PROJECT: **WATERWORKS SYSTEM ASSESSMENT ROUND #3**

PREPARED FOR: **TOWN OF CUT KNIFE, SK**

PINTER
& ASSOCIATES LTD

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19 September 2016

File: 15-1837

CONFIDENTIAL

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Dear Mr. McCallum:

Re: Round #3 Waterworks System Assessment (WSA) for the Town of Cut Knife

Attached is the Final Round #3 Waterworks System Assessment report for the Town of Cut Knife.

Thank you for the opportunity of working with the Town of Cut Knife. If you have any questions, concerns, or further direction, please do not hesitate to call PINTER & Associates Ltd at 306-244-1710.

Yours Sincerely,
PINTER & Associates Ltd.

Yanan Xing

Yanan Xing, P.Eng.
Project Engineer

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Waterworks System Assessment
Round #3

CONFIDENTIAL

Prepared For:
TOWN OF CUT KNIFE

Prepared By:
PINTER & Associates Ltd.

19 SEPTEMBER 2016
File: 15-1837

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Glossary of Terms and Abbreviations

AC	Asbestos Cement
AO	Aesthetic Objective
BWO	Boil Water Orders
CDWQG	Canadian Drinking Water Quality Guidelines
CDWQG	Canadian Drinking Water Quality Guidelines
CDWQGST	Canadian Drinking Water Quality Guidelines Summary Table
CT	Contact Time
dam^3	Cubic decametres
ERP	Emergency Response Plan
GCDWQ	Guidelines for Canadian Drinking Water Quality
GUDI	Groundwater Under the Direct Influence of Surface Water
HDPE	High-density polyethylene
HP	Horse Power
km	kilometres
Lps	Liter per second
m^3	Cubic metres
m	metres
mm	milimeter
MAC	Maximum Acceptable Criteria
MDWQMG	Municipal Drinking Water Quality Monitoring Guidelines
MSDS	Material Safety Data Sheets
MUL	Maximum use level
NaOCl	Sodium Hypochlorite
NG	No Guideline
NTU	Nephelometric Turbidity Units
OG	Operational Guideline
PDWA	Precautionary Drinking Water Advisories
PVC	Polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
SDWQSO	Saskatchewan Drinking Water Quality Standards and Objectives
TDS	Total Dissolved Solids
USEPA	United States Environmental Protection Office
VFD	Variable Frequency Drive
WSA	Waterworks System Assessment
WTO	Water Treatment Operator
WTP	Water Treatment Plant

Executive Summary

Our assessment of the Town of Cut Knife (the TOWN) waterworks identified that due to ammonia interference, the tested free chlorine results may not be the true values.

The Town should focus on solving the ammonia interference issues. It is recommended to carry-out breakpoint chlorination testing to identify whether the breakpoint can be achieved without the sodium hypochlorite (NaOCl) dosage exceeding the maximum limit. If it is not possible to meet the breakpoint, alternative strategies need to be considered. Raw water ammonia can be removed using additional removal techniques. Disinfectants with higher disinfection efficiencies, for example, chlorine gas, ultraviolet radiation, ozone, and chlorine dioxide, are potential alternative options for primary disinfection. Professional consultants should be hired to help determine the best strategy to be adopted.

The construction of a new water well to provide sustainable water supply with good water quality should also be continued.

The sample history shows that not all sampling for turbidity and chlorine testing is carried out in compliance with the Permit requirement. The WTO should ensure that full compliance with the PERMIT's Waterworks Schedule "Treated Water Sampling Locations and Minimum Sampling Frequency" is maintained.

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1.0 BACKGROUND AND GENERAL OVERVIEW

PINTER & Associates Ltd. (PINTER) was retained by the Town of Cut Knife (the TOWN) to conduct a Round #3 Waterworks System Assessment (WSA) of waterworks.

The TOWN, a community with a population of 517 people (Census, 2011) is located 192 kilometres (km) northwest of the city of Saskatoon, and is accessible by Provincial Highway #16 and Provincial Highway #40.

PINTER's Project Engineer, Ms. Yanan Xing, carried out the WSA site inspection on 09 December 2015 with the assistance of the daily Water Treatment Operator (WTO). The certified WTO supervises the weekly operation of the WTP.

The WSA site inspection included a kickoff meeting. The purpose of this meeting was to review the scope of work for this WSA prior to the site inspection, and to discuss the current waterworks system, initial recommendations, and documentation availability.

The purpose of the WSA site inspection was to inspect the waterworks infrastructure, equipment, and maintenance and operational procedures related to the waterworks system components. Potential adverse health risks and environmental impacts associated with the waterworks will also be identified by the WSA.

This WSA reports on the current performance of the water treatment system, the level of performance, optimization, functionality, capability, efficacy, and sustainability of the waterworks. The WSA also provides recommendations for improvements to increase the efficiencies and capabilities of the waterworks to ensure that the province's regulatory drinking water quality standards are achieved.

The WSA was conducted in accordance with:

- The Waterworks and Sewage Works Regulations (Effective in June 1, 2015)
- Waterworks System Assessment (WSA) Standards Round 3, 2014
- Municipal Drinking Water Quality Monitoring Guidelines, (MDWQMG), EPB 202, October 2012
- Canadian Drinking Water Quality Guidelines, (CDWQG), 1996
- Canadian Drinking Water Quality Guidelines Summary Table, (CDWQGST), October 2014
- Saskatchewan Drinking Water Quality Standards and Objectives, (SDWQSO), EPB 507
- Waterworks Design Standards, EPB 501, November 2012
- Water Pipeline Design Guidelines, EPB 276, April 2004
- Wellhead Protection, EPB 299, September 2004; and
- Groundwater Under the Direct Influence (GUDI) of Surface Water, EPB 284, May 2004.

Documentation in support of the WSA is provided in the following appendices:

Appendix A: Water Quality Data;
Appendix B: Plans and Reports;
Appendix C: Figures and Drawings; and
Appendix D: Pictures.

The raw water and treated water quality analysis results are provided in Appendix A for review.

Copies of the "Permit to Operate a Waterworks" Permit #00002579-04-00 (PERMIT) are provided in Appendix B for review.

The following is a list of the drawings obtained from the WTP and other sources that were made available for this WSA report. The drawings are included in Appendix C, Figures and Drawings:

Figure 1: Project Location Map; and
Figure 2: Water Treatment System Diagram.

The pictures taken during the site inspection for this WSA are attached in Appendix D, Pictures.

1.1. SYSTEM OVERVIEW

The WTP raw water supply is mainly derived from one (1) groundwater well, Well #2, installed in October 2014. Well#1, constructed in 1992, is no longer in service. The groundwater is pumped to the WTP via a 2.7 km long water supply pipeline. The raw water is oxidized with potassium permanganate ($KMnO_4$) and then filtered by greensand filters. The filtered water is disinfected by sodium hypochlorite (NaOCl) before entering the underground treated water storage reservoir.

1.2. RECOMMENDATIONS FROM ROUND #2 WSA

The Round #2 WSA was completed for the TOWN by EPEC Consulting Ltd.

CONCLUSION:

This WSA includes several recommendations from the Round #2 WSA report. Table 1 summarizes the recommendations that remain outstanding and the recommendations that have been addressed over the last five (5) years.

RECOMMENDATION:

The TOWN should implement the recommendations from the Round 2 WSA marked as "not completed" to improve the waterworks system operation.

Table 1. Round #2 WSA Recommendations

Item from Round 2 WSA Report	Recommendation	Current Status & Comments
5.1	Construct a new deep well complete with submersible pump and controls to provide 100% water supply standby.	A new well will be constructed in 2016.
5.1	Pumpwell No. 1 does not have licensed well allocation. The well allocation must be registered with Sask Watershed Authority.	Well #1 is no longer in service.
5.2	Ensure that the turbidity of the treated water is maintained below the 1.0 NTU level as stated in the Saskatchewan Drinking Water Quality Standards and Objectives.	Since 2015, the testing results and testing frequency were both improved and meet the PERMIT requirement.
5.2	Establish chlorine demand and practice breakpoint chlorination	Not completed
5.3	Conduct a distribution system analysis.	Not completed
5.3	Replace existing reservoir level controller with ultrasonic type unit.	Not completed

2.0 REVIEW OF AVAILABLE INFORMATION

2.1. WATER SUPPLY SYSTEM

The water source for the TOWN is one (1) groundwater well, Well #2, located approximately 2.7 km northeast of the WTP. Well #2 has been in service since October 2014. The well was constructed by McAllister Drilling Inc. in 2013. Well #1, constructed in 1992, was formerly used as the primary raw water source. It is no longer in service. Therefore, there is no backup well for Well #2. The WTO reported that as part of the contingency plan, a backup well will be constructed in 2016.

A copy of the driller report for Well #2was obtained from the Water Security Agency website. A copy of the water well driller report is attached in Appendix B for reference. It was reported that the well was properly constructed and that the structure of the well is in good condition.

Table 2 contains information details for the Well #2.

Table 2: Town of Cut Knife Well Data

Component	Units	Well #2
Source:		Empress Group/Battleford Valley
Date of construction:		2013
Depth of Well (bgs):	m (ft)	170.7 (560)
Depth of Screen (bgs)	m	150.3 – 164.6 493.0 – 540.0
Type of Casing:		Steel and plastic
Diameter of Casing:	ID mm	203
Estimated Production Rate	Lps	13.64
Pump Type		Grundfos Submersible
Pump Size	HP	25
Pump Capacity	Lps	11.4
Annual Quantity Allocation	m^3	138,700

A raw water meter is installed to measure the raw water intake. According to the water flow rate records provided by the WTO, the maximum annual raw water consumption from 2011 to 2014 is approximately 69,218 cubic metres (m^3) which is less than annual quantity allocation of 138,700 m^3.

A Groundwater Under the Direct Influence of Surface Water (GUDI) assessment for Well #2 has not been completed previous to this WSA. The Groundwater Under the Direct Influence of Surface Water (GUDI) assessment screening criteria considers the well's setting, proximity to surface water, well construction; and water quality to determine if a communities groundwater well is a GUDI or NON-GUDI groundwater source as detailed in Water Security Agency's EPB 284. Sufficient raw water quality data from Well #2 (covering a prolonged period of time) was not available. Considering only the first three (3) screening criteria of

EPB 284 with the limited raw water quality data provided by the TOWN (Appendix A), Well #2 can be deemed as a NON-GUDI source.

The raw water supply pipeline was constructed in 1992 and consists of approximately 2.7 km of 150 millimeter (mm) diameter polyvinyl chloride (PVC) pipeline. This pre-existing raw water supply line was connected to Well #2 when the well was put into service.

The pipeline is equipped with swab launch and retrieval facilities, but has not yet been swabbed. The WTO reported that the pipeline is scheduled to be swabbed in 2016.

It should be noted that there is no raw water storage reservoir for this WTP.

CONCLUSION:

The License to Use Ground Water for the wells is available for review. The total annual raw water consumption is less than the total water quantity allocation. Well #2 is assessed as a NON-GUDI source considering the first three (3) screening criteria of EPB 284. As part of the contingency plan, a backup well will be constructed in 2016.

2.2. WATER CONSUMPTION

This table was developed from the daily water records provided by the WTO for the TOWN. Table 3 presents the monthly treated water consumption data in numerical format for 2011 to 2014.

Table 3. Historical Treated Water Consumption

Year	Annual Total (m^3)	Avg Day (m^3/day)	Avg Day (Lps)	Avg Day (LCD)	Max Day* (m^3/day)	Max Day (Lps)
2011	78,075	214	2.48	414	439	5.08
2012	66,149	181	2.10	351	343	3.97
2013	69,218	190	2.19	367	289	3.34
2014	59,888	164	1.90	317	303	3.51
Average	68,333	187	2.17	362	344	3.98
Minimum	59,888	164	1.90	317	289	3.34
Maximum	78,075	214	2.48	414	439	5.08

- - Note: "Day" refers to average or maximum one day consumption

An average daily volume of 362 litres per capita per day (LCD) was used in this assessment report.

2.3. RAW AND TREATED WATER QUALITY

2.3.1. Raw Water Quality

Raw water health and toxicity parameters were tested in December 2015. The results were provided by the TOWN and are tabulated in Table 4. General chemical testing results for raw water from the last five (5) years were not available for review.

Table 4. Raw Water Analysis Results

Parameter	Unit	SDWQSO Objective	Objective Type	December 2015
Aluminum	mg/L	NG		<2.14
Arsenic	ug/L	10	MAC	**13.2**
Barium	mg/L	1.0	MAC	0.0111
Boron	mg/L	5	IMAC	0.4
Cadmium	mg/L	0.005	MAC	<0.00056
Chromium	mg/L	0.05	MAC	<0.00011
Copper	mg/L	1.0	AO	0.0152
Iron	mg/L	0.3	AO	**1.8**
Lead	mg/L	0.01	MAC	0.0022
Manganese	mg/L	0.05	AO	**0.16**
Selenium	mg/L	0.01	MAC	<0.00096
Uranium	ug/L	20	MAC	0.9
Zinc	mg/L	5	AO	0.033

- Notes for Table 4: values shaded and bolded indicates exceedances of the SDWQSO Objectives.

CONCLUSIONS:

The results show that the raw water has high levels of arsenic, iron, and manganese. The WTO also reported that high Ammonia-N levels are present in the raw water source.

RECOMMENDATIONS:

The TOWN is encouraged to collect and submit raw water samples periodically for general chemical, and health and toxicity analysis, as well as turbidity, total coliform, and *E.Coli*. This will assist, over a period of years, in identifying potential variations in water quality and/or potential contamination of the raw water source. It will also assist in GUDI determination.

Since the ammonia will interfere with the disinfection process, it is also recommended that the ammonia testing on the raw water and filter effluent be carried out to determine the ammonia levels reacting with the sodium hypochlorite.

2.3.2. Treated Water Quality

As per the PERMIT, regular treated water quality testing is required for the following parameters:

- BACTERIOLOGICAL: Once (1) every week from representative locations in the water distribution system;
- TURBIDITY: Daily, from treated water entering the distribution system for groundwater plants and at the same frequency and locations as for bacteriological sampling;
- CHLORINE RESIDUAL: At least once (1) per day for total and free residual in the water entering the water distribution system; and, at the same frequency and locations as for bacteriological sampling, for total residuals;
- CHEMICAL-GENERAL: Once (1) every two (2) years for the treated water at the WTP; and
- CHEMICAL-HEALTH CATEGORY: Once (1) every two (2) years for the treated water at the WTP.

Treated water quality data was obtained from the following sources:

- WTP treated water laboratory testing results;
- SaskH2O website; and

- Drinking Water Quality and Compliance, Annual Notice to Consumers, 2011 to 2014.

2.3.2.1. General Chemistry and Chemical Health Data

General chemistry (2011, 2012, 2013 and 2014) and health and toxicity (2014) analysis reports were obtained from the TOWN for this WSA review and are summarized and compared with the Saskatchewan Drinking Water Quality Standards and Objectives (SDWQSO). Health and toxicity analysis results for year of 2011 and 2013 were obtained from SaskH2O. Copies of the analytical reports are included in Appendix A for review.

Table 5 summarizes the treated water quality parameters that exceed the limit.

