NEW ZEALAND SMALL WATER SYSTEMS SURVEY

September, 2002

Prepared for the Ministry of Health

nzwwa
New Zealand Water & Wastes Association

NZWERF
New Zealand Water Environment Research Foundation

Disclaimer

This report has been prepared by the New Zealand Water Environment Research Foundation (NZWERF) and the New Zealand Water and Wastes Association (NZWWA) for the Ministry of Health. Neither NZWWA nor NZWERF takes any responsibility for the use of this report by any other party.

Acknowledgements

NZWWA and NZWERF would like to thank all those who participated in the survey, in particular the owners, managers and operators of the 100 systems that were surveyed. Thanks to the surveyors themselves, and the help and advice received from Health Protection Officers, and the Small Water Systems Special Industry Group was also appreciated.

A. SUMMARY

The New Zealand Water and Wastes Association (NZWWA) in conjunction with the New Zealand Water Environment Research Foundation (NZWERF) have conducted 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 objective of this report is to highlight the trends and issues facing small water systems, and therefore the focus of the reader should be at the broader issue level, and not on the actual numbers presented.

The 100 systems surveyed were spread across New Zealand, 26 in the South Island with the rest in the North Island, of which 77% normally had 100 users or less. The majority (42%) 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 (49%), followed by surface water (39%) and roof water (20%).

The survey showed that 36% 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 (although only 24% were 'secure' groundwater); however 27% were supplied from surface water and 14% from roof water. Of the 64% of systems that are treated, half of those use a combination of treatment methods considered to be at a standard where they would comply with the DWSNZ. A combination of filtration and ultra-violet light treatment was the most common method of treatment, followed by chlorination alone.

The interviewers undertook a visual inspection of the systems and rated the plant in majority of systems (85%) as in excellent or satisfactory condition; although 'satisfactory' does not mean that they were DWSNZ compliant. The 15% of the systems that were rated as unsatisfactory were given this rating mainly for having no or an inadequate level of treatment. Only 40% of surface water sources were reported to be fenced, at least 20% of the ground water sources had insecure head works, and 47% of roof water sources have no 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 (69%), complaints from users (64%) and systems inspections (55%). Only 58% of the operators kept a log book for record keeping. Many operators (52%) claimed that they "regularly" sampled for microbiological contaminants. Their definition of regular was a broad one, with monthly monitoring

being the most frequent occurrence. Many expressed concern over the (actual or perceived) financial costs of having to monitor more frequently.

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 (44%) claim to be meeting the DWSNZ. Only 11% of those interviewed had prepared a Public Health Risk Management Plan (PHRMP). Of those without a PHRMP, at least 28% of them (22% of total) claimed they were not aware of what a PHRMP is.

A potential cause for this lack of awareness of risk is that 65% 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, 35% reported mechanical failure in the system (i.e. burst pipes, pump failure), 14% with shortages in the water supply, and 7% 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. Many do not have specific budgets for maintenance and operation of their system, and even fewer budget for monitoring costs.

It appears that there is an issue around the knowledge and skill level of operators and managers of small water systems in New Zealand. About 20% were evaluated by the interviewers as having an “inadequate level of knowledge and skills” in their roles, however 53% of operators expressed an interest in further training, and interviewers assessed 58% 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 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, and in-house advisors. 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 76% of the systems there are no plans to upgrade, and of the 24% 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.

A summary of the recommendations are:

1. *A general awareness/education programme covering first principles of potable water supply is undertaken. It should introduce owners/operators to DWSNZ 2000 and PHRMPs, explaining the benefits of fulfilling the requirements contained in these documents and the risks associated with not meeting them.*

2. *A more detailed education programme about DWSNZ 2000 and PHRMPs is undertaken, focusing more specifically on suppliers, installers and others providing advice to small water system owner/operators..*

3. *The Ministry educate organisations that have the potential to influence or act as drivers for voluntary change by owner/operators. For example, request that the Ministry of Education further encourages schools to have a PHRMP and a DWSNZ 2000 compliant system. Request that Qualmark, who provide the accommodation quality star rating for Hotels and Camping Grounds, include compliance with DSWNZ in their evaluation criteria.*

4. *District Health Boards and Territorial Local Authorities are involved in any awareness raising exercises, as most owners/operators gain information from these organisations.*

5. *An investigation is undertaken to determine how incomplete the records of the community drinking water supplies register and WINZ are, and recommend any remedial actions that may be desirable.*

6. *Appropriate training courses covering the specification, installation, maintenance and operation of small water systems be developed. These courses should be modelled on DWSNZ 2000 and provide for long distance adult learning.*

7. *Operators are encouraged to have a minimum level (which would have to be defined) of very basic training required to run plants. This could be provided as a module of 6 above.*

8. *Those who install and upgrade small water systems are encouraged to have a minimum level of training and be independently certified as to meet an appropriate level of technical competency.*

9. *Consideration be given to developing a range of "fact sheets" that provide standard advice for non-expert owners/operators on the basic actions required to operate and maintain small water systems.*

10. *National small water systems technical guidelines are made available that cover design, installation and performance, for use by system installers, equipment suppliers, public health officers etc.*

11. *Systems to be subject to inspection by independent suitably qualified people and certified as fit for purpose. The certification is revalidated on a periodic basis.*

12. *The Ministry to look into the costs of monitoring, and if necessary, provide assistance or minimise the cost of monitoring on operators, such as by providing subsidies for laboratory costs or developing cheaper monitoring methods.*

B. TABLE OF CONTENTS

C. INTRODUCTION

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. It should be noted that this report is based on a small, but thorough survey of 100 small water systems throughout New Zealand. Therefore the results of this survey should be read as an indication of the trends and typical issues facing small water systems in New Zealand. The percentages presented in the results should be considered as an indication of the typical problems, and the actual numbers themselves should not be over emphasised.

D. METHOD

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

Figure D-1: Location of small water systems included in the Small Water Systems Survey. 26 of the systems are located in the South Island, and the remainder in the North Island.

E. DESCRIPTION OF SMALL WATER SYSTEMS

This section outlines the types of small water systems that were visited in the survey, indicating the purpose of their supply, and the supply use, the people that install, use and run the system, and some details about the set up of the water supply system itself.

E.1 General

E.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 E-1 displays the overall range of water supply purposes. The majority (42%) 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 (2%) serviced hospitals.

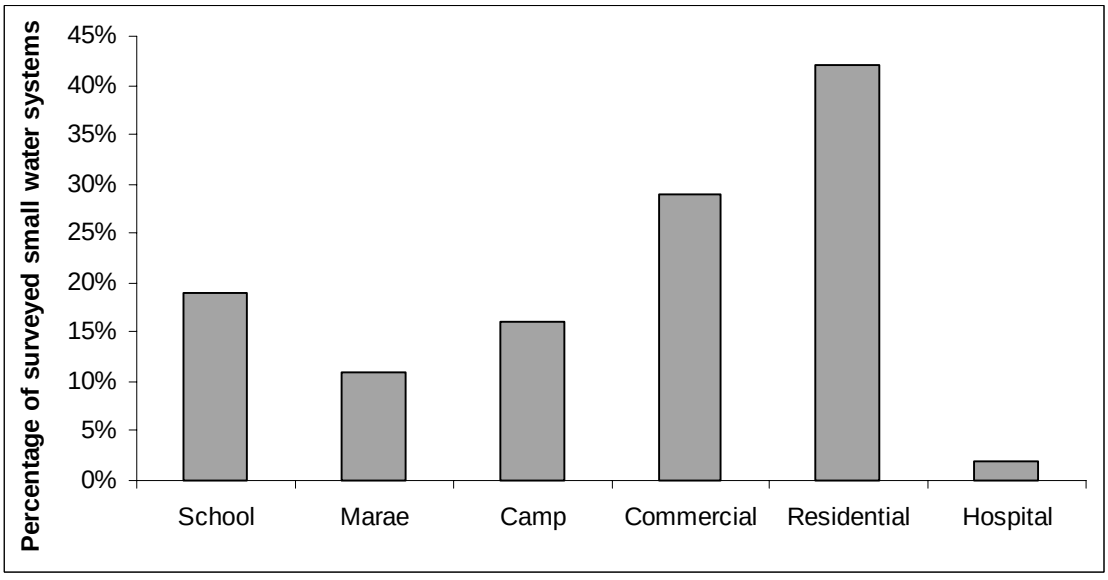

Figure E-1: The main purpose of the supply for the small water systems included in the survey, as indicated in question (A)ii.

E.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 E-2 shows that the majority of small water systems are used for drinking water (87%) and hygiene purposes (78%). Note that for any given water supply there may be more than one use of the water.

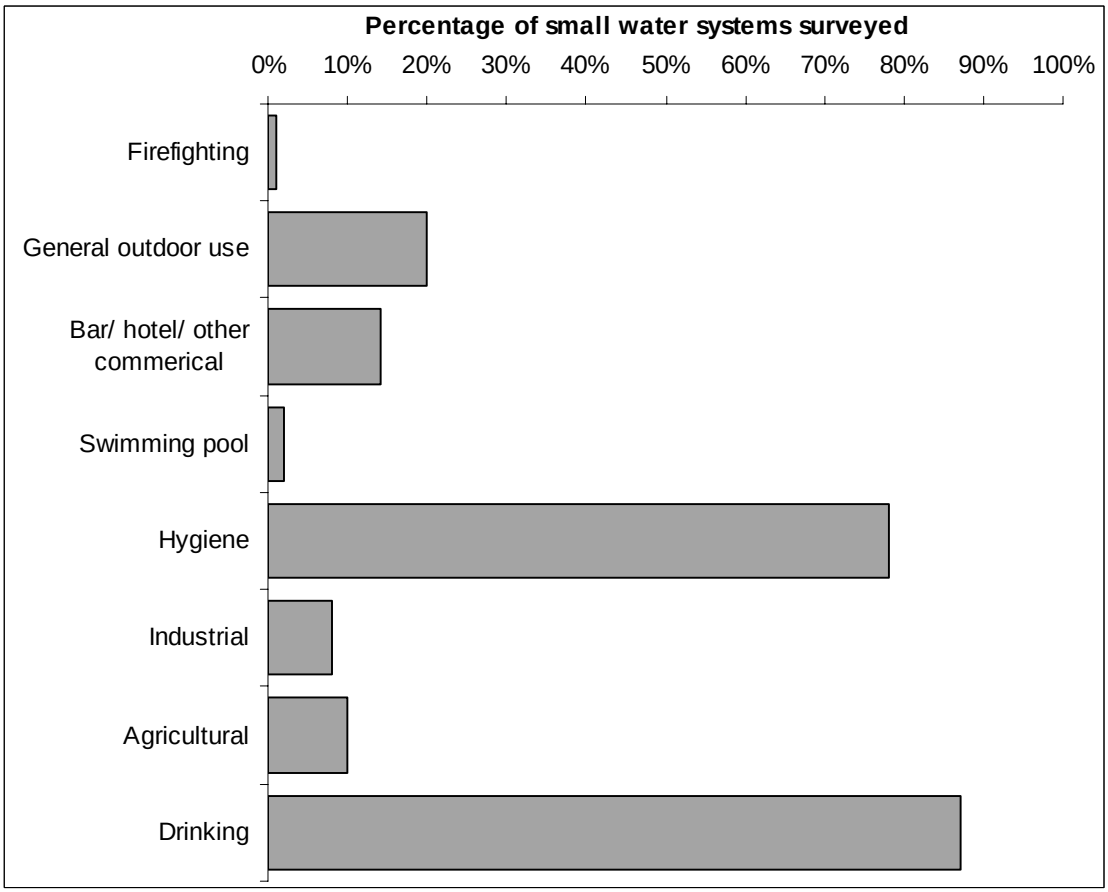

Figure E-2: Purpose of the users connecting to small water supplies in New Zealand, as determined through question (A)IV of the Small Water Systems Survey.

E.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, and 77% of the systems normally catered for 100 users or less.

E.2 The people

E.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 E-3 shows that in 66% 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 34% of systems surveyed the owner does not use the water at all.

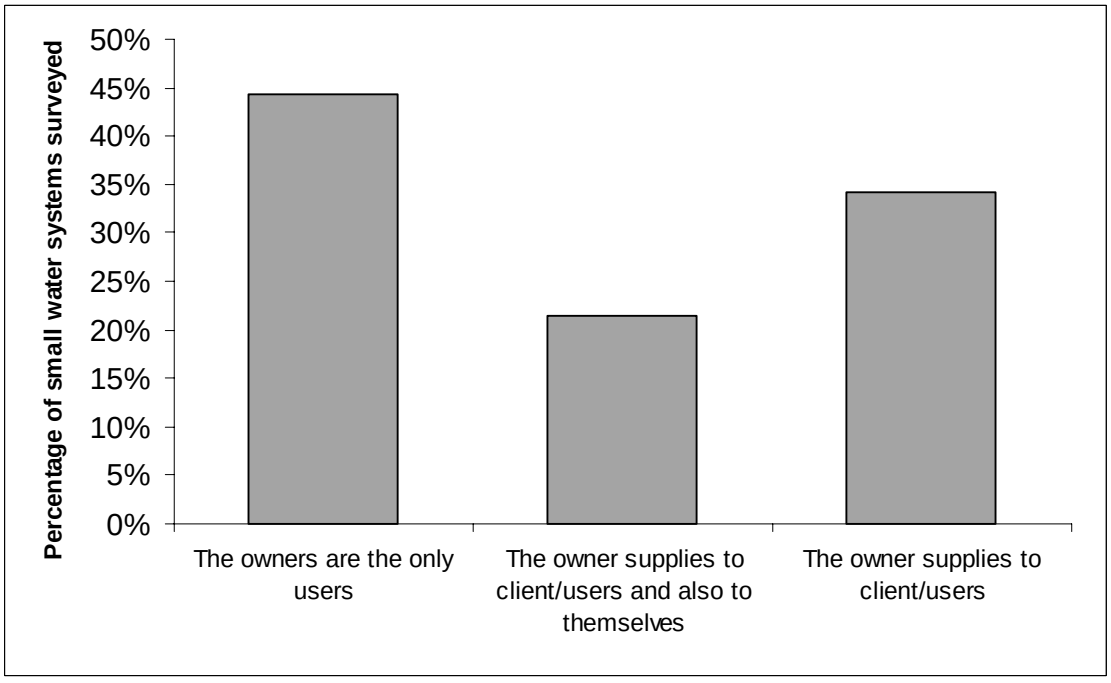

Figure E-3: The relationship between the owner and the user of small water systems, as obtained from answers to question (A)I. of the Small Water Systems Survey, "Relationship between owner and user".

E.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 E-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, boards/trustee groups, or the Ministry of Health. The 'unknown' bar refers to water supplies where the current owners do not know who initially paid to put in the supply.

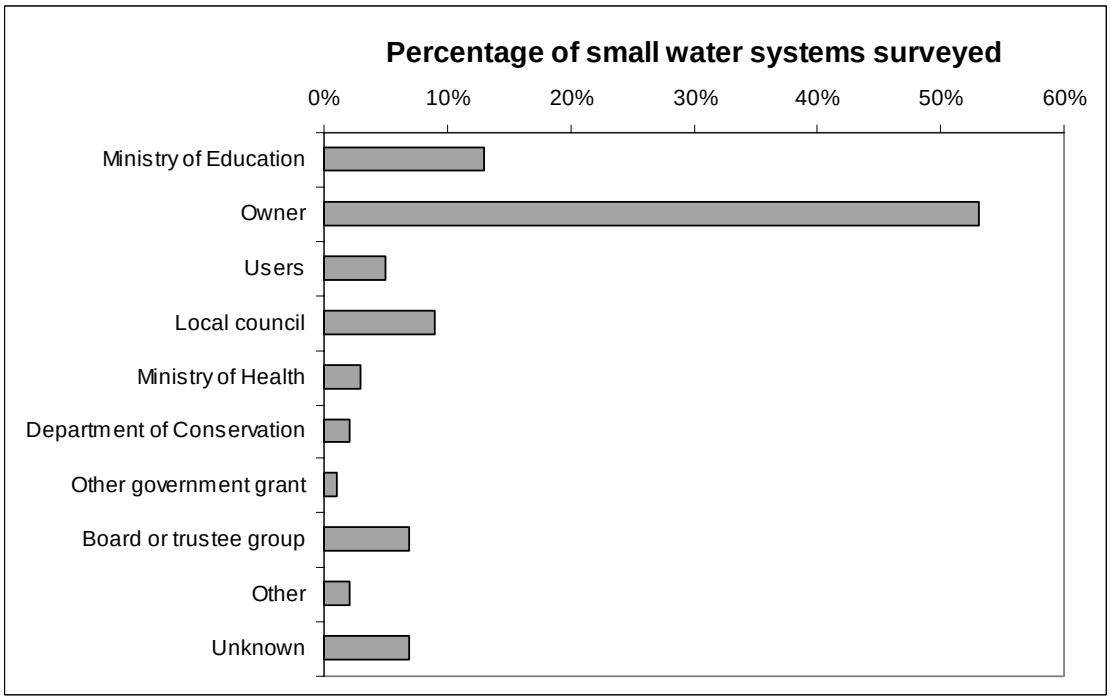

Figure E-4: The organisations that have paid to put in the water supplies at the water systems surveyed. Information from question (D) 1 of the Small Water Systems Survey.

E.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 E-5, indicate that owners are predominantly responsible for upgrades, and that users and Boards of Trustees (at schools) are also responsible in some cases.

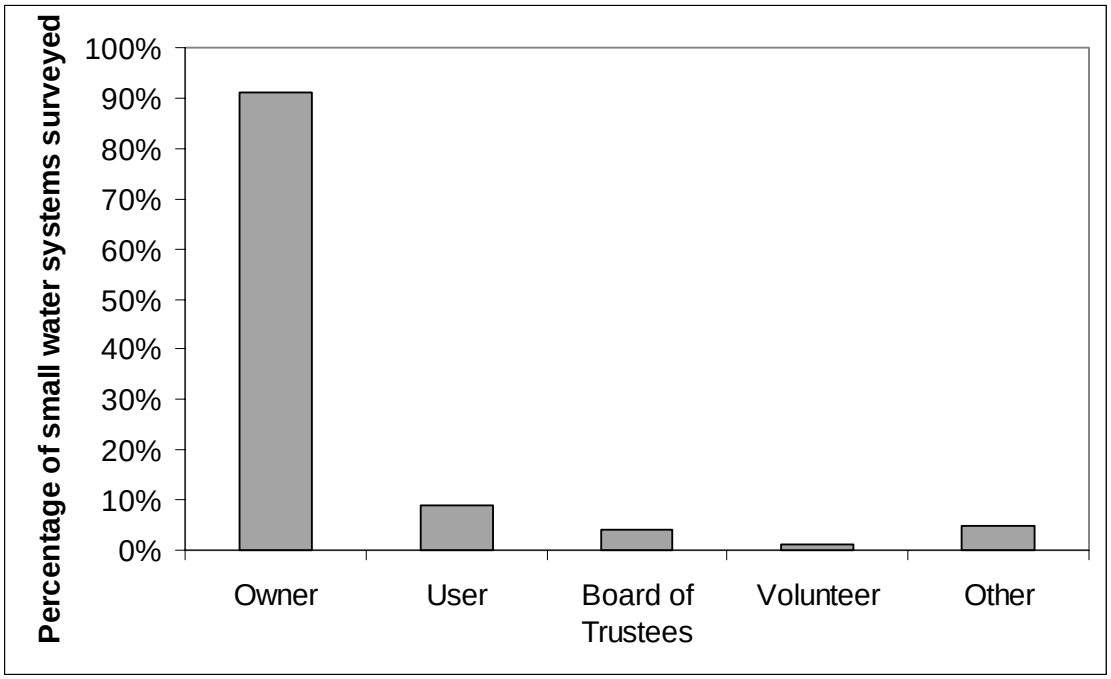

Figure E-5: Persons responsible for upgrades of small water systems, as indicated from question (B)2 of the Small Water Systems Survey: "Responsibility for upgrades?"

