

2 Methodology

2.1 The questionnaires

The 2001 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 2000 questionnaires. Once again, much of the 2001 survey was collected electronically using the revised Microsurvey 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) and *Cryptosporidium* (treatment and monitoring). 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.

2.1.2 DHB surveillance of water treatment plant

This section (plant audit screen) was to determine if 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.

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.

2.1.4 DHB surveillance of the distribution zone

This section (zone audit screen) was included to determine if the DHB had conducted surveillance in the distribution zone and, if so, how the surveillance of FAC and *E. coli* was conducted.

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’. Health Protection Officers 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 for inclusion in tables in which 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 as covered by the annual survey was 3,455,087. This represents 89% of the New Zealand population of 3,880,500, 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 less than 25 persons 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 56,300 or 1.6% of the total population.

2.2 Questionnaire distribution

A copy of the WINZ database was taken on 13 December 2001. As no substantive changes had been made to national WINZ during the remainder of December 2001, this contained only those zones that were active at the end of 2001. This dataset was used as the basis for the 2001 survey. At that time, WINZ contained 2035 active treatment plants and 2109 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 Microsurvey module was distributed to DHBs and local authorities in December 2001. Completed questionnaires were e-mailed to ESR and incorporated into national WINZ. The completion date for the survey was set at 31 March 2002.

2.3 Coverage of the survey

By 31 March 2001, only about three quarters of the questionnaires had been returned in complete form. The deadline was extended to the middle of April and all DHBs were telephoned to remind them of the new deadline. By the end April, 2% of the data were still outstanding. The survey was closed off on 7 May and no further questionnaires were accepted after this date. At that time, questionnaires had been received for 2107 distribution zones and 2032 treatment plants, a return rate of better than 99%.

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 explanation of the survey questions that explained the required responses to each question and was designed to promote consistency among water suppliers and HPOs. The second was a training session covering the questionnaire and the new Microsurvey module of WINZ. The training session was conducted during November of 2001 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 Microsurvey module of WINZ. The third control comprised a series of checks in WINZ that occurred when water suppliers and HPOs entered their data into the AnnualSurvey 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 then re-exported to ESR. (The exception to this process was six zones that were exported from Southland, the data for which required further correction after the final deadline; these data were corrected manually by the ESR project leader in consultation with the supervising HPO.)

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 against the treatment used.
- The status of all laboratories was checked against the list of MoH Recognised Laboratories.
- The water source was marked as entirely groundwater but WINZ indicated roof or surface water sources.

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 MoH Recognised Laboratories.

Approximately 120 (mostly minor) errors that had been missed during the initial checking were detected by this process. 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 in HPOs obtaining the requisite information from water suppliers
- variability in interpretation of questions and data because of the number of HPO and LA staff involved. However, this aspect was reduced by the HPO training session
- transcription errors. However, the electronic format reduced transcription errors in the small number of LAs that entered the survey data directly onto WINZ
- poor understanding of 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 10% of the survey forms. This error rate was lower than the 25% reported for the previous survey, which is encouraging.

Tardy responses to this survey is an ongoing problem that worsened markedly this year. 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. In addition, one school water supplier reportedly refused to divulge their monitoring data, citing the Privacy Act. If true, this is disturbing and should be addressed promptly. 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).

Recommendations

That water suppliers continue to be encouraged to enter water quality data on to WINZ regularly.

That a mechanism be developed to ensure regular updates of the community populations in WINZ.

That HPOs take steps to ensure that the smaller drinking-water suppliers are aware of the DWSNZ:2000.

That the late return of survey data by DHBs be resolved.

3 Overview of Drinking-water Supplies

Survey information was requested from all registered drinking-water treatment plants and distribution zones in the country; information was received from more than 99% of supplies. As noted in Section 2.2, the results of the survey relate to those that had been defined on 13 December 2001. 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	182,833	5%	1717	81%	3%	1650	81%
500–999	74,635	2%	117	6%	1%	103	5%
1000–4999	364,781	11%	162	8%	6%	164	8%
5000–19,999	656,531	19%	72	3%	9%	65	3%
20,000–49,999	978,407	28%	31	1%	16%	28	1%
50,000–99,999	325,300	9%	5	0.2%	15%	15	0.7%
100,000+	872,600	25%	5	0.2%	50%	10	0.5%
Total	3,455,087		2109			2035	