Table 5. Treated Water Analytical Results

Parameter	Unit	SDWQSO Objective	Objective Type	2011	2013	11 Dec2014/16 Dec 2014	17 Dec 2015
Total Dissolved Solids (TDS)	mg/L	<1500	MAC	1415	1417	1415	1412
		<500	AO				
Iron	mg/L	<0.3	AO	<0.1	<0.1	**0.54**/0.1	<0.1
Manganese	mg/L	<0.05	AO	0.04	0.04	**0.4/0.11**	0.01

Results in bold and shaded in grey indicate parameters exceeding the SDWQSO objective. OG = operational guideline, MAC = maximum acceptable criteria, AO = aesthetic objective, NG = no guideline, GCDWQ= Guidelines for Canadian Drinking Water Quality, - = not measured.

CONCLUSION:

The general chemical and health parameters tested were generally well within the GCDWQG and the SDWQSO guideline criteria with two exceptions. The concentrations of iron and manganese tested in 2014 were not always below the limit. TDS testing results meet the provincial regulations (MAC) but exceed the federal limit (AO). The sampling and analysis frequency complied with the PERMIT requirements.

2.3.2.2. Bacteriological Results

As per the PERMIT, the limits for bacteriological levels are:

(i) total coliform levels of zero organisms detectable per 100 milliliters;

(ii) Fecal coliform levels of zero organisms detectable per 100 milliliters; and,

(iii) background bacteria levels on a total coliform or fecal coliform membrane filtration plate of less than 200 organisms per 100 milliliters or no overgrowth.

The bacteriological results were obtained from the SaskH2O website for the period of 04 January 2011 to 29 December 2015 (copies of these results are included in Appendix A). The results show that zero total coliform was detected. The bacteriological sampling and testing was completed and recorded in accordance with the PERMIT's Waterworks Schedule "Treated Water Sampling Locations and Minimum Sampling Frequency".

According to the waterworks representatives, there have been no Precautionary Drinking Water Advisories (PDWA) or Boil Water Orders (BWO) issued to the system due to the detection of bacteriological contamination.

CONCLUSION:

The results presented above indicate no historical incidences of bacteriological contamination detection from 2011 to 2015.

RECOMMENDATION:

Continue to submit treated water samples for bacteriological analysis in compliance with the PERMIT.

2.3.2.3. Turbidity Results

In accordance with the PERMIT, the TOWN tests for turbidity on a daily basis at the WTP and on a weekly basis in conjunction with bacteriological testing in the distribution system.

All available turbidity results for water entering the distribution system were summarized in the Annual Notice to Consumers from 2011 to 2014 (refer to Appendix B). The daily log sheets from 01 January 2013 to 31 December 2015 were also provided for cross reference. The TOWN indicated that the log sheets from 2011 to 2012 cannot be retrieved due to staff turnover and document mismanagement. However, it was reported that all testing was carried out from 2011 to 2012. The Waterworks Compliance Inspection – Human Consumptive Use (Part I) reports from SaskH2O were reviewed for further clarification. These results indicated that the turbidity exceeded the 1.0 Nephelometric Turbidity Units (NTU) limit in 42 of the 365 tests performed in 2014. This does not meet the PERMIT requirement of 95% discrete measurements less than 1.0 NTU. The turbidity exceedances were reported to be caused by a condition with the well. In other calendar years, 2011, 2012, 2013, and 2015, 95% of the turbidity results for water entering the distribution system met the PERMIT requirement and were in compliance with the PERMIT.

All of the turbidity results received in conjunction with bacteriological testing in the distribution system were obtained from the SaskH2O website and are attached in Appendix A for review.

A review of the test results shows that one sampling event was missed in the months of June 2011 and April and December 2012, however, all other turbidity sampling and testing was completed and recorded in accordance with the PERMIT's Waterworks Schedule "Treated Water Sampling Locations and Minimum Sampling Frequency".

CONCLUSION:

The available turbidity results indicate that the turbidity testing results and testing frequency were not always in compliance with the PERMIT. However, since 2015, the testing results and testing frequency were both improved and met the PERMIT requirement.

RECOMMENDATION:

Continue to maintain the turbidity testing frequency and the turbidity values in compliance with PERMIT.

The daily log sheets and all the testing records should be maintained appropriately.

2.3.2.4. Chlorine Residuals

As per the PERMIT, the required chlorine residuals are:

(a) *free residual of not less than 0.1 milligrams per litre in the water entering a distribution system; and*

(b) *a total chlorine residual of not less than 0.5 milligrams per litre or a free chlorine residual of not less than 0.1 milligrams per litre in the water throughout the distribution system.*

The WTP daily log sheets from 01 January 2013 to 31 December 2015 were provided by the TOWN. The TOWN not only tested free chlorine residue but also total chlorine concentration for the water entering the water distribution system. The Annual Notice to Consumers from 2011 to 2014 calendar years were also reviewed (copies of these documents are included in Appendix B). The WTP log sheets show that the daily entries for the free chlorine residual were completed and recorded in accordance with the PERMIT's Waterworks Schedule "Treated Water Sampling Locations and Minimum Sampling Frequency". The data obtained from the SaskH2O website was also reviewed as a cross reference for the water within the water distribution system. There was one missed sampling event within water distribution system for the months of June 2011 and April and December 2012. However, all other chlorine sampling and testing was completed and recorded in accordance with the PERMIT's requirement.

Free Chlorine Residual Entering the System

An evaluation of the chlorine residual test results from the WTP records determined that in 2011 and 2012, less than 100% of the test results for the water entering the distribution met the PERMIT requirement of a minimum level of 0.1 mg/L. There was one sample for free chlorine residual in each month of June 2014, July 2014, and November 2015 that was less than the minimum level of 0.1 mg/L.

Chlorine Residual within the System

All available chlorine residual test results for water within the distribution system, taken in conjunction with the bacteriological testing, were obtained from the SaskH2O website and reviewed for the period of 04 January 2011 to 30 November 2015 (Refer to Appendix A for review).

It was determined that 100% of the free chlorine residual test results from within the distribution system met the PERMIT requirement of 0.1 mg/L.

It is suspected that some or all the free chlorine readings may be false due to interference from high ammonia concentrations. The total chlorine results are very high and breakpoint chlorination may not be met. The breakpoint chlorination testing needs to be carried out to clarify the issue.

CONCLUSION:

The disinfection system was not 100% compliant with the PERMIT.

RECOMMENDATION:

The TOWN should take appropriate action to address the ammonia interference. The following sequence of actions is recommended:

Step 1: Carry out breakpoint chlorination testing to identify whether the breakpoint can be achieved without the sodium hypochlorite (NaOCl) dosage exceeding the maximum limit.

Step 2: If the breakpoint is achieved successfully, the TOWN should adjust the NaOCl injection dosage to meet the PERMIT requirement.

However, if it is not practical to meet the breakpoint, other strategies need to be considered. Raw water ammonia can be removed using alternate removal techniques. Disinfectants such as chlorine gas, ultraviolet (UV) radiation, ozone,

and chlorine dioxide are alternative options to achieve primary disinfection. Professional consultants should be retained to help determine the choice of the strategy to be adopted.

2.4. PLANS, REPORTS, AND MANUALS

The following drawings and reports were acquired from the TOWN:

- Alteration of Permit to Operate a Waterworks, permit##00002579-04-00 , issued on 31 March 2013 and expire on 31 March 2016;
- Alteration of Permit to Operate a Waterworks, permit#00002579-04-00 , issued on 01 April 2011 and expire on 31 March 2013;
- Drinking Water Quality and Compliance, Annual Notice to Consumers, 2011 through 2014; and
- 2014 Ground Water Supply Raw Water Use Data Report, 11 June 2012.

The following manuals are available for the waterworks WTO at the WTP:

- S.E. Drinking Water Information Binder;
- MSDS;
- Waterworks Quality Assurance/Quality Control (QA/QC) Policy;
- Emergency Response Plan (ERP);
- Plant Operating Manual;
- Equipment Maintenance Manual; and
- HACH operational manuals.

2.5. HISTORICAL PROBLEMS

Historically, Well#1 had issues with casing collapse. This well is no longer in service. Due to ammonia interference, it is suspected that the free chlorine does not meet the breakpoint chlorination in the raw water. This issue is yet to be resolved.

2.6. MAINTENANCE RECORDS

Maintenance was performed on an as-required basis.

2.7. NEW COMPONENTS/UPGRADES

Well#2 was constructed in 2013 and commissioned in 2014 and is used as the primary raw water source for the WTP. The water treatment system at WTP was re-piped in 2015.

3.0 WATERWORKS ASSESSMENT FINDINGS

3.1. RAW WATER SUPPLY

3.1.1. Raw Water Supply, Wells/Intakes and Pumping Stations

The raw water is supplied by one (1) groundwater well. Well #2 is the main and only duty well with a pumping capacity of 11.4 Lps. It was reported by the WTO that a backup well will be constructed in 2016. Based on the discussion in Section 2.1, the annual well intake is less than the annual quantity allocation.

Water Security Agency Design Guidelines recommend that the raw water supply should be capable of producing the maximum day demand. As reported in Section 2.2, the maximum daily consumption during the last four (4) years at the TOWN was 5.08 Lps; the existing well's pumping has capacity to meet this requirement. Based on the current population of 514 and a maximum daily consumption of 5.08 Lps, the current raw water supply will be sufficient to supply a maximum population of 1,100 people.

During the site visit, the wellhead of Well #2 was observed to be well protected within a pump house (refer to photograph #1 and #2, page D1, Appendix D). The 25 horse power (HP) pump in the well was reported and observed to be performing well. The pump house was constructed in 2014. Interview evidence indicated that the pump station entrance door is kept locked and that the pump house is checked daily. The electrical panels are in good operating condition (refer to photograph #3, page D2, Appendix D) and there is adequate lighting and heating at the pump station.

CONCLUSION:

Based on the available information, upset conditions affecting the reliability of the raw water supply have not occurred from 2011 to 2015 and potential contaminants were not noted. The raw water supply capacity is adequate for the current water consumption.

RECOMMENDATION:

Continue to maintain the raw water supply in good working order.

3.1.2. Supply Lines and Storage Reservoirs

The raw water pipeline is approximately 2.7 km of 150 mm diameter PVC pipeline. There were no reported problems or breaks in the raw water supply pipeline. The pipeline has not been flushed and swabbed to date. The WTO reported that the pipeline would be swabbed in 2016. The discharge pressure from the pump station provides sufficient flow to the WTP.

Engineering calculations show that the pipeline can flow at maximum rate of 26.5 Lps based on maximum design velocity of 1.5 m/s as per EPB 276, Water Pipeline Design Guideline. The current maximum daily consumption is 5.08 Lps, and the pipeline is sufficiently sized to supply the TOWN's current population of 517. According to the current water consumption rate, the raw water supply can provide for a maximum population of approximately 2,600.

CONCLUSION:

The supply lines were maintained satisfactorily and the capacity is adequate for the current water demand.

RECOMMENDATION:

Continue to maintain the raw water supply line in good working condition. It is recommended to swab and flush the raw water supply pipeline every five (5) years.

3.1.3. Operation and Maintenance Procedures

There are scheduled daily inspections of the operating intake pump house. The supply pipeline and intake are maintained by the WTO.

3.2. WATER TREATMENT PROCESS AND DISINFECTION SYSTEM

3.2.1. Water Treatment Plant

The WTP, which houses the treatment units and associated equipment, and the water distribution system, was originally constructed in 1984. The WTP was upgraded in 1992 to treat groundwater (refer to photograph #4, page D2, Appendix D) and the treatment system was re-piped in 2015. The building was constructed with masonry walls, truss roof, and is insulated. The plant is situated above the underground treated water storage reservoir. The overall condition of the building is good.

Electrical equipment and meters were observed to be in normal operating condition (refer to photograph #5, page D3, Appendix D). Service utilities, including the electrical heater, lighting, and ventilation equipment appear to be in good repair and fully operational.

The general state of cleanliness is good. The plant piping is well organized and color-coded.

CONCLUSION:

The water treatment plant and related utility is maintained in good operating condition. The cleanliness of the WTP is satisfactory and the pipelines are color-coded.

RECOMMENDATION:

Continue to maintain water treatment plant in good working condition.

3.2.2. Water Treatment Process and Equipment

An overview of the water treatment process is provided in Figure 2 (Water Process Flow Diagram, Appendix C). Potassium permanganate ($KMnO_4$) (refer to photograph #6, page D3, Appendix D) is injected by an Aldos DDA chemical feed pump (refer to photograph #7, page D4, Appendix D) into the static mixer at the raw water intake pipe (refer to photograph #6, page D3, Appendix D). Then the oxidized raw water is split into the two (2) manganese greensand filters (refer to photograph #8, page D4, Appendix D). The guidelines recommend that the treatment system be capable of treating the maximum day demand. According to the Round 2 WSA report developed by EPEC Consulting Ltd. in 2011, the total filter capacity of the two filters is approximately 9.09 Lps. The maximum filtration capacity meets the maximum water consumption from the last four (4) years of 5.08 Lps. Based on the current population's unit water consumption rate, the existing filtration system can supply the water demand for a maximum population of approximately 900 people. The filters were reported to be backwashed automatically once daily. The filter media was replaced in 2008.

Following filtration, the filtered effluent is injected with NaOCl (refer to photograph #9, page D5, Appendix D) and is then stored in the underground concrete storage reservoir which has a total storage capacity of 1,137 m^3.

As mentioned in Section 2.2.2.4, due to "high" ammonia values in the raw water and ammonia interference with the chlorine, the free chlorine numbers are not true free available chlorine values. Therefore, breakpoint chlorination needs to be carried out.

CONCLUSION:

Based on the information available, the current treatment system capacity is adequate for the water demand.

It is suspected that due to the ammonia in the raw water, the free chlorine does not meet the breakpoint chlorination. This issue has yet to be resolved.

RECOMMENDATION:

The TOWN should conduct a breakpoint chlorination investigation to ensure the true free chlorine residual meets the requirement of the limit. If the breakpoint cannot be achieved, the TOWN is encouraged to investigate other strategies to solve the problem as suggested in section 2.3.2.4.

3.2.3. Water Treatment Plant Wastewater Disposal

The wastewater from the WTP consists of the floor drain contents and filter backwash waste. The wastewater generated in the WTP is disposed of into the WTP sump, which is connected to the sanitary sewer collection system. Eventually, wastewater is piped to the TOWN sewage lagoon.

3.2.4. Chemicals, Equipment and Dosages

The chemicals used for the water treatment process, their application points, the pumping equipment employed and the associated equipment capacities are shown in Table 6.

Table 6. Chemical Equipment

Chemical Used/Application Point	Feed Pump Type/On Site Setting	Typical Dose	Maximum Use Level (MUL)
Potassium permanganate ($KMnO_4$)/static mixer	ALDOS DDA /744 ml/h	1.6-2.1 mg/L	50 mg/L
Post-Sodium hypochlorite (NaOCl)/filters effluent pipeline	ALDOS DDA /902 ml/h	8.0-10.0 mg/L	87 mg/L

As indicated in Table 6, the chemical feeding dosage does not exceed the maximum use level (MUL).

During the site visit, it was observed that the in-use potassium permanganate tank and sodium hypochlorite tanks were standing in direct contact with the floor (refer to photograph #7, page D4, Appendix D). Chemical tanks should be stored within secondary containment to control any potential spills and leaks. The sodium hypochlorite storage tanks were piled in the middle of the building, which impedes access (refer to photograph #10, page D5, Appendix D). The chemical feed pumps were operating satisfactorily (refer to photograph #7, page D4, Appendix D) and backup feed pumps were available at the WTP.

It was noted during the WSA site inspection that Material Safety Data Sheets (MSDS) for the chemicals are available at the WTP.