E.2.4 Responsibility for maintenance

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

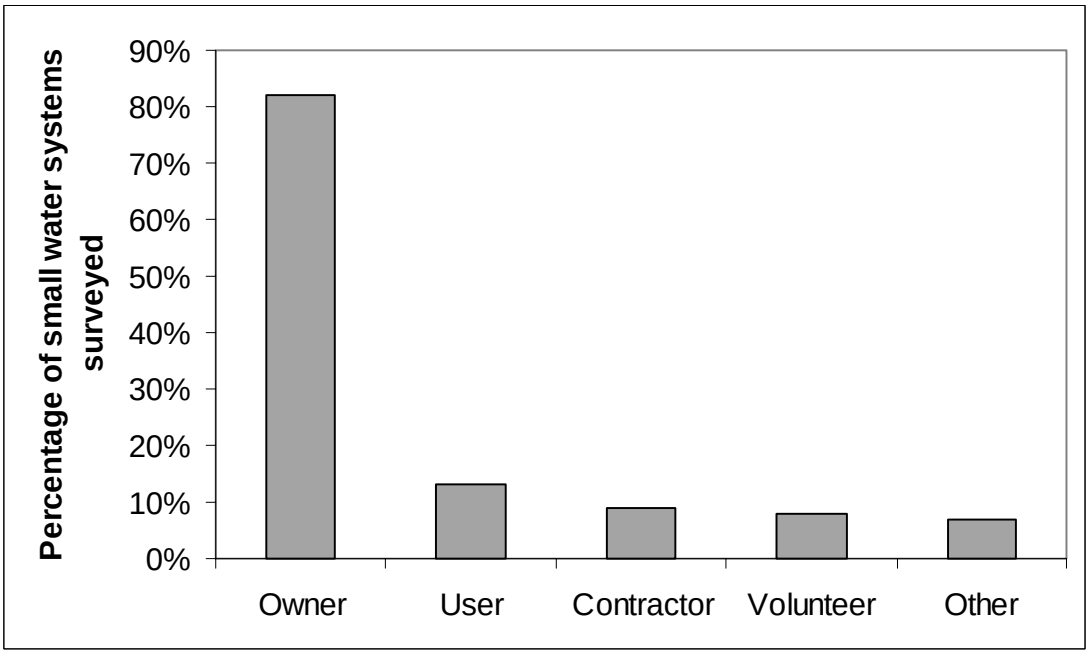

Figure E-6: People or groups that are responsible for maintenance of small water systems, as indicated from question (B)10 of the Small Water Systems Survey.

E.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 E-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 E-6 and Figure E-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.

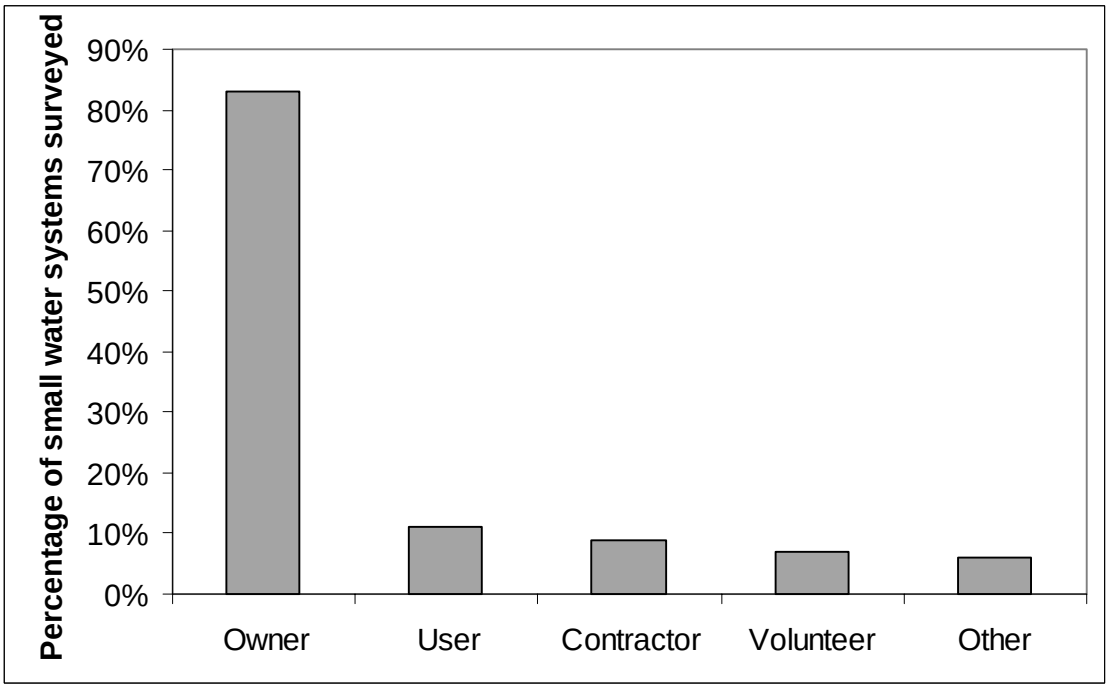

Figure E-7: People or groups that are responsible for the operation of small water systems, as indicated from question (B)8 of the Small Water Systems Survey.

E.3 The systems

E.3.1 Water 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 E-8, is predominantly ground water (49%), followed by surface water (39%), and the least common source was roof water (20%). It should be noted that 10% specified more than one type of source being used for their water system.

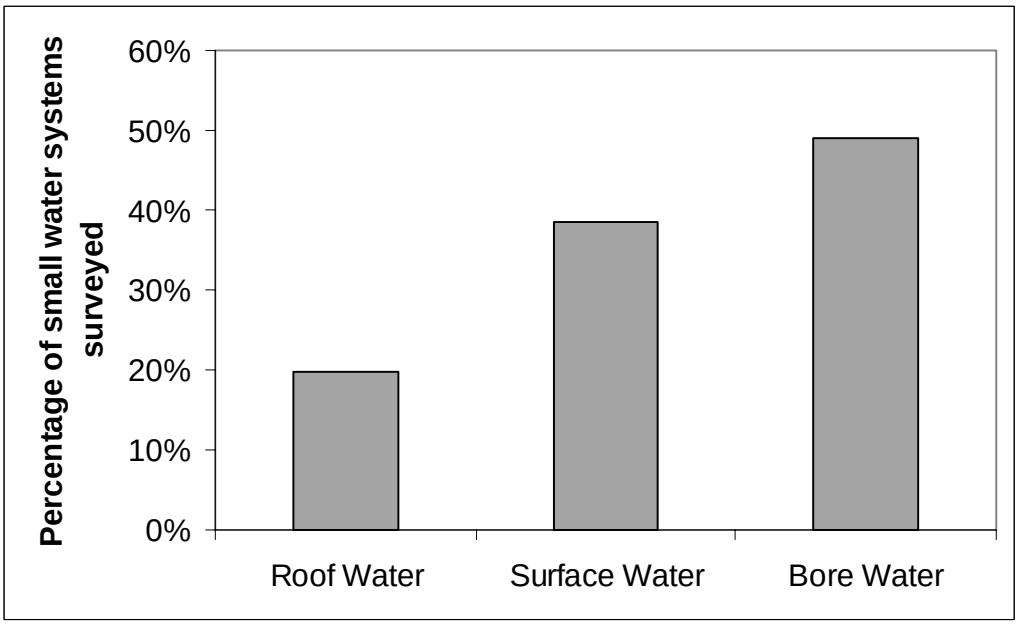

Figure E-8: Sources of water for small water systems, as determined through the system report of the small water system survey.

E.3.2 Microbiological treatment

The survey determined that 36% of small water systems do not treat their water for microbiological contaminants, and 64% do treat it, using a variety of methods (see Figure E-9; and note that sedimentation alone was not considered to be treatment).

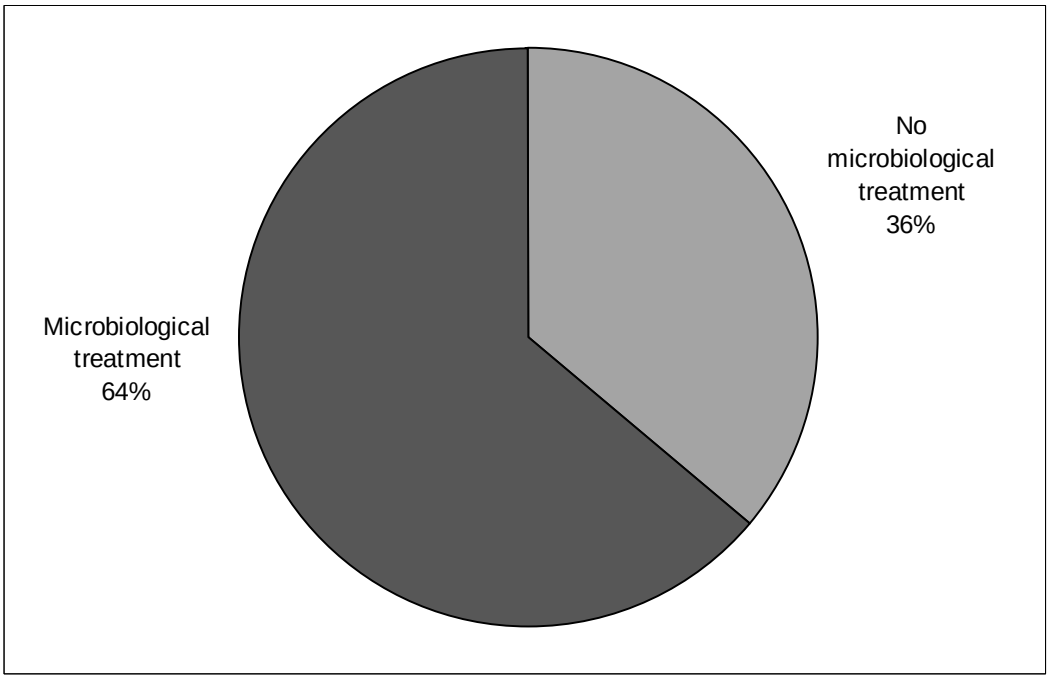

Figure E-9: The practice of treating water in small water systems, as determined from Part A of the System Report in the Small Water Systems Survey.

Of those that have no treatment, the source of their water supply is broken down as is shown in Figure E-10. It can be seen that the majority of untreated water is sourced from groundwater (although 24% is secure groundwater); followed by surface water (27%) and roof water (14%).

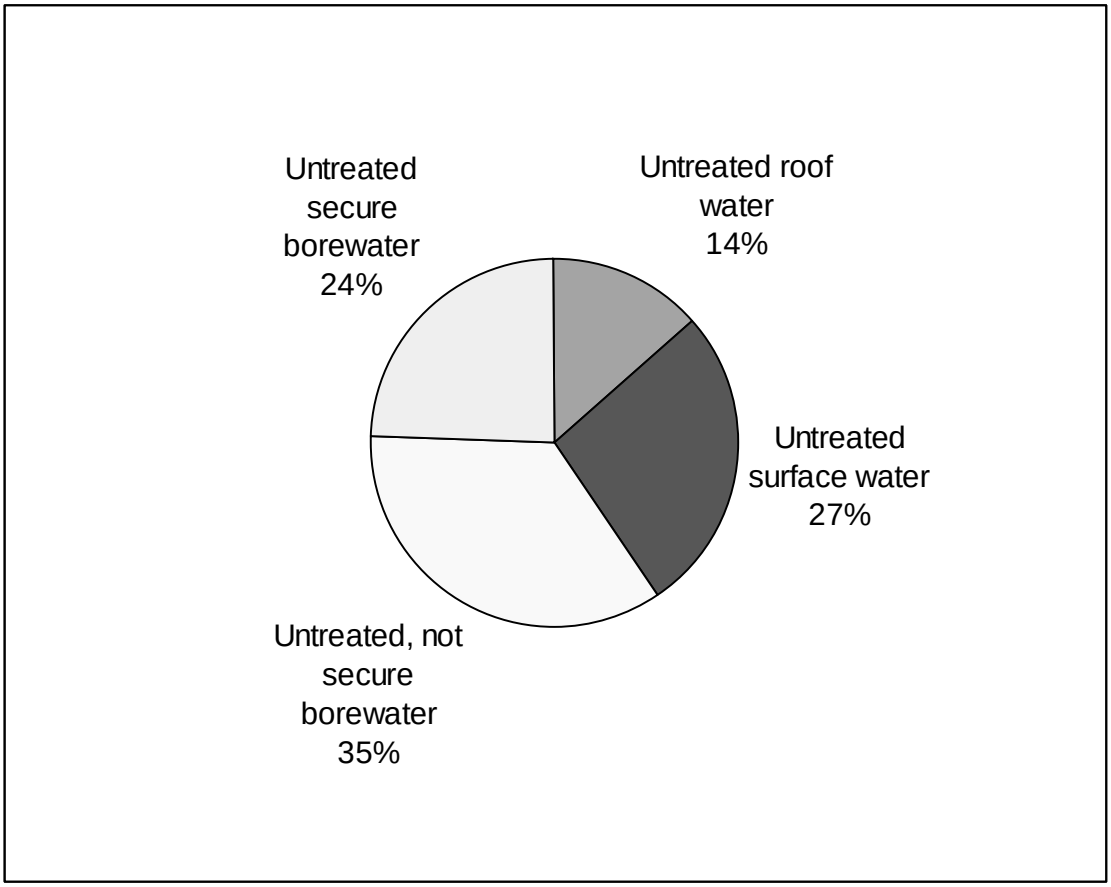

Figure E-10: Sources of water for those that do not treat their supply, as taken from Part A of the System Report in the Small Water Systems Survey.

Of the 64% of systems that are treated, the types of treatment utilised are shown in Figure E-11, below. It can be seen that filtration combined with ultra violet light was the most common method of treatment (31%). Also widely used were combinations involving the use of chlorine. A reasonable proportion of those that treat their water (14%) use cartridge filtration only as their method of treatment.

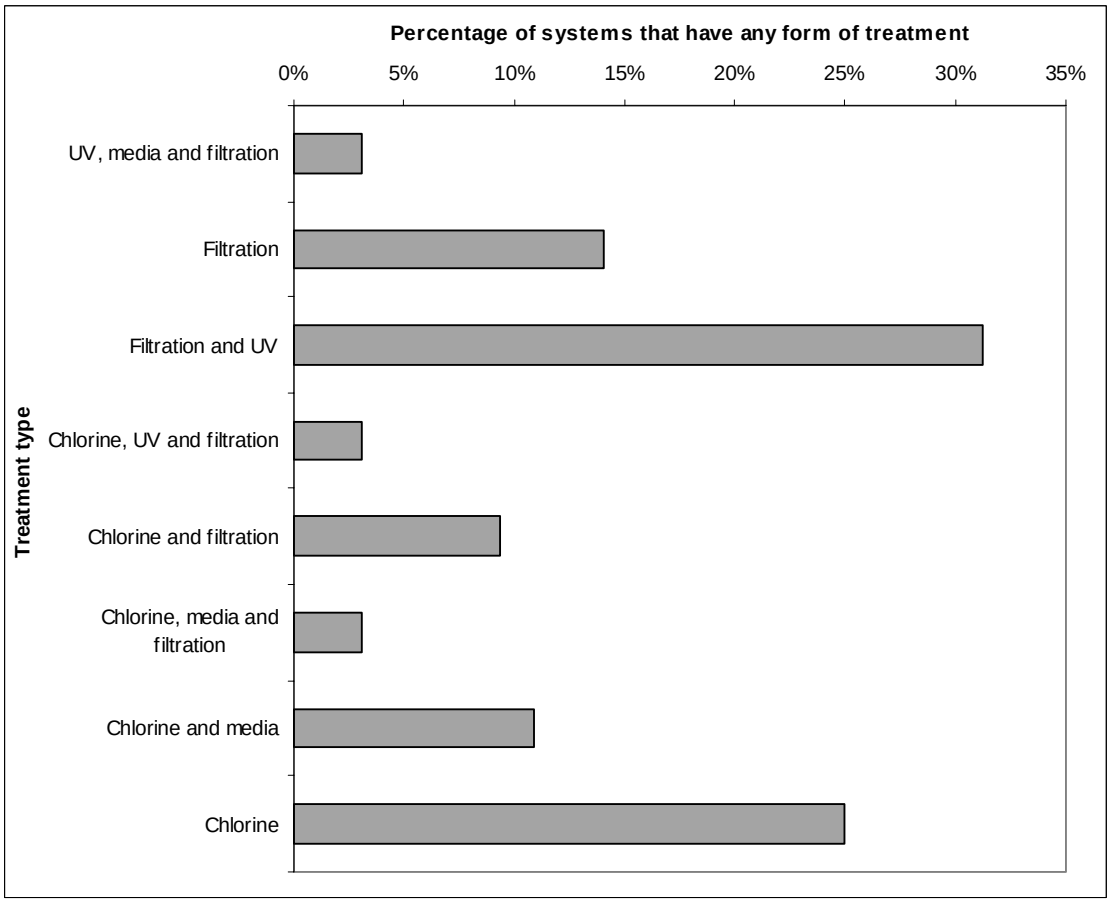

Figure E-11: Treatment methods utilised by those water suppliers that treat their water, as taken from Part A of the Systems Report in the Small Water Systems Survey. Note that the term 'media' refers to multi media or sand filtration.

E.3.3 Aesthetics Treatment

The small water systems managers were asked about their treatment for aesthetics in Part A of the Systems Report in the survey. Figure E-12 shows that 50% of the small water systems have some form of aesthetic treatment. This category was very broad, however, including any media treatment (multimedia or sand media), any filtration, as well as softeners, contact flocculation, and reverse osmosis. The managers were also asked about other types of aesthetic treatment, such as manganese greensand, or birm treatment, however there were no reported uses of these other types of treatment.

