systems (GIS) linking to the Mapzone website. Includes demonstrations of the usefulness of GIS in solving everyday problems, GIS Missions such as flood control, video clips of GIS consultants at work in an Australian context, and links to data/applications to support the use of GIS in the classroom. Available through TaLe for DET only



Future world Stage 5

How trends in population shape our future world. It includes a population pyramid generator, an interactive map on urban planning, video clips on ecological sustainability, questions and activities and a text builder activity. Available through TaLe to DET only and for public purchase at: www.cli.nsw.edu.au/shop/shop.htm or Direct Mail Sales 02 9715 8222



Fire challenge Stage 5

The resource, produced in collaboration with NSW Rural Fire Service, puts students in the role of fire fighters in a bushfire scenario. Students use geographical skills and tools such as map reading. It includes maps, worksheets, audio and video, animations of fire behaviour and weather, a graphic calculator of the rate of fire spread, and an interactive activity about preparation of a property for fire season. Available through TaLe to DET only and for public purchase at: www.cli.nsw.edu.au/shop/shop.htm or Direct Mail Sales 02 9715 8222

Sites2See – Geography

Sites2See are single page online resources, on a range of topics, which collect selected links to quality online resources and provide syllabus connections. Some include links to DET only resources.

Digital resources for Geography



Titles for Geography include:

Water education (Stages 4–6)

Resources and information on water as a human right, global water equality, water management and water consumption, with a range of teacher resources for water education from CLI, the Geography Teachers Association and the Australian Government.

Earthquakes (Stages 3–6)

Links to resources on the topic of earthquakes to help explore the human and physical dimensions. Links to maps and interactive activities on plate tectonics, with a particular focus on the Caribbean plate, the movement of which caused the devastating earthquake in Haiti in January 2010.

Global support communities – SurfAid (Stages 3–5)

Surfers have set up a non-government organisation to provide a range of aid to the people of the Mentawai Islands. This resource outlines what sort of aid is given, who is involved in supporting the effort and what students can do to help, with links to other global organisations and related resources.

How can you change the world? (Stages 5 and 6)

Global environments (Stage 4)

Explore global environments through links to a range of sites with information and interactive activities on biomes of the world.

Volcanoes (Stages 3–6)

Links to resources on the physical and historical dimensions of volcanic activity.

Games for sustainability (Stages 3–6)

Game activities teach about actions to take to improve sustainability and reduce ecological footprint.

Reconciliation (Stages 3–6)

A one-page guide to the people, processes, information and events around reconciliation between Aboriginal and Torres Strait Islanders and other Australians.

Green Skills (Stage 6)

Links to key research on climate change and sustainable business practice. Sites and documents are listed under headings from the global to the local, with industry and trades examples of green skills.

The green office (Stages 5–6)

A page with information, case studies and tips for improving resource efficiency in an office. Sites2See are available to all through TaLe 'Parents and Community' and to DET via 'Primary' or 'Secondary'.

Cross-subject resources

Waterworks Geography/Science/English/Visual Arts, (Stages 3–4)

Students learn about the water cycle and the properties of water, geographical research around the issue of water, explore persuasive texts using authentic Sydney Water texts, and work towards creating a sculpture on the theme of water. Available through TaLe to DET only and for public purchase at: www.cli.nsw.edu.au/shop/shop.htm or Direct Mail Sales 02 9715 8222

International India History/Geography (Stage 4)

International India – Colonisation to globalisation identifies the strong relationship between India's history and geography. Students explore the changing face of the nation, from its pre-colonial times to the effects globalisation on this culturally rich nation. It includes audio and video, case studies and interactive learning activities to develop skills. Available to all on TaLe through 'Parents and Community'.

Digital resources for Geography

Making a difference Commerce/History/Geography/ Legal Studies, Stage 5

Four case studies explore stories that illustrate issues of civics and citizenship and local, state, federal government and international levels. Students learn about active citizenship and plan their own, while covering content such as the Freedom Rides, Franklin Dam, Mabo, Wik and human rights. Available to all on TaLe through 'Parents and Community' or through 'Secondary' DET.

Murder under the microscope Stages 3–5

An online environmental game for school students in Years 5 to 10.

