Chapter 2 Preventing Beach Pollution

Sources of bacterial contamination

The sources of bacterial pollution in waters monitored by Beachwatch are varied. Water quality is affected by a combination of human activities and environmental factors. Factors such as rainfall, catchment characteristics, tidal flushing rate, sunshine (UV radiation) and surf dynamics can significantly alter bacterial levels between sites.

Effect of rainfall

Rainfall has an important effect on flow rates in sewerage systems and stormwater drains. Each beach has a different response depending on the catchment area, the extent and stage of development, and the condition of the sewerage system.

In general, faecal contamination increases with rainfall, but some beaches appear to reach a rainfall threshold above which faecal contamination rises rapidly (for example, North Curl Curl Beach), whereas others exhibit an apparent log-linear response (for example, Bronte Beach). Others appear to be largely unaffected by rainfall (for example, Box Beach).

Stormwater

High rainfall increases the flow in the drains that transport stormwater runoff to receiving waters. This runoff contains pollutants from diffuse catchment sources (urban runoff) as well as sewer overflows and sewer exfiltration. Urban runoff generally contains the artificial and natural compounds found in, or derived from, the catchment.

Visual stormwater pollution is an element of urban runoff and is a combination of street litter and organic matter that has accumulated in the catchment before being flushed into the receiving waters during rain. Substances frequently transported in urban stormwater runoff include:

- silt and organic or inorganic suspended particles
- sewage from overflows and leakages in the sewerage system
- animal faecal waste (for example, dog droppings)
- oils, greases and surfactants from roadways and industrial and domestic sites
- plant fertilisers, pesticides and chemicals from building sites and gardens
- litter (including rubbish and leaf litter, grass clippings and twigs).

The amount of runoff is determined by factors such as geology, topography, the proportion of impervious surfaces in a catchment and soil saturation. The constituents of runoff are generally related to the type and density of development in the catchment. Urban runoff is typified by large volumes of fast-flowing turbid water entering drains within minutes of a rain event and eventually draining into the local creeks, rivers and harbours and on to beaches.

Sewage treatment plants

Sydney cliff-face sewage outfalls

Warriewood and Cronulla are the only two remaining coastal sewage treatment plants in the Sydney region that discharge treated sewage from cliff-face outfalls.

Warriewood Sewage Treatment Plant, located on the Northern Beaches, discharges sewage treated to a secondary level with disinfection from Turimetta Head.

Cronulla Sewage Treatment Plant discharges sewage treated to a tertiary level with ultraviolet disinfection at Potter Point, on the Kurnell Peninsula. Prior to April 2001, Cronulla Sewage Treatment Plant discharged primary treated sewage and was a significant source of pollution affecting Cronulla beaches.

Untreated sewage from Watsons Bay, Vaucluse, Diamond Bay, Rose Bay North and parts of Dover Heights is discharged to the Tasman Sea from three cliff-face outfalls at Vaucluse, Diamond Bay and Diamond Bay South. The volume of untreated sewage discharged is approximately 3.6 million litres per day, or 0.3% of Sydney's sewage (Sydney Water 2002 and 2003).

Sydney deepwater ocean outfalls

Results presented in previous Beachwatch season reports have shown that Sydney's ocean beach water quality has vastly improved since the commissioning of the deepwater ocean sewage outfalls in the early 1990s. The deepwater ocean outfall system was designed to improve dilution and divert sewage from the cliff-face outfalls, transporting primary-treated sewage from Sydney's sewage treatment plants at North Head, Bondi and Malabar to the ocean outfalls two to four kilometres out to sea at depths of 60 to 80 metres.

Since the commissioning of the deepwater ocean outfall system, visible sewage indicators and bacterial levels at Sydney's northern and city ocean beaches have been dramatically lowered (EPA 1995 and 1996). Elevated levels of bacterial indicators are still detected at some beaches after intense rainfall owing to the impacts of stormwater, sewage overflows and (on occasion) sewage treatment plant bypasses.

Hunter region sewage treatment plants

Hunter Water operates 17 sewage treatment plants in the Hunter region, with three ocean outfall plants (Boulder Bay, Burwood Beach, and Belmont).

Illawarra region sewage treatment plants

Sydney Water operates three coastal sewage treatment plants in the Illawarra, located at Wollongong, Shellharbour and Bombo.