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	227	18%	10	5%	10	19%	3	16%	1	42%	0	0%	0	0%
Auckland	175	2%	13	0.7%	13	3%	9	8%	8	23%	2	12%	3	52%
Waikato	148	7%	10	2%	21	20%	9	28%	0	0%	0	0%	1	43%
Tauranga	40	3%	2	0.9%	6	13%	2	10%	2	74%	0	0%	0	0%
Rotorua	75	9%	10	7%	6	14%	4	27%	1	42%	0	0%	0	0%
Whakatane	29	9%	3	5%	6	28%	3	58%	0	0%	0	0%	0	0%
Gisborne	53	10%	1	2%	0	0%	0	0%	1	88%	0	0%	0	0%
Taranaki	70	6%	5	4%	9	23%	3	26%	1	41%	0	0%	0	0%
Hawkes Bay	101	6%	6	3%	6	10%	2	18%	3	64%	0	0%	0	0%
Wanganui	44	8%	1	1%	5	15%	1	8%	1	68%	0	0%	0	0%
Manawatu	70	5%	3	1%	10	16%	3	21%	1	13%	1	44%	0	0%
Wairarapa	27	9%	1	2%	4	31%	1	58%	0	0%	0	0%	0	0%
Hutt Valley	23	0.5%	1	0.2%	7	5%	16	51%	4	28%	1	15%	0	0%
Nelson	58	10%	3	3%	4	9%	1	16%	2	61%	0	0%	0	0%
Marlborough	77	21%	3	4%	3	19%	0	0%	1	56%	0	0%	0	0%
West Coast	69	28%	0	0%	4	30%	2	42%	0	0%	0	0%	0	0%
Canterbury	195	7%	20	3%	18	9%	5	12%	1	7%	1	17%	1	44%
S. Canterbury	46	12%	5	6%	8	32%	0	0%	1	49%	0	0%	0	0%
Otago	124	9%	14	6%	12	17%	6	27%	2	40%	0	0%	0	0%
Southland	66	8%	6	5%	10	21%	2	16%	1	50%	0	0%	0	0%
Total	1717	5%	117	2%	162	11%	72	19%	31	28%	5	9%	5	25%

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 of water treatment plants 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 2109 distribution zones and 2035 treatment plants and covered an approximate population of 3,455,000 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 are the most numerous, constituting 81% 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, on the other hand, constitute approximately one third of the population. The same trend is true for treatment plants. The number of registered zones increased progressively from 502 to 983 to 1180 to 1340 to 1512 to 1865 to 2054 and to 2109 in the successive years from 1994 to 2001. This is indicative of the ongoing success of the programme of registering new and existing drinking-water supplies, mostly serving small communities.

For the purposes of evaluating the public health significance of the water quality data contained in this report, the data need 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. Local authorities 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	81%	14%	17	7%	6	60%	9	90%	3	100%	1	100%	0	-	0	-
Auckland	98%	28%	23	13%	7	54%	11	85%	9	100%	8	100%	2	100%	3	100%
Waikato	95%	41%	40	27%	8	80%	20	95%	9	100%	0	-	0	-	1	100%
Tauranga	95%	23%	2	5%	1	50%	5	83%	2	100%	2	100%	0	-	0	-
Rotorua	94%	42%	21	28%	8	80%	6	100%	4	100%	1	100%	0	-	0	-
Whakatane	94%	41%	5	17%	3	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	100%	8	89%	3	100%	1	100%	0	-	0	-
Hawkes Bay	95%	27%	16	16%	6	100%	5	83%	2	100%	3	100%	0	-	0	-
Wanganui	92%	31%	9	20%	1	100%	4	80%	1	100%	1	100%	0	-	0	-
Manawatu	85%	27%	10	14%	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	99.6%	60%	2	9%	1	100%	7	100%	16	100%	4	100%	1	100%	0	-
Nelson	91%	26%	10	17%	1	33%	4	100%	1	100%	2	100%	0	-	0	-
Marlborough	75%	10%	3	4%	2	67%	2	67%	0	-	1	100%	0	-	0	-
West Coast	89%	37%	22	32%	0	-	4	100%	2	100%	0	-	0	-	0	-
Canterbury	93%	49%	83	43%	16	80%	12	67%	5	100%	1	100%	1	100%	1	100%
S. Canterbury	86%	50%	19	41%	3	60%	7	88%	0	-	1	100%	0	-	0	-
Otago	97%	52%	49	40%	14	100%	11	92%	6	100%	2	100%	0	-	0	-
Southland	94%	45%	21	32%	5	83%	9	90%	2	100%	1	100%	0	-	0	-
Total	95%	35%	370	22%	117	100%	142	88%	71	99%	31	100%	5	100%	5	100%

