

**Annual Review of the  
Microbiological and  
Chemical Quality of  
Drinking-Water in  
New Zealand  
2002**

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# Executive Summary

## Background

This report covers the second year when the microbiological and chemical quality of drinking-water was assessed using the *Drinking-Water Standards for New Zealand: 2000* (DWSNZ:2000) and is the first year when both microbiological and chemical compliance are addressed in the same report. The information on the microbiological quality of drinking-water was obtained through the public health units of the district health boards (DHBs) using questionnaires that sought data concerning surveillance and monitoring programmes carried out by DHBs and water suppliers, respectively. Water suppliers fall into two groups: local authorities (LAs), including commercial water supply companies contracted by local authorities, and private organisations or communities responsible for the operation of their own drinking-water supplies. The water suppliers are responsible for water quality monitoring, whereas the DHB carries out surveillance of the management of drinking-water quality in the health district.

The survey sought information about both distribution zones and water treatment plants. In addition to microbiological and chemical quality information, the questionnaire sought information about the water treatment processes in use and the means used to demonstrate compliance with the DWSNZ:2000.

The report contributes to the fundamental principles in the New Zealand Health Strategy of 'good health and wellbeing for all New Zealanders throughout their lives' and 'an improvement in health status of those currently disadvantaged'. The report also directly encompasses the New Zealand Health Strategy Goal 4: 'A healthy physical environment' as well as Objective 17: 'Support policies and develop strategies and services that ensure all people have access to safe water supplies and effective sanitation services'.

## Key findings

The 2002 annual survey uses the compliance requirements of the DWSNZ:2000 for the second time. In general, the DWSNZ:2000 are more stringent than those defined in the *Drinking-Water Standards for New Zealand:1995* (DWSNZ:1995) for the larger supplies and less stringent for the smaller ones (see Section 1.3). Consequently, many of the results in this annual report are not directly comparable with those in previous annual reports. To help overcome this difficulty, the data in this report are presented in two different ways. The present status of the water supplies was reported against the DWSNZ:2000 – this provides a snapshot of the present status. However, for the purposes of comparison with the previous year's results the 2002 data, where possible, were converted to compliance against the DWSNZ:1995.

The 2002 *Register of Community Drinking-water Supplies in New Zealand* (the Register) (Ministry of Health 2002b) contained 2060 water treatment plants and 2138 distribution zones and covered an estimated 87.5% of the New Zealand population. The microbiological and chemical quality of drinking-water was assessed against the DWSNZ:2000 using a survey of all treatment plants and distribution zones. Information was received from HPOs about all supplies but 80 water suppliers were unable to be contacted and a further 24 were either unable or unwilling to provide monitoring details. To evaluate the public health significance of the water quality data contained in this report, the data need to be expressed

in terms of the population affected rather than in relation to the numbers of water supplies involved because of the different-sized populations served by different water supplies.

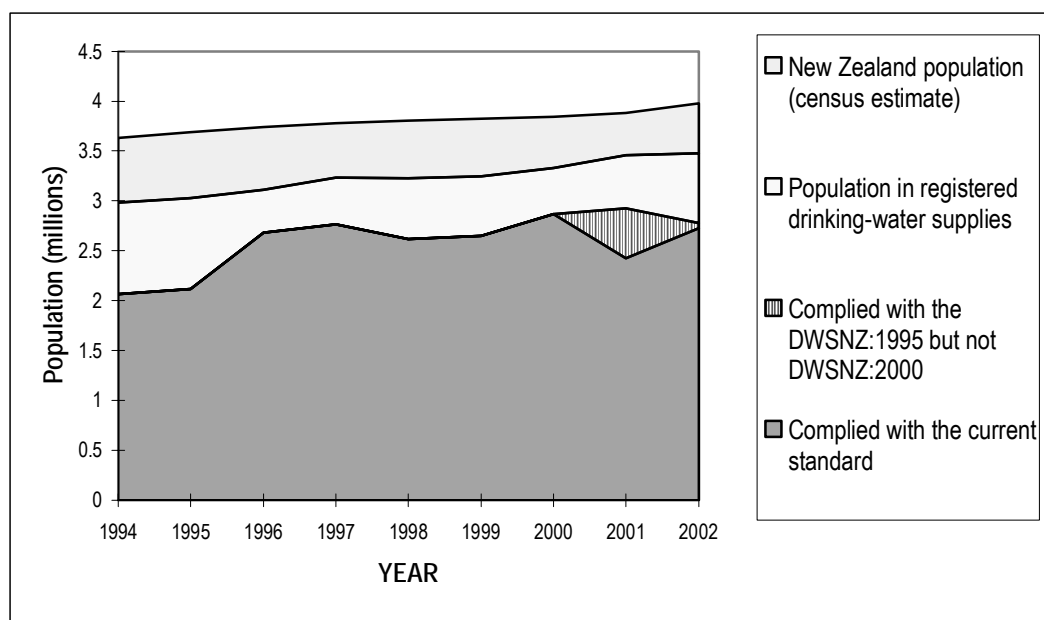
The microbiological health risk was assessed using two main microbiological criteria: *Escherichia coli* and *Cryptosporidium*. The chemical health risk for selected supplies was assessed with respect to those specifically-assigned chemical determinands for which monitoring was required. During 2002, water supplies to 78% of the people served by community drinking-water supplies complied with the *E. coli* criteria of the DWSNZ:2000. Compliance with the *Cryptosporidium* criteria of the DWSNZ:2000 was demonstrated in treatment plants serving an estimated 80% of the population covered by the survey.

Most large communities were served by water supplies which demonstrated microbiological compliance with the DWSNZ:2000 during 2002. However, many smaller communities were supplied with microbiologically non-compliant drinking-water.

The general trend in bacteriological compliance is best assessed at the distribution zone and is shown in Figure 1. The proportion of the surveyed population supplied by DWSNZ:1995-compliant zones has risen from about 70% in 1994 to 80% in 2002. Due to an artefact caused by the overall increased stringency of bacteriological compliance required by the new drinking-water standards (DWSNZ:2000), compliance with the current standards declined to 70% during 2001. However, by the end of 2002, bacteriological compliance had climbed to 78%.

The general trend in protozoan compliance is assessed at treatment plants only and is shown in Figure 2. The proportion of the surveyed population supplied by DWSNZ:1995-compliant zones has risen from about 74% in 1997 to 80% in 2002.

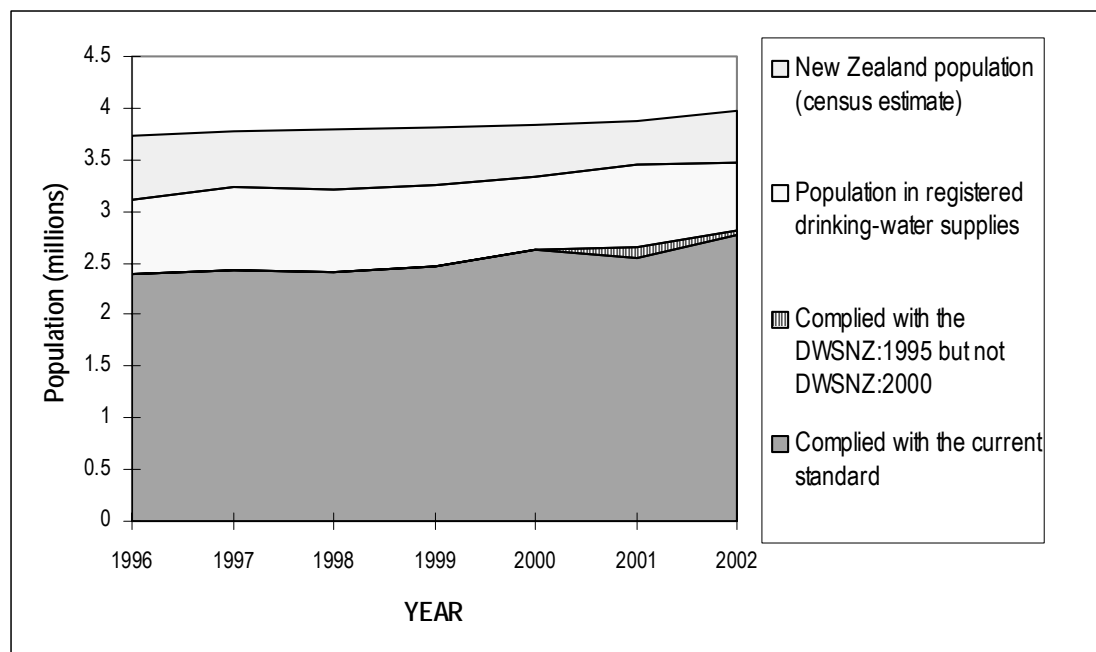
**Figure 1: Trend in bacteriological compliance at the distribution zone**



Source: Ministry of Health (1996, 1997, 1998, 1999, 2000a, 2001, 2002a), Nokes (1995).

There was a general trend for the percentage of distribution zones complying bacteriologically within a population band to decrease as the population of the band decreased (*ie*, the smaller the community water supply, the less likely it is to comply with the DWSNZ:2000).

**Figure 2: Trend in protozoan compliance at the treatment plant**



Source: Ministry of Health (1996, 1997, 1998, 1999, 2000a, 2001, 2002a), Nokes (1995).

Approximately 752,000 (22%) of people in the distribution zone covered by this survey were supplied with drinking-water that failed to comply bacteriologically with the criteria of DWSNZ:2000. A further 760,000 people were supplied with drinking-water that failed to comply bacteriologically with the criteria of the DWSNZ:2000 for technical reasons which have now been addressed, these were deemed to have complied with DWSNZ:2000 by the DHB.

- 133,000 (4%) were supplied with water containing unacceptable levels of *E. coli*.
- 59,000 (2%) were supplied with water where water suppliers failed to take appropriate corrective action once *E. coli* had been found.
- 67,000 (2%) were supplied with water where *E. coli* monitoring was either not carried out or monitoring data were not available.
- 1,382,000 (40%)<sup>1</sup> were supplied with water that did not comply bacteriologically with DWSNZ:2000 because the number of samples taken during the year was insufficient to demonstrate *E. coli* compliance according to the DWSNZ:2000.
- 16,000 (0.5%) were supplied with water that did not comply bacteriologically because the compliance testing was not analysed by a laboratory registered by the Ministry of Health for drinking-water compliance testing (Ministry of Health-recognised Laboratory) (Appendix 7).

<sup>1</sup> This figure includes the population within those distribution zones that were deemed to comply with the monitoring criteria of DWSNZ:2000 by the HPOs, but which failed to comply technically with the standards.

Some people were supplied with water that failed to comply bacteriologically with the DWSNZ:2000 for more than one of the above reasons.

Chemical substances or determinands that are present in a water supply at potentially health-significant concentrations (usually greater than 50% of their maximum acceptable value (MAV)) are the only chemical determinands that are required to be monitored to comply with the chemical criteria of the DWSNZ:2000. These chemical determinands are known as Priority 2 (P2) determinands (microbiological determinands are of higher public health priority, Priority 1) and are of two types: Priority 2a (P2a) determinands are those that may be introduced in treatment chemicals, and include intentionally-added fluoride; and Priority 2b (P2b) determinands are those that arise from any other source, for example geothermal activity. At present, P2 classifications are only made for chemical determinands identified as being a possible health concern in distribution zones with populations of 500 or more people.

