

# Annual Report

*For the 2016 Operating Year*

## Lucknow Drinking Water System 2016 Operation and Maintenance Annual Report

***PREPARED BY***

Veolia Water  
100 Cove Road  
Goderich, Ontario  
N7A 3Z2

***TO***

Township of Huron-Kinloss  
Box 130  
21 Queen Street  
Ripley, Ontario, N0G 2R0

## Table of Contents

- 1.0 INTRODUCTION AND BACKGROUND ..... 4
- 2.0 DESCRIPTION OF WATER SYSTEM ..... 4
- 3.0 SUMMARY OF WATER QUALITY MONITORING ..... 5
  - 3.1 Water Treatment Equipment Operation and Monitoring as Per Schedule 7, O. Reg 170/03..... 5
    - 3.1.1 Point of Entry Chlorine Residual ..... 5
    - 3.1.2 Distribution Chlorine Residual ..... 5
    - 3.1.3 Turbidity ..... 6
  - 3.2 Microbiological Sampling as per Schedule 10, O. Reg.170/03 ..... 6
    - 3.2.1 Raw Water Samples ..... 6
    - 3.2.2 Treated Water Samples ..... 7
    - 3.2.3 Distribution Samples ..... 9
  - 3.3 Chemical Sampling & Testing as per Schedule 13, O. Reg.170/03 ..... 9
    - 3.3.1 Inorganics ..... 9
    - 3.3.2 Lead ..... 10
    - 3.3.3 Organics ..... 11
    - 3.3.4 Trihalomethanes ..... 13
    - 3.3.5 Nitrate & Nitrite ..... 13
    - 3.3.6 Sodium ..... 13
    - 3.3.7 Fluoride ..... 13
    - 3.3.8 Non-Regulatory Testing – Aesthetic Objectives and Operational Guidelines ..... 14
- 4.0 WATER AND CHEMICAL USAGE ..... 15
  - 4.1 Chemical Usage ..... 15
  - 4.2 Annual Volumes ..... 16
- 5.0 IMPROVEMENTS TO SYSTEM AND ROUTINE AND PREVENTATIVE MAINTENANCE ..... 16
- 6.0 MINISTRY OF THE ENVIRONMENT INSPECTIONS AND REGULATORY ISSUES ..... 17
- 7.0 EMERGENT ISSUES ..... 18

**LIST OF TABLES**

Table 1 – Treated and Distribution Chlorine Residuals for Lucknow Drinking Water System .....	5
Table 2 – Raw and Treated Water Turbidities for Lucknow Drinking Water System .....	6
Table 3 – Microbiological Results for Raw Water at Lucknow Drinking Water System .....	7
Table 4 – Microbiological Results for Treated Water at Lucknow Drinking Water System .....	8
Table 5 – Microbiological Results for Lucknow Drinking Water Distribution System .....	9
Table 6 – Inorganics (Schedule 23) Results for Lucknow Drinking Water System .....	10
Table 7 – Lead Sampling Program Results for Lucknow Drinking Water System .....	10
Table 8 – Organics (Schedule 24) Results for Lucknow Drinking Water System .....	11
Table 9 – Nitrate, Nitrite and THM Results at Lucknow Drinking Water System .....	13
Table 10 – Sodium and Fluoride Results at Lucknow Drinking Water System .....	14
Table 11 - Aesthetic Objectives and Operational Guidelines .....	14
Table 12 – Sodium Hypochlorite Usage at Lucknow Drinking Water System .....	15
Table 13 - Treated Water Volumes for Lucknow Drinking Water System .....	16
Table 14 - Regulatory Requirements .....	18
Table 15 - Historic Arsenic Values .....	19

## **1.0 INTRODUCTION AND BACKGROUND**

The purpose of the 2016 Annual Report is to document the operation and maintenance data for the Lucknow Drinking Water System for review by the Ministry of the Environment in accordance with O. Reg. 170/03. This report covers January 1, 2016 to December 31, 2016. A copy of this report will be submitted to the owner to be displayed to the residents.

## **2.0 DESCRIPTION OF WATER SYSTEM**

The Lucknow Drinking Water System (DWS # **2200002663**) is comprised of two (2) wells (Lucknow Well # 4 and Lucknow Well # 5) located within the Municipality of Huron-Kinloss in the Village of Lucknow. The distribution system serves the community of Lucknow with an estimated population of approximately 1,726 residents, with approximately 664 connections, plus 10 Lucknow South properties in the Municipality of Ashfield-Colborne-Wawanosh in Huron County. Both well houses are equipped with on-line chlorine analyzers and are monitored through a SCADA system based out of the Ripley Municipal office. As a redundancy, each well house is also equipped with an auto-dialer that is independent of the SCADA system, to call out alarms in the event of communications/SCADA failure.

The Lucknow Drinking Water System is characterized as a “secure groundwater system” and categorized as a Class 2 Distribution and Supply Large Municipal Residential Drinking Water System as per O. Reg 170/03. The system has a daily maximum capacity to deliver 1,500 cubic metres of potable water to the Village of Lucknow.

