2011

Vermilion Bay Water Treatment Plant

ANNUAL REPORT **2011**

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Introduction

The Vermilion Bay Drinking Water System (DWS# 210000997) is obligated to meet the requirements of Ontario's *Safe Drinking Water Act* and the regulations therein, in addition to requirements associated with the system's approval. Specifically, this system must meet extensive treatment and testing requirements in order to ensure that human health is protected.

This Annual Report has been prepared in accordance with both Schedule 22 and Section 11 of O. Reg. 170/03. In this manner, the Summary Reports for Municipalities required by Schedule 22 and the Annual Reports required by Section 11 have been consolidated into a single document. This Report is intended to brief the ownership of the Vermilion Bay Drinking Water System on the system's performance over the past calendar year (January 1st 2011 to December 31st 2011). This Annual Report will be available for inspection by any member of the public without charge at the Municipal Office.

A summary of this Drinking Water System (DWS) is difficult to produce without the use of technical 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. The Technical Support Document can be found at the following website address:

http://www.ontario.ca/drinkingwater/stel01_046947.pdf

Users of this Drinking Water System are encouraged to contact a representative of Northern Waterworks Inc. for further assistance in interpreting this Annual Report.

System Description

Classified as a large Municipal residential system, this drinking water system provides a potable water supply to the community of Vermilion Bay. This drinking water system is composed of a low lift station located at Eagle Lake supplying water to the Vermilion Bay water treatment plant which services the Vermilion Bay distribution system. This drinking water system is owned by the corporation of the municipality of Machin and operated by Northern Waterworks Inc. Potential pathenogenic organisms are removed from the source water by Ph adjustment, coagulation, flocculation, sedimentation, filtration and primary disinfection processes.

There are two low lift pumps situated in the low lift building which transfer the raw water from Eagle Lake to the treatment units located in the water treatment plant. In the process of Ph adjustment Lime is injected and mixed through a ``static in-line mixer``, in the process of coagulation Poly Aluminium Chloride is injected just before the treatment units. A cationic polymer is then injected during the flash mixing process prior to the flocculation stage in order to create a strong dense floc, which will facilitate settling during the sedimentation stage. In the sedimentation tanks, water flows upward through a maintained floc blanket and settling tubes and then enters Clarifier effluent tubes carrying the water to the mixed media filters. Any suspended particles that did not settle in the sedimentation tanks will be removed by the dual media filters (composed of anthracite and silica sand, on a layer of support gravel). Filter effluent water is then directed to a Non- Chlorinated water well and then transferred to the GAC (Granular activated carbon) filter tanks. The GAC filter tanks will then further remove any particles still in the water though gravity filtration. The GAC filter effluent is then chlorinated using Sodium hypochlorite before it enters the treated water storage reservoirs.

The chlorinated water is held in the treated water reservoirs to allow for the necessary detention time to meet primary disinfection requirements. Treated water is then transferred to the Vermilion Bay distribution system by the use of high lift pumps located in the Vermilion Bay water treatment plant. Upon leaving the treated water reservoirs there is the capability of adding trim disinfection by means of additional Sodium Hypochlorite injection points. Secondary disinfection requirements in the respective distribution systems are achieved by the maintenance of free chlorine residuals.

System Expenses

Section 11 of O. Reg. 170/03 requires the description of any major expenses incurred during the reporting period to install, repair, or replace necessary equipment. In 2011, the Vermilion Bay water treatment plant Drinking Water System incurred an expense of $5407.48 for SCADA system repairs.

Water Quality

The VERMILION BAY WATER TREATMENT PLANT consistently produced water of exceptional quality in 2011. The descriptions below provide brief summaries of the parameters tested in this DWS, and the reader is asked to consult **Appendix A** for a complete summary of 2011 water quality.

In-House Analyses

The Vermilion Bay water treatment plant Drinking Water System employs an extensive in-house analysis program that includes analyses water quality indicators beyond that which is required in the *Safe Drinking Water Act*. There were over 10,000 routine independent in-house water quality tests conducted with respect to this system in 2011.