Monitoring for fluoride as a P2a chemical determinand was required at 44 treatment plants that add fluoride intentionally, supplying a combined population of approximately 2,006,000 people. Eighty-one percent of this population was served by treatment plants that complied with the DWSNZ:2000. Inadequate monitoring was the main reason for non-compliance, but exceedence of the MAV was the reason for non-compliance in two treatment plants.

Compliance with the requirements of the DWSNZ:2000 for chemical determinands other than fluoride was achieved by distribution zones containing 84% (equivalent to a combined population of 2,920,000 people) of the population covered by this survey. This population included approximately 1,108,000 people living in distribution zones to which P2 chemical determinands were assigned and which required monitoring according to the DWSNZ:2000. Fifteen percent of the distribution zones that were assigned to monitor P2 chemical determinands complied with the chemical criteria of DWSNZ:2000 which represents a combined population of approximately 545,000 people. The primary reason for distribution zones not complying with the chemical criteria of DWSNZ:2000 was inadequate monitoring.

Monitoring was required for a total of 385 P2 chemical determinands assigned to water supplies throughout the country. These P2 chemical determinands were mostly heavy metals and disinfection by-products (substances formed as a result of the disinfection process). Of these P2 chemical determinand assignments, 52% (202) were not monitored at all, and a further 20% (75) were inadequately monitored. Non-compliance with the DWSNZ:2000 also resulted from the maximum acceptable value (MAV) for some P2 chemical determinands being exceeded. This occurred for 10% (39) of the P2 chemical determinand assignments. Corrective actions in response to the MAV being exceeded were inadequate for 87% (34) of the transgressions.

## **Summary of survey data**

To evaluate the public health significance of the water quality data contained in this report, summary statistics are expressed in terms of the population affected. Since expression of the zone numbers may be of more value for regulation and water supply management, data are summarised in both ways.

Information was received for each of the 2138 distribution zones and 2060 water treatment plants listed in the Register as at December 2002 covering approximately 3,479,000 people. This represents an increase of almost 24,000 people from the 2109 zones surveyed in 2001 and was due to newly registered supplies and amendments to some zone populations in 2002. Communities with unregistered water supplies were not covered by this survey. In this

report, the percentage of the population refers to the percentage of the population that live in registered distribution zones; it does not refer to the percentage of the total population of New Zealand.

## Distribution zone bacteriological monitoring

During 2002, 78% of the population lived in distribution zones supplied with drinking-water that complied with the distribution zone *E. coli* criterion 3.2.2.2 in the DWSNZ:2000, an increase of 8% since 2001. Water supplied to almost 400,000 people in 108 zones listed in the Register as having 'a' or 'b' grading failed to comply with the bacteriological criteria of the DWSNZ:2000, yet these appear as complying zones according to their grading in the Register. It should be noted that in most cases, grading has not been carried out for several years and will be inaccurate. However, the new grading scheme has just been approved and more accurate grades should be available for next year's report.

Water supplied to 58%<sup>2</sup> of the population, or 26% of distribution zones, was adequately monitored as per the requirements of the DWSNZ:2000. This represents an increase of 2% in terms of the number of adequately monitored zones and an appreciable decrease of 13% since 2001 in terms of the population they served.

During 2002, 98% of the population served by registered supplies lived in distribution zones where some monitoring was conducted. This represents no change since 2001.

Monitoring received less attention in smaller supplies than larger supplies, both in terms of the percentage of zones monitored and the percentage of zones adequately monitored.

## Treatment plant microbiological monitoring

For the purposes of assessing the microbiological quality of drinking-water, a treatment plant is the point where water enters the distribution system, irrespective of whether the water is treated or not. For the treatment plant to comply microbiologically with the DWSNZ:2000, water leaving the treatment plant must comply with both the *Cryptosporidium* and *E. coli* criteria.

An estimated 75% of the population, supplied by 5% of treatment plants were supplied with drinking-water that fully complied with all criteria of DWSNZ:2000 during 2002. *E. coli* compliance almost doubled in 2002 in terms of the number of *E. coli*-compliant treatment plants with 41% of treatment plants supplying 85% of the population demonstrating compliance with DWSNZ:2000. *Cryptosporidium* compliance was demonstrated in 6% of treatment plants supplying 80% of the population.

The secure status of 'secure groundwater' has been verified in 15% of groundwater supplies that were considered as such by the water supplier.

Small supplies tended to be less adequately monitored and a smaller proportion were compliant with the DWSNZ:2000.

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<sup>2</sup> This figure includes the population within those distribution zones that were deemed to comply with the monitoring criteria of DWSNZ:2000 by the HPOs, but which failed to comply technically with the standards.

## **Validity of compliance monitoring**

Most compliance testing is now being carried out by Ministry of Health-recognised laboratories. However, a few LA supplies are still analysed by non-registered laboratories. The LAs still using laboratories which are not recognised by the Ministry of Health are listed in Chapter 6. Laboratories seeking to be included on this register should apply to:

International Accreditation New Zealand  
626 Great South Road,  
Greenlane,  
Auckland.  
Ph: (09) 525 6655

## **DHB surveillance**

Surveillance of water supplier monitoring is carried out either by surveillance testing, by an audit of water supplier monitoring or a site inspection by the DHB.

Three zones were reported as compliant by the water supplier but were found to contain *E. coli* during DHB surveillance. Details of these supplies are given in Appendix 8.

## **School drinking-water supplies**

School compliance with DWSNZ:2000 has improved greatly, but there is still a long way to go. School supplies comprised approximately one-third of all registered drinking-water supplies in 2002. During 2002, 354 (57%) of the schools with their own water supplies conducted bacteriological monitoring, which is 10% more than in 2001. Of these, 107 schools (17%) complied with the bacteriological criteria of the DWSNZ:2000; this is equivalent to 24% of the total population within the schools of New Zealand. The number of schools that complied with the bacteriological criteria of the DWSNZ:2000 has almost doubled since 2001 when 55 schools fully complied.

## **Private and hospital drinking-water supplies**

There were 788 distribution zones designated as private supplies during 2002 supplying water to approximately 140,000 people. Of these, 9% complied bacteriologically with the DWSNZ:2000. Only 4% of the private supplies serving premises providing commercial accommodation complied. This represents an increased risk to customers and tourists at these premises compared with those served by municipal supplies.

At the end of 2002, 11 hospitals and health services were not connected to municipal drinking-water supplies. Of these, eight complied bacteriologically with the DWSNZ:2000 during 2002. Of the three hospitals that failed to comply bacteriologically with DWSNZ:2000, one was inadequately monitored and two were not monitored at all.

## Corrective actions

The DWSNZ:2000 prescribes that any transgression is immediately followed by a corrective action and is documented.

Of the 317 zones where transgressions were reported during 2002, 63% of the corrective actions taken in response to transgressions were reported to have resolved the cause of the transgression. This has improved since 2001 when 51% of the corrective actions taken in response to transgressions were reported to have resolved the cause of the transgression.

Corrective actions following transgressions in 121 zones were inadequate and/or tardy and were probably not carried out in a further 59 zones. This aspect has improved since 2001.

## Disinfection

Several methods of drinking-water disinfection have been reported in New Zealand, comprising chlorination, ozonation and ultraviolet irradiation. Chlorination remains the most popular means of drinking-water disinfection and served two-thirds of people connected to registered drinking-water supplies or 26% of the treatment plants. Supplies that used ultraviolet treatment or drew water from secure aquifers showed greater microbiological compliance than untreated supplies or those using other types of disinfection treatment.

*E. coli* compliance was demonstrated in supplies to 82% of the population on chlorinated supplies or 44% of treatment plants using chlorination. This represents an increase in *E. coli* compliance since 2001. Most non-compliance events in chlorinated supplies were caused by lack of monitoring although 61 were contaminated with *E. coli* during 2002.

The number of treatment plants using ultraviolet treatment declined. Ultraviolet treatment is particularly popular for treating small community supplies, particularly schools, probably because of their low costs to install and operate. Fifty-one percent of ultraviolet-treated supplies complied microbiologically with the DWSNZ:2000, this is an improvement of 27% compared with 2001. Non-compliance mostly resulted from inadequate or no monitoring, although *E. coli* were detected in 8 of these supplies during 2002.

Three of the 16 treatment plants using ozone treatment complied microbiologically with the DWSNZ:2000 during 2002, with non-compliance being due to inadequate monitoring. While the number of treatment plants using ozone for disinfection purposes has declined from 21 in 2001 to 16 in 2002, the percentage of plants which complied microbiologically with the DWSNZ:2000 during 2002 has increased from 0% in 2001 to 19% in 2002.

## P2 chemical determinand monitoring

The overall level of compliance with the chemical criteria of DWSNZ:2000 for those distribution zones where P2 chemical determinands have been assigned was poor. This is true whether the level of compliance is evaluated in terms of the population contained in complying zones (49% of the population with P2b chemical determinand assignments), the fraction of P2b chemical determinand assignments complying (22%) or the number of zones complying (15% of zones with P2b chemical determinand assignments).

Just over half of the P2b chemical determinand assignments were not monitored at all (52%), and 20% of those that were monitored, were not monitored properly, with the result that inadequate monitoring was the primary reason for the high level of non-compliance (72%) with the chemical criteria of DWSNZ:2000.

All P2 chemical determinand assignments (apart from intentionally-added fluoride), with the exception of one, were monitored using Ministry of Health-recognised laboratories.

Transgressions of the MAV were reported in 10% of P2 chemical determinand assignments, but the corrective actions were adequate for only 13% of these transgressions.

A number of suppliers did not monitor for heavy metals. This lack of monitoring occurred because of a misunderstanding over the provision of the DWSNZ:2000 that permits waters to be declared 'aggressive'. Once a drinking-water is designated as 'aggressive' the requirement to monitor the metals is waived provided consumers are warned to flush their taps before use. This designation can *only* be given if enough data have been collected to show that the metals in the water arise from corrosion. This was not done for these supplies.

Sometimes monitoring was not undertaken because the water supplier had not been informed of the P2 chemical determinand assignment. The cause of this breakdown in communication is unclear. Actions must be taken to minimise the likelihood of this happening in the future.

Monitoring for fluoride as a Priority 2a determinand was required at 44 treatment plants where fluoride was intentionally added — these treatment plants supplied a combined population of approximately 2,006,000 people. Eighty-one percent of this population was served by treatment plants that complied with the chemical criteria of the DWSNZ:2000. The level of compliance, in terms of the percentage of treatment plants complying, was much lower at 39%. Inadequate monitoring was the main reason for non-compliance, but exceedence of the MAV was the reason for non-compliance in two treatment plants.

## Recommendations

A number of recommendations are made in this review. The key recommendations listed below address the most important issues raised. Other recommendations are listed at the end of each section and cover issues that are discussed in more detail in that section of the review.

