


# Manitoba Environment Act Proposal RM of Woodworth

January 2013

Jaimee Schmidt, P.Eng



# Environment Act Proposal Form

Name of the development: Rural Municipality of Woodworth Water Treatment Plant Upgrade	
Type of development per Classes of Development Regulation (Manitoba Regulation 164/88): Waste Disposal	
Legal name of the proponent of the development: Rural Municipality of Woodworth	Mailing address: Box 148, Kenton, MB R0M 0Z0
Location (street address, city, town, municipality, legal description) of the development: Community of Kenton N1/2 6-12-23W	
Name of proponent contact person for purposes of the environmental assessment: Jaimee Schmidt, P.Eng.	
Phone: 204-726-6766 Fax: 204-726-7196	Mailing address: The Manitoba Water Services Board P.O. Box 22080 Brandon, MB R7A 6Y9
Email address: jaimee.schmidt@gov.mb.ca	
Webpage address:	
Date:  January 30, 2013	Signature of proponent, or corporate principal of corporate proponent:  Printed name: Travis Parsons, M.A.Sc., P.Eng.

A complete **Environment Act Proposal (EAP)** consists of the following components:

- **Cover letter**
- **Environment Act Proposal Form**
- **Reports/plans supporting the EAP** (see "Information Bulletin - Environment Act Proposal Report Guidelines" for required information and number of copies)
- **Application fee** (Cheque, payable to Minister of Finance, for the appropriate fee)

Per Environment Act Fees Regulation (Manitoba Regulation 168/96):

Class 1 Developments .....	\$500
Class 2 Developments .....	\$5,000
Class 3 Developments:	
Transportation and Transmission Lines.....	\$5,000
Water Developments .....	\$50,000
Energy and Mining.....	\$100,000

**Submit the complete EAP to:**

Director  
Environmental Assessment and Licensing Branch  
Manitoba Conservation  
Suite 160, 123 Main Street  
Winnipeg, Manitoba R3C 1A5

**For more information:**

Phone: (204) 945-7100  
Fax: (204) 945-5229  
Toll Free: 1-800-282-8069, ext. 7100  
<http://www.gov.mb.ca/conservation/eal>

## Table of Contents

Executive Summary.....	1
List of Acronyms.....	2
1.0 Introduction .....	3
1.1 Background Information .....	3
1.1.1 Previous Studies.....	3
1.1.2 Population.....	4
1.1.3 Current and Projected Water Use .....	5
1.1.4 Raw Water Source .....	6
1.1.5 Water Rights Act .....	6
1.1.6 Water Quality.....	6
1.1.7 Compliance Plan.....	8
2.0 Description of proposed Development.....	9
2.1 Project Description .....	9
2.1.1 Operation and Maintenance.....	9
2.2 Certificate of Title .....	10
2.3 Existing and Adjacent Land Use .....	10
2.4 Land Use Designation and Zoning.....	10
2.5 Project Schedule .....	10
2.6 Project Funding.....	10
2.7 Regulatory Approvals.....	11
2.8 Public Consultation .....	11
2.9 Storage of Petroleum Products and Other Chemicals.....	11
3.0 Physical Environment.....	12
3.1 Physiographic Setting and Climate .....	12
3.2 Hydrogeology.....	12
3.3 Hydrology.....	12
3.4 Fish and Fish Habitat.....	13
3.5 Wildlife Habitat and Vegetation .....	13
3.6 Socioeconomic .....	14
3.7 Heritage Resources .....	14
4.0 Potential Environmental Effects .....	15
4.1 Air Quality .....	15
4.2 Soils .....	15
4.3 Surface Water, Fish and Fish Habitat.....	15
4.4 Groundwater Quality .....	19
4.5 Groundwater Levels.....	19
4.6 Vegetation.....	20
4.7 Wildlife Habitat and Vegetation .....	20

