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# NEW ZEALAND SMALL WATER SYSTEMS SURVEY

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First draft  
August, 2002





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## A. EXECUTIVE SUMMARY

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The New Zealand Water and Wastes Association (NZWWA) in conjunction with the New Zealand Water Environment Research Foundation (NZWERF) have done a survey of New Zealand small water systems (systems that supply water to less than 500 people). The survey has attempted to identify how well the systems are being managed, and what difficulties the industry is experiencing in meeting the requirements as set out in the Drinking Water Standards for New Zealand 2000 (DWSNZ).

The 75 systems surveyed were spread across New Zealand, 20 in the South Island and the rest in the North. The majority (45%) supplied to residential sites, followed by commercial (i.e. hotel, bar, food processors), school supplies, maraes, and hospitals. The source of water was predominantly ground water (51%), followed by surface water (38%) and roof water (20%).

The survey showed that 37% of small water systems do not treat their water for microbiological contaminants. The majority of systems that have no microbiological treatment use groundwater as their source; however 25% were supplied from surface water and 11% from roof water. Of the 63% of systems that are treated, just over half of these relied on only one form of treatment. Chlorination alone was the most common method of treatment, followed by a combination of filtration and ultra-violet light treatment.

The interviewers undertook a visual inspection of the systems and rated the plant in majority of systems (87%) as in excellent or satisfactory condition; although 'satisfactory' does not mean that they were DWSNZ compliant. The 13% of the systems that were rated as unsatisfactory were given this rating mainly for having no or an inadequate level of treatment. Only 54% of surface water sources were reported to be fenced, 23% of the ground water sources had insecure head works, and at least 35% of roof water sources do not have flushing points. The storage tanks for 33% of the systems were considered to have inadequate vermin protection or were incorrectly sealed.

Operators use a number of mechanisms to indicate problems with supply; the most common were tests (68%), complaints from users (65%) and systems inspections (50%). Only 61% of the operators kept a log book for record keeping. Many operators (58%) claimed that they "regularly" sampled for contaminants. Their definition of regular was a broad one, with monthly monitoring being the most frequent occurrence.

Many operators and managers displayed a poor understanding of performance requirements and potential health risk. Less than half those surveyed (41%) claim to be familiar with the DWSNZ, with the rest having little or no familiarity of



them, though a slightly higher proportion (45%) claim to be meeting the DWSNZ. Only 12% of those interviewed had prepared a Public Health Risk Management Plan. Of the 78% surveyed that have not done a PHRMP, at least 30% of them (25% of total) claimed they were not aware of what a PHRMP is.

A potential cause for this lack of awareness of risk is that nearly 70% of the operators claim that they never or rarely have problems with their system. Of those who do have problems, 33% were relating to water quality, 29% reported mechanical failure in the system (i.e. burst pipes, pump failure), 15% with shortages in the water supply, and 9% described issues with the intake area. Most operators have a reactive attitude towards to maintenance issues, in that they only carry out maintenance or improvements after a problem has occurred.

It appears that there is an issue around the knowledge and skill level of operators and managers of small water systems in New Zealand. Around 20% were evaluated by the interviewers as having an “inadequate level of knowledge and skills” in their roles, however 66% of operators expressed an interest in further training, and interviewers assessed 57% of the operators as having a medium or high need for further training.

Water supply managers reported that they have available information covering technical and health issues, and a lesser number of water suppliers have access to information addressing financial, public interest, and future needs issues. They source their information mainly from District Health Boards and Territorial Local Authorities, but also from local contractors and plumbers. The most important factors in their decision making were health issues, however technical, financial, public interest, and future need issues were reasonably equally weighted in the decision making process.

For two-thirds of the systems the owner of the system is also a user of the system, and for over 80% of the systems the owner takes responsibility for the maintenance and upgrading of the systems. For over 70% of the systems there are no plans to upgrade, and of the 27% planning upgrades work will be on treatment and storage components.

Less than half (48%) of the managers have a specific maintenance budget and even less (39%) have a capital expenditure budget. Many managers reported that they do not have specific budget for their water system, but simply find the money when something is required to be fixed. For those systems where financial records are kept there is a wide range in maintenance and operational costs.



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## D. INTRODUCTION

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The New Zealand Water and Wastes Association (NZWWA), in conjunction with the New Zealand Water Environment Research Foundation (NZWERF), under contract to the Ministry of Health, have conducted a survey of small water systems (SWS) in New Zealand (systems that serve water to less than 500 people). The purpose of this research is to help the Ministry with their understanding of the small water supply industry, how well the systems are being managed, and what difficulties the industry is experiencing in meeting the supply requirements as set out in the Drinking Water Standards for New Zealand 2000 (DWSNZ).

This report initially describes the systems in terms of what purpose they serve, the system set up, and the people involved. The next section presents the practices of small water systems, in particular the operations, management and problems experienced. The final section discusses the issues and risks that face small water systems in New Zealand, and the reasons for these issues.

The objectives of this report are to present the significant findings of the survey, and to provide an indication of the most common public health risks, the most common management responses, and the most common constraints for small drinking-water supplies.

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## E. METHOD

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The survey form was designed using a set of questions initially provided by the Ministry of Health, and then modified as a result of advice from small water system industry experts. The questionnaire is attached as Appendix A.

The survey was undertaken by nine current industry practitioners who were required to have a minimum of 5 years practical experience (though the average was 10 – 12 years) in installation, operation and maintenance of small water systems for populations of fewer than 500 people. The interviewers were also required to be endorsed by their local Health Protection Officer (HPO) and/or local authority.

Each interviewer was assigned a geographical region throughout New Zealand and surveyed between 2 – 16 small water systems, though the median was 10



apiece. In addition, two HPO's also completed a small number of surveys. The systems surveyed were selected from a list that was initially drawn from those registered on the Water Information New Zealand (WINZ) database, and supplemented with sites that had been identified by practitioners with local knowledge. Participation in the survey was voluntary, so only those willing to have their systems inspected were surveyed.

The survey procedure involved each interviewer making a personal visit to each of the small water systems chosen, and undertaking:

1. An interview of the system manager and/or system operator, or both if they were available;
2. A visual inspection of the system, with attendance paid to the adequacy and condition of the source, treatment and storage components of the system.

A total of 75 small water systems were surveyed. Care was taken to get a nationally representative selection of systems in terms of geographical location (see Figure E-1), utility type, and water source.



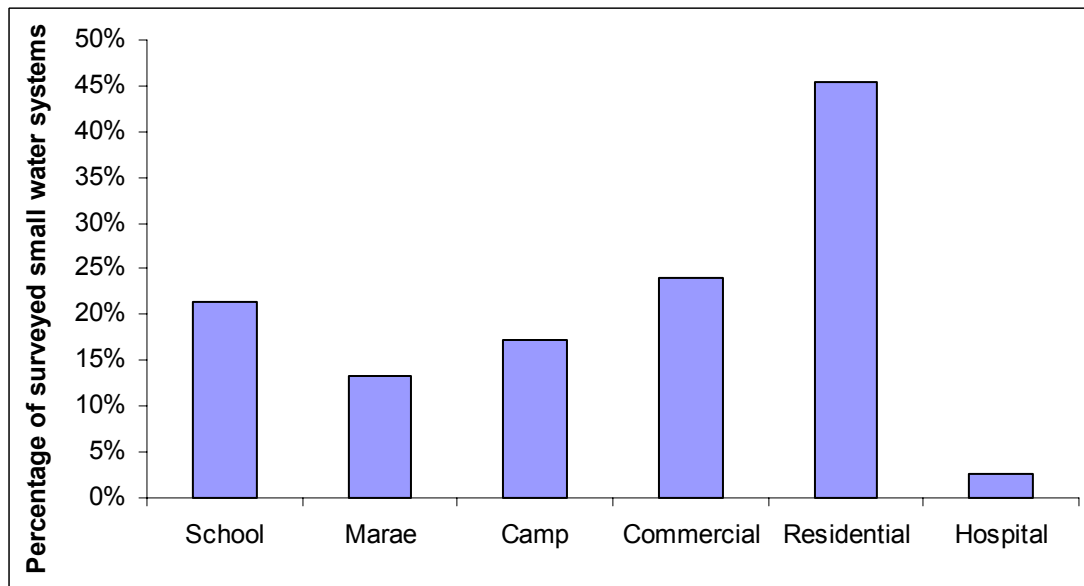
**Figure E-1: Location of small water systems included in the Small Water Systems Survey. 20 of the systems are located in the South Island, and the remainder in the North Island.**

## F. DESCRIPTION OF SMALL WATER SYSTEMS

### F.1 General

#### F.1.1 Supply purpose

The interviewers visited a number of different types of water supplies, which were intended to be representative of small water systems nationwide. A number of the small water supplies specified that their supply had more than one “main purpose”; therefore Figure F-1 displays the overall range of water supply purposes. The majority (45%) of water supplies surveyed were used for residential purposes. A large number were also used for commercial (i.e. hotel, bar, food processors) and school supplies, and to supply maraes, and a small percentage (3%) serviced hospitals.



**Figure F-1: The main purpose of the supply for the small water systems included in the survey, as indicated in question (A)ii.**



### F.1.2 Supply Use

The use of the water supplied at each of the small water systems varied over the sites. Most sites had more than one use for the water, and these have been categorised into the following uses: drinking water, agricultural, industrial, hygiene, swimming pool, bar/hotel/ other commercial use, general outdoor use, and fire fighting. Figure F-2 shows that the majority of small water systems are used for drinking water (91%) and hygiene purposes (79%). Note that for any given water supply there may be more than one use of the water.

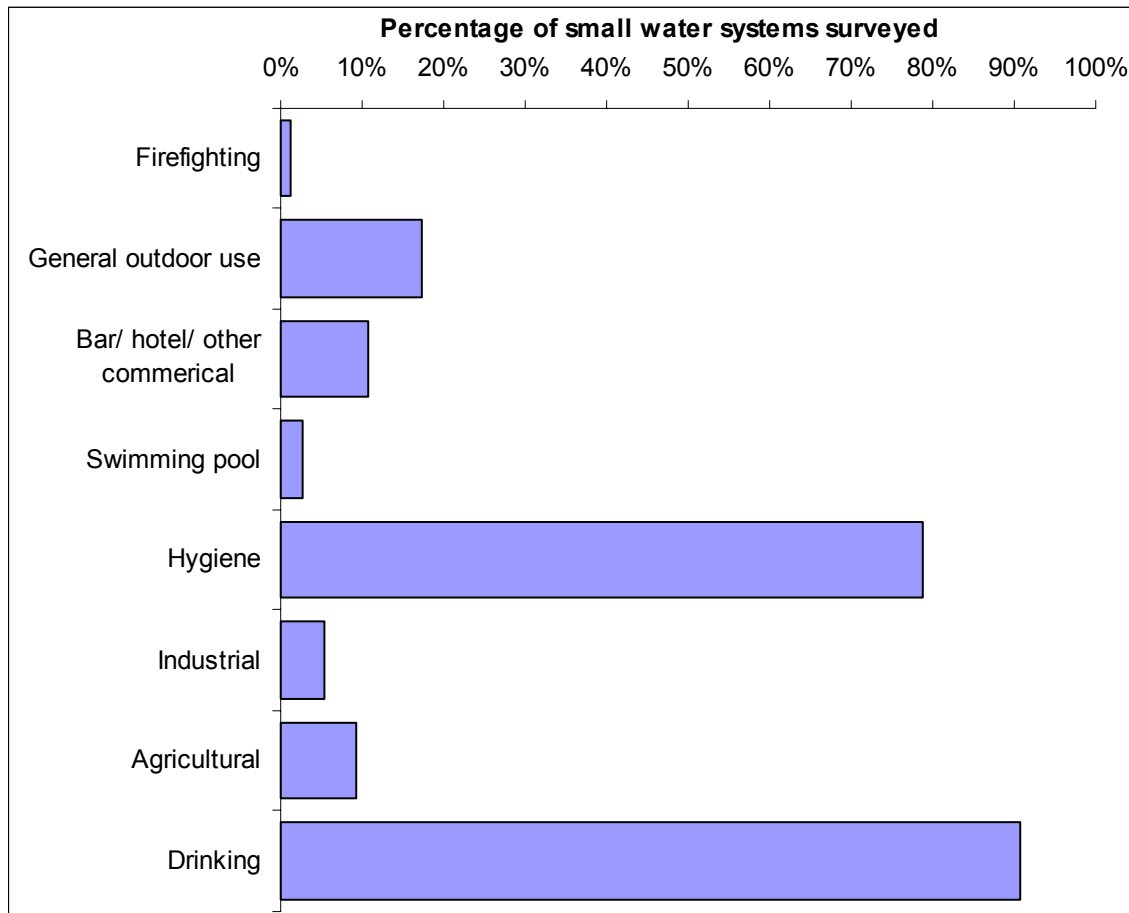


Figure F-2: Purpose of the users connecting to small water supplies in New Zealand, as determined through question (A)IV of the Small Water Systems Survey.

### F.1.3 Users

The small water systems surveyed were asked to provide information about how many users the systems supports. There was a range in answers, depending on whether the base load was referred to, or the maximum load. For example a marae has a minimal number of daily users, however on special events days the numbers can reach up to 1000 water users. The water systems generally ranged



between 1 and 500 users, with most systems supply to between 30 and 200 people. Two maraes specified loads greater than this at certain events.

## F.2 The people

### F.2.1 Owner-user relationship

The managers were asked to describe the nature of the relationship between the owners and the users of the water supply. Figure F-3 shows that in 67% of the systems the owner also uses the water in some way, either as the only users, or by also sharing it with other clients or users. In 33% of systems surveyed the owner does not use the water at all.

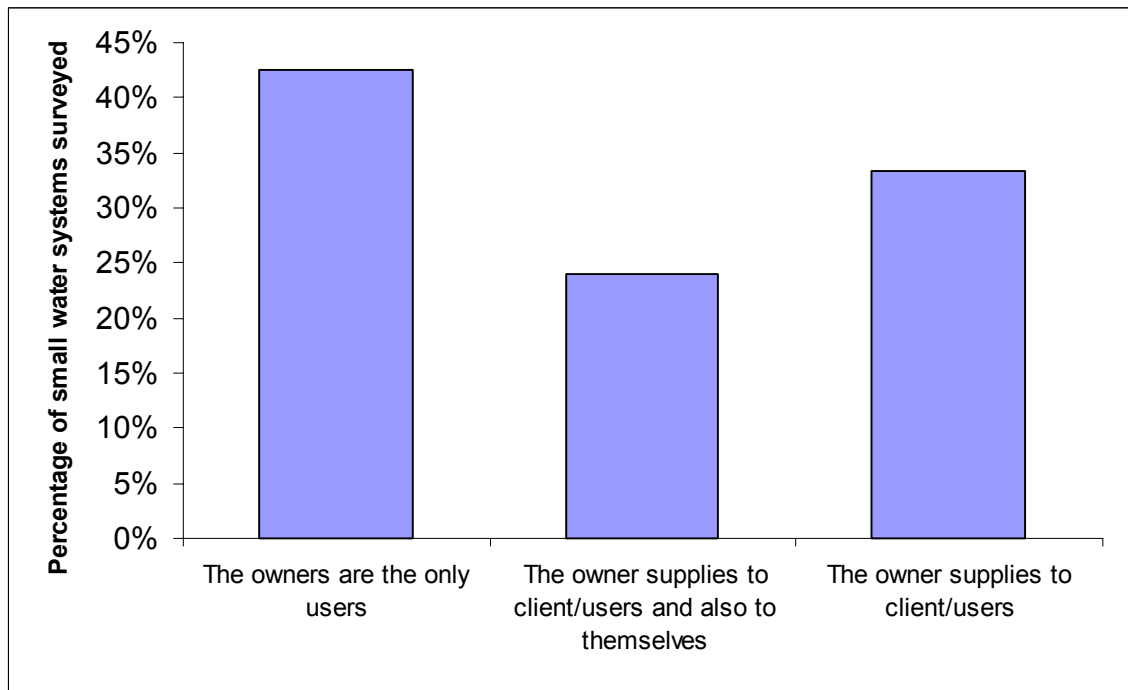
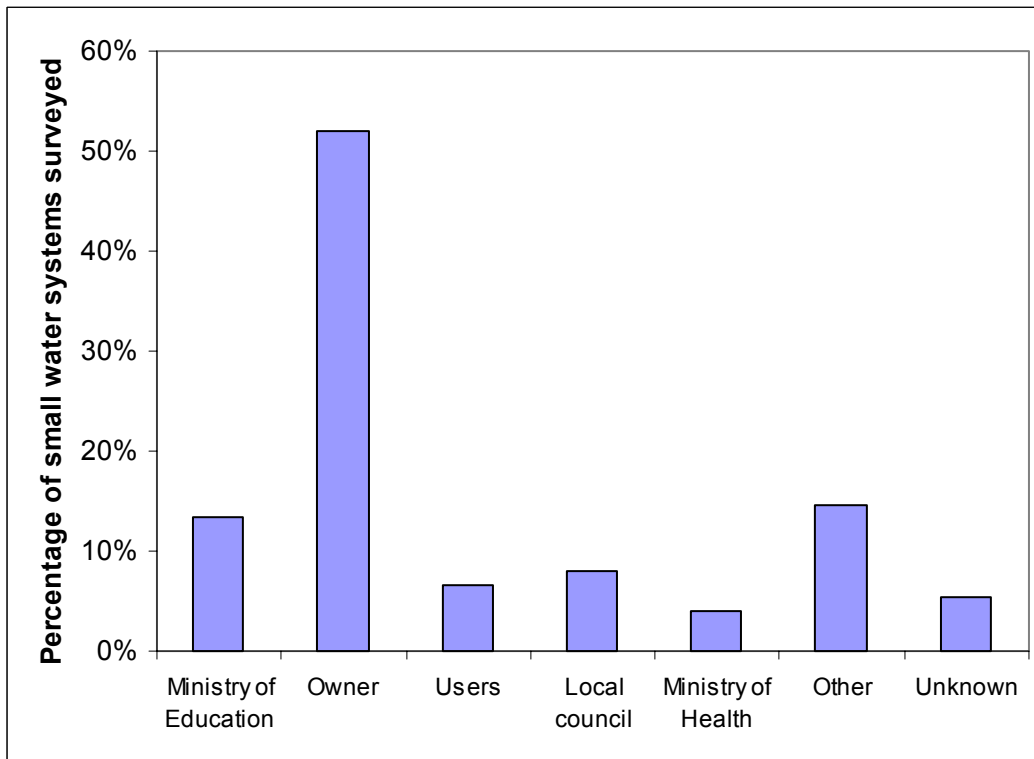


Figure F-3: The relationship between the owner and the user of small water systems, as obtained from answers to question (A)I. of the Small Water Systems Survey, "Relationship between owner and user".