### Key recommendations

- Distribution zones listed in the Register as having an ‘a’ or ‘b’ grading (see Appendix 6) that failed to comply with the bacteriological criteria of the DWSNZ:2000 ought to be reclassified as ungraded until they can be regraded. This will inform the public of the current bacteriological compliance status of the water supply.
- Hospitals and health services with water supplies that do not presently comply with the DWSNZ:2000 are strongly advised to implement appropriate water treatment and/or monitoring immediately to ensure future bacteriological compliance.
- The use of Ministry of Health-recognised laboratories is required for all compliance testing.
- It is advised that zones reported by water suppliers as being compliant but non-compliant by the DHB be thoroughly investigated and the cause determined.
- Water suppliers that purport to use secure groundwater that has not been verified as secure are advised to either ensure its secure status is verified or employ a suitable disinfection process (see Appendix 12).
- In the next revision of the DWSNZ, the wording in Table 4.1 concerning the ‘Minimum Monitoring Frequency’ for Priority 2b, Type 2 chemical determinand assignments needs to be modified to reduce the likelihood of misunderstandings over the procedure by which water may be designated ‘aggressive’.
- Before undertaking any monitoring of P2 chemical determinand assignments, water suppliers need to discuss their planned programmes with their DHB (a requirement of the DWSNZ:2000). This is necessary whether it is for an official P2 chemical determinand assignment, or a chemical determinand for which they wish to accumulate data to contest a possible future P2 determinand assignment. It will ensure that they are aware of any monitoring requirements made in addition to those listed in the DWSNZ:2000.
- The newsletter, *Water and Health*, or a similar means of communication with water suppliers and DHBs, should be used to ensure that all those involved in undertaking and approving compliance monitoring programmes are kept up-to-date with modifications to details of monitoring protocols.

# Consumer Feedback

The following points are intended for people who wish to comment on this review.

The circumstances listed below might indicate some doubt about the safety of drinking-water.

- A community supply that serves 25 or more people for 60 or more days per year should be registered, but has not been registered; a supply that does not fulfil these population criteria does not need to be registered.
- A drinking-water supply that does not comply with the DWSNZ:2000 because of:
  - poor microbiological water quality
  - poor chemical quality
  - unknown water quality (ie, not monitored)
  - inaccurate data (relating to incorrect population figures, chemical or microbiological results).

The following steps can be taken to redress these situations:

1. Check that the water supply is listed in the Register. This should be in the local library; if not, the details can be obtained from the DHB Health Protection Officer (HPO) or from the following website: <http://www.drinkingwater.org.nz> and the webpage: <http://www.moh.govt.nz/water>. If the drinking-water supply is not listed and is of the size that should be registered, the HPO will register it. Water supplies that are listed in the Register but which are not in this review either were not surveyed or were registered after December 2002.
2. Poor microbiological or chemical water quality generally results from poor raw water quality and inadequate water treatment. These aspects should be addressed by the water supplier.
3. Unknown water quality is a result of inadequate monitoring. It is the responsibility of the water supplier to ensure that microbiological and chemical sampling is sufficient to meet the requirements of the current standards (DWSNZ:2000).
4. Microbiological and chemical results may be inaccurate due to misreporting between those undertaking the monitoring (the water supplier) and those collecting the data (the DHB). This will be minimised if the water supplier uses the Water Information New Zealand (WINZ) database, developed by ESR for the Ministry of Health, which allows monitoring results to be entered by the water provider and collated centrally. The WINZ software is provided by the Ministry of Health to water suppliers on request and at no extra cost. Laboratory errors are another source of microbiological or chemical errors; these can be minimised by using a Ministry of Health-recognised laboratory.
5. A few of the population figures are missing. It would help if these could be reported, if known.

Ask your local council to find out who is responsible for the provision of drinking-water to your area. Information about points 2–4 listed above should be sought from the water supplier. Please report any inaccuracies to the Public Health Unit of your local DHB (listed in Appendix 1).

# 1 Introduction

## 1.1 Project specification

This project was conducted for the Ministry of Health by the Institute of Environmental Science and Research Limited (ESR).

### Project description

To assess national compliance of community drinking-water supplies with microbiological and chemical criteria of the drinking-water standards (DWSNZ:2000).

### Project synopsis

- Collate data from surveillance by the public health service providers *ie*, DHBs of the effectiveness of water supply authority monitoring of the microbiological and chemical quality of all community drinking-water supplies listed in the Register, together with the data collected over the year by HPOs.
- Critically assess data on compliance monitoring of community drinking-water supplies by LAs.
- Identify public water supplies where monitoring is inadequate.
- Summarise compliance information to produce an annual register of non-compliance of community water supplies with microbiological and chemical standards, and the action taken in the event of non-compliance.

## 1.2 Previous surveys

Annual reports on the microbiological quality of New Zealand drinking-water supplies have been provided for every year since 1991. The annual report for the 1991 calendar year was prepared by ESR in 1993. The report provided a list of supplies for each Area Health Board or Crown Health Enterprise (CHE) for which microbiological data were available and indicated the source type for each supply, the sampling frequency and the percentage of samples that failed for each supply. The subsequent survey covered the drinking-water quality between January 1992 and December 1993 and was published by ESR in 1994. The 1992/93 survey sought information about monitoring, surveillance, corrective actions and the methods of analysis used by testing laboratories. The 1994 survey was reported by ESR in 1995 and included additional information about chlorination and chlorine control, but laboratory test methods were omitted. The 1995 survey was reported by ESR in 1996 and included additional information about the intent of the water suppliers to upgrade their monitoring to comply with the revised drinking-water standards (DWSNZ:1995).

Before 1996, the microbiological quality of water in the distribution zone was assessed according to the *1984 New Zealand Drinking-Water Standards* (NZDWS:1984). However, since the adoption in 1996 of the DWSNZ:1995 the survey reported on microbiological quality of water in both the distribution zone and at the treatment plant. Water quality data for the 1997 to 1999 calendar years were gathered about monitoring, surveillance and corrective actions.

Since 1999, the surveys have been conducted electronically using the Annual Survey module of the WINZ database instead of using paper questionnaires as previously. Electronic collection has resulted in several benefits: improved response time, fewer transcription errors, and a simpler means of traceability. The population data in this report were taken from the 2002 Register unless a change was noted on the distribution zone questionnaire. For the first time, the 2002 annual survey includes data from surveillance of chemical determinands in community drinking-water.

The questionnaires are reproduced in Appendix 2. Appendix 3 provides notes on the 2002 annual survey.

### 1.3 Drinking-Water Standards for New Zealand: 2000

The following definitions are used in the DWSNZ:2000.

A *community drinking-water supply* is a publicly or privately owned drinking-water supply which serves more than 25 people for at least 60 days per year.

A *water treatment plant* is the point where the drinking-water supply enters the distribution system, regardless of the treatment process. For example, for a supply that is pumped directly into the distribution system without disinfection, the pump is regarded as the treatment plant.

A *distribution zone* is ‘the part of the drinking-water supply network within which all consumers receive drinking-water of identical quality, from the same or similar sources and with the same treatment and usually the same pressure. It is part of the supply network which is clearly separated from other parts of the network, generally by location, but in some cases by the layout of the pipe network.’

*Monitoring* is ‘the sampling and analysis of a drinking-water supply to test for compliance with the DWSNZ:2000 or for process control, by detecting changes in the concentrations of its constituent determinands or deviations of these from target values.’ Monitoring is the responsibility of the water supplier.

*Surveillance* is ‘the process of checking that the monitoring of drinking-water supplies conforms to the specifications set in the DWSNZ:2000. Note that surveillance may be conducted either by analysis of water samples collected by the DHB, or by audit of drinking-water supplies and water supplier records by the DHB. The decision to undertake surveillance using one or both of these methods is made by the DHB.

A drinking-water supply is said to be ‘in *compliance* with the standards’ when the results of monitoring show that the water supply satisfies the requirements of the DWSNZ:2000.

A *transgression* of the standards occurs when a determinand present in the sample exceeds the maximum acceptable value (MAV) or the compliance criteria requirements.

A *water supplier* is the ‘person or entity that owns, or is responsible for operating, a drinking-water supply’.

The term *local authority* is defined in the Local Government Act 2002 and not in the DWSNZ:2000. Local authorities (LAs) supply drinking-water to the great majority of the population. However, there are many instances in which other organisations are responsible for the provision of water to a community. For this reason, the discussion of this report uses the more general term 'water supplier', in most instances.

The drinking-water standards were revised in 2000 and the DWSNZ:2000 replaced the DWSNZ:1995 on 1 January 2001. This is the second report in which compliance is measured using the DWSNZ:2000. The compliance requirements of the DWSNZ:2000 are more stringent than those of the DWSNZ:1995. As a consequence, one might expect national compliance to have declined in the year immediately following the introduction of the revised standards (2001) irrespective of any national trend in drinking-water quality, and to improve in the following year (2002).

## 1.4 Priority Classes

While the number of microbiological determinands listed in the DWSNZ:2000 is small and the tests relatively inexpensive, approximately 135 chemical determinands of health-significance are listed, many of which are expensive to analyse. Whereas all water supplies must monitor microbiological determinands, which have a high importance for public health, only those chemical determinands that have been shown to be present at concentrations of potential health significance must be monitored in a supply to comply with DWSNZ:2000.

To conserve resources, while providing public health protection, the DWSNZ:2000 makes use of Priority Classes. There are four Priority Classes and the health importance of a determinand establishes the class where it belongs. The priority level assigned to a determinand dictates whether it must be monitored for compliance with the DWSNZ:2000. Only Priority 1 (microbiological determinands) and Priority 2 (P2) (chemical determinands only, at present), need to be monitored. All supplies must monitor Priority 1 determinands, but the only P2 determinands that must be monitored in a supply to show chemical compliance with the DWSNZ:2000 are those that have been demonstrated to be present at potentially health-significant concentrations (usually more than 50% of the MAV). This means that the list of P2 determinands that need to be monitored may be different for each supply, and that for some supplies P2 determinand monitoring may not be required at all.

### 1.4.1 The Priority 2 Chemical Determinands Identification Programme

To determine which P2 determinands each supply must monitor, the Ministry of Health funds a programme called the Priority 2 (P2) Chemical Determinands Identification Programme (the P2 Programme). The objective of the P2 Programme is to gather evidence to assess which determinands should be classed as P2 for a supply. There are two types of P2 determinands:

- **Priority 2a (P2a)** which are those that have been introduced into the water from water treatment chemicals (excluding disinfection by-products)
- **Priority 2b (P2b)** which are those that have arisen from other sources.

The P2 Programme is designed to identify determinands of *possible* health concern. The resources available for the P2 Programme do not allow for the collection of sufficient samples to show that all samples collected from the supply will contain the identified P2 determinands at concentrations exceeding 50% of their MAV. It is the purpose of compliance monitoring to establish, more reliably, the levels at which the P2 determinand in question is present in the water.

## 1.5 Changes to the DWSNZ:2000 that affect microbiological compliance

The 2002 annual review uses the compliance requirements of the DWSNZ:2000 for the second time. The DWSNZ:2000 have incorporated several changes to microbiological compliance criteria at both the distribution zone and treatment plant level. The 2002 annual review again compares DWSNZ:2000 with DWSNZ:1995. To understand the implications of these changes it is first necessary to highlight the important microbiological compliance criteria of DWSNZ:2000 that have changed.