The safety equipment available at the WTP for use when handling chemicals includes safety glasses, rubber gloves, first aid kit, eye wash kit, and fire extinguishers.

CONCLUSIONS:

Chemical tanks are stored within the WTP without the benefit of secondary containment to control spills and leaks. The WTP is also somewhat cluttered with empty sodium hypochlorite containers.

RECOMMENDATION:

To provide secondary containment for the potassium permanganate and sodium hypochlorite tanks, we suggest the in-use tanks be set on the spill platform. It is recommended for the sodium hypochlorite containers to be relocated to maintain a clear path within the building.

3.2.5. Disinfection Process Effectiveness

Disinfection process effectiveness was estimated according to the method described by the United States Environmental Protection Office (USEPA)[1] and summarized in EPB 501. The estimation included the following worst-case scenario assumptions and approximations:

[1] *LT1ESWTR Disinfection Profiling and Benchmarking Technical Guidance Manual, at http: /www.epa.gov/safewater/mdbp/mdbptg.html*

- The contact time (CT) calculation was calculated for a NON-GUDI ground water source since the existing water treatment system is designed for true groundwater treatment, the GUDI assessment is recommended to confirm the groundwater source is NON-GUDI;
- Disinfection process effectiveness was evaluated based on the true free chlorine residual of 0.1 mg/L. Due to the ammonia interference with disinfection process, breakpoint investigation needs to be carried out to ensure the free chlorine number is the true free chlorine residual
- Peak flow (Q_{peak}) was taken as the maximum historical daily water consumption value recorded for the last four (4) year period from 2011 to 2014 which was reported to be 439 m^3/day on 24 March 2011;
- As reported by the WTO, the lowest reservoir water level is approximately half of the reservoir depth which occurred when the water main was flushed. The total storage reservoir volume of 1,137 m^3 was conservatively assumed to be minus 50% of the total volume, therefore resulting in treated water storage reservoir volume of 568.5 m^3.
- The storage reservoir has only one compartment, therefore, a baffle factor (T10 /T) of 0.1 was assumed;
- The total contact time, T_{total}, was taken as the contact time for the treated water storage reservoir

$$T_{total}=T_{\text{Storage Reservoirs}}$$

- The piping volumes associated with the WTP and water distribution system were assumed to be negligible.

Results of the CT calculation for virus conditions are shown in Table 7 and Table 8.

Table 7. CT Calculation – Treatment Specification

Parameter	Units	Value
Temperature	°C	5
pH		8
Total Chlorine at the WTP	mg/L	0.1
Q_{peak}, Peak Consumption	m^3/day	439
Unit Process: Treated Water Storage Reservoir		
Volume of Storage Reservoir	m^3	568.5
$TDT_{Storage\ Reservoir}$	min	1873.3
Storage Reservoir Baffle Factor (T_{10}/T)		0.1
T_{10}	min	187.3
$CT_{Storage\ Reservoir}$	mg/L·min	18.7

Table 8. CT Calculation

Parameter	Units	Value
Non-GUDI condition		
For inactivation of Viruses		
$CT_{99.99}$ for inactivation of viruses	mg/L·min	8
Inactivation Ratio (CT_{calc} / $CT_{99.99}$)		2.3
Viruses Log Inactivation: 4(CT_{calc} / $CT_{99.99}$)		9.4
Required Viruses Log Inactivation		4.0
GUDI condition		
For inactivation of Viruses		
$CT_{99.99}$ for inactivation of viruses (Table 7, Appendix A, EPB 501)	mg/L·min	8
Inactivation Ratio (CT_{calc} / $CT_{99.99}$)		2.3
Viruses Log Inactivation: 4(CT_{calc} / $CT_{99.99}$)		9.4
Required Viruses Log Inactivation		4.0
For Inactivation of Giardia		
$CT_{99.9}$ for Inactivation of Giardia (Table 3, Appendix A, EPB 501)	mg/L·min	198.0
Inactivation Ratio (CT_{calc} / $CT_{99.9}$)		0.09
Giardia Log Inactivation: 3(CT_{calc} / $CT_{99.9}$)*		0.28
Credit for this process		0.0
Total log inactivation credit		0.3
Required Giardia Log Inactivation		3.0
For inactivation of Cryptosporidium**		
Not practical with chlorine		
Credit for this membrane treatment process[2]		3.0

*EPB501, Page 17, ``A minimum of at least 0.5-log removal and/or inactivation of Giardia lamblia cysts regardless of the treatment process used.

**Cryptosporidium oocysts are not easily inactivated by chlorine; the CT values required are significantly and unfeasibly greater than those for Giardia.

CONCLUSION:

Based on the information provided in Table 7 and Table 8:

Under the current worst-case scenario conditions for a NON-GUDI groundwater source with the free chlorine as the true value, and the inactivation of virus with the PERMIT minimum free chlorine concentration of 0.1 mg/L, the required disinfection is provided.

If the raw water source is GUDI, the system meets the required disinfection for the inactivation of viruses. Under the worst-case scenario conditions, the

[2] *Table 2. Log Removal Credits for Filtration Technologies, Approval Guideline ODW-AG-03, Manitoba Water Stewardship.*

required disinfection is not provided for inactivation of Giardia lamblia cysts and Cryptosporidium.

RECOMMENDATION:

Since the above the calculation is based on the assumption that the raw water source is NON-GUDI groundwater and that the free chlorine is the true value, it is recommended that the TOWN carry out the following options:

- **A GUDI Phase 1.5 assessment be carried out. Due to ammonia interference, the TOWN should conduct a breakpoint chlorination investigation to ensure that the true free chlorine residual meets the requirement.**

- **If it is not possible to meet the breakpoint, further strategies must be considered. Raw water ammonia can be removed using additional removal techniques. Also, alternative disinfectants with higher disinfection efficiencies, such as chlorine gas, ultraviolet (UV) radiation, ozone, and chlorine dioxide, are potential options for primary disinfection. Professional consultants should be hired to help determine the strategy to be adopted.**

3.2.6. Testing Procedures and Equipment

The WTO performs daily water quality tests for free and total chlorine residuals, and turbidity at the WTP. The water quality test results for samples taken at the WTP are recorded by the WTO in the daily log sheets (these documents are available at the WTP for review). The required general chemical, health and toxicity, bacteriological, turbidity, and chlorine residual testing is set out in the PERMIT. Chlorine residuals are measured using a HACH DR890 Chlorimeter (refer to photograph #11, page D6, Appendix D) and a HACH 2100P Turbidimeter is used to measure the turbidity (refer to the photographs #11, page D6, Appendix D). Testing procedures are provided in the HACH instrumentation manuals. The testing equipment is calibrated every year by the manufacturer.

3.2.7. Operation and Maintenance Procedures

The written operation and maintenance procedures and manuals are available at the WTP office and are up to date. Maintenance work and testing results are documented in the WTP logbook. Municipal/Industrial inspection reports from the SaskH2O website were also reviewed for operation and maintenance.

The WTO performs the following daily operational tasks:

- Records the water meter readings;
- Collects water samples at the WTP and performs water quality tests;
- Monitors the status of plant operating parameters, including distribution system flow pressures, chlorine level, and water quality indicators; and
- Performs minor corrective maintenance on plant equipment.

Periodic waterworks activities include the following tasks:

- Maintaining the raw water supply system;
- Adjusting the speed and stroke settings on the chemical feeders;
- Preparing batch solutions of chemicals;
- Performing routine preventive maintenance tasks, such as lubrication, cleaning and painting of equipment, and other housekeeping tasks;
- Ordering chemicals;
- Retrieving water samples for bacteriological analysis from representative locations in the distribution system;
- Performing distribution flushing twice per year; and
- Submitting water samples once every two (2) years to the laboratory for general chemical and health and toxicity analysis.

3.3. TREATED WATER SUPPLY, STORAGE, AND DISTRIBUTION SYSTEM

3.3.1. Treated Water Supply Lines and Pumping Stations

The WTP distribution pumps provide sufficient pressure and volume to supply all customers. There are no treated water supply lines to the other communities or pumping stations for this system.

3.3.2. Treated Water Storage Reservoirs

Final treated water is stored in an underground storage reservoir with a total volume of 1,137 m^3 that is equipped with raised and watertight steel access hatches (refer to photograph #12, pages D6, Appendix D). The water level in the reservoir is controlled by a mercury switch and float type control which activates the supply and treatment processes. The treated storage reservoir consists of a single compartment that was constructed in 1984. The reservoir is scheduled to be cleaned every five (5) years and was last cleaned in 2014.

The TOWN distribution system is equipped with fire hydrants. As per Section 4.2.3 of the Waterworks Design Standard, EPB501, for systems providing fire protection, the minimum recommended storage should be equal to twice the average daily water consumption. As indicated in Section 2.2, the average daily water consumption from 2011 to 2014 was 187 m^3 and the current storage volume requirement for the TOWN is 374 m^3. The TOWN's treated water reservoir has a total capacity of 1,137 m^3. This is in excess of two (2) times the required storage capacity, which meets the current requirements for a fire protected waterworks system.

With the current water consumption rate listed in Section 2.2, the storage reservoir is sufficient to meet the needs of 1,500 people.

CONCLUSION:

The storage reservoir structure is in good condition and there are no outstanding conditions affecting the reservoir.

3.3.3. Distribution System

Table 9 provides the waterworks equipment details for the treated water supply, storage, and water distribution system.

Table 9. Treated Water Supply, Storage, and Distribution Equipment Specifications

Component	Specification
Treated Water Supply Pumps & Capacities:	Two vertical turbine pumps with 15 HP each
Emergency Supply Pump:	Natural gas driven emergency fire pump
Backup power generator	no
Water Distribution Main Lines:	150 mm (*6 inch*) diameter PVC.
Water Storage Reservoir Capacity:	1,137 m^3

As outlined in Table 9, the distribution system uses two (2) vertical turbine pumps (refer to Photograph #13, page D7, Appendix D). Each pump is a 15 HP Peerless Vertical turbine pump with a capacity of 22.7 Lps. The pumps are equipped with variable frequency drive (VFD).

Water Security Agency EPB501, Waterworks Design Standard, recommends that at least two (2) pumping units should be provided. With any one pump out of service,

the remaining pump should be capable of serving the maximum daily pumping demand of the system. The maximum daily flow rate from 2011 to 2014 was 5.08 Lps, which can be met by one of the distribution pumps. The guidelines recommend that the peak hour demand be easily met when all pumps are operating simultaneously, without danger of overloading. Using a common peak factor of 4 for peak hour flow rate, the current peak hour flow rate is 8.68 Lps (Section 2.2). The TOWN has two (2) peerless vertical turbine pumps with a capacity of 22.7 Lps each, totaling 45.4 Lps. Therefore, the capacity of the TOWN's distribution pumps meets the requirements and do not need to be upgraded. The distribution pumps can meet the required water consumption for a maximum population of 2,700.

There is no alternate power supply for the WTP, but there is a natural gas driven engine emergency fire pump that can pump treated water during a power outage (refer to Photograph #14, page D7, Appendix D). However, there would be no energy to deliver water to the WTP or to push water through the treatment system; therefore raw water cannot be treated in an emergency situation. A standby power generator for the water treatment plant should be considered to ensure the water treatment system remains in operation during a power failure. A backup power source for the pump house should also be provided.

The existing distribution water mains are 150 mm (6 inch) PVC pipelines which were updated since 1990 to 2015. It was reported that the existing distribution pipeline will continue to be used and no further changes are expected at this time. Strategies are needed to fund the cost of future replacement.

CONCLUSIONS:

An alternate source of power is not available to enable water treatment and well pump house operation during a power outage.

RECOMMENDATIONS:

A standby generator is strongly recommended to provide power to the WTP and the well pump house during power outages. The generator should be sized to meet full system requirements.

A reserve fund should be initiated for future upgrades or replacement of the aging asbestos cement pipe.

3.3.4. Fire Prevention

As mentioned, the TOWN is a designated fire protection system. In the event of fire, a standby emergency pump will kick in to provide a fire flow of 37.9 Lps. The emergency pump, operated by a natural gas-driven generator, can also pump treated water to the distribution system in case of a power outage.

As per Section 4.2.3 of Waterworks Design Standards, EPB501, for systems providing fire protection, the minimum recommended storage should be equal to twice the average daily water consumption. As described in Section 3.3.2, the storage volume is sufficient for the fire protection

CONCLUSIONS:

Based on the information provided by the WTO, the fire pump is in good operating condition.

RECOMMENDATION:

No recommendation.

3.3.5. Metering

The TOWN meters the raw water discharge at the WTP and treated water at all consumer locations.

3.3.6. Operation and Maintenance Procedures

The WTO keeps current with technology through training and has a Class 2 certification.

3.3.7. Backflow Prevention

Adequate backflow prevention is provided for the filter system (refer to Photograph #15, page D8, Appendix D) where backwash wastewater is discharged to the sump via air gap. A check valve is also employed at each pump distribution header (refer to Photograph #13, page D7, Appendix D).

3.3.8. Security and Related Issues

For the protection of the raw and treated water sources, the pump house and the WTP are kept locked at all times by the TOWN and access to these buildings is restricted to authorized personnel only.

3.3.9. Estimated Capital Replacement Costs and Remaining Service Life

Financial information estimates were based on the provided Round 2 WSA cost estimate and similar waterworks system assessment estimated capital replacement costs previously conducted by PINTER.

The estimated capital replacement costs and remaining service life for the waterworks components are listed in Table 10.

Table 10. Estimated Capital Replacement Costs and Remaining Service Life

Component/Item	Year of Construction /Installation	Typical Service Life	Estimated Service Life Remaining	Estimated Replacement Cost
Raw Water Supply:				
Pump house	1992-2014	30 yrs – 40 yrs	6 yrs - 38 yrs	$300,000.00
Supply well	2014	40yrs – 50 yrs	38 yrs - 86 yrs	$70,000.00
Pumps and motors	2014	20yrs – 30 yrs	18 yrs - 28 yrs	$80,000.00
Supply pipeline (2.7km)	1992	40 yrs – 50 yrs	16 yrs - 26 yrs	$900,000.00
Water Treatment Plant:				
- Building(B)	1984	60 yrs	28 yrs	$600,000
water treatment system and associated upgrade	1992	30 yrs	6 yrs	$550,000
Pumps & Motors	1992	30 yrs	6 yrs	$100,000
Electrical	1992	30 yrs	6 yrs	$100,000
Water Main				
Water mains	1962-2002	60	0-30 yrs	$2,500,000
			Total (2015)	**$5,200,000**

4.0 RECOMMENDATIONS

4.1. IMMEDIATE ISSUES AND RISKS

The tested free chlorine may not be the true value due to ammonia interference, therefore, it is recommended that the TOWN carry out the following:

- Breakpoint chlorination testing to identify whether the breakpoint can be achieved without the sodium hypochlorite (NaOCl) dosage exceeding the maximum limit.
- If it is not possible to meet the breakpoint, further strategies must to be considered. Raw water ammonia can be removed using additional removal techniques. Also, alternative disinfectants with higher disinfection efficiencies, for example chlorine gas, ultraviolet (UV) radiation, ozone, and chlorine dioxide are potential options for primary disinfection. Professional consultants should be hired to help determine the strategy to be adopted.

