

TERMS OF REFERENCE

FOR AN

**ENGINEERING ASSESSMENT
OF A PUBLIC WATER SYSTEM
(First Round and Re-Assessments)**

**Prepared by: Office of Drinking Water
Date Revised: 01 October 2018**

**TERMS OF REFERENCE
FOR AN ENGINEERING ASSESSMENT OF A PUBLIC WATER SYSTEM
Date Revised: 01 October 2018**

1.0 DEFINITIONS

The following definitions apply throughout this document:

Assessment – means the process of completing a first round or re-assessment of a Public Water System to fulfil the requirement for an “Assessment of Water System Infrastructure and Water Supply Sources” referenced in Section 9 of The Drinking Water Safety Act.

AWWA – means the “American Water Works Association” and its associated Standards, Manuals, White Papers and Policies.

DWO – means the regional “Drinking Water Officer” with regulatory responsibility for the Public Water System.

The DWSA – means The Drinking Water Safety Act assented to August 9, 2002, and as amended from time-to-time.

Engineer – means a Professional Engineer as defined in The Engineering and Geoscientific Professions Act and who:

(a) is competent by virtue of training, and experience in engineering relating to drinking water supplies, to engage in practices that fulfil the requirements of these Terms of Reference, and

(b) is not an employee of the Owner of the Public Water System being assessed, and

(c) has been engaged by the Owner of the Public Water System to complete an Assessment of a Public Water System in accordance with these Terms of Reference to assess the condition of the System and its ability to meet provincial standards and industry best practices, and to provide recommendations on infrastructure-related upgrades required to improve the safety and reliability of the System.

GCDWQ – means the latest version of the Guidelines for Canadian Drinking Water Quality.

GUDI – means a groundwater supply that due to its location, construction or condition is vulnerable to microbial contamination by surface water or run-off and has been deemed to be “groundwater under the direct influence of surface water” as per Section 2 of the Drinking Water Safety Regulation.

ODW – means the “Office of Drinking Water”.

Owner – means the Owner of the Public Water System and includes Operators.

PWS – means a “Public Water System”.

Report – means the written report submitted to fulfil the requirement for an Assessment and the deliverable product of these Terms of Reference.

Satellite system – means a public water system that receives water from another public water system and that does not have a water treatment plant but does have a reservoir or pumphouse.

System – means the Public Water System for which the Assessment is being conducted.

Ten State Standards – means the latest version of the “Recommended Standards for Water Works” as issued by the ‘Great Lakes-Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers’.

2.0 OBJECTIVES

These Terms of Reference have been prepared in support of Section 9, Assessments of Water System Infrastructure and Water Supply Sources, of The DWSA for first round assessments and re-assessments of PWSs. As required by Section 37 of the Drinking Water Safety Regulation, the first assessment of a PWS, with the exception of very small systems with distribution piping only, must be completed by a Professional Engineer authorized to practice in the Province of Manitoba. As required by Section 37 of the Drinking Water Safety Regulation or through Subsection 9(2) of The DWSA, a re-assessment of a large or higher risk PWS must also be completed by a Professional Engineer authorized to practice in the Province of Manitoba. The DWSA established a PWS assessment frequency of five years.

The Assessment involves a source-to-tap review of the safety and reliability of a PWS to determine whether its source, facilities and equipment are effective in producing safe drinking water and in meeting the regulations in force under The DWSA. The assessment process is designed to identify water system deficiencies and limitations, and provide Owners with recommendations on addressing these deficiencies and limitations.

The Owner has been notified of their assessment deadline. If unexpected or uncontrollable delays will result in the Report being submitted more than three months late, an extension can be requested from the ODW Approvals Unit. The request must include the reason(s) an extension is required and the anticipated date the Report will be submitted. Where major upgrading is planned, the Owner should contact the Approvals Unit to discuss scheduling the Assessment. Options include having the Assessment completed as part of pre-design work, or after six months to a year of operation to allow evaluation of the new works.