- The tolerance for bacteriological transgression has decreased slightly at the distribution zone, compliance is now possible for treatment plants in which *E. coli* are detected, whereas, previously a single transgression resulted in non-compliance.
- There is now a prescribed minimum number of days of the week upon which monitoring samples must be taken and a prescribed maximum number of days between successive monitoring samples.
- The minimum frequency of treatment plant *E. coli* monitoring for surface and non-secure groundwater supplies serving 10,000 people or less has been reduced, including exemption from *E. coli* monitoring at the treatment plant for some supplies serving 100 or fewer people (mostly schools).
- The minimum frequency of *E. coli* monitoring for surface and non-secure groundwater supplies serving 10,001 to 100,000 people has increased.
- The minimum frequency of *E. coli* monitoring to maintain secure groundwater status has increased from one per two months to one per month for the first year after the groundwater supply has been deemed secure.
- Compliance with the protozoan compliance criteria is now much more stringent; plants using filtration without coagulation need to demonstrate their ability to remove particles in the 3–15  $\mu\text{m}$  size range, and plants serving more than 10,000 people that use a coagulation/filtration process now need to continuously monitor turbidity.

As a result of these changes it is not valid to directly compare the level of microbiological compliance in previous reports that were based on the DWSNZ:1995 with microbiological compliance with the DWSNZ:2000. A supply that complied with the DWSNZ:1995 but not the DWSNZ:2000 does not necessarily reflect a reduction in the level of treatment nor a decrease in drinking-water quality, but may merely reflect a change in the stringency of the microbiological compliance criteria. Consequently, the data are presented in two different ways. The present status of the water supplies was reported against the DWSNZ:2000 – which is used in all the tables in this report – providing a snapshot of the present status and will serve for comparisons in future reports. Once again, to compare trends in microbiological compliance over the years before the present drinking-water standards were in place, the 2002 data were, where possible, converted to microbiological compliance against the DWSNZ:1995 and, where appropriate, referred to in the text of the report.

## 2 Methodology

### 2.1 The questionnaires

The 2002 survey had two parts, the Water Treatment Plants and the Distribution Zones (see Appendix 2). The questionnaires were designed in collaboration with the Ministry of Health and were reviewed and/or trialled by several HPOs. With the exception of a few minor details they were similar to the 2001 questionnaires. The new P2 compliance monitoring sections of the questionnaire were based on a revision of a pilot survey questionnaire used to gather information about P2 compliance monitoring undertaken in 2001. Once again, much of the 2002 survey was collected electronically using the revised Annual Survey module of WINZ and the data exported to ESR via email and processed on the computer. This improved the speed of collection, and the accuracy and traceability of the data.

Each questionnaire was divided into three sections with each section being contained on a different data entry screen on the computer (these data entry screens are illustrated in Appendix 2). The introductory section of the monitoring 1 screens for both the distribution zone and treatment plant questionnaires sought to verify that information in the current Register was accurate. The remainder of the monitoring 1 and monitoring 2 screens of the distribution zone and treatment plant questionnaires dealt with monitoring by the water supplier. The audit screens of the distribution zone and treatment plant questionnaires respectively dealt with questions regarding DHB surveillance.

#### 2.1.1 Water supplier monitoring – treatment plant and source water

The aim of this section was to determine compliance with the DWSNZ:2000 with respect to *E. coli* (monitoring and presence), *Cryptosporidium* (treatment and monitoring) and P2 chemical determinands assigned to treatment plants. The section concluded with a question to determine compliance or non-compliance with the DWSNZ:2000.

Compliance with the *E. coli* requirement was determined by questions on the plant monitoring 1 screen. Compliance with the *Cryptosporidium* requirement was determined by questions on the monitoring 2 screen. For supplies that used membrane, cartridge, bag, slow sand or diatomaceous earth filters or UV treatment, or that were required to monitor P2 chemicals, compliance was determined by questions on the supplementary windows within the monitoring 2 screen.

#### 2.1.2 DHB surveillance of water treatment plant

This section (plant audit screen) determined whether the DHB had conducted surveillance on the treatment plant and, if so, whether surveillance of free available chlorine (FAC), *E. coli* and turbidity was conducted by analysis or auditing. In addition, for those plants with a P2 chemical monitoring requirement, auditing information was recorded on the supplementary window within the audit screen.

#### 2.1.3 Water supplier monitoring – distribution zone

The aim of this section was to determine compliance with the DWSNZ:2000 with respect to monitoring and presence of *E. coli*. The section concluded with a question to determine

compliance or non-compliance with the DWSNZ:2000. A question about the seasonal variation in the population of the community supply (zone monitoring 1 screen) was included.

Compliance with the *E. coli* requirement was determined by questions on the zone monitoring 1 screen. Questions on the zone monitoring 2 screen sought information on the nature of transgressions that were detected during the year, the success of remedial corrective action, and whether any 'Boil Water' notices were issued. For supplies that were required to monitor P2 chemical determinands in the distribution zone, compliance was determined by questions on the supplementary window within the monitoring 2 screen.

#### **2.1.4 DHB surveillance of the distribution zone**

This section (zone audit screen) determined whether the DHB had conducted surveillance in the distribution zone and, if so, how the surveillance of FAC and *E. coli* was conducted. Also, for those distribution zones with a P2 chemical monitoring requirement, audit details were recorded on the supplementary window within the audit screen.

#### **2.1.5 Population information**

The population of the distribution zone, as given in the Register, was printed on the questionnaire. At the time of preparing the questionnaire, no population data were available for some distribution zones. In such cases the population figure pre-printed on the questionnaire was '0'. HPOs were asked to update the population figure if it was '0' on the questionnaire. There are now only a few instances where HPOs were unable to provide information. Most of these zones were expected to serve small populations and were assigned a nominal population of fewer than 500 people for inclusion in tables where data were distributed according to population band. The normal and seasonal populations were also sought for supplies that displayed significant seasonal variation in population.

The total population covered by the annual survey was 3,478,955 (Table 3.1). This represents 87.5% of the New Zealand population of 3,975,600, as derived from the June 2001 Census. The difference is mostly due to supplies that are not registered but should be, and individual dwellings and small communities of fewer than 25 people that are not required to be registered. Failure to update the population of communities with registered drinking-water supplies could also contribute to this difference.

There has been some double-counting in this survey, mainly in zones that have transient populations. For example, children who attend a school that has a separate water supply to the town in which they live will be counted in both distribution zones. It is necessary to include these people in both supplies as they may have consumed drinking-water from both sources during the course of the year. However, it is likely that this did not cause a significant error as it is thought that only a small proportion of the population were affected in this manner. For example, the number of people reported to attend schools with their own drinking-water supplies was approximately 55,300 or 1.6% of the total population.

In relation to the P2 determinands, data from several zones have not been included in the analysis of the data because the population data collected by the survey showed that their population had dropped below the level of 500 people at which P2 assignments are made.

## **2.2 Questionnaire distribution**

A copy of the WINZ database was taken on 31 December 2002. This contained only those zones that were active at the end of 2002. This dataset was used as the basis for the 2002 survey. At that time, WINZ contained 2060 active treatment plants and 2138 distribution zones.

As in other years, HPOs were responsible for gathering the monitoring data from the water suppliers in their district. This could be carried out electronically where water suppliers were using WINZ. Alternatively, monitoring data could be obtained by HPOs using paper questionnaires or via the telephone and entered manually into WINZ. The surveillance sections were completed only by HPOs. The upgraded WINZ programme that contained the Annual Survey module was distributed to HPOs and LAs in December 2002. Completed questionnaires were emailed to ESR and incorporated into national WINZ. The completion date for the survey was set at 15 March 2003.

## **2.3 Coverage of the survey**

By 15 March 2003, only about three-quarters of the questionnaires had been returned in complete form. The deadline was extended to the middle of April and all HPOs were telephoned to remind them of the new deadline. By the beginning of April, 6% of the data were still outstanding. The survey was closed off on 17 April and no further questionnaires were accepted after this date. At that time, questionnaires had been received for 2138 distribution zones and 2060 treatment plants, a return rate of 100%.

## **2.4 Quality control**

Three tools were used to improve the consistency of the answers and the quality of the data obtained from the questionnaire for this survey. The first was a detailed written explanation of the survey questions that explained the required responses to each question and was designed to promote consistency of response among water suppliers and HPOs. The second was a training session covering the questionnaire and the new Annual Survey module of WINZ. The training session was conducted during November 2002 and was attended by at least one HPO from most DHBs. Attendees were provided with a booklet containing a copy of the distribution zone and treatment plant questionnaires, notes to the survey, and instructions on how to use the Annual Survey module of WINZ. The third quality control tool comprised a series of checks in WINZ that occurred when water suppliers and HPOs entered their data into the Annual Survey module of WINZ. Certain checks did not allow the record to be closed until the requisite data were entered whereas others flagged to the user that two entries looked incompatible.

The data for all zones and plants were checked visually during the data importation process at ESR before being verified by the ESR project leader. Most of the inconsistencies were identified at this point. Once the inconsistencies were identified, the submitting HPO was contacted and the issues discussed. In most cases, discrepancies arose from misinterpretation of the DWSNZ:2000, misunderstanding of the questionnaire by water suppliers or transcription errors by HPOs. Each plant and zone that contained erroneous data was discussed with and corrected by the appropriate HPO and the corrected data re-sent to ESR.

After the survey was closed off, the data were checked using algorithms within a spreadsheet to facilitate the process. The following checks were made to identify possible errors in the responses to various questions.

## Treatment plants

- If WINZ showed disinfection as ‘?’ and the means of disinfection was not specified.
- Discrepancies between the method used to demonstrate compliance and the monitoring data.
- Discrepancies between secure groundwater but not verified as being secure.
- Discrepancies between compliance using continuous FAC monitoring and bacteriological compliance.
- Discrepancies between bacteriological monitoring frequency adequacy and the number of bacteriological samples.
- Discrepancies between bacteriological compliance as stated on the audit screen and the bacteriological transgressions in excess of the permissible frequency.
- Discrepancies between secure groundwater as shown on the Monitoring 2 screen but less than minimum number of *E. coli* tests required to demonstrate groundwater security.
- Conflicts between options in *Cryptosporidium* compliance and the treatment used.
- The status of all laboratories was checked against the list of Ministry of Health-recognised laboratories.
- The water source was marked as entirely groundwater but WINZ indicated roof or surface water sources.
- Discrepancies between the maximum determinand concentration recorded, and the indication of the number of transgressions, or number of samples with concentrations in the 50–100% MAV range.
- Discrepancies between the overall P2 compliance recorded, and the individual factors (sample numbers, transgression, laboratory registration and adequacy of corrective actions) that contribute to the overall compliance.

## Distribution zones

- Discrepancies between overall *E. coli* compliance on the audit screen and FAC compliance and/or *E. coli* monitoring frequency and results on the monitoring 1 screen.
- Conflict between inadequate corrective action and compliance on the monitoring 2 screen.
- The status of all laboratories identified were checked against the list of Ministry of Health-recognised laboratories.
- Discrepancies between the maximum determinand concentration recorded, and the indication of the number of transgressions, or number of samples with concentrations in the 50–100% MAV range.
- Discrepancies between the overall P2 compliance recorded, and the individual factors that contribute to the overall compliance.

