

Annual Report

For the 2015 Operating Year

Lucknow Drinking Water System 2015 Operation and Maintenance Annual Report

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1.0 INTRODUCTION AND BACKGROUND

The purpose of the 2015 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, 2015 to December 31, 2015. 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 No. 4 and Lucknow Well No. 5) located within the Municipality of Huron-Kinloss in the Village of Lucknow. The distribution system serves the community of Lucknow with a population of approximately 1230 residents, with approximately 485 connections, plus 10 Lucknow South properties in the Municipality of Ashfield-Colborne-Wawanosh in Huron County. Both pumphouses 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 pumphouse 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 1500 cubic metres of potable water to the village of Lucknow.

The two (2) wells are described as follows:

Well No. 4 is a 200 mm diameter, 54.8 m deep drilled groundwater production well, located within the existing pumphouse at 600 Havelock Street. Well No. 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 No. 4 is used to supply water to the system when the output from primary production Well No.5 proves insufficient to meet the demand of the system. The well house and Well No. 4 were constructed in 1957.

Well No. 5 is a 203 mm diameter, 58.8 m deep drilled groundwater production well located within the existing pumphouse at 381 Delhi Street, and is the main production well for the system. Well No. 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 No. 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 watermains.

The standpipe is situated at 656 Wheeler Street. The total volume of the standpipe is 996 m³ (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 2015, a total of 726 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. Three (3) grab samples were missed: two (2) on January 7, 2015 due to closed roads from weather conditions, and one (1) sample was missed on January 11, 2015 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 on-line free chlorine residual values.

3.1.2 Distribution Chlorine Residual

In 2015, a Total of 364 grab samples were collected in the Lucknow Distribution System. One (1) grab sample was missed due to closed roads from weather conditions (January 7, 2015).

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

Table 1 – Treated (on-line) and Distribution (grab) Chlorine Residuals for Lucknow Drinking Water System ^a

<i>Date</i>	<i>Site</i>	<i>Jan</i>	<i>Feb</i>	<i>Mar</i>	<i>Apr</i>	<i>May</i>	<i>Jun</i>	<i>Jul</i>	<i>Aug</i>	<i>Sep</i>	<i>Oct</i>	<i>Nov</i>	<i>Dec</i>	<i>Avg</i>	<i>Min</i>	<i>Max</i>	<i># Samples</i>
Average Treated (on-line) Chlorine Residual (mg/L)	Well 4	1.30	1.44	1.55	1.68	1.61	1.78	1.77	1.66	1.55	1.56	1.60	1.72	1.60	0.00	5.02	8,760
	Well 5	1.39	1.40	1.43	1.70	1.52	1.76	1.42	1.60	1.49	1.68	1.57	1.67	1.55	0.00	5.00	
Average Distribution Chlorine Residual (mg/L)	Dist.	1.11	1.21	1.28	1.43	1.30	1.39	1.36	1.27	1.26	1.26	1.38	1.42	1.31	0.92	1.83	364

^a – Results collected from January 1, 2015 – December 31, 2015

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 0.350 NTU and the maximum turbidity measured in the treated water was 0.430 NTU.

Table 2 – Raw and Treated Water Turbidities for Lucknow Drinking Water System ^a

<i>Date</i>	<i>Site</i>	<i>Jan</i>	<i>Feb</i>	<i>Mar</i>	<i>Apr</i>	<i>May</i>	<i>Jun</i>	<i>Jul</i>	<i>Aug</i>	<i>Sep</i>	<i>Oct</i>	<i>Nov</i>	<i>Dec</i>	<i>Avg</i>	<i>Min</i>	<i>Max</i>	<i># Samples</i>
Average Raw Turbidity (NTU)	W #4	0.213	0.200	0.210	0.200	0.183	0.190	0.165	0.160	0.180	0.180	0.180	0.095	0.180	0.070	0.240	27
	W #5	0.197	0.177	0.180	0.170	0.165	0.200	0.170	0.205	0.247	0.110	0.175	0.110	0.182	0.060	0.350	27
Average Treated Turbidity (NTU)	W #4	0.280	0.320	0.190	0.360	0.250	0.213	0.215	0.160	0.147	0.160	0.220	0.145	0.227	0.120	0.390	29
	W #5	0.280	0.338	0.210	0.260	0.265	0.217	0.190	0.217	0.223	0.180	0.165	0.230	0.244	0.150	0.430	30