For regional water systems where a central system provides treated water to several satellite or distribution systems with different Owners, the ODW strongly encourages Owners to collaborate on the Assessment and the production of a single, combined Report. Similarly, if an Owner has several licensed PWSs relying on the same water source with similar treatment systems, a single Report can be prepared. For combined Assessments and Reports, the Owners and Engineer must ensure that the condition and capabilities of each licensed system are assessed as per these Terms of Reference. Assessment deadlines will likely vary for the individual systems and should be considered in planning Assessment activities.

3.0 GENERAL REQUIREMENTS

The Assessment and the Report must be completed under the supervision of an Engineer. Assessment work may, at the discretion of the Engineer, be performed by subordinate staff with sufficient training and experience; however, the Engineer must review and seal the Report. (Note: in subsequent Sections, reference to the “Engineer” shall mean the Professional Engineer in overall charge of the Report or delegated staff as discussed above and appropriate to the context of the reference.)

In performing the Assessment, the Engineer should try, as much as possible, to obtain water system records and information from the Owner. Owners are required under their Operating Licence to maintain copies of key water system records. The Owner can contact the DWO for assistance in collecting certain water system records where required (i.e. bacterial summaries).

Sustainable Development

The level of effort for the Assessment and level of detail of the Report should reflect water system size, complexity and potential risks. The focus of the Assessment should be on the design, condition and capabilities of the key water system components. A detailed review of operation and maintenance practices is not required except where these practices are having a direct and significant bearing on treated water quality or compliance (i.e. turbidity issues due to inadequate backwashing). The DWO conducts regular reviews of system operation.

Relevant Terms of Reference topics must be addressed given a water system's infrastructure. For example, if the System receives treated water and simply rechlorinates and redistributes, only regulatory requirements and industry best practices applicable to secondary disinfection and distribution systems, and only the components under their responsibility need to be assessed. ***For re-assessments, much of the System description and background information should be available from the last assessment report.*** If information is not available for a required topic, the Engineer must note this. The Owner or Engineer can contact the ODW Approvals Unit at any time for advice or clarification.

The Engineer is expected to conduct the following steps as part of the Assessment and summarize the results of these efforts in the Report. The Engineer should state the findings as briefly and succinctly as possible. Extensive explanation of process theory is not required. Point form notes and tables should be used whenever possible. Data should be in metric (SI) units.

3.1 Records Review

The Owner is expected to provide the Engineer with key water system records including:

- Current Operating Licence.
- Annual Audits issued by the DWO for the last three years.
- Inspection letters issued by the DWO over the last three years.
- Bacterial summaries for the last three years (available from the DWO by Owner request).
- Laboratory chemical water quality analysis reports over the last five years.
- Compliance Plan and ODW response, if applicable.
- Most recent assessment report, ODW response and Action Plan, if available.
- Most recent PWS Annual Report for systems serving 1000 or more persons.
- Applicable water system design reports or studies.
- Current water system drawings, treatment schematics and distribution system maps.
- Well construction reports (well logs) for water supply wells.
- Operation and Maintenance (O&M) manuals for key water system components.
- Water use records for the last three years.

3.2 Interview with the Owner

The Engineer must interview the Owner. The Engineer should focus on clarifying any uncertainties about water system design and operation, clarifying compliance issues, and identifying Owner concerns with the condition, design and operation of the System. The Engineer should ask about any plans for major changes, upgrades or expansion that need to be considered in assessing the safety, capacity and reliability of the System.

Sustainable Development

For re-assessments, the Engineer should also focus on gathering information to assist in determining the requirements for a site inspection; including whether any major changes, upgrades or expansions have occurred since the last assessment, whether there have been significant source water or treated water quality changes, and whether any significant deterioration in the physical condition, reliability or ability to meet demands has taken place.

