



Department of
**Environment and
Conservation (NSW)**

Part 2

Field Manual for Monitoring the Quality of Recreational Waters

*A guide for agencies involved in monitoring
the quality of recreational waters in coastal regions*

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1. Introduction

This field manual provides agencies and their officers with the information required for sampling coastal recreational waters to determine their quality. The manual includes a list of equipment required for conducting a sampling program, a detailed procedure for sampling water and algae, procedures for storing and transporting samples, and example data recording forms for field and office use.

2. Equipment required for the collection of coastal water and algal samples

The following list of equipment is the minimum required for conducting a sampling run. The required number of specific items such as sample containers, Eskies and field sheets will vary depending on the number of sites to be sampled and the number of replicate samples collected at each site for quality assurance (QA) and quality control (QC) purposes.

- Esky and ice or ice bricks
- sterilised bacterial sample containers
- sample container labels
- field sheets
- this field manual
- disposable gloves
- personal disinfectant or hand wash
- appropriate pens and pencils (including a permanent marker for labelling sample bottles)
- access keys if required
- QA/QC blanks.

Additional optional equipment

- extension pole (at least 1.5 metres)
- water quality instruments (correctly calibrated) for measuring pH and temperature
- Secchi disc
- algal net
- algal sample containers and preservative.

3. Location of sample sites (example)

See map on next page.



Figure 3: Location of sample sites



Figure 4: Sample site description

4. Sample site description (example)

4.1 Sample site location

The sample site is located within the netted Cove Beach Baths swimming enclosure, towards the south-eastern end of the beach. The sample should be taken at the mid-point of the enclosure. The beach is backed by a promenade and a large park and picnic area.

4.2 Pollution sources

Stormwater drains discharge directly to the beach to the north-west and south-east of the baths. Water quality may be affected by sewage overflows and stormwater runoff farther up the Cove Bay catchment; by discharge from Cove Island sewage treatment plant (STP); and by effluent pump-out from moored boats, more so during times of high boat usage.

4.3 Site restrictions and potential hazards

The site has restricted road access in winter, when the access road at Cove Road is locked. Potential hazards include heavy traffic during peak hours on the Pacific Highway, making it hazardous to turn into Cove Road to access the site. Waters may be heavily contaminated with sewage pollution at times when the Cove Island STP is in bypass mode.

4.4 Directions

The site is reached from Cove Road, then Acacia Street, Cove Beach.

4.5 Site coordinates

151.32526E, 33.60042S

4.6 UBD reference

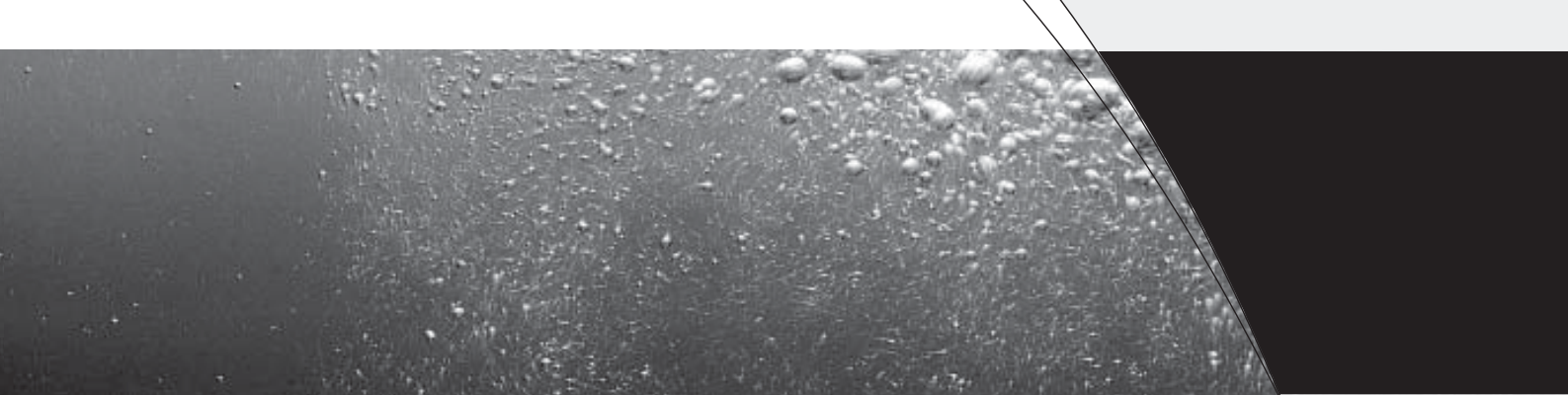
Page 387, Map 245, Reference: D9

5. Contact list

5.1 Department of Environment and Conservation (NSW)

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5.2 Department of Infrastructure, Planning and Natural Resources