Approximately 60 (mostly minor) errors in the microbiological data that had been missed during the initial checking were detected by this process. Approximately 100 errors were found in the chemical data set, many of which arose from misunderstandings concerning aggressive waters, which are discussed in more detail later in the report. These data were corrected by the ESR project leader in consultation with the HPO and amendments made directly into the national WINZ dataset. The exported files from each DHB and the final dataset were archived. This process enabled an audit trail of all data to be kept.

## 2.5 Analysis

Electronic processing of the questionnaire data was completed using a module of WINZ. This module gave access to tables containing information such as population within the Register's database.

Data summaries and searches for data correlation were carried out in Microsoft Access, then downloaded into Microsoft Excel for manipulation or incorporation into documents.

## 2.6 Shortcomings of the questionnaire

The use of a questionnaire to obtain data has a number of shortcomings:

- delays in completing the survey because of difficulties experienced by HPOs in obtaining the requisite information from water suppliers
- variability in interpretation of questions and data because of the number of HPO and LA staff involved; this aspect was reduced by the HPO training session
- transcription errors — the electronic format reduced transcription errors for the small number of LAs that entered the survey data directly onto WINZ
- poor understanding by non-LA staff to whom the questionnaires were sent (especially small private water suppliers), many of whom have apparently still not heard of the drinking-water standards
- great variability in the ease of access to water quality and treatment information that should have been formally recorded (this is perhaps related to the previous point)
- variability in the stringency that different HPOs apply the DWSNZ:2000. For example, when a water supplier took one too few monitoring samples during the year, some HPOs allowed the supply to comply whereas other HPOs registered the supply as not complying.

Some of these points emphasise the importance of DHBs and LAs maintaining their own WINZ databases to streamline data collection and to allow more accurate and consistent information to be readily obtained.

Cross-checking carried out during compilation of the survey data revealed a number of obvious errors that were made during the completion of about 17% of the survey forms. This error rate was higher than the 10% reported for the previous survey, and was mainly caused by repetitive errors in a small number of questions that may have been ambiguous.

Tardy responses to this survey are an ongoing problem, however, this improved slightly in 2002. In part it was due to difficulties in contacting water suppliers; this was especially so for small and remote communities. In the main, HPOs dealt with these supplies by noting that they were unable to contact these supplies on or about the original deadline. However, there were several instances this year where the delay was caused at the DHB. There were problems with getting the latest version of WINZ installed correctly at several DHBs. The main causes of this problem seem to be inadequate computer hardware/networks, delays in installation of the WINZ software and failure to follow the WINZ installation instructions by DHB IT staff, and HPOs not beginning the task early enough (after the deadline in one or two cases).

### 3 Overview of Drinking-Water Supplies

Survey information was received from all registered drinking-water treatment plants and distribution zones in the country. As noted in Section 2.2, the results of the survey relate to those that had been defined on 31 December 2002. This is summarised in terms of the size of the population band in Table 3.1 and in terms of individual health districts in Table 3.2.

**Table 3.1: Numbers and populations of distribution zones and treatment plants**

Population Band	Distribution Zones				Treatment Plants		
	Population		Zones		Population	Plants	
	Pop.	% Pop	No.	% Zones	% Pop.	No.	% TPs
<500	181,015	5%	1749	82%	2%	1679	82%
500–999	75,534	2%	116	5%	1%	100	5%
1000–4999	364,821	10%	160	7%	5%	162	8%
5000–19,999	675,370	19%	72	3%	7%	62	3%
20,000–49,999	978,712	28%	31	1%	15%	30	1%
50,000–99,999	328,203	9%	5	0.2%	14%	16	0.8%
100,000+	875,300	25%	5	0.2%	55%	11	0.5%
<b>Total</b>	<b>3,478,955</b>		<b>2138</b>			<b>2060</b>	

Note: The discrepancy between the percentages of the zone and plant populations for each population band is caused by the doubling-up of people in plant populations where a zone is supplied by more than one plant.

**Table 3.2: Number of distribution zones and populations supplied in the health districts**

Health District	Number of Distribution Zones and Percentage Population in Different Population Bands													
	<500		500–999		1000–4999		5000–19,999		20,000–49,999		50,000–99,999		100,000+	
	Zones	% Pop.	Zones	% Pop.	Zones	% Pop.	Zones	% Pop.	Zones	% Pop.	Zones	% Pop.	Zones	% Pop.
Northland	239	18%	8	4%	10	19%	3	16%	1	43%	0	0%	0	0%
Auckland	174	1%	13	0.7%	13	3%	9	8%	8	23%	2	12%	3	52%
Waikato	146	7%	10	2%	21	20%	9	28%	0	0%	0	0%	1	44%
Tauranga	41	3%	1	0.5%	6	13%	2	10%	2	74%	0	0%	0	0%
Rotorua	75	9%	10	7%	6	14%	4	27%	1	43%	0	0%	0	0%
Whakatane	27	7%	4	6%	6	24%	3	63%	0	0%	0	0%	0	0%
Gisborne	54	10%	1	2%	0	0%	0	0%	1	88%	0	0%	0	0%
Taranaki	69	6%	6	5%	8	21%	3	26%	1	41%	0	0%	0	0%
Hawke's Bay	123	7%	6	3%	6	10%	3	28%	3	53%	0	0%	0	0%
Wanganui	48	8%	1	1%	5	15%	1	8%	1	67%	0	0%	0	0%
Manawatu	66	5%	3	1%	10	16%	3	21%	1	13%	1	44%	0	0%
Wairarapa	28	9%	1	2%	4	31%	1	58%	0	0%	0	0%	0	0%
Hutt Valley	27	0.7%	1	0.2%	7	6%	16	49%	4	30%	1	15%	0	0%
Nelson	56	10%	3	3%	4	9%	1	16%	2	61%	0	0%	0	0%
Marlborough	77	12%	2	3%	3	21%	0	0%	1	63%	0	0%	0	0%
West Coast	73	29%	0	0%	4	30%	2	41%	0	0%	0	0%	0	0%
Canterbury	193	7%	21	3%	18	9%	5	12%	1	7%	1	17%	1	44%
S. Canterbury	45	12%	5	6%	8	32%	0	0%	1	49%	0	0%	0	0%
Otago	122	10%	14	6%	11	17%	5	25%	2	42%	0	0%	0	0%
Southland	66	8%	6	5%	10	21%	2	16%	1	50%	0	0%	0	0%
<b>Total</b>	<b>1749</b>	<b>5%</b>	<b>116</b>	<b>2%</b>	<b>160</b>	<b>10%</b>	<b>72</b>	<b>19%</b>	<b>31</b>	<b>28%</b>	<b>5</b>	<b>9%</b>	<b>5</b>	<b>25%</b>

As the sizes of the populations served by treatment plants are not recorded in the Register, it was necessary to estimate the treatment plant populations for several aspects to be examined. As in the previous reports, the population served by each treatment plant was estimated by addition of the populations of all distribution zones supplied by the treatment plant. This overestimates the population where one zone is supplied by more than one treatment plant. Consequently, actual populations served by treatment plants are not used in this report; where cited, the percentage of the population served by treatment plants is referred to as an estimate.

This survey comprised data from 2138 distribution zones and 2060 treatment plants and covered an approximate population of 3,479,000 people, as listed in WINZ. Table 3.1 classes the zones according to their population. The population bands used in the tables are the same as those used in previous reports.

It is clear from the tables that the relative importance of a population band in the survey depends on whether the analysis is based on treatment plant, distribution zone or population. Distribution zones with populations less than 500 people are the most numerous, constituting 82% of the zones surveyed, but they contain only 5% of the surveyed population. In contrast, the ten zones that serve 50,000 or more people, constitute approximately one-third of the population (Table 3.1). The same trend is true for treatment plants. The number of registered zones has increased progressively from 502 to 983 to 1180 to 1340 to 1512 to 1865 to 2054 to 2109 and to 2138 in the successive years from 1994 to 2002. This is indicative of the ongoing success of the programme of registering new and existing drinking-water supplies, mostly serving small communities.

To evaluate the public health significance of the water quality data contained in this report, the data has to be analysed in terms of the population affected. Expression of the results in terms of zone numbers may be of more value for purposes of regulation and water supply management. Data are therefore summarised in both ways.

Distribution zones and treatment plants are considered separately because zone and plant compliance are affected by different factors.

Table 3.3 contains a summary of the number and proportion of zones that are managed by, or on behalf, of LAs. This information is split into different sized populations. LAs manage 35% of the water supplies supplying 95% of the people served by registered supplies — most of the larger community supplies are managed by LAs. However, a majority of zones serving communities of less than 500 people are privately operated.

**Table 3.3: Number of local authority-owned/managed distribution zones in each health district**

Health District	LA-Operated Distribution Zones in Different Population Bands															
	% of pop	% of Zones	<500		500-999		1000-4999		5000-19,999		20,000-49,999		50,000-99,999		100,000+	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Northland	82%	14%	17	7%	6	75%	9	90%	3	100%	1	100%	0	-	0	-
Auckland	98%	29%	24	14%	7	54%	11	85%	9	100%	8	100%	2	100%	3	100%
Waikato	95%	42%	40	27%	8	80%	20	95%	9	100%	0	-	0	-	1	100%
Tauranga	95%	23%	2	5%	1	100%	5	83%	2	100%	2	100%	0	-	0	-
Rotorua	94%	41%	20	27%	8	80%	6	100%	4	100%	1	100%	0	-	0	-
Whakatane	95%	43%	4	15%	4	100%	6	100%	3	100%	0	-	0	-	0	-
Gisborne	90%	9%	3	6%	1	100%	0	-	0	-	1	100%	0	-	0	-
Taranaki	96%	33%	12	17%	5	83%	8	100%	3	100%	1	100%	0	-	0	-
Hawke's Bay	94%	23%	16	13%	6	100%	5	83%	3	100%	3	100%	0	-	0	-
Wanganui	91%	29%	9	19%	1	100%	4	80%	1	100%	1	100%	0	-	0	-
Manawatu	85%	29%	10	15%	2	67%	8	80%	2	67%	1	100%	1	100%	0	-
Wairarapa	91%	24%	3	11%	0	-	4	100%	1	100%	0	-	0	-	0	-
Hutt Valley	99%	55%	2	7%	1	100%	7	100%	16	100%	4	100%	1	100%	0	-
Nelson	91%	27%	10	18%	1	33%	4	100%	1	100%	2	100%	0	-	0	-
Marlborough	85%	10%	3	4%	2	100%	2	67%	0	-	1	100%	0	-	0	-
West Coast	88%	35%	22	30%	0	-	4	100%	2	100%	0	-	0	-	0	-
Canterbury	93%	50%	83	43%	16	76%	12	67%	5	100%	1	100%	1	100%	1	100%
S Canterbury	86%	51%	19	42%	3	60%	7	88%	0	-	1	100%	0	-	0	-
Otago	97%	52%	49	40%	13	93%	11	100%	5	100%	2	100%	0	-	0	-
Southland	93%	44%	20	30%	5	83%	9	90%	2	100%	1	100%	0	-	0	-
<b>Total</b>	<b>95%</b>	<b>35%</b>	<b>368</b>	<b>21%</b>	<b>116</b>	<b>100%</b>	<b>142</b>	<b>89%</b>	<b>71</b>	<b>99%</b>	<b>31</b>	<b>100%</b>	<b>5</b>	<b>100%</b>	<b>5</b>	<b>100%</b>

## 4 Drinking-Water Bacteriological Monitoring in the Distribution Zone

### 4.1 Adequacy of bacteriological monitoring

Two aspects of the distribution zone monitoring regime must be examined when assessing the adequacy of bacteriological monitoring for bacteriological compliance:

1. Whether a sufficient number of *E. coli* samples were taken for the population supplied in the zone, and whether FAC monitoring was used as a partial replacement for *E. coli* testing.
2. Whether the frequency and results of FAC monitoring satisfied the requirements of the DWSNZ:2000 with respect to FAC concentration, pH and turbidity. The criteria for these assessments are set out in the table contained in Section 3.3.2.1 of DWSNZ:2000.

