2015 Annual Report

Hudson Drinking Water System

Prepared by:

NORTHERN WATERWORKS INC.

INTRODUCTION

This consolidated Annual Report (the Report) has been prepared in accordance with both section 11 (Annual Reports) and Schedule 22 (Summary Reports for Municipalities) of Ontario Regulation 170/03 (Drinking Water Systems Regulation). This Report is intended to inform both the public and the municipal council on the operation of the system over the previous calendar year (January 1 to December 31, 2015).

Section 11 of O. Reg. 170/03 requires the development and adequate dissemination to the public of an annual report summarizing water quality monitoring results, adverse water quality incidents, system expenses, and chemicals used in the water treatment process.

Schedule 22 of O. Reg. 170/03 requires the development and dissemination to municipal council of an annual report summarizing incidents of regulatory non-compliance and associated corrective actions, in addition to providing flow monitoring results for the purpose of enabling the owner to assess the capability of the system to meet existing and planned demand.

Report Availability

In accordance with section 11 of O. Reg. 170/03 this Report must be given, without charge, to every person who requests a copy. Effective steps must also be taken to advise users of water from the system that copies of the report are available, without charge, and of how a copy may be obtained. This Annual Report shall be made available for inspection by the public at the following locations:

(1) Municipal Office, Customer Service Desk, Sioux Lookout
(2) Lost Lake Seniors Drop-In Centre, Hudson
(3) Municipal Website (www.siouxlookout.ca)
(4) NWI Website (www.nwi.ca/publications)

In accordance with Schedule 22 of O. Reg. 170/03, this Annual Report must be given to the members of municipal council. Section 19 (Standard of care, municipal drinking-water system) of Ontario's *Safe Drinking Water Act* also places certain responsibilities upon those municipal officials who oversee an accredited operating authority or exercise decision-making authority over a system. The examination of this Report is one of the methods by which municipal officials may fulfil the obligations required by section 19 of O. Reg. 170/03.

System users and members of municipal council are strongly encouraged to contact a representative of Northern Waterworks Incorporated (NWI) for assistance in interpreting this Report. Questions and comments may be directed to the local NWI Supervisor or by email to compliance@nwi.ca.

SYSTEM OVERVIEW

The Hudson Drinking Water System (DWS No. 220005385) must meet extensive treatment and testing requirements to ensure that human health is protected. The operation and maintenance of the system is governed by Ontario's *Safe Drinking Water Act* and the regulations therein, in addition to requirements within system-specific approvals.

System Description

The Hudson Drinking Water System (DWS) is classified as a large municipal residential system, and it is composed of the Low Lift Pumping Station (LLPS), the Hudson Water Treatment Plant (WTP), and the Hudson distribution system. The system is owned by the Corporation of the Municipality of Sioux Lookout and is operated and maintained by Northern Waterworks Incorporated. Potential pathogenic organisms are removed and inactivated by chemical coagulation, flocculation, clarification, rapid sand filtration, and primary disinfection by UV irradiation.

Raw water flows by gravity from the intake structure located in Lost Lake to an underground wet well located at the LLPS. Pumps transfer water from the wet well directly to the treatment units at the WTP through a transmission line. At the Hudson WTP, polyaluminum chloride (coagulant) is injected and rapidly mixed into the raw water immediately upstream from the package treatment units. Coagulated water then enters two treatment units each including a three-chambered flocculation basin, a clarifier and filter. Water is gently mixed as it passes through the flocculation basins in order to promote floc formation. The optional application of polymer (flocculant) at this stage of treatment is intended to form larger floc aggregates. Process water then enters the clarifier, where its velocity is reduced to allow for the separation and settling of floc. Supernatant overflows into the clarifier effluent launders and is directed to the filter; settled floc (sludge) is automatically removed from the bottom of the clarifier.

Any suspended particles that did not settle in the clarifier are removed by passing water through a dual media filter (composed of anthracite and silica sand on a layer of support gravel). The filters are periodically cleaned by using an air scour to agitate the entire media bed and reversing the flow of water through the filter using dedicated pumps. Sodium metabisulfite is used as required to dechlorinate the treated water that is used clean the filters.

As filtrate is directed to the treated water storage reservoir, it is passed through one of two available UV reactors for disinfection. A super-chlorinated solution (secondary disinfection – gas chlorine) and sodium hydroxide (pH adjustment) are also applied to the filtrate. Disinfected water is then held in the reservoir and transferred to the Hudson distribution system by the use of pumps located at the WTP.