4.8	Noise and Vibration .....	20
4.9	Employment/Economy .....	20
4.10	Human Health and Well Being .....	21
4.11	Climate Change .....	21
5.0	Environmental Management Measures .....	22
5.1	Air Quality .....	22
5.2	Soils .....	22
5.3	Surface Water .....	22
5.4	Groundwater.....	23
5.5	Vegetation and Wildlife .....	23
5.6	Fisheries .....	23
5.7	Noise and Vibration .....	23
5.8	Water Conservation.....	23
5.9	Socio-Economic Implications .....	24
6.0	References .....	25
	Appendix A.....	26
	Appendix B.....	28
	Appendix C.....	30
	Appendix D.....	33
	Appendix E .....	36
	Appendix F .....	39
	Appendix G.....	42
	Appendix H.....	44
	Appendix I.....	47

## Executive Summary

The RM of Woodworth requested The Manitoba Water Services Board (MWSB) to prepare an Environment Act Proposal for a Class 1 Development License under the Manitoba Environment Act for an upgrade to the water treatment plant (WTP). This Environment Act proposal includes components for a new water treatment plant and discharge of membrane concentrate.

Currently, the Kenton WTP provides treatment and disinfection for approximately 550 people in the Community of Kenton and the RM of Woodworth. The rural service includes some agricultural operations including a large hog farms and numerous feed lots. The Kenton WTP has a capacity of 7 – 7.5 L/s and a 110 m<sup>3</sup> reservoir. The reservoir is inadequate and incapable of supplying fire storage requirements for Kenton due to the high demand from the rural component.

Raw water is supplied from two groundwater wells. Current treatment consists of manganese greensand filtration for iron and manganese removal. Sodium hypochlorite is added to the treated water as an oxidant for iron and manganese removal and for disinfection prior to storage and distribution. Water quality concerns include high hardness, iron, manganese, total dissolved solids (TDS), total organic carbon (TOC), trihalomethanes (THM), and colour. Treated water parameters exceeding the Guidelines for Canadian Drinking Water Quality (GCDWQ) include hardness and TDS. The current treatment system does not reduce organics enough to prevent the formation of disinfection by-products such as THMs.

In order to meet drinking water guidelines, the proposed development includes the construction of a new 7.2 L/s membrane WTP located next to the existing WTP in the Community of Kenton. The treatment system will be required to have a 500 m reject pipeline whereby highly mineralized reject water will be discharged to a third order drain located on the east side of Kenton. The drain flows into Brierwood Creek and then to the Oak River. The proposed new plant will have a minimum reservoir capacity of 250 m<sup>3</sup> and when connected to the existing 110 m<sup>3</sup> reservoir, will have a total storage of 360 m<sup>3</sup>. This size of reservoir would meet both Kenton's fire storage and rural water storage requirements. A 6 - 6.5 km 150 mm raw water pipeline must be constructed from the well site to the new plant.

## List of Acronyms

AO	Aesthetic Objective
DBP	Disinfection By-Product
DWSA	Drinking Water Safety Act
EAP	Environment Act Proposal
GCDWQ	Guidelines for Canadian Drinking Water Quality
GUDI	Groundwater Under Direct Influence of Surface Water
MWSB	Manitoba Water Services Board
ODW	Office of Drinking Water
RM	Rural Municipality
TDS	Total Dissolved Solids
THM	Trihalomethane
TOC	Total Organic Carbon
UV	Ultraviolet
WTP	Water Treatment Plant

## 1.0 Introduction

The RM of Woodworth requested The Manitoba Water Services Board (MWSB) to prepare an Environment Act Proposal (EAP) for a Class 1 Development License under the Manitoba Environment Act for an upgrade to the water treatment plant (WTP). This document provides the compiled information required on Manitoba Conservation's Environment Act Proposal Report Guidelines and Supplementary Guidelines for Municipal Water Supply Systems. This Environment Act proposal includes components for a new water treatment plant and discharge of membrane concentrate.