Microbiological Analyses

Microbiological analyses are conducted on source, treated, and distribution system water. A total of 260 water samples were collected for bacteriological analysis by an accredited laboratory in 2011, as required by Schedule 10 of O. Reg. 170/03. These routine water samples were collected on a weekly basis, and included tests for E. coli, total coliforms, and heterotophic plate counts.

Organic Parameters and Trihalomethanes

Organic parameters are sampled on an annual basis in treated water in accordance with Schedules 13 and 24 of O. Reg. 170/03. These parameters include various acids, pesticides, herbicides, PCBs, volatile organics, and other organic chemicals. With respect to the Vermilion Bay water treatment plant Drinking Water System, sampling for organic parameters was conducted on February 16th 2011.

Trihalomethanes (THMs) are sampled on a quarterly basis from the farthest point in the Vermilion Bay distribution system, in accordance with Schedule 13 of O. Reg. 170/03. Compliance with the provincial standard for trihalomethane concentrations is determined by calculating a running quarterly average (with a Maximum Acceptable Concentration of 0.100 mg/L or 100 ug/L). In 2011, there were no exceedances for any organic parameter. The results of all organic parameter testing were below the detectable limits.

Inorganic Parameters and Nitrate/Nitrite

Inorganic parameters are sampled on an annual basis in treated water in accordance with Schedules 13 and 23 of O. Reg. 170/03. These parameters include various metals such as Antimony, Arsenic, Cadmium, Mercury, and Uranium. With respect to the Vermilion Bay water treatment plant Drinking Water System, the required annual sampling for inorganic parameters was conducted on February 16th 2011.

Treated water is also tested for nitrate and nitrite concentrations on a quarterly basis in accordance with Schedule 13 of O.Reg. 170/03. There were no exceedances for any inorganic parameter in 2011.

Community Lead Sampling

The Vermilion Bay water treatment plant drinking water system is currently in the provincial community lead testing program, in accordance with Schedule 15.1 of O. Reg 170/03. Consequently, community lead sampling was conducted in this system in 2011. Winter lead sampling included 22 plumbing and 5 distribution samples of which only 2 residential samples exceeded the limit of 10Ug/l or 9.09% of samples. Summer lead sampling included 22 plumbing and 4 distribution samples of which only 1 residential sample exceeded the limit of 10ug/l or 4.55% of the samples.

Flow Statistics

2011 Flows

Throughout the reporting period of 2011, the VERMILION BAY WATER TREATMENT PLANT supplied 72442 m^3 of treated water to consumers. On an average day in 2011, 198.18 m^3 of treated water was supplied. The average daily flow rate in 2011 represented 14.6 % of the rated capacity of the plant (1360 m^3/day). The maximum daily flow rate in 2011 was 441 m^3, which represented 32.4 % of the rated capacity of the plant. The reader is asked to consult **Appendix B** for a complete summary of the 2011 flow data.

Comparison and Outlook

There was a decrease in water production and consumption in 2011 in relation to the previous calendar year. In 2010, 76412 m^3 of treated water was supplied to users of the Vermilion Bay water treatment plant Drinking Water System, compared to 72442 m^3 in 2011. This represented a 0.8 % decrease in the amount of water supplied. Although this difference is appreciable, it is does represent a significant improvement in the integrity of the DWS. It is reasonable to expect that total daily treated flows in 2012 will be between 198 and 441 m^3, which would be consistent with the amounts of water supplied in the years spanning 2009 to 2011.

Chemical Consumptions

The decrease in the amount of water supplied between 2010 and 2011 led to corresponding decreases in the amounts of all chemicals used in the treatment process. The table below summarizes all the water treatment chemicals used during the reporting period and their consumption data. All chemicals used in the treatment process are NSF 60 certified for use in potable water, as required by provincial regulations. Note: The increase in lime consumption was due to corrosion control treatment to circumvent having to conduct a corrosion control program and has demonstrated significant improvements with the systems corrosion control as monitored by the residential lead sampling program.