The Hudson distribution system was installed exclusively in 1990 and includes approximately 6 km of water mains, 46 water main gate valves, and 7 hydrants. Watermain materials consist of HDPE and PVC, ranging in size from 50 to 150 mm in diameter. Secondary disinfection requirements in the distribution system are achieved by the maintenance of a free chlorine residual.

Water Treatment Chemicals

In accordance with section 11 of O. Reg. 170/03, this Report must include a list of all water treatment chemicals used by the system during the period covered by the report (**Table 1**). All chemicals used in the treatment process are NSF/ANSI 60 certified for use in potable water, as required by system approvals. The Hudson Drinking Water System did not require the use of polymer as a flocculant or sodium metabisulfite as a dechlorinating agent during the reporting period.

Table 1: Water treatment chemicals used in 2015.

Treatment Chemical	Application
polyaluminum chloride	coagulant
chlorine gas	secondary disinfectant
sodium hydroxide	pH and alkalinity adjustment

System Expenses

In accordance with section 11 of O. Reg. 170/03, this Report must describe any major expenses incurred during the reporting period to install, repair or replace required equipment. This Report also summarizes those expenses related to strengthening equipment inventories and to maintenance activities undertaken by subcontracted service providers. Major expenses incurred in 2015 include:

- installation of a free residual chlorine (trim chlorination) and pH analyzer, including the purchase of spare sensors and components;
- purchase of a new fire flow test kit;
- replacement of chemical feed system flow switches, back pressure and pressure relief valves;
- replacement of suspended unit heaters at the LLPS; and,
- calibration verification of flow measuring devices.

WATER QUALITY

In accordance with section 11 of O.Reg. 170/03, this Report must summarize the results of water quality tests required by regulations, approvals, and orders. The following sections use technical water quality terms, some of which the reader may not be familiar with. It is recommended that the reader refer to the *Technical Support Document for Ontario Drinking Water Standards, Objectives, and Guidelines*. Within this document the reader will find information on provincial water quality standards, objectives and guidelines, rationale for monitoring, and a brief description of water quality parameters. This document can be found at the following website address: https://www.ontario.ca/document/technical-support-document-ontario-drinking-water-standards-objectives-and-guidelines

Operational Parameters

In accordance with Schedule 7 (Operational checks) of O. Reg. 170/03, regulated operational parameters that must be monitored include raw water turbidity, filtrate turbidity, and the free chlorine residual associated with samples collected from the water distribution system. The Hudson DWS employs a comprehensive monitoring program that extends beyond these regulated operational parameters to include additional tests conducted on source, process and treated water samples. **Table 2** summarizes water quality results for regulated and selected unregulated operational parameters. In accordance with Schedule 6 (Operational checks, sampling and testing – general) of O. Reg. 170/03, certain operational parameters are continuously monitored.

Table 2: Results summary for operational parameters.

Parameter[1] (Location)	Sample Method[2] (Minimum Frequency)	Units	Minimum Monthly Average	Maximum Monthly Average	Annual Average
Turbidity (Raw Water)	Grab (Twice-weekly)	NTU	0.56	1.90	1.25
Turbidity (Filter 1)	Continuous	NTU	0.021	0.041	0.033
Turbidity (Filter 2)	Continuous	NTU	0.013	0.038	0.026
Turbidity (Treated)	Continuous	NTU	0.20	0.30	0.25
pH (Treated)	Grab (Twice-weekly)	---	7.45	7.76	7.60
FRC (Treated)	Continuous	mg/L	0.99	1.30	1.16
FRC (Distribution)	Grab (Daily)	mg/L	0.80	1.01	0.91

1. FRC = free residual chlorine.
2. For continuously monitored parameters, all results are derived from daily instantaneous readings of continuous monitoring equipment. Grab samples are also collected and tested in order to verify the accuracy of monitoring equipment for all continuously monitored parameters.

Conventional Filtration Performance

In accordance with the *Procedure for Disinfection of Drinking Water in Ontario*, conventional filtration facilities must meet certain performance criteria in order to claim removal credits for *Cryptosporidium* oocysts. In addition to continuously monitoring filtrate turbidity and other requirements, filtrate turbidity must be less than or equal to 0.3 NTU in at least 95% of the measurements each month. **Table 3** summarizes filtrate turbidity compliance against the <0.3 NTU/95% performance criterion. Minimum and maximum values in the table correspond to the proportion of time that filtered water turbidity was less than or equal to 0.3 NTU in a calendar month in 2015.