## F.2.2 The supply installers

It was asked at each of the interviews, “Who pays to put in the supply” (Question D.1.). This question effectively addresses how the supply came to be there, by determining who initially funded its installation. Figure F-4 summarises the responses, and shows that predominantly the owner pays for the supply installation. In some cases the supply has been funded externally, by the Ministry of Education, users, local councils, or the Ministry of Health.



**Figure F-4: The organisations that have paid to put in the water supplies at the water systems surveyed. Information from question (D) 1 of the Small Water Systems Survey.**



### F.2.3 Responsibility for upgrade

To determine who takes some of the managerial roles over the system, the managers were asked who takes responsibility for upgrades (Question B.2.). Some of those surveyed indicated more than one person/group responsible for upgrades, i.e. owner and users. The results, displayed in Figure F-5, indicate that owners are predominantly responsible for upgrades, and that users and Boards of Trustees (at schools) are also responsible in some cases.

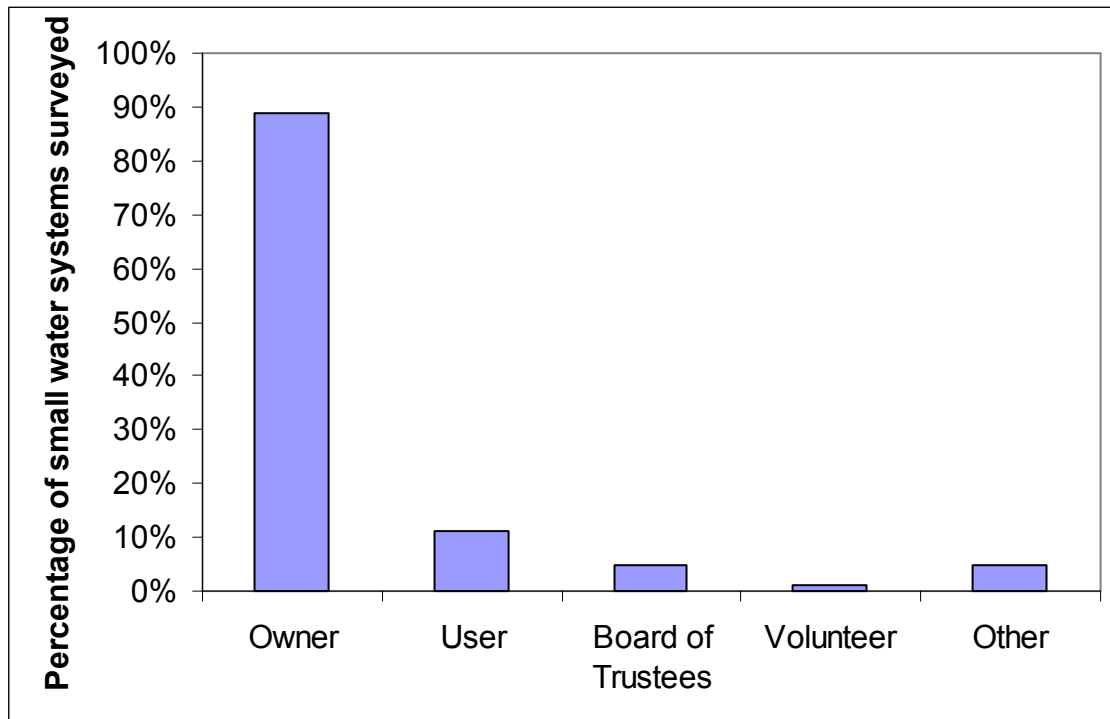


Figure F-5: Persons responsible for upgrades of small water systems, as indicated from question (B)2 of the Small Water Systems Survey: “Responsibility for upgrades?”



### F.2.4 Responsibility for maintenance

The people or groups that are responsible for the maintenance of the small water systems are identified in Figure F-6. Some managers indicated more than one person as responsible. Figure F-6 shows that overwhelmingly the owner is the same person (or group) that is responsible for maintenance of the system.

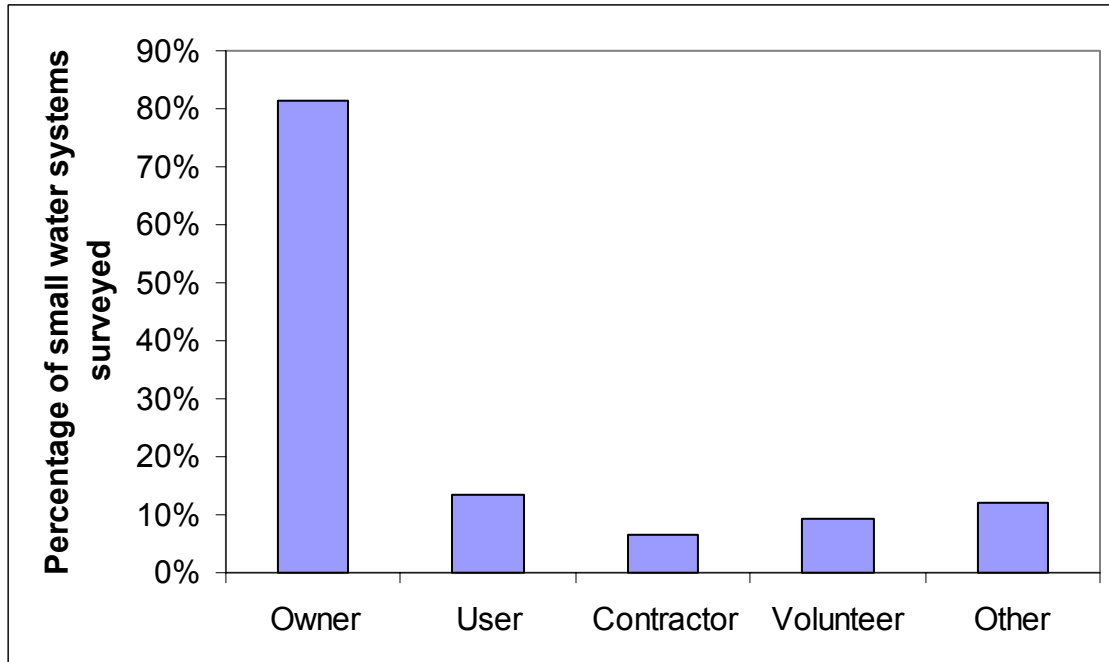
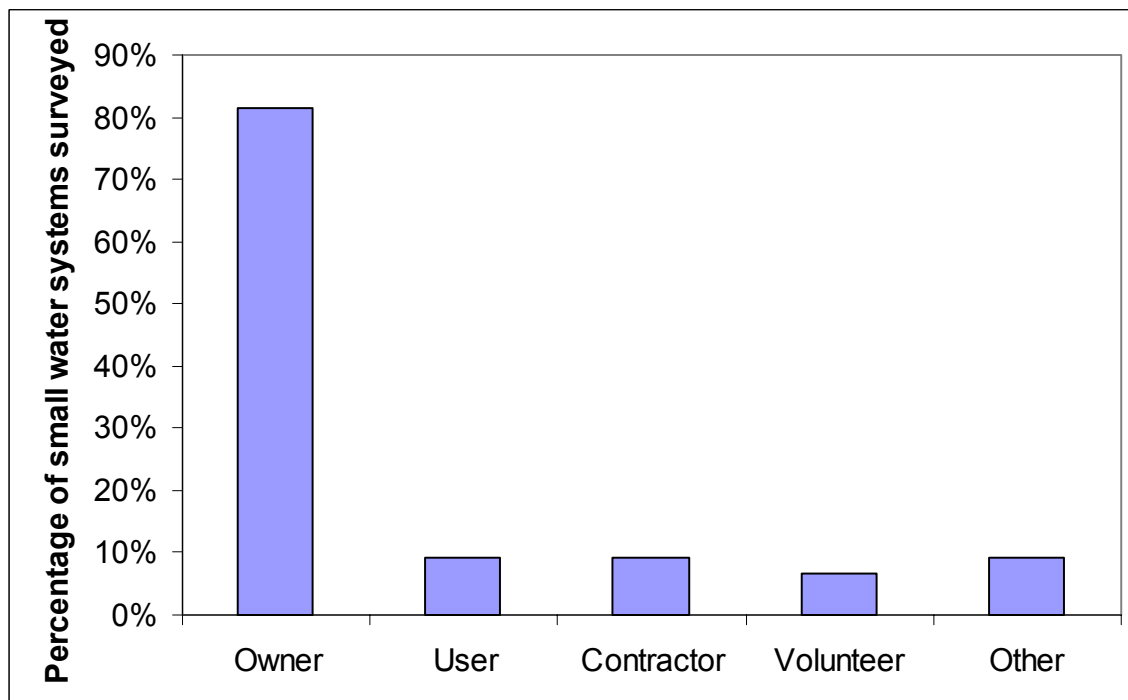


Figure F-6: People or groups that are responsible for maintenance of small water systems, as indicated from question (B)10 of the Small Water Systems Survey.

## **F.2.5 Responsibility for operations**

The people or groups that are responsible for the operation of the small water systems were identified in question (B) 8. Some managers indicated more than one person as responsible. Figure F-7 shows that, as with maintenance, the owner is predominantly the person (or group) responsible for operation of the system.

When this graph is compared with Figure F-6 and Figure F-5 above, it shows that those that are responsible for maintenance are also those that are responsible for operations, and in most cases, are also the people responsible for upgrades.



**Figure F-7: People or groups that are responsible for the operation of small water systems, as indicated from question (B)8 of the Small Water Systems Survey.**

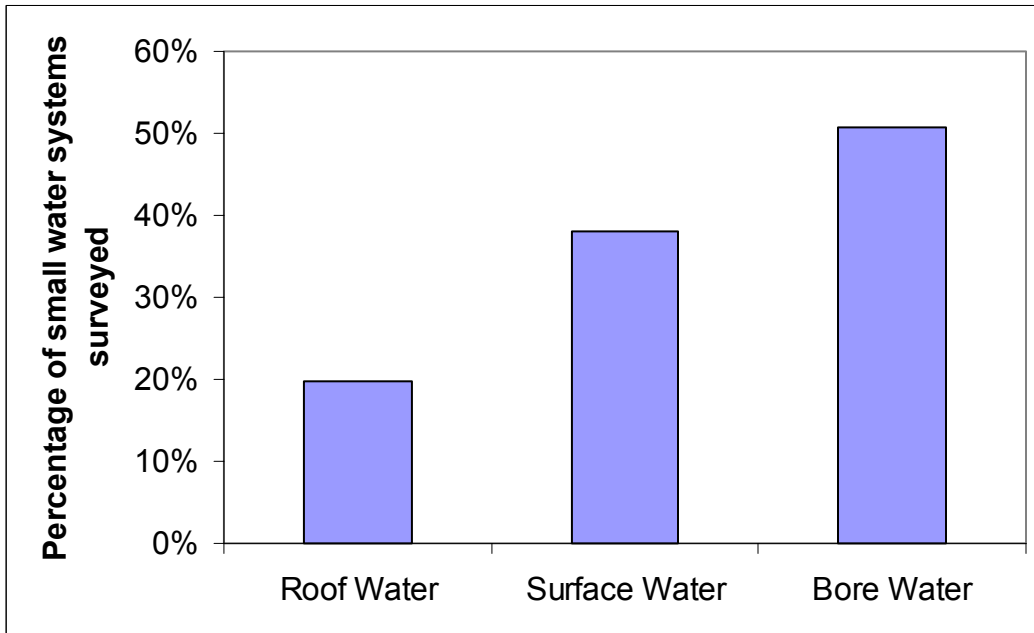
## **F.3 The system itself**

### **F.3.1 Source**

The small water systems that were surveyed were asked a series of questions about the source and nature of their water supply. The source of water, as shown in Figure F-8, is predominantly ground water (51%), followed by surface water (38%), and the least common source was roof water (20%). It should be



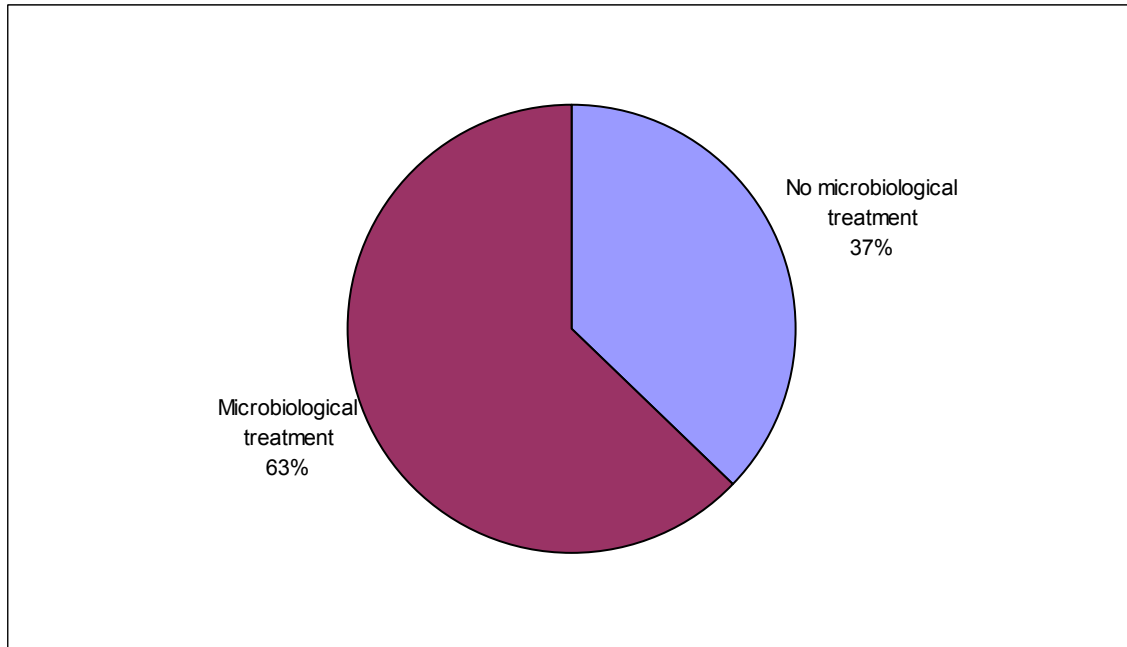
noted that 8% specified more than one type of source being used for their water system.



**Figure F-8:** Sources of water for small water systems, as determined through the system report of the small water system survey.