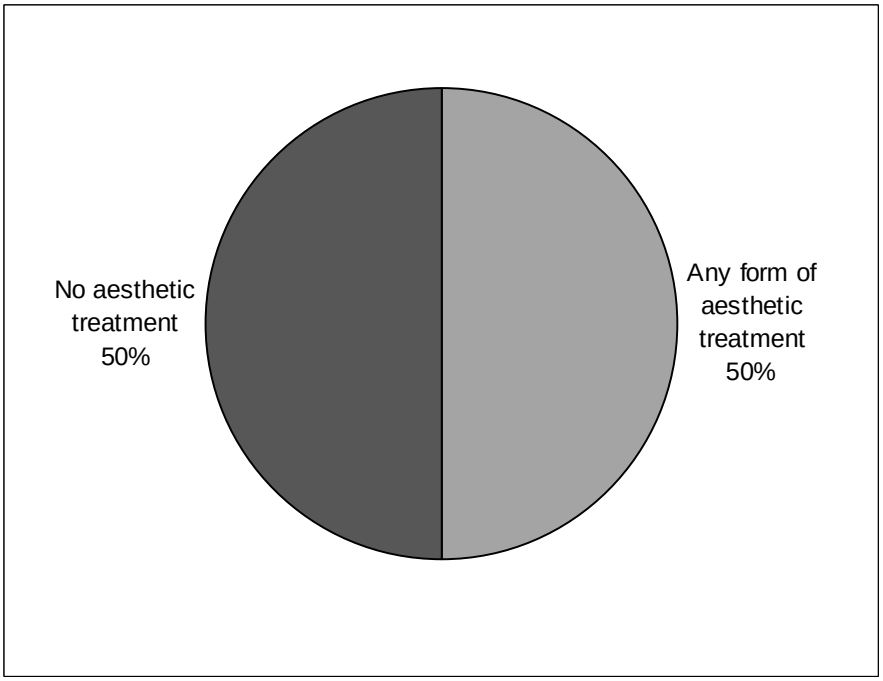

Figure E-12: Aesthetic treatment at small water systems (includes any media treatment (multimedia or sand media), any filtration, as well as softeners, contact flocculation, and reverse osmosis). Information from Part A of the Systems Report in the Small Water Systems Survey.

F. CURRENT PRACTICES

This section goes into detail about how the small water systems described in the previous section operate in practice. The first part explains the day to day operation of the system, and the procedures in place. The next part portrays the operators themselves, their qualification and training. Management and decision making is covered in this section also, including decision making processes, plans regarding the system, budgets and costs associated with the system. Finally the reported problems are described, and the frequency of those problems.

F.1 Operations

F.1.1 Maintenance staff activities

The small water systems mangers 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 F-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 49% of systems surveyed, respectively.

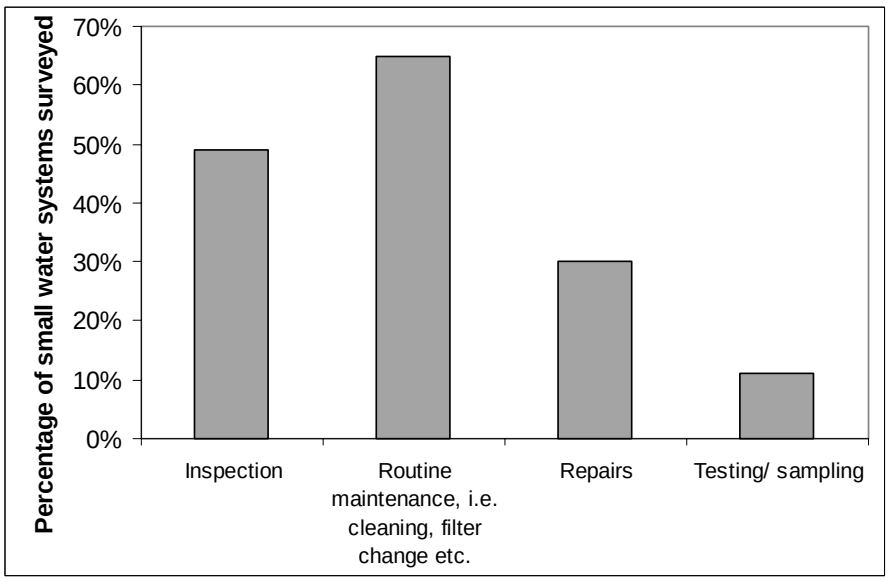

Figure F-1: Activities carried out by maintenance staff of small water systems, as determined from question (C)10 of the Small Water Systems Survey.

F.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 F-2 shows that for 69% of those interviewed, tests were a mechanism for finding problems with the supply. 64% reported that complaints would alert them to problems with the supply, while 55% indicated that inspections of the system would highlight any possible problems (note that many managers provided more than one mechanism for identifying problems).

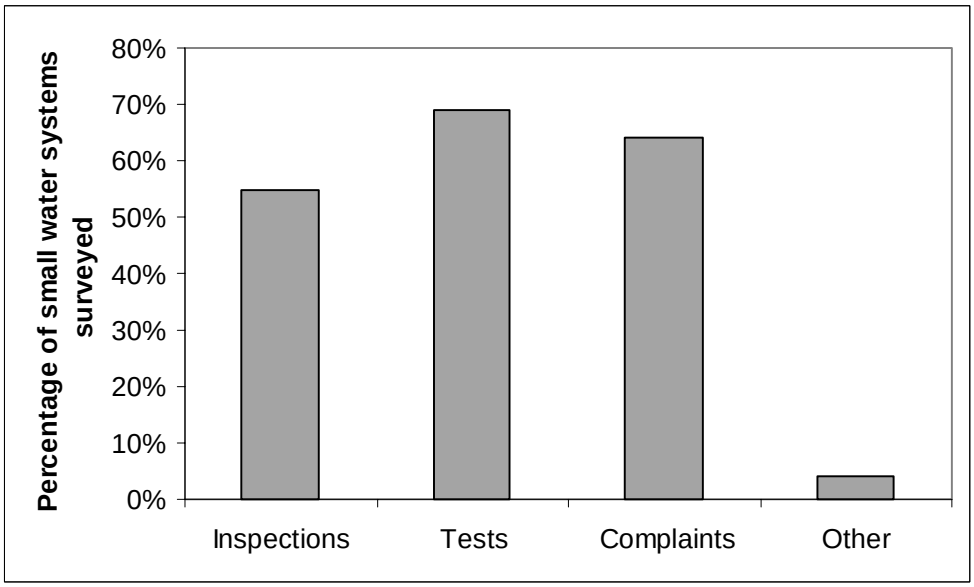

Figure F-2: Mechanisms for learning that something is wrong with the water supply, as determined from question (C)5 of the Small Water Systems Survey.

F.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 F-3. Most problems are reported to the owners (72%), with just under a third reported to the Ministry of Health or a Public Health Officer (28%).

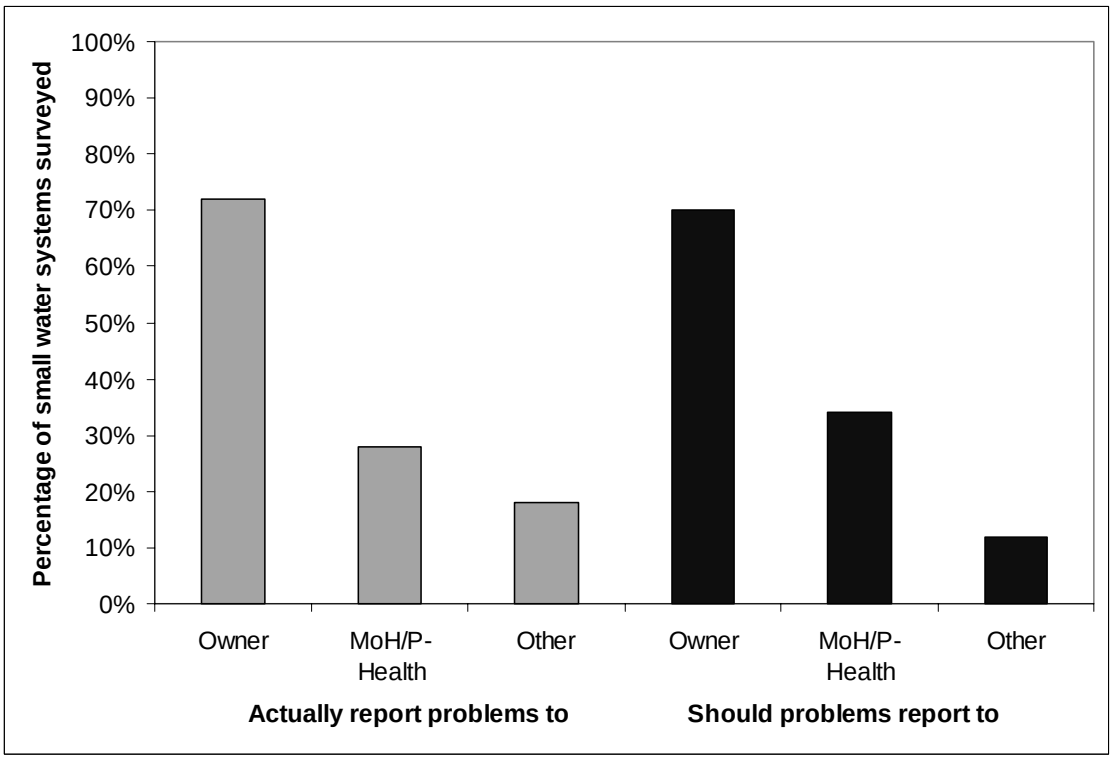

Figure F-3: Who water system problems are reported to, and who water systems managers thought that they should be reporting to. Information from questions (C) 12 and (C) 13 of the Small Water Systems Survey.

F.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 F-4, show that 58% do keep a log book with these details.

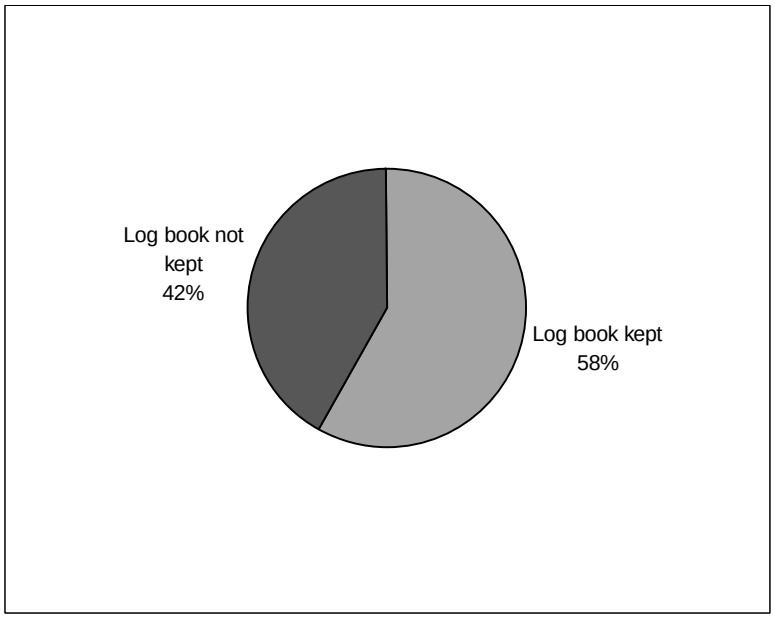

Figure F-4: Record keeping practices of small water systems managers, from question (C)9 of the Small Water Systems Survey.

F.1.5 Frequency of monitoring

The operators were asked how often they monitor for both aesthetic and microbiological contaminants. In terms of microbiological monitoring, 52% said that they 'regularly' sample for contaminants. Figure F-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.

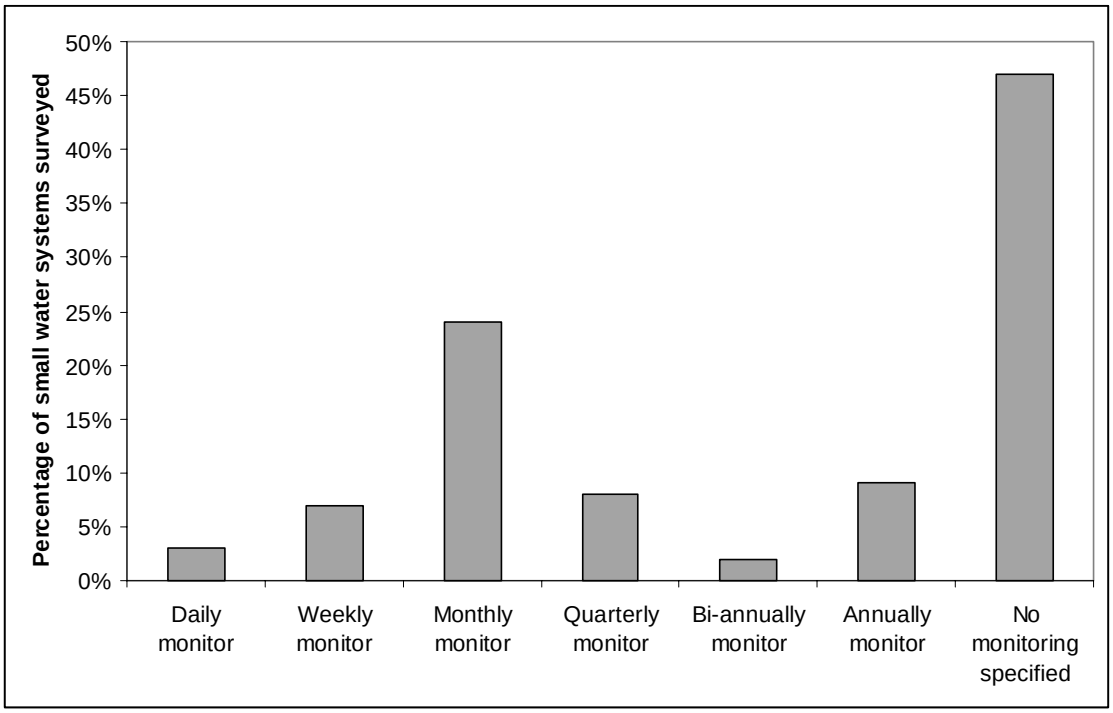

Figure F-5: Frequency of monitoring for microbiological contaminants, as determined in Part B of the Systems Report in the Small Water Systems Survey.

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 F-6 shows that most of those who did sample sampled on a daily or monthly time scale.

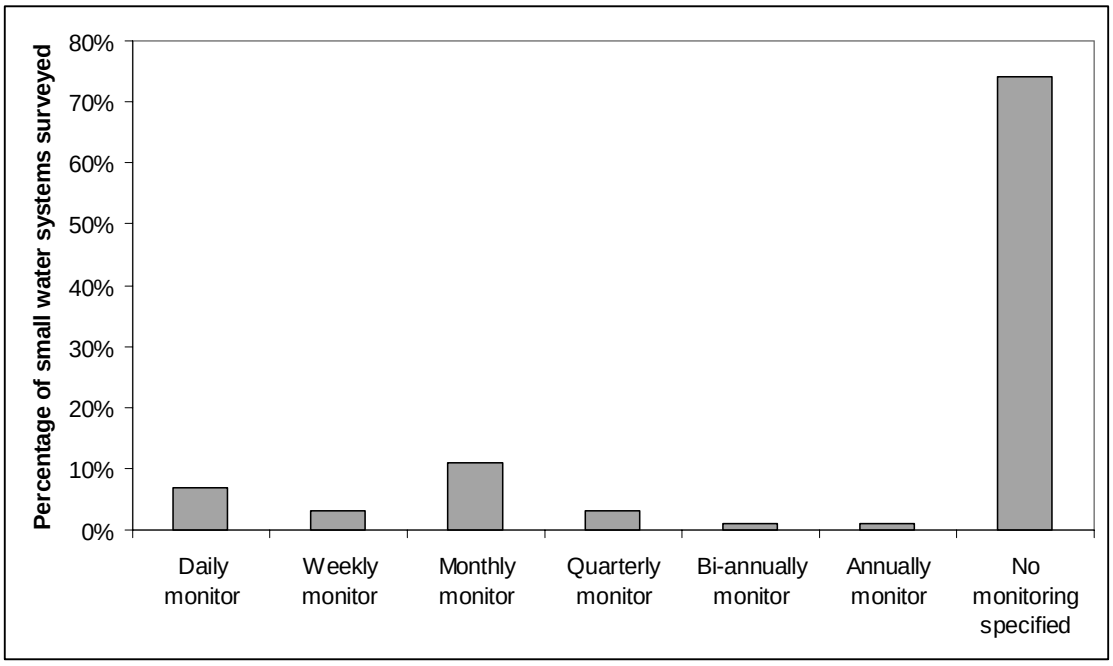

Figure F-6: Frequency of monitoring for aesthetic contaminants, as determined in Part B of the Systems Report in the Small Water Systems Survey.

F.1.6 Disinfection after repairs

Managers were asked if they disinfected their system following repairs or alterations. Figure F-7 shows that 43% reported they never disinfect the system following such activities, and that 33% always did.

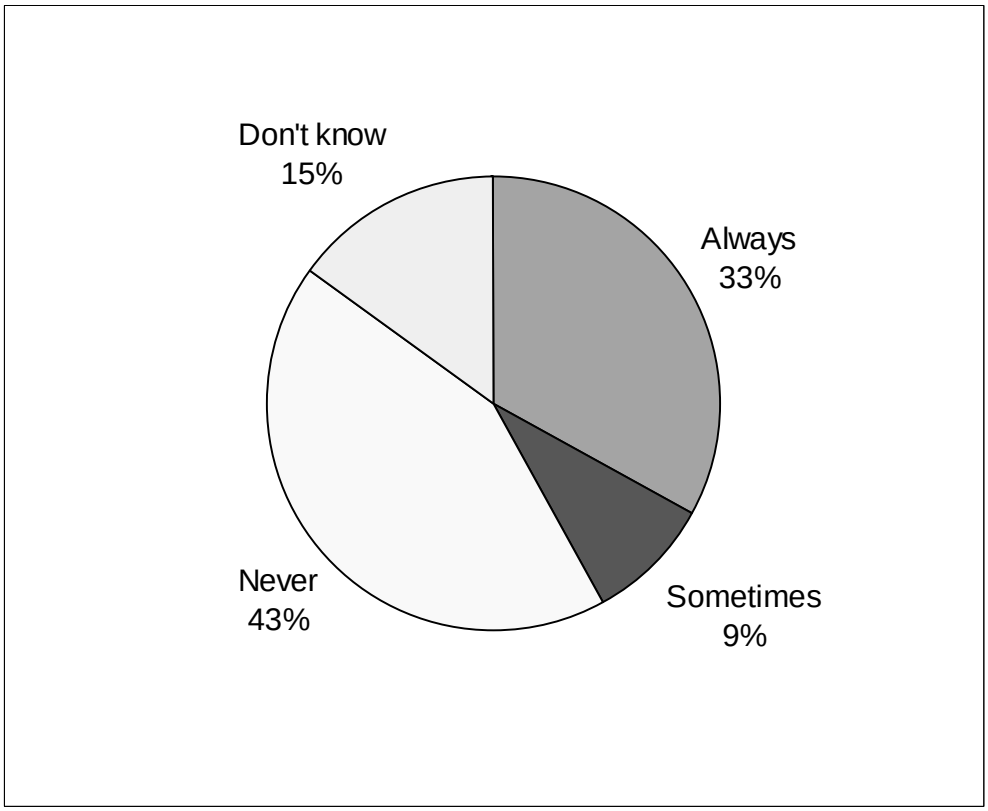

Figure F-7: Regularity of disinfection being carried out in small water systems, following a repair or alteration in the system. Information from question (C) 11 of the Small Water Systems Survey: "Is disinfection carried out after repairs or alterations?"