Sam Surf

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5.3 North Coast Cooperative of Councils

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6. Field sheets and labels

6.1 Field sheets

Maintaining accurate records of field sample collections is an essential part of any water quality monitoring program. Field sheets must include the date and time of sample collection for each parameter tested, names of collectors, and sample site names or codes. Other important information to be recorded on the sample field sheet includes stormwater, creek or lagoon flows to the beach, water clarity, stormwater debris and sewage grease. Environmental factors such as tide, rainfall, wind strength and direction, swell height and direction, surface scum, algae and temperature extremes should also be recorded. Field sheets should be signed by field staff when all entries are completed and all samples are collected. **Remember:** good-quality data collection is an essential component of your sampling program. A sample field sheet is provided in the next section.

6.2 Labels

Correct documentation of samples is important, as it ensures sample identification. Labelling should be clean, secure, waterproof, non-smearing and large enough for site name and date. *You must ensure that sample labels do not become detached during storage and transport.* Pre-printing standard information on the label can save time in the field. The marking pen must be non-smearing and maintain a permanent legible mark. It is important to include the date, sample code and name of the collector on the label to avoid confusion upon receipt by the laboratory. An example sample label is included in Section 8.

7. Example field sheet

NSW Department of Environment and Conservation (DEC) Field Sheet for Monitoring Water Quality at Coastal Recreational Sites

Date: _____ Time: _____

Sample collector/s: _____

Site name/code: _____ Sample codes: _____

Field measurements:

pH: _____

Secchi depth: _____ m

Temp: _____ °C

Water depth: _____ m

Field observations:

Details:

Circle one of each:

sunny/overcast/fine/wet

Swell height and direction: _____

Wind strength and direction: _____

Stormwater flow:

yes/no _____

Lagoon or creek flow:

yes/no _____

Stormwater pollution:

yes/no _____

Sewage pollution:

yes/no _____

Odour or frothing:

yes/no _____

Scum on surface or beach:

yes/no _____

Algae (surface water or tide line):

yes/no _____

Other comments: _____

Site checklist:

Bacterial sample collected

Field measurements taken

Samples placed on ice

Field sheet completed

Signature: _____

OFFICE USE ONLY

Data entered on: _____ (date) by _____ (name)

Data checked on: _____ (date) by _____ (name)

8. Example label for a sample bottle

Sample code:

Date of collection:

Time of collection:

Organisation/project:

Name of collector:

9. Collection, storage and transport of samples for bacterial analysis

9.1 Sample containers

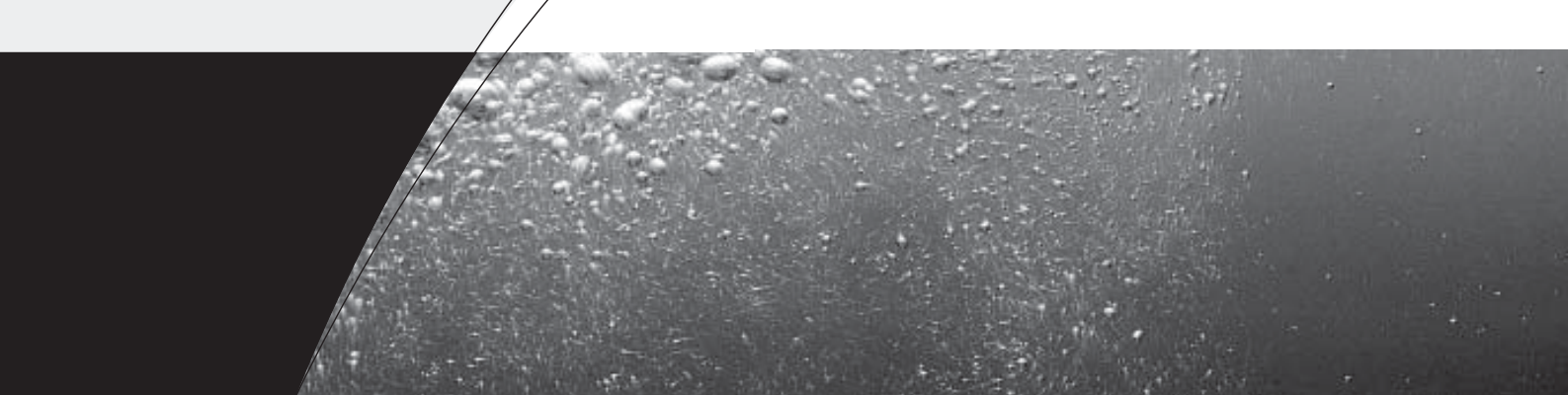
Collect samples for bacterial analysis in *sterile* 250 mL bacto containers. Pack empty containers into a clean box or basket before each sampling trip. Do not use containers that have chips, cracks or etched surfaces or have had the lid removed before sample collection. Bottle closures must be watertight. *Do not use any container that may have been contaminated before use.*