The minimum sampling frequency for *E. coli* in distribution zones is specified in Tables 3.2 a and b of the DWSNZ:2000. This can be reduced if the water is effectively treated with chlorine and adequate FAC monitoring occurs. FAC substitution was attempted in only two zones (0.09%), both of which demonstrated compliance with the FAC requirement. Consequently, assessment of the adequacy of monitoring of all but a very few zones was made using the *E. coli* sampling frequency criterion.

The supplies for which questionnaires were not returned were scored as not monitored unless otherwise indicated.

#### 4.1.1 Classification by health district

Table 4.1 summarises information about the number of zones being monitored for *E. coli* and the adequacy of their monitoring; Table 4.2 gives the same information as percentages of the total number of zones contained in the survey.

The number of distribution zones in a particular health district ranged from 34 in the Wairarapa to 261 in Northland. Significant changes from 2001 in the number of registered zones were observed in two health districts. Northland and Hawke's Bay newly registered 10 and 23 mainly small supplies, respectively, in 2002.

**Table 4.1: Summary of the adequacy of bacteriological monitoring in distribution zones**

Health District	Total No. Zones in Survey		Monitored		Adequately Monitored		Not Monitored		Monitoring Status Unknown		Neither Monitored nor Surveyed	
	2002	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002	2001
Northland	261	251	107	114	25	24	154	137	0	0	97	73
Auckland	222	223	145	125	68	73	77	98	0	0	77	97
Waikato	187	189	160	160	73	86	27	29	0	0	18	26
Tauranga	52	52	15	19	8	3	37	33	0	0	13	17
Rotorua	96	96	54	51	32	28	42	45	0	0	21	18
Whakatane	40	41	26	27	16	10	14	14	0	0	2	2
Gisborne	56	55	18	16	3	4	38	39	0	0	20	23
Taranaki	87	88	45	48	15	14	42	40	0	0	9	12
Hawke's Bay	141	118	67	55	31	28	74	63	0	0	36	55
Wanganui	56	52	28	26	6	15	28	26	0	0	4	6
Manawatu	84	88	52	44	28	18	32	44	0	0	6	20
Wairarapa	34	33	27	20	0	0	7	13	0	0	2	2
Hutt Valley	56	52	42	40	36	37	14	12	0	0	11	10
Nelson	66	68	52	50	29	26	14	18	0	0	1	1
Marlborough	83	84	14	17	2	0	69	67	0	0	61	18
West Coast	79	75	34	28	23	22	45	47	0	0	37	29
Canterbury	240	241	171	180	66	54	69	61	0	0	47	44
S. Canterbury	59	60	35	33	19	21	24	27	0	0	13	16
Otago	154	158	104	113	39	14	50	45	0	0	6	6
Southland	85	85	63	46	42	27	22	39	0	3	4	8
<b>Total</b>	<b>2138</b>	<b>2109</b>	<b>1259</b>	<b>1212</b>	<b>561</b>	<b>504</b>	<b>879</b>	<b>897</b>	<b>0</b>	<b>3</b>	<b>485</b>	<b>483</b>

Note: 'Neither Monitored nor Surveyed' means those zones that were not included in a monitoring programme or in a DHB surveillance programme.

The monitoring status of distribution zones was very similar to the previous year — 26% of zones were adequately monitored in 2002 compared with 24% in 2001 (Table 4.2). While this represents a slight increase from 2001 to 2002, it is still lower than the 34% of adequately-monitored zones reported in 2000 before the DWSNZ:2000 were implemented. Zone monitoring is classed as adequate when all three monitoring criteria (minimum number of samples, minimum number of days per week sampled and maximum interval between successive samples) are satisfied. These criteria have not changed between the DWSNZ:1995 and DWSNZ:2000. However, the 2002 survey sought information about each of these three criteria. Prior to 2000, this information was recorded in a single question about the monitoring frequency, which required assessment of the same three criteria without requiring individual answers to be recorded. It is possible that the small observed increase in adequate monitoring was due to some supplies not implementing DWSNZ:2000 at the time of the 2002 survey and this may relate to the timing of the distribution of the results from the 2001 annual survey to these supplies. For example, if a water supplier used the information in Appendix 4 of the 2001 *Annual Review of the Microbiological Quality of Drinking-Water in New Zealand* as a guide to monitoring compliance instead of being cognisant of the monitoring requirements of the DWSNZ:2000, then any actions taken to redress monitoring deficiencies would not have been carried out until after the report was released (*ie*, December 2002) and, consequently, such improvements would not have been noticeable in 2002.

A substantial increase of 20% was observed in the proportion of monitored zones in the Southland health district during 2002 (Table 4.2). In the Manawatu and Wairarapa health districts appreciable increases in the proportion of monitored zones were observed in 2002 — 12% and 18%, respectively. Where health districts displayed decreases in the proportion of monitored zones, this may reflect a lack of appreciation of the monitoring requirements in DWSNZ:2000 in some areas.

**Table 4.2: Adequacy of zone bacteriological monitoring expressed as percentages**

Health District	Total No. Zones in Survey		Monitored		Adequately Monitored		Not Monitored		Monitoring Status Unknown		Neither Monitored nor Surveyed	
	2002	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002	2001
Northland	261	251	41%	45%	10%	10%	59%	55%	0%	0%	37%	29%
Auckland	222	223	65%	56%	31%	33%	35%	44%	0%	0%	35%	43%
Waikato	187	189	86%	85%	39%	46%	14%	15%	0%	0%	10%	14%
Tauranga	52	52	29%	37%	15%	6%	71%	63%	0%	0%	25%	33%
Rotorua	96	96	56%	53%	33%	29%	44%	47%	0%	0%	22%	19%
Whakatane	40	41	65%	66%	40%	24%	35%	34%	0%	0%	5%	5%
Gisborne	56	55	32%	29%	5%	7%	68%	71%	0%	0%	36%	42%
Taranaki	87	88	52%	55%	17%	16%	48%	45%	0%	0%	10%	14%
Hawke's Bay	141	118	48%	47%	22%	24%	52%	53%	0%	0%	26%	47%
Wanganui	56	52	50%	50%	11%	29%	50%	50%	0%	0%	7%	12%
Manawatu	84	88	62%	50%	33%	20%	38%	50%	0%	0%	7%	23%
Wairarapa	34	33	79%	61%	0%	0%	21%	39%	0%	0%	6%	6%
Hutt Valley	56	52	75%	77%	64%	71%	25%	23%	0%	0%	20%	19%
Nelson	66	68	79%	74%	44%	38%	21%	26%	0%	0%	2%	1%
Marlborough	83	84	17%	20%	2%	0%	83%	80%	0%	0%	73%	21%
West Coast	79	75	43%	37%	29%	29%	57%	63%	0%	0%	47%	39%
Canterbury	240	241	71%	75%	28%	22%	29%	25%	0%	0%	20%	18%
S. Canterbury	59	60	59%	55%	32%	35%	41%	45%	0%	0%	22%	27%
Otago	154	158	68%	72%	25%	9%	32%	28%	0%	0%	4%	3.8%
Southland	85	85	74%	54%	49%	32%	26%	46%	0%	4%	5%	9%
<b>Total</b>	<b>2138</b>	<b>2109</b>	<b>59%</b>	<b>57%</b>	<b>26%</b>	<b>24%</b>	<b>41%</b>	<b>43%</b>	<b>0%</b>	<b>0%</b>	<b>23%</b>	<b>23%</b>

**Table 4.3: Distribution zone bacteriological monitoring expressed in terms of population**

Health District	Total Population Covered by Survey	Population supplied by:									
		Monitored Zones		Complying Zones		Zones Adequately Monitored		Zones Not Monitored or of Unknown Status		Zones Neither Monitored nor Surveyed	
Northland	112,057	99,010	88%	42,788	38%	34,363	31%	13,047	12%	7704	7%
Auckland	1,127,889	1,121,847	99%	1,113,149	99%	613,273	54%	6,042	0.5%	6,042	0.5%
Waikato	269,033	265,793	99%	82,251	31%	86,110	32%	3,240	1%	1,942	0.7%
Tauranga	120,026	117,033	98%	116,956	97%	95,919	80%	2,993	2%	602	0.5%
Rotorua	99,930	95,736	96%	71,362	71%	39,401	39%	4,194	4%	988	1%
Whakatane	44,580	42,210	95%	23,350	52%	28,650	64%	2,370	5%	140	0.3%
Gisborne	34,185	32,128	94%	31,203	91%	736	2%	2,057	6%	845	2%
Taranaki	86,411	84,910	98%	61,579	71%	61,469	71%	1,501	2%	240	0.3%
Hawke's Bay	130,846	126,327	97%	120,548	92%	120,760	92%	4,519	3%	2568	2%
Wanganui	58,939	57,670	98%	49,312	84%	9,870	17%	1,269	2%	118	0.2%
Manawatu	149,320	146,723	98%	131,420	88%	113,881	76%	2,597	2%	306	0.2%
Wairarapa	32,668	31,699	97%	23,200	71%	0	0%	969	3%	55	0.2%
Hutt Valley	383,957	382,754	99.7%	382,489	99.6%	326,461	85.0%	1,203	0.3%	740	0.2%
Nelson	65,390	64,732	99%	62,213	95%	56,460	86%	658	1%	25	0.04%
Marlborough	34,227	31,256	91%	1,570	5%	1,570	5%	2,971	9%	2278	7%
West Coast	26,004	22,836	88%	17,774	68%	18,946	73%	3,168	12%	2386	9%
Canterbury	400,496	392,306	98%	317,373	79%	331,458	83%	8,190	2%	5,080	1%
S. Canterbury	54,311	52,592	97%	38,837	72%	44,442	82%	1,719	3%	1068	2%
Otago	154,110	151,799	99%	19,775	13%	22,573	15%	2,311	1%	95	0.1%
Southland	94,576	92,224	98%	20,250	21%	23,870	25%	2,352	2%	248	0.3%
<b>Total</b>	<b>3,478,955</b>	<b>3,411,585</b>	<b>98%</b>	<b>2,727,399</b>	<b>78%</b>	<b>2,030,212</b>	<b>58%</b>	<b>67,370</b>	<b>2%</b>	<b>33,470</b>	<b>1%</b>

Table 4.3 summarises the bacteriological monitoring data on a health district basis and approximate figures for the populations affected. Although only 59% of the zones in the survey were monitored (Table 4.2), this represents the water supplied to approximately 98% of the population served by registered supplies (Table 4.3). Two health districts had less than 90% of the population living in registered zones that were monitored during 2002: Northland (remained at 88%), West Coast (increased to 88%) during the time period 2001–2002. The comparatively low levels of monitoring reported in the Northland and West Coast health districts was mainly due to the relatively high proportion of water supplies serving fewer than 500 people (91% compared with 82% for all of New Zealand) and that were not monitored. Marlborough showed an appreciable increase in the percentage of the population living in registered zones that were monitored during 2002, from 82% in 2001 to 91% of the population in 2002.