The two (2) wells are described as follows:

Lucknow Well # 4 is a 200 mm diameter, 54.8 m deep drilled groundwater production well, located within the existing well house at 600 Havelock Street. Well # 4 is equipped with a vertical turbine pump, with well pump discharge piping into a chlorine contact watermain (90 m x 0.437 m ID = 13,499 L). Well # 4 is used to supply water to the system when the output from primary production Well # 5 proves insufficient to meet the demand of the system. The well house and Well # 4 were constructed in 1957.

Well # 5 is a 203 mm diameter, 58.8 m deep drilled groundwater production well located within the existing well house at 381 Delhi Street, and is the main production well for the system. Well # 5 is equipped with a submersible pump with a discharge line connected to the well pump header with well pump discharge piping into a chlorine contact watermain (230 m x 0.437 m ID = 34,497 L). The well house and Well # 5 were constructed in 1967.

Both wells are equipped with receptacles and manual transfer switches for a portable generator.

Both Lucknow wells are secure deep bedrock wells, not under the influence of surface water. The wells penetrate limestone aquifers. Due to the depth and structure of the aquifers, the water temperature is relatively constant (<10°C), turbidity is low, and the water is relatively hard. The raw water is also relatively high in fluoride, but the lead content of the raw water is well below the half-MAC (Maximum Allowable Concentration). Those who are supplied water from the Lucknow Drinking Water System are made aware of the various concentrations in their drinking water by numerous means of communication with the Township of Huron-Kinloss.

The raw water from each well is disinfected using sodium hypochlorite (12%) and serves primarily as a measure to prevent microbiological growth within the raw water pipeline, standpipe, and distribution system. The Lucknow Drinking Water System achieves a minimum of 2-log removal or inactivation of viruses as outlined in the MOECC *Procedure for Disinfection of Drinking Water in Ontario* with the respective chlorine contact watermain.

The standpipe is situated at 656 Wheeler Street. The total volume of the standpipe is 996 m<sup>3</sup> (27.5 m H, 6.7 m diameter). The well pumps of Well No. 4 and Well No. 5 are automatically controlled by the water level in the standpipe via communications located at 482 Ross Street - former pumphouse.

The Lucknow Drinking Water System is equipped with a Supervisory Control and Data Acquisition system (SCADA), which is located at the Ripley Municipal Office. This allows for remote control, monitoring and record keeping of the system. It provides the operator with the current operating status of the supply and treatment equipment throughout the system at any given time via remote access by computer or iPhone.

### 3.0 SUMMARY OF WATER QUALITY MONITORING

#### 3.1 Water Treatment Equipment Operation and Monitoring

##### 3.1.1 Treated Water (Point of Entry) Chlorine Residual

In 2016, a total of 731 grab samples were collected and analyzed for Free Chlorine Residual at the Point of Entry (POE) for treated water (total both wells) using a HACH pocket chlorine colorimeter. One (1) sample was missed on October 14, 2016 at Well No. 5. The chlorine residuals at both sites are measured continuously with on-line HACH CL-17 Analyzers.

**Table 1** shows the monthly average of the grab free chlorine residual values.

##### 3.1.2 Distribution Chlorine Residual

In 2016, a Total of 366 grab samples were collected in the Lucknow Distribution System. **Table 1** shows the monthly average of the distribution grab free chlorine residual values.

**Table 1 – Average Treated (grab) and Distribution (grab) Chlorine Residuals for Lucknow Drinking Water System**

Month	Lucknow Well 4	Lucknow Well 5	Distribution
Jan	1.61	1.49	1.34
Feb	1.69	1.52	1.35
Mar	1.65	1.55	1.35
Apr	1.51	1.57	1.32
May	1.55	1.55	1.32
Jun	1.45	1.55	1.19
Jul	1.41	1.54	1.22
Aug	1.59	1.57	1.22
Sep	1.60	1.51	1.23
Oct	1.73	1.64	1.27
Nov	1.75	1.61	1.35
Dec	1.76	1.69	1.39
Annual Min	1.24	1.31	0.92
Annual Max	1.98	2.00	1.74
Annual Avg	1.61	1.57	1.30
# Samples	366	365	366

3.1.3 Turbidity

Drinking water turbidity was measured by a portable turbidity analyzer. The raw and treated water grab samples were collected monthly and analyzed for turbidity. **Table 2** provides a summary of raw and treated turbidity results. The maximum turbidity measured in the raw water was 0.21 NTU and the maximum turbidity measured in the treated water was 0.26 NTU.

**Table 2 – Average Raw and Treated Water Turbidities for Lucknow Drinking Water System**

Month	Lucknow Well 4		Lucknow Well 5	
	Raw	Treated	Raw	Treated
Jan	0.12	0.17	0.12	0.19
Feb	0.15	0.17	0.09	0.23
Mar	0.08	0.14	0.09	0.19
Apr	0.17	0.19	0.18	0.21
May	0.13	0.19	0.10	0.22
Jun	0.15	0.17	0.14	0.22
Jul	0.09	0.17	0.10	0.22
Aug	0.11	0.17	0.08	0.21
Sep	0.13	0.16	0.11	0.18
Oct	0.08	0.17	0.15	0.14
Nov	0.08	0.15	0.14	0.26
Dec	0.08	0.14	0.08	0.20
Annual Min	0.07	0.13	0.07	0.14
Annual Max	0.17	0.20	0.21	0.26
Annual Avg	0.11	0.17	0.11	0.21
# Samples	15	15	17	17

3.2 **Microbiological Sampling**

3.2.1 Raw Water Samples

Raw water samples are taken from each well every week. In 2016, a total of 104 samples were collected and analyzed for E. Coli and Total Coliform. The E. Coli results obtained were 0 cfu/100 mL. The Total Coliform results were 0 cfu/100 mL. **Table 3** provides a summary of bacteriological results performed on the raw water.