An environmental crime has been committed. Clues are uncovered during the competition via the Murder under the Microscope website. Teams research and analyse the evidence to solve the crime. The project culminates with the students submitting an action plan into the Connected Learning Awards to demonstrate the actions they are going to take to protect the environment. The games from previous years are accessible on the websites for use after the competition has closed. (Available internationally, an entry fee applies)



Using student laptops in the study of Geography

While the availability of the DER-NSW student laptops and the new software opens up many opportunities for using computer technology in teaching and learning, it also raises many issues of training, management, pedagogy and politics which present a challenge to students, teachers and school leaders. The Centre for Learning Innovation and Curriculum Support Directorate have provided a range of materials for students and teachers to help meet the challenges and take advantage of the opportunities.

Laptop wraps

A collection of single page resources designed for use on the DER-NSW student laptops. The wraps link to existing resources and provide activities that employ the software available on the laptops for relevant purposes. (Some links may be to DET only). Topics for Geography so far include:



Australia's Aid (Stage 5)

A page with a focus on aid, as one of Australia's regional and global links. With supporting activities, such as the collection of data, construction of a graph, a writing task and links to resources.

My future community (Stage 5)

A page with a focus on using geographical data to plan for future community needs, with supporting activities and links to resources.

Urban growth and decline (Stage 5 and 6)

A page with a focus on urban growth and decline as an issue in Australian environments with supporting activities and links to resources.

The shape of our population

(was: *What makes Australia unique?*) (Stage 5)

A page with a focus on demographic characteristics and population pyramids with supporting activities and links to resources.

Migrants on the move (Stage 5)

A page with a focus on types and patterns of migration with supporting activities and links to resources.

The Stolen Generations (Stage 5)

A page with a focus on the experiences of the Stolen Generations with supporting activities and links to resources.

Mapping it out (Stage 4 to 6)

A page with a focus on creating a virtual tour of an outdoor space, with supporting activities and links to resources.

Coming:

- Human rights and wrongs
- The reconciliation record
- Take me touring
- The Freedom Rides
- Rainforest reversal
- The reconciliation record
- Careful with the coral.

Digital resources for Geography



Help for creating your own digital resources

Tools4U

A collection of single-page teacher guides for using software available in the CLI DER-NSW laptop program, with suggestions for the usefulness and purpose of the software. Topics so far include: Adobe Dreamweaver CS4, Word 2007, Adobe Captivate, Adobe Premier Elements 7, Windows 7, Adobe Photoshop Elements, Adobe Presenter, Adobe Acrobat Pro, Microsoft OneNote, SMART Notebook, Audacity. Available to all through TaLe.

UCreate

This collection of resources helps you create digital resources using a range of software applications available in the DER-NSW laptop program. The resources include links to online tutorials and other websites which explore the use of the resources to enhance teaching and learning outcomes. Topics so far include: a slideshow, a digital portfolio, a laptop wrap, a video podcast, diagrams, an audio podcast. Available to all through TaLe.

Sites2See: *Copyright for teachers*

Information about copyright and Creative Commons for teachers, with links to resources, including sites to find images, video, music and sounds online you can use in the classroom. Available to all through TaLe.

ICT for Teaching and Learning

This website supports teachers in their professional development of ICT skills and in the application of these skills in their teaching practice. Modules cover: Creating effects (with images); Manipulating digital images; Creating digital stories; Developing digital games; Compiling databases; Creating spreadsheets; Extracting video; Creating wikis and blogs. Available to all through TaLe.

For more information on any of these sites contact: sally.watts@det.nsw.edu.au.

Support for teachers

NSW DET Curriculum Support has developed a range of resources that are available on the Curriculum Support HSIE Digital Education Revolution (DER) website, as well as through TaLe.

The resources have been developed to support the deployment of DER laptops in schools across the state and to ensure that teachers have access to support and training in the use of ICT that enables enrichment of student learning.

Teachers can use annotated programs and stand-alone ICT based lessons that utilise the capabilities of software included on DER student laptops as well as exploring the infinite teaching resource possibilities of the Internet.

Professional learning activities for faculty leaders and support materials provide advice for teachers working with DER laptops in the classroom. More resources are in development.

The Curriculum Support DER website includes:

- Stage 5 Geography, Focus Area 5A1 Investigating Australia's Physical Environments
- Stage 5 Annotated Program for 5A2 Changing Australian Communities, showing where digital resources can be incorporated
- Links4Learning – selected weblinks relevant to Geography 7-12 topics
- Professional Learning on: Leading my faculty, Workshops (support materials) and Advice for Teachers.

Website: www.curriculumsupport.education.nsw.gov.au/digital_rev/hsie/index.htm For more information on teacher support contact: pauline.sheppard@det.nsw.edu.au.