^a – Results collected from January 1, 2015 – December 31, 2015

3.2 Microbiological Sampling

3.2.1 Raw Water Samples

Raw water samples are taken from each well every week. In 2015, 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 range of 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 ^a

Date	<i>E.Coli</i>			<i>Total Coliform</i>		
	# Samples	# Samples 0	# Samples ≥1	# Samples	# Samples 0	# Samples ≥1
Jan	8	8	0	8	8	0
Feb	8	8	0	8	8	0
Mar	10	10	0	10	10	0
Apr	8	8	0	8	8	0
May	8	8	0	8	8	0
Jun	10	10	0	10	10	0
Jul	8	8	0	8	8	0
Aug	8	8	0	8	8	0
Sept	10	10	0	10	10	0
Oct	8	8	0	8	8	0
Nov	8	8	0	8	8	0
Dec	10	10	0	10	10	0
Total	104	104	0	104	104	0

^a – Results collected from January 1, 2015 – December 31, 2015

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 and Total Coliform result from the treated water was 0 cfu/100 mL. The range of HPC results were 0 – 16 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 ^a

Date	<i>E.Coli</i>			<i>Total Coliform</i>			<i>HPC</i>		
	# Samples	# Samples 0	# Samples ≥1	# Samples	# Samples 0	# Samples ≥1	# Samples	# Samples 0	# Samples 1 - 16
Jan	8	8	0	8	8	0	8	3	5
Feb	8	8	0	8	8	0	8	5	3
Mar	10	10	0	10	10	0	10	7	3
Apr	8	8	0	8	8	0	8	6	2
May	8	8	0	8	8	0	8	3	5
Jun	10	10	0	10	10	0	10	5	5
Jul	8	8	0	8	8	0	8	5	3
Aug	8	8	0	8	8	0	8	7	1
Sep	10	10	0	10	10	0	10	4	6
Oct	8	8	0	8	8	0	8	3	5
Nov	8	8	0	8	8	0	8	8	0
Dec	10	10	0	10	10	0	10	6	4
Total	104	104	0	104	104	0	104	62	42

^a – Results collected from January 1, 2015 – December 31, 2015

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 2015, a total of 165 distribution samples were collected and analyzed for the E.Coli and Total Coliform. A total of 109 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 – 16 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 ^a

Date	<i>E.Coli</i>			<i>Total Coliform</i>			<i>HPC</i>		
	# Samples	# Samples 0	# Samples ≥1	# Samples	# Samples 0	# Samples ≥1	# Samples	# Samples 0	# Samples 1 - 16
Jan	12	12	0	12	12	0	8	4	4
Feb	12	12	0	12	12	0	8	3	5
Mar	17	17	0	17	17	0	11	6	5
Apr	12	12	0	12	12	0	8	4	4
May	12	12	0	12	12	0	8	4	4
Jun	17	17	0	17	17	0	10	3	7
Jul	12	12	0	12	12	0	8	4	4
Aug	16	16	0	16	16	0	11	5	6
Sep	15	15	0	15	15	0	10	6	4
Oct	12	12	0	12	12	0	8	3	5
Nov	12	12	0	12	12	0	8	3	5
Dec	16	16	0	16	16	0	11	7	4
Total	165	165	0	165	165	0	109	52	57

^a – Results collected from January 1, 2015 – December 31, 2015.

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

3.3.1 Inorganics

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 – Schedule 23 Results for Lucknow Drinking Water System ^a

<i>Parameter</i>	<i>Well No. 4 Result (µg/L)</i>	<i>Well No. 5 Result (µg/L)</i>	<i>Maximum Allowable Concentration (µg/L)</i>
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

^a – Samples collected on June 5, 2015.

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 ^a

<i>Sampling Season</i>	<i>pH</i>	<i>Alkalinity (mg/L)</i>
Dec-Apr	7.59	204
	7.42	205
Jun-Oct	7.89	208
	7.91	209

^a – Samples collected on March 18, 2015 and Oct. 7-8, 2015 respectively.