**Table 3 – Microbiological Results for Raw Water at Lucknow Drinking Water System**

**Lucknow Well 4 Raw Water**

Month	E. Coli			Total Coliform		
	# Samples	# Samples "0"	# Samples ≥1	# Samples	# Samples "0"	# Samples ≥1
Jan	4	4	0	4	4	0
Feb	4	4	0	4	4	0
Mar	5	5	0	5	5	0
Apr	4	4	0	4	4	0
May	5	5	0	5	5	0
Jun	4	4	0	4	4	0
Jul	4	4	0	4	4	0
Aug	5	5	0	5	5	0
Sep	4	4	0	4	4	0
Oct	4	4	0	4	4	0
Nov	5	5	0	5	5	0
Dec	4	4	0	4	4	0
<b>Total</b>	<b>52</b>	<b>52</b>	<b>0</b>	<b>52</b>	<b>52</b>	<b>0</b>

**Lucknow Well 5 Raw Water**

Month	E. Coli			Total Coliform		
	# Samples	# Samples "0"	# Samples ≥1	# Samples	# Samples "0"	# Samples ≥1
Jan	4	4	0	4	4	0
Feb	4	4	0	4	4	0
Mar	5	5	0	5	5	0
Apr	4	4	0	4	4	0
May	5	5	0	5	5	0
Jun	4	4	0	4	4	0
Jul	4	4	0	4	4	0
Aug	5	5	0	5	5	0
Sep	4	4	0	4	4	0
Oct	4	4	0	4	4	0
Nov	5	5	0	5	5	0
Dec	4	4	0	4	4	0
<b>Total</b>	<b>52</b>	<b>52</b>	<b>0</b>	<b>52</b>	<b>52</b>	<b>0</b>

**3.2.2 Treated Water (Point of Entry) Samples**

One (1) treated water sample is taken from each point of entry every week and analyzed for E. Coli, Total Coliform, and for Heterotrophic Plate Count (HPC). A total of 104 treated water samples were collected and analyzed for the above parameters. All samples were found to be safe. Each E. Coli result from the treated water was 0 cfu/100 mL. There was one sample at Lucknow # 4 where 1 Total Coliform was reported by the laboratory. The range of HPC results were 0 – 7 cfu/100 mL. **Table 4** provides a summary of all bacteriological results performed on treated water.

**Table 4 –Microbiological Results for Treated Water (Point of Entry) at Lucknow Drinking Water System**

**Lucknow Well 4 Treated Water**

Month	E. Coli			Total Coliform			HPC		
	# Samples	# Samples "0"	# Samples ≥1	# Samples	# Samples "0"	# Samples ≥1	# Samples	# Samples "0"	# Samples ≥1
Jan	4	4	0	4	4	0	4	3	1
Feb	4	4	0	4	4	0	4	3	1
Mar	5	5	0	5	5	0	5	5	0
Apr	4	4	0	4	4	0	4	2	2
May	5	5	0	5	5	0	5	3	2
Jun	4	4	0	4	4	0	4	4	0
Jul	4	4	0	4	4	0	4	2	2
Aug	5	5	0	5	5	0	5	4	1
Sep	4	4	0	4	4	0	4	3	1
Oct	4	4	0	4	4	0	4	3	1
Nov	5	5	0	5	5	1	5	3	2
Dec	4	4	0	4	4	0	4	4	0
<b>Total</b>	52	52	0	52	52	1	52	39	13

**Lucknow Well 5 Treated Water**

Month	E. Coli			Total Coliform			HPC		
	# Samples	# Samples "0"	# Samples ≥1	# Samples	# Samples "0"	# Samples ≥1	# Samples	# Samples "0"	# Samples ≥1
Jan	4	4	0	4	4	0	4	2	2
Feb	4	4	0	4	4	0	4	3	1
Mar	5	5	0	5	5	0	5	4	1
Apr	4	4	0	4	4	0	4	2	2
May	5	5	0	5	5	0	5	3	2
Jun	4	4	0	4	4	0	4	1	3
Jul	4	4	0	4	4	0	4	0	4
Aug	5	5	0	5	5	0	5	4	1
Sep	4	4	0	4	4	0	4	1	3
Oct	4	4	0	4	4	0	4	1	3
Nov	5	5	0	5	5	0	5	4	1
Dec	4	4	0	4	4	0	4	3	1
<b>Total</b>	52	52	0	52	52	0	52	28	24



### 3.2.3 Distribution System

Typically, three (3) distribution samples are collected every week and tested for E. Coli, Total Coliform, and for Heterotrophic Plate Count (HPC). In 2016, a total of 158 distribution samples were collected and analyzed for the E. Coli and Total Coliform. A total of 105 samples were analyzed for Heterotrophic Plate Count. All samples were found to be safe. Each E. Coli and Total Coliform result from the treated water was 0 cfu/100 mL. The range of HPC results were 0 – 5 cfu/100 mL. **Table 5** provides a summary of all bacteriological samples taken in the distribution system.

