Quality Management Systems Framework for Ontario Water Utilities: Standards Options

Introduction

In investigating potential approaches to improving the management and performance of Ontario's water utilities, several have recommended the development, implementation and certification of a quality management systems framework designed specifically for the industry. This paper discusses alternatives and issues associated with the development of such an approach in Ontario from a standards perspective.

Standards Concepts and Terminology

Standards Council of Canada (SCC) is a federal Crown corporation with the mandate to promote efficient and effective standardization in Canada through the coordination of the National Standards System.

National Standards System (NSS) includes organizations and individuals involved in voluntary standards development, promotion and implementation in Canada.

Canadian Standards Association (CSA) is an accredited standards development organization that operates as part of the National Standards System. CSA is a not-for-profit membership-based association serving business, industry, government and consumers in Canada and the global marketplace. CSA is an international leader in management systems standards development.

Management System refers to the action that an organization does to manage its processes or activities. A management system of an organization can comprise various systems, such as a quality management system, a financial management system or an environmental management system.

Quality Management System is a management system which directs and controls an organization with regard to the quality of its processes, product(s) or project(s).

Quality Management System Standards provide the organization with a voluntary model to follow in developing, implementing, monitoring and improving a quality management system.

Conformity Assessment is the practice of determining whether a product, service or system meets the requirements of an applicable standard.

Management Systems Certification/Registration is the process of demonstrating conformity to the requirements of a management system standard (henceforth referred to as "certification")

Accreditation is the formal recognition of the competence of an organization to perform a particular conformity assessment function. The SCC is responsible for accrediting conformity assessment organizations in Canada.

Standards Development Options

There are a number of approaches to developing voluntary standards in support of a quality management systems framework for Ontario water utilities. Six options are presented:

1. Existing International Standard – (ISO 9001)
2. New International Standard – (ISO)
3. New National Standard – (SCC/CSA)
4. New Ontario-based Standard – (CSA)
5. Existing Industry Standard – (AWWA/WEP)
6. New Information Product – (CSA)

Each option is described below, including a brief analysis of anticipated scope, development time, development costs, and accreditation and conformity assessment issues.

OPTION 1 - Existing International Standard (ISO 9001)

Overview

ISO 9001:2000 - Quality Management Systems – Requirements specifies the requirements for a QMS where an organization needs to demonstrate its ability to consistently provide products that meet customer and applicable regulatory requirements. A QMS also assists organizations in enhancing customer satisfaction. In the context of a water utility, customers require a product (eg. water) with characteristics that satisfy their needs and expectations. Needs and appropriate specifications (eg. drinking water quality legislation, regulation and guidelines) would be collectively referred to as "customer requirements" within a QMS.

The QMS approach encourages organizations to analyze customer requirements, define the processes that contribute to the provision of a product that meets the specified requirements, and to control these processes. A QMS can provide the framework for continual improvement to enhance the satisfaction of customers and other interested parties (Figure 1).

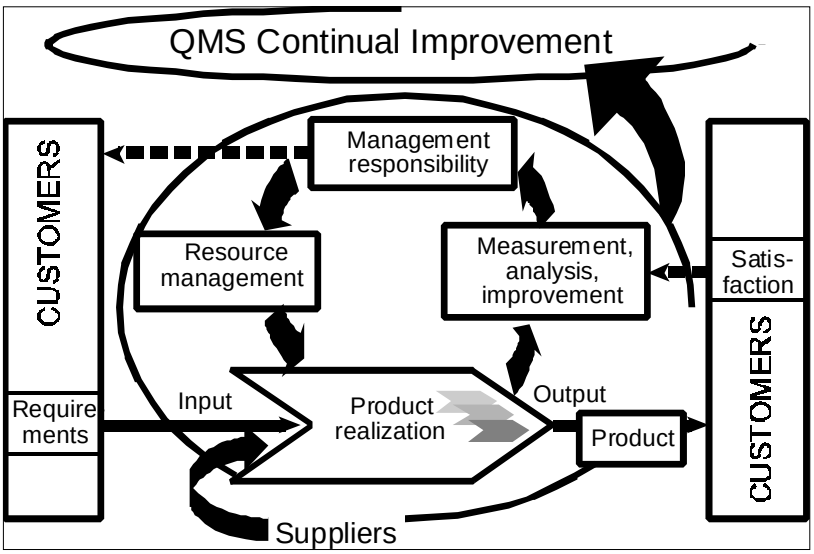

Figure 1 – QMS Continual Improvement

The ISO 9001 standard has been developed to assist organizations, of all types and sizes, to implement and operate effective QMSs. The standard was revised in 2000 to ensure that it continues to represent international best practice in quality management. The fact that approximately 350,000 organizations worldwide have been certified to ISO 9000 standards is evidence of its international acceptance.