3.3.3 Organics

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 – Schedule 24 Results for Lucknow Drinking Water System ^a

<i>Parameter</i>	<i>Well No. 4 Result (µg/L)</i>	<i>Well No. 5 Result (µg/L)</i>	<i>Maximum Allowable Concentration (µg/L)</i>
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	-
Oxychlordane	0.01 <MDL	0.01 <MDL	-

<i>Parameter</i>	<i>Well No. 4 Result (µg/L)</i>	<i>Well No. 5 Result (µg/L)</i>	<i>Maximum Allowable Concentration (µg/L)</i>
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

^a – Samples submitted on June 12, 2015.

3.3.4 Trihalomethanes

Distribution samples are taken every three months from representative points in the distribution system and tested for Trihalomethanes (THMs). 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 100 µg/L for this parameter and it is expressed as a running annual average. In 2015, 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 2016, 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 2016, samples will be collected in February, May, August, and November.

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

Date	Nitrate			Nitrite			THMs	
	# Samples	Well No. 4 Result (mg/L)	Well No. 5 Result (mg/L)	# Samples	Well No. 4 Result (mg/L)	Well No. 5 Result (mg/L)	# Samples	Result (mg/L)
Feb	1	0.006<MDL	0.006<MDL	1	0.003<MDL	0.003<MDL	1	5.0
May	1	0.010	0.006<MDL	1	0.003<MDL	0.003<MDL	2	4.1 7.0
Aug	1	0.006<MDL	0.006<MDL	1	0.003<MDL	0.003<MDL	1	13
Nov	1	0.006<MDL	0.006<MDL	1	0.003<MDL	0.003<MDL	1	9.8
Total	4			4			5	
Average		0.007	0.006<MDL		0.003<MDL	0.003<MDL		7.8
Maximum		0.010	0.006<MDL		0.003<MDL	0.003<MDL		13

^a – Results collected from January 1, 2015 – December 31, 2015.

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 200 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 17, 2011. Refer to Table 10. The next water sample for Sodium will be collected and analyzed on or before June 17, 2016.

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

	<i>Sodium</i>		<i>Fluoride</i>	
	<i>Well No. 4 Result (µg/L)</i>	<i>Well No. 5 Result (µg/L)</i>	<i>Well No. 4 Result (µg/L)</i>	<i>Well No. 5 Result (µg/L)</i>
Treated Water	8.72 ^a	9.92 ^a	1.69^b	1.69^b
MAC	20	20	1.50	1.50

^a – Result collected on June 17, 2011.

^b – Result collected on May 5, 2015.

4.0 WATER AND CHEMICAL USAGE

4.1 Chemical Usage

Refer to **Table 11**. From January 1, 2015 to December 31, 2015, a total combined usage of 1038.036 kg of sodium hypochlorite (NaOCl) was used to treat the water that was provided to the distribution system with an average dosage of 3.92 mg/L.

Table 11 – Sodium Hypochlorite Usage at Lucknow Drinking Water System ^a

Date	Usage (kg)		Average Dosage (mg/L)	
	Well No. 4	Well No. 5	Well No. 4	Well No. 5
Jan	0.552	52.440	4.08	3.20
Feb	6.072	61.824	4.38	3.10
Mar	9.384	107.364	4.02	3.41
Apr	11.178	77.280	4.12	3.31
May	36.294	63.066	4.00	3.54
Jun	23.874	78.108	3.89	3.99
Jul	18.354	107.502	4.32	3.88
Aug	35.19	86.526	4.78	3.71
Sept	18.354	47.472	4.50	3.25
Oct	9.246	55.338	4.65	3.94
Nov	13.524	52.026	4.15	3.69
Dec	16.146	50.922	4.45	3.60
Total	198.168	839.868		
Total Combined	1038.036			
Average	16.514	69.989	4.28	3.55
Average Combined			3.92	

^a – Results collected from January 1, 2015 – December 31, 2015.

4.2 Annual Volumes

A summary of the water supplied to the distribution system in 2015 is provided in **Table 12**. 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 2016.