4 Drinking-water Monitoring in the Distribution Zone

4.1 Adequacy of monitoring

There are two aspects of the distribution zone monitoring regime that must be examined when assessing the adequacy of monitoring for microbiological compliance: 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 and, if so, 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. However, FAC monitoring was attempted in only two zones (0.1%), 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 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 zones in a particular health district ranged from 33 in the case of Wairarapa to 251 in Northland. Significant changes in the number of registered zones were observed in three health districts. Northland and the West Coast newly registered 20 and 16 mainly small supplies respectively in 2001 whereas 11 small supplies were deregistered in Marlborough during the same period.

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

Health District	Total No. Zones in Survey		Monitored		Adequately Monitored		Not Monitored		Monitoring Status Unknown		Neither Monitored nor Surveyed	
	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000
Northland	251	231	114	85	24	38	137	146	0	2	73	103
Auckland	223	220	125	100	73	70	98	120	0	1	97	84
Waikato	189	186	160	149	86	99	29	37	0	0	26	36
Tauranga	52	55	19	19	3	10	33	36	0	0	17	20
Rotorua	96	95	51	58	28	44	45	37	0	0	18	14
Whakatane	41	41	27	24	10	13	14	17	0	2	2	2
Gisborne	55	60	16	12	4	9	39	48	0	0	23	4
Taranaki	88	91	48	55	14	24	40	36	0	0	12	25

Hawkes Bay	118	110	55	49	28	20	63	61	0	0	55	46
Wanganui	52	51	26	29	15	10	26	22	0	0	6	9
Manawatu	88	87	44	49	18	33	44	38	0	0	20	6
Wairarapa	33	29	20	21	0	15	13	8	0	0	2	7
Hutt Valley	52	52	40	39	37	36	12	13	0	0	10	4
Nelson	68	67	50	51	26	29	18	16	0	0	1	3
Marlborough	84	95	17	18	0	8	67	77	0	1	18	6
West Coast	75	59	28	28	22	20	47	31	0	0	29	30
Canterbury	241	237	180	174	54	89	61	63	0	0	44	44
S. Canterbury	60	53	33	32	21	24	27	21	0	17	16	21
Otago	158	155	113	114	14	73	45	41	0	0	6	10
Southland	85	80	46	59	27	44	39	21	3	0	8	2
Total	2109	2054	1212	1165	504	708	897	889	3	23	483	476

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 with one exception; 24% of zones were adequately monitored in 2001 compared to 2000 (Table 4.2). This sharp decline is an artefact of the questionnaire used in this survey. 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 2001 survey sought, for the first time, information about each of these three criteria. In previous years 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 entirely possible that the decrease in adequate monitoring was an artefact caused by incorrect information being supplied in previous years rather than reduced monitoring by water suppliers during 2001.

Appreciable increases (*ie* 10% or more) in the proportion of monitored zones were observed in the Auckland health district during 2001. However, monitoring declined appreciably in the Southland, Wairarapa and West Coast health districts. This result was probably affected by the lack of appreciation of the monitoring requirements on the DWSNZ:2000 by the water suppliers in the newly registered zones in the Wairarapa and West Coast health districts.

Table 4.2: Adequacy of zone monitoring expressed as percentages

Health District	Total No. Zones in Survey		Monitored		Adequately Monitored		Not Monitored		Monitoring Status Unknown		Neither Monitored nor Surveyed	
	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000
Northland	251	231	45%	37%	10%	16%	55%	63%	0%	1%	29%	45%
Auckland	223	220	56%	45%	33%	32%	44%	55%	0%	0%	43%	38%
Waikato	189	186	85%	80%	46%	53%	15%	20%	0%	0%	14%	19%
Tauranga	52	55	37%	35%	6%	18%	63%	65%	0%	0%	33%	36%
Rotorua	96	95	53%	61%	29%	46%	47%	39%	0%	0%	19%	15%
Whakatane	41	41	66%	59%	24%	32%	34%	41%	0%	5%	5%	5%
Gisborne	55	60	29%	20%	7%	15%	71%	80%	0%	0%	42%	7%
Taranaki	88	91	55%	60%	16%	26%	45%	40%	0%	0%	14%	27%
Hawkes Bay	118	110	47%	45%	24%	18%	53%	55%	0%	0%	47%	42%
Wanganui	52	51	50%	57%	29%	20%	50%	43%	0%	0%	12%	18%