Compared with the previous year, the proportion of the population supplied with drinking-water that was monitored for *E.coli* remained static at 98%. The proportion of the population living in zones that complied with the bacteriological monitoring requirements of the DWSNZ:2000 increased by 8%, from 70% in 2001 to 78% of the population in 2002. In contrast, the proportion of consumers on adequately monitored drinking-water supplies decreased sharply from 71% in 2001 to 58% during 2002 (Table 4.3). This decline indicates the failure by water suppliers to adopt the monitoring requirements of the DWSNZ:2000, which are more stringent than those prescribed in the DWSNZ:1995 (refer to Section 12.1 of this report).

The number of zones where there was no recorded bacteriological monitoring decreased from 897 in 2001 to 879 in 2002 (see Table 4.1), which represented 2% of the total population (see Table 4.3). Most of these zones supplied small populations.

Approximately 1% of the population lived in zones where neither monitoring nor DHB surveillance was undertaken during 2002 (Table 4.3). The number of zones without monitoring or surveillance increased slightly from 483 during 2001 to 485 during 2002 (Table 4.1). The population served by unmonitored and unsurveyed zones was 5% or more in three health districts (Table 4.3). There was no bacteriological analysis recorded for 97 distribution zones in the Northland health district, an increase of 24 since 2001 (Table 4.1) and serving 7% of the population in that district (Table 4.3). Similarly, drinking-water supplied to 9% of the population in the West Coast district and 7% of the population in the Marlborough health district had neither bacteriological monitoring nor surveillance testing recorded during 2002.

There are also degrees of non-compliance with the monitoring requirements. For example, a zone may have failed to comply with the bacteriological monitoring frequency requirements of the DWSNZ:2000 by taking one sample too few during the year, or by being grossly under-monitored. However, some leniency was given in respect to the former situation. If the HPO was convinced that technical non-compliance was caused by omission of a single sample as a result of a one-off event, then the zone may have been classified as 'adequately monitored'.

#### 4.1.2 Classification by population band

Classification by population band (Table 4.4) provides further insight into how the population of the zones covered by the survey influences their management, in particular the degree to which they are monitored and the adequacy of the bacteriological monitoring.

**Table 4.4: Adequacy of distribution zone bacteriological monitoring by population band**

Population Band	Monitored				Adequately Monitored				Neither Monitored nor Surveyed			
	Population		Zones		Population		Zones		Population		Zones	
	No.	% of Total	No.	% of Total	No.	% of Total	No.	% of Total	No.	% of Total	No.	% of Total
< 500	122,811	68%	883	50%	57,149	32%	342	20%	31,454	17%	481	28%
500–999	69,868	92%	106	91%	33,722	45%	51	44%	2,016	3%	4	3%
1000–4999	361,321	99%	157	98%	216,133	59%	89	56%	0	0%	0	0%
5000–19,999	675,370	100%	72	100%	480,770	71%	50	69%	0	0%	0	0%
20,000–49,999	978,712	100%	31	100%	685,138	70%	23	74%	0	0%	0	0%
50,000–99,999	328,203	100%	5	100%	272,100	83%	4	80%	0	0%	0	0%
100,000+	875,300	100%	5	100%	285,200	33%	2	40%	0	0%	0	0%
<b>Total</b>	<b>3,411,585</b>	<b>98%</b>	<b>1259</b>	<b>59%</b>	<b>2,030,212</b>	<b>58%</b>	<b>561</b>	<b>26%</b>	<b>33,470</b>	<b>1%</b>	<b>485</b>	<b>23%</b>

The data in Table 4.4 show that all of the distribution zones that served 5000 people or more were monitored or adequately monitored for *E.coli* in 2002. This represents an appreciable improvement in the level of bacteriological monitoring in New Zealand in 2002. However, monitoring received less attention in supplies for smaller populations than it did in the larger ones. This may have been caused by the relatively low priority given to monitoring when water supply resources were allocated. However, water suppliers in many small zones were

again reported to have been unaware of the bacteriological monitoring requirements of the DWSNZ:2000, which may also have contributed to this situation. While this situation is understandable in the case of some private water supplies, it should not apply to water supplies administered by LAs, all of whom have received copies of the DWSNZ:2000 and previous annual reports on the microbiological quality of the drinking-water supplies in their district.

Three distribution zones with populations of more than 1000 people were not monitored for *E.coli*: Amberley Town (Hurunui District Council), Hikutaia-Opotiki (Opotiki District Council) and Mangonui-Cooper's Beach (a private supply in the Far North district). The percentage of zones monitored for *E.coli* gradually decreased to 91% as the zone population fell to 500 people and this is a slight improvement in overall monitoring when compared with bacteriological monitoring in 2001 (87%). Half of the distribution zones serving populations of less than 500 people were monitored for *E.coli* during 2002. This represents a slight increase in overall monitoring since the 2001 survey. There was also a slight increase in the percentage of zones monitored adequately for *E.coli* during 2002 (26%) compared with 2001 (24%).

## 4.2 Bacteriological compliance

Two factors must be taken into account when the bacteriological compliance of distribution zones is being evaluated:

1. Whether the sampling frequency and distribution meet the guidelines set out in Tables 3.2 a and b of the DWSNZ:2000 respectively. The question of monitoring adequacy has already been discussed in Section 4.1.
2. Whether the samples are free of *E. coli*.

This section examines the overall bacteriological compliance of the zones, using the monitoring frequency data together with information about the bacteriological quality of the samples taken. As with the monitoring adequacy data, the bacteriological compliance data have been presented in a number of tables providing different aspects of the same information. Detailed bacteriological compliance information for each zone included in the survey is contained in Appendix 4a.

Bacteriological compliance was determined for each distribution zone on the basis of questions that sought to determine:

- whether *E. coli* testing was carried out in a Ministry of Health-recognised laboratory
- the number of compliance monitoring samples tested for *E. coli* during 2002
- whether the sampling frequency was in accordance with the DWSNZ:2000
- the number of routine monitoring samples that contained *E. coli*
- whether or not corrective action was undertaken by the water supplier in the event of an *E. coli* transgression and, if so, whether the corrective action satisfied the requirements of the DWSNZ:2000.

Bacteriological compliance is determined by the monitoring frequency, which is dependent on the zone population (see Table 3.2a of the DWSNZ:2000), the results (ie, the number of

samples containing *E. coli* should not exceed the maximum as specified in Section 3.2.2 of the DWSNZ:2000<sup>3</sup> and the adequacy of any corrective action undertaken following any *E. coli* transgressions (see Figure 3.4 of the DWSNZ:2000). Only if all criteria are satisfied can the zone be said to comply bacteriologically with DWSNZ:2000. In other words, although all samples taken from a zone may be of acceptable bacteriological quality, if insufficient samples have been taken it is not possible to ascertain whether the water is of this quality for an acceptable portion of the time. The zone would therefore not comply. Similarly, monitoring samples that were tested in a laboratory not on the list of Ministry of Health-recognised laboratories are not eligible to be used to demonstrate bacteriological compliance with the DWSNZ:2000.

#### 4.2.1 Classification by health district

Table 4.5 presents bacteriological compliance data categorised by health district.

It should be noted that this table specifies bacteriological compliance or the causes of non-compliance and includes each of the reasons why a supply did not comply. Consequently, the totals do not appear to add up because a non-complying zone may have failed to comply with one or more of the bacteriological compliance criteria, so were scored in each.

Nationally, 78% of the population served by registered supplies was supplied with drinking-water that complied bacteriologically with the DWSNZ:2000 (Table 4.3). This is an increase from 70% in 2001 and represents a corresponding increase in complying zones from 20% in 2001 to 24% in 2002 (Table 4.5). The main reason for the increase in the number of complying zones is that water supplies changed over to DWSNZ:2000 standards during 2002. However, it is clear that not all water supplies have made this change and, as a result, there is still room for significant improvement. The degree of bacteriological compliance expressed as a percentage of the district population was highly variable among health districts, ranging from 5% in Marlborough to 99.6% in the Hutt Valley. This phenomenon was largely caused by the differing attitudes of HPOs who, when faced with a zone that complied except for the minimum days of the week or maximum interval between successive monitoring samples, might assess the supply as compliant (as is their prerogative) while others may adhere strictly to the technical compliance as defined in WINZ. As neither of these approaches is incorrect, there is little point in scrutinising the differences between the compliance rates in different health districts.

A total of 1624 distribution zones did not comply bacteriologically with the DWSNZ:2000 during 2002, a decrease of 60 distribution zones over the previous year (Table 4.6). The numbers of zones failing to comply for different reasons are summarised in Table 4.6.

As with previous surveys, the predominant reason for failure to comply bacteriologically with the DWSNZ:2000 was a lack of any documented monitoring and this accounted for 41% of distribution zone failures (Table 4.6). Similarly, the second most frequent cause of failure to comply bacteriologically with the DWSNZ:2000 in 2002 was inadequate monitoring, which occurred in 33% of distribution zones.

The number of zones demonstrated to have poor bacteriological water quality (*ie*, as indicated by the detection of *E. coli* in more than the maximum permitted number of

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<sup>3</sup> A more complete specification is given in Appendix 5.

monitoring samples<sup>4</sup>) decreased from 302 to 291 between 2001 and 2002. This means that in 2002, 4% of the population was served by supplies that were contaminated with *E. coli* more often than is permitted for bacteriologically compliant zones (Table 4.5).

The number of distribution zones where failure to comply bacteriologically with the DWSNZ:2000 was caused by inadequate, slow or corrective action following an *E. coli* transgression decreased appreciably from 157 in 2001 to 118 in 2002. This represents 6% of zones (Tables 4.5 & 4.6) or 2% of the population served by registered drinking-water supplies.

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<sup>4</sup> Refer to Appendix 5.