Development Time

The use of ISO 9001 would not present any time constraints to Ontario, as it is an existing international standard adopted by the SCC.

Development Costs

There would be no additional cost to Ontario from a standards development perspective in using ISO 9001 as a QMS framework.

Accreditation and Conformity Assessment

The SCC has an established accreditation program for QMSs in Canada. This program is guided by SCC's procedural document - *CAN-P10B Criteria for Accreditation of Organizations Registering Quality Systems.* There are currently 15 organizations that are accredited by the SCC to assess the conformance of quality systems to ISO 9001 in Canada.

Highlights – Option 1

Strengths

- Demonstrated international acceptance and experience in use
- Third-party certification standard

Challenges

- Not specific to the needs of water utilities
- Not Ontario specific

- Established Canadian accreditation and conformity assessment system in place
- No additional time or costs associated with development of a standard

OPTION 2 - New International Standard (ISO)

Overview

France recently submitted a proposal to establish a new ISO technical committee to address issues related to quality management and drinking water/sewerage. The French proposal is entitled: *Standardization of service activities relating to drinking water supply and sewerage – Quality criteria of the service and performance indicators*. Proposed technical committee objectives include:

- Facilitating dialogue between users and authorities responsible for the water supply and sewerage system services;
- Specifying good practice rules for improving management of water resources;
- Defining objective quality assessment criteria and performance indicators; and
- Facilitating the monitoring of progress at a facility level and benchmarking among different water services.

In accordance with the above objectives, the French proposal identifies the following as potential future standards:

- Guidelines for the management of a drinking water supply system, including all operations required to meet user needs (eg. water resources management, production, transport, storage, distribution, maintenance and development); and
- Guidelines for the management of a wastewater or rainwater sewerage system, including all operations required to meet the needs of users and protect the environment.

The development of a third party QMS certification standard specific to the needs of water utilities is not a part of the current French proposal.

Development Time

The ISO standards development process takes a minimum of 36 months to complete. This assumes, as a starting point, that a formal proposal for a new standard has been prepared under an established technical committee. The French proposal, however, is one step earlier in the process as it proposes the establishment of a new technical committee. It is projected that an additional 4 to 6 months would be added to the overall development process given the status of this proposal.

Development Costs

Participation in the development of new international standards through the ISO process could occur at relatively low cost to Ontario. These costs would include support to individuals attending international meetings to promote and negotiate Canadian positions.

Accreditation and Conformity Assessment

Accreditation and conformity assessment issues are not applicable in this case as the French proposal does not currently include third party QMS certification standards for water utilities.

Highlights – Option 2

Strengths

- International acceptance
- Limited cost to Ontario stakeholders

Challenges

- Development time (40 months +)
- Proposal to develop "quality criteria" rather than third party QMS certification standard for water utilities
- Not Ontario specific

OPTION 3 - New National Standard (CSA/SCC)

Overview

This option would develop a new, consensus-based national QMS standard that builds upon the elements of ISO 9001 while specifically addressing requirements for water utilities. The development of the standard would be managed by CSA, with the SCC approving it as a National Standard of Canada upon completion of the CSA process.

CSA's primary expertise is in facilitating and managing the *process* of voluntary, consensus-based standards development as part of the NSS. CSA project managers work to ensure the efficient and effective operation of technical committees throughout the standards development process and to ensure that CSA's Policy, Directives and Guidelines governing standardization are followed.

The *technical content* of CSA standards are developed and approved by a broad group of affected parties or their representatives on an approved technical committee. These volunteer committees are comprised of representatives of groups such as producers, government, consumers, academics, non-governmental organizations and others affected by the product or service covered by the standard.

CSA standards are borne out of an identified market need by a recognized project proponent or champion. CSA works in partnership with the project proponent on the development of a proposal and engages in discussions regarding project scoping and funding. An appropriate CSA Steering Committee, responsible for overseeing program

areas, is responsible for reviewing the proposal and providing input/authorization for the development of the new standard.