Table 12 – Treated Water Volumes for Lucknow Drinking Water System ^a

Well No. 4

<i>Date</i>	<i>Jan</i>	<i>Feb</i>	<i>Mar</i>	<i>Apr</i>	<i>May</i>	<i>Jun</i>	<i>Jul</i>	<i>Aug</i>	<i>Sep</i>	<i>Oct</i>	<i>Nov</i>	<i>Dec</i>	<i>Average</i>	<i>Maximum</i>	<i>Total</i>
Average Daily Volume (m³)	4.26	48.72	68.82	89.45	290.07	192.86	147.66	247.95	139.19	57.68	108.62	116.43	125.98		
Maximum Daily Volume (m³)	59.99	515.14	334.26	484.37	753.32	800.98	815.13	611.74	557.89	245.00	313.73	504.44		815.13	
Total Monthly Volume (m³)	131.99	1,364.14	2,133.30	2,683.62	8,992.16	5,785.80	4,577.54	7,686.42	4,175.75	1,788.00	3,258.50	3,609.39			46,186.61

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Well No. 5

<i>Date</i>	<i>Jan</i>	<i>Feb</i>	<i>Mar</i>	<i>Apr</i>	<i>May</i>	<i>Jun</i>	<i>Jul</i>	<i>Aug</i>	<i>Sep</i>	<i>Oct</i>	<i>Nov</i>	<i>Dec</i>	<i>Average</i>	<i>Maximum</i>	<i>Total</i>
Average Daily Volume (m³)	538.02	745.03	1018.64	795.66	606.64	709.31	908.33	761.19	500.41	453.31	477.20	471.59	665.44		
Maximum Daily Volume (m³)	653.90	1335.21	1414.50	1031.14	930.42	960.80	1394.75	1667.46	1134.79	648.29	1063.32	715.35		1667.46	
Total Monthly Volume (m³)	16678.66	20860.83	31577.92	23869.84	18805.73	19860.68	28158.33	23596.84	15012.42	14052.59	14316.15	14619.14			241409.13

Well No. 4 and Well No. 5 Combined

<i>Date</i>	<i>Jan</i>	<i>Feb</i>	<i>Mar</i>	<i>Apr</i>	<i>May</i>	<i>Jun</i>	<i>Jul</i>	<i>Aug</i>	<i>Sep</i>	<i>Oct</i>	<i>Nov</i>	<i>Dec</i>	<i>Average</i>	<i>Maximum</i>	<i>Total</i>
Maximum Daily Volume (m³)	653.90	1335.21	1435.31	1043.95	1264.00	1100.50	1394.75	1667.46	1137.33	648.29	1120.63	766.81		1667.46	
Total Monthly Volume (m³)	16810.65	22224.97	33711.22	26553.46	27797.89	25646.48	32735.87	31283.26	19188.17	15840.59	17574.65	18228.53			287595.74

^a – Results collected from January 1, 2015 – December 31, 2015

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 No. 4:

Replaced chlorine controller panel on January 29, 2015.

Replaced Ethernet router on February 13, 2015.

Replaced communications modem on March 17, 2015.

Replaced tap inside pumphouse on the line that feeds chlorine analyzer April 21, 2015.

Replaced pipe section on the line that feed chlorine analyzer July 15, 2015.

Replaced circuit board on chlorine analyzer October 15, 2015.

Lucknow Well No. 5:

Repaired the line inside the pumphouse that feeds chlorine analyzer March 12, 2015.

Replace communications modem on March 26, 2015.

Replaced speed control valves on singer valve on April 9, 2015.

Cleaned pilot valve assembly on May 20, 2015.

Singer valve maintenance on June 3, 2015.

Replaced underground power line to pumphouse on July 17, 2015.

Replaced pilot valve on singer valve September 8, 2015.

Replaced main power disconnect and meter base September 24, 2015.

Repaired backflow device on October 28, 2015.

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 13, 2015 – August 17, 2015.

DWQMS Audit was conducted on June 25, 2015.

Flow meter calibration was conducted on July 28, 2015.

Lucknow No. 4:

One adverse water quality event occurred at Well No. 4 during 2015. AWQI # 123689. On May 22, 2015, a failure of the chlorine system caused a low chlorine residual of 0.13 mg/L. The low-chlorine water was flushed from the system.

Lucknow No. 5:

Two adverse water quality events occurred at Well No. 5 during 2015.

- 1) AWQI # 122729 – On March 6, 2015, a failure of the chlorine system resulted in a low chlorine residual of 0.08 mg/L. The low-chlorine water was flushed from the system.
- 2) AWQI # 122979 – On March 30, 2015, a failure of the chlorine system resulted in a low chlorine residual of 0.00 mg/L. The low-chlorine water was flushed from the system.