**Table 4.5: Summary of distribution zone bacteriological monitoring compliance data**

Health District	Total No. DZs	<i>E. coli</i> Compliance			<i>E. coli</i> Transgression			Inadequate/ Slow Corrective Action			Not Monitored			Inadequate Monitoring **			Non-registered Laboratory		
		No.	Pop. *	DZs #	No.	Pop.	DZs	No.	Pop.	DZs	No.	Pop.	DZs	No.	Pop.	DZs	No.	Pop.	DZs
Northland	261	30	38%	11%	21	2%	8%	8	0.6%	3%	154	12%	59%	82	58%	31%	1	0.07%	0.4%
Auckland	222	76	99%	34%	27	0.4%	12%	19	0.2%	9%	77	0.5%	35%	77	45%	35%	24	0.1%	11%
Waikato	187	56	31%	30%	37	3%	20%	4	0.5%	2%	27	1%	14%	87	67%	47%	6	2%	3%
Tauranga	52	14	97%	27%	0	0%	0%	0	0%	0%	37	2%	71%	7	18%	13%	0	0%	0%
Rotorua	96	33	71%	34%	7	14%	7%	2	0.6%	2%	42	4%	44%	22	56%	23%	1	0.4%	1%
Whakatane	40	13	52%	33%	6	16%	15%	3	27%	8%	14	5%	35%	10	30%	25%	0	0%	0%
Gisborne	56	7	91%	13%	9	3%	16%	9	3%	16%	38	6%	68%	15	92%	27%	0	0%	0%
Taranaki	87	17	71%	20%	4	2%	5%	0	0%	0%	42	2%	48%	30	27%	34%	9	0.7%	10%
Hawke's Bay	141	32	92%	23%	9	1%	6%	5	0.1%	4%	74	3%	52%	36	4%	26%	4	0.2%	3%
Wanganui	56	8	84%	14%	8	6%	14%	4	0.7%	7%	28	2%	50%	22	81%	39%	4	5%	7%
Manawatu	84	24	88%	29%	13	9%	15%	10	16%	12%	32	2%	38%	24	22%	29%	5	0.3%	6%
Wairarapa	34	2	71%	6%	9	8%	26%	0	0%	0%	7	3%	21%	27	97%	79%	0	0%	0%
Hutt Valley	56	37	99.6%	66%	1	0.03%	2%	0	0%	0%	14	0.3%	25%	6	15%	11%	0	0%	0%
Nelson	66	30	95%	45%	8	2%	12%	1	0.2%	2%	14	1%	21%	23	13%	35%	0	0%	0%
Marlborough	83	2	5%	2%	5	70%	6%	0	0%	0%	69	9%	83%	12	87%	14%	0	0%	0%
West Coast	79	18	68%	23%	6	5%	8%	5	4%	6%	45	12%	57%	11	15%	14%	0	0%	0%
Canterbury	240	52	79%	22%	39	5%	16%	13	2%	5%	69	2%	29%	105	15%	44%	2	0.1%	0.8%
S. Canterbury	59	11	72%	19%	18	16%	31%	3	4%	5%	24	3%	41%	16	15%	27%	1	0.7%	2%
Otago	154	23	13%	15%	48	9%	31%	29	4%	19%	50	1%	32%	65	84%	42%	2	0.6%	1%
Southland	85	29	21%	34%	16	2%	19%	3	0.08%	4%	22	2%	26%	21	72%	25%	3	3%	4%
<b>Total</b>	<b>2138</b>	<b>514</b>	<b>78%</b>	<b>24%</b>	<b>291</b>	<b>4%</b>	<b>14%</b>	<b>118</b>	<b>2%</b>	<b>6%</b>	<b>879</b>	<b>2%</b>	<b>41%</b>	<b>698</b>	<b>40%</b>	<b>33%</b>	<b>62</b>	<b>0.5%</b>	<b>3%</b>

Note: DZs # refers to the percentage of distribution zones in that health district.  
Pop \* refers to the percentage of the population in that health district.

\*\* A zone is adequately monitored if it complies in all respects with the monitoring requirements defined in the DWSNZ:2000 (*ie*, samples must be taken at or in excess of the minimum sampling frequency (Table 3.2a of the DWSNZ:2000), at or in excess of the minimum number of days of the week and not exceeding the maximum interval between successive samples (Table 3.2b of the DWSNZ:2000) and tested by a Ministry of Health-recognised Laboratory). A zone is inadequately monitored if it does not comply with all of the above requirements.

During 2002, 62 distribution zones failed to comply bacteriologically with the DWSNZ:2000 because testing was not carried out in a Ministry of Health-recognised Laboratory. This is an increase in numbers from 2001 when 56 zones fell into this category. (This aspect is more fully discussed in Section 6.)

The main causes of bacteriological non-compliance in zones supplying 5000 or more consumers in 2002 were:

#### **Northland health district**

- Inadequate monitoring (interval) by Whangarei District Council of the Whangarei supply.

#### **Waikato health district**

- Inadequate monitoring (interval) by Hamilton City Council of the Hamilton City supply.
- Inadequate monitoring (days-of-week) by Waipa District Council of the Cambridge supply.
- Inadequate monitoring (days-of-week) by Waikato District Council of the Huntly and Ngaruawahia supplies.
- Inadequate monitoring (days-of-week and number of samples) by Ruapehu District Council of the Taumarunui supply.

#### **Eastern Bay of Plenty (Whakatane office) health district**

- Inadequate monitoring (days-of-week) and failure to conduct appropriate and timely corrective action following *E.coli* transgression by Kawerau District Council at the Kawerau supply.\*

#### **Rotorua health district**

- Too many samples contaminated with *E.coli* at the Rotorua Eastern Suburbs supply of Rotorua District Council.
- Inadequate monitoring (interval) by Taupo District Council of the Taupo South supply.

#### **Taranaki health district**

- Inadequate monitoring (days-of-week) by South Taranaki District Council of the Hawera supply.\*

#### **Manawatu health district**

- Inadequate monitoring (days-of-week\* and number), too many samples contaminated with *E.coli* and failure to conduct appropriate and timely corrective action following *E.coli* transgression by Tararua District Council of the Dannevirke supply.

#### **Nelson-Marlborough (Blenheim office) health district**

- Too many samples contaminated with *E.coli* and inadequate monitoring (days-of-week) by Marlborough District Council of the Blenheim supply.

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\* Supplies that failed for the same reason in 2001.

### Canterbury health district

- Inadequate monitoring (days-of-week, interval and number of samples) by Waimakariri District Council of the Rangiora\* and Kaiapoi\* supplies.

### Otago health district

- Inadequate monitoring by Dunedin City Council of supplies at the Booth Road,\* Low Levels/Peninsula\* and Mosgiel\* (interval and number) and Green Island (interval).\*
- Inadequate monitoring of the (days-of-week, interval and number of samples) by Dunedin City Council of the Maori Hill\* supply.
- Inadequate monitoring (number of samples) by Central Otago District Council of the supply at Alexandra.\*

### Southland health district

- Inadequate monitoring (days-of-week) by Invercargill City Council of the Invercargill City supply.\*
- Inadequate monitoring (number of samples) by Queenstown Lakes District Council of the Queenstown supply.

**Table 4.6: Reasons for bacteriological non-compliance in the distribution zone**

Reason for Non-Compliance	Distribution zones not complying with DWSNZ:2000								
	2002	2002	2001	2000	1999	1998	1997	1996	1995
	No.	%	%	%	%	%	%	%	%
<i>E. coli</i> fail	291	14%	14%	11%	15%	12%	16%	21%	29%
Inadequate corrective action	118	6%	7%	6%	1%	1%	N/A	N/A	N/A
Unmonitored	879	41%	43%	55%	57%	71%	64%	60%	44%
Inadequately monitored	698	33%	34%	14%	18%	18%	19%	24%	30%
Non-registered laboratory	62	3%	3%	9%	17%	N/A	-	-	-
Questionnaires not returned	0	0%	0.1%	0.4%	1%	2%	9%	3%	3%
<b>Total</b>	<b>1624</b>	<b>76%</b>							

The trend in the proportions of the various causes of bacteriological non-compliance in zones can be seen in Table 4.6. Bacteriological non-compliance due to unmonitored zones and use of laboratories other than Ministry of Health-recognised laboratories is trending downward. The increased proportion of zones that were inadequately monitored is to be expected given the large and encouraging increase in zone monitoring of small supplies that previously did no monitoring at all.

\* Supplies that failed for the same reason in 2001.

## 4.2.2 Classification by population band

Table 4.7 sets out the degree of bacteriological compliance monitoring by population band.

**Table 4.7: Bacteriological compliance monitoring in the distribution zone by population band**

Population Band	Total No. of Zones	Population	Complying			
			Population in Zones		Distribution Zones	
			No.	% of Total	No.	% of Total
<500	1749	181,015	49,705	27%	293	17%
500–999	116	75,534	28,456	38%	44	38%
1000–4999	160	364,821	219,193	60%	86	54%
5000–19,999	72	675,370	546,587	81%	56	78%
20,000–49,999	31	978,712	797,055	81%	26	84%
50,000–99,999	5	328,203	328,203	100%	5	100%
100,000+	5	875,300	758,200	87%	4	80%
<b>Total</b>	<b>2138</b>	<b>3,478,955</b>	<b>2,727,399</b>	<b>78%</b>	<b>514</b>	<b>24%</b>

Generally, the proportion of zones that complied bacteriologically increased as the zone population increased, as would be expected. The number of zones which complied bacteriologically with the DWSNZ:2000 increased from 425 to 514 over the past year with the population served by complying zones climbing to approximately 2.72 million, an increase of approximately 300,000 (Table 4.7). The proportion of the population supplied with drinking-water which complied bacteriologically with the DWSNZ:2000 rose by 8% in 2002 to 78%. In terms of the number of zones, bacteriological compliance increased by 4% to 24% during 2002. This increase was especially noticeable in the larger population bands, which seem to be implementing the more stringent monitoring requirements of the DWSNZ:2000. In addition, the bacteriological compliance rates improved between 2001 and 2002 for the smaller supplies. This may reflect the amount of leniency given by HPOs to the small water supplies in that many were deemed to have complied with the monitoring requirements despite many having failed to meet the minimum days-of-the-week and maximum interval between successive samples requirements of the DWSNZ:2000. This has been permitted to encourage the small water suppliers (particularly schools) that have complied in greater numbers with the required monitoring frequency but were maybe unaware of the additional monitoring parameters outlined in the DWSNZ:2000.

The bacteriological compliance status of each distribution zone is listed in Appendix 4a. Many zones listed show a discrepancy between the bacteriological compliance with DWSNZ:2000 and the zone grade as at December 2002. Almost 380,000 people, in 108 distribution zones, were supplied with drinking-water that failed to comply with the bacteriological requirements of DWSNZ:2000 but were listed in the Register as having ‘a’ or ‘b’ grades. The number of zones for which this phenomenon occurred and the number of people affected has improved considerably since 2001 when approximately 600,000 people in 106 registered zones were in this category. These zones are detailed further in Appendix 6 which also indicates whether the zone has been regraded between January 2002 and the time this report goes to press and, if so, the current grade.

As a zone that fails to demonstrate bacteriological compliance during the grading process cannot achieve better than a 'c' grading, this indicates that the monitoring frequency or bacteriological quality of these zones may have deteriorated since they were previously graded. These zones should be regraded because their present grades, as listed in the Register, could give consumers a false impression of their drinking-water quality.

However, there is reluctance on the part of water suppliers to regrade water supplies to the present grading system, which is based on the NZDWS:1984 and is greatly out of date, until the revised grading system based on the DWSNZ:2000 is completed. Once the revised grading system has been completed, these supplies should be regraded with dispatch. In the meantime, it would seem appropriate to classify these supplies as ungraded until they are regraded.

### **Recommendation**

- Distribution zones listed in the Register as having an 'a' or 'b' grading (see Appendix 6) that failed to comply with the bacteriological criteria of the DWSNZ:2000 ought to be reclassified as ungraded until they can be regraded. This will inform the public of the current bacteriological compliance status of the water supply.