Manawatu	88	87	50%	56%	20%	38%	50%	44%	0%	0%	23%	7%
Wairarapa	33	29	61%	72%	0%	52%	39%	28%	0%	0%	6%	24%
Hutt Valley	52	52	77%	75%	71%	69%	23%	25%	0%	0%	19%	8%
Nelson	68	67	74%	76%	38%	43%	26%	24%	0%	0%	1%	4%
Marlborough	84	95	20%	19%	0%	8%	80%	81%	0%	1%	21%	6%
West Coast	75	59	37%	47%	29%	34%	63%	53%	0%	0%	39%	51%
Canterbury	241	237	75%	73%	22%	38%	25%	27%	0%	0%	18%	19%
S. Canterbury	60	53	55%	60%	35%	45%	45%	40%	0%	32%	27%	40%
Otago	158	155	72%	74%	9%	47%	28%	26%	0%	0%	4%	6.5%
Southland	85	80	54%	74%	32%	55%	46%	26%	4%	0%	9%	3%
Total	2109	2054	57%	57%	24%	34%	43%	43%	0.1%	1%	23%	23%

Table 4.3: Distribution zone monitoring expressed in terms of population

Health District	Total Population Covered by the Survey	Population Supplied By:									
		Monitored Zones		Complying Zones		Zones Adequately Monitored		Zones Not Monitored or of Unknown Status		Zones Neither Monitored nor Surveyed	
Northland	113,034	99,850	88%	91,232	81%	84,862	75%	13,184	12%	7,581	7%
Auckland	1,125,577	1,118,158	99%	1,098,633	98%	1,100,278	98%	7,419	1%	7,369	0.7%
Waikato	269,235	266,762	99%	218,441	81%	230,423	86%	2,473	1%	1,973	0.7%
Tauranga	121,478	118,927	98%	90,450	74%	90,450	74%	2,551	2%	806	0.7%
Rotorua	100,243	95,186	95%	20,689	21%	24,179	24%	5,057	5%	914	0.9%
Whakatane	38,110	36,810	97%	20,220	53%	25,020	66%	1,300	3%	70	0.2%
Gisborne	34,171	32,311	95%	31,150	91%	31,150	91%	1,860	5%	822	2%
Taranaki	86,484	85,148	98%	59,787	69%	59,891	69%	1,336	2%	348	0.4%
Hawkes Bay	129,148	125,828	97%	120,434	93%	120,464	93%	3,320	3%	3045	2%
Wanganui	60,367	58,790	97%	11,074	18%	11,884	20%	1,577	3%	433	0.7%
Manawatu	148,472	145,663	98%	113,845	77%	118,460	80%	2,809	2%	1241	0.8%
Wairarapa	32,679	31,334	96%	0	0%	0	0%	1,345	4%	55	0.2%
Hutt Valley	358,921	358,166	99.8%	357,991	99.7%	358,071	99.8%	755	0.2%	650	0.2%
Nelson	65,335	63,975	98%	57,920	89%	58,790	90%	1,360	2%	35	0.1%
Marlborough	36,644	30,020	82%	28,631	78%	0	0%	6,624	18%	1692	5%
West Coast	25,634	22,410	87%	18,930	74%	22,158	86%	3,224	13%	1984	8%
Canterbury	400,438	392,964	98%	29,014	7%	33,102	8%	7,474	2%	5,287	1%
S. Canterbury	54,362	52,247	96%	42,987	79%	47,197	87%	2,115	4%	1003	2%
Otago	160,251	151,761	95%	6,185	4%	8,095	5%	8,490	5%	108	0.1%
Southland	94,504	89,227	94%	9,947	11%	22,233	24%	6,897	7%	2045	2.2%
Total	3,455,087	3,375,537	98%	2,427,560	70%	2,446,707	71%	81,170	2%	37,461	1%

Table 4.3 summarises the monitoring data on a health district basis and approximate figures for the populations affected. Although only 57% of the zones in the survey were monitored (Table 4.2), this represented the water supplied to approximately 98% of the population served by registered supplies. There were three health districts with less than 90% of the population living in registered zones that were monitored during 2001: Northland (increased by 1% to 88%), Marlborough (remained at 82%) and West Coast (fell 4% to 87%) between 2000 and 2001. The comparatively poor reported monitoring in the Marlborough and Northland health districts was mainly due to the relatively high proportion of water supplies serving fewer than 500 people (91% compared with 81% for all of New Zealand) and that were not monitored.