Table 3: Conventional filtration performance.

Filter	Monthly Min.[1]	Monthly Max.
Filter 1	99.88%	100%
Filter 2	100%	100%
Combined	99.94%	100%

1. The monthly minimum value for Filter 1 and Combined filtrate occurred in March 2015.

Microbiological Parameters

Microbiological analyses are performed on source, treated, and distribution system water. A total of 260 routine water samples were collected for microbiological analysis by an accredited laboratory in 2015, as required by Schedule 10 (Microbiological sampling and testing) of O. Reg. 170/03. These water samples were collected on a weekly basis, and included tests for E. coli (EC), total coliforms (TC), and heterotrophic plate counts (HPC). Results from both routine and non-routine microbiological analyses are provided in **Table 4**. All results were below the associated Ontario Drinking Water Quality Standards.

Table 4: Microbiological sampling results.

Sample Type	# of EC/TC Samples	EC Results Range[1] (MPN/100mL)	TC Results Range[1] (MPN/100mL)	# of HPC Samples	HPC Results Range (CFU/mL)
Raw Water	52	<1 to 16	<1 to 93	---	---
Treated Water	52	absent	absent	52	0 to 252
Distribution	156	absent	absent	60	0 to 1
Distribution (Non-routine)	4	absent	absent	---	---

1. The Ontario Drinking Water Quality Standard for E. Coli and Total Coliforms in a treated or distribution sample is 'not detectable'. The presence of either parameter in a treated or distribution sample is considered an exceedance.

Trihalomethanes

Trihalomethanes (THMs) are required to be sampled on a quarterly basis from a distribution system location that is likely to have an elevated potential for THM formation, in accordance with Schedule 13 (Chemical sampling and testing) of O. Reg. 170/03. Compliance with the provincial standard for trihalomethane concentrations is determined by calculating a running annual average (with a Maximum Acceptable Concentration of 0.100 mg/L or 100 µg/L). In 2015, the running annual average for the Hudson DWS was 63.5 µg/L. Total THM results are summarized in **Table 5**.

Table 5: Total trihalomethane sampling results.

2015 Total THM Results (µg/L)				Annual Average Total THM Results (µg/L)						
Feb. 17	May 12	Aug. 18	Nov. 17	2015	2014	2013	2012	2011	2010	2009
44.5	45.2	96.7	67.4	63.5	78.8	71.0	66.7	71.6	58.5	59.9

Nitrate and Nitrite

Treated water is tested for nitrate and nitrite concentrations on a quarterly basis in accordance with Schedule 13 (Chemical sampling and testing) of O. Reg. 170/03. Nitrate and nitrite results are provided in **Table 6**. All results were below the associated Ontario Drinking Water Quality Standards.

Table 6: Nitrate and nitrite results.

Sample Date (2015)	Nitrate Result (mg/L)	Nitrite Result (mg/L)	Nitrate + Nitrite (mg/L)
Feb. 17	0.039	<0.010	<0.040
May 12	<0.020	<0.010	<0.040
Aug. 18	<0.020	<0.010	<0.040
Nov. 17	0.036	<0.010	<0.040
ODWQS	10	1	10

Environmental Discharge Sampling

The Municipal Drinking Water Licence for the Hudson DWS requires additional sampling related to environmental discharges. Specifically, samples must be collected on a quarterly basis from settling tank effluent and analyzed for the parameter total suspended solids (TSS). This effluent is discharged to a disbursement field which has been designed for the management of residues produced during the normal operation of the WTP. Environmental discharge sampling results are provided in **Table 7**.

Table 7: Environmental discharge sampling results.[1]

Sample Date (2015)	TSS Result (mg/L)
Feb. 25	131
May 26	244
Nov. 17	2.8

1. No sample was collected during the third quarter of 2015. Refer to the *Compliance* section of this Report.

Lead Sampling

The Hudson DWS was required to develop and implement a Corrosion Control Plan based upon initial lead sampling results in 2008 and 2009, in accordance with Schedule 15.1 (Lead) of O. Reg. 170/03. The chosen corrosion control measure involved increasing and maintaining treated water pH at 7.5 +/- 0.2 units. To verify the effectiveness of corrosion control measures, sampling for lead under the standard schedule continued in 2010, 2011, and 2012. Lead results from this sampling program indicated that the increase in pH was effective at controlling lead release in household plumbing, and the Hudson DWS subsequently qualified for reduced sampling based upon the favourable results. The Hudson DWS continues to operate at the target pH, and sampling from plumbing locations under the reduced schedule will resume in 2016. **Table 8** summarizes the results of community lead sampling and related required tests that were conducted on distribution samples in 2015. All results were below the associated Ontario Drinking Water Quality Standard (ODWQS – 10 µg/L).