2011 CHEMICAL CONSUMPTIONS

Treatment Chemical	Quantity Used	Average Dosage (mg/L)	% Change in Quantity Used Between 2010 and 2011 (%)
Poly aluminum Chloride	4305.66	22.96	-0.98
Chlorine	2255.92	4.24	-1.0
Polymer in Kg	7.63	0.10	-56.98
Lime in Kg	461.76	6.02	+160.97

Compliance

Compliance with the Drinking waterworks license to operate

Northern Waterworks Inc. operates the Vermilion Bay water treatment plant and Drinking Water System for the Municipality of Machin, and complies with the terms and conditions of the License to operate and the drinking water permit. Staffing is maintained at levels to ensure that adequate numbers of trained and licensed personnel are available for proper operations, during emergency or upset conditions, for vacation/sick relief, or to deal with equipment breakdown.

Contingency plans and operations manuals are established and located in the appropriate facilities, and are available to all staff members. Operations manuals include information necessary for the day-to-day operation and maintenance of the treatment and distribution systems, as well as information that may be required to be accessed quickly for various purposes. Contingency plans include information that may be required for proper operation of the system during emergency or upset conditions, and contains items such as emergency plans and contact lists.

The operational strategy of Northern Waterworks Inc. includes ensuring that permits and approvals are in place, ensuring efficient maintenance and operations, and ensuring that the quality of water supplied to its customers meets or exceeds the minimum requirements as set out in the *Safe Drinking Water Act*. It is also our responsibility to ensure that permissible flow rates are not exceeded. Flow measuring devices for measuring the amount of water taken and the amount of water supplied are calibrated annually. Accuracy in these measurements ensures that treatment chemicals are precisely applied and that flows do not exceed the capacity at which the system is designed to be effective. These flows are recorded to provide current and historical information for decision making purposes, in addition to being used by the Ministry of the Environment to review and verify the treatment operations.

Water quality analyzers are in place to continuously monitor water quality after critical treatment processes. Each filter is equipped with a filter effluent turbidity analyzer which monitors the amount of suspended particles in the water leaving the filter. A chlorine residual analyzer continuously monitors the free chlorine residual at a point where primary disinfection is complete. Each piece of equipment can be monitored from a remote location, is equipped with an alarm indicating adverse water quality, and is maintained in accordance with manufacturer's recommendations and the License to operate.

A water sampling program is conducted to exceed the minimum requirements of O. Reg. 170/03 under the *Safe Drinking Water Act*. Raw water sampling is conducted to give operational staff the information required to effectively operate the treatment process. Samples are collected throughout the

process to determine the effectiveness of treatment at each stage. Treated and distribution system sampling provide information regarding the quality of water delivered to consumers. All of these samples are analyzed by licensed staff or by an accredited laboratory.

The Drinking waterworks License 290-101 (issued February 14th 2011) for the VERMILION BAY WATER TREATMENT PLANT requires that the annual average concentration of decant effluent total suspended solids be below 15 mg/L. This effluent is returned to Eagle Lake, and originates from the water consumed during plant process purposes (such as filter backwashing, clarifier "desludging", and filter rinsing-to-waste). In 2011, the annual average concentration for decant effluent total suspended solids was 2.23 mg/L.

Non-Compliance with the Certificate of Approval

There were no incidents of non-compliance during this reporting period.

Adverse Water Quality Incidents

Under O. Reg 170/03, notifications and corrective actions are required for any instances where a sample result shows that a parameter used to measure water quality exceeded a Maximum Acceptable Concentration, or where other observations indicate that the safety of the water cannot be guaranteed. There were 4 such instances for the Vermilion Bay water treatment plant DWS in 2011.

Incident Date	Parameter	Result	Unit of Measure	Corrective Action	Corrective Action Date
April 11th , 2011	**Residential plumbing Lead exceedance**	**13.7**	**Ug/l**	**Standard NWHU Flushing instructions to residence**	**April 11th , 2011**
April 12th , 2011	**Residential plumbing Lead exceedances**	**13.9**	**Ug/l**	**Standard NWHU Flushing Instructions to residence**	**April 13th , 2011**

June 8th , 2011	**Total Coliforms**	**P**	**N/A**	**Resample**	**June 9th, 2011, June 10th, 2011**
Sept 30th, 2011	**Residential plumbing Lead exceedances**	**18.9**	**Ug/l**	**Standard NWHU Flushing Instructions to residence**	**October 3rd, 2011**

NOTE: The incidents of lead exceedances were due to the use of lead in the household plumbing of the individual residences and there were no exceedances for lead in any of the distribution system samples taken from the distribution system.