**Table 5 – Microbiological Results for Lucknow Drinking Water Distribution System**

Month	E. Coli			Total Coliform			HPC		
	# Samples	# Samples "0"	# Samples ≥1	# Samples	# Samples "0"	# Samples ≥1	# Samples	# Samples "0"	# Samples ≥1
Jan	12	12	0	12	12	0	8	4	4
Feb	12	12	0	12	12	0	8	4	4
Mar	15	15	0	15	15	0	11	7	4
Apr	12	12	0	12	12	0	8	3	5
May	15	15	0	15	15	0	10	10	0
Jun	12	12	0	12	12	0	8	4	4
Jul	13	13	0	13	13	0	8	3	5
Aug	16	16	0	16	16	0	10	5	5
Sep	12	12	0	12	12	0	8	4	4
Oct	12	12	0	12	12	0	8	5	3
Nov	15	15	0	15	15	0	10	7	3
Dec	12	12	0	12	12	0	8	8	0
<b>Total</b>	158	158	0	158	158	0	105	64	41

### 3.3 Chemical Sampling & Testing as per Schedule 13, O. Reg.170/03

#### 3.3.1 Inorganics (Schedule 23)

Treated water samples are collected every 36 months and tested for inorganics. The most recent samples for the Lucknow Drinking Water System were collected on June 12, 2015 and submitted to the laboratory for analysis of inorganics as listed in Schedule 23. All parameters were found to be within compliance. Inorganics will be sampled and analyzed again on or before June 12, 2018. Results from the June 12, 2015 samples can be found in **Table 6**.

**Table 6 – Inorganic (Schedule 23) Results for Lucknow Drinking Water System**

Parameter	Lucknow Well 4 (µg/L)	Lucknow Well 5 (µg/L)	Maximum Allowable Concentration (µg/L)
Antimony	0.02 <MDL	0.02 <MDL	6
Arsenic	5.0	6.2	25
Barium	301	311	1000
Boron	40.3	37.5	5000
Cadmium	0.003 <MDL	0.003 <MDL	5
Chromium	0.03 <MDL	0.03 <MDL	50
Mercury	0.01 <MDL	0.01 <MDL	1
Selenium	0.04 <MDL	0.04 <MDL	10
Uranium	0.738	0.775	20

3.3.2 Lead

Schedule 15.1 of Ontario Regulation 170/03 requires that samples be taken during two seasons: once between December 15 and April 15 and once between June 15 and October 15. The Lucknow Drinking Water System is currently under a reduced sampling program for lead where lead, pH and alkalinity are sampled in each season every 3 years. In the interim, pH and alkalinity are tested during each sampling season. In the two previous lead sampling seasons, two pH and alkalinity samples were taken on March 13, 2015 and two pH and alkalinity samples on June 10, 2015. These parameters are required to be sampled and analyzed again between the months of December 2015 and April 2016 and again between June and October 2016. Lead samples are required next in the 2017 sampling season. 2015 results can be found in Table 7.

**Table 7 – Lead Sampling Program Results for Lucknow Drinking Water System**

Sampling Season	pH	Alkalinity (mg/L CaCO <sub>3</sub> )
Dec – Apr	7.36	227
	7.33	228
Jun - Oct	7.47	223
	7.38	224

3.3.3 Organics (Schedule 2 4)

Treated water samples are collected every 60 months and tested for Schedule 24 organic parameters. The most recent samples were submitted on June 12, 2015. All parameters were found to be within compliance. Organics will be sampled and analyzed again on or before June 12, 2020. June 12, 2015 sample results can be found in **Table 8**.