The CSA standards development process is an inclusive and dynamic process that is governed by the principles of consensus and balance. From a technical standpoint, it is critical to note that the standard would be clearly scoped out by the project proponent and CSA in recognition of existing knowledge and guidance on the subject matter. CSA would then work in partnership with the committee Chair and project proponent to identify key stakeholders and organizations to invite to the technical committee thereby ensuring the development of a technically sound standard acceptable to the marketplace. The development of a national standard would require a technical committee representative of national expertise and interests.

Development Time

The development and publication of a national standard is typically between 18 to 24 months. The most important factor affecting the time associated with CSA's standards development process is the maturity of the seed document and the ability to build consensus around it. If the process begins with a mature seed document that is technically sound and generally acceptable to stakeholders, the process can be expedited.

A brief review of documentation provided to Part II of the Walkerton Inquiry indicates that QMS frameworks for water utilities exist (eg. CH2M HILL Canada Limited and Diamond Management Institute, "A Total Quality Water Management System for Ontario: The Model Water Utility"; NHMRC, "The Draft Australian Framework"). If support existed to standardize the above frameworks, the process could be expedited.

It should be noted that there is an option to publish a "preliminary" standard under CSA's directives and guidelines. Preliminary standards are published to provide a set of proposed requirements as the basis of further investigations and to obtain broader input prior to finalizing requirements. In essence, a preliminary standard provides a portion of the complete set of requirements to users as the outstanding requirements are being developed and negotiated by the technical committee. Given a mature seed document, a preliminary standard might be published in less than 1 year.

The time required to develop a national standard is dependent on several factors, some outside of CSA's control:

- Number and timing of technical committee meetings required to reach consensus;
- Design and implementation of the public review program; and
- Need for a pilot study stage within the standards development process.

Development Costs

Costs associated with the development of a national standard are typically between $200,000 to $400,000. This cost includes CSA project management labour and

expenses (eg. meetings, member travel support, subcontractors, etc.). Actual costs will also depend on issues such as:

- Seed Document: Costs associated with obtaining rights/payment for use of an existing document versus subcontracting the development of a new document;
- Funding support for participants: Support for a broad or narrow range of participants;
- Extensiveness of the public review program; and
- Requirement for a pilot study.

Accreditation and Conformity Assessment

A national QMS standard for water utilities could be designed such that organizations could receive third party certification to the requirements of the standard. An accreditation program for a new national standard could build upon the existing SCC quality systems program and be formalized with minimal effort and cost.

Highlights – Option 3

Strengths

- National acceptance
- Specific to the needs of water utilities
- Able to develop third-party certification standard
- Able to build upon existing SCC ISO 9000 accreditation/conformity assessment framework

Challenges

- Development time (18 to 24 months)
- Not Ontario specific (eg. national technical committee)
- Higher costs than international standards options

OPTION 4 - New Ontario-based CSA Standard

Overview

This option would involve the development of a new consensus-based CSA standard for Ontario that builds upon the elements of ISO 9001, while specifically addressing requirements for water utilities. The development of the standard would be managed by CSA.

The standards development process outlined under Option 3 above would also apply to the development of an Ontario-based CSA standard. Technical committee members for this option would, however, be comprised of key stakeholders and organizations from Ontario only. This would ensure a standards solution specific to the needs of Ontario. It would also put Ontario in a favourable strategic position if, at a later date, it were decided to progress to a national standard of Canada. In progressing the standard to a national level, the Ontario standard would be used as a seed document with a new technical committee comprised of national expertise and interests (Figure 2).

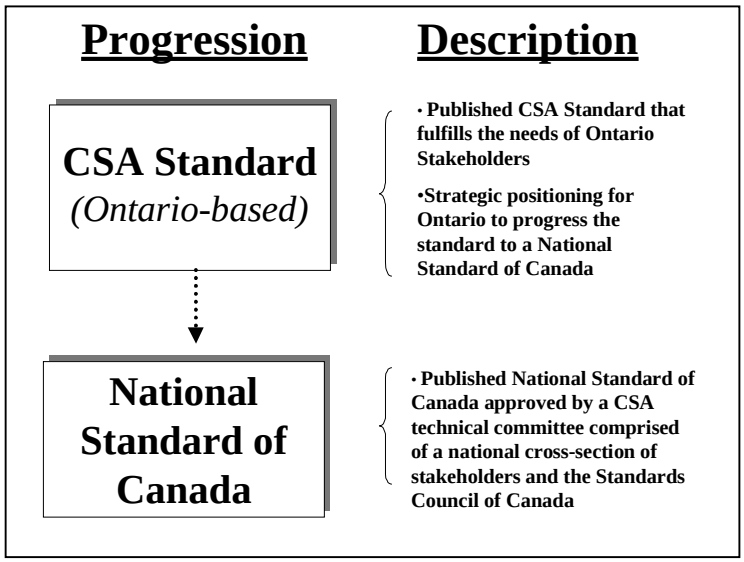

Figure 2 – Ontario-based CSA Standard → National Standard

Development Time

The development and publication of an Ontario-based CSA standard would likely take less time than a national standard. While the standards development process would remain the same, CSA could achieve efficiencies in managing a provincial, as opposed to national, committee. As such, it is estimated that the development and publication of an Ontario-based CSA standard may take 12 to18 months.