4.2. RECOMMENDED IMPROVEMENTS

1. The TOWN should implement the recommendations from the Round 2 WSA marked as "not completed" to improve the waterworks system operation.
2. The TOWN should continue to work on the construction of a new backup well.
3. The TOWN is encouraged to collect and submit raw water samples, periodically, for general chemical, and health and toxicity analysis as well as turbidity, total coliform, and *E.Coli*. This will assist in identifying potential variations in water quality and/or contamination of the raw water source over a period of years.
4. Continue to maintain daily log sheets and document all the testing results appropriately.
5. Since the ammonia will interfere with the disinfection process, it is also suggested that the ammonia testing on the raw water and filter effluent be carried out to determine the ammonia levels reacting with the sodium hypochlorite.
6. It is recommended to swab and flush the raw water supply pipeline every five (5) years.

4.3. WATER TREATMENT PLANT RECOMMENDATIONS

1. It is recommended that the WTO adjust the potassium permanganate ($KMnO_4$) dosage to ensure that iron is effectively removed. Backwash frequency and/or filter media regeneration should be carried out more frequently to ensure the efficient removal of manganese by the greensand filters.
2. To provide secondary containment for the potassium permanganate and sodium hypochlorite tanks, we suggest that the in-use tanks be set on the spill platform. The sodium hypochlorite storage tanks should be relocated to maintain a clear path within the building.
3. A standby generator is strongly recommended to provide power to the WTP and the well pump house during power outages. The generator should be sized to meet full system requirements.

4.4. CONCEPTUAL COST ESTIMATES

Table 11 provides the conceptual cost estimates for recommended improvements at the waterworks.

Table 11. Conceptual Cost Estimates

Recommended Improvement	Conceptual Cost
Phase 1.5 GUDI assessment	$9,000
New well construction	$120,000
Standby power generator	$65,000
In-use chemical tank secondary containment	$3,000
Professional consulting for ammonia interference issues	$20,000
Total	**$217,000**

4.5. WATERWORKS COST ANALYSIS AND ECONOMIC SUSTAINABILITY

As per the *Waterworks System Assessments – Round 3 Standards,* engineering consultants are required to recommend appropriate water rates to meet "all Operation and Maintenance costs as well as expected or anticipated future costs." The Water Security Agency wants to ensure that waterworks are "financially self-sustainable."

Quoting from the Standards, "the analysis to be completed by the engineering consultant shall include:

- *The annual operation and maintenance costs of the waterworks, including items such as chemical costs, electrical costs, personnel costs, sampling and monitoring costs, and routine maintenance costs.*

- *An estimate of the capital replacement costs of any major system components that are expected to require replacement within the next 10 years.*
- *Approximate cost estimates for anticipated non-routine maintenance, upgrades or expansions."*

The Water Security Agency implies in their Standards that for the economic sustainability analysis completed in this Waterworks System Assessment, large capital replacement expenditures required within the next 10 years need to be financed by revenues generated within that period of time. Those expenditures may, in fact, be debt-financed over a longer period of time, which would have an impact on the calculated and recommended water rates.

Table 12 summarizes the Town of Cut Knife total waterworks expenditures for 2011 to 2014 that were provided by the TOWN.

Table 12. Waterworks Revenue Summary

Items	2011	2012	2013	2014
Total annual revenue needed	$273,627	$338,501	$287,650	$384,239
Annual operation and maintenance cost	$279,769	$255,257	$277,517	$327,702
Net	**-$6,142**	**$83,244**	**$10,133**	**$56,537**
Debt	0	0	0	0
Utility reserve	0	0	0	0

As summarized in Table 11, to maintain and upgrade the Waterworks, the Town of Cut Knife could face expenditures as high as $217,000 within the next 10 years. Based on the financial records from 2011 to 2014, current annual water revenues exceed expenditures by approximately $35,900 per year, which if accumulated in a reserve, would provide approximately $359,000 over the next 10 years. If the surplus is placed into a reserve fund, the current water rate can maintain the Town waterworks as "financially self-sustainable".

4.6. CLOSURE

The TOWN should focus on solving the ammonia interference issues and on the construction of a new water well to provide sustainable water supply with good water quality. The WTO should also be fully compliant with the PERMIT's Waterworks Schedule "Treated Water Sampling Locations and Minimum Sampling Frequency".

PINTER & Associates Ltd. extends its appreciation to the Town of Cut Knife and Water Security Agency for their assistance in conducting this Waterworks System Assessment.

5.0 LIMITATIONS

In carrying out this waterworks system assessment and in rendering our findings and conclusions of the performance, operation or issues concerning the Town of Cut Knife waterworks system, PINTER & Associates Ltd. gives the benefit of its best judgment based on its experience and in accordance with generally accepted professional standards for this type of assessment. Our conclusions are limited by the following:

- The scope of work requested to be undertaken;
- Information provided by the personnel and employees of the Town of Cut Knife and the observation of the waterworks system under normal operating conditions. Equipment, pipe, machinery or areas of the waterworks system were not dismantled during this assessment;
- Our conclusions and recommendations are drawn from the information provided to PINTER & Associates Ltd., in whole or in part, during the course of this waterworks system assessment and which have been included in this report;
- No warranty, expressed or implied, is given concerning the status or the operation of this waterworks system. This WSA report has been prepared for the exclusive use of the Town of Cut Knife and Water Security Agency. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. PINTER & Associates Ltd. accepts no responsibility for damages, if any suffered, by any third party because of decisions made or actions based on this report; and
- Due to industry standard methods used in this study it is possible that certain issues, concerns and system weaknesses were not observed or brought to PINTER's attention.

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I, the undersigned, hereby declare that to the best of my knowledge, the information contained herein and the information in support of this submission as completed by me is complete and accurate in accordance with my obligations under The Engineering and Geoscience Professions Act (2000) and its regulations. I further declare that this submission has been prepared in accordance with the standard for this submission as published by the Saskatchewan Water Security Agency.

PINTER & Associates Ltd.

Yanan Xing, P.Eng.
Project Engineer

Lawrence Pinter, P.Eng.
Senior Engineer

Date: 19 September 2016

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L.G. PINTER
MEMBER 6565
16 09 19
YR. MN. DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan

CERTIFICATE OF AUTHORIZATION
PINTER & Associates Ltd.

Number C1232

Permission to Consult held by:

Discipline	Sk. Reg. No.	Signature
Municipal	6565	
Environmental	6565	
Geotechnical	6565	

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PLAN OF ACTION

Area	Item of Concern	Action	Date of Completion
WTP	Carry out breakpoint chlorination testing.		
	Strategy needs further discussion if the breakpoint cannot be met.		
	Raw water samples should be collected and tested, periodically, for general chemical, and health and toxicity analysis as well as turbidity, total coliform, and *E.Coli.*		
	To provide secondary containment for the potassium permanganate and sodium hypochlorite tanks, we suggest the in-use tanks be set on the spill platform. The sodium hypochlorite storage tanks should also be relocated to maintain a clear path within the building.		
	A standby generator is strongly recommended to provide power to the WTP and the well pump house during power outages. The generator should be sized to meet full system requirements.		
Wells	Install a new well.		
	Phase 1.5 GUDI assessment for the current main duty well.		
	It is suggested to swab and flush the raw water supply pipeline every five (5) years.		
Water Distribution System	A reserve fund should be started for future upgrades or replacement for the aging AC pipes.		
Administration	The daily log sheets and the testing records should be documented appropriately.		

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Saskatchewan Disease Control Laboratory
Environmental Services

5 Research Drive
Regina, Saskatchewan
S4S 0A4

http://www.health.gov.sk.ca/lab

(306) 787-7138 / (306) 787-3140

Environmental Services Analysis Report

...oice Number: 1027843
...ample Location: WTP
Collected by: Chris
Station #: SK05FF0001

Permit: 2121
CUT KNIFE DIST.SYSTEM

Collected: 31-May-2011 1:15 PM
Received: 01-Jun-2011 11:54 AM
Reported: 06-Jun-2011 4:27 PM
Water Source: Distributed

Submitted By:
CUT KNIFE TOWN OF
BOX 70
CUT KNIFE, SK
S0M 0N0

Invoice:
CUT KNIFE TOWN OF
BOX 70
CUT KNIFE, SK
S0M 0N0

Gen: 2011, 2012, 2013, 2014

Analysis	Result	Unit	Sask Guideline	Test Comment	Fee
General Chemistry/Water Quality Panel					94.50
Conductivity	1640	µS/cm	< 2300		
pH	7.7	pH Units	6.5 - 9.0		
Total Alkalinity	450	mg/L CaCO3	< 500		
Phenol Alkalinity	0.00	mg/L CaCO3	No Guideline		
Bicarbonate	549	mg/L	No Guideline		
Carbonate	0	mg/L	No Guideline		
Hydroxide	0	mg/L	No Guideline		
Chloride Dissolved	24.4	mg/L	< 250		
Fluoride Dissolved	0.34	mg/L	< 1.5		
Nitrate Dissolved	<0.2	mg/L	< 45		
Sulfate Dissolved	466.3	mg/L	< 500		
Calcium	125	mg/L	No Guideline		
Magnesium	55	mg/L	< 200		
Potassium	6	mg/L	No Guideline		
Sodium	189	mg/L	< 300		
Total Hardness (Calculated)	539	mg/L CaCO3	< 800		
Total Dissolved Solids	1415	mg/L	< 1500		
Iron	<0.1	mg/L	< 0.3		
Manganese	0.04	mg/L	< 0.05		

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JUN 09 2011

SRC Group # 2014-13121

Dec 12, 2014

SRC ANALYTICAL

422 Downey Road
Saskatoon, Saskatchewan, Canada
S7N 4N1
(306) 933-6932 or 1-800-240-8808

Town of Cut Knife
Box 70
102 Broad Street
Cut Knife, SK S0M 0N0
Attn: Dana Klus

Date Samples Received: Dec-11-2014 Client P.O.: DANA

40844 12/10/2014 13:30 TOWN OF CUTKNIFE - TOWN SHOP *WATER*

Analyte	Units	40844
ICP		
Aluminum	mg/L	0.012
Arsenic	ug/L	3.0
Barium	mg/L	0.010
Boron	mg/L	0.36
Cadmium	mg/L	<0.00001
Chromium	mg/L	<0.0005
Copper	mg/L	0.090
Iron	mg/L	0.54
Lead	mg/L	0.0012
Manganese	mg/L	0.40
Selenium	mg/L	<0.0001
Uranium	ug/L	1.1
Zinc	mg/L	0.023

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Saskatchewan Ministry of Health

Saskatchewan Disease Control Laboratory
Environmental Services
http://www.health.gov.sk.ca/lab

5 Research Drive
Regina, Saskatchewan
S4S 0A4
(306) 787-7138 / (306) 787-3140

Environmental Services Analysis Report - Final

Invoice Number: 1070956
Sample Location: WTP treated
Collected by: James
Station #: SK05FF0001

Permit: 2121
CUT KNIFE DIST.SYSTEM

Collected Date: 14-Dec-2015 1:30 PM
Received: 15-Dec-2015 8:45 AM
Reported: 17-Dec-2015 3:46 PM
Water Source: Distributed

Submitted By:
CUT KNIFE TOWN OF
BOX 70
CUT KNIFE, SK
S0M 0N0

RECEIVED
DEC 2 2 2015

Invoice:
CUT KNIFE TOWN OF
BOX 70
CUT KNIFE, SK
S0M 0N0

Analysis	Result	Unit	Sask Guideline	Test Comment	Fee
General Chemistry/Water Quality Panel					94.50
Conductivity	1603	µS/cm	< 2300		
pH	8.0	pH Units	6.5 - 9.0		
Total Alkalinity	455	mg/L CaCO3	< 500		
Phenol Alkalinity	0.00	mg/L CaCO3	No Guideline		
Bicarbonate	555	mg/L	No Guideline		
Carbonate	0	mg/L	No Guideline		
Hydroxide	0	mg/L	No Guideline		
Chloride Dissolved	21.3	mg/L	< 250		
Fluoride Dissolved	0.16	mg/L	< 1.5		
Nitrate Dissolved	0.2	mg/L	< 45		
Sulfate Dissolved	453.6	mg/L	< 500		
Total Hardness (Calculated)	525	mg/L CaCO3	< 800		
Total Dissolved Solids	1412	mg/L	< 1500		
Iron	<0.1	mg/L	< 0.3		
Manganese	0.01	mg/L	< 0.05		
Calcium	123	mg/L	No Guideline		
Magnesium	53	mg/L	< 200		
Potassium	6	mg/L	No Guideline		
Sodium	200	mg/L	< 300		

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Results of Advanced Search - Water Quality Data

00002121 04 00
Cut Knife Waterworks, Cut Knife, Box 70 Cut Knife Sk S0m 0n0, Permit To Operate Renewal

Parameter (Source)	Arsenic Total (Distributed Water)
Frequency	Every Two Years
Location	Random Location-Cut Knife Distribution System

Previous measurements for Arsenic Total (Distributed Water)

Sample Date	Value
December 14, 2015	13.2 UG/L
December 10, 2014	3 UG/L
September 10, 2013	.7 UG/L
May 31, 2011	.5 UG/L

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Parameter (Source)	Boron Total (Distributed Water)
Frequency	Every Two Years
Location	Random Location-Cut Knife Distribution System

Previous measurements for Boron Total (Distributed Water)

Sample Date	Value
December 10, 2014	.36 MG/L
September 10, 2013	.35 MG/L
May 31, 2011	.34 MG/L

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Parameter (Source)	Chromium Total (Distributed Water)
Frequency	Every Two Years
Location	Random Location-Cut Knife Distribution System

Previous measurements for Chromium Total (Distributed Water)

Sample Date	Value
December 14, 2015	< .03 UG/L
December 10, 2014	< .0005 MG/L
September 10, 2013	< .0005 MG/L
May 31, 2011	< .0005 MG/L

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Parameter (Source)	Iron Total (Distributed Water)
Frequency	Every Two Years
Location	Random Location-Cut Knife Distribution System

Previous measurements for Iron Total (Distributed Water)

Sample Date	Value
December 10, 2014	.54 MG/L
September 10, 2013	.04 MG/L
May 31, 2011	.013 MG/L

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Cut Knife Waterworks, Cut Knife, Box 70 Cut Knife Sk S0m 0n0, Permit To Operate Renewal

Parameter (Source)	Manganese Total (Distributed Water)
Frequency	Every Two Years
Location	Random Location-Cut Knife Distribution System

Previous measurements for Manganese Total (Distributed Water)

Sample Date	Value
December 10, 2014	.4 MG/L
September 10, 2013	.14 MG/L
May 31, 2011	.063 MG/L

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Parameter (Source)	Uranium Total (Distributed Water)
Frequency	Every Two Years
Location	Random Location-Cut Knife Distribution System

Previous measurements for Uranium Total (Distributed Water)

Sample Date	Value
December 14, 2015	.9 UG/L
December 10, 2014	1.1 UG/L
September 10, 2013	1.1 UG/L
May 31, 2011	1 UG/L

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00002121 04 00
Cut Knife Waterworks, Cut Knife, Box 70 Cut Knife Sk S0m 0n0, Permit To Operate Renewal

Location	Random Location-Cut Knife Distribution System
Parameter (Source)	Chlorine Free - Client (Distributed Water)
Frequency	Weekly
Sample Count	1
Sample Type	Discrete Sample
Reading Type	
Oper Monitoring Req Eff Date	25-FEB-05
Oper Monitoring Req End Date	

Previous measurements for Chlorine Free - Client (Distributed Water)

