

# 1. Introduction

The City of Winnipeg (City) water system consists of a raw water intake and pumping station located at Shoal Lake on the Manitoba / Ontario border; an estimated 136 km long aqueduct that conveys water from Shoal Lake to four raw water reservoirs; a water treatment plant consisting of a raw water pumping station, dissolved air flotation clarification, ozonation, biologically activated carbon filtration, residuals treatment, chemical feed and storage, a clearwell, a booster pumping station, ultraviolet (UV) disinfection, fluoride addition, and orthophosphate addition for corrosion control; two branch aqueducts feeding three treated water reservoirs (Wilkes, MacLean and McPhillips); and three booster pumping stations that deliver water through a vast array of underground piping.

The City's raw water supply is being treated to meet provincial standards under conditions laid out in the water system Operating Licence. These include the *Manitoba Drinking Water Safety Act* (C.C.S.M. c. D101), the *Drinking Water Safety Regulation* (M.R. 40/2007), and the *Drinking Water Quality Standards Regulation* (DWQSR) (M.R. 41/2007). While provincial regulations regarding water quality supersede federal regulations, the *Guidelines for Canadian Drinking Water Quality* (GCDWQ) also dictate various water quality standards under the DWQSR. Of particular importance is the requirement to have less than one detectable Total Coliform (TC) and *Escherichia coli* (*E.coli*, EC) per 100 mL of treated water.

Water samples collected from City's water distribution system on January 26, 2015 showed a highly unusual pattern of detection for TC and EC. Of the 42 samples collected, 6 were positive for TC, and of these 6, 5 were positive for EC. HPC (heterotrophic plate counts) counts (a general indicator of microbial water quality) and free chlorine residuals (also an indicator bacterial water quality) were normal, as were other water quality and system operations parameters. The Medical Officer of Health for the Winnipeg Regional Health Authority (WRHA) issued a precautionary boil water advisory, which was lifted after two days of repeat upstream/downstream samples produced normal results (no TC/EC positive results, and continued normal levels of turbidity, free chlorine residuals, and HPC). The ODW followed on February 3, 2015 with an order, in accordance with The Drinking Water Safety Act, to: "...carry out an investigation of the water system which shall be completed in accordance with the U S Environmental Protection Agency's Revised Total Coliform Rule Assessments and Corrective Actions Guidance Manual (USEPA RTCR) (September 2014) ... adapted as necessary to accommodate the regulatory regime in Manitoba." This Guidance Manual (GM) states that the assessment should include a review of:

- Samples, sampling sites and sampling procedures in the area near positive sample(s);
- Operational data and water quality data;
- Operational activities and unusual activities;
- Distribution system components (e.g., pipes, valves, pumps, etc.);
- Storage facilities;
- Treatment facilities; and
- Source water,

and further that:

*"...the assessment form must describe sanitary defects detected, corrective actions completed, and a proposed timetable for any corrective actions not completed. If no sanitary defects were identified, systems may also note in their form that no sanitary defects were identified."*

ODW directed that the assessment be completed by a qualified professional engineer registered to practice in Manitoba with assistance from City staff. ODW further confirmed on February 4, 2015 that a Level 2 assessment under the GM was to be performed. ODW also requested that EC events from May, 2014 and October 2013 be included in the assessment.

The City engaged AECOM Canada Ltd. (AECOM) with the task of leading this assessment. Mr. Steve Hubbs, PE, was retained under a sub-contract with AECOM to direct and write the assessment report.

One of the first steps in the assessment was to prioritize facilities for evaluation by analyzing likely scenarios for the cause of the January 2015 event, noting that this event was the most recent and conditions affecting the event were readily available. City staff compiled records on water quality, water sampling locations, water system facilities, and water system operations and maintenance data and provided them to AECOM. These data were reviewed, and a preliminary report was generated. A site visit was scheduled February 24-27, 2015 during which the sampling procedure, laboratory analytical procedure, and several key utility facilities were observed. Results of the site visit were summarized and presented to City staff on February 27, 2015 at which time various scenarios were further developed to systematically evaluate all data and information pertinent to the event. City staff provided computer simulations of typical distribution system hydraulic patterns, and produced graphical illustrations of major facilities and maintenance work activities.

Based on the scenarios developed at the February 27, 2015 meeting with City staff, facilities were identified that would be evaluated in the assessment, according to the format provided in the GM. These facilities included:

- All sampling stations;
- Air relief valve pits near sample locations positive for TC and subject to flooding;
- Four high-risk potential cross connection locations with backflow preventers near the positive sites;
- Facilities near the positive sites that were subject to field maintenance in the two weeks prior to January 26, 2015; and
- Any other facilities that were considered possibly associated with the January 26, 2015 event, including the laboratory.

Records and facility evaluations collected in this assessment are found in the Appendices. This assessment report is structured as a systematic evaluation of the likely causative scenarios, based on observations, data analysis, and records provided by City staff and independent reports. In addition to the TC samples found positive on January 26, 2015, positive samples reported for TC and EC on May 26, 2014 and October 7, 2013 were also included in this assessment and analyzed using the same structured approach.