As with Option 3, the process could be expedited given the introduction of a mature and well-accepted seed document. The option to publish a preliminary standard, with the technical committee continuing to negotiate the final document, would also be applicable to this option.

Development Costs

The cost to develop an Ontario-based CSA standard would be similar to those estimated for a national standard (see Option 3 – Development Costs).

Accreditation and Conformity Assessment

An Ontario-based CSA standard could be designed such that organizations could receive third party certification to the requirements of the standard. An accreditation program for a new Ontario standard could be managed by a provincial ministry or authority, perhaps building upon the existing SCC quality systems program.

Highlights – Option 4

Strengths

- Ontario specific
- Specific to the needs of water utilities
- Development time (12-18 months)
- Ability to develop third-party certification standard

Challenges

- Higher cost than international standards option
- SCC only establishes accreditation programs for national standards of Canada, therefore an alternate (eg. Provincial) program will be necessary

OPTION 5 - Existing Industry Standards (AWWA/WEF-QualServe)

Overview

QualServe, developed by the American Water Works Association (AWWA) and Water Environment Federation (WEF), is a voluntary quality improvement program designed specifically for water and wastewater utilities. It is a self-assessment and/or peer review program, based on a series of consensus "best practices" in each of the business process areas of utility operations and services. Figure 3 illustrates how the QualServe program works.

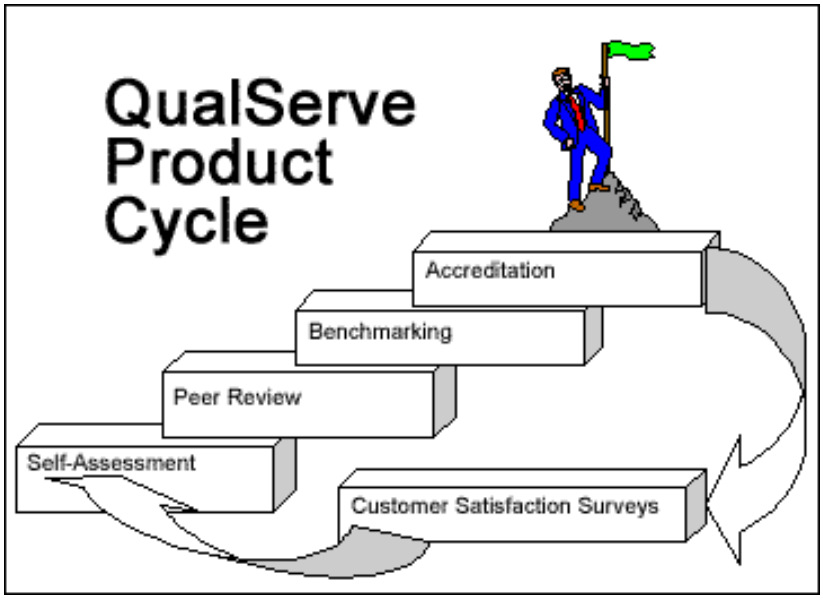

Figure 3 – Qualserve Product Cycle

Development Time

As the QualServe program is in existence, its implementation in Ontario would not incur additional developmental time.

Development Costs

There would be no standards development costs associated with this option.

Accreditation and Conformity Assessment

The QualServe program presently operates as a second party (ie. peer review) conformity assessment program. As a result, a weakness of the program is that peer reviewers are sometimes reluctant to point out issues and non-conformances during audits. The AWWA and WEF are currently approaching conformity assessment bodies interested in providing third-party services to the QualServe program.

Highlights – Option 5

Strengths	Challenges
• Specific to the needs of water utilities • No additional time or costs associated with standards development	• Not Ontario specific • Second party conformity (ie. peer review) assessment program

OPTION 6 - New Information Product (CSA)

Overview

CSA information products are non-consensus documents. Accordingly, CSA could develop and publish a non-consensus document outlining or specifying the application of a QMS approach to water utilities. Generally, draft CSA information products are vetted by a group of key stakeholders.