Sample Date	Value	Method #
November 30, 2015	.36 MG/L	2365
November 23, 2015	.33 MG/L	2365
November 16, 2015	.44 MG/L	2365
November 09, 2015	.2 MG/L	2365
November 01, 2015	.26 MG/L	2365
October 26, 2015	.32 MG/L	2365
October 19, 2015	.3 MG/L	2365
October 13, 2015	.2 MG/L	2365
October 05, 2015	.3 MG/L	2365
September 28, 2015	.16 MG/L	2365
September 21, 2015	.23 MG/L	2365
September 14, 2015	.17 MG/L	2365
September 08, 2015	.21 MG/L	2365
September 01, 2015	.97 MG/L	2365
August 24, 2015	.34 MG/L	2365
August 17, 2015	.4 MG/L	2365
August 10, 2015	.37 MG/L	2365
August 04, 2015	.49 MG/L	2365
July 27, 2015	.52 MG/L	2365

December 02, 2014	.51 MG/L	2365
December 01, 2014	.72 MG/L	2365
December 01, 2014	.36 MG/L	2365
December 01, 2014	.53 MG/L	2365
November 25, 2014	.43 MG/L	2365
November 17, 2014	.44 MG/L	2365
November 10, 2014	.34 MG/L	2365
November 03, 2014	.68 MG/L	2365
October 27, 2014	.55 MG/L	2365
October 20, 2014	.25 MG/L	2365
October 14, 2014	.44 MG/L	2365
October 07, 2014	.29 MG/L	2365
September 29, 2014	.13 MG/L	2365
September 22, 2014	.27 MG/L	2365
September 16, 2014	.36 MG/L	2365
September 08, 2014	.19 MG/L	2365
September 02, 2014	.14 MG/L	2365
August 18, 2014	.24 MG/L	2365
August 11, 2014	.35 MG/L	2365
August 05, 2014	.13 MG/L	2365
July 28, 2014	.29 MG/L	2365
July 21, 2014	.17 MG/L	2365
July 14, 2014	.64 MG/L	2365
July 07, 2014	.37 MG/L	2365
July 02, 2014	.35 MG/L	2365
June 23, 2014	.22 MG/L	2365
June 18, 2014	.32 MG/L	2365
June 18, 2014	.21 MG/L	2365
June 17, 2014	.29 MG/L	2365
June 17, 2014	.32 MG/L	2365
June 16, 2014	.38 MG/L	2365
June 09, 2014	.18 MG/L	2365
June 02, 2014	.22 MG/L	2365
May 28, 2014	.29 MG/L	2365
May 20, 2014	.37 MG/L	2365
May 12, 2014	.27 MG/L	2365
May 05, 2014	.52 MG/L	2365
April 28, 2014	.34 MG/L	2365
April 22, 2014	.49 MG/L	2365

July 08, 2013	.39 MG/L	2365
July 02, 2013	.44 MG/L	2365
June 24, 2013	.19 MG/L	2365
June 17, 2013	.41 MG/L	2365
June 10, 2013	.4 MG/L	2365
June 03, 2013	.23 MG/L	2365
May 28, 2013	.23 MG/L	2365
May 21, 2013	.34 MG/L	2365
May 13, 2013	.23 MG/L	2365
May 06, 2013	.47 MG/L	2365
April 29, 2013	.55 MG/L	2365
April 22, 2013	.39 MG/L	2365
April 15, 2013	.3 MG/L	2365
April 09, 2013	.35 MG/L	2365
April 02, 2013	.24 MG/L	2365
March 25, 2013	.35 MG/L	2365
March 18, 2013	.37 MG/L	2365
March 11, 2013	.21 MG/L	2365
March 04, 2013	.32 MG/L	2365
February 25, 2013	.48 MG/L	2365
February 19, 2013	.36 MG/L	2365
February 11, 2013	.28 MG/L	2365
February 04, 2013	.18 MG/L	2365
January 28, 2013	.33 MG/L	2365
January 21, 2013	.24 MG/L	2365
January 14, 2013	.23 MG/L	2365
January 08, 2013	.27 MG/L	2365
January 02, 2013	.37 MG/L	2365
December 17, 2012	.28 MG/L	2365
December 11, 2012	.32 MG/L	2365
December 04, 2012	.11 MG/L	2365
November 27, 2012	.29 MG/L	2365
November 19, 2012	.28 MG/L	2365
November 13, 2012	.24 MG/L	2365
November 05, 2012	.28 MG/L	2365
October 30, 2012	.27 MG/L	2365
October 22, 2012	.35 MG/L	2365
October 15, 2012	.25 MG/L	2365
October 09, 2012	.18 MG/L	2365
October 01, 2012	.37 MG/L	2365

December 12, 2011	.14 MG/L	2365
December 05, 2011	.17 MG/L	2365
November 29, 2011	.34 MG/L	2365
November 28, 2011	.18 MG/L	2365
November 28, 2011	.19 MG/L	2365
November 21, 2011	.19 MG/L	2365
November 14, 2011	.16 MG/L	2365
November 07, 2011	.18 MG/L	2365
October 31, 2011	.25 MG/L	2365
October 24, 2011	.12 MG/L	2365
October 17, 2011	.22 MG/L	2365
October 11, 2011	.23 MG/L	2365
October 03, 2011	.26 MG/L	2365
September 26, 2011	.25 MG/L	2365
September 19, 2011	.19 MG/L	2365
September 12, 2011	.26 MG/L	2365
September 06, 2011	.67 MG/L	2365
August 29, 2011	.3 MG/L	2365
August 22, 2011	.23 MG/L	2365
August 15, 2011	.33 MG/L	2365
August 08, 2011	.41 MG/L	2365
August 02, 2011	.23 MG/L	2365
July 25, 2011	.13 MG/L	2365
July 18, 2011	.35 MG/L	2365
July 11, 2011	.28 MG/L	2365
July 04, 2011	.22 MG/L	2365
June 27, 2011	.13 MG/L	2365
June 20, 2011	.38 MG/L	2365
June 06, 2011	.24 MG/L	2365
May 30, 2011	.16 MG/L	2365
May 24, 2011	.24 MG/L	2365
May 17, 2011	.21 MG/L	2365
May 16, 2011	.23 MG/L	2365
May 16, 2011	.19 MG/L	2365
May 09, 2011	.18 MG/L	2365
May 02, 2011	.17 MG/L	2365
April 26, 2011	.22 MG/L	2365
April 18, 2011	.21 MG/L	2365
April 10, 2011	.13 MG/L	2365

Results of Advanced Search - Water Quality Data

00002121 04 00
Cut Knife Waterworks, Cut Knife, Box 70 Cut Knife Sk S0m 0n0, Permit To Operate Renewal

Parameter (Source)	Chlorine Free - Client (Distributed Water)
Frequency	Followup Sampling
Location	Random Location-Cut Knife Distribution System

Previous measurements for Chlorine Free - Client (Distributed Water)

Sample Date	Value
August 14, 2014	.34 MG/L
August 27, 2013	.41 MG/L
August 27, 2013	.46 MG/L
August 26, 2013	.42 MG/L
August 26, 2013	.45 MG/L

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July 21, 2015	5.76 MG/L	2414
July 20, 2015	5.64 MG/L	2414
July 13, 2015	4.38 MG/L	2414
July 08, 2015	6.54 MG/L	2414
June 29, 2015	6.21 MG/L	2414
June 22, 2015	5.67 MG/L	2414
June 16, 2015	3.57 MG/L	2414
June 08, 2015	4.44 MG/L	2414
June 01, 2015	6.09 MG/L	2414
May 25, 2015	4.21 MG/L	2414
May 18, 2015	5.55 MG/L	2414
May 11, 2015	3.9 MG/L	2414
May 04, 2015	4.26 MG/L	2414
April 27, 2015	5.49 MG/L	2414
April 20, 2015	5.73 MG/L	2414
April 13, 2015	5.04 MG/L	2414
April 07, 2015	5.91 MG/L	2414
March 30, 2015	6 MG/L	2414
March 23, 2015	5.49 MG/L	2414
March 16, 2015	3.93 MG/L	2414
March 09, 2015	6 MG/L	2414
March 02, 2015	5.76 MG/L	2414
February 23, 2015	6.15 MG/L	2414
February 17, 2015	3.09 MG/L	2414
February 09, 2015	5.73 MG/L	2414
February 02, 2015	6.6 MG/L	2414
February 02, 2015	6.6 MG/L	2414
January 26, 2015	6.6 MG/L	2414
January 19, 2015	5.52 MG/L	2414
January 13, 2015	6.15 MG/L	2414
January 05, 2015	6.12 MG/L	2414
December 29, 2014	3.27 MG/L	2414
December 22, 2014	5.52 MG/L	2414
December 16, 2014	3.72 MG/L	2414
December 09, 2014	4.14 MG/L	2414
December 09, 2014	.18 MG/L	2414
December 09, 2014	4.14 MG/L	2414
December 09, 2014	3.78 MG/L	2414
December 08, 2014	3.27 MG/L	2414
December 02, 2014	6.12 MG/L	2414

April 15, 2014	3.81 MG/L	2414
April 07, 2014	5.1 MG/L	2414
March 31, 2014	5.13 MG/L	2414
March 24, 2014	5.13 MG/L	2414
March 18, 2014	4.08 MG/L	2414
March 10, 2014	5.13 MG/L	2414
March 03, 2014	5.01 MG/L	2414
February 24, 2014	4.05 MG/L	2414
February 18, 2014	4.71 MG/L	2414
February 10, 2014	5.79 MG/L	2414
February 03, 2014	5.37 MG/L	2414
January 27, 2014	5.16 MG/L	2414
January 20, 2014	4.02 MG/L	2414
January 13, 2014	5.4 MG/L	2414
January 06, 2014	5.31 MG/L	2414
December 30, 2013	5.19 MG/L	2414
December 23, 2013	3.42 MG/L	2414
December 16, 2013	5.61 MG/L	2414
December 09, 2013	5.31 MG/L	2414
December 02, 2013	5.49 MG/L	2414
November 25, 2013	4.59 MG/L	2414
November 19, 2013	5.28 MG/L	2414
November 12, 2013	5.19 MG/L	2414
November 04, 2013	4.86 MG/L	2414
October 28, 2013	4.89 MG/L	2414
October 21, 2013	5.73 MG/L	2414
October 15, 2013	5.61 MG/L	2414
October 07, 2013	5.4 MG/L	2414
September 30, 2013	3.96 MG/L	2414
September 23, 2013	5.16 MG/L	2414
September 16, 2013	5.31 MG/L	2414
September 09, 2013	4.53 MG/L	2414
September 03, 2013	4.98 MG/L	2414
August 26, 2013	4.74 MG/L	2414
August 19, 2013	4.77 MG/L	2414
August 12, 2013	4.2 MG/L	2414
August 06, 2013	4.56 MG/L	2414
July 29, 2013	4.59 MG/L	2414
July 23, 2013	4.29 MG/L	2414
July 15, 2013	4.35 MG/L	2414

October 01, 2012	4.56 MG/L	2414
September 24, 2012	4.41 MG/L	2414
September 18, 2012	1.92 MG/L	2414
September 10, 2012	2.58 MG/L	2414
September 04, 2012	4.89 MG/L	2414
August 27, 2012	4.56 MG/L	2414
August 20, 2012	2.73 MG/L	2414
August 13, 2012	3.96 MG/L	2414
August 08, 2012	4.83 MG/L	2414
July 30, 2012	5.01 MG/L	2414
July 24, 2012	4.38 MG/L	2414
July 17, 2012	4.32 MG/L	2414
July 10, 2012	5.19 MG/L	2414
July 03, 2012	5.43 MG/L	2414
June 26, 2012	5.01 MG/L	2414
June 18, 2012	4.98 MG/L	2414
June 11, 2012	5.67 MG/L	2414
June 04, 2012	5.16 MG/L	2414
May 29, 2012	5.46 MG/L	2414
May 22, 2012	4.89 MG/L	2414
May 14, 2012	5.73 MG/L	2414
May 09, 2012	5.64 MG/L	2414
April 30, 2012	4.14 MG/L	2414
April 24, 2012	5.49 MG/L	2414
April 16, 2012	5.16 MG/L	2414
March 26, 2012	5.1 MG/L	2414
March 19, 2012	5.37 MG/L	2414
March 12, 2012	5.07 MG/L	2414
March 05, 2012	3.6 MG/L	2414
February 27, 2012	5.25 MG/L	2414
February 27, 2012	6.6 MG/L	2414
February 21, 2012	5.46 MG/L	2414
February 13, 2012	4.98 MG/L	2414
February 06, 2012	4.26 MG/L	2414
January 30, 2012	4.74 MG/L	2414
January 23, 2012	4.83 MG/L	2414
January 16, 2012	4.86 MG/L	2414
January 09, 2012	3.99 MG/L	2414
January 03, 2012	4.89 MG/L	2414
December 28, 2011	4.95 MG/L	2414

April 10, 2011	4.86 MG/L	2414
April 04, 2011	4.68 MG/L	2414
March 29, 2011	4.98 MG/L	2414
March 29, 2011	4.98 MG/L	2414
March 28, 2011	5.1 MG/L	2414
March 28, 2011	4.56 MG/L	2414
March 28, 2011	4.56 MG/L	2414
March 21, 2011	4.98 MG/L	2414
March 14, 2011	4.62 MG/L	2414
March 07, 2011	4.59 MG/L	2414
February 28, 2011	5.31 MG/L	2414
February 22, 2011	5.04 MG/L	2414
February 14, 2011	4.65 MG/L	2414
February 07, 2011	4.35 MG/L	2414
January 31, 2011	4.83 MG/L	2414
January 24, 2011	5.07 MG/L	2414
January 17, 2011	4.95 MG/L	2414
January 10, 2011	4.41 MG/L	2414
January 04, 2011	5.88 MG/L	2414

SASKATCHEWAN ENVIRONMENT
Results of Advanced Search - Water Quality Data

00002121 04 00
Cut Knife Waterworks, Cut Knife, Box 70 Cut Knife Sk S0m 0n0, Permit To Operate Renewal

Location	Random Location-Cut Knife Distribution System
Parameter (Source)	Turbidity - Client (Distributed Water)
Frequency	Weekly
Sample Count	1
Sample Type	Discrete Sample
Reading Type	
Oper Monitoring Req Eff Date	25-FEB-05
Oper Monitoring Req End Date	

Previous measurements for Turbidity - Client (Distributed Water)

Sample Date	Value	Method #
November 30, 2015	.51 NTU	2414
November 23, 2015	.18 NTU	2414
November 16, 2015	.22 NTU	2414
November 09, 2015	.13 NTU	2414
November 01, 2015	.15 NTU	2414
October 26, 2015	.17 NTU	2414
October 19, 2015	.71 NTU	2414
October 13, 2015	.81 NTU	2414
October 05, 2015	.47 NTU	2414
September 28, 2015	.8 NTU	2414
September 21, 2015	.59 NTU	2414
September 14, 2015	.44 NTU	2414
September 08, 2015	.44 NTU	2414
September 01, 2015	.98 NTU	2414
August 24, 2015	.33 NTU	2414
August 17, 2015	.78 NTU	2414
August 10, 2015	.83 NTU	2414
August 04, 2015	.9 NTU	2414
July 27, 2015	.98 NTU	2414