Compared to the previous year, the proportion of the population supplied with drinking-water that was monitored remained static at 98%. In comparison, the proportion of consumers on adequately monitored drinking-water supplies decreased from 90% to 71% during 2001. This decline was mostly caused by the failure of 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 in which there was no recorded microbiological monitoring increased slightly from 889 during 2000 to 897 in 2001 (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 2001. The number of zones without monitoring or surveillance increased slightly from 476 during 2000 to 483 during 2001. The population served by unmonitored and unsurveyed zones was 5% or more in three health districts. There was no microbiological analysis recorded for 73 distribution zones in the Northland health district (a decrease of 30 since 2000), serving 7% of the population in that district. Similarly, drinking-water supplied to 8% of the population in the West Coast district and 5% of the population in the Marlborough health district had neither microbiological monitoring nor surveillance testing recorded during 2001.

There are also degrees of non-compliance with the monitoring requirements. For example, a zone may have failed to comply with the 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 monitoring.

Table 4.4: Adequacy of distribution zone monitoring data 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	121,549	66%	839	49%	54,435	30%	297	17%	32,545	18%	475	28%
500–999	66,769	89%	102	87%	22,242	30%	34	29%	3,516	5%	7	6%
1000–4999	360,981	99%	159	98%	220,735	61%	92	57%	1,400	0%	1	0.6%
5000–19,999	649,931	99%	71	99%	464,044	71%	49	68%	0	0%	0	0%
20,000–49,999	978,407	100%	31	100%	732,351	75%	24	77%	0	0%	0	0%
50,000–99,999	325,300	100%	5	100%	255,300	78%	4	80%	0	0%	0	0%
100,000+	872,600	100%	5	100%	697,600	80%	4	80%	0	0%	0	0%
Total	3,375,537	98%	1212	57%	2,446,707	71%	504	24%	37,461	1%	483	23%

The data in Table 4.4 confirm that 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 microbiological 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 local authorities, 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.

All of the zones serving 20,000 people or more were monitored during 2001. Four zones with populations above 1000 were not monitored: Ross Creek, Dunedin was amalgamated with the Low Levels/Peninsula zone at the end of 2000 and appears in this list merely because this change was not notified; Amberley Town (Hurunui District Council), Alliance Lorneville (a private supply in the Southland district) and Mangonui-Cooper's Beach (a private supply in the Far North district). The percentage of zones monitored gradually decreased to 87% as the zone population fell to 500. Just under half of the distribution zones serving populations of less than 500 people were monitored during 2001. This represents a marginal decline in overall monitoring since the 2000 survey.

There was also a decrease in the percentage of zones monitored adequately during 2001 (24%) compared with 2000 (34%). Of the zones serving 20,000 or more people, nine were inadequately monitored: Rotorua City (Rotorua District Council), Wanganui City (Wanganui District Council), Blenheim (Marlborough District Council), Central-, West- and North-west Christchurch (Christchurch City Council), Booth Road and Low Levels/Peninsula, Dunedin (Dunedin City Council) and Invercargill City (Invercargill City Council). All of these failed to meet the minimum days of the week and/or maximum interval between successive samples requirements specified in the DWSNZ:2000 but would have complied with the DWSNZ:1995.

4.2 Compliance

There are two factors that must be taken into account when the microbiological compliance of distribution zones is being evaluated. These are: whether the sampling frequency and

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

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

Microbiological compliance was determined for each distribution zone on the basis of questions at the bottom of the Monitoring 1 screen of the AnnualSurvey module on WINZ. These sought to determine:

- whether *E. coli* testing was carried out in a registered laboratory.
- the number of compliance monitoring samples tested for *E. coli* during 2001.
- 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.

Microbiological 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:2000¹ 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 microbiologically with DWSNZ:2000. In other words, although all samples taken from a zone may be of acceptable microbiological 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 MoH Recognised Laboratories are not eligible to be used to demonstrate compliance with the DWSNZ: 2000.

4.2.1 Classification by health district

Table 4.5 presents compliance data categorised by health district.