9.2 Sample collection procedure

9.2.1 Samples collected for bacterial determinations

Important points to remember:

- Collect samples using aseptic techniques to avoid sample contamination at all times. If there is any doubt, then discard the sample and container and collect another sample.
- Where replicate samples are to be collected at each site, collect replicates several metres apart: i.e. don't collect all replicates in exactly the same place – move around.
- Collect the samples *before* you collect water quality measurements or any other samples. This will decrease the likelihood of sample contamination.
- Where samples are to be collected from the shore, use a 1.5 m extension pole to assist collection of samples.
- Get a sterilised 250 mL bottle out of the box or basket. Be sure to keep it closed until you are ready to collect the sample, and minimise contact with the neck and lid.
- Fill out the label with the correct sample site or code, date and time and attach it to the bottle. Labelling should be clean, secure, waterproof and non-smearing, and large enough for the necessary information. *You must ensure that sample labels do not become detached during storage and transport.*
- Move to the sampling location and try to avoid stirring up bottom material. Take the sample from the pre-determined sample site. In most cases the sample site should be located within the most frequently used section of the beach, usually within the flagged area or in front of the surf club (if present).

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- Carefully remove the lid and keep it in your hand. Do not handle the inside of either the bottle or the lid. Grasp the bottle in the other hand and plunge the bottle mouth downward into the water to about 30 cm below the water surface. Position the mouth of the bottle into the current, keeping your hand away from the mouth. If the water is still, sweep the bottle horizontally through the water with the mouth of the bottle pointed away from you. Tip the bottle slightly upward to allow air to exit and the bottle to fill.
 - Remove the bottle from the water.
 - Pour out a small portion of the sample to allow an air space of 1 to 2 cm above the sample to facilitate mixing of the sample by the laboratory.
 - Immediately replace the lid tightly.
 - Place the bottle in the Esky on ice or ice bricks. Position it so that it cannot fall over or roll around. Water samples for bacteriological analysis should be iced or refrigerated at 1°C to 4°C while in storage and during transportation to the laboratory. Seal the Esky so as to maintain the temperature inside. Take care to ensure that the bottles are not immersed in water (from ice melt) in the Esky during transit or storage.
 - Complete a field sheet for each sample site. Record the collection date and time. Record factors that may affect water quality at each site. These include stormwater, creek or lagoon flow to the beach, discoloured water, stormwater debris and sewage grease. Also record other environmental factors, such as tide, rainfall, wind strength and direction, surface scums, algae, temperature extremes and water clarity.
 - Samples should be analysed as soon as possible after collection. Samples should be collected and delivered to the laboratory for analysis within 6 hours. Do not submit samples that have been held for longer than 24 hours.
 - Collect water samples for analysis of other parameters in separate containers at the same time.
 - If necessary (e.g. when sampling polluted waters), after samples have been collected from a site, wash hands and arms with a disinfectant lotion (e.g. Hexaform) to reduce exposure to potentially harmful bacteria or other micro-organisms.

9.2.2 Determining water quality in the field

Take physical water quality measurements after bacterial samples have been collected. This prevents contamination of bacterial samples. Water quality instruments (for pH, conductivity and temperature) must be calibrated and used as per the manufacturer's instructions. Correct instrument use and calibration ensures the reliability and credibility of water quality data.

9.2.3 Sampling algae

When sampling algae, ensure that all occupational health and safety procedures are followed during the sampling process.