Table 8: Distribution lead sampling results.

Sample Date (2015)	Sample Location	pH	Alkalinity (mg/L as $CaCO_3$)	Lead Result (µg/L)
March 19	Hydrant, 21 Second Street	7.37	50	<1.0
March 19	Hydrant, Bernier Crescent	7.40	50	<1.0
October 5	Hydrant, 21 Second Street	7.43	37.7	<1.0
October 5	Hydrant, Bernier Crescent	7.38	38.1	<1.0

Inorganic Parameters

With the exception of the parameters sodium and fluoride, inorganic parameters are sampled on an annual basis in treated water in accordance with Schedules 13 (Chemical sampling and testing) and 23 (Inorganic parameters) of O. Reg. 170/03. Sodium and fluoride are sampled every five (5) years in treated water in accordance with Schedules 13 and 23 of O. Reg. 170/03. The most recent inorganic parameter sampling results are provided in **Table 9**. All results were below the associated Ontario Drinking Water Quality Standards.

Table 9: Inorganic sampling results.

Parameter	Sample Date	Units	Result	ODWQS
Antimony	February 17, 2015	µg/L	<0.60	6
Arsenic	February 17, 2015	µg/L	<1.0	25
Barium	February 17, 2015	µg/L	<10	1000
Boron	February 17, 2015	µg/L	<50	5000
Cadmium	February 17, 2015	µg/L	<0.10	5
Chromium	February 17, 2015	µg/L	<1.0	50
Fluoride	February 17, 2015	mg/L	<0.020	1.5
Mercury	February 17, 2015	µg/L	<0.10	1
Selenium	February 17, 2015	µg/L	<1.0	10
Sodium	February 17, 2015	mg/L	6.87	20[1]
Uranium	February 17, 2015	µg/L	<2.0	20

1. This value for the parameter sodium is not a water quality standard as prescribed in O. Reg. 169/03, although an exceedance of this value is associated with reporting requirements and corrective actions.

Organic Parameters

Organic parameters are sampled on an annual basis in treated water in accordance with Schedules 13 (Chemical sampling and testing) and 24 (Organic parameters) of O. Reg. 170/03. These parameters include various acids, pesticides, herbicides, PCBs, volatile organics, and other organic chemicals. Organic parameter sampling results are provided in **Table 10**. Sampling for the majority of organic parameters was conducted on February 17, 2015, with additional sampling occurring on February 25, 2015 and March 10, 2015. All results were below the associated Ontario Drinking Water Quality Standards.

Table 10: Organic parameter sampling results.

Parameter	Result (µg/L)	ODWQS (µg/L)	Parameter	Result (µg/L)	ODWQS (µg/L)
Alachlor	<0.10	5	Diquat	<1.0	70
Aldicarb	<1.0	9	Diuron	<1.0	150
Aldrin + Dieldrin	<0.040	0.7	Glyphosate	<5.0	280
Atrazine + N-dealkylated metabolites	<0.20	5	Heptachlor + Heptachlor Epoxide	<0.20	3
Azinphos-methyl	<0.10	20	Lindane	<0.10	4
Bendiocarb	<0.20	40	Malathion	<0.10	190
Benzene	<0.50	5	Methoxychlor	<0.10	900
Benzo(a)pyrene	<0.010	0.01	Metolachlor	<0.10	50
Bromoxynil[2]	<0.20	5	Metribuzin	<0.10	80
Carbaryl	<0.20	90	Monochlorobenzene	<0.50	80
Carbofuran	<0.20	90	Paraquat	<1.0	10
Carbon Tetrachloride	<0.50	5	Parathion	<0.10	50
Chlordane (Total)	<0.30	7	Pentachlorophenol[1]	<0.50	60
Chlorpyrifos	<0.10	90	Phorate	<0.10	2
Cyanazine	<0.10	10	Picloram[2]	<0.20	190
Diazinon	<0.10	20	Polychlorinated Biphenyls (PCBs)	<0.035	3
Dicamba[2]	<0.20	120	Prometryne	<0.10	1
1,2-Dichlorobenzene	<0.50	200	Simazine	<0.10	10
1,4-Dichlorobenzene	<0.50	5	Temephos	<0.10	280
DDT + metabolites	<0.40	30	Terbufos	<0.20	1
1,2-Dichloroethane	<0.50	5	Tetrachloroethylene	<0.50	30
1,1-Dichloroethylene	<0.50	14	2,3,4,6-Tetrachlorophenol[1]	<0.50	100
Dichloromethane	<5.0	50	Triallate	<0.10	230
2,4 -Dichlorophenol[1]	<0.30	900	Trichloroethylene	<0.50	5
2,4-Dichlorophenoxy acetic acid[2]	<0.20	100	2,4,6-Trichlorophenol[1]	<0.50	5
Diclofop-methyl	<0.20	9	2,4,5-Trichlorophenoxy acetic acid[2]	<0.20	280
Dimethoate	<0.10	20	Trifluralin	<0.10	45
Dinoseb[2]	<0.20	10	Vinyl Chloride	<0.20	2