Geography Teachers' Association of NSW

ARTHUR PHILLIP AWARDS 2010

GEOGRAPHY FIELDWORK COMPETITION

The Geography Teachers' Association of NSW (GTA NSW) organises an annual competition for students and schools to foster an enthusiasm for Geography through engagement and rewards. The emphasis of the competition is fieldwork and the gathering of primary data as part of authentic research in geography.

The competition is open to all secondary schools, both members and non-members of GTA NSW.

All the categories of the competition are based on the research action plan outlined in the syllabus on page 17 of the Years 7–10 Geography syllabus. The steps of this research plan have also been applied to the senior Geography course for the purposes of this competition and fit neatly with the Senior Geography Project.

NATURE OF THE COMPETITIONS

1. **The GTA Fieldwork and Visual Presentation Competition (Years 7–9)**
 - choose a relevant topic
 - undertake fieldwork to gather primary data
 - support fieldwork with secondary data if required
 - analyse gathered data
 - present research findings as a visual presentation (digital or poster)
2. **The Global Education Research (Fieldwork) Competition (Years 7–12)**
Three categories: Stage 4, Stage 5, Stage 6
 - choose a relevant global geography topic
 - undertake research (may include fieldwork)
 - analyse data gathered
 - present research findings in a digital form
 - propose individual or group action in response to findings
3. **The Dr Don Biddle Issues in Australian Environments Fieldwork Competition (Year 10 only)**
 - undertake research into a relevant issue in NSW, using fieldwork to gather primary data
 - support fieldwork with secondary data if required
 - analyse data gathered
 - present research findings
 - propose individual or group action in response to findings



Geography Teachers' Association of NSW

ARTHUR PHILLIP AWARDS 2010

NATURE OF THE COMPETITIONS

4. The Brock Rowe Senior Geography Project Fieldwork Competition (Year 11 only)

- undertake a Senior Geography Project, using fieldwork to gather primary data
- support fieldwork with secondary data if required
- analyse data gathered
- present research findings
- propose individual or group action in response to findings

5. The Water for Life Fieldwork Competition (Years 7–10)

- undertake research into a relevant water issue in NSW, using fieldwork to gather primary data
- support fieldwork with secondary data if required
- analyse data gathered
- present research findings
- propose individual or group action in response to findings

6. The Dr Maurine Goldston-Morris Civic and Citizenship Awards

There will be Civics and Citizenship Awards available for entries that demonstrate action has occurred at either the individual or group level, as a result of the research/fieldwork activity. Awards may be allocated to the best action taken in Stages 4, 5 and 6.

7. The Dr Maurine Goldston-Morris Teacher Awards

These will be allocated to teachers for outstanding involvement in the Geography Fieldwork Competition during 2010.



ARTHUR PHILLIP AWARDS 2010

INFORMATION

ENTRIES

GTA Member schools – \$3.30 per entry (incl GST)

Non-member schools – \$6.60 per entry (incl GST)

Each school can submit up to FOUR (4) entries in each section. Final date for entries to be received is **Friday 19th November 2010**.

All entries **MUST** have an *Entry Form* (see over page) fully completed and securely attached to be considered. Make sure the correct section is indicated on the entry form.

Entries should be sent or delivered to:

GTA NSW Office
Block B, Leichhardt Public School grounds
Corner Norton and Marion Streets
101 – 105 Norton St, Leichhardt 2040

Enquiries via email to Carmel Logalbo, carmel.logalbo@ptc.nsw.edu.au

All packages should be clearly marked as **Geography Fieldwork Competition**.

Entries may be in a book or loose leaves (with reinforced rings), mounted on cardboard (limit 2 sheets of 65 x 55cm), PowerPoint presentation (max slide number 20) or a webpage. No models will be accepted.

All entries will be available for collection at the end of the award ceremony. GTA NSW is unable to return uncollected entries to schools.

SCHOOL REGISTRATION AND PAYMENT

Teachers will need to obtain the *School Registration and Payment Form* on the GTA NSW website at: www.gtansw.org.au. This form must be completed for the full set of student entries being submitted from the school. Payment for ALL student entries must accompany this form. This form and payment must be attached to the set of entries to be eligible for judging.

PRIZES

Prizes are substantial and vary according to section and prize donors. The Civics and Citizenship Awards are major awards.

AWARDS

Each student who submits an entry will receive a *Certificate of Commendation*.