**Table 8 – Organics (Schedule 24) Results for Lucknow Drinking Water System**

Parameter	Lucknow Well 4	Lucknow Well 5	Maximum Allowable Concentration (µg/L)
Benzene	0.32 <MDL	0.32 <MDL	5
Carbon Tetrachloride	0.16 <MDL	0.16 <MDL	5
1,2-Dichlorobenzene	0.41 <MDL	0.41 <MDL	200
1,4-Dichlorobenzene	0.36 <MDL	0.36 <MDL	5
1,1-Dichloroethylene	0.33 <MDL	0.33 <MDL	14
1,2-Dichloroethane	0.35 <MDL	0.35 <MDL	5
Dichloromethane	0.35 <MDL	0.35 <MDL	50
Monochlorobenzene	0.3 <MDL	0.3 <MDL	80
Tetrachloroethylene	0.35 <MDL	0.35 <MDL	30
Trichloroethylene	0.44 <MDL	0.44 <MDL	50
Vinyl Chloride	0.17 <MDL	0.17 <MDL	2
Diquat	1 <MDL	1 <MDL	70
Paraquat	1 <MDL	1 <MDL	10
Glyphosate	1 <MDL	1 <MDL	280
Polychlorinated Biphenyls	0.04 <MDL	0.04 <MDL	3
Benzo(a)pyrene	0.004 <MDL	0.004 <MDL	0.01
2,4-dichlorophenol	0.15 <MDL	0.15 <MDL	900
2,4,6-trichlorophenol	0.25 <MDL	0.25 <MDL	5
2,3,4,5-tetrachlorophenol	0.20 <MDL	0.20 <MDL	100
Pentachlorophenol	0.15 <MDL	0.15 <MDL	60
Alachlor	0.02 <MDL	0.02 <MDL	5
Aldicarb	0.01 <MDL	0.01 <MDL	9
Aldrin+Dieldrin	0.01 <MDL	0.01 <MDL	0.7
Aldrin	0.01 <MDL	0.01 <MDL	-
Dieldrin	0.01 <MDL	0.01 <MDL	-
Atrazine+N-dealkylated metabolites	0.01 <MDL	0.01 <MDL	5
Atrazine	0.01 <MDL	0.01 <MDL	-
De-ethylated atrazine	0.01 <MDL	0.01 <MDL	-
Azinphos-methyl	0.05 <MDL	0.05 <MDL	20
Bendiocarb	0.01 <MDL	0.01 <MDL	40
Carbaryl	0.05 <MDL	0.05 <MDL	90
Carbofuran	0.01 <MDL	0.01 <MDL	90
Chlordane	0.01 <MDL	0.01 <MDL	7
a-chlordane	0.01 <MDL	0.01 <MDL	-
g-chlordane	0.01 <MDL	0.01 <MDL	-

*Lucknow Drinking Water System Annual Report*  
*For the 2016 Operating Year*

<b>Parameter</b>	<b>Lucknow Well 4</b>	<b>Lucknow Well 5</b>	<b>Maximum Allowable Concentration (µg/L)</b>
Oxychlorane	0.01 <MDL	0.01 <MDL	-
Chlorpyrifos	0.02 <MDL	0.02 <MDL	90
Cyanazine	0.03 <MDL	0.03 <MDL	10
Diazinon	0.02 <MDL	0.02 <MDL	20
(DDT)+Metabolites	0.01 <MDL	0.01 <MDL	30
op-DDT	0.01 <MDL	0.01 <MDL	-
pp-DDD	0.01 <MDL	0.01 <MDL	-
pp-DDE	0.01 <MDL	0.01 <MDL	-
pp-DDT	0.01 <MDL	0.01 <MDL	-
Dimethoate	0.03 <MDL	0.03 <MDL	20
Diuron	0.03 <MDL	0.03 <MDL	150
Heptachlor-Heptachlor Epoxide	0.01 <MDL	0.01 <MDL	3
Heptachlor	0.01 <MDL	0.01 <MDL	-
Heptachlor epoxide	0.01 <MDL	0.01 <MDL	-
Lindane	0.01 <MDL	0.01 <MDL	4
Malathion	0.02 <MDL	0.02 <MDL	190
Methoxychlor	0.01 <MDL	0.01 <MDL	900
Metolachlor	0.01 <MDL	0.01 <MDL	50
Metribuzin	0.02 <MDL	0.02 <MDL	80
Parathion	0.02 <MDL	0.02 <MDL	50
Phorate	0.01 <MDL	0.01 <MDL	2
Prometryne	0.03 <MDL	0.03 <MDL	1
Simazine	0.01 <MDL	0.01 <MDL	10
Temephos	0.01 <MDL	0.01 <MDL	280
Terbufos	0.01 <MDL	0.01 <MDL	1
Triallate	0.01 <MDL	0.01 <MDL	230
Trifluralin	0.02 <MDL	0.02 <MDL	45
2,4-dichlorophenoxyacetic acid	0.19 <MDL	0.19 <MDL	100
2,4,5-trichlorophenoxyacetic acid	0.22 <MDL	0.22 <MDL	280
Bromoxynil	0.33 <MDL	0.33 <MDL	5
Dicamba	0.20 <MDL	0.20 <MDL	120
Diclofop-methyl	0.40 <MDL	0.40 <MDL	9
Dinoseb	0.36 <MDL	0.36 <MDL	10
Picloram	1 <MDL	1 <MDL	190

### 3.3.4 Trihalomethanes (THMs)

Distribution samples are taken every three months from representative points in the distribution system and tested for Trihalomethanes (THMs). In 2016, samples were collected during the months of February, May, August, and November. The Ontario Drinking Water Quality Standard (ODWQS) have set a Maximum Allowable Concentration (MAC) of 100 µg/L for this parameter and it is expressed as a running annual average. In 2016, the average THM was found to be 7.8 µg/L, which is within compliance. Refer to **Table 9** for the summary of trihalomethane results. In 2017, samples will be collected in February, May, August, and November.

### 3.3.5 Nitrate & Nitrite

Four treated water samples are taken every three months and tested for nitrate and nitrite. In 2015, samples were collected during the months of February, May, August, and November. The Ontario Drinking Water Quality Standard (ODWQS) have set a Maximum Allowable Concentration (MAC) of 1 mg/L for nitrites and 10 mg/L for nitrates. The analytical results were found to be within compliance. Refer to **Table 9**. In 2017, samples will be collected in February, May, August, and November.

