

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 0.5% of Sydney's sewage (Sydney Water 2003 and 2008b). The receiving waters for these discharges are not used for swimming owing to the ruggedness of the coastline.

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 sewage treatment plants which store and treat excess wastewater flows during large wet weather events but do not operate during dry weather.

The Gerringong-Gerroa Sewage Treatment Plant is operated by Veolia 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 3,000 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 mechanical or power failures 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 2007–2008 for Warriewood, Cronulla, Bellambi, Wollongong, 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

Funding for sustainability projects is provided under the NSW Government's Environmental Trust \$80 million Urban Sustainability Program. Grant funding is targeted at local councils working with the community and business to protect and improve the urban environment. Some funded projects have specifically addressed urban water management issues, including stormwater management, reducing urban runoff and improving water quality.

In 2007, the Environmental Trust approved five projects through the Urban Waterways funding stream, totalling more than \$2.8 million. The projects implemented include initiatives such as stormwater reuse schemes, implementation of water-sensitive urban design, and activities to restore streams and creeks in various local government areas, improving local water quality and overall catchment health.

In 2008, \$30 million in grant funding was made available through the Urban Sustainability Major Projects and Urban Waterways Initiative for up to three years. The priority catchment areas for the Urban Waterways funding stream are the Cooks River, Georges River, Hawkesbury Nepean River, Central Coast/Lower Hunter catchments and Sydney Harbour.

In addition, the NSW Government has developed a state-wide Diffuse Source Water Pollution (DSWP) Strategy to reduce diffuse source pollution inputs into all NSW surface and ground waters. Diffuse source water pollution is the contamination of water bodies by pollutants (such as pathogens, chemicals and salinity) from urban and rural land use activities in the catchment. The DSWP Strategy will contribute towards the NSW water quality objectives, and state-wide natural resource management targets listed in the State Plan. The DSWP Strategy will bring together Catchment Management Authorities (CMAs), relevant NSW government agencies and local councils to jointly manage and address these issues.

Sydney Water has completed the \$19.4 million Stormwater Environmental Improvement Program (SEIP) which commenced in 2000. The program has improved stormwater quality across 26 sites in the Sydney area. A number of stormwater quality improvement devices were installed such as litter booms, sediment traps and gross pollutant traps and a wetland at Woollahra Golf Club. The banks of Finlaysons Creek, Wentworthville were also stabilised to control erosion. Various education and monitoring projects were also implemented. The program is expected to prevent 750 cubic metres of litter and 950 cubic metres of sediment from entering the waterways.

Sydney Water now removes litter and sediment (using 64 stormwater quality improvement devices) from nearly 46% of stormwater runoff in its stormwater infrastructure, targeting litter and sediment hotspots in its area of operation.

Previous funding for stormwater projects was provided under the NSW Government's Urban Stormwater Program. Between 1997 and 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 an opportunity to develop new ways of addressing poor stormwater quality

and ameliorating its impact on receiving waters.

The major outcomes of the Urban Stormwater Program included numerous stormwater project grants to councils totalling \$67 million, and additional contributions of \$40 million by councils, stormwater harvesting projects, and the construction of almost 100 artificial wetlands. Other results also included an independent evaluation of the \$7 million Urban Stormwater Education Program, which showed that one person in five has changed their behaviour to reduce stormwater pollution as a result of the program. As of June 2007 an estimated 29,000 tonnes of pollution has been prevented from entering our waterways as a result of the urban stormwater program's activities.

The Urban Stormwater Program has proven to be a successful, integrated, state-wide program that has made a difference to stormwater quality. It has raised the community's knowledge of stormwater pollution, shown people how to make a difference, improved attitudes and changed the behaviour of people in NSW.

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, and saving potable water. 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. A total of 1,251 properties in the Bundeena and Maianbar areas are now connected to the sewerage system. An unknown number of properties in the Bundeena and Maianbar area may still rely on on-site systems such as septic tanks.

Upgrades to Sydney's ocean outfall sewage treatment plants

Works as part of the \$95 million Bondi Sewage Treatment Plant Reliability Improvement and Modernisation Program (RIAMP) were completed in January 2007. The works included new ventilation and scrubbing systems, devices to control wastewater flow, and fitting of pipework. The installation of a wastewater recycling system at the plant enables the reuse of 3 million litres of treated wastewater daily. The program ensures that plant reliability and performance are maintained to meet environmental protection licence conditions set by DECC and provide a safe working environment.

Many projects are in progress at North Head Sewage Treatment Plant, with a number completed. These include:

- a recycled water plant (RWP) constructed in 2005 reuses 1.5 million litres of wastewater per day in plant processes, reducing the demand on potable water supplies (a saving of 550 million litres per year)
- a biosolids management facility to replace the existing biosolids lime stabilisation facility and thus reduce odour impact and truck movements for the removal of biosolids from the site
- the construction of a cogeneration plant generating green electricity for use at the plant, reducing the plant's external electricity demand.
- a new odour management facility to replace the existing odour scrubbing facility and thus improve the reliability and performance of odour scrubbing.