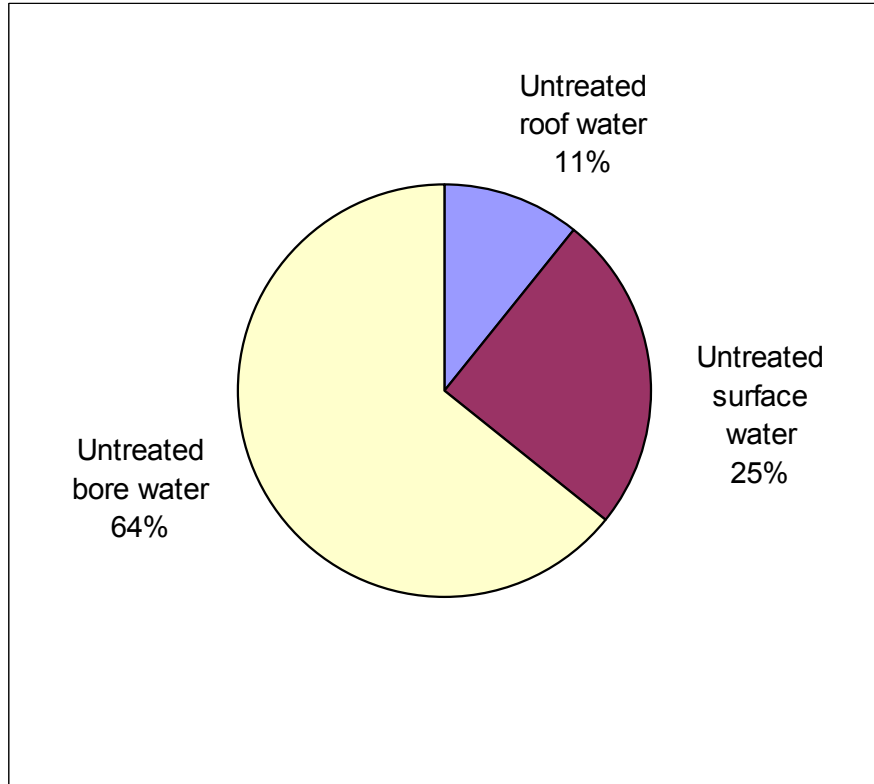
### ***F.3.2 Microbiological treatment***

The survey determined that 37% of small water systems do not treat their water for microbiological contaminants, and 63% do treat it, using a variety of methods (see Figure F-9; and note that sedimentation alone was not considered to be treatment).



**Figure F-9: The practice of treating water in small water systems, as determined from Part A of the System Report in the Small Water Systems Survey.**

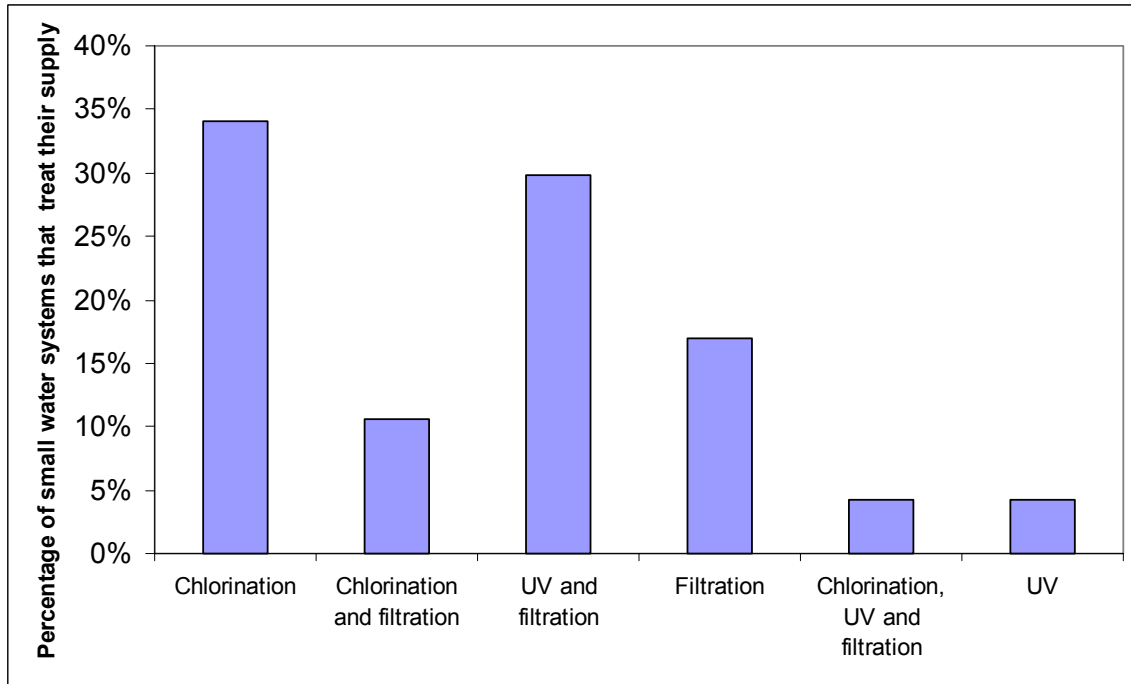
Of those that have no treatment, the source of their water supply is broken down as is shown in Figure F-10. It can be seen that the majority of untreated water is sourced from groundwater; followed by surface water (25%) and roof water (11%).



**Figure F-10: Sources of water for those that do not treat their supply, as taken from Part A of the System Report in the Small Water Systems Survey.**



Of the 63% of systems that are treated, the types of treatment utilised are shown in Figure F-11, below. It can be seen that chlorination alone was the most common method of treatment. Also widely used were combinations involving filtration and then UV treatment. A reasonable proportion of those that treat their water (17%) use filtration only as their method of treatment.



**Figure F-11: Treatment methods utilised by those water suppliers that treat their water, as taken from Part A of the Systems Report in the Small Water Systems Survey.**

## G. CURRENT PRACTICES

### G.1 Operations

#### G.1.1 Maintenance staff activities

The small water systems managers were asked what activities their maintenance staff are involved in. Replies generally fell into the following four categories of work: inspection tasks, routine maintenance (such as cleaning, changing filters or UV lamps), reactive maintenance and repairs where needed, and testing or sampling from the water system. Figure G-1 shows that the most common tasks of maintenance staff were routine maintenance, followed by inspections of the system. These tasks were done at 65% and 40% of systems surveyed, respectively.

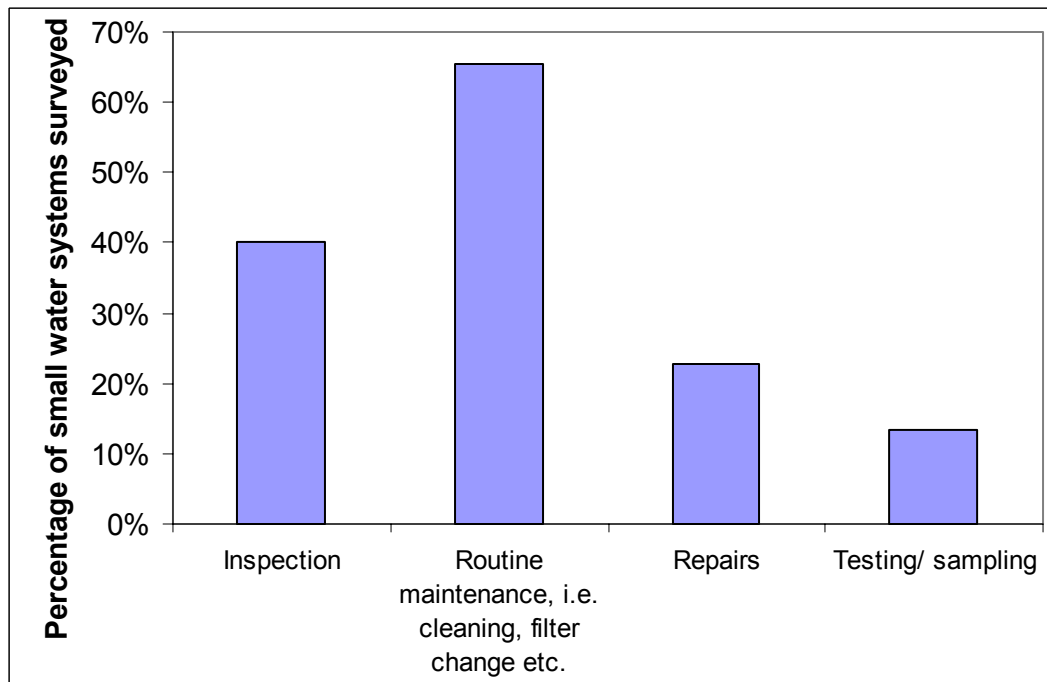


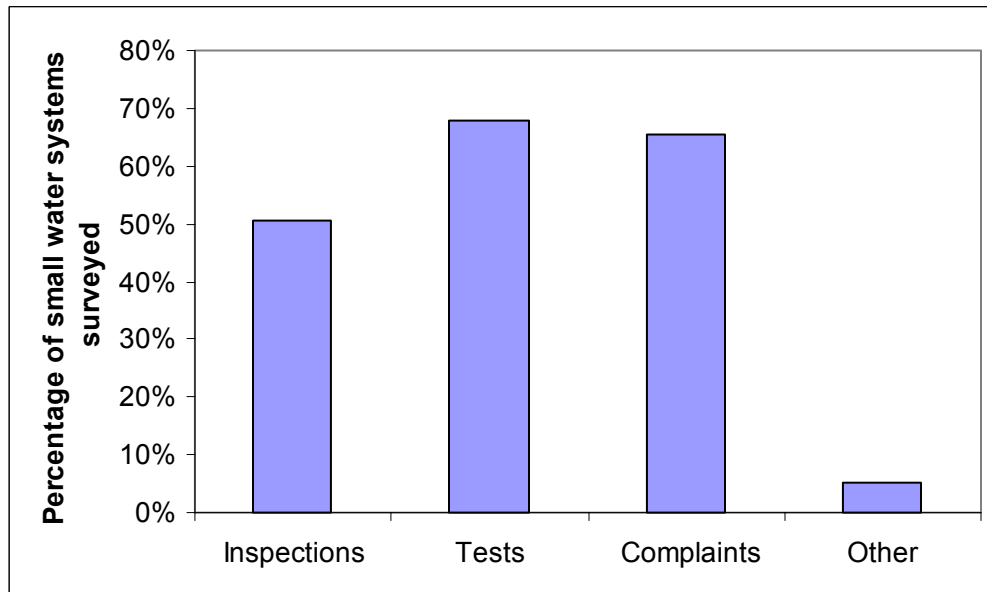
Figure G-1: Activities carried out by maintenance staff of small water systems, as determined from question (C)10 of the Small Water Systems Survey.

#### G.1.2 How problems are identified

Small water systems managers were asked how they would know if something was wrong with the water supply, and given examples such as inspections, tests, or complaints. Many of those interviewed provided more than one answer, e.g.



tests and or complaints from users were used to determine if something was wrong with the supply. Figure G-2 shows that for 68% of those interviewed, tests were a mechanism for finding problems with the supply. 65% reported that complaints would alert them to problems with the supply, while 50% indicated that inspections of the system would highlight any possible problems (note that many managers provided more than one mechanism for identifying problems).



**Figure G-2: Mechanisms for learning that something is wrong with the water supply, as determined from question (C)5 of the Small Water Systems Survey.**



### G.1.3 Problem reporting

Water systems managers were asked who any problems with the system are reported to, and also who they thought they should be reported to. The answers to these questions were very similar, as can be see in Figure G-3. Most problems are reported to the owners (68%), with around a third reported to the Ministry of Health or a Public Health Officer (31%).

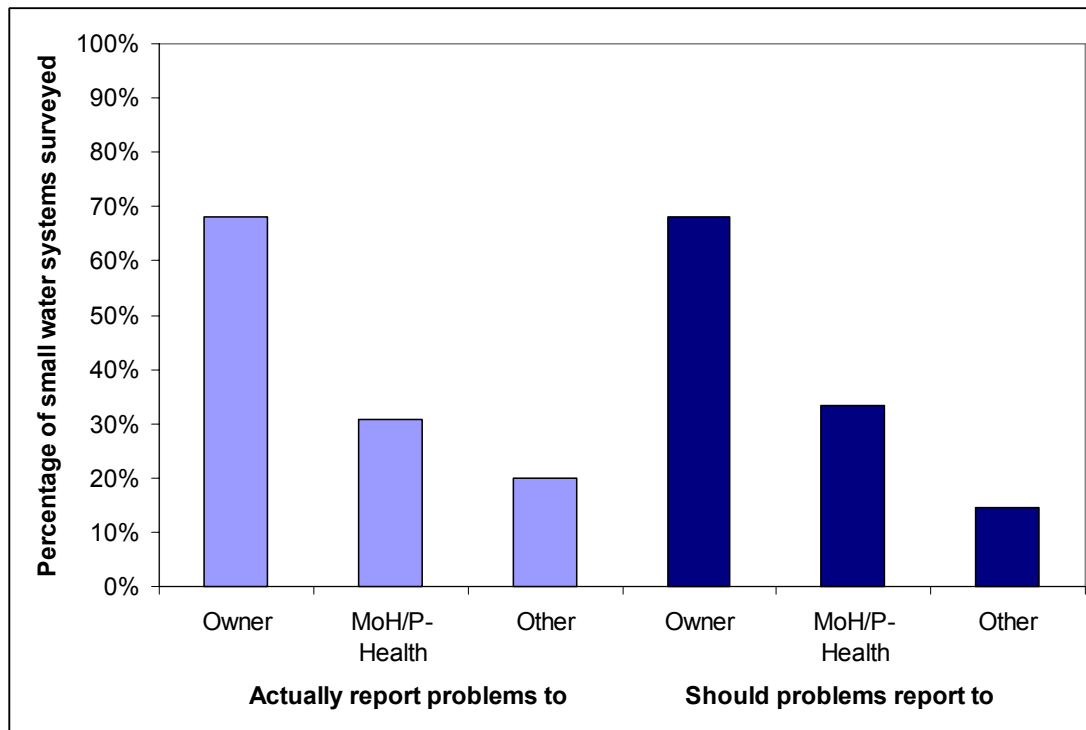
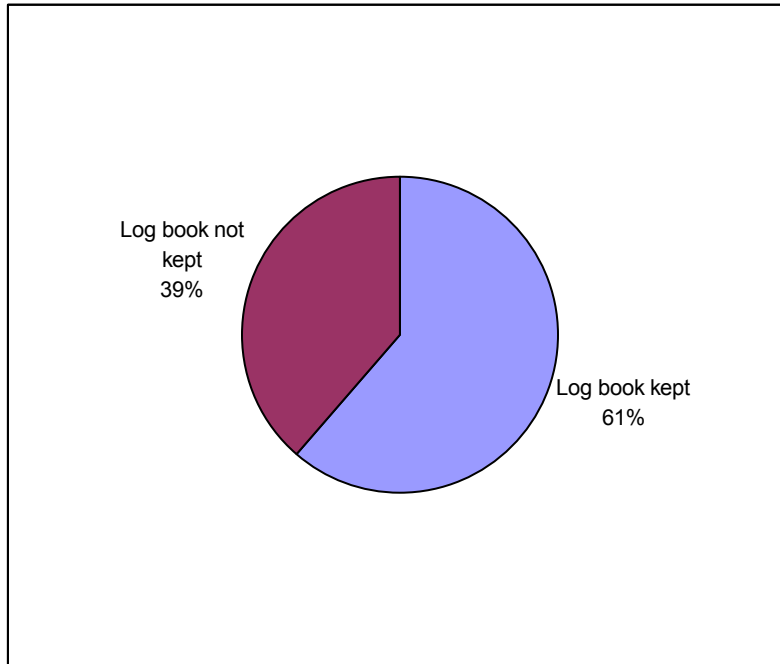


Figure G-3: Who water system problems are reported to, and who water systems managers thought that they should be reporting to. Information from questions (C) 12 and (C) 13 of the Small Water Systems Survey.

### G.1.4 Record Keeping

Small water system managers were asked if they kept a log book to record problems that they have had with the water system, and what was done about those problems. Their responses, shown as Figure G-4, show that 61% do keep a log book with these details.