3.3 Interview with the DWO

The Engineer must interview the DWO. The Engineer should discuss concerns raised in the Annual Audits and inspections, and on identifying outstanding action items which constitute potential risks to the safety and reliability of the System.

3.4 Site Inspection

For the first assessment, an on-site inspection is typically required. The exception may be a distribution-only system where minimal infrastructure is available for visual inspection. (i.e. hydrants, flush-outs, valves.) For re-assessments, an on-site inspection is optional. In deciding whether to perform an on-site inspection, the Engineer should consider:

- The size and complexity of the System.
- The completeness of the information available for the System.
- The ability to understand the System, its condition and deficiencies from available information with sufficient confidence to seal and sign the Report.
- The extent of infrastructure changes or deterioration which may have taken place since the last assessment and the degree to which those changes may have affected the ability of the System to produce or distribute safe water.

During an inspection, digital photographs should be taken of key components and included in the Report to supplement discussions of system operation and deficiencies. Preparing an inspection checklist may be helpful. Resources include: Office of Drinking Water assessment checklists, the CCME “From Source-to-Tap” technical guidance manual, and US EPA Sanitary Survey and Total Coliform Rule Assessment guidance manuals.

4.0 REPORT CONTENTS

In general, the Report must include the following sections:

1. Water System Description
 2. Review of Key Water System Records
 - 1) Operating Licence Standards
 - 2) Previous Assessment and Status of Follow-up Actions (if applicable)
 - 3) Annual Audits and Inspections and Status of Follow-up Actions
 - 4) Other Studies or Reports and Status of Follow-up Actions
 - 5) Water Quality Data
 3. Owner and DWO Concerns
 4. Site Inspection Findings (if applicable)
 5. Ability to Meet Regulatory Requirements
 6. Ability to Meet Industry Best Practices
 7. Ability to Meet Demands
 8. Recommended Upgrades and Actions
 9. Opinion of Probable Cost (optional)
- Appendices

The following items do not have to be included in the Assessment and the Report:

- Detailed review of laboratory bacterial analysis reports, monthly disinfection and turbidity monitoring reports, and other routine operational records (reviews are completed by the DWO for the Annual Audits and Inspections).
- Review of Emergency Response Plans.
- Review of facility classification and operator certification requirements.
- Review of Water Rights, Environment Act, or other regulatory licences.

A sample Table of Contents, along with explanatory notes, is provided to identify the expected format and topics for the Assessment and the Report. The Engineer is asked to follow this sample Table of Contents as closely as possible.

5.0 PREPARATION AND SUBMISSION OF THE REPORT

The Owner is responsible for ensuring that the Assessment is performed and that a copy of the Report is submitted to the ODW. The Engineer should provide a draft version of the Report to the Owner for review as per their instructions. Once the Report has been finalized and accepted by the Owner, the following steps shall be taken by the Owner and the Engineer:

- The Owner and the Engineer each complete their section of the Submission Form (*last page of this document*).
- The Owner submits one (1) paper copy of the Report and the Submission Form, and an electronic copy (Adobe Acrobat pdf) of the Report on a storage device (i.e. USB drive or CD), or by email (if file size allows) to their DWO, or
- Approvals Unit, Office of Drinking Water, 1007 Century Street, Winnipeg MB R3H 0W4
- Kim.Barlishen@gov.mb.ca



Sustainable Development

6.0 FOLLOW-UP ACTIONS

The Owner should develop and implement a prioritized plan for addressing the Report recommendations to improve the safety and reliability of their water system. Major alterations require ODW approval (i.e. a Permit). The ODW can be contacted by the Owner or the Engineer to discuss upgrading plans. Submission of a formal Action Plan to the ODW is not required; however, the ODW may require an update from the Owner on actions taken to address recommendations or may assess the status of follow-up actions during inspections.