P – indicates a presence in the presence / absence coliform testing conducted by ALS laboratories.

Appendix A: Water Quality

MICROBIOLOGICAL PARAMETERS

Parameter (Sample Type)	Units	Number of Samples	Minimum	Maximum	ONDWS	Compliant ONDWS
E. Coli (Raw)	MPN/100m	53	0 (absent)	0 (absent)	–	–
E. Coli (Treated)	MPN/100m	55	0 (absent)	0 (absent)	<1MPN/100	✓
E. Coli (Distribution)	MPN/100m	179	0 (absent)	0 (absent)	<1MPN/100	✓
Total Coliforms (Raw)	MPN/100m	53	1	2420	–	–
Total Coliforms (Treated)	MPN/100m	55	0 (absent)	0 (absent)	<1MPN/100	✓
Total Coliforms	MPN/100m	179	0 (absent)	1 (1sample)	<1MPN/100	99.6
HPC (Treated)	CFU/mL	55	0	1	–	–
HPC (Distribution)	CFU/mL	110	0	4	–	–

CHEMICAL AND PHYSICAL PARAMETERS (IN-HOUSE)

Parameter	Units	Number of Samples	Minimum	Maximum	Annual Average	Compliant ONDWS
Filter Effluent Turbidity	NTU	Continuou	0.040	0.070	0.053	✓
Treated Water Turbidity	NTU	Continuou	0.066*	0.149*	0.084	–
Residual Free Chlorine	mg/L	Continuou	1.038	1.330	1.21	✓
pH	pH units	Continuou	7.0*	7.25*	7.1	–
Total Alkalinity	mg/L	250	19.1*	21.6	20.7	–
Temperature	°C	250	1.7*	22.8*	9.6	–
Residual Aluminum	mg/L	250	0.011*	0.040*	0.023	–

INORGANIC PARAMETERS

Parameter (Treated Water)	Units	Number of Samples	Minimum	Maximum	ONDWS	Compliant ONDWS
Antimony	ug/L	1	<0.6	<0.6	6	✓
Arsenic	ug/L	1	<1.0	<1.0	25	✓
Barium	ug/L	1	<10	<10	1000	✓
Boron	ug/L	1	<50	<50	5000	✓
Cadmium	ug/L	1	<0.10	<0.10	5	✓
Chromium	ug/L	1	<1.0	<1.0	50	✓
Fluoride	mg/L	1	0.030	0.030	1.5	✓
Lead	ug/L	2	<1.0	<1.0	10	✓
Mercury	ug/L	1	<0.10	<0.10	1	✓
Nitrate	mg/L	4	<0.030	0.100	10	✓
Nitrite	mg/L	4	<0.020	<0.020	1	✓
Selenium	ug/L	1	<5.0	<5.0	10	✓
Sodium**	mg/L	1	15.7	20.5	20	75.0
Uranium	ug/L	1	<5.0	<5.0	20	✓

*These values represent minimum and maximum monthly averages. The remaining values are instantaneous in nature.
**Sodium exceedances were not required to be reported in 2011. Refer to O. Reg. 170/03, Schedule 16, 16-3(1).