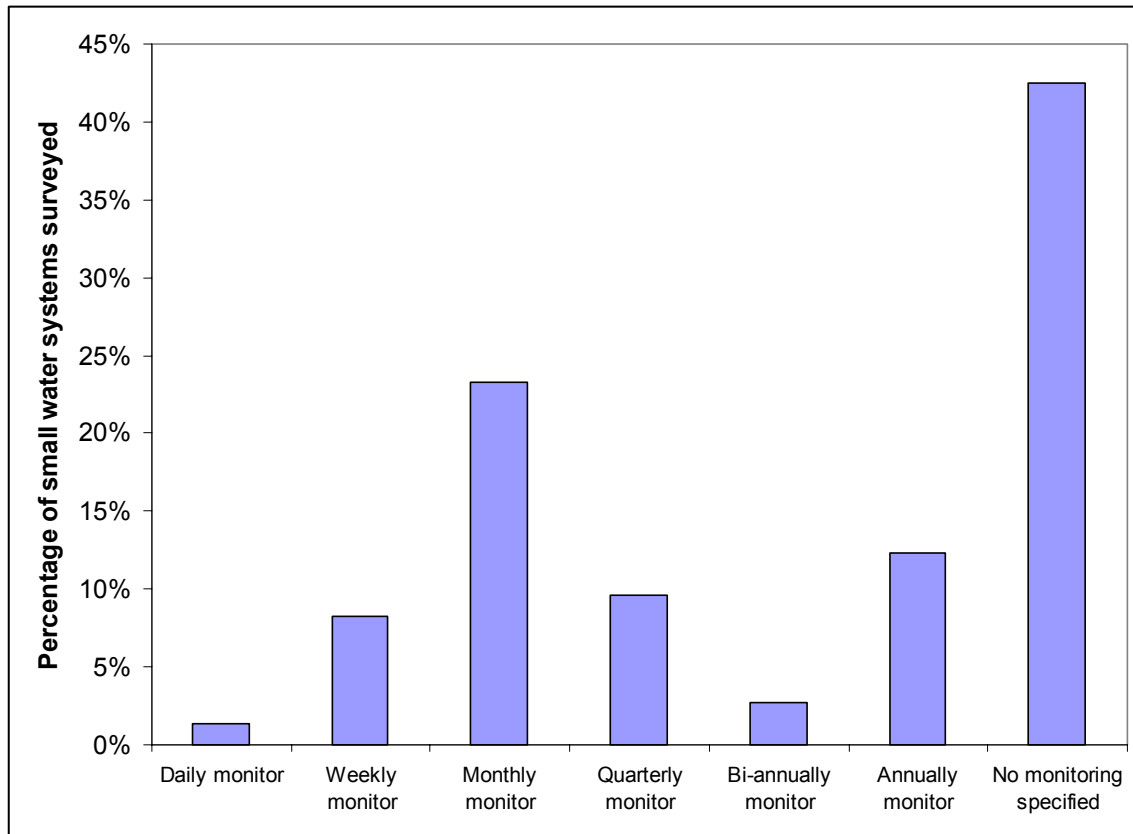


**Figure G-4: Record keeping practices of small water systems managers, from question (C)9 of the Small Water Systems Survey.**



### G.1.5 Frequency of monitoring

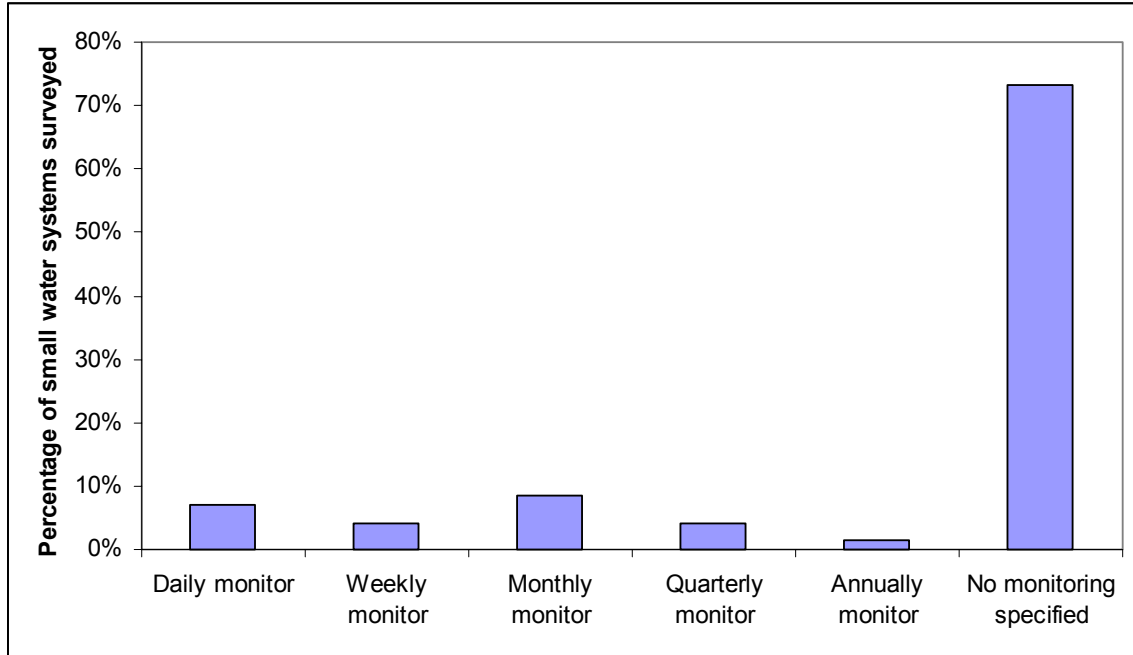
The operators were asked how often they monitor for both aesthetic and microbiological contaminants. In terms of microbiological monitoring, 58% said that they 'regularly' sample for contaminants. Figure G-5 shows that the definition of 'regular' is a broad one and that most actually monitored on a monthly basis, if they monitored at all.



**Figure G-5: Frequency of monitoring for microbiological contaminants, as determined in Part B of the Systems Report in the Small Water Systems Survey.**



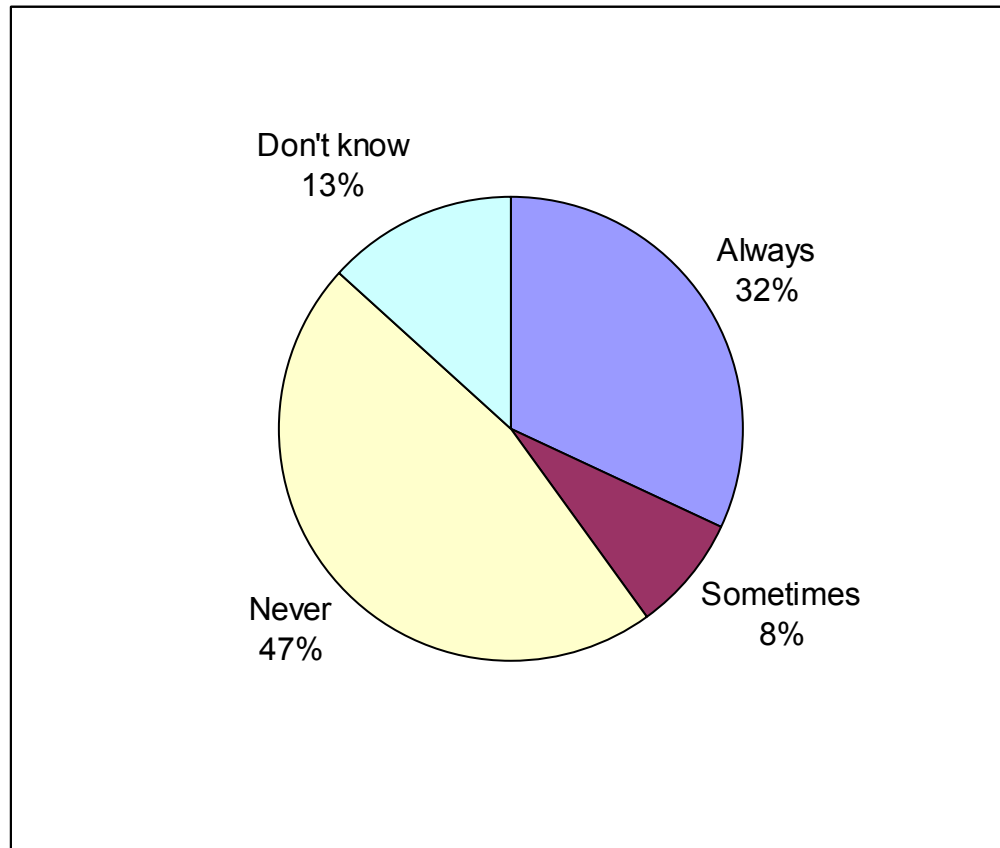
The monitoring for aesthetic contaminants was very rarely done at the systems surveyed. Only 27% said that they ‘regularly’ sampled for aesthetic contaminants, and again, the regularity was quite varied. Figure G-6 shows that most of those who did sample sampled on a daily or monthly time scale.



**Figure G-6: Frequency of monitoring for aesthetic contaminants, as determined in Part B of the Systems Report in the Small Water Systems Survey.**

### G.1.6 Disinfection after repairs

Managers were asked if they disinfected their system following repairs or alterations. Figure G-7 shows that 47% reported they never disinfect the system following such activities, and that 32% always did.



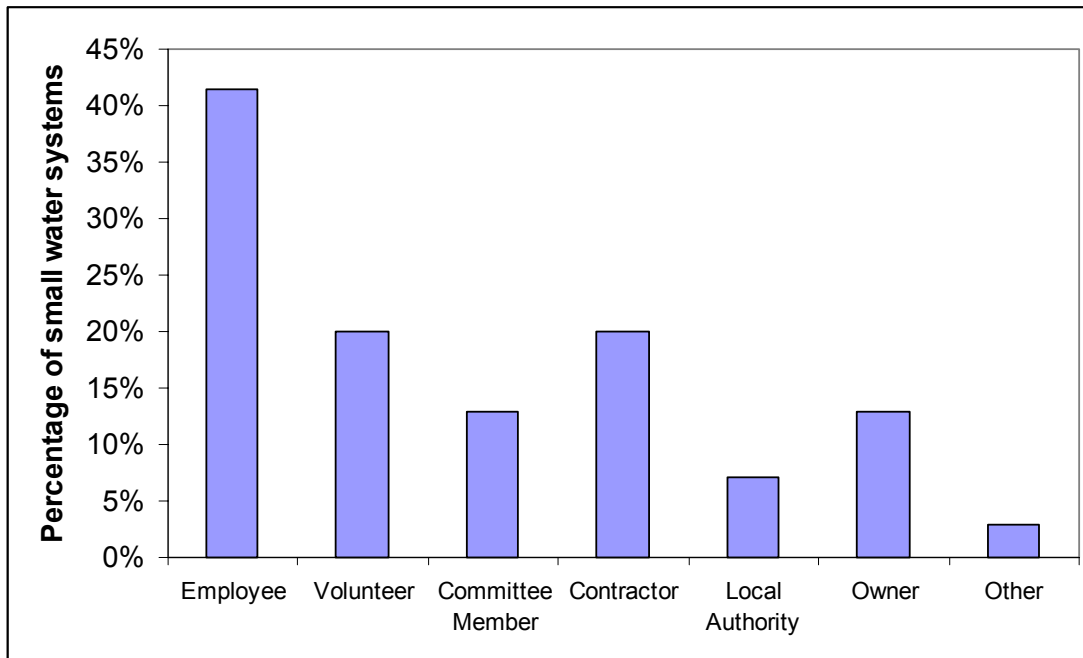
**Figure G-7: Regularity of disinfection being carried out in small water systems, following a repair or alteration in the system. Information from question (C) 11 of the Small Water Systems Survey: “Is disinfection carried out after repairs or alterations?”**



## G.2 Operators

### G.2.1 Who are they?

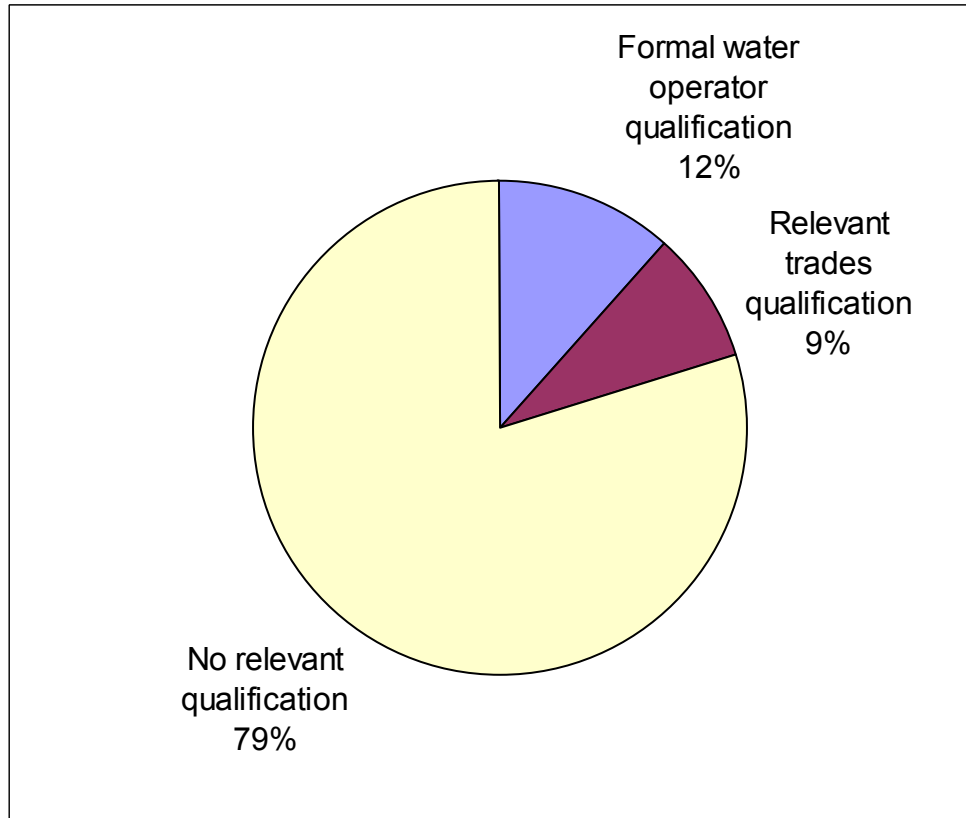
Operators (the people who actually carry out the operations, as opposed to those that are *responsible* for it) were asked what their relationship was to the small water system. Figure G-8 demonstrates that most operators were related to the owners, as either the owners themselves (13%) or as an employee of the owner (41%). A reasonable proportion of the people who carry out the operations were volunteers (20%) or contactors (20%).



**Figure G-8** The relationship of operators to the small water system, as determined in Part A of the Systems Report in the Small Water Systems Survey.

### G.2.2 Qualifications of operators

The operators were asked to list their qualifications. Of those that answered, 12% had a relevant water systems operation certificate (B or C grade), and 9% had a relevant trade qualification (i.e. plumber). 79% said that they had no relevant qualifications at all (see Figure G-9).



**Figure G-9:** The relevant qualifications of the operators of small water systems, as determined in Part A of the Systems Report.



### G.2.3 Further training of operators

The operators were then asked about any further training they had been given, formal or informal. Of those that answered, 33% had no training, and 39% said that they were self taught (see Figure G-10). It should be noted, however, that some operators specified more than one source of training.