F.2 Operators

F.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 F-8 demonstrates that most operators were related to the owners, as either the owners themselves (16%) or as an employee of the owner (44%). A reasonable proportion of the people who carry out the operations were volunteers (16%) or contactors (20%).

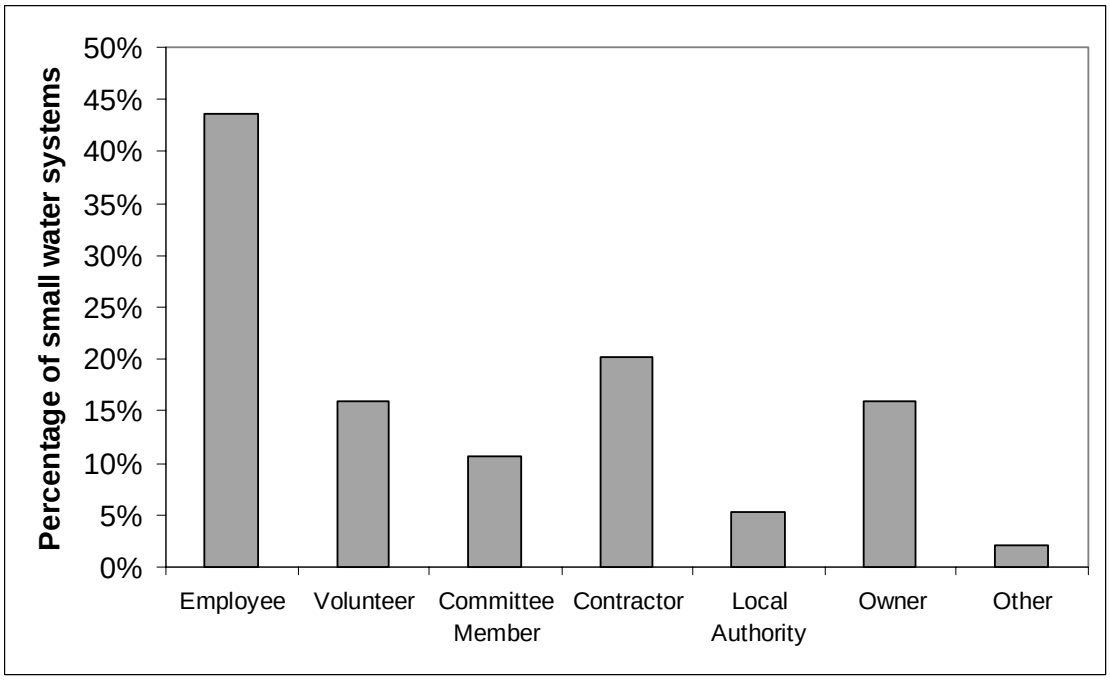

Figure F-8 The relationship of operators to the small water system, as determined in Part A of the Systems Report in the Small Water Systems Survey.

F.2.2 Qualifications of operators

The operators were asked to list their qualifications. Of those that answered, 10% had a water systems operation certificate (B or C grade), and 6% had a relevant trade qualification (i.e. plumber). 84% said that they had no relevant qualifications at all (see Figure F-9).

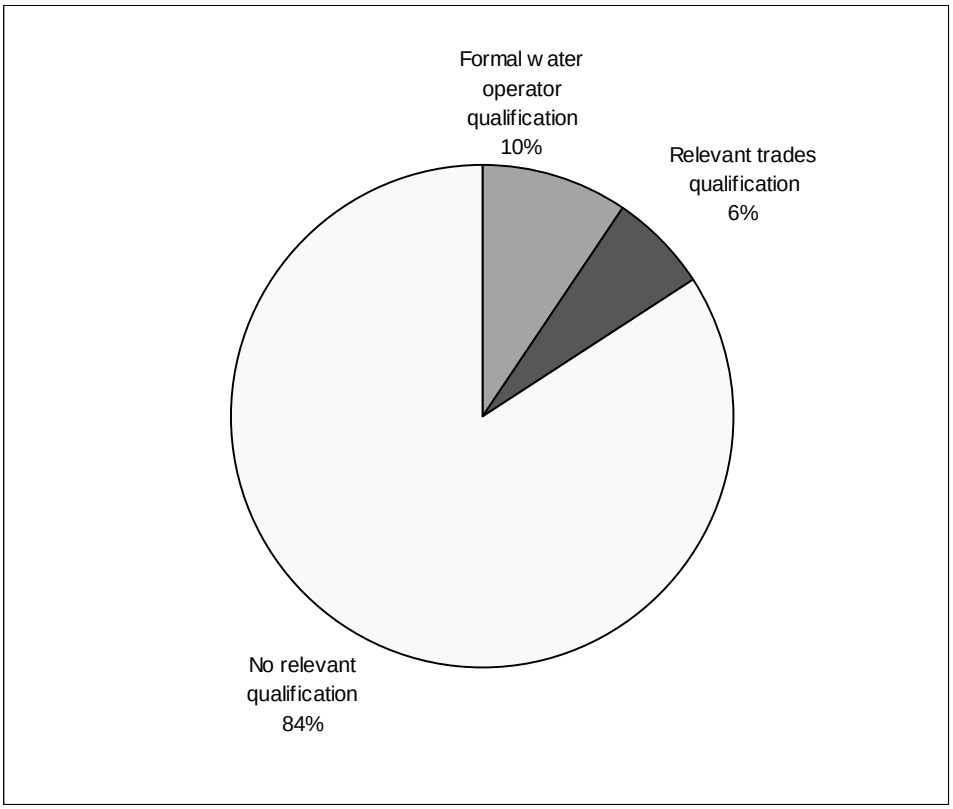

Figure F-9: The relevant qualifications of the operators of small water systems, as determined in Part A of the Systems Report.

F.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 38% said that they were self taught (see Figure F-10). It should be noted, however, that some operators specified more than one source of training.

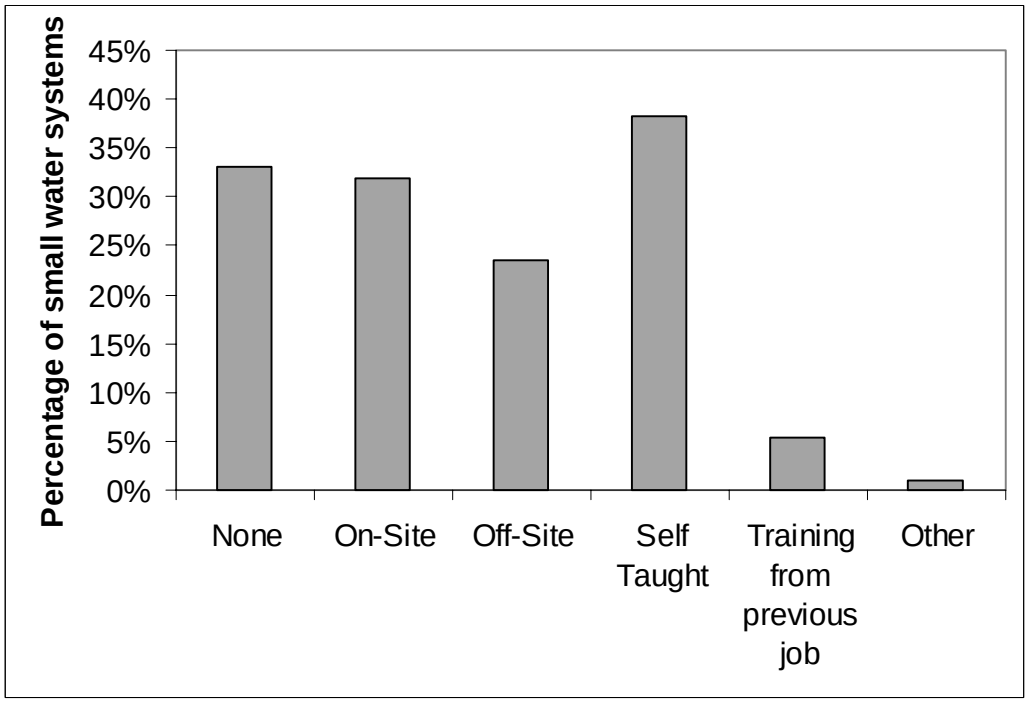

Figure F-10: Training that the operator has received, as determined from Part A of the System Report in the Small Water Systems Survey.

F.3 Management and decision making

F.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 F-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.

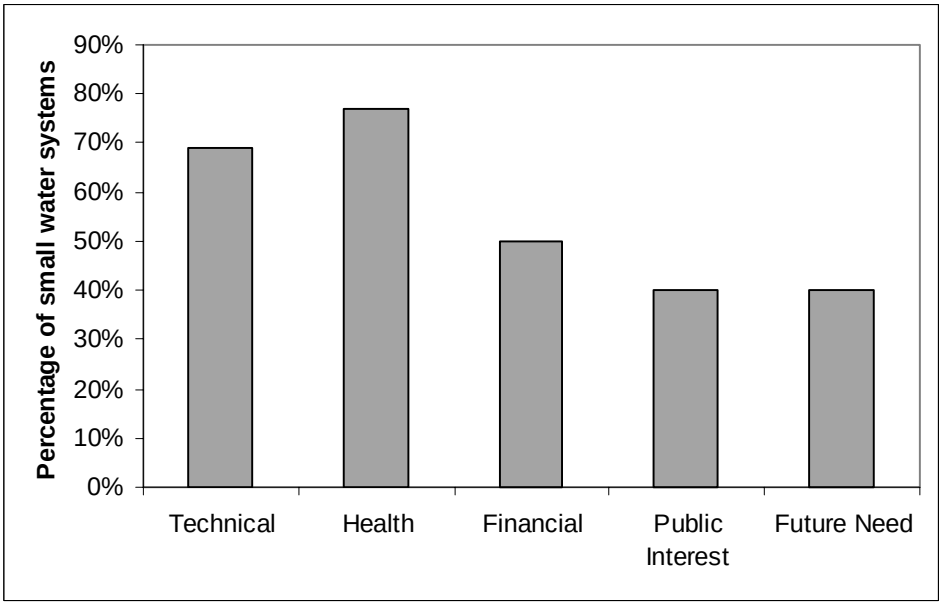

Figure F-11: The issues covered in support information available to water suppliers, as indicated from question (B) 3 of the Small Water Systems Survey: "Support information available?"

F.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 F-12. It can be seen that District Health Boards and District Councils were the most common source of information, followed by local contractors and plumbers. In-house sources, consultants, the Ministry of Health, and 'other sources' were also cited as information and advice sources at 10 or more water suppliers. Other sources included the internet, reference materials, community, hapu and solicitor.

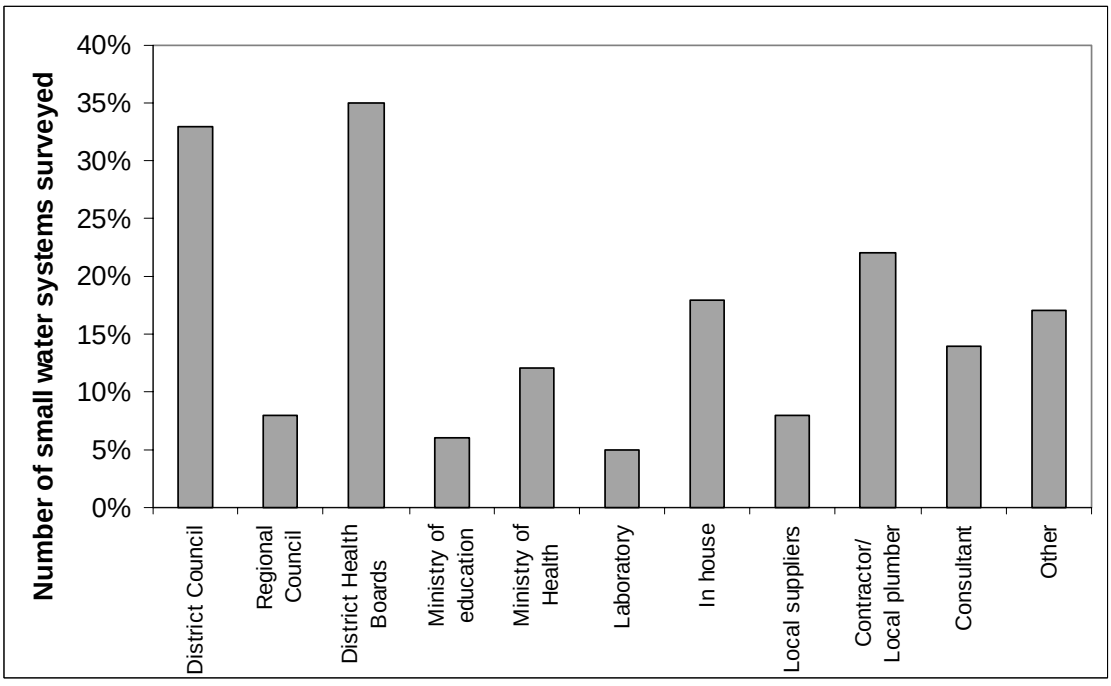

Figure F-12: Sources of information and advice for small water system managers, as determined from question (B)4 of the Small Water Systems Survey: "Where is the information /advice sourced?"

F.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 F-13. It shows that health was the most important factor in decision making, with 'public interest', 'technical' factors, and 'financial' factors providing a reasonably even weighting, higher than the factor of 'future needs'.

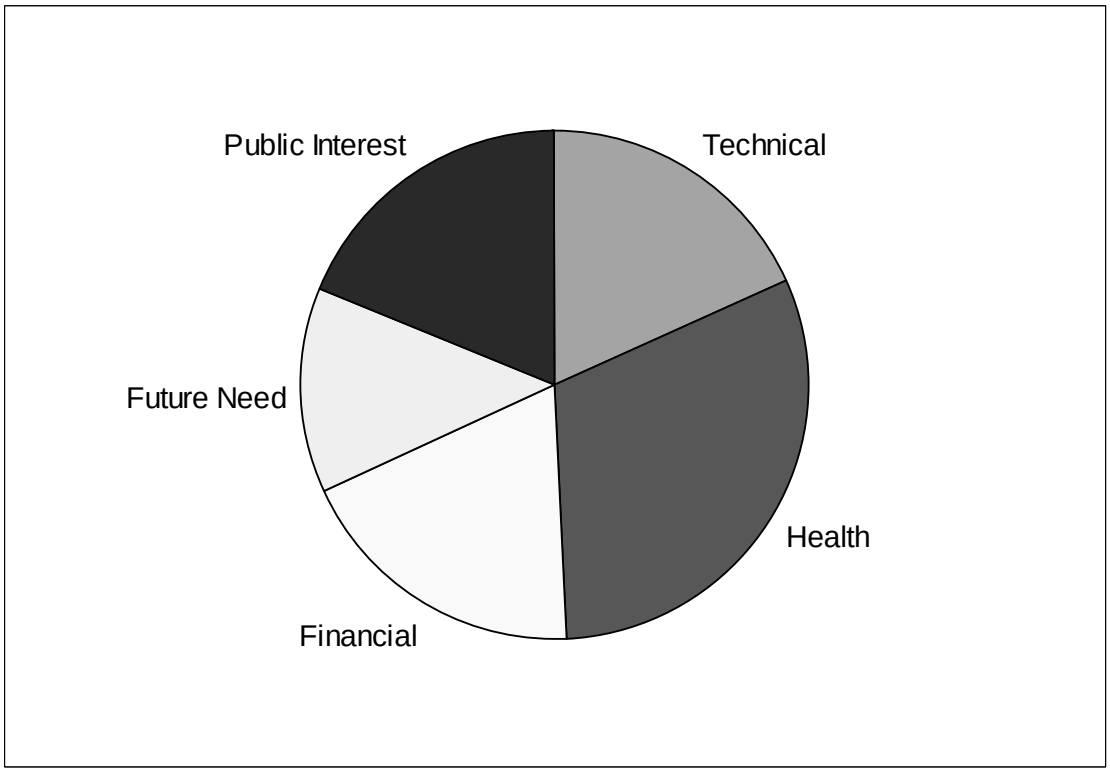

Figure F-13: Importance of factors for small water systems managers when decision making about the operation and support of their systems. Information from importance weightings given in question (B) 5 of the Small Water Systems Survey: "Factors in decisions".

F.3.4 Influences on management decisions

The managers of small water systems were asked who most influences management and operations decisions. The schools that were surveyed generally indicated that it was their Boards of Trustees or principals that have the most influence over decisions. The caretaker was also mentioned as having the most influence at some schools. For maraes the biggest influencers were generally from the owners or owner groups, such as the marae committee, trustees or the whanau. At the camps that were surveyed, it was the owners and/ or managers that were reported to have the most influence. At small water

systems supplying commercial uses, the owner predominantly had the most influence on decisions. At residential supplies there were a variety of influences – from committees or boards and owners mainly, but also from District Councils, users, and contractors. The hospitals surveyed reported that their owner has the most influence.

F.3.5 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 E-1, showed that 11% of small water system managers had prepared a PHRMP guide. Of those that had not completed a PHRMP, 22% of those interviewed reported that the reason why they have not is because they are not even aware of what a PHRMP is.

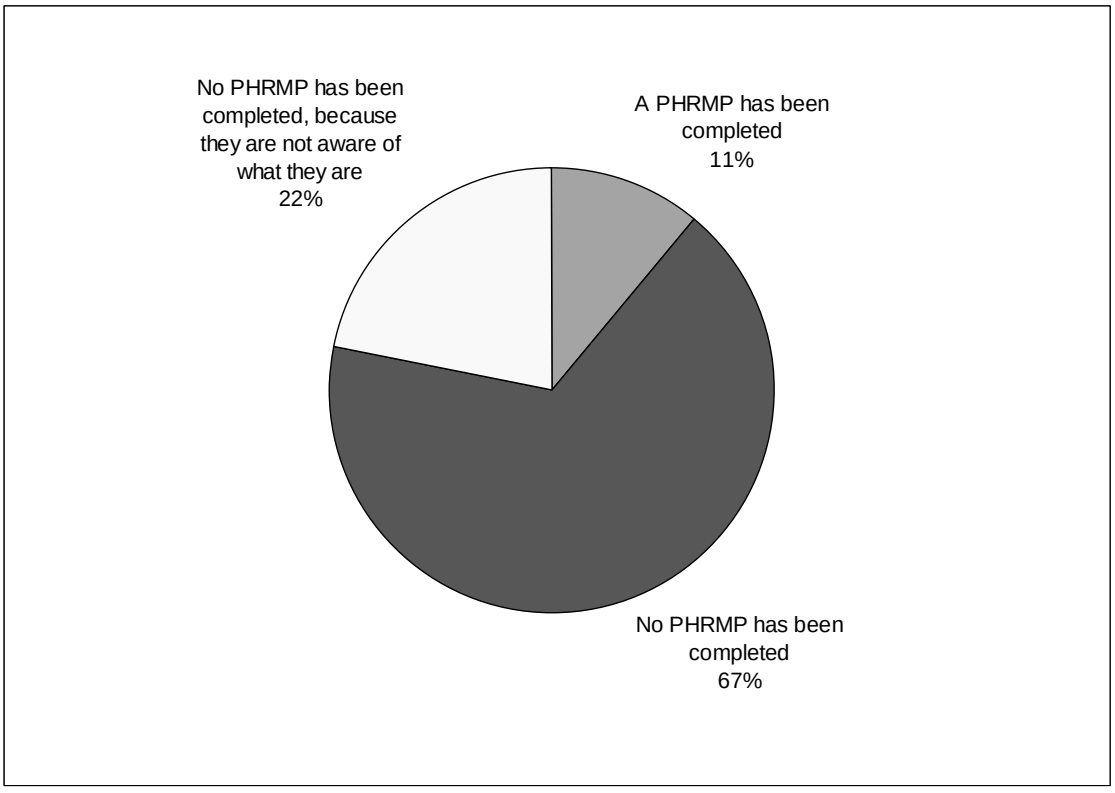

Figure F-14: The status of the preparation of a public health risk management plan (PHRMP), as determined from question (C)1 of the Small Water Systems Survey.