**Table 9** – Nitrate, Nitrite and THM Results at Lucknow Drinking Water System

Date	Nitrite			Nitrate			THM	
	# Samples	Lucknow 4	Lucknow 5	# Samples	Lucknow 4	Lucknow 5	# Samples	Distribution
Feb	1	0.003<MDL	0.003<MDL	1	0.006<MDL	0.006<MDL	1	3.2
May	1	0.003<MDL	0.003<MDL	1	0.006<MDL	0.006<MDL	1	8.2
Aug	1	0.003<MDL	0.003<MDL	1	0.006<MDL	0.006<MDL	1	6.4
Nov	1	0.003<MDL	0.003<MDL	1	0.006<MDL	0.006<MDL	1	4.4
<b>Total</b>	4			4			4	
<b>Avg</b>		0.003<MDL	0.003<MDL		0.006<MDL	0.006<MDL		5.6
<b>Max</b>		0.003<MDL	0.003<MDL		0.006<MDL	0.006<MDL		8.2

### 3.3.6 Sodium

One water sample is collected from each point of entry every 60 months and tested for Sodium. The Ontario Drinking Water Standards (ODWQS) have set a Maximum Acceptable concentration (MAC) of 20 mg/L for Sodium and requires the Medical Office of Health be notified if the concentration exceeds 20 mg/L. These samples were last collected on June 21, 2016. Refer to **Table 10**. The next water sample for Sodium will be collected and analyzed on or before June 21, 2021.

### 3.3.7 Fluoride

One water sample is collected from each point of entry at least once in every 60 months and tested for Fluoride. The Ontario Drinking Water Quality Standards (ODWQS) have set a MAC of 1.5 mg/L. On May 5, 2015, a sample was collected for this analysis. The sample collected exceeded the Maximum Allowable Concentration (MAC). This is due to naturally occurring fluoride in the aquifer. The next water samples for Fluoride will be collected and analyzed on or before May 5, 2016. Refer to **Table 10**.

**Table 10 – Sodium and Fluoride Results at Lucknow Drinking Water System**

Location	Sodium	Fluoride
Lucknow Well 4	10.8	1.69
Lucknow Well 5	12.8	1.69
Max Allowable Concentration (mg/L)	20.0	1.50

3.3.8 Non-Regulatory Testing – Aesthetic Objectives and Operational Guidelines

Samples were collected on November 21, 2016 and tested for parameters listed in the *MOECC Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines, June 2006, PIBS 4449e01*. Refer to **Table 11** for Aesthetic Objective/Operational Guideline results.

**Table 11 – Aesthetic Objectives and Operational Guidelines**

Parameter	AO/OG	Lucknow Well 4 Treated Water	Lucknow Well 5 Treated Water
pH	6.5 – 8.5	7.88	8.03
Alkalinity (mg/L as CaCO <sub>3</sub> )	30 – 500	217	224
Colour (TCU)	5	3	3<MDL
Total Dissolved Solids (mg/L)	500	280	274
Organic Nitrogen (mg/L)	0.15	0.05<MDL	0.05<MDL
Total Kjeldahl Nitrogen (mg/L)	---	0.05<MDL	0.05<MDL
Ammonia + Ammonium (mg/L)	---	0.06	0.06
Hydrogen Sulphide (mg/L)	0.05	0.006<MDL	0.006<MDL
Sulphide (mg/L)	0.05	0.006<MDL	0.006<MDL
Chloride (mg/L)	250	3.7	3.9
Sulphate (mg/L)	500	31	31
Hardness (mg/L as CaCO <sub>3</sub> )	80 – 100	206	209
Aluminum (µg/L)	100	0.5	2.5
Copper (µg/L)	1000	4.25	1.99
Iron (µg/L)	300	132	264
Manganese (µg/L)	50	8.38	13.8
Zinc (µg/L)	5000	3	4
Dissolved Organic Carbon (mg/L)	5	1<MDL	1<MDL
Methane (L/m <sup>3</sup> )	3	0.02<MDL	0.02<MDL
Ethylbenzene (µg/L)	2.4	0.33<MDL	0.33<MDL
Toluene (µg/L)	24	0.36<MDL	0.36<MDL
Xylene (µg/L)	300	0.43<MDL	0.43<MDL
m/p-xylene (µg/L)	---	0.43<MDL	0.43<MDL
o-xylene (µg/L)	---	0.17<MDL	0.17<MDL

AO/OG – Aesthetic Objective / Operational Guideline

MDL – Laboratory Method Detection Limit

## 4.0 WATER AND CHEMICAL USAGE

### 4.1 Chemical Usage

Refer to **Table 12**. From January 1, 2016 to December 31, 2016, a total combined usage of 848.62 kg of sodium hypochlorite (NaOCl) was used to treat the water that was provided to the distribution system with an average dosage of 4.08 mg/L.