Bellambi and Port Kembla sewage treatment plants have been converted to specialised storm-flow plants that will store and treat wastewater during large wet weather events but do not operate during dry weather.

The Gerringong-Gerroa Sewage Treatment Plant is operated by Vivendi Water under a 20-year design, build and operate contract.

Sewage overflows

Overflows can occur during both dry and wet weather. During dry weather the sewers can become blocked by tree roots, oil and grease, and debris. Sewage builds up behind the blockage, leading to a discharge from openings in the sewer, usually at inspection points.

During wet weather rainwater can enter the sewer, causing a build-up of flow that can exceed the transport capacity of the sewer, leading to a discharge from an overflow structure or other opening. Mechanical and electrical components of the sewer system, such as those at pumping stations, can also stop working owing to power outages and pump failures, and can thus cause overflows.

Dry and wet weather overflows can enter stormwater drains and natural waterways. Discharges from overflow structures are specifically designed to minimise discharges to habitation and the risk to human health.

An estimated 3000 designed overflow points exist within Sydney's sewer systems, of which 200 contribute approximately 80% of the total discharge volume (Sydney Water 2002).

Sewage treatment plant bypasses

Bypasses from sewage treatment plants occur when the sewage stream, either untreated or partly treated, is diverted from the plant directly into a river, estuary or ocean. This may cause local beach pollution.

Bypasses may occur in dry weather because of problems such as a mechanical failure at the plant. Wet weather bypasses may occur when the capacity of the plant is exceeded by large volumes of stormwater in the sewer system.

Notifications of bypasses were received in 2006–2007 for Warriewood, Cronulla, Bombo, Shellharbour and Port Kembla sewage treatment plants. The majority of bypasses were related to wet weather.

Preventing beach pollution

Many actions are being taken to prevent pollution at the beach. State and local governments are successfully tackling sources of beach pollution in a range of different ways. Many non-government and community groups are also making a significant contribution to pollution prevention.

Actions to improve the quality of stormwater

The NSW Government's Urban Stormwater Program was established in 1997 and was completed on 30 June 2006.

A total of \$82 million in seed funding was provided to address stormwater quality hotspots and to give the stormwater industry and stormwater managers opportunities to develop new ways of addressing poor stormwater quality and ameliorating its impact on receiving waters.

The major outcomes of Urban Stormwater Programs include:

- \$67 million worth of stormwater project grants to councils, with additional contributions of \$40 million by councils
- stormwater harvesting projects that will provide ongoing benefit in reducing water consumption and pollution
- nearly 100 artificial wetlands built to reduce the amount of nutrients and sediment entering waterways
- an independent evaluation of the \$7 million Urban Stormwater Education Program, showing that one person in five has changed their behaviour to reduce stormwater pollution as a result of the program
- as of June 2006, an estimated 24 000 tonnes of pollution has been stopped from entering our waterways as a result of the stormwater program's activities. This is equivalent to over 2400 full garbage-truck loads of rubbish.

The Urban Stormwater Program has proved to be a successful, integrated, state-wide

program that has improved stormwater quality and mitigated its impact. It has raised the community's knowledge of stormwater pollution, shown people how to make a difference, and changed the behaviour of people in NSW.

As part of its continuing reform agenda the NSW Government has made considerable improvements to the management of the State's natural resources. Urban stormwater management in the future will build on the improved knowledge that has accrued during the Urban Stormwater Program and integrate it with the whole urban water cycle. Catchment Management Authorities in conjunction with DECC will provide technical support to councils, with a focus on projects that have regional significance.

DECC is leading the development of a NSW Diffuse Source Water Pollution Strategy, which aims to define priority sources for coordinating action by agencies, councils and stakeholders. The first priority issue being addressed is pathogen pollution in oyster growing areas.

The Local Government Amendment (Stormwater) Bill was passed in October 2005 and provides councils with the ability to raise additional revenue for river health improvements, flood mitigation, stormwater harvesting and asset management.

Future funding for stormwater projects will also be provided under the Urban Sustainability Fund. Grant funding will be targeted to supplement funds raised by local councils under the new stormwater management service charge.

Sydney Water has also invested \$19.4 million in the Stormwater Environmental Improvement Program (SEIP) over five years. This has included the installation of 24 new stormwater quality improvement devices, one wetland and one stabilisation project, as well as various education and monitoring projects.