SAMPLE TABLE OF CONTENTS

1.0 WATER SYSTEM DESCRIPTION

1.1 GENERAL SYSTEM CHARACTERISTICS

Summarize **basic water system characteristics** including:

- Name of water system, location and basic flow diagram/ schematic.
- Year system began operating.
- Type of source (groundwater, potential GUDI, GUDI, surface water), name of source if applicable (i.e. Lake Winnipeg, Winkler Aquifer).
- Operating season.
- Population served, for seasonal systems provide average and peak day populations.
- Total number of service connections and types of connections (i.e. residential, commercial, industrial, institutional, cottage, RV, standpipes, central washroom).
- Current average day demand (ADD), maximum day demand (MDD), peak hourly flow and per capita/ site water use (if meter records are not available, industry water consumption and peaking factors should be applied).
- Whether the system is operating under a long-term advisory and the type of advisory (i.e. Boil Water Advisory or Water Quality Advisory).

1.2 WATER SOURCE

For a **groundwater/ GUDI supply** provide: number and general location of the wells relative to the water treatment plant; a summary of well construction details for each well (diameter, casing depth, soil overburden); whether the source has been deemed to be GUDI or potentially GUDI by the ODW; any obvious sources of contamination within 100m of the wells (i.e. septic fields, agricultural operations).

For a **surface water supply** describe: the intake location and design, general use of the source near the intake, any known sources of contamination within 300m of the intake (i.e. wastewater discharges, agricultural operations).

For **all water sources** describe: how water is transferred to the water treatment plant, raw water pumping capacity, raw water pipeline (length, type, diameter and pressure rating), source water protection measures (i.e. fencing, sealed well cap).

For a **satellite or distribution-only system** provide: the name of the PWS that supplies the treated water, the location and description of the connection.

1.3 WATER TREATMENT SYSTEM

Provide a schematic of water treatment processes showing unit processes, valves, sampling taps, chemical injection points and on-line instruments, and briefly describe process flow. Provide the design capacity as a flow rate and as a percentage of current MDD, and the number of hours per day the treatment system operates.

Describe overall treatment objectives including design-related process guarantees or goals if available (i.e. what was the treatment system designed to address).

For **each major unit process**, provide the purpose/ target parameter(s), level of redundancy, key design and operating parameters:

- Rapid mix: type (i.e. in-line mixer); basin volume and retention time (if applicable).
- Flocculation: number of stages, whether mixing speeds are adjustable; basin volume and retention time.
- Clarification: flow orientation (i.e. upflow); basin volume and retention time; settling enhancements (i.e. plate or tube settlers, sludge blanket).

Sustainable Development

- Media filter: type (i.e. pressure, slow sand, rapid multi-media), media types, filtration rate, backwash rate, backwash control and set-points (i.e. manual, timed, pressure, NTU), backwash frequency, source of backwash water, filter-to-waste control and set-points (i.e. manual, timed, NTU).
- GAC adsorption filter: type of GAC, date GAC last replaced, empty bed contact time, backwash control and set-points (i.e. manual, timed, pressure), backwash frequency, source of backwash water.
- Cartridge filter: micron rating (μm nominal or absolute), capacity, set-point/ trigger for change-out, change-out frequency.
- Membrane: type (MF, UF, NF, RO), model, rated capacity, flux rate, removal rate(s) for target parameter(s), rated pathogen log removal (%); recovery rate (%); type, frequency and response for direct integrity testing, if applicable; if blending, blending rate or ratio (i.e. 80% RO, 20% greensand bypass); type and frequency of cleaning including cleaning chemicals and ability to clean separate stages/ modules.
- Air stripper: type (i.e. packed tower), air-to-water ratio, rated capacity, off-gas venting.
- Ion exchange: type of resin (i.e. strong base anion), rated capacity, regenerant, regeneration frequency.
- Chemical feed: name of chemical, target dose in mg/L, pump control (manual, flow-paced, feedback), trigger for changing feed rate, trigger for initiating feed if intermittent, alarm set-points for on-line analyzers.
- Ultraviolet light (UV) disinfection unit: model, configuration, rated capacity, minimum dose and UVT to claim inactivation credit, method of monitoring and set-points (UV intensity, calculated dose), confirmation of NSF 55A or USEPA UVDGM validation.