1. Sampling for these organic parameters was conducted on February 25, 2015.
2. Sampling for these organic parameters was conducted on March 10, 2015.

FLOW MONITORING

In accordance with Schedule 22 (Summary Reports for Municipalities) of O. Reg. 170/03, this Annual Report must include certain information for the purpose of enabling the owner to assess the capability of the system to meet existing and planned uses. Specifically, this Report must include a summary of the quantities and flow rates of the water supplied during the report period, including monthly average and maximum daily flows. The Report must also include a comparison of flow monitoring results to the rated capacity and flow rates approved in the system's Municipal Drinking Water Licence.

Throughout the reporting period, the Hudson DWS operated within its rated capacity and supplied a total 22,501 m^3 of treated water. On an average day in 2015, 61.6 m^3 (61,600 L) of treated water was supplied to the community. The average daily flow in 2015 represents 8.5 % of the rated capacity of the Hudson WTP (726 m^3/day). The maximum daily flow in 2015 was 157.0 m^3/day, which represents 21.6 % of the rated capacity. 2015 flow monitoring results are summarized in **Table 11** and **Figure 1**.

Table 11: 2015 total volumes, daily flows, and capacity assessments.

Month	Total Volumes (m^3)		Daily Flows (m^3/day)		Capacity Assessments[1]	
	Raw Water	Treated Water	Average - Treated Water	Maximum - Treated Water	Average - Treated Water	Maximum - Treated Water
Jan	3,506	2,851	92.0	139.6	12.7%	19.2%
Feb	2,735	2,164	77.3	110.5	10.6%	15.2%
Mar	2,777	2,108	68.0	117.6	9.4%	16.2%
Apr	2,434	1,750	58.3	78.2	8.0%	10.8%
May	2,657	2,083	67.2	126.7	9.3%	17.5%
Jun	2,541	1,970	65.7	87.2	9.0%	12.0%
Jul	2,355	1,814	58.5	86.6	8.1%	11.9%
Aug	2,352	1,801	58.1	85.8	8.0%	11.8%
Sep	2,170	1,662	55.4	157.0	7.6%	21.6%
Oct	1,914	1,374	44.3	52.6	6.1%	7.2%
Nov	1,873	1,355	45.2	56.0	6.2%	7.7%
Dec	2,007	1,570	50.6	67.0	7.0%	9.2%
Total	29,321	22,501	---	---	---	---
Avg.	2,443	1,875	61.6	---	8.5%	---

1. Capacity assessments compare average and maximum daily treated water flows to the rated capacity of the water treatment facility (726 m^3/day), as provided within the Municipal Drinking Water Licence for the Hudson DWS.

Figure 1: 2015 average and maximum daily treated water flows.