Sydney Water now removes litter and sediment from nearly 46% of stormwater runoff in its stormwater infrastructure, targeting litter and sediment hotspots in its area of operation. In 2006–2007, Sydney Water's 64 stormwater quality improvement devices prevented 6190 tonnes of sediment and 2134 cubic metres of litter from entering waterways.

Actions to upgrade Sydney's cliff-face sewage outfalls

The State Government's upgrade of the Cronulla Sewage Treatment Plant was commissioned in April 2001. The upgrade involved the addition of secondary biological treatment, tertiary sand filtration, ultraviolet disinfection and chlorination of recycled water. The treatment scheme allows for use of the treated wastewater by local industry, thereby reducing the volume of discharge from the plant. The capacity of the plant was also increased (Sydney Water 2001).

Pipelines were constructed under Port Hacking to connect residents of Bundeena and Maianbar to the Cronulla Sewage Treatment Plant. These areas have historically relied on on-site systems such as septic tanks.

Upgrades to Sydney's ocean outfall sewage treatment plants

Works to ensure reliable performance and worker safety at the Bondi Sewage Treatment Plant have been completed. This project will ensure that the plant continues to reliably operate to meet environmental protection licence conditions set by DECC.

At North Head STP, projects which have been completed or in progress are:

- a 2 ML/day recycled water plant (RWP) to replace potable water used in processes in the plant
- an anaerobic digestion facility to replace the existing biosolids lime stabilisation facility and thus reduce odour impact and truck movements for the removal of biosolids from site.
- a new three-stage odour scrubbing facility to replace the existing odour scrubbing facility and thus improve the reliability and performance of odour scrubbing (scheduled for completion in January 2008).

A Process and Reliability/Renewals project is planned for construction in the period 2007 to 2009. This project will provide two additional primary sedimentation tanks, which will allow the STP to continue to meet the Sewage Treatment System (STS) Licence effluent discharge requirements (regulated by DECC) whilst accommodating population growth within the catchment up to 2023. The project will also improve the reliability, operability and maintainability of various plant processes.

At Warriewood STP a project is in progress to reduce odour emissions from the plant by January 2009.

Sydney Water is developing a portfolio of Renewable Energy Generation Projects throughout its operations, utilising both cogeneration and hydro-electricity generation. Cogeneration uses biogas (a waste product produced by wastewater treatment process) that is harnessed through state-of-the-art technology and converted into electricity. Hydro-electricity generators will use water and wastewater flows to generate electricity.

Similar projects will commence at North Head, Warriewood, Bondi and Wollongong Sewage Treatment Plants. Cogeneration is already in place at both Cronulla and Malabar Sewage Treatment Plants. Together these plants reduce Sydney Water's reliance on black power and will reduce greenhouse gas emissions from its operations.

Actions to upgrade Hunter region sewage treatment and transport systems

A major upgrade to wastewater transporation systems in Warners Bay, Valentine and Belmont areas has been completed. These works will increase the capacity of the system and reduce the amount of water entering the system in wet weather. Design of an upgrade to Redhead Wastewater Pump Station is in progress and further works are planned for the Blacksmiths and Swansea areas over the next five years (Hunter Water 2006).

The Newcastle wastewater transportation system is being upgraded to include a wet weather pumping system. This system will

operate during heavy rainfall to transfer flows from the wastewater transportation system directly to the Burwood Beach wastewater treatment plant. New pumping stations and larger pipes will be installed to enable the wastewater system to cope better with the larger flows that occur in heavy rainfall. The section of pipeline below Merewether Hills has been constructed by using 'directional drilling'. The pipe is laid deep beneath the surface to avoid the need for pumping stations and reduce the energy requirements of the system. Design work on the remainder of the wet weather pumping station is in its final stages with construction work expected to commence in 2008 (Hunter Water 2006).

Properties in Fern Bay are being sewered under the State Government's Priority Sewer Program, replacing on-site systems (Hunter Water 2006).

Actions to upgrade the Illawarra region sewage treatment and transport systems

The Illawarra Wastewater Strategy has been commissioned to deliver water quality improvements at a number of Illawarra beaches, particularly those near the Bellambi, Wollongong and Port Kembla sewage treatment plants.

The Strategy has ended dry weather discharge from the Bellambi and Port Kembla treatment plants and, through water recycling, it reduces total ocean discharge and saves about 7.3 billion litres of fresh water each year.