The major difficulty in algal sampling is that algae are not spread uniformly throughout the water column. The following points outline the technique for sampling algae from surface waters:

- Collect samples in a clean plastic bottle (minimum volume 250 mL) from a sample pole (if possible) while wearing gloves. Try to avoid skin contact with algae, as all algal blooms must be assumed to be toxic until proved otherwise.
- Immerse the inverted bottle to a depth of 25 cm and then turn it upright to fill it.
- For samples that are to be used for algal identification and counts, preserve the sample by adding 1 mL of Lugol's solution to the bottle. Lugol's solution kills, stains and preserves the algae.
- DO NOT FREEZE ALGAL SAMPLES. The sample needs to contain intact algal cells and should only be refrigerated. Samples must be kept in a cool place (e.g. in an Esky on ice or ice bricks) for transport to the laboratory for analysis.
- For samples that are to be tested for toxicity, DO NOT PRESERVE SAMPLES in Lugol's solution, and DO NOT FREEZE them.
- Once the algal sample has been collected, complete the NSW DEC Algal Reporting Form (Section 10), and submit the form to DEC.
- Samples should be sent to a NATA-registered laboratory for algal identification, counting or toxicity testing within 24 hours of collection.

9.2.4 Sampling recreational waters suspected to be contaminated by chemical toxicants

If it is suspected that the water is polluted with chemicals (e.g. resulting from a pollution incident), it may be necessary to collect samples in the immediate area of the discharging pollutant. Toxic chemicals that may pose a direct threat to the quality of recreational waters are divided into two groups: inorganic such as arsenic, lead, mercury and cyanide; and organic such as pesticides (e.g. DDT, dieldrin, chlordane), benzene and chlorophenols. With strict regard to occupational health and safety regulations, sample water immediately upstream and outside the polluted area and where the polluting water joins the recreational water. For further details on sample methodology, refer to APHA (1998).

9.3 Sample storage and transport

The microbiological analysis of a water sample should start promptly after sample collection to avoid unpredictable changes in sample composition. If samples cannot be processed within one hour of collection, then they must be stored in an Esky on ice or ice bricks (or in a car fridge) during transport. Samples must be maintained at temperatures between 1°C and 4°C during a maximum transport time of six hours. Samples must be refrigerated upon receipt in the laboratory and processed within two hours. Failure to follow these guidelines will result in unreliable results. Many laboratories will specify a time by which the samples must be delivered in order to ensure that analysis can begin immediately. *If you are going to be late, call the laboratory.*

It is important that a chain-of-custody procedure is prepared by the sampling agency and the analytical laboratory. This will ensure that the collection, storage, transportation and analysis of water samples can be traced at all times. The person conducting the sampling must fill out a chain-of-custody form, which must include sampling location and program, time of collection, date of collection, collector's name, agency, contact details, and other comments if necessary.

10. Department of Environment and Conservation (NSW) algal reporting form

In social research surveys, the NSW community has nominated beach water quality as one of the most important environmental issues in NSW. Algal blooms are linked to water quality, but the mechanisms by which they occur are as yet poorly understood. We need to gather information on algal blooms in NSW coastal waters. This information will help DEC understand the occurrence and frequency of algal blooms and the conditions under which they develop.

Observer details

Name of observer: _____

Contact phone number: _____

Bloom details

Date of bloom: _____ Time: _____ a.m./p.m.

Location details (latitude and longitude if possible; hand-drawn sketch):



Extent of bloom (approximate area, distance etc.): _____

Duration of bloom (days, weeks, months): _____

Colour, appearance, odour of bloom (milky, threads etc.): _____

Weather conditions (before and during algal bloom, including rainfall, wind, seas): _____

Sample details

Sample(s) collected (yes/no): _____ Date: _____

Method used to collect sample(s) (grab, net, bottle etc.) _____

Was the sample preserved? (yes/no): If yes, how? _____

Name of laboratory (attach laboratory report):

Contact number:

Algal details

Dominant species:

Sub-dominant species:

Algal cell count: _____ cells/mL

Cell count method:

Toxicity details

Has toxicity testing been carried out? (yes/no) If yes, describe method?

Was the sample toxic? (yes/no) If yes, give result

Effects on animals and humans

Were there any adverse effects from contact with the water? (give details e.g. itchy skin or rashes) _____

Were there any dead or distressed animals on the shoreline? (give details)

Were any health warnings, bans or closures issued as a result of the algal bloom? (give details)

Were any other water quality or oceanographic parameters measured at the time of the bloom? (give details)

Were any photos taken of the bloom? (please provide details, copies etc.)