### 1.1 Background Information

With assistance from the MWSB, the Rural Municipality (RM) of Woodworth constructed a rural water supply system during the early 1990s. In 1991 a large diameter well was installed in NE 9-12-24W located 5 km west and 1.6 km north of Kenton. At this time water was distributed without treatment except for chlorination near the well and chlorine contact time occurring in the pipeline system. Kenton's raw water source was originally from an impoundment south of the community and treatment consisted of a coagulation sedimentation process. In 1996, due to an aging WTP, Kenton switched to the rural supply well and the WTP equipment was replaced with manganese greensand filtration for iron and manganese removal.

Currently, the Kenton WTP provides treatment and disinfection for approximately 550 people in the Community of Kenton and the RM of Woodworth. The rural service includes some agricultural operations including hog production and numerous feed lots. The Kenton WTP has a capacity of 7 – 7.5 L/s and a 110 m<sup>3</sup> reservoir. The reservoir is inadequate and incapable of supplying fire storage requirements for Kenton due to the high demand from the rural component.

Two 8.5 m deep water supply wells were constructed into fine to medium sand and coarse shale gravel. The area has numerous surface water potholes and the well is known to have a quick spring recharge. Numerous potholes near the well site are likely the result of the high water table and granular overburden indicating the well is likely supplied by groundwater under direct influence (GUDI) of surface water. Wells classified as GUDI under the Drinking Water Safety Act (DWSA) require a 3 log reduction or inactivation of potential *Giardia lamblia* cysts and *Cryptosporidium* oocysts (*Giardia* & *Cryptosporidium*). The current treatment system does not meet this requirement as it would require the installation of an ultraviolet (UV) disinfection system. In addition, dissolved organics in the water supply is resulting in elevated THM compounds monitored within Kenton and rural distribution.

#### 1.1.1 Previous Studies

The MWSB conducted a groundwater investigation in 1990 (Pedersen, Arnie) to establish a well site for the current rural pipeline supply system. Resistivity surveys were done to define the limits of a surface channel sand and gravel aquifer that extends from the northwest to the Kenton west loading station. Five test-holes were drilled to complement the information



obtained from the loading stations. The sand and gravel aquifer was determined to be at least 10 km long and up to 200 – 300 m wide. The channel serves as a collecting point for surface runoff such that recharge is much higher than if only from precipitation on land directly above the aquifer. The sand and gravel in the channel reaches a depth of at least 14 metres and is interconnected with the Odanah shale aquifer.

In 1991, Manitoba's Water Resources Branch roughly estimated the storage in the aquifer as 590 cubic decameters (dam<sup>3</sup>) for every 1.6 km (1 mile) along the channel. An observation well located approximately 140 m east of the production well has been recording water elevations since 1991. Water table records show that seasonal spring snow melt and precipitation events have an immediate impact on recharge.

An Environment Act Proposal was submitted for the RM of Woodworth in March 2009 for new rural distribution pipelines and a new water treatment plant. A licence was received however the development was not constructed. New information regarding the THM formation issues has resulted in a change in treatment technology and WTP location.

### 1.1.2 Population

The RM of Woodworth internet web-page indicates Kenton has a population of approximately 160 people. Assuming a minimal 0.5% growth rate over the next 20 years equates to a future population of 177 people in Kenton. Based on the 2006 Canada Census population density for the RM of Woodworth and the number of existing and potential future connections, a rural water system population of 395 was estimated.

In general the population trend for the RM is shown to be decreasing.