¹ A more complete specification is given in Appendix 5

Table 4.5: Summary of distribution zone 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	251	30	81%	12%	25	3%	10%	17	2%	7%	137	12%	55%	90	13%	36%	1	0%	0%
Auckland	223	59	98%	26%	32	1%	14%	29	0.4%	13%	98	0.7%	44%	52	2%	23%	4	0%	2%
Waikato	189	69	81%	37%	39	6%	21%	5	0.08%	3%	29	0.9%	15%	74	13%	39%	8	3%	4%
Tairāngia	52	3	74%	6%	2	8%	4%	1	5%	2%	33	2%	63%	16	23%	31%	0	0%	0%
Rotorua	96	25	21%	26%	8	13%	8%	0	0%	0%	45	5%	47%	23	71%	24%	0	0%	0%
Whakatane	41	5	53%	12%	11	34%	27%	6	22%	15%	14	3%	34%	17	31%	41%	0	0%	0%
Gisborne	55	4	91%	7%	3	1%	5%	3	1%	5%	39	5%	71%	12	3%	22%	0	0%	0%
Taranaki	88	13	69%	15%	6	2%	7%	1	0.03%	1%	40	2%	45%	34	29%	39%	5	0.6%	6%
Hawkes Bay	118	27	93%	23%	4	0.6%	3%	1	0.07%	0.8%	63	3%	53%	27	4%	23%	6	0%	5%
Wanganui	52	11	18%	21%	6	2%	12%	2	0.6%	4%	26	3%	50%	11	78%	21%	2	5%	4%
Manawatu	88	12	77%	14%	18	5%	20%	15	5%	17%	44	2%	50%	26	18%	30%	6	0.6%	7%
Wairarapa	33	0	0%	0%	7	3%	21%	2	0.9%	6%	13	4%	39%	20	96%	61%	0	0%	0%
Hutt Valley	52	36	99.7%	69%	1	0.02%	2%	1	0.02%	2%	12	0.2%	23%	3	0%	6%	0	0%	0%
Nelson	68	23	89%	34%	11	2%	16%	2	0.1%	3%	18	2%	26%	24	8%	35%	0	0%	0%
Marlborough	84	9	78%	11%	3	2%	4%	2	2%	2%	67	18%	80%	17	82%	20%	0	0%	0%
West Coast	75	13	74%	17%	9	13%	12%	5	6%	7%	47	13%	63%	6	1%	8%	0	0%	0%
Canterbury	241	46	7%	19%	51	5%	21%	34	4%	14%	61	2%	25%	126	90%	52%	20	7%	8%
S. Canterbury	60	11	79%	18%	16	14%	27%	2	1%	3%	27	4%	45%	12	9%	20%	1	0.7%	2%
Otago	158	11	4%	7%	43	11%	27%	26	5%	16%	45	5%	28%	99	90%	63%	2	0.7%	1%
Southland	85	18	11%	21%	7	0.7%	8%	3	0.08%	4%	39	6%	46%	19	71%	22%	1	1%	1%
Total	2109	425	70%	20%	302	4%	14%	157	2%	7%	897	2%	43%	708	27%	34%	56	1%	3%

Note: DZs # refers to the percentage of 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 MoH Recognised Laboratory). A zone is inadequately monitored if it does not comply with all of the above requirements.

It should be noted that this table specifies 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 compliance criteria, so were scored in each.

Information about the population supplied from zones that complied microbiologically with DWSNZ:2000 is contained in Table 4.3. Nationally, 70% of the population served by registered supplies was supplied with drinking-water that complied microbiologically with the DWSNZ:2000. This is a large decrease from 86% in 2000 and represents a corresponding decrease in complying zones from 25% in 2000 to 20% in 2001. A number of factors have influenced this result. The most significant is the more stringent monitoring requirements of the DWSNZ:2000 compared with those of the DWSNZ:1995. In addition, the population covered by the survey increased by more than 124,000 during this period. However, the degree of compliance was highly variable among health districts, ranging from 0% to 99.7% of the district population. This phenomenon was largely caused by the differing attitudes of HPOs; faced with a zone that complied except for the minimum days of the week or maximum interval between successive monitoring samples, some HPOs assessed the supply to comply (as is their prerogative) while others adhered strictly to the technical compliance as defined in WINZ. Neither of these approaches is incorrect. However, because of this, there is little point in scrutinising the differences between the compliance rates in different health districts.

A total of 1684 distribution zones did not comply with the DWSNZ:2000 during 2001, an increase of 149 over the previous year. However, while this was influenced by the increase by 55 in the number of newly-registered zones, most of this change was an artefact of the increased stringency in the monitoring requirements as previously indicated. The numbers of zones failing to comply for various reasons are summarised in Table 4.6.