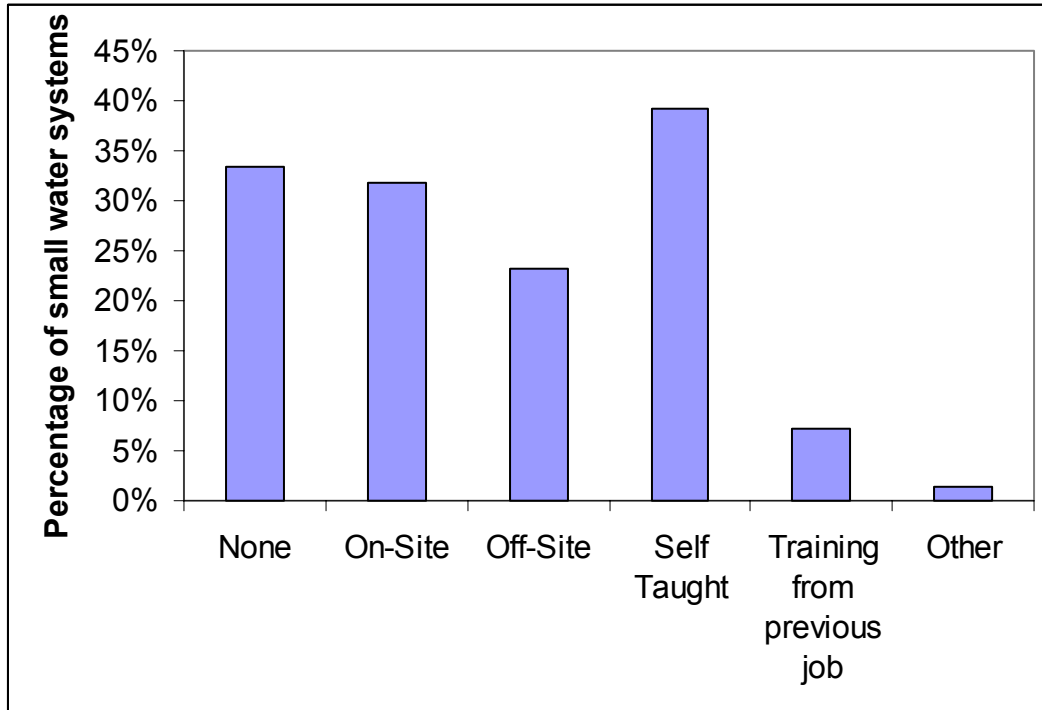


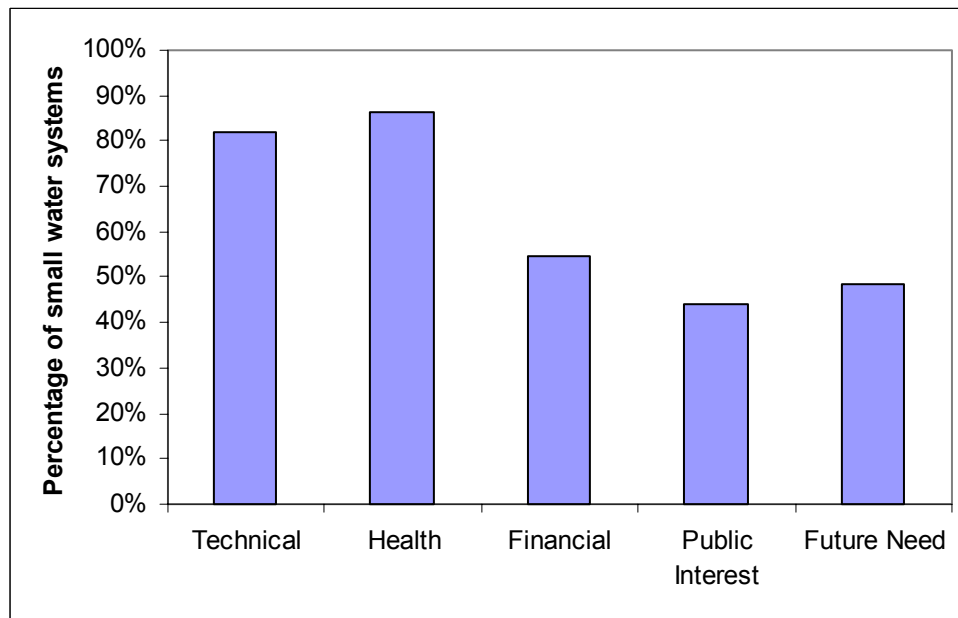
Figure G-10: Training that the operator has received, as determined from Part A of the System Report in the Small Water Systems Survey.



## G.3 Management and decision making

### G.3.1 Types of information available

Waters systems managers were asked what type of support information is available to them to aid in their decision making about their system. Their responses, shown in Figure G-11, indicate that many water suppliers have available information covering technical and health issues, and a lesser number of water suppliers have access to information addressing financial, public interest, and future needs issues.



**Figure G-11: The issues covered in support information available to water suppliers, as indicated from question (B) 3 of the Small Water Systems Survey: “Support information available?”**



### G.3.2 Sources of information

Water systems managers were asked where this information or advice is sourced from with regards to the maintaining and upgrading of their water system. Most replies detailed a number of sources, and the summary of these are shown in Figure G-12. It can be seen that District Health Boards and District Councils were the most common source of information, closely followed by local contractors and plumbers. The Ministry of Health, consultants, in-house sources, and 'other sources' were also cited as information and advice sources at 10 or more water suppliers. Other sources included community, hapu and solicitor.

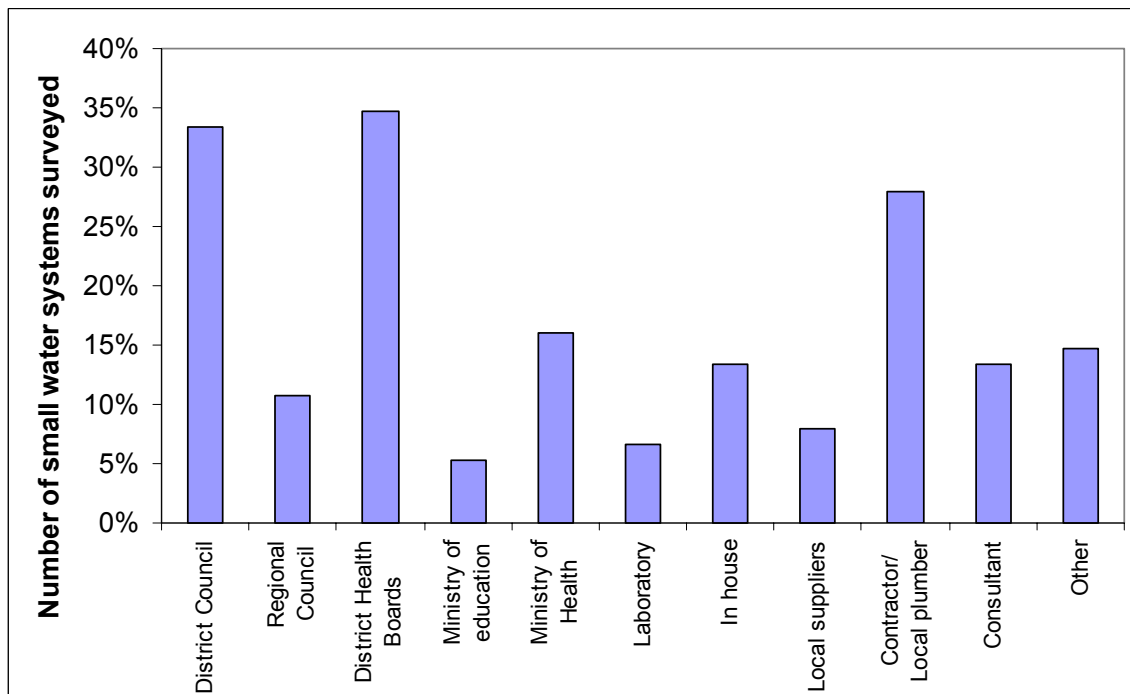
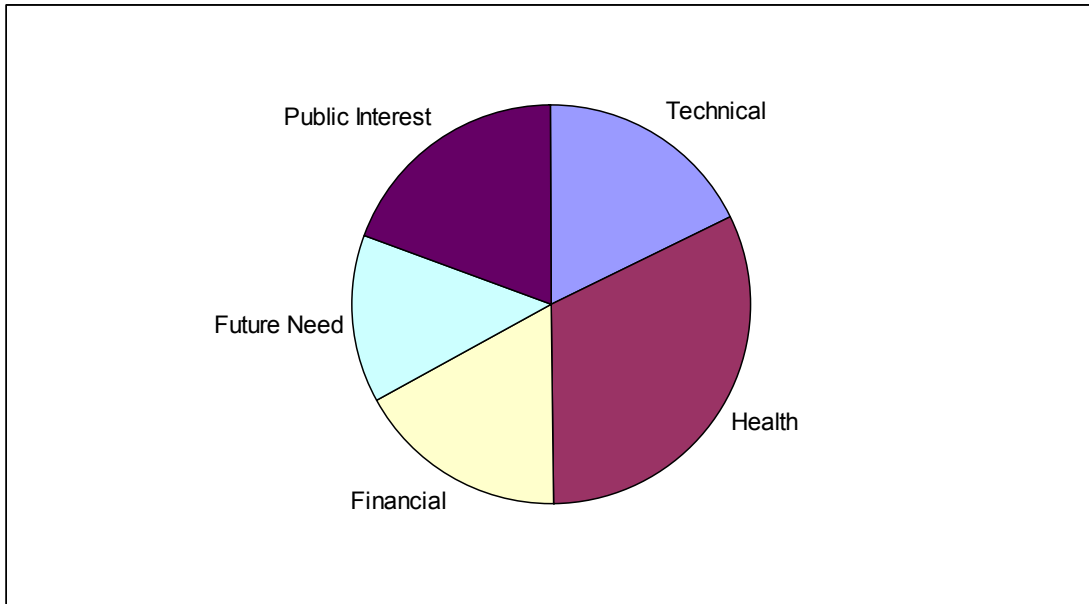


Figure G-12: Sources of information and advice for small water system managers, as determined from question (B)4 of the Small Water Systems Survey: "Where is the information /advice sourced?"

### G.3.3 Factors in decisions

Water system managers were asked to rate the factors that they take into account during decision making about upgrades and support for their small water system. Managers were asked to rate the importance of technical, health, financial, public interest, and future need issues in their decision making, and most provided a rating of 1-5 for each of those factors (5 being the most important). These ratings were summed to generate the pie chart in displayed in

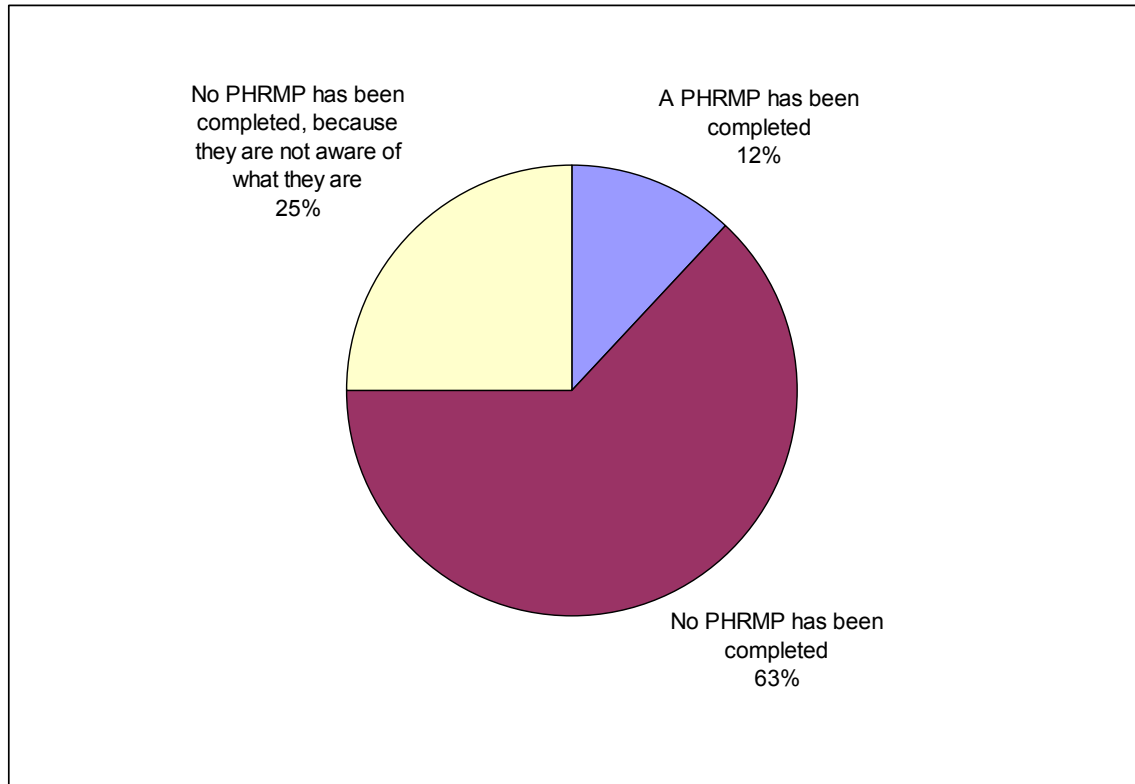
Figure G-13. It shows that health was the most important factor in decision making, with all other factors providing a reasonably even weighting.



**Figure G-13: Importance of factors for small water systems managers when decision making about the operation and support of their systems. Information from importance weightings given in question (B) 5 of the Small Water Systems Survey: “Factors in decisions”.**

### **G.3.4 Risk management plans**

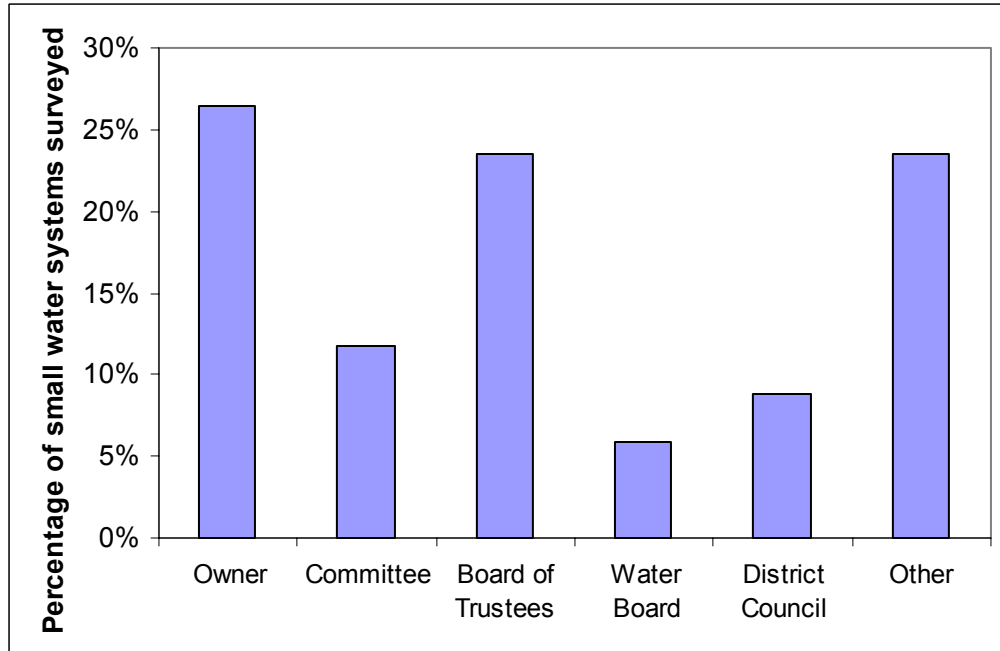
Managers of small water systems were asked if they had prepared a Public Health Risk Management Plan (PHRMP). The results, shown as Figure F-1, showed that 12% of small water system managers had prepared a PHRMP guide. Of those that had not completed a PHRMP, 25% of those interviewed reported that the reason why they have not is because they are not even aware of what a PHRMP is.



**Figure G-14: The status of the preparation of a public health risk management plan (PHRMP), as determined from question (C)1 of the Small Water Systems Survey.**

### **G.3.5 Operating and maintenance budgets**

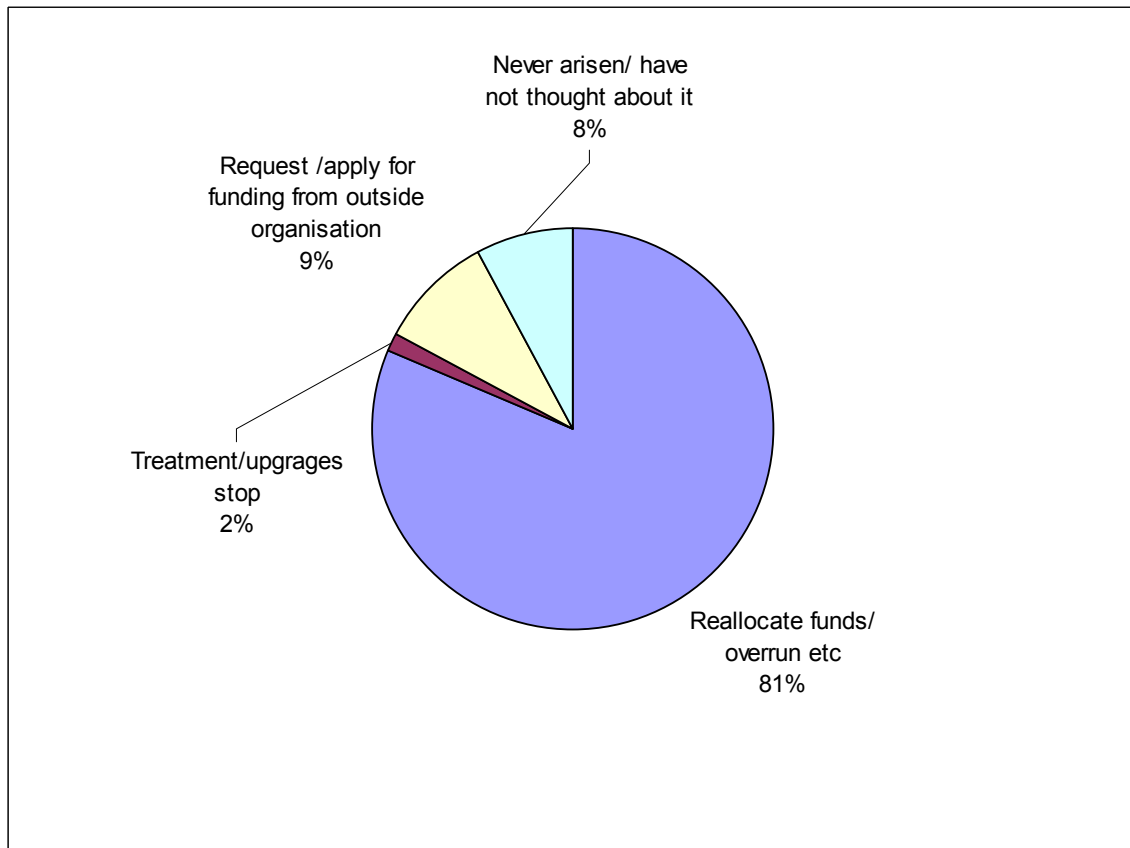
The small water system managers were asked if there is a specific budget for operating costs, and if there is, who sets that budget. 45% of those surveyed said that there was a specific budget, and Figure G-15 shows who it is that determines the budget. It can be seen that the owner and boards of trustees are predominantly the people that set the operations budget.