F.3.6 Insurance

In nearly 35% of the systems, managers have not taken out insurance cover. For those that are insured the most common form of policy is for public liability insurance. Those systems run by local authorities had local authority infrastructure insurance policy, plus plant/equipment damage/loss policies.

F.3.7 Operations 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. 46% of those surveyed said that there was a specific budget, and Figure F-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. 'Other' includes the accountants, the Ministry of Education, and the user company.

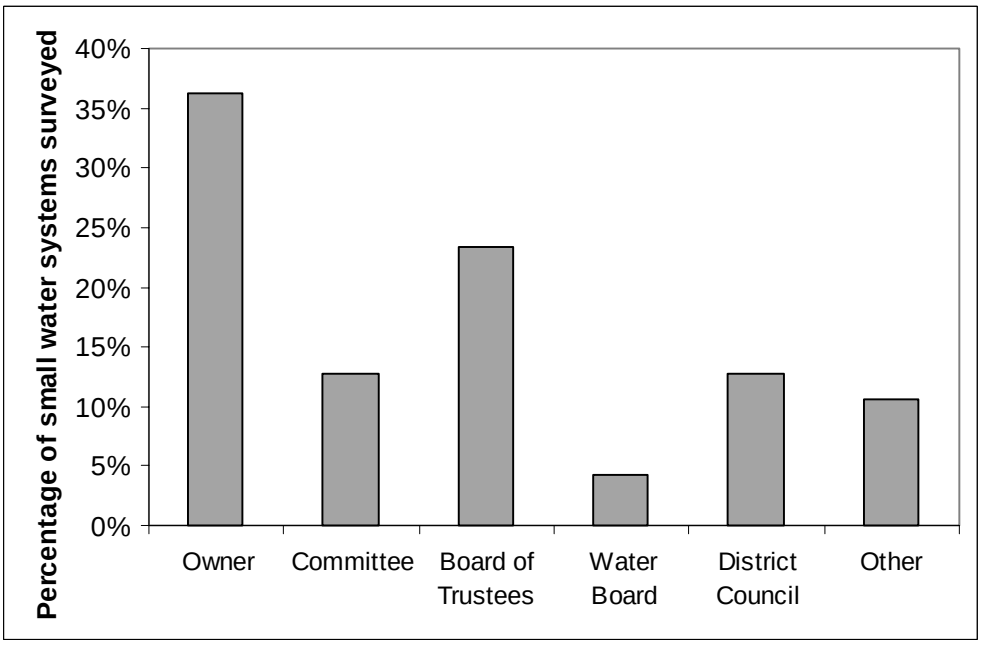

Figure F-15: The people or groups that set the operating budgets for small water systems, as determined in question (B)12 of the Small Water Systems Survey.

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 F-16 shows that most organisations (65%) would just continue to do what was required to maintain the water system, such as reallocating budgets, over running the budget, of just allocating money as required (i.e. no specific budget to run out anyway). 19% reported that there was no specific budget, and did not provide consideration for what they would do if the system required upgrades etc. 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 specifically said that treatment would have to stop if that occurred.

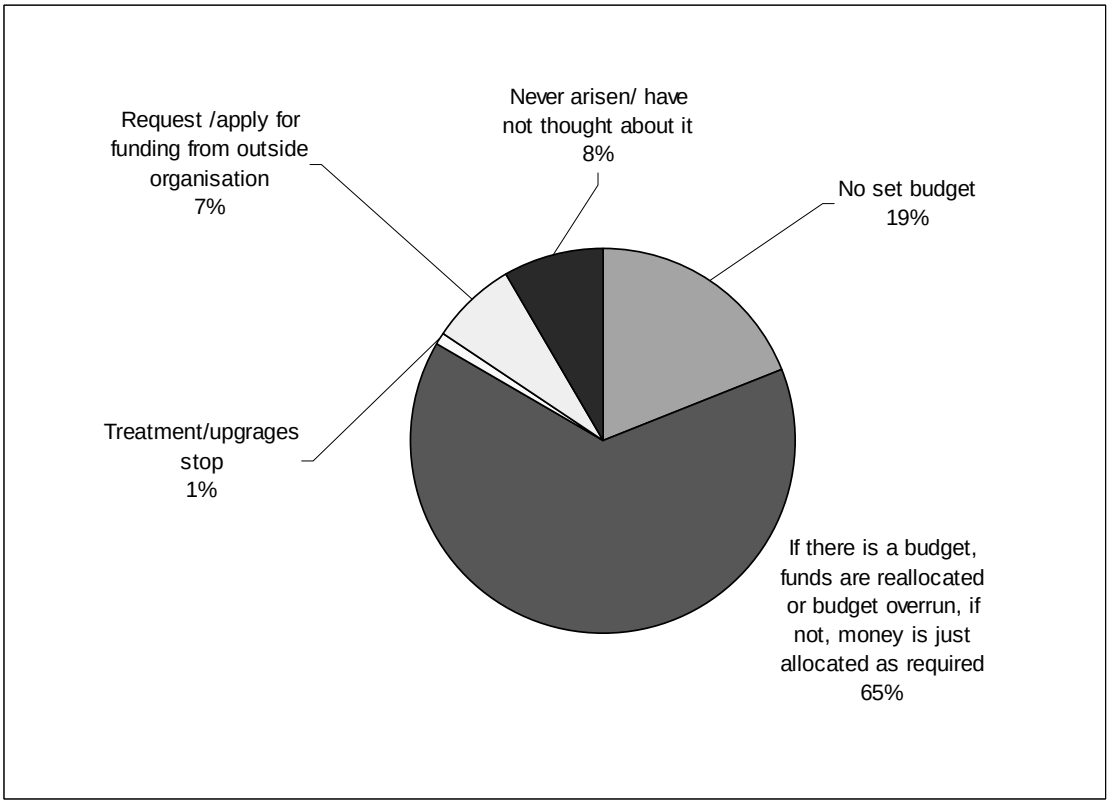

Figure F-16: Responses to the question (B)14: "What happens if the budget for the water supply runs out?" from the Small Water Systems Survey.

F.3.8 Operations 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 F-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

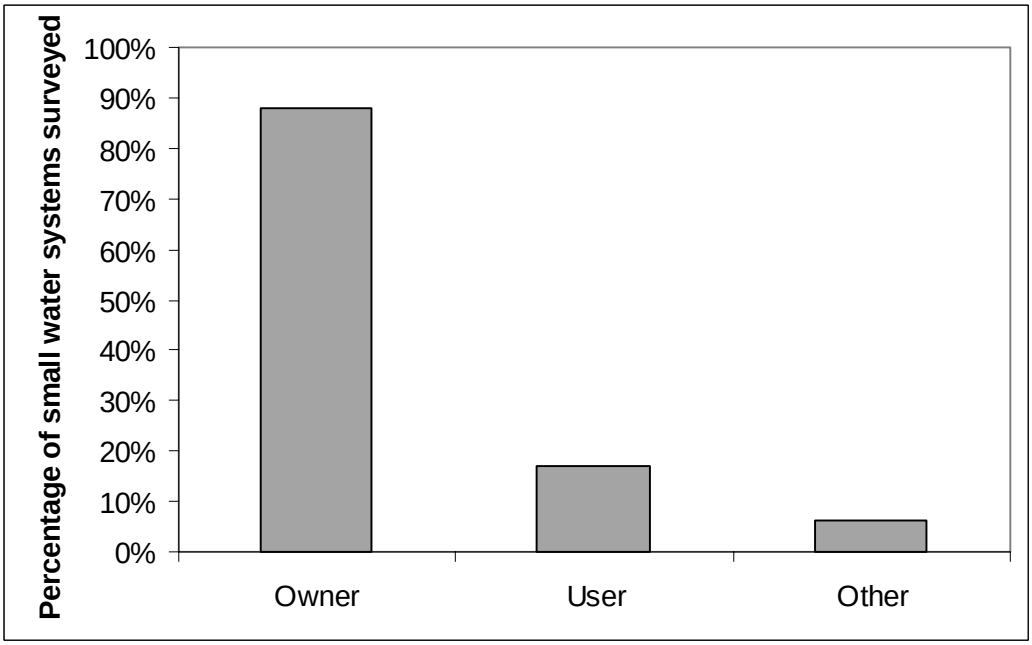

Figure F-17: The people who meet the operating costs of small water systems, as prescribed from question (B)9 of the Small Water Systems Survey.

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 F-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 F-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 B13 of the Small Water Systems Survey.

Total no. of each supply type	Supply Type	Staff	Operations	Maintenance	Compliance
19	No. - Schools	5	5	8	8
	Range - Schools	$20-$500	$80-$2,000	$50-$6000	$180-750
29	No. - Commercial	4	7	6	2
	Range - Commercial	$1,000-$23,000	$100-$7,000	$50-$29,000	$300-$500
16	No. - Camp	3	2	4	2
	Range - Camp	$500-$2,000	$1000	$200-$1,000	$120-$360
11	No. - Marae	0	1	1	0
	Range - Marae	$0	$200	$200	$0
41	No. Residential	8	14	13	10
	Range – Residential	$500-$8,320	$100-$19,000	$50-$13,500	$100-$3,700
2	No. - Hospital	2	2	2	2
	Range - Hospital	$10,000-$30,000	$500-$5,000	$5,000-$10,000	$4,000-$5,000

F.3.9 Upgrades to the system

Water systems managers were asked whether they have any upgrades planned, and if so, what type of work they were planning. Of those surveyed, **76%** indicated that they have no plans for upgrades, and **24%** reported that they did. Of that 24%, most upgrades involved changes to the treatment process, as shown in Figure F-18. Also mentioned were changes to the actual water supply type (i.e. stream water to groundwater), upgrades and extension of the reticulation network, and changes to the storage system.

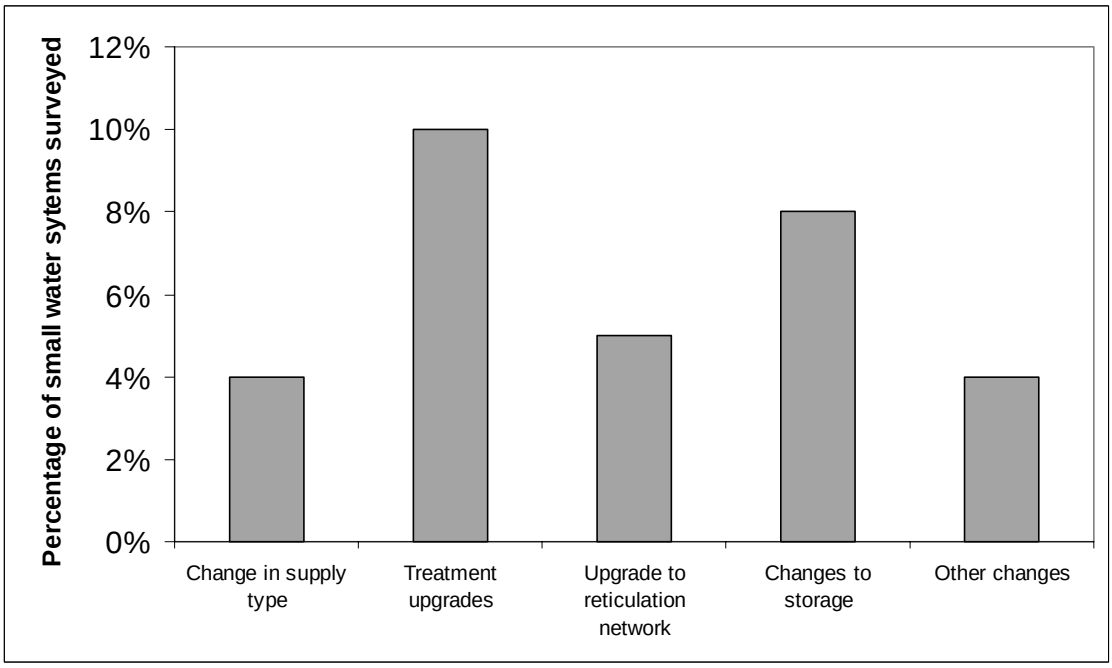

Figure F-18: Types of infrastructure upgrades planned by small water systems managers, out of the 27% of those surveyed that indicated that an upgrade had been planned in the future. Note that some specified more than one type of upgrade. Information from question (B)6 of the small water systems survey: "Any infrastructure upgrades planned?"

Water system managers were then asked how any planned infrastructure upgrades would be funded. Although only 24% of those surveyed indicated that they had upgrades planned, others also responded to this question indicating where funding would come from if at some later stage upgrades were required. Figure F-19 shows that most infrastructure upgrades will be funded by the owner themselves, and secondly via government or community grants. Users were another avenue for funding upgrades that came out of the survey.

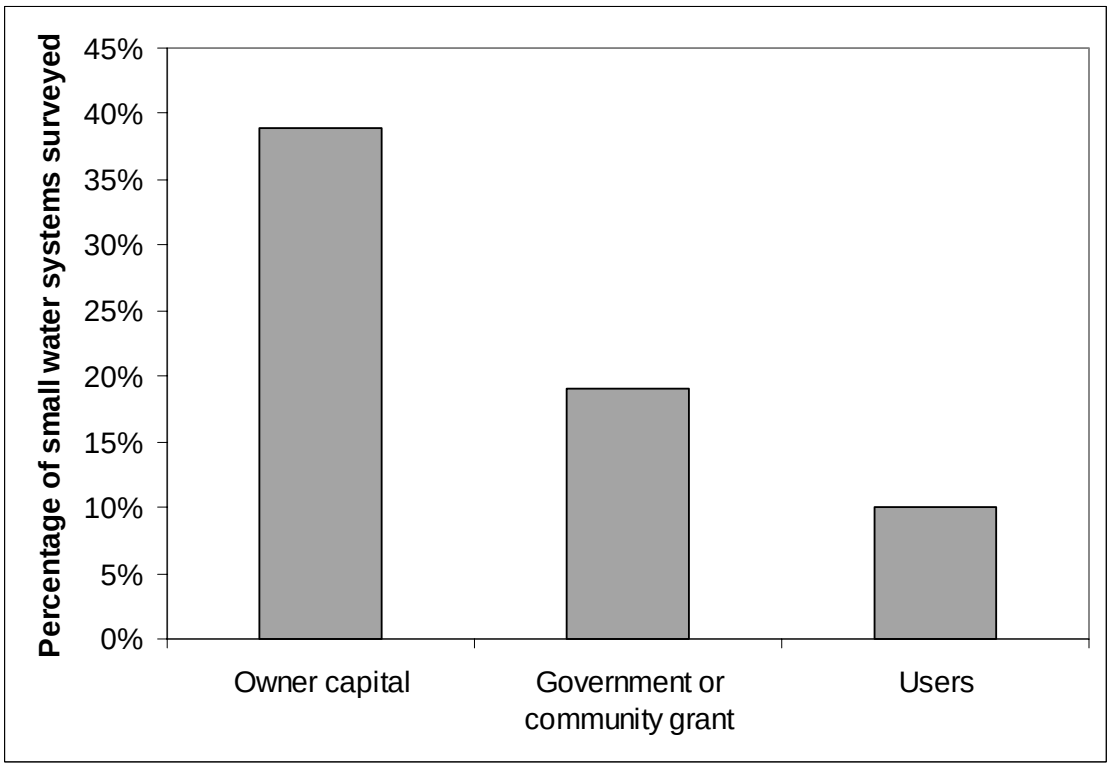

Figure F-19: Mechanisms for funding for infrastructure upgrades to small water systems, as determined through question (B)7 of the small water systems survey: "How will this be funded?"

F.4 Problems experienced

F.4.1 Frequency of problems

The small water systems managers were asked how frequently they had problems with their water supply. Figure F-20 shows that 41% rarely have problems with their supply, and that 5% 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.

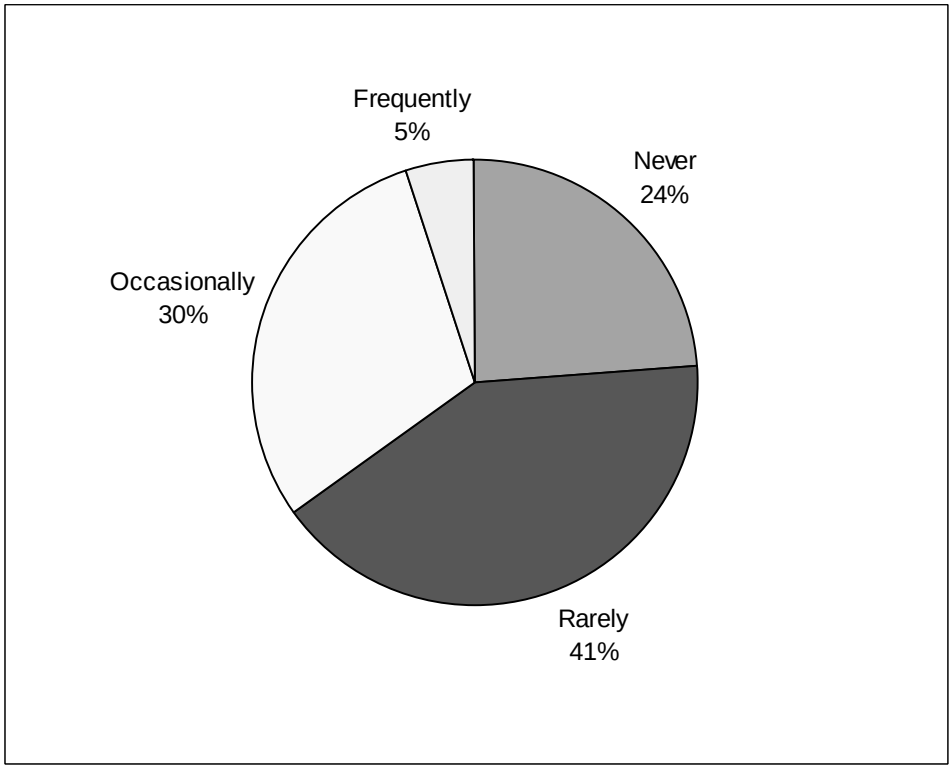

Figure F-20: Frequency of problems with the water supply, as reported in question (C)6 of the Small Water Systems Survey.