The Illawarra Wastewater Strategy involved:

- building a water recycling plant at Wollongong sewage treatment plant that produces at least 20 million litres of neardrinkable treated effluent each day. Under a 15-year agreement the recycled water is used at nearby BlueScope Steel.
- building a pipeline to transfer wastewater from the Bellambi and Port Kembla catchments to Wollongong sewage treatment plant for high-level (tertiary) treatment
- working to improve swimming conditions at Wollongong beaches by

stepping up to tertiary treatment and significantly upgrading the existing ocean outfall

• converting Bellambi and Port Kembla sewage treatment plants to specialised storm-flow plants that store and treat wastewater during prolonged wet weather.

The Strategy is now largely commissioned.

Other components of the Illawarra Wastewater Strategy include the amplification of the Shellharbour Sewage Treatment Plant to meet the demands of population growth within the Albion Park and Shellharbour areas up to 2025. Works include construction of additional tanks to allow for increased flows, improvements in sewage treatment processes and modifications to the ocean outfall to improve effluent dispersion. The amplified STP and the ocean outfall have been commissioned.

Actions to reduce sewage overflows – SewerFix

Sydney Water is required by Environment Protection Licence conditions to manage sewerage treatment systems efficiently. This is required to protect and minimise harm to the environment and public health from sewage treatment plant effluent and sewage overflows by minimising the frequency and volume of sewage treatment plant bypasses and sewage overflows.

SewerFix is Sydney Water's 20-year program for maintaining and improving the sewer system. Key works include:

The Northside Storage Tunnel has been constructed to capture wet weather overflows from the four major overflow sites at Lane Cove, Quakers Hat Bay, Tunks Park and Scotts Creek. The Tunnel was designed to reduce the number of overflows at the four major wet weather overflow points from more than 150 to less than 20 in an average 10-year period. Since coming on-line the Tunnel has prevented more than 26 billion litres of diluted sewage from entering Sydney Harbour (Sydney Water 2007).

- In consultation with DECC, Sydney Water is targeting sewage overflows that occur in the vicinity of beaches and other sensitive locations. Where poor performance is identified, works will be conducted to reduce the overflows and improve beach water quality. These works will include amplification, storage and sewer lining to reduce wet weather overflows. Works near completion (Hotspots 1) will benefit Darling Harbour on Port Jackson, Oately Bay Baths and Jew Fish Bay Baths on Georges River and Gunnamatta Bay Baths on Port Hacking. Other works (Hotspots 2) will benefit Haves St Beach on Port Jackson and the Sydney Ocean Beaches from Queenscliff to Long Reef.
- Sydney Water recently conducted a review of its dry weather overflow abatement strategy. A key component of the new strategy is to inspect and fix problems on small-diameter sewer mains that carry high flows. These small-diameter sewers have been found to cause the majority of the dry weather overflows to waterways. A large proportion of the \$20 million allocated for 2007–2008 to reduce dry weather overflows will address these problematic sewers. Further funding has been allocated out to 2009–2010 to ensure that discharge targets for waterways are met.
- Upgrades have been completed to 250 sewage pumping stations to minimise the risk of dry weather sewage overflows. Telemetry systems have been upgraded at all of the 659 operating stations to provide warnings of failure. The improved telemetry improves response times and reduces the likelihood and severity of overflows to the environment.

Partnership with local councils

Twelve councils conducted recreational water quality monitoring during summer 2006–2007 under the Beachwatch Partnership Program. A report detailing results from 2006–2007 will be released during summer 2007–2008. The program also ran in 2004–2005 and 2005–2006 (DEC 2005 and DEC 2006b) and follows on from the Beachwatch Partnership Pilot Program, which was funded by the Coastal Protection Package between 2002 and 2004. The aim of the Beachwatch Partnership Pilot Program was to increase the consistency and quality of recreational water quality monitoring undertaken along the NSW coast. Fifteen coastal councils in NSW participated in the pilot during summer 2002–2003 (DEC 2004a) and seven councils continued their involvement in 2003–2004 (DEC 2004b).

Environment and community groups and associations

A great range of commercial and non-profit groups are also doing their bit to tackle stormwater pollution. These include council and commercially-funded environment centres, volunteer groups, and stormwater and wastewater associations.