CSA develops information products where there is a need to provide information or guidance on a particular standards-related issue. A CSA information product could be a manual or guide to implementing the requirements of a particular standard. It could also include requirements similar to that of a standard, but developed outside of the consensus process.

Similar to the consensus-based standards development options presented above (Options 3 and 4), the CH2M HILL Canada Ltd. And Diamond Management Institute's "Model Water Utility" and/or the NHMRC's "Draft Australian Framework" may be used as framework approaches for such a document.

While this option may have perceived advantages in terms of control and timeliness, the ensuing document would not be as credible as a consensus document, nor would the development of a national accreditation program under the SCC be possible.

Development Time

A CSA information product can typically be developed and published within a 6 to 12 month timeframe.

Development Costs

The cost of a CSA information product typically ranges from between $10,000 to $50,000. Costs include CSA project management labour and expenses, including costs associated with subcontracting document development or the purchase of an existing document.

Accreditation and Conformity Assessment

In theory, an organization could certify conformance with a CSA information product. While a province may wish to consider developing an accreditation program for such a product, the SCC only develops accreditation programs for national, consensus-based standards.

Highlights – Option 6

Strengths

- Ontario specific
- Specific to the needs of water utilities
- Most favourable development timeframe (6-12 months)
- Low cost

Challenges

- Non-consensus document may lead to credibility issues if used as basis for certification
- SCC only establishes accreditation programs for national standards of Canada, therefore an alternate (eg. Provincial) program will be necessary

Conclusions

A range of options for the development of a QMS standard for water utilities was presented in this brief report (Tables 1 and 2). The preferred standards development option will depend on which drivers are considered the most important in the decision-making process; for example:

- Scope (eg. international, national, provincial, industry);
- Credibility (eg. consensus, non-consensus);
- Accreditation/conformity assessment program (eg. provincial, national, industry);
- Developmental time; and/or
- Standards development costs.

Option 1 (Existing International Standard – ISO 9001) would provide a timely, cost-effective and internationally accepted QMS response; it will not, however, be Ontario- or water utility-specific.

Option 2 (New International Standard - ISO) may provide a cost effective, internationally accepted QMS response specific to water utilities; it will not, however, be Ontario-specific or a third-party certification standard. In addition, this option has not yet been approved by ISO and would typically require a minimum development time of 36 months.

Option 3 (New National Standard) would provide a national response specific to the needs of water utilities and build on the existing QMS accreditation/conformity assessment framework in Canada. It would not, however, be Ontario-specific and would be more expensive than an international standard. This option could be completed in a shorter timeframe than an international standard and could be expedited given a mature seed document.

Option 4 (New Ontario-based CSA Standard) would provide an Ontario-specific, third-party certification standard specific to the needs of water utilities. This option could be completed more quickly than a national standard, but would require the development of an accreditation system.

Option 5 (Existing Industry Standard) could provide an existing QMS response specific to the needs of water utilities in a cost-effective manner; however, it is not Ontario-specific nor does it include requirements for third-party auditing and certification (ie. QualServe).

Option 6 (New Information Product) could provide a timely, cost-effective Ontario-based response specific to the needs of water utilities. A national accreditation system would not be possible under this option, while a provincial system, including resulting third-party certifications, may lack credibility as the document would be non-consensus in nature.

Table 1 – Summary of Standards Development Options

Option		Standards Development			Accreditation and Conformity Assessment Framework
		Description	*Time*[1]	*Cost*[2]	
1	**Existing International Standard** *ISO 9001 – Quality Management Systems – Requirements*	The ISO 9001 standard is an internationally accepted Quality Management System (QMS) standard. It specifies requirements for a QMS where an organization needs to demonstrate its ability to provide products that meet customer requirements and applicable regulatory compliance.	Na	Na	The Standards Council of Canada (SCC) has an existing accreditation program for ISO 9001 registrars.
2	**New International Standard**	A proposal to develop a new international technical committee and standards related to quality and water utilities was recently submitted to ISO by France.	36 months+	Low	Not proposed as a third-party certification standard.
3	**New National Standard**	A new national QMS standard developed by consensus that builds upon the elements of ISO 9001 while specifying requirements for water utilities.	18-24 months[3]	Medium	An accreditation program for registrars would be developed based on SCC's existing ISO 9001 program.
4	**New Ontario Standard**	A new Ontario-based QMS standard developed by consensus that builds upon the elements of ISO 9001 while specifying requirements for water utilities.	12-18 months[4]	Medium	An accreditation program for a new Ontario standard could be managed by a provincial authority building on the existing SCC quality systems program.
5	**Existing Industry Standards** *AWWA/WEF – Qualserve*	QualServe is a self-assessment and peer review quality program designed specifically for water and wastewater utilities.	Na	Na	The QualServe program is a 2nd party or "peer review" program.
6	**New Information Product**	A new non-consensus information product that builds upon the elements of ISO 9001 while specifying requirements for water utilities.	6-12 months	Low	An accreditation program for a information product is not common, but could be developed by Ontario. No national program would be possible.