Awards will be allocated to each section according to criteria. The presentation of awards will be at a special ceremony in February 2011.



ARTHUR PHILLIP AWARDS 2010 GEOGRAPHY FIELDWORK COMPETITION

ENTRY FORM

This form **MUST** be fully completed and securely attached to each entry. *(One form per entry – please photocopy)*

**PLEASE
PRINT
CLEARLY**

EACH SCHOOL CAN SUBMIT UP TO FOUR ENTRIES IN EACH SECTION

STUDENT (full name)

SCHOOL

SCHOOL YEAR **TEACHER**

SECTION *(Please tick **ONE** section only)*

- ☐ 1. The GTA Fieldwork and Visual Presentation Competition
- ☐ 2. The Global Education Fieldwork and Research Competition
- ☐ 3. The Dr Don Biddle Issues in Australian Environments Fieldwork Competition
- ☐ 4. The Brock Rowe Senior Geography Project Fieldwork Competition
- ☐ 5. The Water for Life Fieldwork Competition

**ONLY ONE
SECTION TO
BE SELECTED**

TITLE OF ENTRY

SYNOPSIS

.....

.....

.....

CERTIFICATE OF ORIGINALITY

I certify that this is all my original work:

.....
Student's name

.....
Student's signature

.....
Date

.....
Teacher's name

.....
Teacher's signature

.....
Date

ALL ENTRIES MUST BE RECEIVED BY CLOSE OF BUSINESS ON FRIDAY 19th NOVEMBER 2010

ACT Sub-branch Report



Participants at the What is Geography workshop

Geography teachers from the ACT and regional NSW recently voted to join the NSW GTA as a sub branch. They have since met several times this year to discuss the state of Geography and how best to support their teachers. There has not been an organisation that has serviced ACT geography teachers' specific needs for many years.

There have been two workshop days, led by local teachers and targeting basic geographic teaching methods as well as providing a network of support for all teachers of geography.

The first workshop for Canberra in March this year, What is Geography? was designed specifically for teachers without a background in geography. This is a real concern for ACT teachers as we move toward a National Geography Curriculum in the coming years.

The program offered interesting lecture style information on the teaching of geography as a discipline by Dr John Field from ANU, who maintained our interest with personal anecdotes and practical information we could use in the classroom. Nick Hutchinson also spoke about the relevance of teaching Geography and how it had changed over time. Nick shared many of his precious resources with us and gave us some teaching ideas to take away and apply. He unashamedly reminded us that the only ones who are going to inspire us to teach Geography well is us – a sobering thought!

During the day we were also offered practical ideas from Graeme Sixsmith who has taught at Karabar High School in Queanbeyan for over 30 years and Sandy Goddard who has taught Geography at Canberra Grammar School for many years. Graeme engaged us with ideas for a local field trip to the waste management facilities in the Queanbeyan and Canberra areas and on local places where we could take students to show them an awareness of land and water management systems. Sandy inspired us with the idea for a local suburb study that he undertakes with year seven students, as well as taking us through a field trip of



Nick Hutchinson presenting at the What is Geography workshop

Carol Pogson, Coordinator
ACT Sub-branch of GTA NSW

local areas in Canberra. Dr Anne Holland from Canberra Girls Grammar School and Karen Tuhan from Alfred Deakin High School shared some examples of how they teach mapping and climate graphs to their students.

To conclude the day Nick Hutchinson gave a presentation on the progress of the National Geography Curriculum, which was of interest to all.

The workshop was well attended by teachers in both government and non-government schools and from around the district. In that respect the day was a great success and achieved one of our aims. We thank the tireless work of Deirdre Geelan and Sally Alexander from the Curriculum Support section of ACT DET, Sue Field from GTA NSW for all her organisation from Sydney and Carol Pogson (Canberra Grammar School) who kept us focussed and on time.

The day was a great success as there was something for everyone, both beginning and experienced, with practical examples and even a bag of goodies prepared by Curriculum Support.

Right: What is Geography workshop Karen Tuhan presenting



Left: What is Geography workshop Graeme Sixsmith presenting

Some quotes from the participants were:

'Very informative and useful.'

'Thank you for organising this workshop. it is good to network with other teachers in the same discipline.'

'I would like more workshops like this...you couldn't have covered any more. thank so much - very worthwhile.'

'The teaching skills sessions...were very specific and helped greatly....however Nick, Sandy and Graeme were equally fantastic [and] inspirational.'

...engaging, informative and relevant to the classroom and the local area.'