List other key instruments with their location and use (ex: on-line analyzers, flow meters, level sensors, pressure sensors). List bench-scale or portable water quality test kits (type/model, parameters measured).

Describe process piping (type and pressure rating). Briefly describe the methods of domestic, process and drain wastewater management for water system buildings.

1.4 TREATED WATER STORAGE (including satellite reservoirs)

Describe treated water storage components including: reservoir/ tank material; location; total volume; effective volume (at normal low operating level); level control provisions; flow configuration, if multiple tanks/ cells; degree of baffling; access or inspection provisions (i.e. curbed hatch); appurtenances (i.e. screened vent, screened overflow, drain, intercell piping); provisions to isolate; whether fire protection storage is provided.

Estimate water residence times under ADD and peak hourly flow rates (with and without fire flow, if applicable). Note storage volume as a function of ADD (%).

For underground reservoirs or tanks, indicate whether any non-potable piping passes above or through the reservoir or tanks, and containment provisions.

1.5 DISTRIBUTION

Describe distribution pumping components including: type and location of distribution and standby pumps, total and firm pumping capacities, pump control, and distribution pressure setting. For fuel-driven pumps, note fuel type and spill containment measures if located above a reservoir.

Sustainable Development

Indicate normal pressure ranges within the distribution system.

Describe any bulk fill (i.e. truck fill, pail fill) connected to the system. Identify the means of backflow prevention.

Summarize general distribution network characteristics including: water loss (%) if available, general types and sizes of watermains, relative locations of water and sewer mains, general locations of isolation valves and hydrants/ flush-outs, extent of looping versus dead ends, degree of water metering, presence of high hazard connections where backflow should be assessed (i.e. livestock operations, wastewater facilities), and estimated percentage or number of lead service lines.

Identify any other special installations such as underground valve chambers or automatic air/ vacuum release valves noting flood protection and drainage provisions.

If system includes satellite reservoirs or pumping stations, describe these components as noted above for treated water storage and distribution pumping.

1.6 OPERATION AND CONTROL

Describe the control system including: methods of process and equipment control, level of automation, major/critical alarms, and alarm enunciation method.

Note whether up-to-date water system drawings, records and manuals are maintained.

Note any standby power generation equipment along with its location, ability to run all or some of the equipment, and fuel containment if located above a reservoir.

Describe any bypass that could allow untreated or partially treated water to enter the distribution system. Identify any piping cross connections within the water treatment plant and the method of backflow prevention.

Briefly describe how annual O&M costs and capital upgrades are funded.

2.0 REVIEW OF WATER SYSTEM RECORDS

Review of water system records should focus on identifying infrastructure, process, treatment or equipment related deficiencies as opposed to comments on basic operational tasks, such as submitting samples that are addressed in ODW Annual Audits and Inspections.

2.1 OPERATING LICENCE STANDARDS

Summarize water treatment standards and any associated on-line monitoring requirements. Summarize the status of the Compliance Plan, if applicable, with consideration to any feedback received from the ODW.

2.2 PREVIOUS ASSESSMENT AND FOLLOW-UP ACTIONS

Summarize the major findings and recommendations of the last assessment with consideration to any feedback from the ODW, and actions taken, or still required, to address these findings and recommendations.

2.3 ANNUAL AUDITS AND INSPECTIONS

Summarize comments from the Annual Audits and Inspection letters issued by the ODW where an outstanding deficiency or compliance concern was identified along with the status of any required or recommended follow-up actions.

Sustainable Development

2.4 OTHER STUDIES OR REPORTS

Summarize findings on infrastructure, process or equipment deficiencies, or upgrading options from other relevant studies or reports such as feasibility studies, pre-design reports, pilot projects, GUDI assessments, bacterial investigations or network analysis studies. Include the status of any required or recommended follow-up actions.