**Table 12** – Sodium Hypochlorite Usage at Lucknow Drinking Water System

Month	Usage (kg)		Dosage (mg/L)	
	Lucknow Well 4	Lucknow Well 5	Lucknow Well 4	Lucknow Well 5
Jan	14.44	52.28	4.28	3.40
Feb	12.33	47.09	4.49	3.11
Mar	21.72	36.58	4.07	3.48
Apr	10.23	53.26	6.76	3.49
May	23.97	41.63	3.98	3.59
Jun	12.47	66.72	4.97	3.51
Jul	18.64	77.51	3.97	3.47
Aug	20.18	70.36	5.28	3.77
Sep	18.35	57.27	4.60	3.79
Oct	22.22	47.47	4.77	3.79
Nov	36.44	18.22	4.29	3.17
Dec	23.55	45.69	3.67	4.22
<b>Total</b>	234.54	614.08		
<b>Total Combined</b>	848.62			
<b>Avg</b>			4.59	3.57
<b>Avg Combined</b>			4.08	

### 4.2 Annual Volumes

A summary of the water supplied to the distribution system in 2016 is provided in **Table 13**. This Table provides a breakdown of the monthly volume provided to the distribution system.

Flow meters are calibrated annually by Coulter Water Meter Service and were found to be acceptable. The water meters will be calibrated again in July 2017.

**Table 13** – Treated Water Volumes for Lucknow Drinking Water System

# Lucknow Drinking Water System Annual Report

For the 2016 Operating Year

## Lucknow Well 4

Month	Avg Daily Volume (m <sup>3</sup> )	Max Daily Volume (m <sup>3</sup> )	Total Monthly Volume (m <sup>3</sup> )
Jan	119.16	365.21	3,693.98
Feb	86.33	435.96	2,503.62
Mar	174.27	614.19	5,402.25
Apr	84.90	334.87	2,546.87
May	181.04	637.82	5,645.22
Jun	97.86	457.24	2,935.88
Jul	137.67	415.36	4,267.64
Aug	139.17	386.51	4,314.27
Sep	123.70	385.04	3,711.09
Oct	145.56	424.90	4,512.48
Nov	280.44	501.74	8,413.09
Dec	161.86	497.96	5,017.61
Avg	144.33		
Max		637.82	
Total			52,964.00

## Lucknow Well 5

Month	Avg Daily Volume (m <sup>3</sup> )	Max Daily Volume (m <sup>3</sup> )	Total Monthly Volume (m <sup>3</sup> )
Jan	493.55	682.08	15,254.88
Feb	513.37	762.34	14,862.23
Mar	388.16	665.89	12,118.18
Apr	495.63	894.10	14,844.39
May	425.86	879.33	13,185.92
Jun	719.40	1,060.30	21,581.86
Jul	720.90	1,091.60	22,347.85
Aug	593.49	1,066.34	18,398.14
Sep	474.32	926.52	14,229.45
Oct	394.64	611.414	12,233.96
Nov	201.50	559.83	6,044.88
Dec	404.13	701.00	12,527.97
Avg	485.41		
Max		1,091.60	
Total			177,629.71



**Lucknow Well 4 and Lucknow Well 5 Combined**

Month	Max Daily Volume (m <sup>3</sup> )	Total Monthly Volume (m <sup>3</sup> )
Jan	743.16	18,949.43
Feb	762.34	17,365.84
Mar	694.07	17,520.43
Apr	1,018.73	17,391.26
May	879.33	18,831.14
Jun	1,118.92	24,502.27
Jul	1,115.77	26,576.64
Aug	1,147.06	21,373.09
Sep	941.13	17,914.71
Oct	633.93	16,720.00
Nov	576.79	14,476.78
Dec	699.90	17,592.76
Max	1,147.06	
Total		229,214.35

**5.0 IMPROVEMENTS TO SYSTEM AND ROUTINE AND PREVENTATIVE MAINTENANCE**

The following summarizes water system improvements and routine and preventative maintenance for the Lucknow Drinking Water System Supply:

Lucknow Well 4:

- Bell phone line repaired June 7, 2016.
- HuronTel updated fibre optic service line June 8, 2016.
- Installed new flow sensor on chlorine board June 29, 2016.
- Replaced pressure control valve on chlorine board July 7, 2016.
- Annual service to backflow preventer October 19, 2016.
- Repaired copper line feeding chlorine analyzer November 4, 2016.
- Replaced autodialer November 11, 2016.
- Bell phone line repaired November 14, 2016.

Lucknow Well 5:

- Replace communications modem on March 8, 2016.
- HuronTel repaired communications line March 15, 2016.
- Eramosa on-site to service the control board contact points March 17, 2016.
- Replaced hand-off-auto switch on well pump controller March 21, 2016.
- Replaced UPS for chlorine analyzer March 28, 2016.
- Replaced HMI module on well pump controller panel April 27, 2016.
- Eramosa on-site to replace analog input card on RTU controller May 27, 2016.
- HuronTel updated fibre optic service line June 3, 2016.
- Repaired singer valve July 6, 2016.
- Installed pre-contact chlorine analyzer August 30, 2016.
- Installed chart recorder September 10, 2016.
- Replaced chlorine analyzer October 10, 2016.
- Annual service to backflow preventer October 19, 2016.
- Installed new dehumidifier October 21, 2016.
- Installed new chlorine pumps November 9, 2016.