**Figure G-15: The people or groups that set the operating budgets for small water systems, as determined in question (B)12 of the Small Water Systems Survey.**

The managers were then asked if they have a specific budget for maintenance and capital expenditure. The results were that **48%** have maintenance budget, and **39%** confirmed a capital expenditure budget. The people who set those budgets were almost exactly the same as those who set the operations costs, i.e. the owners and boards of trustees (at schools).

The possibility of the budget running out was considered in the survey, and the managers were asked what happens if this was to occur. Figure G-16 shows that most organisations (81%) would just continue to do what was require to maintain the water system, such as reallocating budgets, or just over running the budget. 8% reported that the budget had never run out, and did not indicate what would happen if it did. 9% indicated that they would have to request or apply for funding from an outside organisation to keep the small water system operating, and therefore are dependant on others for this to occur. Only 2% said that there were no plans for if the budget ran out, and said that treatment would have to stop if that occurred.



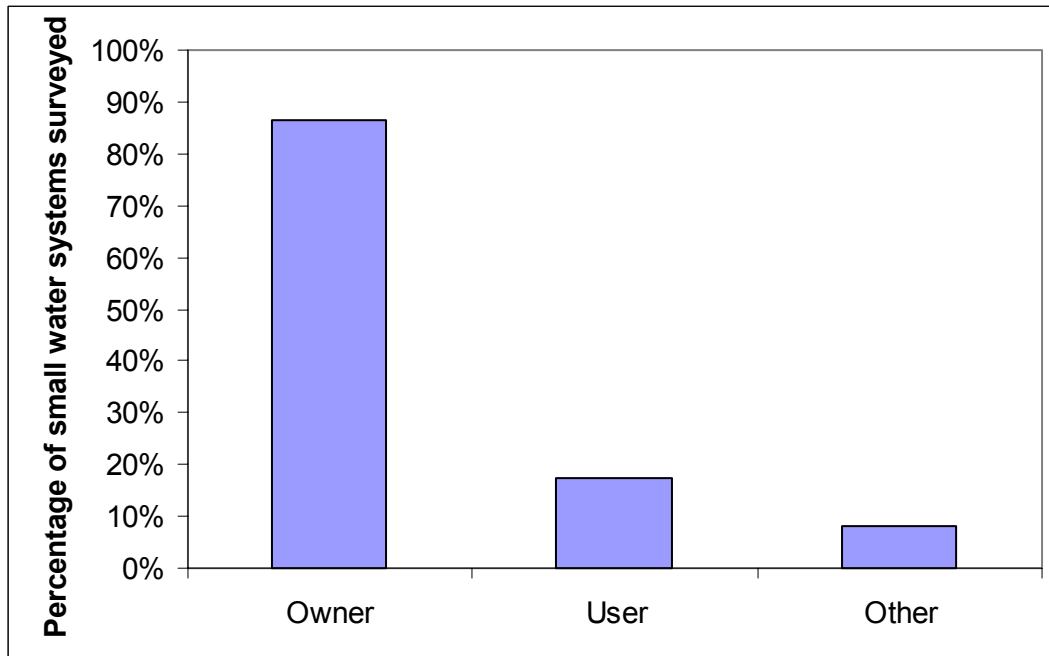
**Figure G-16: Responses to the question (B)14: "What happens if the budget for the water supply runs out?" from the Small Water Systems Survey.**

### ***G.3.6 Operating and maintenance costs***

The small water system managers were asked who meets the operating costs of their system. It should be noted that some managers indicated more than one avenue for meeting costs. Figure G-17 shows that the owners are predominantly the people who meet the operating costs. The managers were also asked who



meets the maintenance costs, and the responses were almost exactly the same, i.e. the owners also predominantly meet the maintenance costs



**Figure G-17: The people who meet the operating costs of small water systems, as prescribed from question (B)9 of the Small Water Systems Survey.**



Small water system managers were asked to provide their annual operating costs for staff, operations, maintenance and compliance. Note that a number of water systems either did not have any costs, did not know what their costs were, or did not report them in the survey. Table G-1 summarises the information, showing the range in costs for the systems, if there were any costs reported.

There is quite a large range in the reported costs, depending on the use of the water and the importance of a quality, continuous water supply to the community.

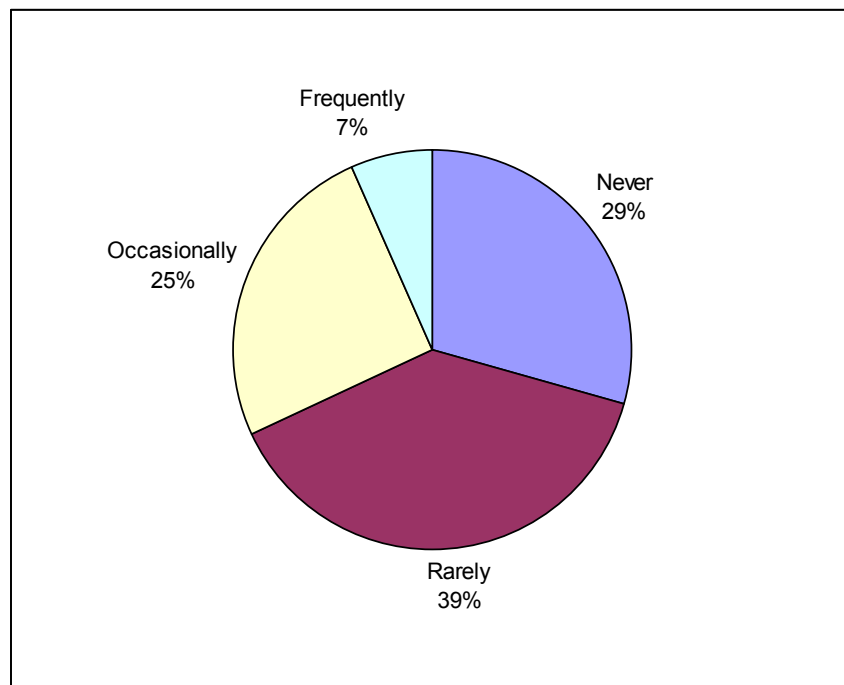
**Table G-1 Annual costs reported for staff, operations, maintenance, and compliance, for each type of supply. Note that the first column indicates how many of each supply type were surveyed (some small water systems fall under more than one category). The numbers in the other columns refer to the number of each supply type that reported ANY cost at all. The range reported also only refers to those that reported ANY costs at all (i.e. for some the costs were \$0). Information from question 13 of the Small Water Systems Survey.**

Total no. of each supply type	Supply Type	Staff	Operations	Maintenance	Compliance
16	No. - Schools Range - Schools	4 \$20-\$500	4 \$80-\$2,000	6 \$50-\$700	7 \$180-750
18	No. - Commercial Range - Commercial	2 \$8,320-\$23,000	5 \$100-7,000	4 \$50-\$29,000	1 \$300
13	No. - Camp Range - Camp	3 \$500-\$2,000	2 \$1000	4 \$200-\$1,000	2 \$120-\$360
10	No. - Marae Range - Marae	0 \$0	1 \$200	1 \$200	0 \$0
33	No. Residential Range - Residential	4 \$500-\$8,320	10 \$100-\$19,000	10 \$50-\$5,000	6 \$100-\$3,000
2	No. - Hospital Range - Hospital	2 \$10,000-\$30,000	2 \$500-\$5,000	2 \$5,000-\$10,000	2 \$4,000-\$5,000

## G.4 Problems experienced

### G.4.1 Frequency of problems

The small water systems managers were asked how frequently they had problems with their water supply. Figure G-18 shows that 39% rarely have problems with their supply, and that 7% have problems frequently. It should be noted however, that these are only problems that the manager is aware of. If no monitoring is done, then it is possible that problems with water quality may be occurring that they are not aware of.



**Figure G-18: Frequency of problems with the water supply, as reported in question (C)6 of the Small Water Systems Survey.**



### G.4.2 Nature of problems with the water supply

The managers were then asked about the kinds of problems they have experienced with their water supply, if any. The answers have been summarised in Figure G-19. 33% had experienced problems relating to water quality, 29% reported mechanical failure in the system (i.e. burst pipes, pump failure), 15% said that shortages in the water supply had presented problems previously, and 9% described issues with the intake area i.e. silting or weed growth.

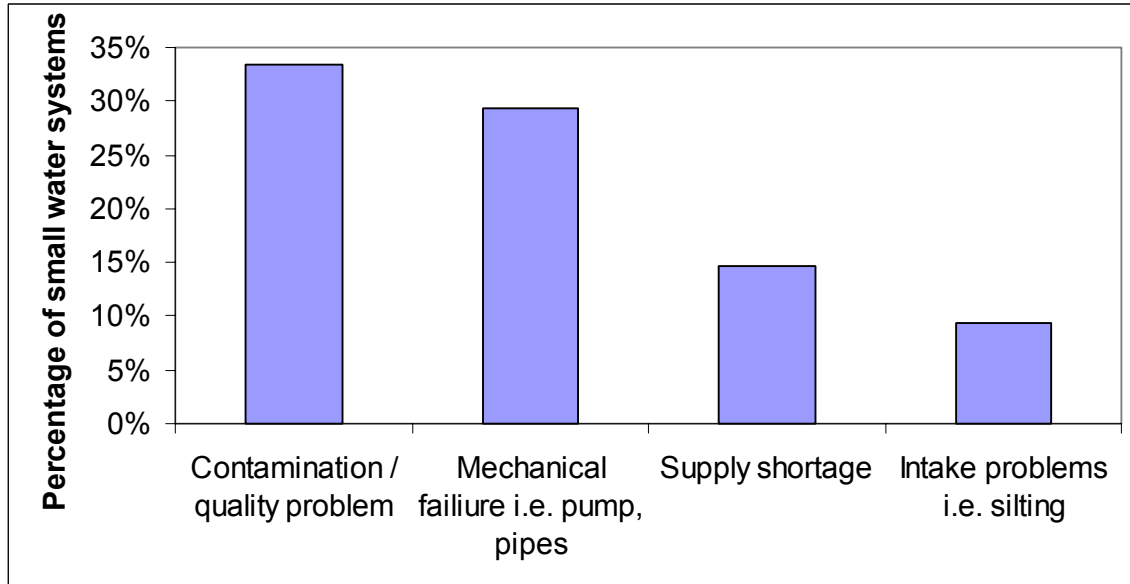


Figure G-19: Types of problems experienced with small water systems in New Zealand, as determined by question (C)7 of the Small Water Systems Survey.



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## H. ISSUES AND RISKS FOR SMALL WATER SYSTEMS

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The survey has identified a number of issues that are either potential causes of risk to public health or may have the potential to impede the effective implementation of the proposed drinking water legislation. These issues have been grouped in three broad theme areas:

- A. Issues related to the managers and operators, their perceptions and understanding of risk and operational requirements, their level of competency and training;
- B. Issues concerned with the installed system itself, such as being properly designed, current state of plant, and cost of maintenance and upgrading; and
- C. Issues associated with the day-to-day operations of the system, such as non-compliance with the Drinking Water Standards for New Zealand (DWSNZ) due to no monitoring or testing.

As a comparison against the responses provided by the system managers and operators, the interviewers themselves were also asked to provide their own assessment on particular issues. These comments are also included in this section.

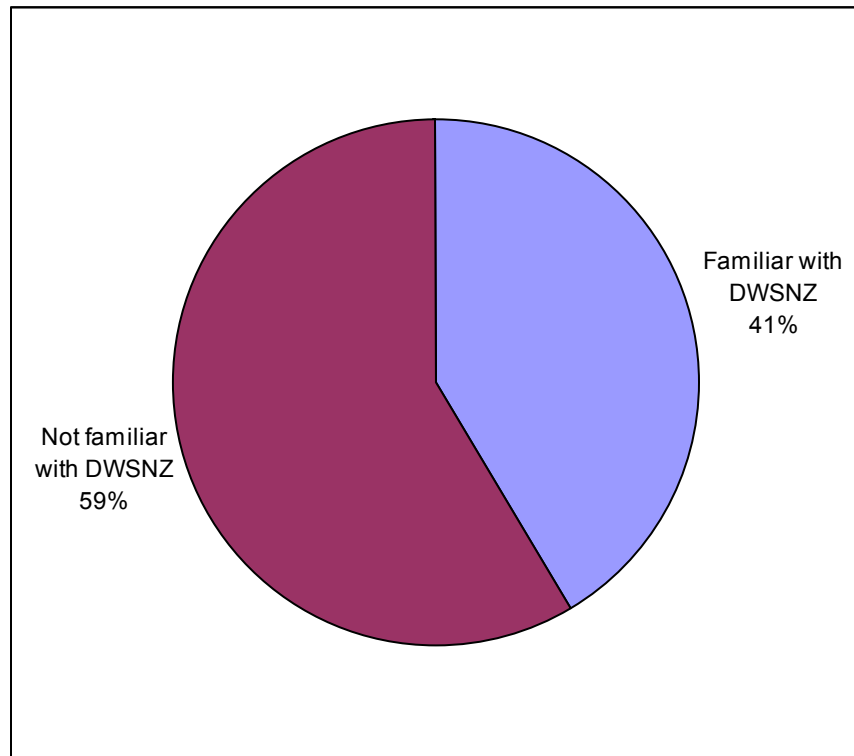
### H.1 People related issues

These are issues that relate to a manager's or operator's perceptions and knowledge. Such as their awareness of public health risks, their understanding of their requirement to meet performance standards, their level of training and competency in managing the systems

#### *H.1.1 Awareness of DWSNZ*

Less than half those surveyed (41%) claim to be familiar with the DWSNZ, with the rest having little or no familiarity of them (see Figure H-1). A slightly higher proportion (45%) claim to be meeting the DWSNZ, and the rest either do not meet them or are unsure if they do. Although it may at first seem strange that a higher proportion claim to meet the standards than have even heard of them, this simply reflects the situation at these systems: many of the owners and managers have been using the water in their supply for years without any water quality problems coming to their attention, and they therefore think that they must comply with the standards. In reality, many of the 45% who claim to be meeting

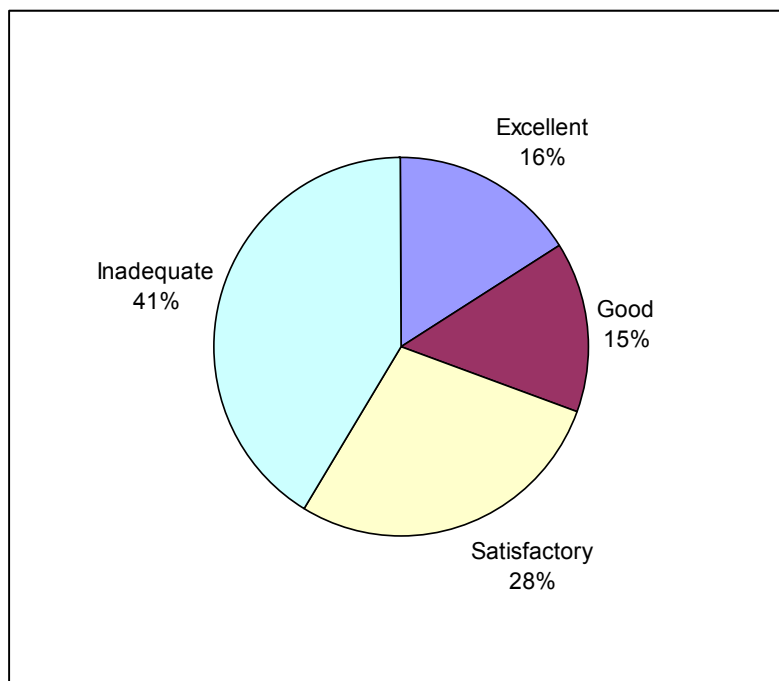
the standards will not actually be meeting them, primarily because they do not monitor often enough.