Appendix A: Water Quality

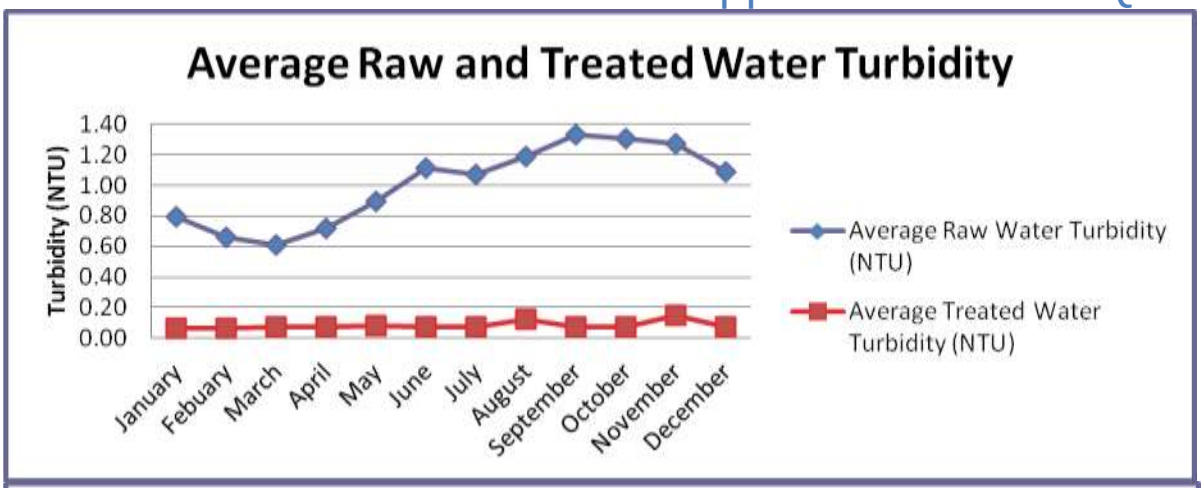
ORGANIC PARAMETERS

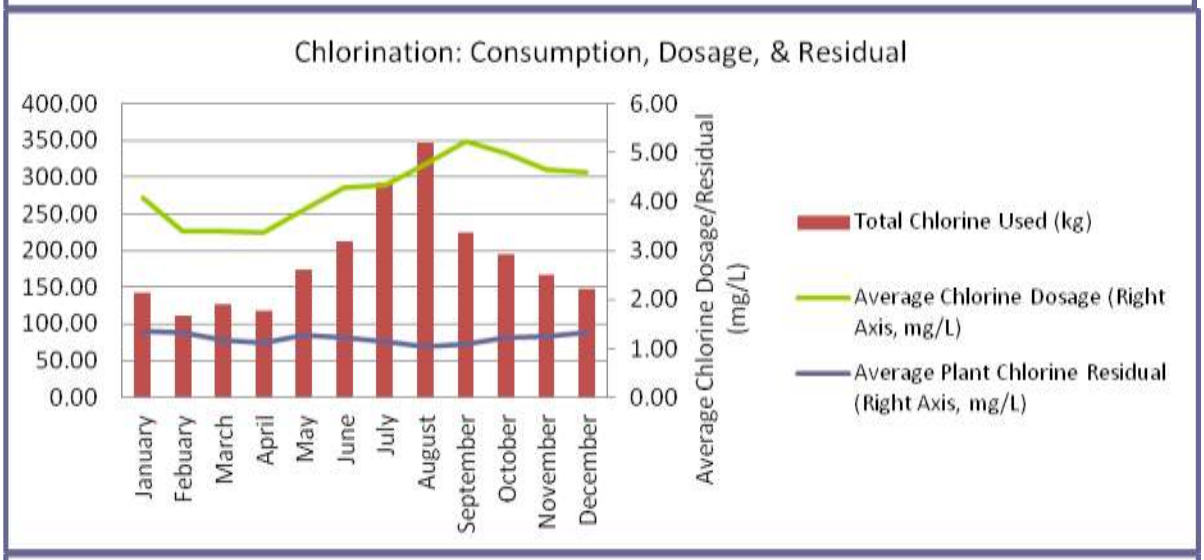
Parameter (Treated Water)	Result (ug/L)	ONDWS (ug/L)	Compliant ONDWS	Parameter (Treated Water)	Result (ug/L)	ONDWS (ug/L)	Compliant ONDWS
Alachlor	<0.20	5	✓	Diquat	<1.0	70	✓
Aldicarb	<1.0	9	✓	Diuron	<1.0	150	✓
Aldrin + Dieldrin	<0.04	0.7	✓	Glyphosate	<5.0	280	✓
Atrazine + N-dealkylated	<0.2	5	✓	Heptachlor + Heptachlor Epoxide	<0.20	3	✓
Azinphos-methyl	<0.10	20	✓	Lindane (Total)	<0.10	4	✓
Bendiocarb	<0.20	40	✓	Malathion	<0.10	190	✓
Benzene	<0.50	5	✓	Methoxychlor	<0.10	900	✓
Benzo(a)pyrene	<0.01	0.01	✓	Metolachlor	<0.10	50	✓
Bromoxynil	<0.2	5	✓	Metribuzin	<0.10	80	✓
Carbaryl	<0.2	90	✓	Monochlorobenzene	<0.50	80	✓
Carbofuran	<0.20	90	✓	Paraquat	<1.0	10	✓
Carbon Tetrachloride	<0.5	5	✓	Parathion	<0.10	50	✓
Chlordane (Total)	<0.3	7	✓	Pentachlorophenol	<0.50	60	✓
Chlorpyrifos	<0.1	90	✓	Phorate	<0.10	2	✓
Cyanazine	<0.10	10	✓	Picloram	<0.20	190	✓
Diazinon	<0.10	20	✓	Polychlorinated Biphenyls (PCBs)	<0.035	3	✓
Dicamba	<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-terachchlorphenol	<0.50	100	✓
Dichloromethane	<0.50	50	✓	Triallate	<0.10	230	✓
2,4 -Dichlorophenol	<0.30	900	✓	Trichloroethylene	<0.50	5	✓
2,4-Dichlorophenoxy acetic acid	<0.20	100	✓	2,4,6-Trichlorophenol	<0.50	5	✓
Diclofop-methyl	<0.20	9	✓	2,4,5-Trichlorophenoxy	<0.20	280	✓
Dimethoate	<0.10	20	✓	Trifluralin	<0.10	45	✓
Dinoseb	<0.20	10	✓	Vinyl Chloride	<0.50	2	✓