2.5 WATER QUALITY DATA

Provide tables summarizing general chemistry and site-specific analysis reports for the raw water, if applicable, and the treated water. Note any exceedances of provincial standards, exceedances of any other Maximum Acceptable Concentration (MAC) from the GCDWQ, and exceedances of any aesthetic objective (AO) from the GCDWQ. A separate table may be required for trihalomethanes (THMs) or other disinfection by-products, if applicable, due to sampling frequency and locations. (Note: additional water quality sampling and analysis should not be required.)

For **surface water sources**, summarize raw water and filtered water turbidity ranges and seasonal trends.

Note water quality conditions that are affecting, or could affect, treatment processes, process control or compliance (i.e. seasonal turbidity spikes, high organic content, patterns or trends in bacterial positives, elevated ammonia and its impacts on chlorination, corrosivity and its impacts on lead levels).

Evaluate the ability of the treatment system to address water quality issues and to be operated to meet design objectives/ goals.

3.0 OWNER AND DWO CONCERNS

Summarize any concerns identified during the interviews with the Owner and the DWO. Describe any major changes, upgrades or expansions since the last assessment (if applicable) and any planned for the System over the next five years. Describe any major incidents or emergencies over the last five years including boil water advisories.

4.0 SITE INSPECTION FINDINGS

Summarize visual observations of the general condition of key water system buildings and equipment. Identify deficiencies which could compromise water safety or quality. (Note: a structural condition survey and detailed mechanical/ electrical system surveys are not required.) Note any piping cross connections in water supply, treatment, storage and distribution pumping systems where backflow could occur and lead to contamination.

5.0 ABILITY TO MEET REGULATORY REQUIREMENTS

5.1 DISINFECTION REQUIREMENTS

Provide **contact time calculations** where a chemical disinfectant is used for primary disinfection to confirm compliance with contact time requirements for the System. Use calculation procedures and tables from the ODW Filtration and Disinfection Log Reduction Credits guideline. Provide justification for peak hourly flow, effective volume and baffling factor assumptions. Consider the location of inlets and outlets including distribution pump intakes in selecting a baffling factor.

Identify any deficiencies in process design or operation that compromise the ability to provide this contact time at all times (i.e.: raw water bypass present, reservoir cell bypassed during cleaning).

Sustainable Development

5.2 LOG REDUCTION CREDITS

For **all water sources** where a chemical disinfectant is used for primary disinfection, complete CT calculations to determine log inactivation for viruses.

For **surface water and GUDI sources**, determine filtration credits and/ or complete CT calculations or UV dosage comparisons to determine log removal and log inactivation credits for Cryptosporidium and Giardia.

Use CT calculation procedures and tables from the ODW Filtration and Disinfection Log Reduction Credits guideline. Note any deficiencies in process design or operation that compromise the ability to claim full credits (i.e. regular unresolved UV alarms, no filter-to-waste, not consistently meeting turbidity standards, not reporting as per continuous monitoring requirements, not conducting and reporting daily direct integrity testing of MF/UF membranes).

5.3 TURBIDITY STANDARDS (if applicable)

Discuss any compliance issues related to meeting turbidity standards identified in the Operating Licence including whether an appropriate filtration system is in place. Identify any deficiencies in filtration design or operation that compromise the ability to meet these standards on a continuous basis (i.e. lack of continuous monitoring or alarm provisions, inadequate control limits for backwashing or filter-to-waste).