**Figure H-1: Familiarity with the DWSNZ, as reported by the managers themselves in question (C)2 of the Small Water Systems Survey.**

The interviewers were requested to rate their perceptions of the small water systems managers in terms of their awareness of the DWSNZ (see Figure H-2). A significant proportion (41%) of the managers were identified as having an inadequate awareness of the standards, 28% were rated as having a satisfactory awareness, and 31% had an excellent or good awareness.

The interviewers (in Figure H-2) are therefore giving greater credit to the managers / operators awareness of DSWNZ than what they themselves are claiming (in Figure H-1). However, it is clear that at least 40% of the operators/managers lack sufficient knowledge of the DSWNZ. This is therefore a significant barrier for small water systems to meet these standards, as they are not even aware of what standards exist.

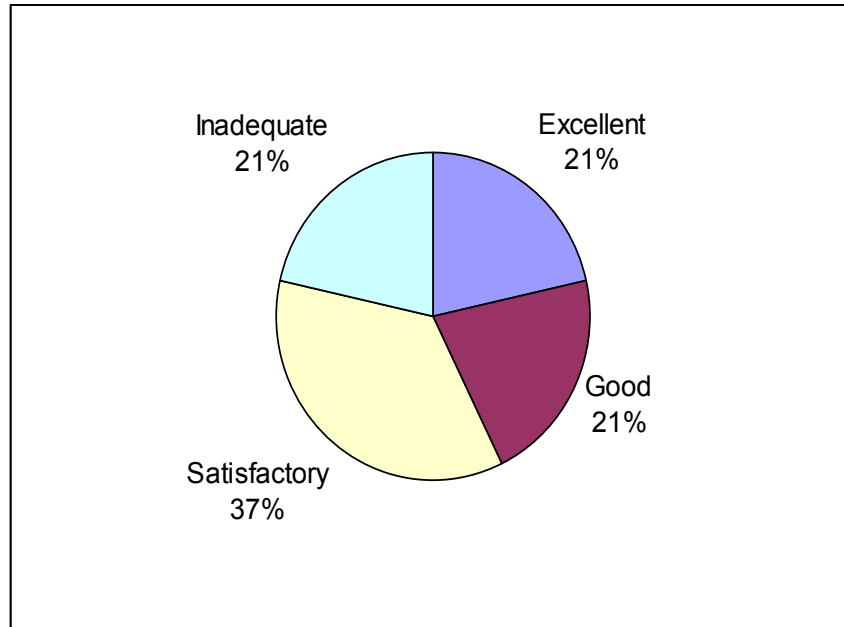


**Figure H-2: Awareness of water systems managers of the Drinking Water Standards for New Zealand, as rated by the interviewers in the Small Water Systems Survey.**

### ***H.1.2 Awareness of Public Health Risks***

There appears to be a wide range in the understanding by managers and operators of the potential public health risks that are associated with their systems. This is evident in the graphs presented in Section H.3.4, above, where only 12% of those interviewed had prepared a Public Health Risk Management Plan. Of the 78% surveyed that have not done a PHRMP, at least 30% of them (25% of total) claimed they were not aware of what a PHRMP is. (Note that a copy of the Ministry of Health PHRMP Guide was offered to all those interviewed)

The interviewers rated the small water systems managers in terms of their perception of risk (see Figure H-3). A wide range of perceptions were reported, from inadequate to excellent, with the most common risk perception ability being rated as satisfactory.



**Figure H-3: Perception of risk by small water systems managers, as rated by the interviewers in the Small Water Systems Survey.**

The range of comprehension of the public health risk is reflected in the interviewers comments. Some of these comments are:

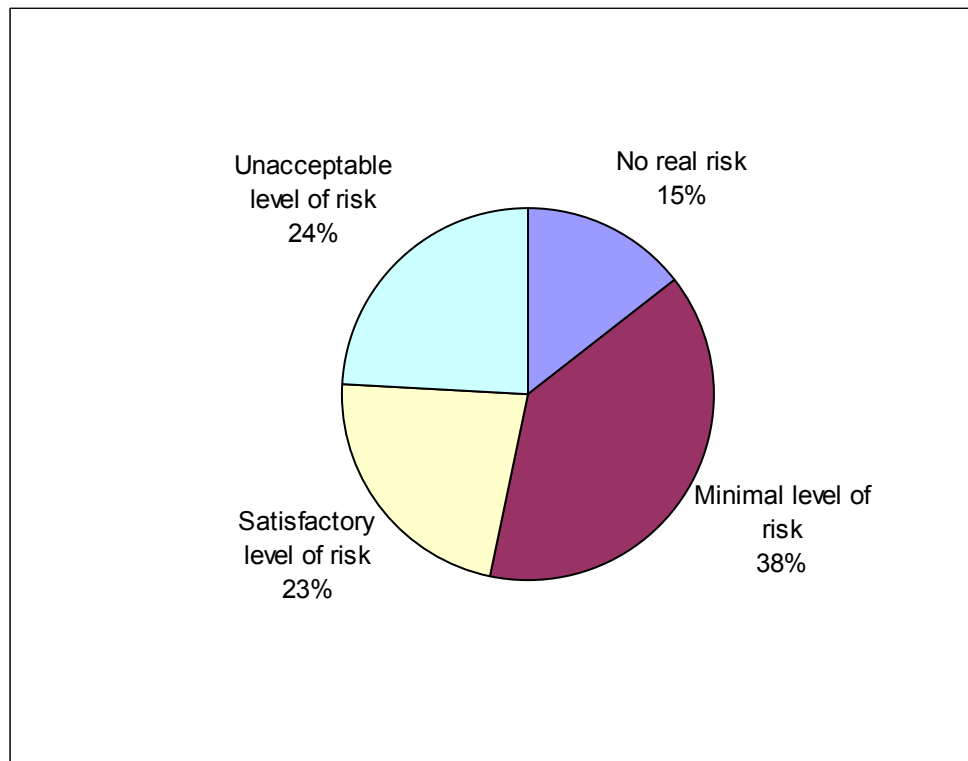
- “Owner and operator consider DWSNZ and PHRMP to be a bureaucratic requirement rather than steps to minimise public health risk. Some bugs are necessary to keep you healthy.” (From a motor camp).
- “Owner considers he is complying with the DWSNZ because one test showed no problems.” (From a hotel)
- “Low level of awareness. Also the attitude that the system if fine and no improvements are required. Operators consider that the supply meets the DWSNZ.” (From a small community water supply).
- “There is a general awareness but it needs someone to reinforce the need for compliance and to show them how it can be achieved.” (From a school).

A factor that may influence the managers/operators awareness of risk is their perception of the soundness of their system. Interviewees were asked how

frequently they have had problems with their water supply. Figure G-18 shows that 68% never or rarely have problems with their supply, while only 7% have problems frequently. It should be noted however, that these are only problems that the manager is aware of.

The fact that two-thirds of managers never or rarely have problems with their system (refer back to Figure G-18) probably influences the perception of managers about the health risks and potential issues that could result from poor management and planning.

Interviewers were asked to provide their own judgement of the level of risk at the small water systems they visited. The results, shown in Figure H-4, show that more than half of the systems surveyed have no real risk or a minimal level of risk. 23% of water systems have only satisfactory level of risk, and 24% of systems were rated as having an unacceptable level of risk. Therefore the actual frequency of problems does not reflect the potential for problems at the sites. This graph shows that there are a reasonable proportion of sites where the level of risk is unacceptable, more than the level of reported problems at the sites.



**Figure H-4:** The level of risk of the small water systems surveyed, as assessed by the interviewers in question F(7) of the Small Water Systems Survey.

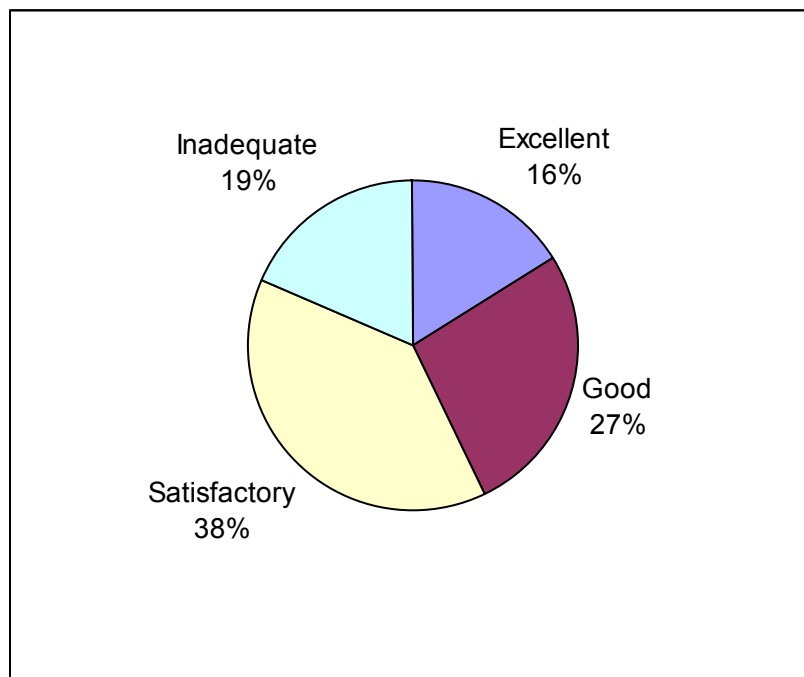
### **H.1.3 Competency and training of the managers and operators**

#### *H.1.3.1 Operator qualifications and training*

The operators were asked to list their qualifications, and any further training that they had received. These patterns were presented in Figure G-9 and Figure G-10, above. To recap, 12% had a relevant water systems operation certificate (B or C grade), and 9% had a relevant trade qualification (i.e. plumber), and 79% said that they had no relevant qualifications at all. In terms of less formal training, 33% had no training, and 39% said that they were self taught, and 52% said that they had been given some form of training (on-site, off-site, or in a previous job). Note that some operators specified both 'self-taught' and some other form of training.

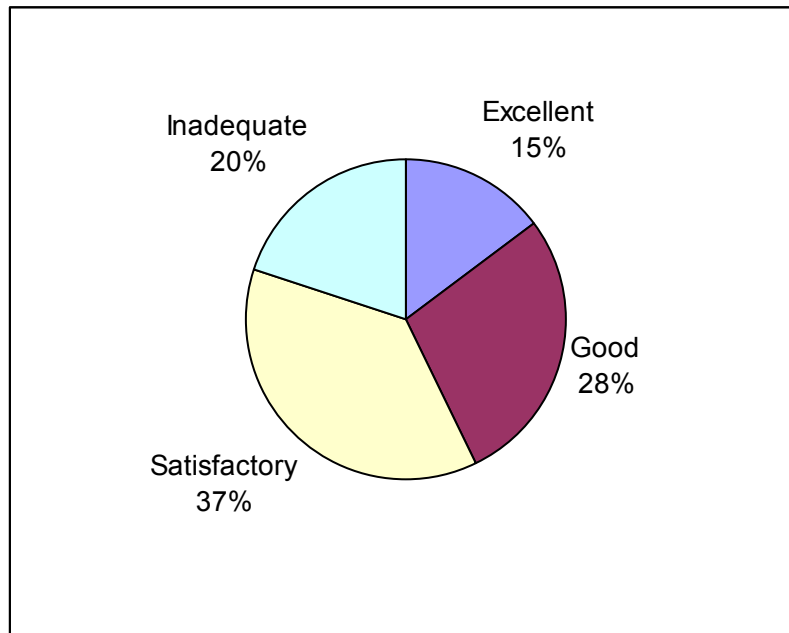
#### *H.1.3.2 Interviewers evaluation of knowledge and skills*

The interviewers were asked to evaluate the small water systems operators in terms of their knowledge and skills (see Figure H-5). The majority of operators were placed in the 'satisfactory' or 'good' categories, with 19% of operators rated as having 'inadequate' knowledge and skills.



**Figure H-5: Knowledge and skills of small water systems operators, as rated by the interviewers in the Small Water Systems Survey.**

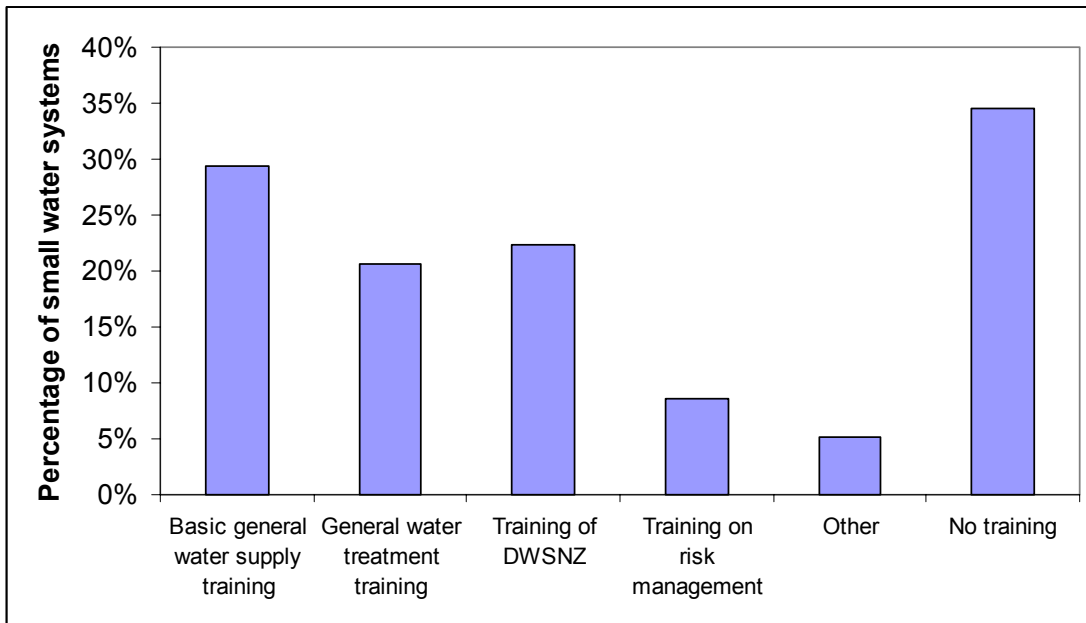
Managers were also evaluated in this way, with the interviewers rating their level of understanding and skills (see Figure H-6). Again, there was quite a spread across those surveyed, with the most predominant level of understanding being 'satisfactory'. The level of understanding and skills of managers is almost exactly the same as the level of operators; however it should be remembered that in many cases, these roles are actually filled by the same people.



**Figure H-6: Level of understanding and skills of small water systems managers, as rated by the interviewers in the Small Water Systems Survey.**

### H.1.3.3 Training that is wanted

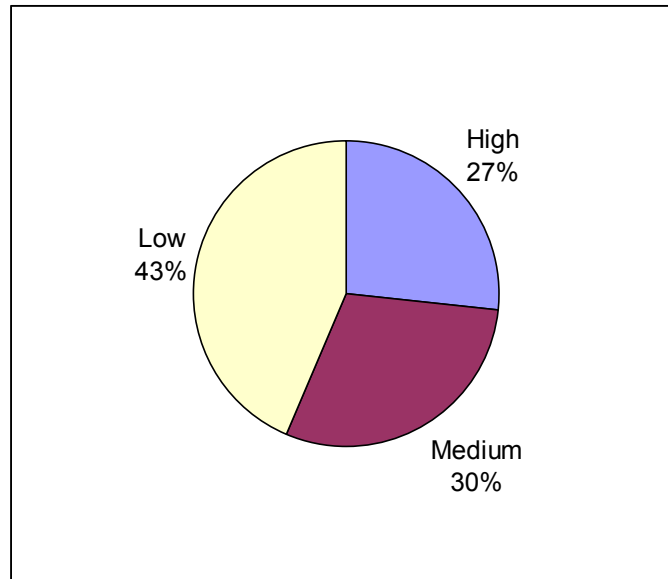
Operators were then asked what training they would like to have, the responses from those that did provide feedback are summarised as Figure H-7. Of interest was that 34% of operators said that they would like no training! 29% expressed an interest in general and basic water system and supply training, while 21% said that information about water treatment methods would be valuable, and 22% reported that they would like to complete a module specifically on the DWSNZ.



**Figure H-7: Training that the operators of small water systems would like to have, as evaluated in Part A of the Systems Report.**

### H.1.3.4 Training that is needed

The interviewers were also asked to evaluate the need for training of the operators. Of those that responded, Figure H-8 shows that in 43% of small water systems there was a low need for training, and that in 27% of cases, the need was high.