As with previous surveys, the predominant reason for failure to comply was a lack of any documented monitoring and this accounted for 43% of distribution zone failures. Similarly, the second most frequent cause of failure in 2001 was inadequate monitoring, which occurred in 34% of zones. Taken together, this indicates an increase in the number of water suppliers that began monitoring zones during 2001 but for which insufficient samples were taken.

The number of zones demonstrated to have poor microbiological water quality (ie, as indicated by having *E. coli* detected in more than maximum permitted number of monitoring samples²) increased from 272 to 302 between 2000 and 2001. This means that in 2001, 4% of the population was served by supplies that were contaminated with *E. coli* more often than is permitted for compliant zones (Table 4.5). Taken in context, this is likely to have been caused by the increased number of monitored zones, particularly those serving small communities which generally have less sophisticated water treatment and therefore can be expected to have poorer quality reticulated water. Water suppliers that conducted microbiological sampling for the first time during 2001, and whose drinking-water was found to be faecally-contaminated, will hopefully contemplate installing or improving their water treatment systems.

The number of zones where failure to comply was caused by inadequate, slow or no corrective action following a *E. coli* transgression increased from 140 during 2000 to 157 in 2001. This represents 7% of zones (Table 4.6) or 2% of people (Table 4.5) served by registered drinking-water supplies.

² Refer to Appendix 5

During 2001, 56 zones failed to comply because testing was not carried out in a MoH Recognised Laboratory. This is a significant improvement since 2000 when 108 zones fell into this category. This aspect is more fully discussed in Section 6.

The main causes of non-compliance in zones supplying 5000 or more consumers in 2001 were:

Auckland health district:

- inadequate monitoring by the Franklin District Council of the Victoria Avenue supply.

Waikato health district:

- inadequate monitoring of the South Waikato District Council supply at Tokoroa (days-of-week) and the Ruapehu District Council supply at Taumaranui*
- failure of the Ruapehu District Council to use a registered laboratory for compliance testing of the Taumaranui* supply.

Tauranga health district:

- too many samples contaminated with *E. coli* and failure to conduct appropriate and timely corrective action of the Western Bay of Plenty District Council supply at Te Puke
- inadequate monitoring (days-of-week) of the Western Bay of Plenty District Council supply at Katikati.

Whakatane health district:

- too many samples contaminated with *E. coli* and failure to conduct appropriate and timely corrective action of the Kawerau District Council supply at Kawerau*.

Rotorua health district:

- inadequate monitoring by the Rotorua District Council of supplies at Rotorua Eastern Suburbs (days-of-week) and Rotorua City (days-of-week and interval)
- inadequate monitoring of the Taupo District Council supply at Turangi*.

Taranaki health district:

- inadequate monitoring (days-of-week) of the South Taranaki District Council supply at Hawera.

Wanganui health district:

- inadequate monitoring (days-of-week and interval) by the Wanganui District Council of the Wanganui City supply.

Manawatu health district:

- inadequate monitoring (days-of-week) by the Tararua District Council of the Dannevirke supply
- inadequate monitoring (days-of-week and interval) by the Manawatu District Council of the Feilding supply.

Wairarapa health district:

- inadequate monitoring (days-of-week and interval) by the Masterton District Council of the Masterton supply.

Canterbury health district:

- inadequate monitoring (days-of-week) by the Christchurch City Council of the Parklands and Riccarton supplies
- inadequate monitoring (days-of-week and interval) by the Christchurch City Council of the Central, North-West and West Christchurch supplies
- failure of the Waimakariri District Council to use a registered laboratory for compliance testing of, and inadequate monitoring of the Kaiapoi* and Rangiora* supplies.

Otago health district:

- inadequate monitoring (days-of-week and interval) by the Dunedin City Council of the Booth Road, Green Island, Low Levels/Peninsula, and Mosgiel supplies
- inadequate monitoring of the Maori Hill (Dunedin City Council), North End Oamaru (Waitaki District Council) and Alexandra (Central Otago District Council) supplies.

Southland health district:

- inadequate monitoring (days-of-week) by the Invercargill City Council of the Invercargill City supply
- inadequate monitoring of the West Gore* (Gore City Council) and the Queenstown (Queenstown Lakes District Council) supplies. In the case of the Queenstown supply, the monitoring programme failed only in that it did not take into account the increased sampling rate required during the peak season when the population doubles. During this period, sampling needs to be conducted at least the equivalent of 22 samples per calendar quarter instead of the usual 16 samples per quarter as the population increases from 8000 to approximately 16,000 people.