In the event of a marine or estuarine algal bloom, please call our Coastal Waters Unit on (02) 9995 5511 (business hours) to relay the information you have collected. Please forward the completed data sheet to the Coastal Waters Unit, Department of Environment and Conservation, PO Box A290, Sydney South, NSW 1232 or fax to (02) 9995 5924.

11. Example chain-of-custody form

Chain-of-Custody Form	
<i>Department of Environment and Conservation (NSW)</i> <i>Program for Monitoring the Quality of Coastal Recreational Waters</i>	
Sampling staff _____	
Project name/ID and location _____	
Receipt of sample by courier from sampler (complete if necessary):	
Time: _____ a.m./p.m.	Date _____
Location: _____	
Sample quantity: _____	
Samples unaltered: yes/no	
Signed: _____	
Sampling officer	Courier
Receipt of sample by laboratory from sampling officer or courier:	
Time: _____ a.m./p.m.	Date _____
Location: _____	
Sample quantity: _____	
Samples unaltered: yes/no	
Signed: _____	
Sampling officer/courier	Laboratory staff



12. Reporting of beach pollution and pollution incidents

Correct pollution reporting procedures must be adhered to at all times to ensure that government agencies can respond effectively and efficiently.

If you observe what you suspect is a potential pollution incident (such as irregular discharge from a stormwater drain to the beach), follow the procedure below:

- Record accurate notes on the sample collection field sheet. The notes should include the suspected pollutant affecting the beach or water body, the area affected by the pollutant, the velocity of flow (if applicable), the time of observation and any odour present.
- Call Pollution Line on **131 555**. Provide them with as much information as possible, including all details that were recorded on the field sheet. Pollution Line staff will then forward the details to the relevant authorities to initiate further action if necessary.

13. Methods for identifying and assessing beach pollution

Beach pollution can come in various forms. The two most prevalent forms that pose health risks to bathers are **stormwater-derived** and **sewage-derived** beach pollution.

13.1 Pollution categories

The level of stormwater or sewage pollution may be classified as clean (nil or trace), low, medium or high. These categories provide for a uniform standard for assessing and reporting beach pollution. Sewage-derived litter such as condoms and sanitary napkins should be considered along with large items of beach grease.

13.2 Stormwater-derived beach pollution

Stormwater runoff will affect most beaches during and after periods of rain, particularly after thunderstorms. Leaves, twigs and street litter, carried to the beach in stormwater drains or creeks, are later washed up on the sand. It is a very common event and quite natural for natural debris (leaves, twigs and other organic matter) to be washed up on beaches. Stormwater runoff may also cause discolouration of beach water.

Stormwater litter is often mixed up with marine debris such as seaweed and other marine plant and animal remains. Marine debris is quite natural and should not be confused with pollution. When reporting stormwater pollution, do not confuse it with marine debris.

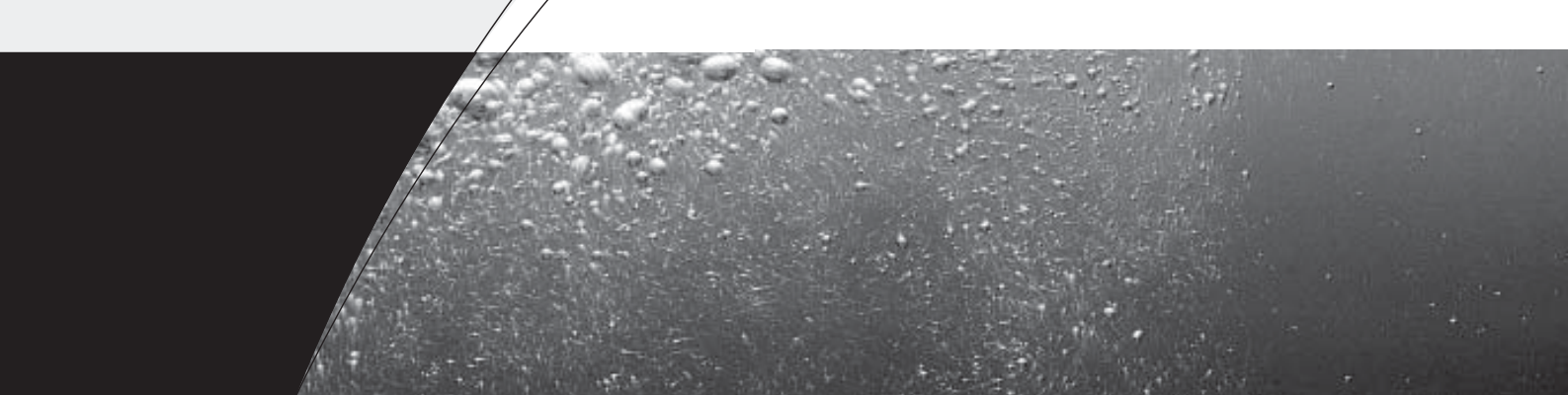
Sewage grease and sewage-derived litter may become attached to seaweed and stormwater litter. Take care to distinguish between stormwater pollution and sewage pollution to avoid overestimating the level of pollution.