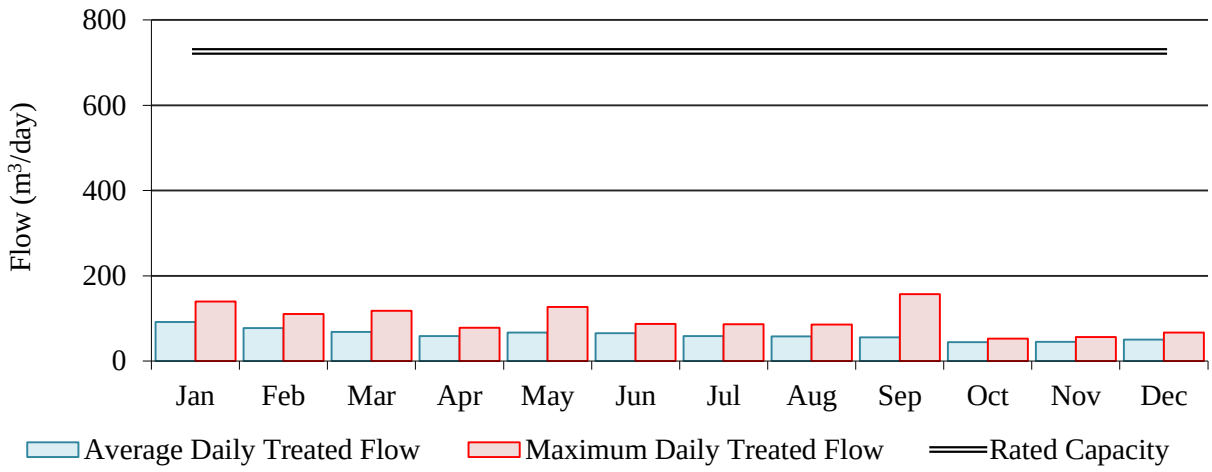

Table 12 summarizes recent historical flow monitoring results for the Hudson DWS. There were slight decreases in the amounts of source water withdrawn and treated water supplied in 2015 when compared to 2014. Total annual volumes of treated water supplied in the near future may be expected to be between 20,000 m^3 and 40,000 m^3, which represents approximately 7.5% to 15% of the rated capacity of the Hudson WTP.

Table 12: Recent historical flow monitoring results.

Year	Total Volumes (m^3)		Daily Flows (m^3/day)		Annual % Change	
	Raw Water	Treated Water	Average – Treated Water	Maximum – Treated Water	Raw Water	Treated Water
2007	---	34,663	95.0	---	---	---
2008	---	35,385	96.7	---	---	+2.1%
2009	---	36,333	99.5	---	---	+2.7%
2010	42,965	37,485	102.7	---	---	+3.2%
2011	52,922	45,980	126.0	238.1	+23.2%	+22.7%
2012	33,668	25,760	70.4	236.0	-36.4%	-44.0%
2013	28,380	20,642	56.6	135.9	-15.7%	-19.9%
2014	32,466	24,077	66.0	201.8	+14.4%	+16.6%
2015	29,321	22,501	61.6	157.0	-9.7%	-6.5%

COMPLIANCE

Northern Waterworks Incorporated and the Municipality of Sioux Lookout employ an operational strategy that is committed to achieving the following goals:

1) Providing a safe and reliable supply of drinking water to the community of Hudson;
2) Meeting or exceeding all applicable legislative and regulatory requirements;
3) Maintaining and continually improving the operation and maintenance of the system; and,
4) Maintaining and operating the Hudson Drinking Water System in a responsible manner in accordance with documented quality management system policies and procedures.

The following sections will summarize incidents regulatory noncompliance and adverse water quality that occurred during the reporting period. NWI is committed to employing timely and effective corrective actions to prevent recurrence of all identified incidents of adverse water quality and noncompliance.

Regulatory Noncompliance

In accordance with Schedule 22 (Summary Reports for Municipalities) of O. Reg. 170/03, this Report must list any requirements of the *Act*, the regulations, the system's approval, drinking water works permit, municipal drinking water licence, and any orders applicable to the system that were not met at any time during the period covered by the report (i.e. an incident of regulatory noncompliance). Additionally, this Report must specify the duration of the failure and the measures that were taken to correct the failure.

No incidents of regulatory noncompliance were identified during the most recent inspection by Ontario's Ministry of the Environment and Climate Change (MOECC) initiated on June 15, 2015. However, the system failed to collect an environmental discharge sample in the third quarter of 2015, in accordance with conditions in the Municipal Drinking Water Licence. Sampling resumed in the fourth quarter, and a reminder system was implemented to prevent incident recurrence. The system also failed to follow the reduced lead sampling schedule in accordance with Schedule 15.1 (Lead) of O. Reg. 170/03. Reduced lead sampling will be conducted in 2016, and the results will be used to determine future lead sampling requirements.

Adverse Water Quality Incidents

In accordance with section 11 (Annual Reports) of O. Reg. 170/03, this Report must summarize any reports made to the Ministry under subsection 18(1) (Duty to report adverse test results) of *the Act* or section 16-4 (Duty to report other observations) of Schedule 16 of O. Reg. 170/03. Additionally, this Report must describe any corrective actions taken under Schedule 17 of O. Reg. 170/03 during the period covered by the report.

There were no adverse water quality incidents during the report period for the Hudson DWS.