F.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 F-21. 33% had experienced problems relating to water quality, 35% reported mechanical failure in the system (i.e. burst pipes, pump failure), 14% said that shortages in the water supply had presented problems previously, and 7% described issues with the intake area i.e. silting or weed growth.

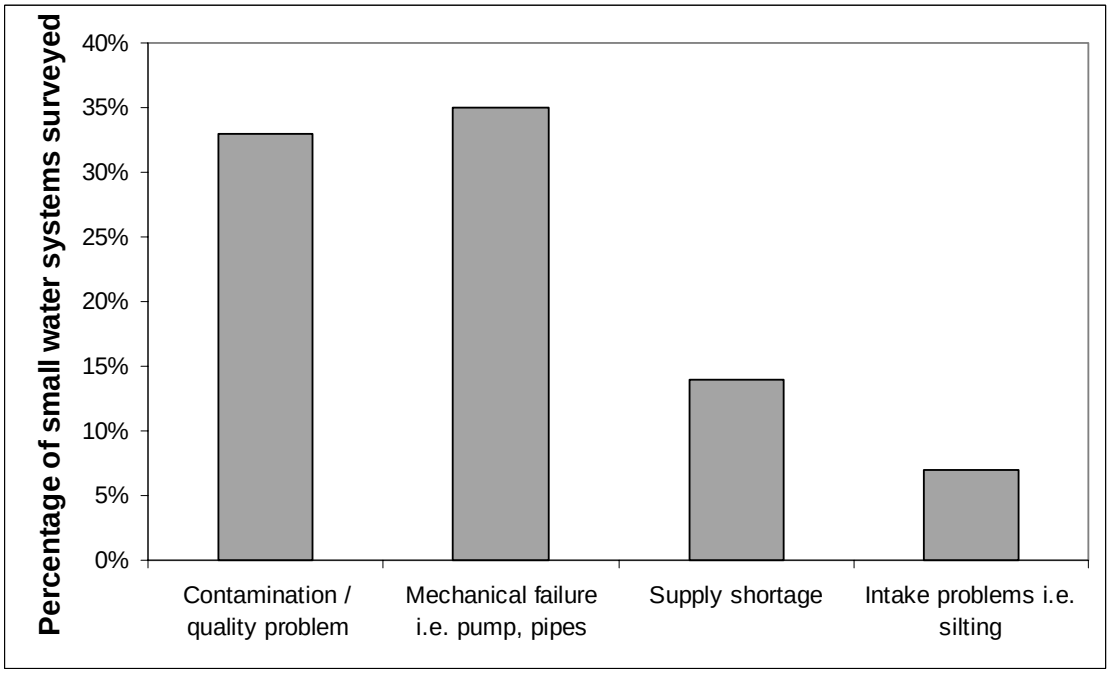

Figure F-21: Types of problems experienced with small water systems in New Zealand, as determined by question (C)7 of the Small Water Systems Survey.

G. ISSUES AND RISKS FOR SMALL WATER SYSTEMS

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.

G.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

G.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 G-1). A slightly higher proportion (44%) 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 44% who claim to be meeting the standards will not actually be meeting them, primarily because they do not monitor often enough.

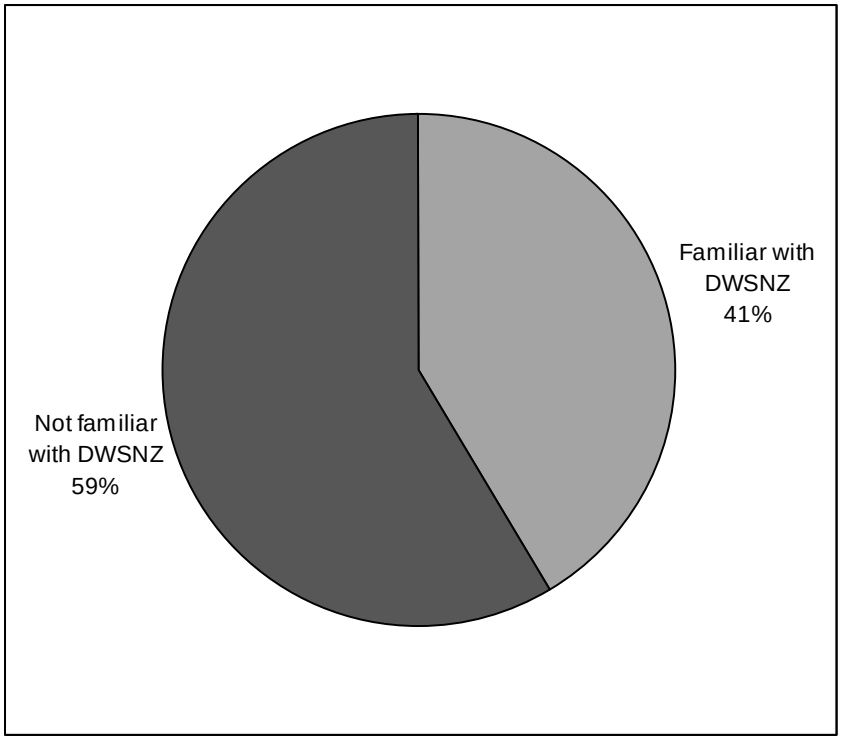

Figure G-1: Familiarity with the DWSNZ, as reported by the managers themselves in question (C)2 of the Small Water Systems Survey.

The interviewers were requested to rate their perceptions of the small water systems managers in terms of their awareness of the DWSNZ (see Figure G-2). A significant proportion (42%) of the managers were identified as having an inadequate awareness of the standards, 26% were rated as having a satisfactory awareness, and 32% had an excellent or good awareness.

The interviewers (in Figure G-2) are therefore giving greater credit to the managers / operators awareness of DSWNZ than what they themselves are claiming (in Figure G-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.

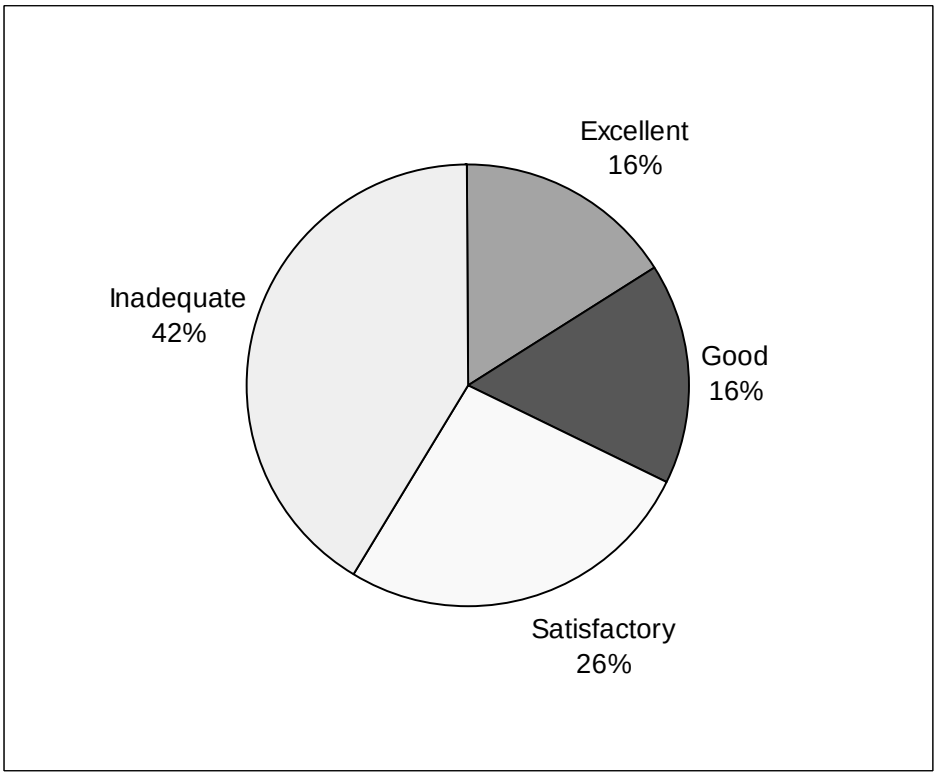

Figure G-2: Awareness of water systems mangers of the Drinking Water Standards for New Zealand, as rated by the interviewers in the Small Water Systems Survey.

G.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 F.3.5, above, where

only 11% of those interviewed had prepared a Public Health Risk Management Plan. Of the 79% surveyed that have not done a PHRMP, at least 28% of them (22% 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 G-3). A wide range of perceptions were reported, from inadequate to excellent, with the most common risk perception ability being rated as satisfactory.

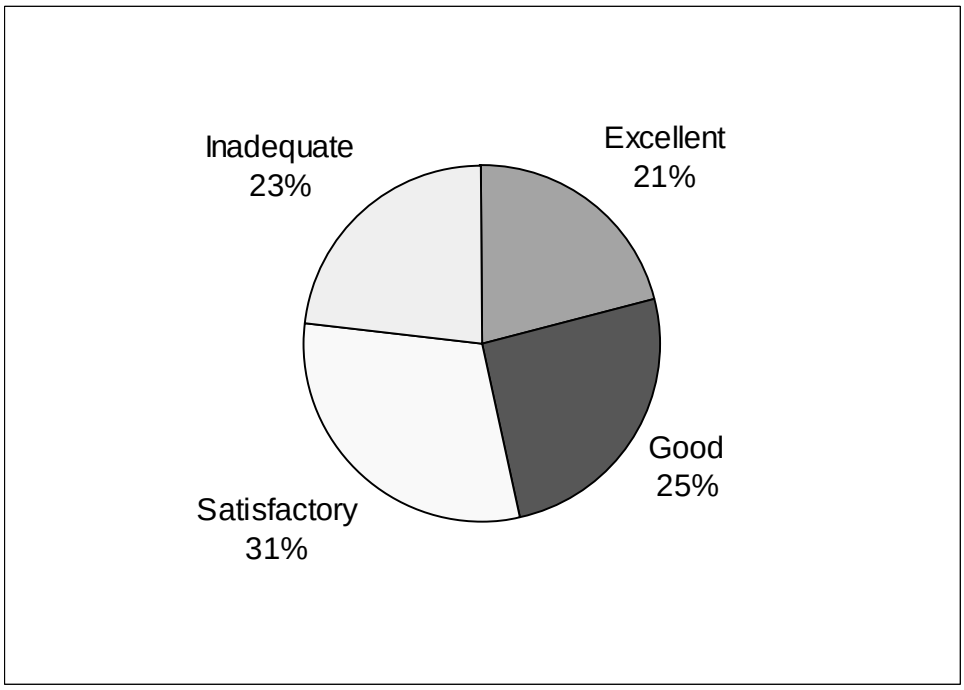

Figure G-3: Perception of risk by small water systems mangers, as rated by the interviewers in the Small Water Systems Survey.

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 F-20 shows that 65% never or rarely have problems with their supply, while only 5% 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 F-20) 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 G-4, show that more than half of the systems surveyed have no real risk or a minimal level of risk. 25% of water systems have only satisfactory level of risk, and 25% 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.

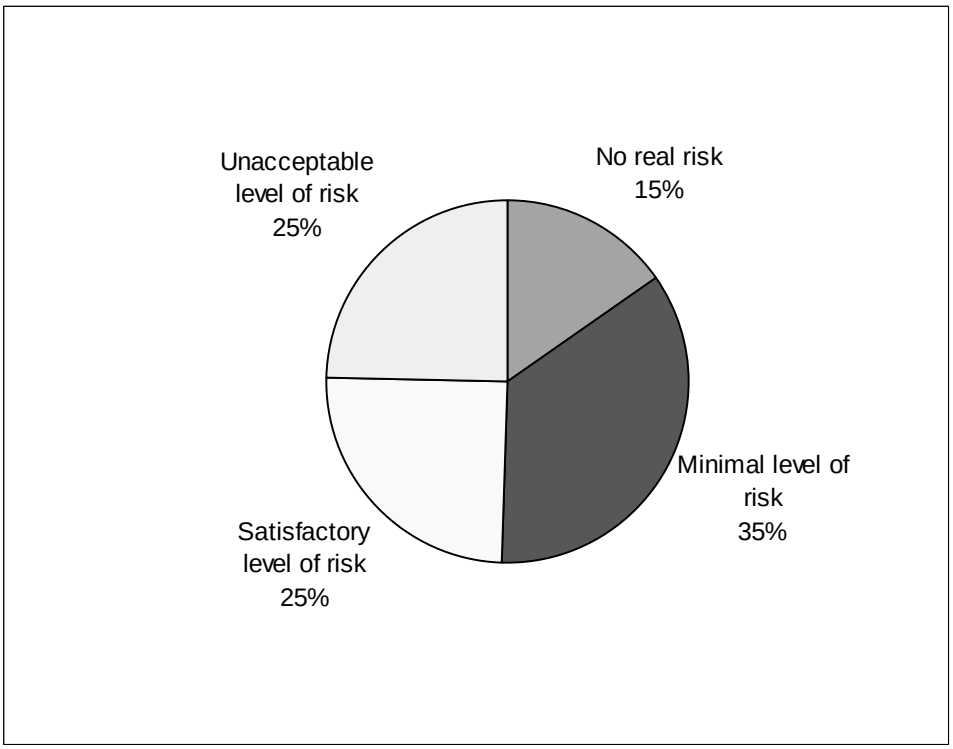

Figure G-4: The level of risk of the small water systems surveyed, as assessed by the interviewers in question F(7) of the Small Water Systems Survey.

G.1.3 Competency and training of the managers and operators

G.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 F-9 and Figure F-10, above. To recap, 10% had a relevant water systems operation certificate (B or C grade), and 6% had a relevant trade qualification (i.e. plumber), and 84% said that they had no relevant qualifications at all. In terms of less formal training, 33% had no training, and 38% said that they were self taught, and 60% 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.

Figure G-5, below, shows the relationship between the qualifications of small water systems operators, and their knowledge of the Drinking Water Standards New Zealand (DWSNZ). The graph shows that nearly all of those with a formal water operator qualification are aware of the DWSNZ, and that none of those with a 'relevant qualification', i.e. plumbers etc, have an awareness of the standards. About a third of those with no relevant qualification (who make up the majority of small water systems operators) have an awareness of the standards. Therefore this graph highlights the difference in the type of training that is given to those with formal water supply qualifications, and plumbers, who may understand the system very well, but have not had training on the standards of the water supply to the users, and the management of risks.

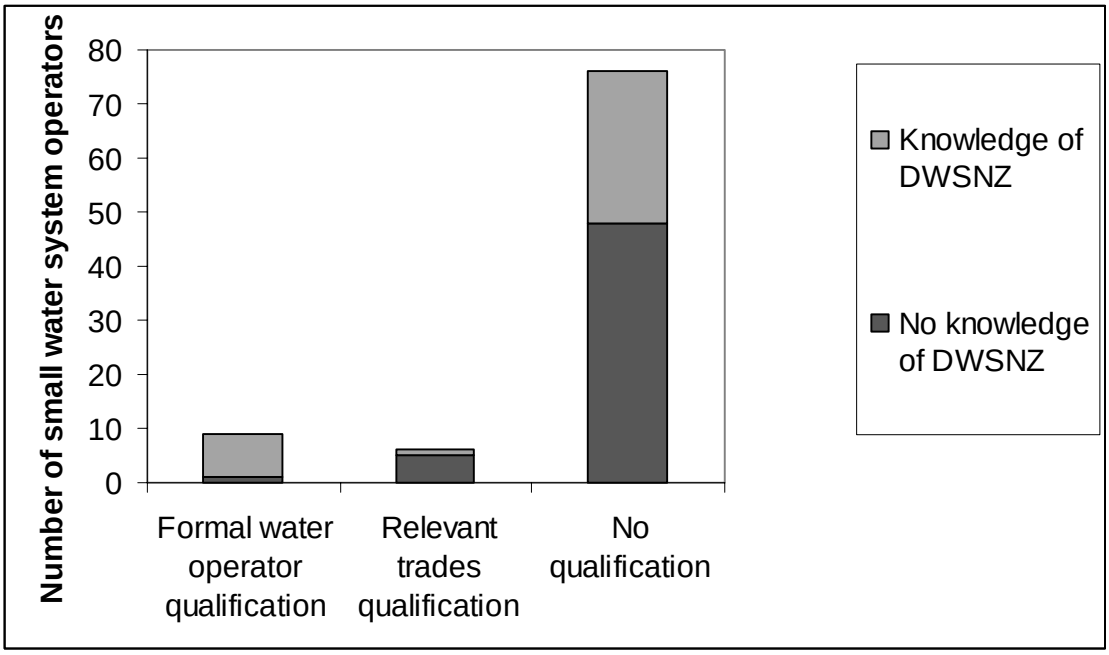

Figure G-5: The qualifications of operators of small water systems, compared with their knowledge of the DWSNZ. Information from the Small Water Systems Survey.

G.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 G-6). The majority of operators were placed in the 'satisfactory' or 'good' categories, with 21% of operators rated as having 'inadequate' knowledge and skills.

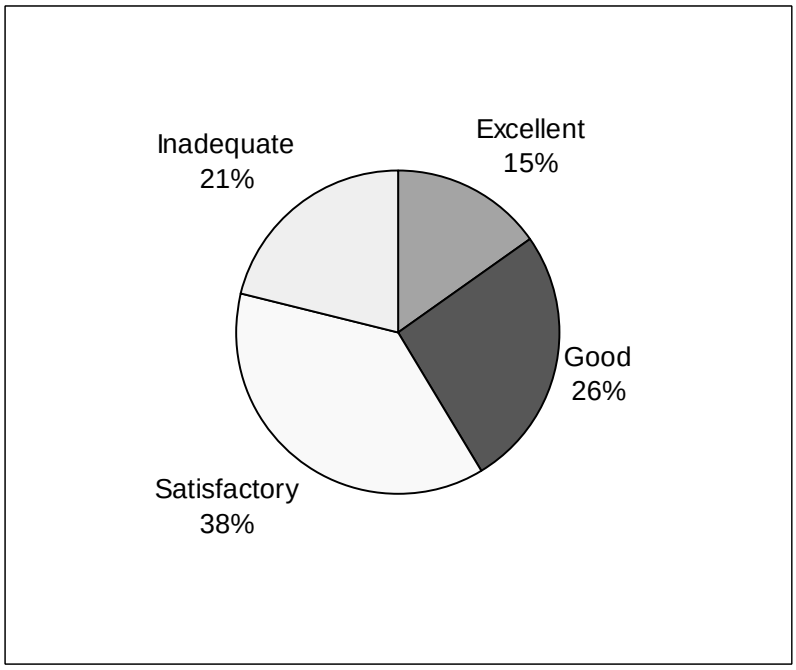

Figure G-6: Knowledge and skills of small water systems operators, as rated by the interviewers in the Small Water Systems Survey.

Managers were also evaluated in this way, with the interviewers rating their level of understanding and skills (see Figure G-7). 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.