'The PD really gave me a chance to see what the subject was about, and I came away from it with quite a few ideas about how I might be able to improve my Year 8 and Year 10 Geography curricula. I spent most of the weekend in a frenzy of work because of some of the ideas I came away with on Friday, and I am really excited about implementing some of these changes in my class.'

Advice to contributors

1. **Objective:** The *Geography Bulletin* is the quarterly journal of the New South Wales Geography Teachers' Association, Inc. The role of the *Geography Bulletin* is to disseminate up-to-date geographical information and to widen access to new geographic teaching ideas and methods. Articles of interest to teachers and students of geography in both secondary and tertiary institutions are invited, and contributions of factually correct, informed analyses, and case studies suitable for use in secondary schools are particularly welcomed.
2. **Content:** Articles, not normally exceeding 5000 words (no minimum specification), should be submitted to the Editor at the following address:
PO Box 577, Leichhardt, NSW, 2040

Articles are welcomed from tertiary and secondary teachers, students, business and government representatives. Articles may also be solicited from time to time. Articles submitted will be evaluated according to their ability to meet the objectives outlined above.
3. **Format:** An original on disk plus one hard copy should be submitted. Tables should be on separate pages, one per page, and figures should be clearly drawn, one per page, in black on opaque paper suitable for photographing. Photographs should be on glossy paper, and strong in contrast. An indication should be given in the text of approximate location of tables, figures and photographs. Every illustration needs a caption.
4. **Title:** The title should be short, yet clear and descriptive. The author's name should appear in full, together with a full title of position held and location of employment.
5. **Covering Letter:** A covering letter, with return forwarding address should accompany all submitted articles. If the manuscript has been submitted to another journal, this should be stated clearly.
6. **Photo of Contributor:** Contributors should enclose a passport-type photograph and a brief biographical statement.
7. **References:** References should follow the conventional author-date format:
Abbott, B. K. (1980) *The Historical and Geographical Development of Muswellbrook* Newcastle: Hunter Valley Press.
Harrison, T. L. (1973a) *Railway to Jugiong* Adelaide: The Rosebud Press. (2nd Ed.)
Harrison, T. L. (1973b) The Spatial Distribution of Macadamia Plantations on the Far North Coast of New South Wales, *Journal of Rural and Agricultural Problems*, 13, 4, Oct. pp. 347–359.
O'Donovan, M. J., et. al. (1980) "Animal life in the North Star District of New South Wales". In W.W. Murphy, (Ed.) *Readings in Regional Geography* (Vol. 2), Sydney: Williams and Sons.
8. **Italics** should be indicated by underlining.
9. **Spelling** should follow the *Macquarie Dictionary*, and Australian place names should follow the Geographical Place Names Board for the appropriate state.



Dunn's Swamp, Rylstone NSW. Photo by J. Sillar

Books for review should be sent to:

Mr John Lewis, Review Editor,
The GTA NSW Office
PO Box 577
Leichhardt NSW 2040

Deadlines for articles and advertising

Issue 1 – 1 December

Issue 2 – 1 March

Issue 3 – 1 May

Issue 4 – 1 August

Notice to Advertisers

'Geography Bulletin' welcomes advertisements concerning publications, resources, workshops, etc. relevant to geography education.

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Special issues \$649.00

HALF PAGE (18 x 13cm or 26 x 8.5cm) – \$214.50
Special Issues \$382.80

QUARTER PAGE (13 x 8.5cm or 18 x 6.5cm) – \$132.00
Special issues \$242.00

INSERTS (A4 supplied) – \$374.00
All prices include GST

Advertising bookings should be directed to:

Carmel Logalbo, GTA NSW Office
Telephone: (02) 9564 3322
Fax: (02) 9564 2342
Email: carmel.logalbo@ptc.nsw.edu.au

EDITORIAL POLICY

Editorial policy attempts to:

- promote material which will assist the study and teaching of geography
- encourage teachers to share their ideas on teaching geography
- provide a means by which teachers can publish articles
- inform readers of developments in geographical education

Articles are sought reflecting research and innovations in teaching practices in schools. From time to time issues of the Bulletin address specific themes.

Refereeing

All suitable manuscripts submitted to the Geography Bulletin are subject to the process of review. The authors and contributors alone are responsible for the opinions expressed in their articles and while reasonable checks are made to ensure the accuracy of all statements, neither the editor nor the Geography Teachers' Association of New South Wales Inc accepts responsibility for statements or opinions expressed herein.