Notes:
1. Includes time to develop the proposed option (not time associated with implementation by organizations).
2. Relative cost to develop standard as compared to other options.
3. Timing is approximate and will depend on the maturity of the seed document and level of consensus within the technical committee.
4. See Note 3.

Table 2 – Comparison of Existing Management Frameworks

(Source: Australian Framework for Management of Drinking Water Quality)

Framework for Management of Drinking Water Quality	ADWG	ISO 9001[2] (1994)	ISO 14001 (1996)	HACCP	AS/NZS 4360:1999 Risk Management	Partnership for Safe Water
Commitment to Drinking Water Quality Management	+	+++	+++	+	+++	+++
Drinking Water Quality Policy		+++	+++		+++	+
Requirements	++	+	+++	+++		+
Partnership Agencies						
Assessment of the Drinking Water Supply System	++		++	+++	+	+++
Water Supply System Analysis	+++		++	+++		+
Review of Water Quality Data	+++					+++
Hazard Identification and Risk Assessment	++		++	+++	+++	+
Planning – Preventive Strategies for Drinking Water Quality Management	+	+++	+++	+++	+++	+++
Multiple Barriers	+++					+++
Critical Control Points				+++		+
Implementation – Operational Procedures and Process Control	++	+++	+++	+++	+	+++
Operational Procedures	+	++	++	+++		++
Equipment Capability		++		++		+++
Materials and Chemicals	++	++		++		++
Operational Monitoring	+++	++	+++	+++	+	+++
Operational Preventive and Corrective Action	++	+++	+++	+++		+++
Verification of Drinking Water Quality	+++	+++	+++	+++	+++	
Drinking Water Quality Monitoring	+++	+++	+++	+++	+++	
Consumer Satisfaction	+++	+	+	+		
Short-term Evaluation of Results		+	+	++	++	
Corrective Action	++	+++	+++	+++		

Framework for Management of Drinking Water Quality	ADWG	ISO 9001[2] (1994)	ISO 14001 (1996)	HACCP	AS/NZS 4360:1999 Risk Management	Partnership for Safe Water
Incident and Emergency Response	++	+	+++	+		+
Communication	+		+++			
Incident and Emergency Response Protocols	++	+	+++	+		
Employee Awareness and Training	++	+++	+++			+++
Employee Awareness and Involvement			+++			+++
Employee Training	++	+++	+++			+++
Community Involvement and Awareness	+++	+	+		+	
Community Consultation	+++				+++	
Communication	+++	+	+++		+++	
Research and Development	+	+				+++
Investigative Studies and Research Monitoring	+++					+++
Validation of Processes		+++		+++		+
Design of Equipment		+++		+++		+++
Documentation and Reporting	+++	+++	+++	+++	+++	+
Documentation and Records Management	+	+++	+++	+++	+++	+
Reporting	+++	+	++	+	+++	+
Evaluation and Audit	+++	+++	+++	+++	+++	+++
Long-term Evaluation of Results	+++	+	+	+	+	+++
Drinking Water Quality Management Audit	++	+++	+++	+++	+++	+++
Review and Continual Improvement	++	+++	+++		+++	+++
Senior Executive Review	++	+++	+++		+	
Drinking Water Quality Improvement Plan						

1. Table reproduced from NHMRC/ARMCANZ Co-ordinating Group, Framework for Management of Drinking Water Quality: A Preventative Strategy from Catchment to Consumer (2001)
2. ISO 9001:1994 has been modified with the newly released ISO 9001:2000. The Framework for Management of Drinking Water Quality was developed considering ISO 9001:1994.

+++ Aspect explicitly stated and covered
++ Aspect mentioned; not covered in any detail
+ Aspect not explicitly stated but could be interpreted to include