5.4 CHEMICAL STANDARDS (if applicable)

Discuss any compliance issues related to meeting chemical water quality standards identified in the Operating Licence or through the water quality data review, and identify whether an adequate treatment barrier is in place. If a treatment barrier is in place, identify any deficiencies in design or operation that compromise the ability to meet these standards (i.e. arsenic not oxidized ahead of membrane). Where a THM or HAA issue is identified, note water quality or system characteristics affecting control (i.e. high organic content, lengthy residence times). Discuss compliance with any other applicable disinfection by-product standards (i.e. chlorite, chlorate, bromate, NDMA). If algal blooms are an issue for the source water, discuss any available microcystin (i.e. cyanobacterial toxin) monitoring results and assess the general capabilities of the treatment process to remove algae and their toxins. Evaluate the effectiveness of any corrosion control measures or lead control programs.

6.0 ABILITY TO MEET INDUSTRY BEST PRACTICES

6.1 DESIGN AND OPERATION

Identify significant deviations in the design and operation of the water supply, treatment, storage, distribution and control systems from accepted industry practice (i.e. Ten State Standards, Ontario Design Guidelines for Drinking-Water Systems). For example: critical treatment process not sized to meet MDD with one unit out of service; reservoir overflow not screened; reservoir hatch not watertight; untreated bypass; filtration rate higher than recommended; drain/ overflow connection to sewer; inadequate water-sewer main separation. Focus on major deviations which could lead to detrimental effects on supply reliability, a treatment process or treated water quality.

Sustainable Development

6.2 CROSS CONNECTION CONTROL

Discuss the adequacy of backflow prevention within water supply, treatment, storage and distribution systems focusing on any back-up water supplies, treatment system bypasses, bulk fill stations, water-sourced heat exchange systems, chemical feed and backwash connections at the treatment plant, and the potential for unprotected connections at high hazard connections in the distribution system.

6.3 AESTHETIC OBJECTIVES

Discuss the ability to meet aesthetic water quality guidelines. Note if treatment via point-of-use or point-of-entry devices is common (i.e. softeners).

6.4 OTHER INDUSTRY BEST PRACTICES

Discuss observations of any other design provisions or operational procedures that vary from industry best practice such as lack of 24/7 alarm system, no UVT meter, filter-to-waste timed as opposed to automatic based on turbidity, GAC media not regularly replaced, lack of standard operating procedures, no instrument calibration schedule, backflow prevention assemblies not regularly tested, or no leak detection program.

7.0 ABILITY TO MEET DEMANDS

7.1 CAPACITY

Evaluate the ability of water supply, treatment, storage, pumping and distribution components to meet existing demands. Identify any physical or capacity limitations that may affect anticipated growth or expansion of the system over the next five years.

7.2 RELIABILITY

Evaluate the ability of water supply, treatment, storage, pumping and distribution components to reliably produce and distribute safe drinking water through a discussion of physical condition as well as system redundancy, back-up equipment, control and alarm limitations.

8.0 RECOMMENDED UPGRADES AND ACTIONS

Provide a prioritized list/ table of infrastructure, process, treatment or equipment related deficiencies and specific recommendations or options for addressing each deficiency.

Provide a prioritized list/ table of any other major deficiencies observed during the assessment and recommended actions to address these deficiencies, for example, lack of system drawings, no reserve fund for watermain replacement or inadequate sampling.

Where process optimization is recommended, provide advice on optimization strategies (i.e. increasing coagulant dosages, lowering pH, adjusting backwash rates).

9.0 OPINION OF PROBABLE COST (not required)

If major capital upgrades are recommended, the Owner may ask the Engineer to prepare a preliminary, broad-scope (order-of-magnitude) opinion of the probable cost of the upgrades.

APPENDICES

(as applicable) (copies of originals)

APPENDIX A -

PROCESS SCHEMATIC

APPENDIX B -

INSPECTION PHOTOS

APPENDIX C -

OPERATING LICENCE

APPENDIX D -

ASSESSMENT ACTION PLAN AND RESPONSE

APPENDIX E -

COMPLIANCE PLAN AND RESPONSE

APPENDIX F -

MOST RECENT ANNUAL AUDIT/ DWO INSPECTION LETTER