The design, planning and implementation of the reliability and renewals projects are under way, with construction taking place during 2007 to 2009. The projects will improve the reliability, operability and maintainability of various plant processes.

At Warriewood Sewage Treatment Plant a project to reduce odour emissions from the plant is under way, and includes the installation of a ventilation transfer system.

The project is due to be completed by September 2008.

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 of the 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.

Cogeneration plants have been approved for Bondi and Warriewood sewage treatment plants. Cogeneration is already in place at both Cronulla and Malabar sewage treatment plants. Similarly, a hydro-electricity generation plant is planned for North Head Sewage Treatment Plant in the near future. 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

Hunter Water Corporation is currently preparing detailed studies called Upgrade Management Plans for each of its reticulation systems relating to its Wastewater Treatment Works. The upgrades and actions from these plans are focused on improving the overall system performance during wet weather periods and will cater for new growth in each catchment.

Upgrade works being undertaken or planned as part of these upgrade management plans include those in the coastal areas of Lake Macquarie, Newcastle and Port Stephens. Significant work is programmed for the Newcastle System wastewater catchment draining to Burwood Beach Wastewater Treatment Plant, including works to improve wet weather system performance in Mayfield, Adamstown and New Lambton over the next five years.

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 enable the wastewater system to manage 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 work expected to commence in 2008 (Hunter Water 2006).

Design work to upgrade the Burwood Beach Wastewater Treatment Plant has commenced and is due to be completed in mid 2010. The upgrade will improve plant reliability and provide capacity for growth.

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, reduces total ocean discharge and saves about 7.3 billion litres of fresh water each year.

The Illawarra Wastewater Strategy involved:

- construction of a water recycling plant at Wollongong sewage treatment plant that produces at least 20 million litres of effluent treated by reverse osmosis to a high standard of quality 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 and ultraviolet) treatment and disinfection

- 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 sewage treatment plants (SSTP) that store and treat wastewater during prolonged wet weather.

The Strategy is now largely commissioned.

Other components of the Illawarra Wastewater Strategy included 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 included the construction of additional grit and primary tanks to allow for increased flows, improvements in sewage treatment processes and modifications to the ocean outfall to improve effluent dispersion. The amplified sewage treatment plant and the ocean outfall works were completed in 2006.

Actions to reduce sewage overflows

Sydney Water is required by DECC Environment Protection Licence conditions to manage sewerage treatment systems efficiently, to protect and minimise harm to the environment and public health. The licence conditions require that the frequency and volume of sewage treatment plant bypasses and sewage overflows be reduced.

Northside Storage Tunnel

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 33 billion litres of diluted sewage from entering Sydney Harbour (Sydney Water 2008a).

SewerFix

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

- 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 recently completed (Hotspots 1) will benefit Darling Harbour on Port Jackson, Oatley Bay Baths and Jew Fish Bay Baths on the Georges River, and Gunnamatta Bay Baths, Shelly Beach and Oak Park on Port Hacking. Other works (Hotspots 2) will benefit Hayes St Beach on Port Jackson and the Sydney ocean beaches of Queenscliff and North Curl Curl.
- Sydney Water's dry weather overflow abatement strategy inspects priority areas and fixes problems on small-diameter sewer mains that carry high flows. These sewers have been found to cause the majority of the dry weather overflows to waterways. A large proportion of the \$20 million allocated for 2008–2009 to reduce dry weather overflows will address the problems with these sewers. Further funding has been allocated out to 2009–2010 to ensure that discharge targets for waterways are met.
- Sydney Water is working on its Avoid Fail program, which aims to rehabilitate the aging sewerage system, particularly in the Sydney region. The program focuses on priority areas, assesses the structural integrity and makes repairs where necessary. Sewers in the Botany, Coogee and Berkley area of the Illawarra regions have had repairs. Repairs are planned for completion by 2010 on sewers in Warriewood, Manly, Bondi and Padstow, and at Warrawong in the Illawarra.

- 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. Further upgrades will be completed by 2010 for the telemetry system in the Illawarra. The upgraded telemetry system 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 2007–2008 under the Beachwatch Partnership Program. A report detailing results from 2007–2008 will be released during summer 2008–2009.

The program also ran in 2004–2005, 2005–2006 and 2006–2007 (DEC 2006a and 2006b, DECC 2007) 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.mccn.org.au). 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.waterforlife.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.

Table 1: Ways to Improve Stormwater Quality

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 green waste 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 2: Ways to Ease the Load on the Sewer

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.