December 02, 2014	1.48 NTU	2414
December 01, 2014	1.62 NTU	2414
December 01, 2014	1.71 NTU	2414
December 01, 2014	1.55 NTU	2414
November 25, 2014	2.33 NTU	2414
November 17, 2014	.76 NTU	2414
November 10, 2014	.45 NTU	2414
November 03, 2014	.52 NTU	2414
October 27, 2014	.7 NTU	2414
October 20, 2014	.7 NTU	2414
October 14, 2014	.56 NTU	2414
October 07, 2014	.51 NTU	2414
September 29, 2014	.35 NTU	2414
September 22, 2014	.91 NTU	2414
September 16, 2014	.9 NTU	2414
September 08, 2014	.7 NTU	2414
September 02, 2014	.43 NTU	2414
August 18, 2014	.76 NTU	2414
August 11, 2014	.39 NTU	2414
August 05, 2014	.52 NTU	2414
July 28, 2014	.42 NTU	2414
July 21, 2014	.39 NTU	2414
July 14, 2014	.53 NTU	2414
July 07, 2014	.66 NTU	2414
July 02, 2014	.3 NTU	2414
June 23, 2014	.49 NTU	2414
June 18, 2014	.45 NTU	2414
June 18, 2014	.41 NTU	2414
June 17, 2014	.56 NTU	2414
June 17, 2014	.59 NTU	2414
June 16, 2014	.44 NTU	2414
June 09, 2014	.36 NTU	2414
June 02, 2014	.55 NTU	2414
May 28, 2014	.47 NTU	2414
May 20, 2014	.34 NTU	2414
May 12, 2014	.39 NTU	2414
May 05, 2014	.37 NTU	2414
April 28, 2014	.31 NTU	2414
April 22, 2014	.44 NTU	2414
April 15, 2014	.37 NTU	2414

July 02, 2013	.27 NTU	2414
June 24, 2013	.25 NTU	2414
June 17, 2013	.26 NTU	2414
June 10, 2013	.25 NTU	2414
June 03, 2013	.27 NTU	2414
May 28, 2013	.22 NTU	2414
May 21, 2013	.24 NTU	2414
May 13, 2013	.58 NTU	2414
May 06, 2013	.2 NTU	2414
April 29, 2013	.35 NTU	2414
April 22, 2013	.23 NTU	2414
April 15, 2013	.23 NTU	2414
April 09, 2013	.24 NTU	2414
April 02, 2013	.23 NTU	2414
March 25, 2013	.15 NTU	2414
March 18, 2013	.26 NTU	2414
March 11, 2013	.22 NTU	2414
March 04, 2013	.26 NTU	2414
February 25, 2013	.2 NTU	2414
February 19, 2013	.16 NTU	2414
February 11, 2013	.2 NTU	2414
February 04, 2013	.18 NTU	2414
January 28, 2013	.16 NTU	2414
January 21, 2013	.14 NTU	2414
January 14, 2013	.2 NTU	2414
January 08, 2013	.15 NTU	2414
January 02, 2013	.15 NTU	2414
December 17, 2012	.42 NTU	2414
December 11, 2012	.3 NTU	2414
December 04, 2012	.33 NTU	2414
November 27, 2012	.28 NTU	2414
November 19, 2012	.37 NTU	2414
November 13, 2012	.32 NTU	2414
November 05, 2012	.3 NTU	2414
October 30, 2012	.26 NTU	2414
October 22, 2012	.23 NTU	2414
October 15, 2012	.38 NTU	2414
October 09, 2012	.25 NTU	2414
October 01, 2012	1.27 NTU	2414

December 12, 2011	.27 NTU	2414
December 05, 2011	.33 NTU	2414
November 29, 2011	.29 NTU	2414
November 28, 2011	.19 NTU	2414
November 28, 2011	.86 NTU	2414
November 21, 2011	.3 NTU	2414
November 14, 2011	.32 NTU	2414
November 07, 2011	.22 NTU	2414
October 31, 2011	.17 NTU	2414
October 24, 2011	.22 NTU	2414
October 17, 2011	.53 NTU	2414
October 11, 2011	.27 NTU	2414
October 03, 2011	.23 NTU	2414
September 26, 2011	.41 NTU	2414
September 19, 2011	.18 NTU	2414
September 12, 2011	.29 NTU	2414
September 06, 2011	.4 NTU	2414
August 29, 2011	.34 NTU	2414
August 22, 2011	.31 NTU	2414
August 15, 2011	.29 NTU	2414
August 08, 2011	.2 NTU	2414
August 02, 2011	.49 NTU	2414
July 25, 2011	.26 NTU	2414
July 18, 2011	.24 NTU	2414
July 11, 2011	.24 NTU	2414
July 04, 2011	.33 NTU	2414
June 27, 2011	.17 NTU	2414
June 20, 2011	.31 NTU	2414
June 06, 2011	.28 NTU	2414
May 30, 2011	.24 NTU	2414
May 24, 2011	.28 NTU	2414
May 17, 2011	.21 NTU	2414
May 16, 2011	.17 NTU	2414
May 16, 2011	.19 NTU	2414
May 09, 2011	.11 NTU	2414
May 02, 2011	.18 NTU	2414
April 26, 2011	.19 NTU	2414
April 18, 2011	.15 NTU	2414
April 10, 2011	.11 NTU	2414
April 04, 2011	.14 NTU	2414

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For Operators

Results of Advanced Search - Water Quality Data

00002121 04 00
Cut Knife Waterworks, Cut Knife, Box 70 Cut Knife Sk S0m 0n0, Permit To Operate Renewal

Parameter (Source)	Turbidity - Client (Distributed Water)
Frequency	Followup Sampling
Location	Random Location-Cut Knife Distribution System

Previous measurements for Turbidity - Client (Distributed Water)

Sample Date	Value
August 14, 2014	.43 NTU
August 27, 2013	.35 NTU
August 27, 2013	.36 NTU
August 26, 2013	.55 NTU
August 26, 2013	.48 NTU

Download a CSV File now!

Generate a printable report!

August 10, 2015	0 NO/100ML	3317
August 04, 2015	0 NO/100ML	3317
July 27, 2015	0 NO/100ML	3317
July 21, 2015	0 NO/100ML	3317
July 20, 2015	0 NO/100ML	3317
July 13, 2015	0 NO/100ML	3317
July 08, 2015	0 NO/100ML	3317
June 29, 2015	0 NO/100ML	3317
June 22, 2015	0 NO/100ML	3317
June 16, 2015	0 NO/100ML	3317
June 08, 2015	0 NO/100ML	3317
June 01, 2015	0 NO/100ML	3317
May 25, 2015	0 NO/100ML	3317
May 18, 2015	0 NO/100ML	3317
May 11, 2015	0 NO/100ML	3317
May 04, 2015	0 NO/100ML	3317
April 27, 2015	0 NO/100ML	3317
April 20, 2015	0 NO/100ML	3317
April 13, 2015	0 NO/100ML	3317
April 07, 2015	0 NO/100ML	3317
March 30, 2015	0 NO/100ML	3317
March 23, 2015	0 NO/100ML	3317
March 16, 2015	0 NO/100ML	3317
March 09, 2015	0 NO/100ML	3317
March 02, 2015	0 NO/100ML	3317
February 23, 2015	0 NO/100ML	3317
February 17, 2015	0 NO/100ML	3317
February 09, 2015	0 NO/100ML	3317
February 02, 2015	0 NO/100ML	3317
February 02, 2015	0 NO/100ML	3317
January 26, 2015	0 NO/100ML	3317
January 19, 2015	0 NO/100ML	3317
January 13, 2015	0 NO/100ML	3317
January 05, 2015	0 NO/100ML	3317
December 29, 2014	0 NO/100ML	3317
December 22, 2014	0 NO/100ML	3317
December 16, 2014	0 NO/100ML	3317
December 09, 2014	0 NO/100ML	3317
December 09, 2014	0 NO/100ML	3317
December 09, 2014	0 NO/100ML	3317

May 12, 2014	0 NO/100ML	3317
May 05, 2014	0 NO/100ML	3317
April 28, 2014	0 NO/100ML	3317
April 22, 2014	0 NO/100ML	3317
April 15, 2014	0 NO/100ML	3317
April 07, 2014	0 NO/100ML	3317
March 31, 2014	0 NO/100ML	3317
March 24, 2014	0 NO/100ML	3317
March 18, 2014	0 NO/100ML	3317
March 10, 2014	0 NO/100ML	3317
March 03, 2014	0 NO/100ML	3317
February 24, 2014	0 NO/100ML	3317
February 18, 2014	0 NO/100ML	3317
February 10, 2014	0 NO/100ML	3317
February 03, 2014	0 NO/100ML	3317
January 27, 2014	0 NO/100ML	3317
January 20, 2014	0 NO/100ML	3317
January 13, 2014	0 NO/100ML	3317
January 06, 2014	0 NO/100ML	3317
December 30, 2013	0 NO/100ML	3317
December 23, 2013	0 NO/100ML	3317
December 16, 2013	0 NO/100ML	3317
December 09, 2013	0 NO/100ML	3317
December 02, 2013	0 NO/100ML	3317
November 25, 2013	0 NO/100ML	3317
November 19, 2013	0 NO/100ML	3317
November 12, 2013	0 NO/100ML	3317
November 04, 2013	0 NO/100ML	3317
October 28, 2013	0 NO/100ML	3317
October 21, 2013	0 NO/100ML	3317
October 15, 2013	0 NO/100ML	3317
October 07, 2013	0 NO/100ML	3317
September 30, 2013	0 NO/100ML	3317
September 23, 2013	0 NO/100ML	3317
September 16, 2013	0 NO/100ML	3317
September 09, 2013	0 NO/100ML	3317
September 03, 2013	0 NO/100ML	3317
August 26, 2013	0 NO/100ML	3317
August 19, 2013	0 NO/100ML	3317
August 12, 2013	0 NO/100ML	3317

October 22, 2012	0 NO/100ML	3317
October 15, 2012	0 NO/100ML	3317
October 09, 2012	0 NO/100ML	3317
October 01, 2012	0 NO/100ML	3317
September 24, 2012	0 NO/100ML	3317
September 18, 2012	0 NO/100ML	3317
September 10, 2012	0 NO/100ML	3317
September 04, 2012	0 NO/100ML	3317
August 27, 2012	0 NO/100ML	3317
August 20, 2012	0 NO/100ML	3317
August 13, 2012	0 NO/100ML	3317
August 08, 2012	0 NO/100ML	3317
July 30, 2012	0 NO/100ML	3317
July 24, 2012	0 NO/100ML	3317
July 17, 2012	0 NO/100ML	3317
July 10, 2012	0 NO/100ML	3317
July 03, 2012	0 NO/100ML	3317
June 26, 2012	0 NO/100ML	3317
June 18, 2012	0 NO/100ML	3317
June 11, 2012	0 NO/100ML	3317
June 04, 2012	0 NO/100ML	3317
May 29, 2012	0 NO/100ML	3317
May 22, 2012	0 NO/100ML	3317
May 14, 2012	0 NO/100ML	3317
May 09, 2012	0 NO/100ML	3317
April 30, 2012	0 NO/100ML	3317
April 24, 2012	0 NO/100ML	3317
April 16, 2012	0 NO/100ML	3317
April 02, 2012	0 NO/100ML	3317
March 26, 2012	0 NO/100ML	3317
March 19, 2012	0 NO/100ML	3317
March 12, 2012	0 NO/100ML	3317
March 05, 2012	0 NO/100ML	3317
February 27, 2012	0 NO/100ML	3317
February 27, 2012	0 NO/100ML	3317
February 21, 2012	0 NO/100ML	3317
February 13, 2012	0 NO/100ML	3317
February 06, 2012	0 NO/100ML	3317
January 30, 2012	0 NO/100ML	3317
January 23, 2012	0 NO/100ML	3317

May 16, 2011	0 NO/100ML	3317
May 09, 2011	0 NO/100ML	3317
May 02, 2011	0 NO/100ML	3317
April 26, 2011	0 NO/100ML	3317
April 18, 2011	0 NO/100ML	3317
April 10, 2011	0 NO/100ML	3317
April 04, 2011	0 NO/100ML	3317
March 29, 2011	0 NO/100ML	3317
March 29, 2011	0 NO/100ML	3317
March 28, 2011	0 NO/100ML	3317
March 28, 2011	0 NO/100ML	3317
March 28, 2011	0 NO/100ML	3317
March 21, 2011	0 NO/100ML	3317
March 14, 2011	0 NO/100ML	3317
March 07, 2011	0 NO/100ML	3317
February 28, 2011	0 NO/100ML	3317
February 22, 2011	0 NO/100ML	3317
February 14, 2011	0 NO/100ML	3317
February 07, 2011	0 NO/100ML	3317
January 31, 2011	0 NO/100ML	3317
January 24, 2011	0 NO/100ML	3317
January 17, 2011	0 NO/100ML	3317
January 10, 2011	0 NO/100ML	3317
January 04, 2011	0 NO/100ML	3317

Appendix B
Plans and Reports

Saskatchewan
Ministry of
Environment

Permit to Operate Waterworks

Municipal Branch

Issued Pursuant to Section 23 of *The Environmental Management and Protection Act, (2002)*

Permit #: 00002579-04-00

File: NB21020-50/WW/OP/Cut Knife

To: ***The Town of Cut Knife***(the Permittee), the person responsible for the waterworks located on at LSD NW, Sec 32, Tp 43, Rg 21, W3, Cut Knife, Saskatchewan, which must provide water for human consumptive use to the ***Town of Cut Knife***

PURSUANT to Section 23 of *The Environmental Management and Protection Act, 2002*, a permit to operate a waterworks, located at Town of Cut Knife, in the Province of Saskatchewan.

This Permit takes effect on the 1st day of April, 2011.

This Permit expires on the 31st day of March, 2013 unless canceled or suspended before that date.

Issued

Kristopher Dushire
Environmental Project Officer
Municipal Branch

North Battleford Office

Ministry of Environment
Acting for and on behalf of the Minister of Environment

Section Four: Sampling and Monitoring and Water Quality

4.1 The Permittee shall cause water samples to be taken from the Waterworks to test for bacteria, turbidity, chlorine and for the other parameters listed in Appendix A, at the locations, times and frequency set out in Appendix A.

4.2 The Permittee shall ensure that the water provided to consumers does not exceed the limits set out in Appendix B for bacteria, turbidity, and the chemical parameters listed in that Appendix. The Permittee shall cause to be maintained the free chlorine residual and the total chlorine residual as set out in Appendix B.

4.3 Subject to 4.4, the Permittee shall have water samples analyzed by an accredited laboratory in accordance with the *Regulations*.

4.4 The Permittee may perform water sampling and analysis for chlorine and turbidity by means of on-site testing.

4.5 The Permittee shall take water samples in accordance with the instructions provided by the institution or laboratory which provides the sampling bottles or containers.

Section Five: Record keeping

5.1 The Permittee shall maintain records containing the following information:

(a) total water pumped into the distribution system on a daily basis or the total raw water used;
(b) the types, dosages and total amounts of chemicals applied to the water for treatment;
(c) the locations from which samples for any tests conducted by the Permittee of the Waterworks were taken in accordance with this permit and the name of the person who conducted the sampling or testing and the results of those tests;
(d) any departures from normal operating procedures that may have occurred and the time and date that they occurred;
(e) any instructions that were given during operation of the Waterworks to depart from normal operating practices and the name of the person who gave the instructions;
(f) any upset condition or bypass condition, the time and date of the upset condition or bypass condition and measures taken to notify others and resolve the upset condition or bypass condition;
(g) any condition of low disinfectant levels, the time, date and location of occurrence and measures taken to restore disinfectant levels to required values;
(h) the dates and results of calibrating any metering equipment and testing instruments; and
(i) the dates and types of maintenance performed on equipment and any actions taken to ensure the normal operation of the Waterworks.