These groups are working closely with local business, industry and government agencies on cooperative projects to improve stormwater quality and eliminate pollution, as well as developing 'leading edge' technology and approaches to stormwater management and pollution control. They also play an important role in community education on water pollution issues.

You, your friends and family

To help protect your local beach and waterway, there are plenty of community groups to join:

- Contact Streamwatch to find out if there is a group linked to your local school.
- Get involved in local activities sponsored by Clean Up Australia and Keep Australia Beautiful.
- Call your local council to find out about Bushcare activities in your local area.
- Join a local conservation group, such as Dune Care, Landcare or Coastcare, or the Australian Trust for Conservation Volunteers.

Further information can be accessed from the Marine and Coastal Community Network (www.ozemail.com.au/~mccnet). The Network promotes information-sharing among community groups, government agencies and industry.

For information on how to live more sustainably at home, work and play, visit the Our Environment It's a Living Thing (www.livingthing.net.au) and Water for Life (www.waterfor life.nsw.gov.au) websites.

You can also make a difference at the beach:

• Take litter and leftovers home with you.

- Park cars carefully, preferably on hard surfaces to avoid damaging grass verges or coastal vegetation.
- Keep beach showers to a minimum.

The community can help prevent beach pollution in lots of ways. Table 1 lists the ways in which you can help to improve stormwater quality and Table 2 lists ways you can ease the load on the sewer.

Actions to do more often	Actions to avoid
Pick up litter in the park or on the street.	Washing the car in the street.
Sweep the gutters and driveways regularly and place the sweepings on the garden, in the compost or in the bin.	Hosing dirt off hardstand surfaces (roads, paths, driveways) into gutters.
Do not allow soil or mulch to be washed or blown off the garden.	Dropping packaging or cigarette butts on the ground.
Clean up pet droppings and dispose of them in the garden, rubbish bin or toilet.	Leaving rubbish where bins are already full.
Rake up leaves or lawn clippings and use them as mulch on the garden or place them in the compost.	Hosing leaves and grass clippings into gutters.
Grass or replant areas of disturbed soil.	Piling sand and soil on areas where it can wash into the stormwater system.
Consider natural alternatives to pest-control chemicals.	Washing cement mixes into the gutter.
Maintain the car, making sure there are no leaks and that the fuel is burnt 'cleanly' by keeping the vehicle tuned.	Overuse of chemicals (pesticides and herbicides) that could be washed into stormwater from the garden or yard.
Use the minimum amount of detergent for cleaning outside.	Using too much fertiliser (follow the instructions).
Wash brushes and rollers over a sand filter on the lawn.	Using pesticides and herbicides when rain is forecast the same day.
Take the car to a car wash where the water gets treated and recycled.	Disposing of oil or chemicals into gutters.
Drive less – use public transport, walk, or ride a bike.	Vehicle maintenance where oil and grease may wash into gutters.
Make sure sewerage pipes are not connected illegally to stormwater.	Pouring paint, solvent or cleaners in the gutter or where they may enter drains.
Install a rainwater tank.	Covering large areas with impervious surfaces, e.g. concrete, bitumen.
Direct roof runoff from downpipes to the garden (with council approval).	
Replace impermeable surfaces (e.g. concrete) with permeable surfaces such as timber decks and pavers (with gaps between pavers).	
Get involved with Bushcare or Landcare projects that restore or protect local waterways.	
Plant native gardens that require less water, fertiliser and pesticides.	
Have a composter or worm farm for garden and household organic waste.	

Table 1: ways to improve Stormwater Quality	Table	1: W	lays to	Improve	Stormwater	Quality
---	-------	------	---------	---------	------------	---------

Actions to do more often	Actions to avoid
Install dual flushing in the toilet.	Putting oil down the sink.
Get sewer pipes smoke-tested for false stormwater connections.	Planting trees near sewer lines, as tree roots are a major cause of pipe damage.
Use a sink strainer.	Stormwater entering outdoor sewer pits.
Use the dishwasher and washing machine only when there is a full load. This not only reduces the amount of detergents entering the sewer system, but also saves water and energy.	Putting vegetable scraps, tea leaves, coffee grounds or eggshells down the sink. These can be composted.
	Using the toilet as a garbage bin by flushing tampons, sanitary napkins, condoms, cotton buds and cigarette butts down the toilet. Place them in a bin instead.
	Washing hair down drains. This can be composted.

Table 2: Ways to Ease the Load on the Sewer