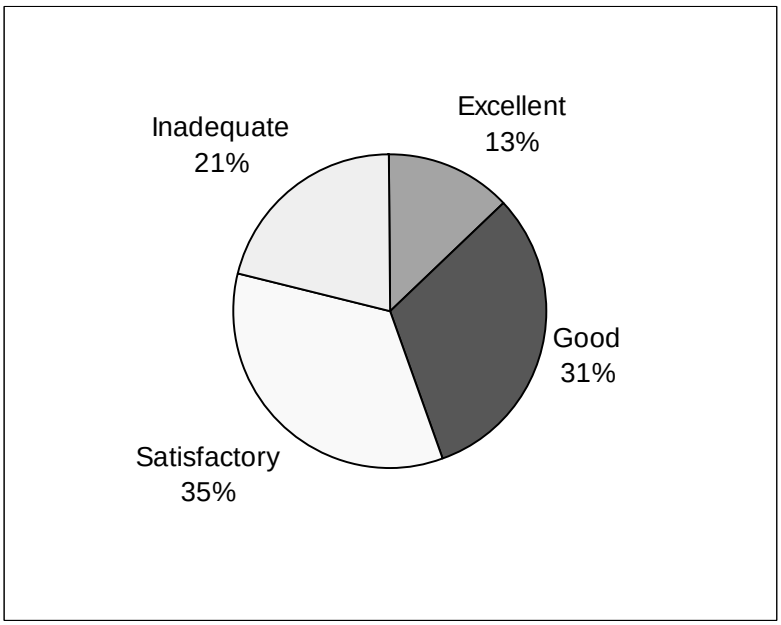

Figure G-7: Level of understanding and skills of small water systems mangers, as rated by the interviewers in the Small Water Systems Survey.

G.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 G-8. Of interest was that 24% of operators said that they would like no training! 24% expressed an interest in general and basic water system and supply training, while 15% 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.

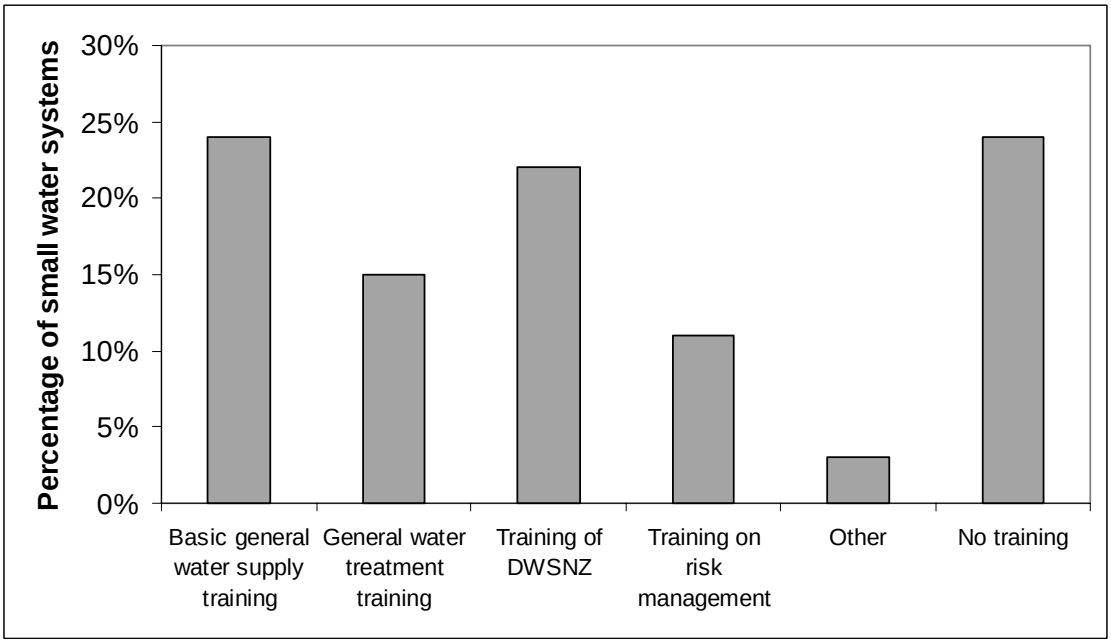

Figure G-8: Training that the operators of small water systems would like to have, as evaluated in Part A of the Systems Report.

G.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 G-9 shows that in 42% of small water systems there was a low need for training, and that in 31% of cases, the need was high.

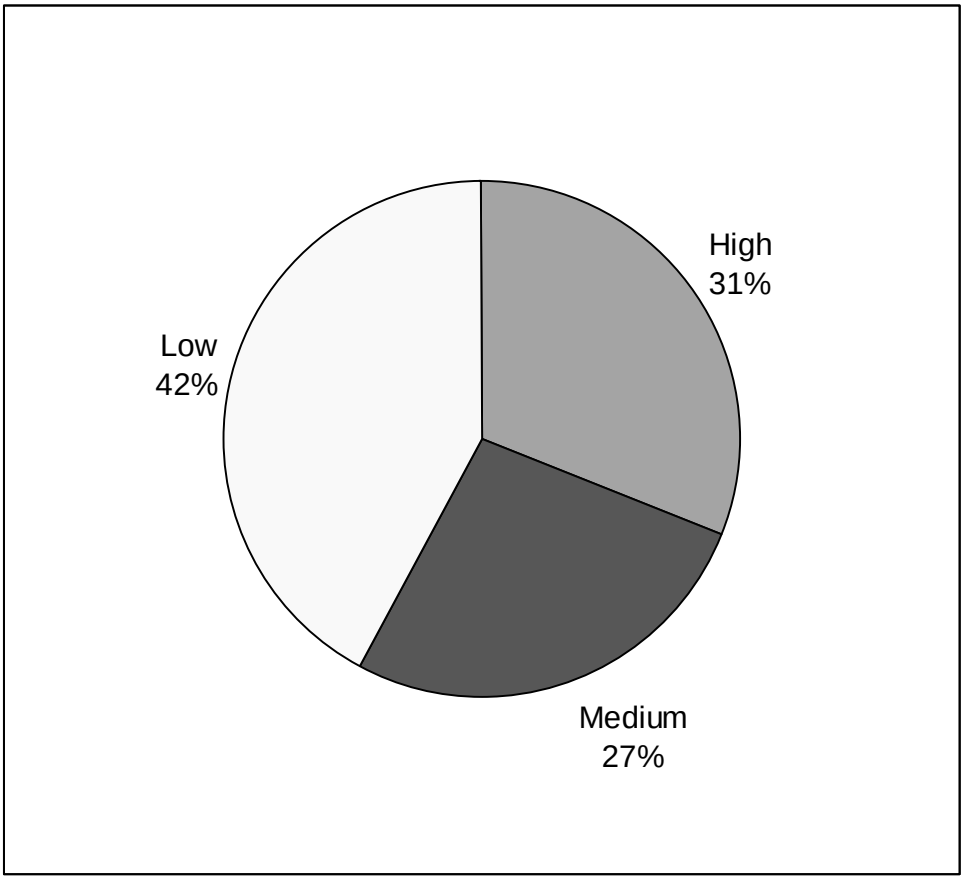

Figure G-9: The need for training of the operators, as evaluated by the interviewers in Part B of the Systems Survey.

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.”

G.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 21% were evaluated as having an inadequate level of understanding and skill in their roles, 53% of operators expressed an interest in further training, and interviewers reported that 58% 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 three-fifths of the small water systems.

G.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 F.3.1, 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 G-10 shows that 63% 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.

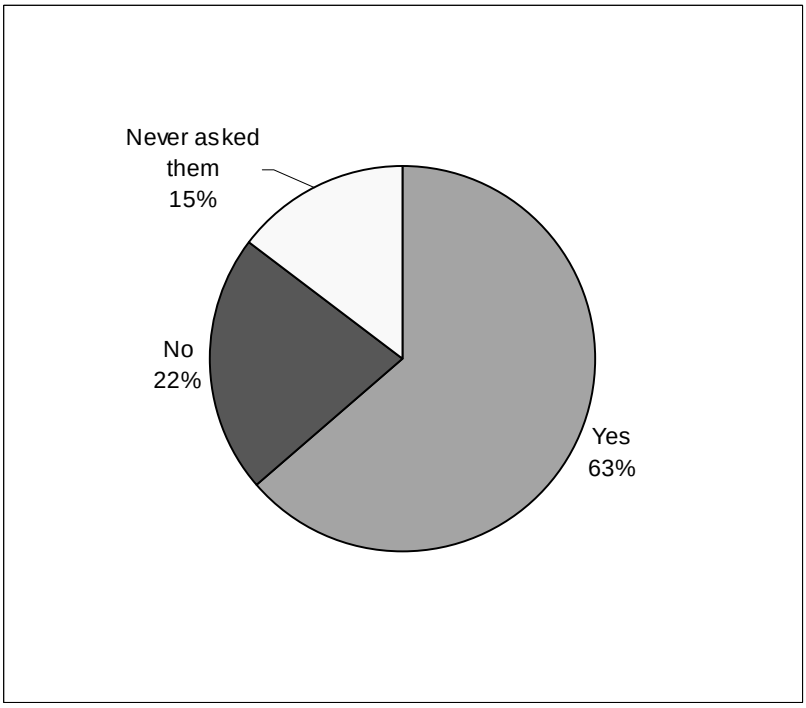

Figure G-10: Responses to the question "Is support available from your Local Authority?", from the Small Water Systems Survey (D) 10.

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 though District Health Boards and District Councils. A more difficult information channel to educate through is the plumbers and other contractors that 22% 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 reply on their own knowledge for decision making about their small water system.

G.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.

G.2.1 Problems with the water source

Section E.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 40% 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.
- At least 20% of systems with bore water sources reported insecure headworks.
- Over 47% 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.

The operators and managers were asked whether the source provided an adequate quantity of water for their supply. The results, shown in, indicate that in 87% of cases the water supply is of adequate quantity, and that in 7% of cases more water would be preferable.

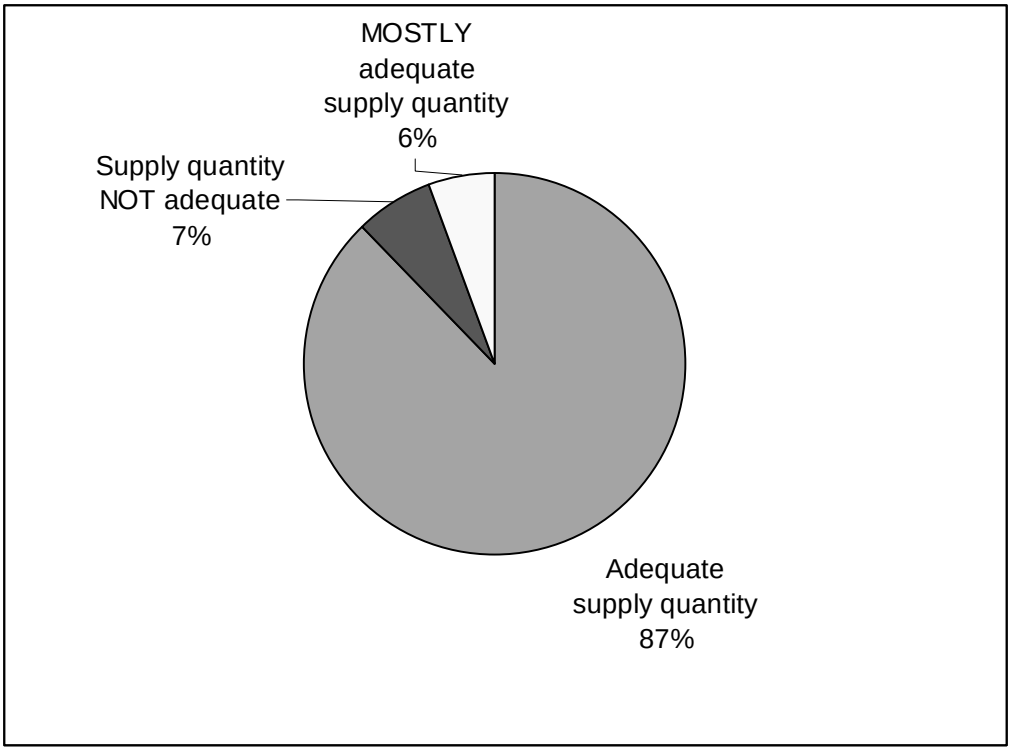

Figure G-11: The adequacy of the quantity of the water supply, as rated by the operators and managers in the Systems Report of the Small Water Systems Survey.

G.2.2 Overall condition of the plant

Interviewers were asked to evaluate the condition of the plant. Figure G-12 shows that at the majority of systems (85%) 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 15% 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.

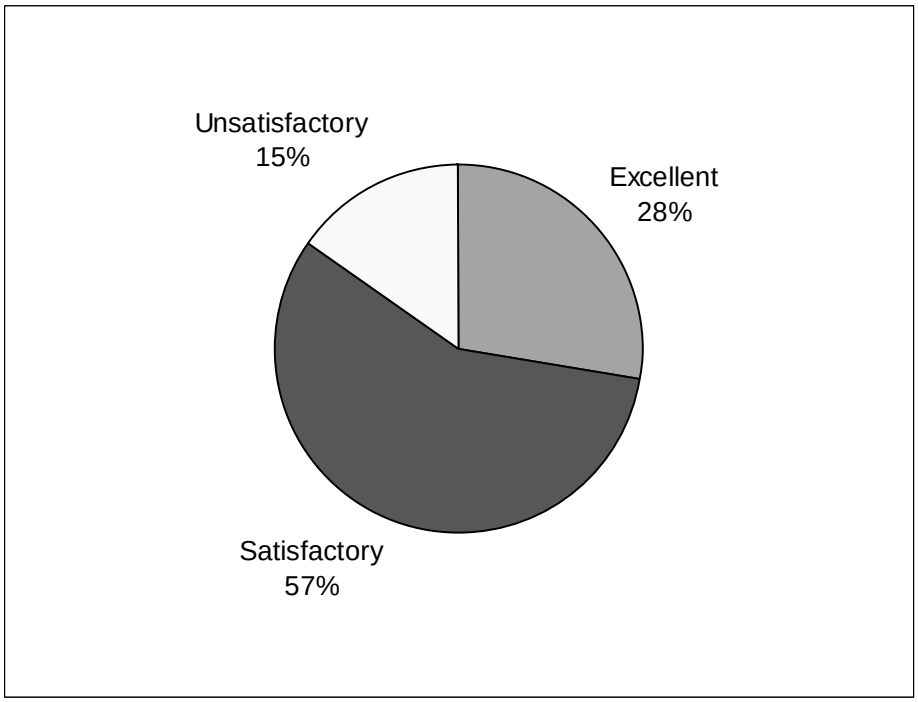

Figure G-12: The condition of the treatment plants of small water systems, as evaluated by the interviewers in Part B of the Systems Report.

G.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 G-13 shows that in 80% of cases, the plant was excellent or satisfactory in terms of its suitability to the site.

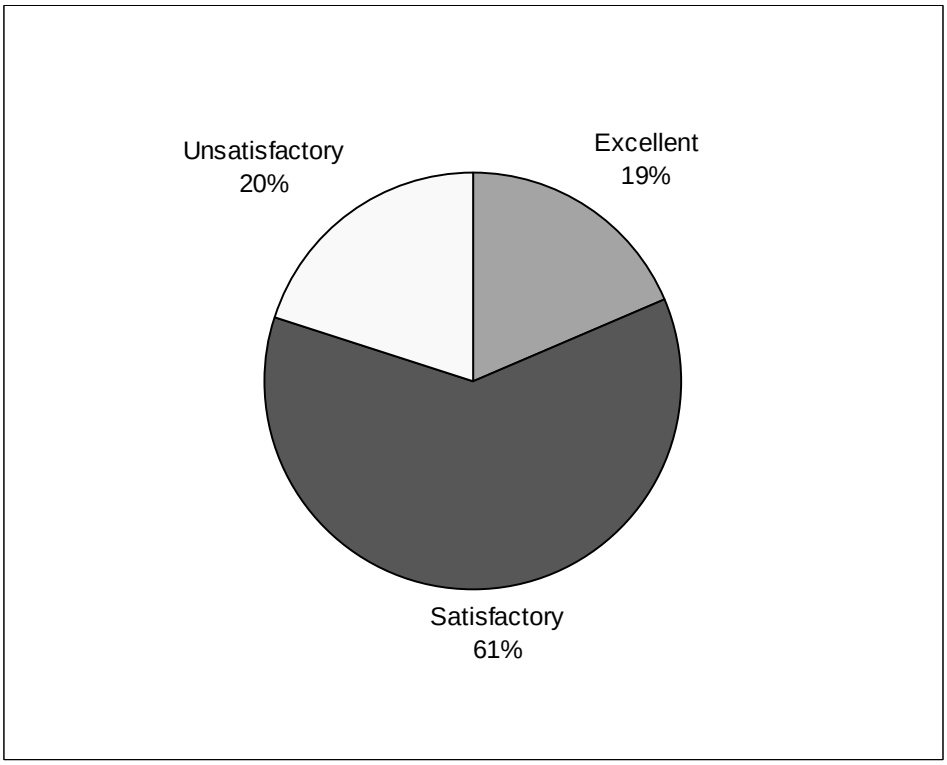

Figure G-13: Suitability of the treatment plant for the small water system and its use, as evaluated by the interviewer in Part B of the Systems Report.

G.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.

G.3.1 Failure to comply with the DWSNZ

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 G-14, below shows that the primary reason for failure was in not meeting the monitoring requirements (27% have failed for this reason). The results show that 11% have failed due to the presence of microbiological contaminants in their water supply.

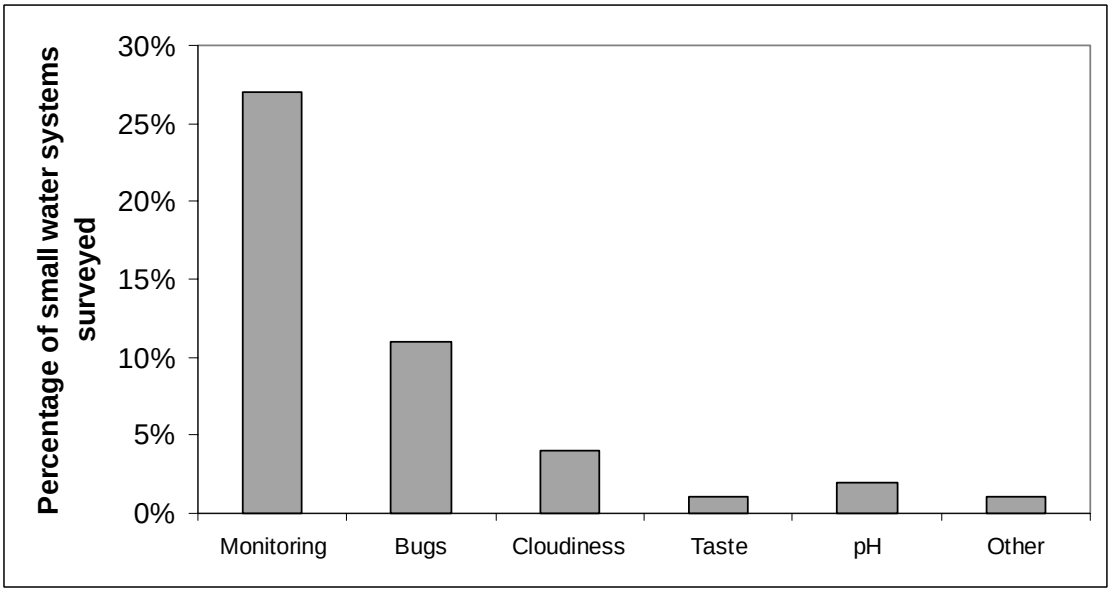

Figure G-14: Reasons for not complying with the DWSNZ 2000, as determined by question (C)4 of the Small Water Systems Survey: "Do you meet the DWSNZ2000? If no, for what reasons?"