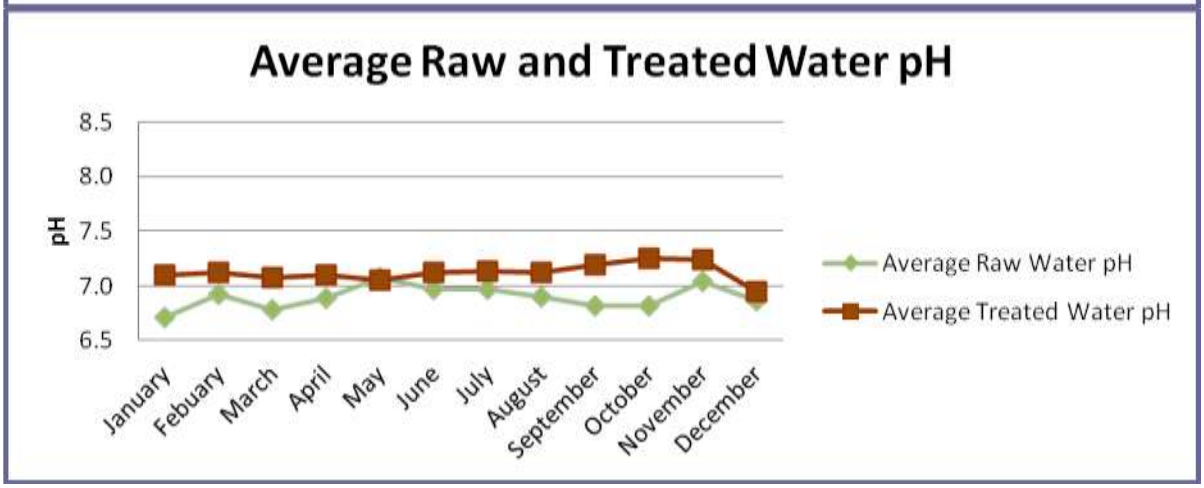
TRIHALOMETHANES

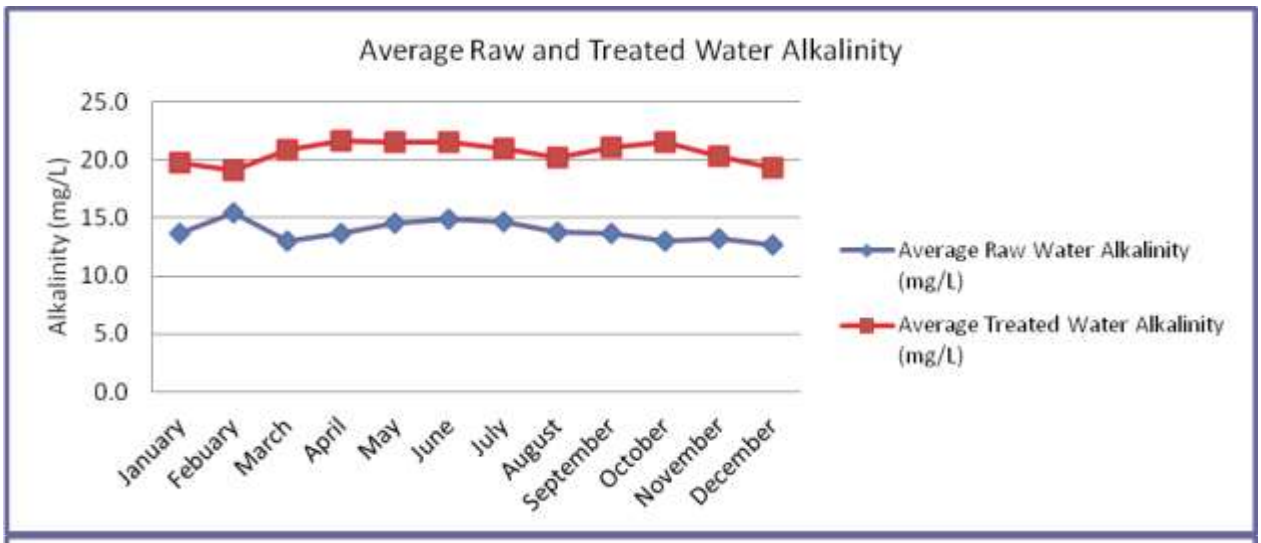
Sample Date (2011)	Total THMs Result (ug/L)	2011 Annual Average (ug/L)	2010 Annual Average (ug/L)	2009 Annual Average (ug/L)		ONDWS (ug/L)	Compliant ONDWS
February	58.2	79.85	52.6	47.0		100	✓
May	73.2						
August	98.3						
November	89.7						