**Figure H-8: The need for training of the operators, as evaluated by the interviewers in Part B of the Systems Survey.**

These interviewers' assessments are simply their opinions of the situation (i.e. not scientifically sound) and are provided only to provide some sense of the significance of the issue. Some of the interviewers' comments include:

- At a school: "Operator knows the system. However, unaware of contamination path into treated water storage"
- At a marae: "Very simple system, minimal skills required, operation instructions on wall in pump house."
- At a school: "They are unaware of what problems a roof collected system can incur, education is a must."
- At a motor camp: "Needs to understand the risk of waterborne disease and repercussions."



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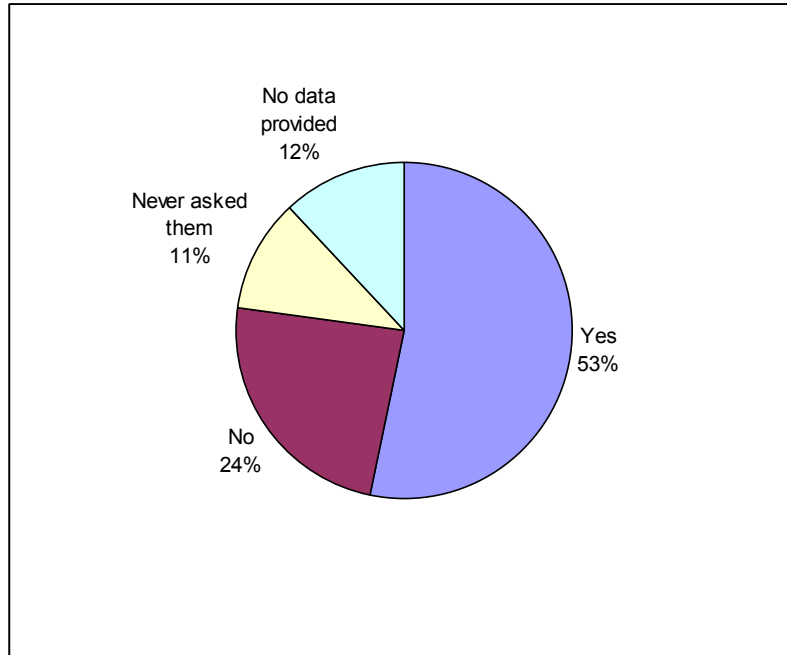
### *H.1.3.5 Summary*

In summary, the issue of the knowledge and skill level of operators and managers is one of the issues facing small water systems in New Zealand. Around 20% were evaluated as having an inadequate level of understanding and skill in their roles, 66% of operators expressed an interest in further training, and interviewers reported that 57% had a medium-high need for further training. In order to raise the standard of water supplies in New Zealand therefore, additional training in some form would be of benefit to around two-thirds of the small water systems.

### ***H.1.4 Management decision making***

A number of questions were asked to identify what support was available for management to assist them in their decision-making. Section D.2.4, above, details the type of information that is available to managers and the sources of that information, as well as the factors that they take into account in their decision making processes. To recap, this section showed that water supply managers have available information covering technical and health issues, and a lesser number of water suppliers have access to information addressing financial, public interest, and future needs issues. They source their information mainly from District Health Boards and District Councils, but also from local contractors and plumbers. The most important factors in decision making were health issues, however technical, financial, public interest, and future need issues were reasonably equally weighted in the decision making process.

Water supply managers were asked if there was support available from their Local Authority. It should be noted that this question reflects their perception of whether support is available, and does not necessarily reflect actual support available. Figure H-9 shows that 53% of those surveyed reported that support was available in some sense. Some detailed that this was specifically for monitoring, or only advice and not financial, therefore the definition of support varied across those surveyed.



**Figure H-9: Responses to the question “Is support available from your Local Authority?”, from the Small Water Systems Survey (D)10.**

Though managers do have access to information and advice, the wide variety of information sources could raise concern over the lack of consistency in the information that is provided. It appears that to achieve widespread coverage for any education or communication campaign targeted at small water systems managers, more than one type of agency will need to be involved. To increase the issues of awareness of public health risks and of the DWSNZ, identified in the previous sections, information should be channelled primarily through District Health Boards and District Councils. A more difficult information channel to educate through is the plumbers and other contractors that 28% of small water system managers get their information and advice from. Overall, however, the results from this section are promising; as the majority of water systems managers expressed that they do source outside advice and information, and do not simply rely on their own knowledge for decision making about their small water system.



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## H.2 Plant and system issues

An effort was made to ascertain the general standard of the physical systems. This was primarily done by a visual inspection by the interviewer. The interviewers had a minimum of 5 years experience in installing small water systems, though the average was closer to 10 years experience. This method of visual inspection will only reveal obvious external flaws in the system, and this limitation needs to be kept in mind when considering the interviewers' findings.

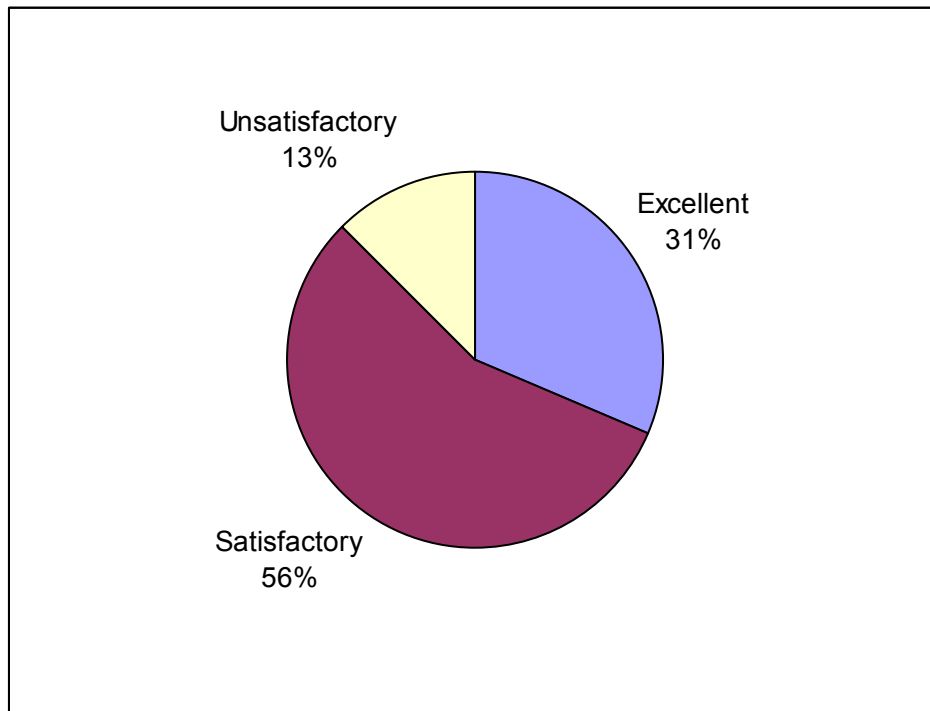
### *H.2.1 Problems with the water source*

Section G.3.1 discusses the sources of water for the small water systems in New Zealand. Further questioning of the operators and managers in Section A of the Systems Report found some interesting statistics about the security of the source in terms of preventing contamination:

- Only 54% of systems with surface water sources reported to have their source fenced, leaving a number of systems potentially open to risk of contamination by animals and humans.
- 23% of systems with bore water sources reported insecure headworks.
- At least 35% of systems with roof water sources do not have flushing points.
- 33% of storage tanks were considered to have inadequate vermin protection or were incorrectly sealed.

### **H.2.2 Overall condition of the plant**

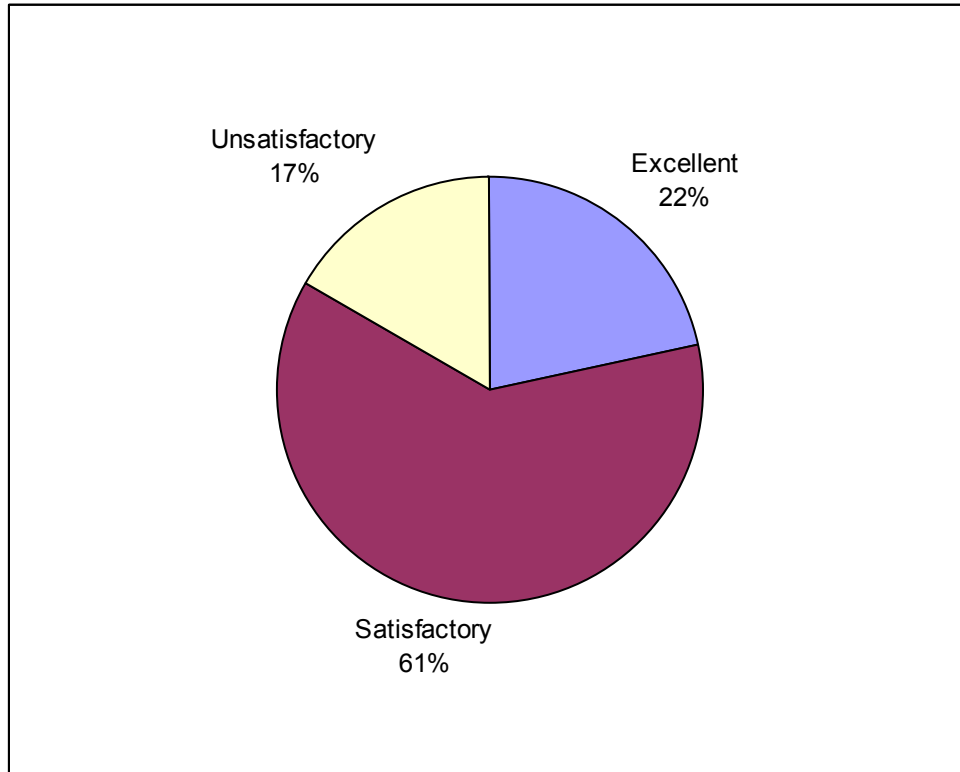
Interviewers were asked to evaluate the condition of the plant. Figure H-10 shows that at the majority of systems (87%) the plant was in an excellent or satisfactory condition. Most comments from the interviewers were a variation of “plant is in good and tidy condition”. Although over half of the plant systems were rated as satisfactory, this does not mean that they were DWSNZ compliant. The 13% of the systems that were rated as unsatisfactory, were given this rating mainly for having no or an inadequate level of treatment. The poor condition of reservoirs and storage tanks was another main reason for an unsatisfactorily rating.



**Figure H-10: The condition of the treatment plants of small water systems, as evaluated by the interviewers in Part B of the Systems Report.**

### **H.2.3 Suitability of plant**

Interviewers were asked to evaluate the suitability of the treatment plant to the purpose and use of the water. Of those that responded to the question, Figure H-11 shows that in 83% of cases, the plant was excellent or satisfactory in terms of its suitability to the site.



**Figure H-11: Suitability of the treatment plant for the small water system and its use, as evaluated by the interviewer in Part B of the Systems Report.**

## **H.3 Operational Issues**

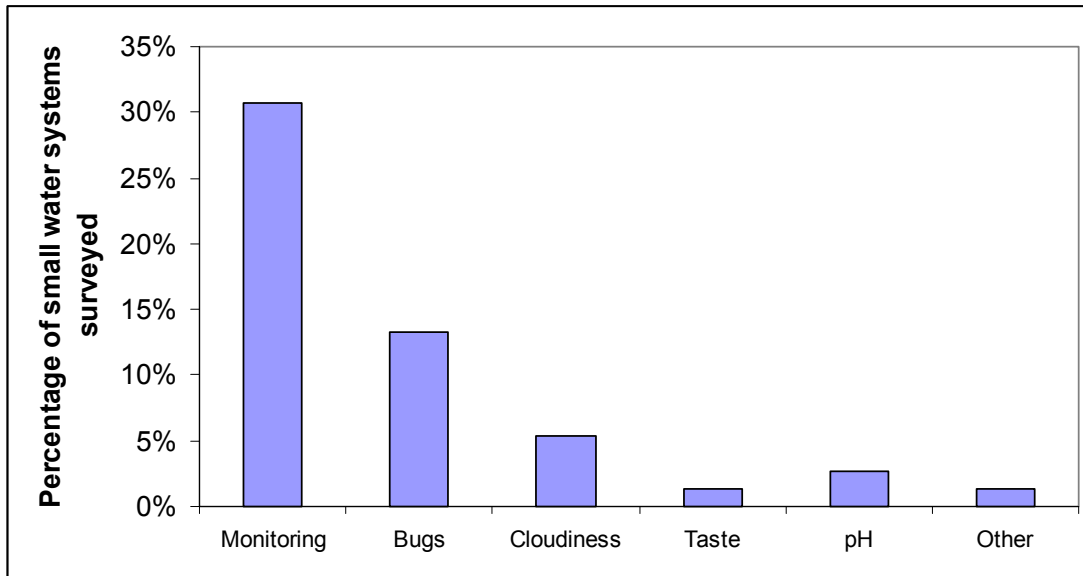
This section discusses the issues associated with the day-to-day operations of the system, and how these may be affecting small water systems.

### **H.3.1 Failure to comply with the DWSNZ 2000**

The small water systems managers that are aware of the DWSNZ, but did not meet them were asked what the reasons were for failing to meet the standards. Figure H-12, below shows that the primary reason for failure was in not meeting the monitoring requirements (31% have failed for this reason). The results show

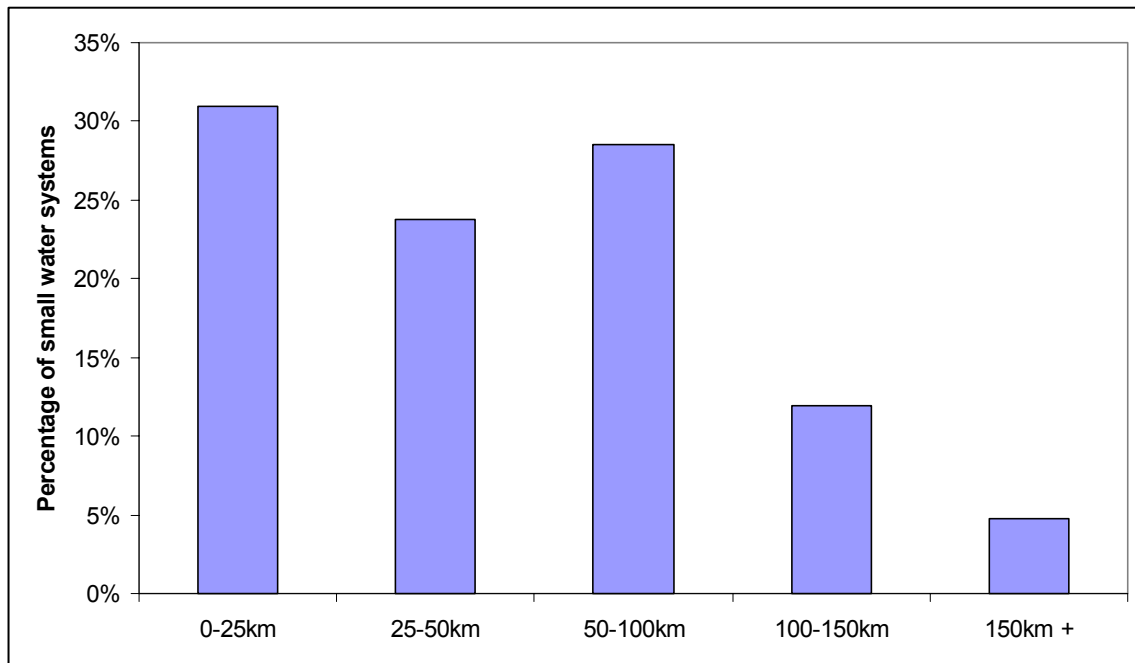


that 13% have failed due to the presence of microbiological contaminants in their water supply.



**Figure H-12: Reasons for not complying with the DWSNZ 2000, as determined by question (C)4 of the Small Water Systems Survey: “Do you meet the DWSNZ2000? If no, for what reasons?”**

A question was asked about whether access to a testing laboratory was considered to be a difficulty. Of those that responded to the question, only 5% said that lab access was a problem, and 95% said no. The distance to the nearest water testing laboratory is displayed in Figure H-13, below. It can be seen that over 80% of water systems are within 100 km of a laboratory, which reinforces that lab distance is not an issue in preventing monitoring taking place. It should be noted, however, that only the reported distances are shown in the graph. A number of managers did not answer that question, possibly because they did not know where the nearest lab was.



**Figure H-13: Distance to the nearest water quality testing laboratory, as indicated in Part B of the System Report in the Small Water Systems Survey.**