5.2 The Permittee shall cause the operational records or logs mentioned in 5.1 to be recorded and maintained in the following manner:

(a) operational records or logs must be made in chronological order, with the dates, times and testing locations clearly indicated;
(b) entries in an operational record or log must only be made by the Permittee, which includes by definition any principal or agent of a Permittee;
(c) any person making an entry in an operational record or log must do so in a manner that allows the person to be unambiguously identified as the maker of the entry; operational records or logs must be maintained on a daily basis and retained for at least five years;
(d) any anomalies or instances of missing entries in an operational record or log must be accompanied by explanatory notes;
(e) operational records or logs must only contain data or information that is actually observed or produced;
(f) operational records or logs must not contain default values generated manually or by automated means;
(g) operational records or logs maintained pursuant to clause (d) must be made available promptly on request of the Minister.

5.3 The Permittee shall review the records and logs mentioned in 5.1 on a monthly basis to ensure that the operating parameters are being achieved and that the limits set out in Appendix B are not exceeded.

5.4 The Permittee shall report the findings to the Minister as soon as is reasonably practicable after each review required by 5.3 should the review of the records and logs indicate that the quality of water from the Waterworks has been adversely affected.

Section Eight:: General

8.1 A copy of this Permit shall be posted in a conspicuous place at the Waterworks.

8.2 The Permittee shall provide each operator of the Waterworks with a copy of this Permit and the *Regulations*.

8.3 The Minister may cancel, alter or suspend this Permit for the reasons and in the manner set out in the Act.

8.4 In the event of any inconsistency between an Approval to Operate Works or a Minister's Order (as set out on the first page), and the Terms and Conditions of this Alteration of Permit to Operate a Waterworks, the Terms and Conditions of this Alteration prevail. (Use for section 34 Permit Alteration only)

8.5 Where any notice or reporting is required to be given by the Permittee, it shall be provided to:

(a) in the case of the **Minister**:

Ministry of Environment
Municipal Branch

North Battleford, Saskatchewan

#108 – 1146 102nd Street

Fax: (306) 446 - 7464.

Telephone: (306) 446 - 7683.

After hours, weekends and holidays, the North Battleford field office can be contacted by calling the 1-800-667-7525 Spill Report Line.

(b) in the case of the **Environmental Protection Branch**

Ministry of Environment
Environmental Protection Branch
3211 Albert Street
Regina, Saskatchewan S4S 5W6
Fax: (306) 787-0197
Telephone (306) 787-6504

Permit Number: 00002121-04-00

Appendix B – Permit Limits

File: NB21020-50/WW/OP/Cut Knife

The following Water Quality limits apply where identified in Appendix A

Bacteriological:
(i) total coliform levels of zero organisms detectable per 100 millilitres;
(ii) fecal coliform levels of zero organisms detectable per 100 millilitres; and
(iii) background bacteria levels on a total coliform or a fecal coliform membrane filtration plate of less than 200 organisms per 100 milliliters or no overgrowth.

Chlorine Residual:
(a) free residual of not less than 0.1 milligrams per litre in the water entering a distribution system; and
(b) a total chlorine residual of not less than 0.5 milligrams per litre or a free chlorine residual of not less than 0.1 milligrams per litre in the water throughout the distribution system.

NTU - Requirements by Source/Treatment type:

Source/Treatment	Routine Standard	Continuous Monitoring Time Duration Max.	Absolute Maximum
Groundwater [1]	Less than 1.0 NTU, 95% of discrete measurements or 95% time if continuous monitoring employed.	No Requirement.	No requirement.

[1] Turbidity value for water entering the distribution system

Chemical – Health Category	Parameter	MAC (mg/L)	IMAC (mg/L)
	Arsenic		0.010
	Barium	1.0	
	Boron		5.0
	Cadmium	0.005	
	Chromium	0.05	
	Fluoride	1.5	
	Lead	0.01	
	Nitrate	45.0	
	Selenium	0.01	
	Uranium	0.02	

Terms and Conditions

Section One: Definitions

1.1 All words and phrases have the same definitions as set out in *The Environmental Management and Protection Act, 2002*, or *The Water Regulations, 2002*, as the case may be.

1.2 In this Permit:

(a) "*Act*" means *The Environmental Management and Protection Act, 2002;*

(b) "*Regulations*" means *The Water Regulations, 2002;*

(c) "Drinking Water and Wastewater Management Division" means the Drinking Water and Wastewater Management Division of the Water Security Agency of Saskatchewan;

(d) "Accredited" means attainment of the Standards Council of Canada, National Standards System, General Requirements for the Competence of Testing and Calibration Laboratories, (ISO/IEC17025-1999) CAN-P-4D, March 2002, including but not limited to attaining the parameters necessary to undertake the reports required by Part V of the *Regulation* or by a permit to operate a Waterworks issued for the purposes of subsection 21(1) of the *Act*;

(e) "Positive Bacteriological Result" means a test result showing the presence of total coliforms, fecal coliforms, *Escherichia coli* or 200 or more organisms per 100 millilitres as an overgrowth of background bacteria.

Section Two: Effective Date and Expiry

2.1 This Permit takes effect on the date shown on the Permit.

2.2 This Permit expires on the **31st day of March, 2016** unless canceled or suspended before that date.

2.3 ***The Permittee shall apply for renewal/alteration of this permit at least 90 days prior to its expiry.***

Section Three: Operation

3.1 The Permittee shall comply with the *Act* and the *Regulations*, and the Terms and Conditions of this Permit.

3.2 In the event of an inconsistency between the *Act* and this Permit, or the *Regulations* and this Permit, the more stringent requirement shall apply.

3.3 The Permittee shall not extend or alter the Waterworks without a permit issued pursuant to section 23 of the *Act*.

3.4 The Permittee shall have a written quality assurance and quality control policy in place that is satisfactory to the Water Security Agency. The Permittee shall update its quality assurance and quality control policy from time to time to incorporate changes to the waterworks equipment, operational procedures, chemical use, or any other matter or thing which could affect the quality of the water produced by the waterworks. The Permittee shall:

(a) provide a copy of the policy to any employee, agent or contractor performing work or service in relation to the Waterworks; and

(b) inform the persons mentioned in 3.4(a) of the contents of the quality assurance and quality control policy.

(i) The dates and types of maintenance performed on equipment and any actions taken to ensure the normal operation of the Waterworks.

5.2 The Permittee shall cause the operational records or logs mentioned in 5.1 to be recorded and maintained in the following manner:

(a) operational records or logs must be made in chronological order, with the dates, times and testing locations clearly indicated;

(b) entries in an operational record or log must only be made by the Permittee, which includes by definition any principal or agent of a Permittee;

(c) any person making an entry in an operational record or log must do so in a manner that allows the person to be unambiguously identified as the maker of the entry; operational records or logs must be maintained on a daily basis and retained for at least five years;

(d) any anomalies or instances of missing entries in an operational record or log must be accompanied by explanatory notes;

(e) operational records or logs must only contain data or information that is actually observed or produced;

(f) operational records or logs must not contain default values generated manually or by automated means;

(g) operational records or logs maintained pursuant to clause (d) must be made available promptly on request of the Water Security Agency.

5.3 The Permittee shall review the records and logs mentioned in 5.1 on a monthly basis to ensure that the operating parameters are being achieved and that the limits set out in Appendix B are not exceeded.

5.4 The Permittee shall report the findings to the Water Security Agency as soon as is reasonably practicable after each review required by 5.3 should the review of the records and logs indicate that the quality of water from the Waterworks has been adversely affected.

Section Six: Reporting and Consumer Reporting

6.1 The Permittee shall submit the results of water sampling analysis performed in accordance with this Permit to the Drinking Water and Wastewater Management Division:

(a) in the case of a positive bacteriological result, within 24 hours following completion of the sampling analysis;

(b) in the case of all other parameters, within 7 days following completion of the sampling analysis.

6.2 The Permittee shall direct the laboratory performing its water sampling analysis to submit the results within the timeframes mentioned in 6.1 directly to the Drinking Water and Wastewater Management Division, in a format acceptable to the Drinking Water and Wastewater Management Division – Environmental Management System Lab/-Operator (LAB-OPR) data file format, in addition to submitting the written results to the Permittee.

6.3 The Permittee shall report to the Water Security Agency Drinking Water and Wastewater Management Division any known or anticipated upset condition, bypass condition or events at or affecting a Waterworks that could adversely affect the quality of water produced by the Waterworks.

6.4 The Permittee shall immediately report to the Water Security Agency Drinking Water and Wastewater Management Division any instance where:

8.4 Where any notice or reporting is required to be given by the Permittee, it shall be provided to:

(a) in the case of the Water Security Agency Drinking Water and Wastewater Management Division:

Water Security Agency
North Battleford
#108 – 1146 – 102nd Street
North Battleford, Saskatchewan
Fax: (306) 446 - 7464.
Telephone: (306) 446 - 7683
After hours, weekends and holidays, Saskatchewan Environment can be contacted by calling the 1-800-667-7525 Spill Report Line.

(b) In the case of the Water Security Agency Drinking Water and Wastewater Management Division:

Water Security Agency
3211 Albert Street
Regina, Saskatchewan S4S 5W6
Fax: (306) 787-0197
Telephone (306) 787-6504

Appendix B

File: NB21020-60/WW/OP/Cut Knife

The following Water Quality limits apply where identified in Appendix A

Bacteriological:
(i) total coliform levels of zero organisms detectable per 100 millilitres;
(ii) fecal coliform levels of zero organisms detectable per 100 millilitres; and
(iii) background bacteria levels on a total coliform or a fecal coliform membrane filtration plate of less than 200 organisms per 100 milliliters or no overgrowth.

Chlorine Residual:
(a) free residual of not less than 0.1 milligrams per litre in the water entering a distribution system; and
(b) a total chlorine residual of not less than 0.5 milligrams per litre or a free chlorine residual of not less than 0.1 milligrams per litre in the water throughout the distribution system.

NTU - Requirements by Source/Treatment type:

Source/Treatment	Routine Standard	Continuous Monitoring Time Duration Max.	Absolute Maximum
Groundwater [1]	Less than 1.0 NTU, 95% of discrete measurements or 95% time if continuous monitoring employed.	No Requirement.	No requirement.

[1] Turbidity value for water entering the distribution system

Chemical – Health Category	Parameter	MAC (mg/L)	IMAC (mg/L)
	Arsenic		0.010
	Barium	1.0	
	Boron		5.0
	Cadmium	0.005	
	Chromium	0.05	
	Fluoride	1.5	
	Lead	0.01	
	Nitrate	45.0	
	Selenium	0.01	
	Uranium	0.02	

Parameter	MAC(mg/L)	IMAC (mg/L)	Result(s)	Exceeding Limit	
Aluminum			.0005		
Arsenic	25		.5	Nil	* Results expressed
Barium	1.0		.0067	Nil	as average values
Boron		5.0	.34	Nil	for communities or
Cadmium	0.005		.00001	Nil	waterworks that
Chromium	0.05		.0005	Nil	fluoridate drinking
Fluoride (avg*)	1.5		.34		water supplies or
Copper			.031	Nil	those with elevated
Iron			.04		concentrations of
Lead	0.01		.0014	Nil	fluoride or nitrates
Manganese			.14		
Nitrate (avg.*)	45.0		2	Nil	
Seleniuum	0.01		.0001	Nil	
Uranium	20		1.	Nil	
Zinc			.012		

Chemical – Trihalomethanes (THMs)

Parameter	THMs Limit (mg/L)	Sample Result (average)	# Samples Required	# Samples Submitted
Trihalomethanes	0.1	_____	4 (1 every 3 months)	_____

Note: Only water supplies derived from surface water or groundwater under the influence of surface water are required to monitor for THMs. Waterworks using groundwater sources beyond the influence of surface water do not need to report THMs since sampling/analysis will not likely have been performed.

General Chemical

Parameter	Aesthetic Objectives * (mg/L)	Sample Results (average)	# Samples Required	# Samples Submitted
Alkalinity	500	386	1	1
Bicarbonate	No Objective	549		
Calcium	No Objective	125	1	1
Carbonate	No Objective	0		
Chloride	250	24.4	1	1
Conductivity	No Objective	1622	1	1
Hardness	800	423	1	1
Magnesium	200	.04	1	1
PH	No Objective	7.7	1	1
Sodium	300	197	1	1
Sulphate	500	456.8	1	1
Total dissolved Solids	1500	1415	1	1

All waterworks serving less than 5000 persons are required to submit water samples for SE's General Chemical category once every two years if a ground water source and once per three months every second year if a surface water or blended surface/groundwater source. The General Chemical category includes analysis for alkalinity, bicarbonate, calcium, carbonate, chloride, conductivity, hardness (as $CaCO_3$), magnesium, sodium, sulphate and total dissolved solids.
The last sample for General Chemical analysis was required on 2011 and submitted on *May 31, 2011 (use this statement if a groundwater supply)*. The last sets of quarterly samples for General Chemical analysis were required on (insert year or sample submission period required) and were submitted on *(insert dates) (use this statement if a surface source or blended source)*. Sample results indicated that there were no exceedences of the provincial aesthetic objectives for the General Chemical category *(use this statement if there were no exceedences)*. **(OR)** Samples exceeded provincial aesthetic objectives for the General Chemical category for the following parameters: *(use only the applicable portions of the table below for which values have been exceeded)*.

*Objectives apply to certain characteristics of or substances found in water for human consumptive or hygienic use. The presence of these substances will affect the acceptance of water by consumers and/or interfere with the practice of supplying good quality water. Compliance with drinking water aesthetic

Drinking Water Quality and Compliance
Town Short Form – A Template for Annual Notice to Consumers
(Note: This short form may be used for communities or waterworks serving a population of less than 5000).

Introduction

Saskatchewan Environment (SE) requires that at least once each year waterworks owners provide notification to consumers of the quality of water produced and supplied as well as information on the performance of the waterworks in submitting samples as required by a Minister's Order or Permit to Operate a waterworks. The following is a summary of the Town of Cut Knife water quality and sample submission compliance record for the year 2012 . This report was completed on August l28, 2013) Readers should refer to SE's "Municipal Drinking Water Quality Monitoring Guidelines, November 2002, EPB 202" for more information on minimum sample submission requirements and the meaning of type of sample. Permit requirements for a specific waterworks may require more sampling than outlined in the department's monitoring guidelines. If consumers need more information on the nature and significance of specific water tests, for example, "what is the significance of Selenium in a water supply", more detailed information is available from:
http://www.hc-sc.gc.ca/hecs-sesc/water/dwgsup.htm.

Water Quality Standards
Bacteriological Quality

Parameter/Location	Limit	Regular Samples Required	Regular Samples Submitted	# of Positive Regular Submitted (%)
Total Coliform and Background Bacteria	0 Organisms/100 mL Less than 200/100 mL	52	52	100%

Water Disinfection –
Chlorine Residual in Distribution System for Test Results Submitted with Bacteriological Samples

Parameter	Minimum Limit	Total Chlorine Residual Range	Free Chlorine Residual Range	# Tests Required	# Tests Submitted	# Adequate Chlorine (%)
Chlorine Residual	0.1 mg/L free OR 0.5 mg/L total	1.92-5.73	.11-.49	52	52	100%

Water Disinfection - Free Chlorine Residual for Water Entering Distribution System from Waterworks Records- From Water Treatment Plant Records

Parameter	Limit (mg/L)	Test Level Range	# Tests Performed	# Tests Not Meeting Requirements
Free Chlorine Residual	at least 0.1	.02-.51	365	100%

A minimum of 0.1 milligrams per litre (mg/L) free chlorine residual is required for water entering the distribution system. Tests are normally performed on a daily basis by the waterworks operator and are to be recorded in operation records. This data includes the number of free chlorine residual tests performed, the overall range of free chlorine residual (highest and lowest recorded values) and the number of tests and percentage of results not meeting the minimum requirement of 0.1 mg/L free chlorine residual.