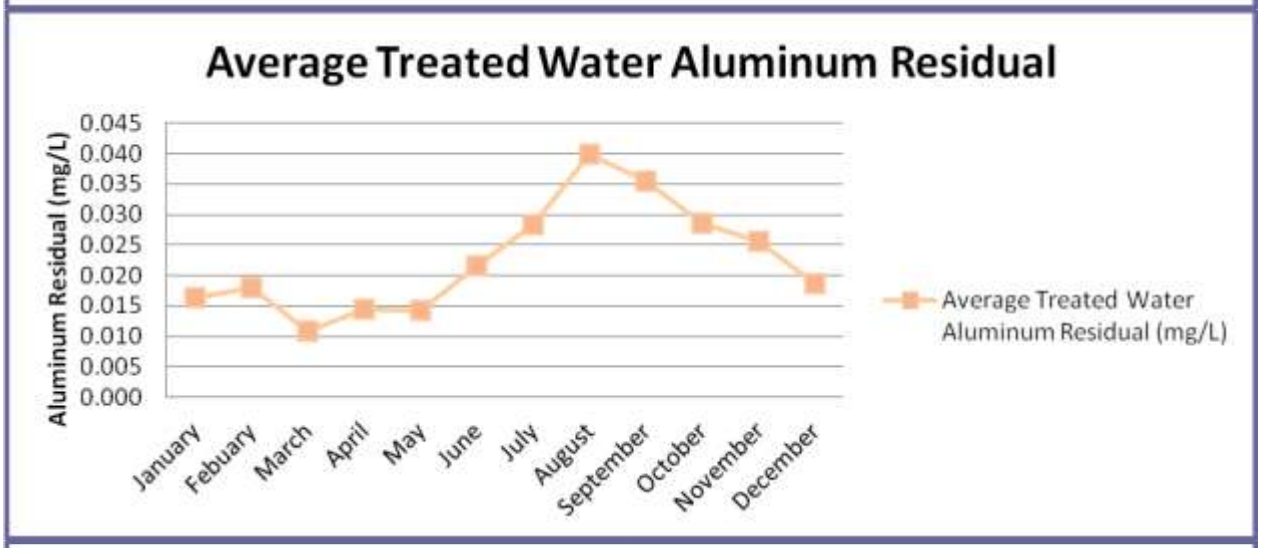
Appendix A: Water Quality

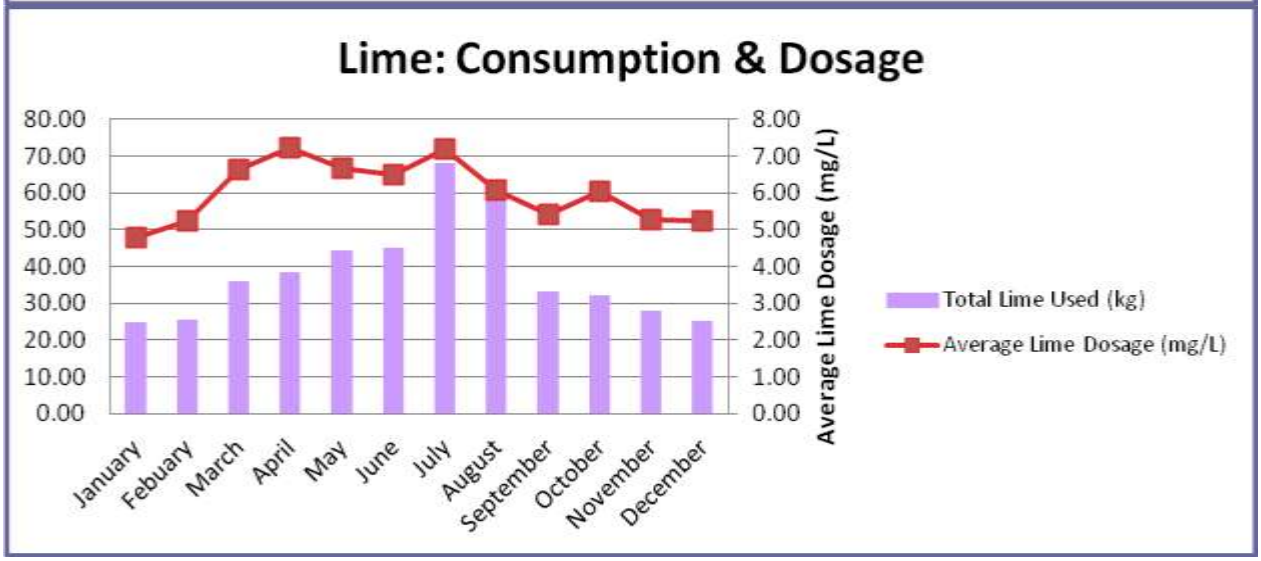







Average Raw and Treated Water Alkalinity
Alkalinity (mg/L)
25.0
20.0
15.0
10.0
5.0
0.0
January
Febuary
March
April
May
June
July
August
September
October
November
December
Average Raw Water Alkalinity (mg/L)
Average Treated Water Alkalinity (mg/L)


Average Treated Water Aluminum Residual
Aluminum Residual (mg/L)
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
January
Febuary
March
April
May
June
July
August
September
October
November
December
Average Treated Water Aluminum Residual (mg/L)


Lime: Consumption & Dosage
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Average Lime Dosage (mg/L)
January
Febuary
March
April
May
June
July
August
September
October
November
December
Total Lime Used (kg)
Average Lime Dosage (mg/L)

Appendix B: Flow Statistics

2011 OVERALL FLOW STATISTICS					
Month	Total Raw Water Flow (m^3)	Ave. Raw Water Flow (m^3)	Total Treated Water Flow (m^3)	Average Treated Water Daily Flow (m^3)	Maximum Treated Water Daily Flow (m^3)
January	5417	169.281	5647	176.469	194.000
February	4968	177.429	5015	179.107	196.000
March	5589	180.290	5616	181.161	244.000
April	5479	182.633	5061	174.517	210.000
May	6691	215.839	6336	204.387	270.000
June	6928	230.933	6534	217.800	273.000
July	9486	306.000	8552	275.871	427.000
August	10138	327.032	9018	290.903	441.000
September	6219	207.300	5900	196.667	294.000
October	5825	187.903	5471	176.484	234.000
November	5273	175.767	4840	161.333	224.000
December	4850	156.452	4452	143.613	171.000
Total	**76863**		**72442**		
Average	**6405.25**	**209.738**	**6036.83**	**198.193**