## 6.0 MINISTRY OF THE ENVIRONMENT INSPECTIONS AND REGULATORY ISSUES

The Ministry of the Environment and Climate Change conducted an inspection on Lucknow Drinking Water System Supply between May 4, 2016 and July 22, 2016.

- DWQMS Management Review was conducted on May 12, 2016.
- DWQMS Surveillance Audit was conducted between May 26 and June 26, 2016.
- Flow meter calibration was conducted on June 29, 2016.
- DWQMS Risk Assessment was completed on October 20, 2016.
- DWQMS Internal Audit was conducted on November 23, 2016.
- DWQMS Emergency Response Exercise was completed on November 30, 2016.

### Lucknow Well 4:

One adverse water quality event occurred at Well No. 4 during 2016.

- AWQI # 131819 - On November 10, 2016, 1 Total Coliform was reported by the laboratory. Resampling came back with 0 Total Coliform.

### Lucknow Well 5:

One adverse water quality event occurred at Well No. 5 during 2016.

- AWQI # 130602 – On August 4, 2016, a failure of the pressure relief valve on the chlorination equipment resulted in a low chlorine residual of 0.02 mg/L for 5 minutes. The low-chlorine water was back-flushed from the system.

## 7.0 EMERGENT ISSUES

It should be noted that there will be some upcoming changes to Ontario Regulation 170/03 and Ontario Regulation 169/03 that strengthen standards and clarify testing requirements as follows:

- Strengthen standards for Arsenic, Carbon Tetrachloride, Benzene, and Vinyl Chloride;
- Adopt new standards for Chlorate, Chlorite, 1-Methyl-4-Chlorophenoxyacetic acid (MCPA) and Haloacetic Acids (HAAs); (NOTE: Chlorate and Chlorite testing is only required for Municipal Drinking Water Systems using Chlorine Dioxide treatment equipment.)
- Clarify/optimize testing, sampling and reporting requirements for Trihalomethanes (THMs) and HAAs; and
- Remove 13 pesticides from testing requirements.

The aforementioned amendments will be phased in over the next four years to allow system owners and/or operators the opportunity to collect baseline information and complete required system upgrades. Currently, the new sampling, testing, reporting and re-sampling requirements, and the removal of 13 pesticides came into effect January 1, 2016. Refer to **Table 14** for the new Regulatory Requirements. Subsequent phase-in dates are:

- January 1, 2017: Testing requirements for HAAs and updates to standards for Carbon Tetrachloride, Benzene, Vinyl Chloride, Chlorate, Chlorite, and MCPA come into effect / require reporting
- January 1, 2018: Updates to standards for Arsenic come into effect / require reporting
- January 1, 2020: New standards for HAAs and HAAs testing optimization rule for smaller systems will come into effect / require reporting.

**Table 14 – Regulatory Requirements**

Parameter	Current Requirement		Amended Requirement	
	MAC	½ MAC	MAC	½ MAC
<b>Arsenic</b>	25 µg/L	12.5 µg/L	10 µg/L	5 µg/L
<b>Benzene</b>	5 µg/L	2.5 µg/L	1 µg/L	0.5 µg/L
<b>Carbon Tetrachloride</b>	5 µg/L	2.5 µg/L	2 µg/L	1 µg/L
<b>Vinyl Chloride</b>	2 µg/L	1 µg/L	1 µg/L	0.5 µg/L

**ARSENIC REVIEW**

Historic Arsenic values were reviewed from 2003 to 2015 and are shown in **Table 15**.

**Table 15** – Historic Arsenic Values

Date	Lucknow Well 4	Lucknow Well 5
Feb 2003	3	4
Jun 2003	3	3
Jun 2006	5.2	5.8
Jan 2008	3.8	5.6
Jun 2009	5.1	5.1
Nov 2010	5.4	5.9
Dec 2010	4.8	5
Aug 2011	4.9	5.3
Nov 2011	4.9	5.8
Aug 2012	4.7	5.4
Nov 2012	4.6	5.8
Sep 2013	4.8	5.7
Nov 2013	10.9	6.3
Sep 2014	4.9	5.6
Dec 2014	5.5	6.1
Jun 2015	5	6.2

**EMERGENT ISSUES SUMMARY:**

A review of the sample results between 2003 and 2015 indicates that Arsenic may be in exceedance of the amended ½ MAC requirements in Lucknow (highlighted in yellow) and possibly the MAC requirements (highlighted in red). This would require quarterly sampling to be conducted (see note below).

Historic values of the other parameters (Benzene, Carbon Tetrachloride, and Vinyl Chloride), are all below the amended standards prescribed.

**NOTE:**

**O. Reg. 170/03, Schedule 13: Increased frequency under ss. 13-2 and 13-4**

13-5. (1) If a test result obtained under section 13-2 or 13-4 for a parameter **exceeds half of the standard prescribed** for the parameter in Schedule 2 to the Ontario Drinking Water Quality Standards, the frequency of sampling and testing for that parameter under that section shall be **increased** so that at least one water sample is taken and tested **every three months**.