Turbidity – From Water Treatment Plant Records

Parameter	Limit (NTU)	Test Level Range	# Tests Not Meeting Requirements	Maximum Turbidity (NTU)	# Tests Required	# Tests Performed
Turbidity	_____	.14-2.63	Nil	2.63	365	365

Chemical – Health Category

All waterworks serving less than 5000 persons are required to submit water samples for SE's Chemical Health category once every 2 years. The Chemical Health category includes analysis for arsenic, barium, boron, cadmium, chromium, fluoride, lead, nitrate, selenium and uranium.

The last sample for Chemical Health analysis was submitted on (*insert date*). Sample results indicated that the provincial drinking water quality standards were not exceeded. (*Use this one if review indicates that there were no exceedences*). **(OR)** Samples exceeded provincial water quality standards for the following parameters: (*Use only the applicable portions of table below for which values have been exceeded*).

Parameter	MAC(mg/L)	IMAC (mg/L)	Result(s)	Exceeding Limit	
Aluminum			.0005		
Arsenic	25		.7	Nil	* Results expressed
Barium	1.0		.0071	Nil	as average values
Boron		5.0	.35	Nil	for communities or
Cadmium	0.005		.00002	Nil	waterworks that
Chromium	0.05		.0005	Nil	fluoridate drinking
Fluoride (avg*)	1.5		.49		water supplies or
Copper			.18	Nil	those with elevated
Iron			.013		concentrations of
Lead	0.01		.0014	Nil	fluoride or nitrates
Manganese			.063		
Nitrate (avg.*)	45.0		..2	Nil	
Seleniuum	0.01		.0001	Nil	
Uranium	20		1.1	Nil	
Zinc			.064		

Chemical – Trihalomethanes (THMs)

Parameter	THMs Limit (mg/L)	Sample Result (average)	# Samples Required	# Samples Submitted
Trihalomethanes	0.1	_____	4 (1 every 3 months)	_____

Note: Only water supplies derived from surface water or groundwater under the influence of surface water are required to monitor for THMs. Waterworks using groundwater sources beyond the influence of surface water do not need to report THMs since sampling/analysis will not likely have been performed.

General Chemical

Parameter	Aesthetic Objectives * (mg/L)	Sample Results (average)	# Samples Required	# Samples Submitted
Alkalinity	500	451	1	1
Bicarbonate	No Objective	550		
Calcium	No Objective	130	1	1
Carbonate	No Objective	0		
Chloride	250	21.2	1	1
Conductivity	No Objective	1622	1	1
Hardness	800	555	1	1
Magnesium	200	.56	1	1
PH	No Objective	7.9	1	1
Sodium	300	197	1	1
Sulphate	500	456.8	1	1
Total dissolved Solids	1500	1417	1	1

All waterworks serving less than 5000 persons are required to submit water samples for SE's General Chemical category once every two years if a ground water source and once per three months every second year if a surface water or blended surface/groundwater source. The General Chemical category includes analysis for alkalinity, bicarbonate, calcium, carbonate, chloride, conductivity, hardness (as $CaCO_3$), magnesium, sodium, sulphate and total dissolved solids.
The last sample for General Chemical analysis was required on 2011 and submitted on *May 31, 2011 (use this statement if a groundwater supply)*. The last sets of quarterly samples for General Chemical analysis were required on (insert year or sample submission period required) and were submitted on *(insert dates) (use this statement if a surface source or blended source)*. Sample results indicated that there were no exceedences of the provincial aesthetic objectives for the General Chemical category *(use this statement if there were no exceedences)*. **(OR)** Samples exceeded provincial aesthetic objectives for the General Chemical category for the following parameters: *(use only the applicable portions of the table below for which values have been exceeded)*.

*Objectives apply to certain characteristics of or substances found in water for human consumptive or hygienic use. The presence of these substances will affect the acceptance of water by consumers and/or interfere with the practice of supplying good quality water. Compliance with drinking water aesthetic

Drinking Water Quality and Compliance
Town Short Form – A Template for Annual Notice to Consumers
(Note: This short form may be used for communities or waterworks serving a population of less than 5000).

Introduction

Saskatchewan Environment (SE) requires that at least once each year waterworks owners provide notification to consumers of the quality of water produced and supplied as well as information on the performance of the waterworks in submitting samples as required by a Minister's Order or Permit to Operate a waterworks. The following is a summary of the Town of Cut Knife water quality and sample submission compliance record for the year 2014 . This report was completed on November 3, 2015) Readers should refer to SE's "Municipal Drinking Water Quality Monitoring Guidelines, November 2002, EPB 202" for more information on minimum sample submission requirements and the meaning of type of sample. Permit requirements for a specific waterworks may require more sampling than outlined in the department's monitoring guidelines. If consumers need more information on the nature and significance of specific water tests, for example, "what is the significance of Selenium in a water supply", more detailed information is available from:
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Water Disinfection - Free Chlorine Residual for Water Entering Distribution System from Waterworks Records- From Water Treatment Plant Records

Parameter	Limit (mg/L)	Test Level Range	# Tests Performed	# Tests Not Meeting Requirements
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Turbidity – From Water Treatment Plant Records

Parameter	Limit (NTU)	Test Level Range	# Tests Not Meeting Requirements	Maximum Turbidity (NTU)	# Tests Required	# Tests Performed
Turbidity	_____	.2-2.48	Nil	2.48	365	365

Chemical – Health Category

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interfere with the practice of supplying good quality water. Compliance with drinking water aesthetic objectives is not mandatory as these objectives are in the range where they do not constitute a health hazards. The aesthetic objectives for several parameters (including hardness as $CaCO_3$, magnesium, sodium and total dissolved solids) consider regional differences in drinking water sources and quality.

More information on water quality and sample submission performance may be obtained from:

TOWN OF CUT KNIFE
Box 70, Cut Knife, Sask. S0M0N0
Phone: 398-2363; Fax: 398-2839
rm439@sasktel.net

March 2006 *EPB 236D*

Appendix C
Figures And Drawings

SUBJECT PROPERTY

*Reference: Map details from "Google Map 2016"

PINTER & ASSOCIATES LTD.

710 48TH STREET EAST
SASKATOON SK S7K 5B4
306.244.1710
pintermain@pinter.ca

LEGEND

Subject Property ★

METRES

SCALE: N/A

FILE: H:\PROJECTS\1837 CUT KNIFE ROUND 3 WSA\1837REPORT\APPENDIX

FIGURE 1

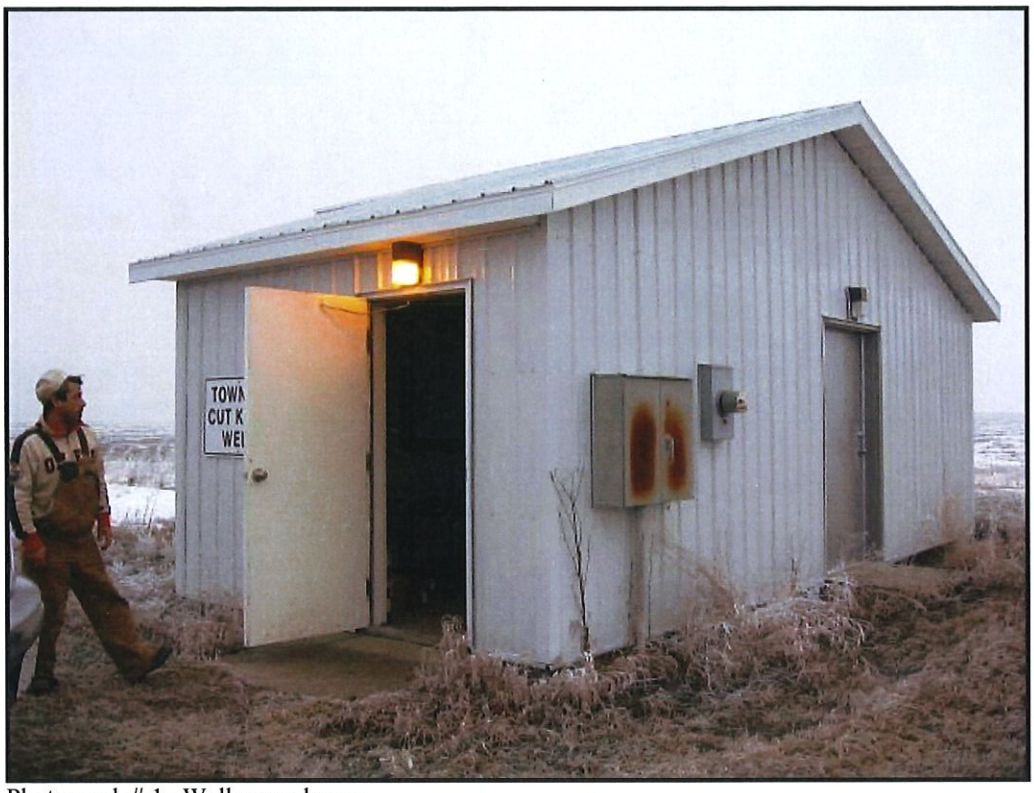
WSA ROUND 3 - SITE LOCATION

01 FEBRUARY 2016
15-1837 CUT KNIFE, SK

DRAWN BY: Y. XING, P. ENG.

CHECKED BY: L. PINTER, P.ENG.

Appendix D
Pictures

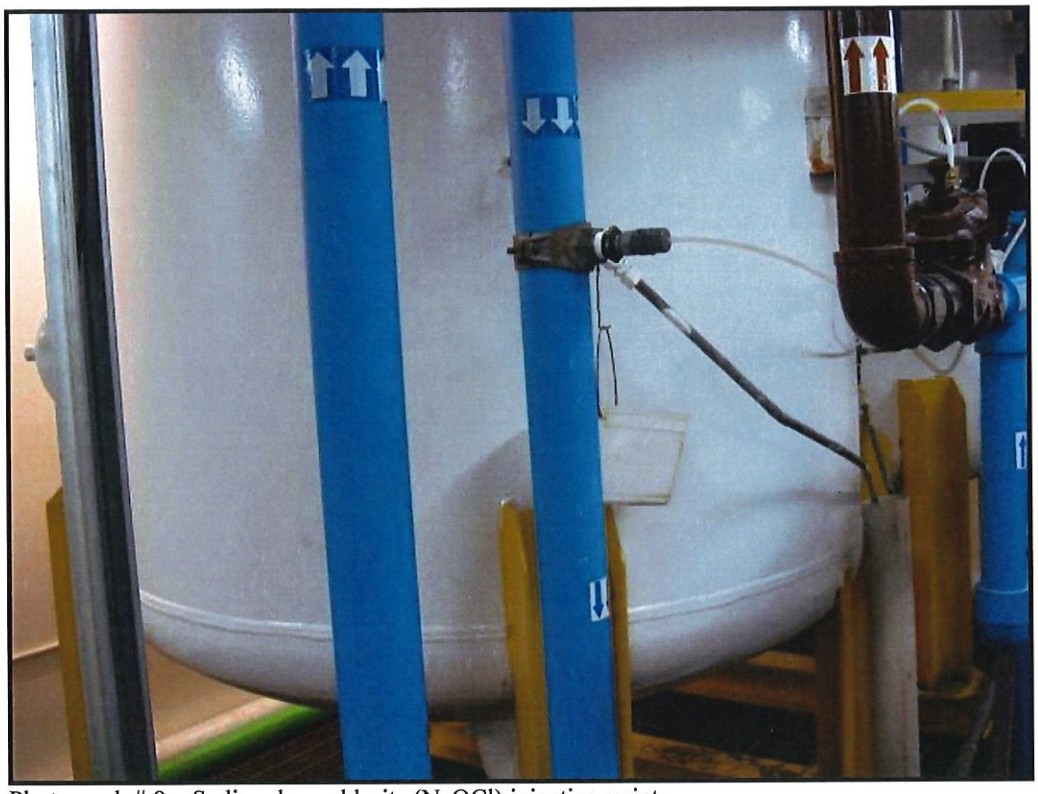


Photograph # 1– Well pump house.

Photograph # 2 – Well#2 well head.

Photograph # 5 –Control panel at WTP.

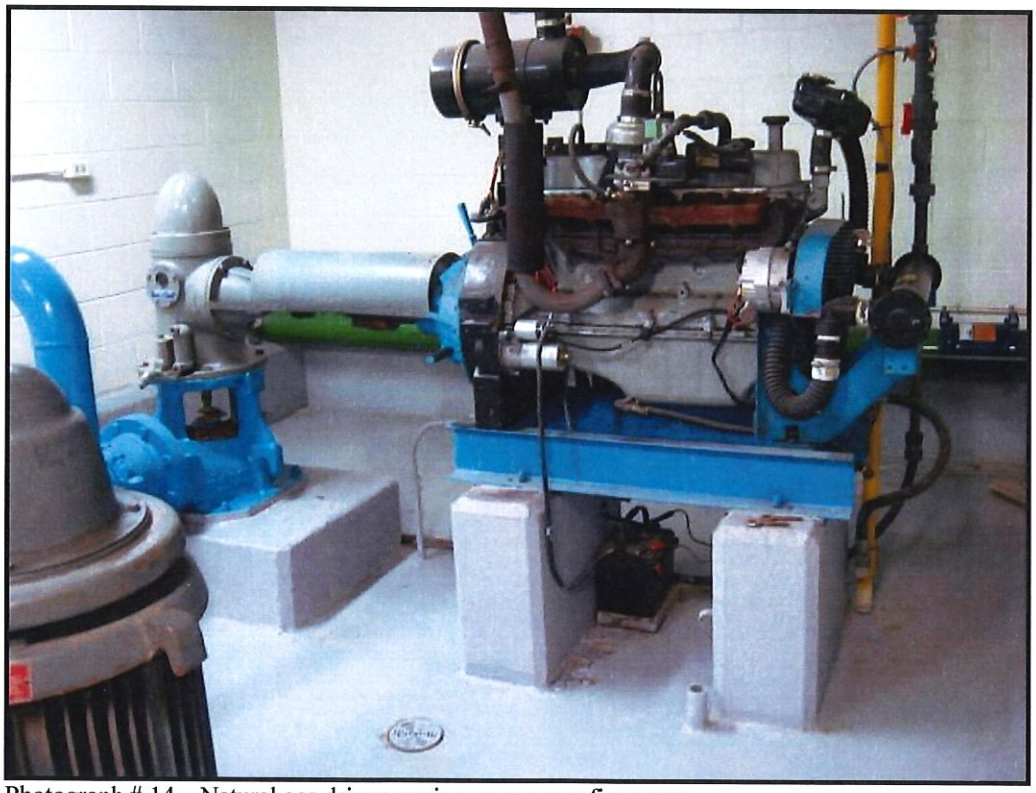
Photograph # 6 – Potassium permanganate ($KMnO_4$) injection point.



Photograph # 9 – Sodium hypochlorite (NaOCl) injection point.

Photograph # 10 – Sodium hypochlorite tanks.

Photograph # 13 – Two water distribution pumps and backup pump.



Photograph # 14 – Natural gas driven engine emergency fire pump.