Classify the amount of stormwater pollution on the beach or in the water as follows:

Clean (nil): Report *Nil* when there are no signs of stormwater pollution.

Clean (trace): Report *Trace* if there is a small amount of stormwater litter that would not inconvenience beach users.

Low: Report *Low* when stormwater litter is noticeable but unlikely to affect beach users.



Medium: Report *Medium* when stormwater litter or discolouration of the surf waters significantly detracts from the appearance of the beach and is likely to discourage beach users.

High: Report *High* when stormwater significantly discolours the surf or when large amounts of stormwater litter and debris make conditions unpleasant for beach users.

13.3 Sewage-derived beach pollution

The best place to begin an assessment of beach pollution is along the most recent high tide mark. Sewage pollution and other debris are washed up by the incoming tide and concentrated along the high tide mark. Sewage-derived items may include grease particles or balls, floatable litter discharged at outfalls, condoms, sanitary napkins, cotton buds and plastic remnants.

Clean

Clean is divided into *Nil* and *Trace* categories.

Nil: Report *Nil* pollution only when there is no evidence of sewage-derived items on the beach or in the water.

Trace: Use the *Trace* category to report scattered sewage-derived items that are not consistent with conditions on the beach generally for that day. A few items could be left over from previous days.

Low beach pollution

Report *Low* level when there is a consistent, small amount of sewage pollution along the beach. A low level of pollution is often hard to see, and is easy to walk over without noticing. Low-level sewage pollution may be reported when, in an area of one square metre:

- granular beach grease (fewer than 50 items) is observed
- small items of beach grease (typically 2–5 mm and fewer than 10 items) are observed
- large items of beach grease (typically > 1 cm and maximum of 2 items) are observed.

Medium beach pollution

Report *Medium* level when there is a consistent amount of sewage-derived items along the beach or along the high tide mark. If the criteria below are consistent with what you see on the beach, then the sewage pollution level is medium.

In an area of one square metre:

- there is granular beach grease (between 50 and 100 items)
- there are small items of beach grease (typically 2–5 mm, between 10 and 20 items)
- there are large items of beach grease (typically 1 cm or larger, between 3 and 5 items).



High beach pollution

The *High* level of sewage pollution is probably the easiest to assess. When sewage pollution is extensive and the high tide line is whitened by tiny grease particles, or when the beach is littered with larger clumps of sewage grease, then the sewage pollution level is *High*.

In an area of one square metre:

- there is granular beach grease (more than 100 items)
- there are small items of beach grease (typically 2–5 mm, more than 20 items)
- there are large items of beach grease (typically 1 cm or larger, more than 5 items).

Sewage pollution in the water

Sewage pollution in the water is difficult to assess. The most reliable indicator is the presence of 'fresh' grease particles on new waves lines. The amount of grease will not be as apparent along the new waves lines on the wet sand as it will be later on the beach when all the grease is pushed up by the tide and is concentrated along the high tide mark.

Sewage odour

Odour is another indication of sewage pollution in the water. You must be sure that the odour is coming from the surf and not some other source. Sewage odour may be classified as either *Slight* or *Strong*. For example, a beach with a slight sewage odour should be given a *Low* rating unless a higher reading is indicated by grease on the new wave lines. Similarly, if a strong sewage odour from the water is apparent, a *Medium* or *High* pollution rating should be given, depending on the amount of grease on the new wave lines.

14. References

APHA 1998. *Standard Methods for the Examination of Water and Wastewater*, 20th edition. American Public Health Association, Washington, DC.

Beachwatch Pollution Assessment Guidelines (unpublished)

M/SC RACC 2000. *Algal Contingency Plan*. Metropolitan/South Coast Regional Algal Coordinating Committee, NSW Department of Land and Water Conservation, Parramatta.