* Supplies that failed for the same reason in 2000.

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

Reason for non-compliance	Zones not complying							
	2001	2001	2000	1999	1998	1997	1996	1995
	No.	%	%	%	%	%	%	%
<i>E. coli</i> fail	302	14%	11%	15%	12%	16%	21%	29%
Inadequate corrective action	157	7%	6%	1%	1%	N/A	N/A	N/A
Not monitored	897	43%	55%	57%	71%	64%	60%	44%
Inadequately monitored	708	34%	14%	18%	18%	19%	24%	30%
Non-registered laboratory	56	3%	9%	17%	N/A	-	-	-
Questionnaires not returned	3	0.1%	0.4%	1%	2%	9%	3%	3%
Total	1684	80%						

The trend in the proportions of the various causes of non-compliance in zones can be seen in Table 4.6. Non-compliance due to unmonitored zones and use of laboratories other than MoH Recognised Laboratories is trending downward. The increased proportion of zones that were inadequately monitored is to be expected given the large increase in zone monitoring of small supplies that previously did no monitoring at all. However, the increase in zones that received inadequate corrective action following a transgression is of concern.

4.2.2 Classification by population band

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

Table 4.7: 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	1717	182,833	41,513	23%	232	14%
500–999	117	74,635	19,672	26%	30	26%
1000–4999	162	364,781	204,578	56%	82	51%
5000–19,999	72	656,531	456,044	69%	48	67%
20,000–49,999	31	978,407	752,853	77%	25	81%
50,000–99,999	5	325,300	255,300	78%	4	80%
100,000+	5	872,600	697,600	80%	4	80%
Total	2109	3,455,087	2,427,560	70%	425	20%

Generally the proportion of complying zones increased with the increasing zone population, as would be expected. The number of zones which complied microbiologically with the DWSNZ:2000 decreased markedly from 519 to 425 over the past year with the population served by complying zones falling to approximately 2.42 million, a decrease of approximately 440,000. The proportion of the population supplied with drinking-water

which complied microbiologically with the DWSNZ:2000 dropped by 16% in 2001 to 70%. In terms of the number of zones, compliance fell by 5% to 20% during 2001. The decline was especially noticeable in the larger population bands, which seem to have been slow to implement the more stringent monitoring requirements of the DWSNZ:2000. However, the compliance rates improved between 2000 and 2001 for the smaller supplies. This is in part caused by a degree 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 was permitted so as not to discourage the small water suppliers (particularly the schools) who have complied in greater numbers with the required monitoring frequency but were perhaps in ignorance of the additional monitoring parameters outlined in the DWSNZ:2000. However, this leniency was given on the proviso that HPOs inform these suppliers of the need to fully comply with the monitoring requirements of the DWSNZ:2000 from now on; and failure to do so in the 2002 calendar year will result in non-compliance.

The compliance status of each distribution zone is listed in Appendix 4. Many zones listed show a discrepancy between the microbiological compliance with DWSNZ:2000 and the zone grade as at December 2001. Almost 600,000 people, in 106 distribution zones, were supplied with drinking-water that failed to comply with the microbiological requirements of DWSNZ:2000 but were listed in the Register as having 'a' or 'b' grades. This result appears to be considerably worse than in 2000. However, these numbers dropped to *ca.* 71,000 in 54 distribution zones when the list was restricted to zones that also failed to comply with the DWSNZ:1995. These zones are detailed further in Appendix 6 which also indicates whether the zone has been regraded between January 2001 and the time this report goes to press and, if so, the current grade.

The number of zones for which this phenomenon occurred and the number of people affected improved since 2000 when *ca.* 176,000 people in 74 registered zones were in this category. As a zone that fails to demonstrate microbiological compliance during the grading process cannot achieve better than a 'c' grading, the monitoring frequency or microbiological quality of these zones may have deteriorated since they were previously graded. These zones should be regraded as 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 interim, it would seem appropriate to classify these supplies as ungraded until they are regraded.

Recommendations

That all water suppliers, particularly those serving small populations, are informed of the microbiological requirements of the DWSNZ:2000.

That zones listed in the Register as having 'a' or 'b' grading but that failed to comply with the microbiological requirements of the drinking-water standards be reclassified as ungraded until they are re-graded.