G.3.2 Compliance with the DWSNZ in terms of microbiological treatment methods

Half of the systems with water treatment (32% of the total systems surveyed) have the potential to meet the requirements of the DWSNZ, as they appear to have the appropriate microbiological treatment systems set up. Figure G-15

shows that although 64% do have some treatment system with their water supply, only 32% use a combination of either chlorine and catridge filtration, or UV and catridge filtration. This is the level of treatment that is generally considered as minimum to treat water to a level that would meet the microbiological treatment section of the DWSNZ.

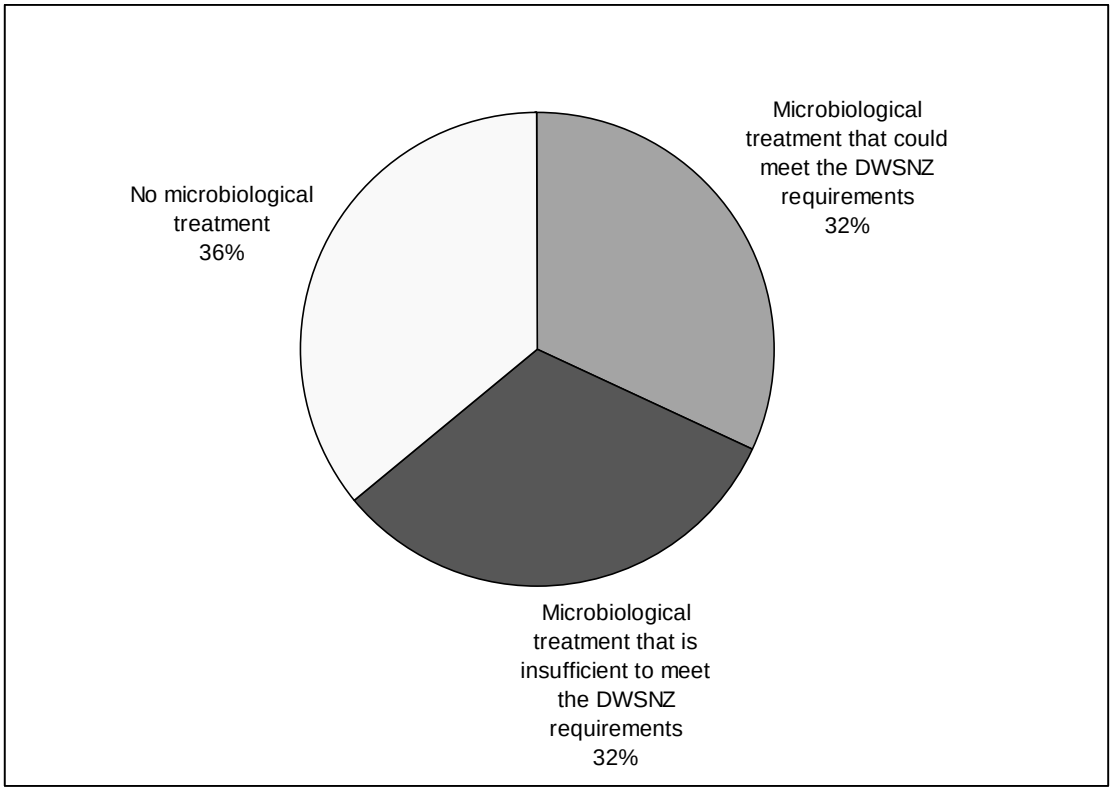

Figure G-15: Treatment methods installed in small water systems, and the ability of those systems to meet the DWSNZ. Information from Part A of the Systems Report in the Small Water Systems Survey.

This does not mean, however, that they do meet the DWSNZ requirements overall. For example, one of the small water systems surveyed was a North Island school, which utilises roof water for their supply. The treatment system includes two pleated cartridge filters in sequence (a 30µm filter followed by a 1µm filter), and then ultra violet light treatment. There was, however, insufficient monitoring of the water quality, as well as no way of knowing if the UV lamp is working. In the past, the school has reported problems including filters falling to pieces, and outbreaks of a "bug" at the school. Therefore, in this example, the system is set up satisfactorily to potentially meet the requirements of the DWSNZ, but the operation and maintenance of the system has resulted in a transgression of the standards.

G.3.3 Frequency of problems compared with monitoring practices

A wide range in monitoring practices for small water systems have been reported in Figure F-5 and Figure F-6 in the previous section, together with a range in the frequency of problems experienced (Figure F-20). To recall, 41% reported that they rarely have problems with their supply, 30% occasionally have problems and 5% experience problems frequently.

One reason for the systems reporting that they never or rarely have problems could be because they are not actually *aware* of any problems, as they do not monitor. Figure G-16 was constructed, which displays the frequency of problems compared with the frequency of monitoring at each system.

It can be seen from this graph that those that do no monitoring at all are generally also those that never or rarely have problems. The more often people monitor, the larger the proportion of them that have problems 'occasionally' or 'frequently'. Therefore in general, the more frequently a water system operator monitors, the more frequently they report problems, and those that do not monitor frequently may just be *not aware* of any problems.

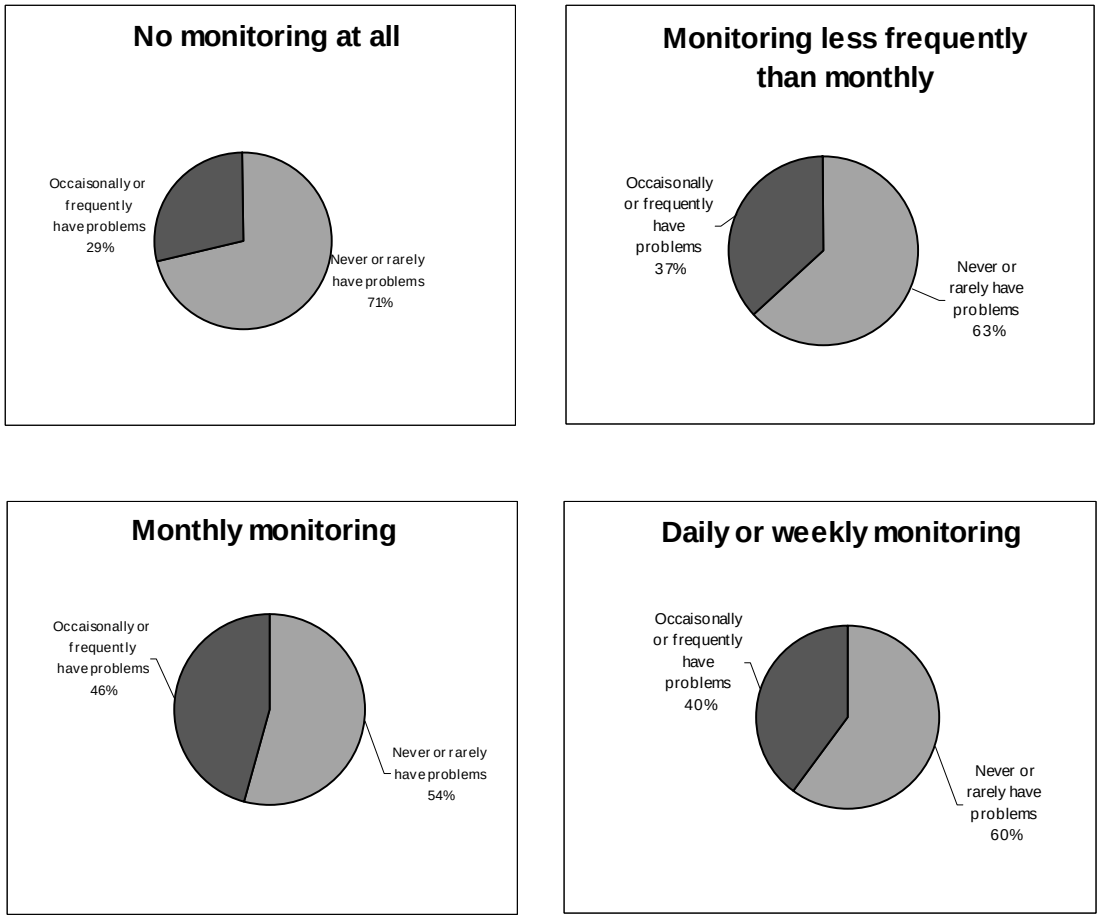

Figure G-16: Frequency of microbiological monitoring compared with the frequency of reported problems at a water supply. The darker slice indicates the percentage of small water systems that have problems occasionally or frequently. The lighter slice represents the percentage of small water systems that have problems never or rarely. Information from the Small Water Systems Survey. See text for interpretation and explanation.

G.3.4 Access to a laboratory

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 4% said that lab access was a problem, and 96% said no. The distance to the nearest water testing laboratory is displayed in Figure G-17, below. It can be seen that 45% of water systems are within 100 km of a laboratory, and only 6% have further than that to travel, 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 (49%) did not

answer that question, possibly because they did not know where the nearest lab was.

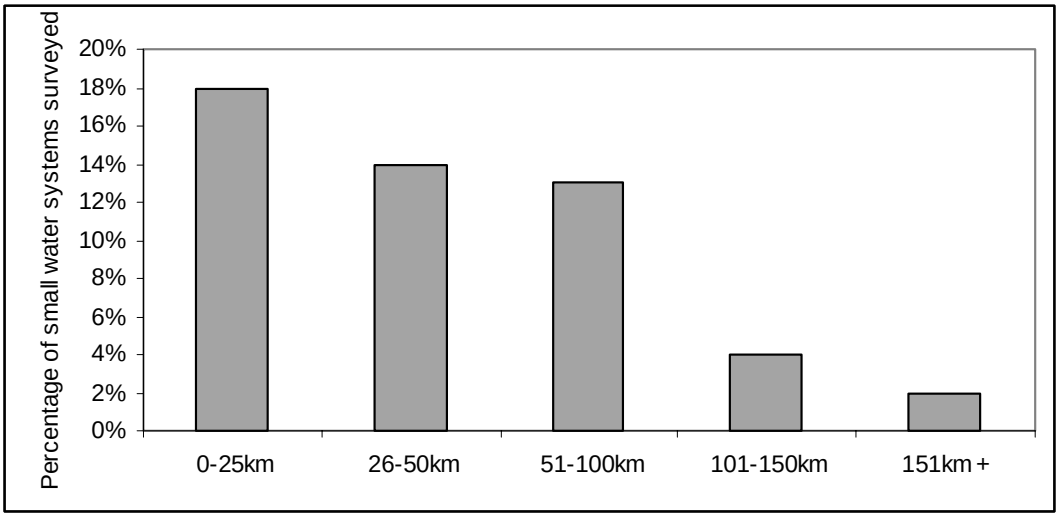

Figure G-17: Distance to the nearest water quality testing laboratory, as indicated in Part B of the System Report in the Small Water Systems Survey.

G.4 Interviewers assessment of individual systems

Interviewers were asked to rate what they saw the major resource difficulties being: skills, finance, workloads, training, or accessibility. Some interviewers provided more than one difficulty, while others ranked the difficulties in order. The rankings given have been averaged to create Figure G-18, which shows each factor on a scale of 1 to 5. The higher the number, the more of a problem that factor is for water supply managers (as evaluated by the interviewer). The graph shows that finance and training (or lack of) are the resources that present the most difficulties for small water systems.

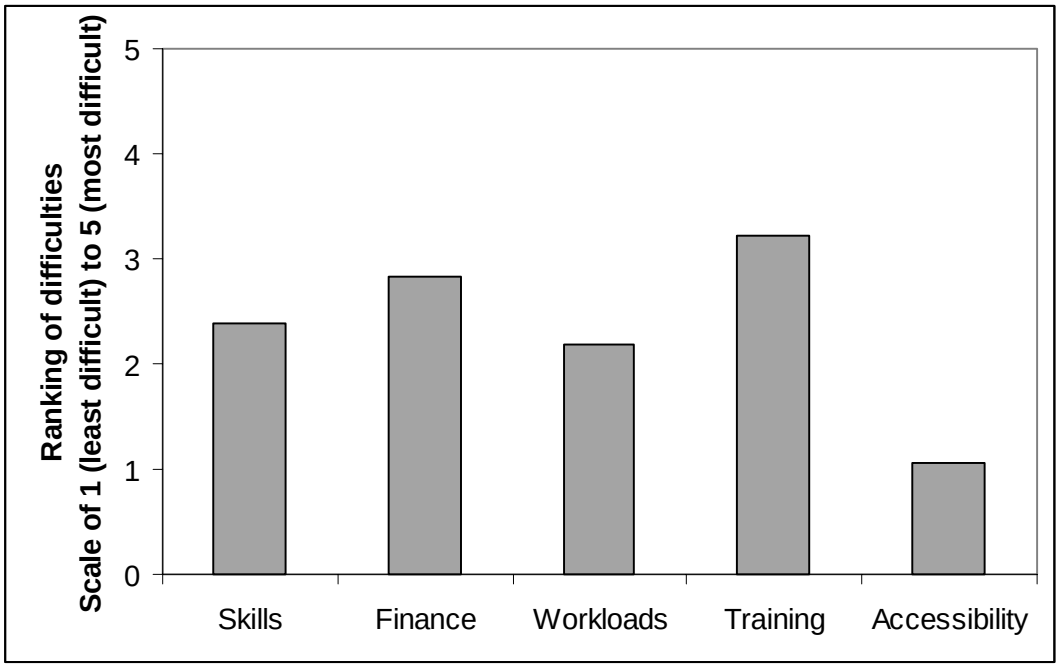

Figure G-18: The areas that provide the most difficulties for small water systems, as evaluated by the interviewer in question (F)9. The scale on the y-axis is from 1-5 and is the average ranking provided in the survey. The higher the number, the more of a difficulty that factor is.

H. ADDITIONAL COMMENTS

H.1.1 The WINZ database

A number of the systems surveyed were not registered on the Water Information New Zealand database (WINZ). This raised the issue of how complete WINZ is. As an indication of the coverage of WINZ database, we compared the WINZ records with that of Environment Canterbury (Ecan), who have taken this database and attempted to update it fully for the Canterbury region for planning purposes.

The Ecan database aims to include all community water supplies that service a population greater than 25 people for at least 60 days per year. The total database of drinking water supply systems in Canterbury includes 367 sites, and of those, 168 sites supply water to between 25 and 500 people. In establishing the Canterbury inventory, ECan began with the 2000 version of the WINZ database, selecting all supply sites that are registered in the Canterbury region. This was then compared with the consents database held at ECan, and it became apparent that not all of the consented water suppliers were registered on WINZ. A total of 94 small water systems were registered (data from WINZ 2000), compared with the 168 that have now been located, i.e. only 56% of small water systems in Canterbury were registered with WINZ. This number however, does not cover all of the possible sites for the supply of water to small communities, only those who have *a consent* for their water abstraction for supply. Very small systems that do not require a consent (i.e. less than 20m3/day for groundwater sourced supplies) are not included in the Ecan numbers. Therefore the WINZ database contains **a maximum of 56%** of the small water systems in Canterbury, and this percentage is likely to be smaller if those non-consented suppliers are taken into account.

As this survey was not designed to check the WINZ database we are unable to extrapolate the Canterbury figure into a national one.

I. DISCUSSION AND RECOMMENDATIONS

This survey has identified a number of issues associated with small water systems in New Zealand. The following are recommendations to Ministry of Health for actions that may result in improvements in the supply of drinking water.

Raising awareness

Many owners and operators have a poor understanding of the performance required and potential health risks of their systems. As this lack of awareness acts as a barrier to encouraging owners and operators to raise the standard of their water system, it is considered to be one the first issues that should be addressed.

It is recommended that:

13. *A general awareness/education programme covering first principles of potable water supply is undertaken. It should introduce owners/operators to DWSNZ 2000 and PHRMPs, explaining the benefits of fulfilling the requirements contained in these documents and the risks associated with not meeting them.*

14. *A more detailed education programme about DWSNZ 2000 and PHRMPs is undertaken, focusing more specifically on suppliers, installers and others providing advice to small water system owner/operators..*

15. *The Ministry educate organisations that have the potential to influence or act as drivers for voluntary change by owner/operators. For example, request that the Ministry of Education further encourages schools to have a PHRMP and a DWSNZ 2000 compliant system. Request that Qualmark NZ Ltd, who provide the accommodation quality star rating for Hotels and Camping Grounds, include compliance with DSWNZ in their evaluation criteria.*

16. *District Health Boards and Territorial Local Authorities are involved in any awareness raising exercises, as most owners/operators gain information from these organisations.*

Improving registration levels

This survey has identified that there may be a problem with a potentially large number of small water systems not being registered and recorded on the National Water Information New Zealand (WINZ). This may create a problem of how to educate owners, and monitor systems if they can not be located.

It is recommended that:

17. *An investigation is undertaken to determine how incomplete the records of the community drinking water supplies register and WINZ are, and recommend any remedial actions that may be desirable.*

Improving skills by providing appropriate training and advice

The survey has revealed that there are very few operators with any formal relevant training in small water systems. Many operators have had no training at all. Installers are also installing and repairing systems that are not technically capable of meeting the DWSNZ without advising the owner/operator.

It is recommended that:

18. *Appropriate training courses covering the specification, installation, maintenance and operation of small water systems be developed. These courses should be modelled on DWSNZ 2000 and provide for long distance adult learning.*

19. *Operators are encouraged to have a minimum level (which would have to be defined) of very basic training required to run plants. This could be provided as a module of 6 above.*

20. *Those who install and upgrade small water systems are encouraged to have a minimum level of training and be independently certified as to meet an appropriate level of technical competency.*

21. *Consideration be given to developing a range of "fact sheets" that provide standard advice for non-expert owners/operators on the basic actions required to operate and maintain small water systems.*

22. *National small water systems technical guidelines are made available that cover design, installation and performance, for use by system installers, equipment suppliers, public health officers etc.*

Ensuring systems are fit for purpose

There are a number of small water systems that expose people to an unacceptable level of risk due either to inadequate design and installation or poor condition of infrastructure and equipment.

It is recommended that:

23. *Systems to be subject to inspection by independent suitably qualified people and certified as fit for purpose. The certification is revalidated on a periodic basis.*

Reducing the financial burden of monitoring

A number of owners/operators expressed concerns about the cost implications of either having to monitor at all, or to monitor at the frequency required by the DWSNZ.

It is recommended that:

24. *The Ministry to look into the costs of monitoring, and if necessary, provide assistance or minimise the cost of monitoring on operators, such as by providing subsidies for laboratory costs or developing cheaper monitoring methods.*

J. LIST OF FIGURES

K. APPENDIX: THE SMALL WATER SYSTEMS SURVEY