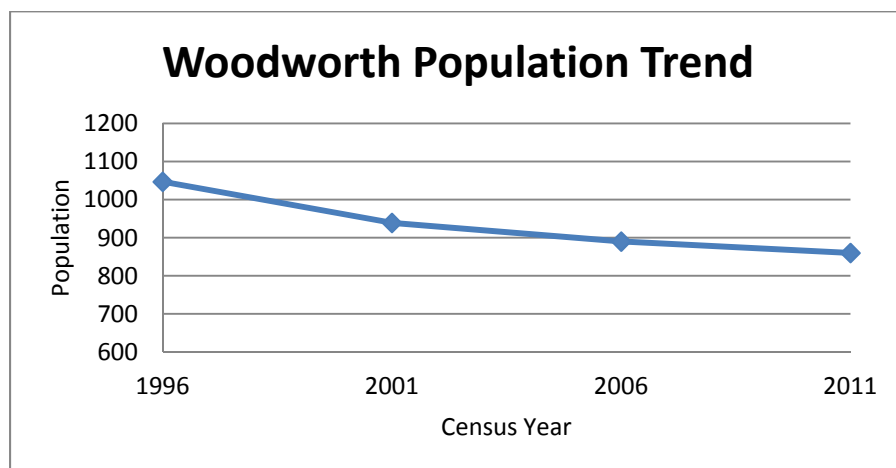


FIGURE 1 - POPULATION TRENDS



### 1.1.3 Current and Projected Water Use

Water use is metered separately between the community of Kenton and the rural water system. Currently, the total average day demand (Kenton and rural) is approximately 260,000 L/day. Kenton uses approximately 31,000 L/day and the rural system uses about 229,000 L/day. The disproportionate usage per population on the rural system indicates a significant livestock component and/or bulk water demand.

Livestock/bulk usage can be approximated by estimating typical rural residential water use considering the existing number of connections. Typical rural residential water use is about 250 L/capita/day and based on 94 connections and 2.6 people per connection, the rural residential use is estimated at 61,000 L/day (250 x 94 x 2.6). Therefore, livestock/bulk water consumption is estimated at 168,000 L/day (229,000 – 61,000) which represents approximately 70% of the rural water system usage.

Table 1.1 outlines 20 year future day water demands assuming expansion of the rural water system. An average day demand of 373,000 L/day and a peak day demand of 517,000 L/day were determined as shown in Table 1.1. Peak day demand assumes a peaking factor of 2.0 times the average day for residential use. Peak days are typically not observed for livestock operations. Since a WTP treatment capacity must meet the peak demand, the plant must be designed to meet a minimum treatment capacity of 7.2 L/s. This assumes 20 hours of operation per day with 4 hours per day provided for maintenance activities.

**TABLE 1.1 – FUTURE 20 YEAR WATER DEMANDS**

	Unit	
<b>Kenton Population</b>		177
<b>Rural Population</b>		395
<b>Total Population</b>		572
<b>Average Demand</b>		
Consumption/capita/day	L/c/day	x 250
Average Day Residential = 572 x 250	L/day	143,000
Livestock/Bulk Water Daily Use	L/day	+ 230,000
<b>Total Average Day Demand</b>	<b>L/day</b>	<b>373,000</b>
<b>Peak Demand</b>		
Average Day Residential	L/day	143,000
Peak Day Factor		x 2
Peak Day Residential	L/day	286,000
Livestock Daily Use	L/day	+ 230,000
<b>Total Peak Day Demand</b>	<b>L/day</b>	<b>516,000</b>
<b>Average Day Flow (20hrs)</b>	<b>L/s</b>	<b>5.2</b>
<b>Treatment Capacity (20hrs)</b>	<b>L/s</b>	<b>7.2</b>

#### **1.1.4 Raw Water Source**

The wells are located in the NE 9-12-24W constructed into 9 metres of coarse shale gravel and fine to medium sand. The aquifer is a surface channel that extends at least 10 km to the northwest. The channel is estimated at 200 - 300 metres wide, reaches a depth of at least 14 metres and is interconnected with the Odanah shale aquifer. The area has numerous surface water potholes and the well is known to have a quick spring recharge. The channel serves as a collecting point for surface runoff such that recharge is from a greater land area. An observation well approximately 140 m east of the production well has been recording water elevations since 1991. Records show that spring snow melt and precipitation events have an immediate impact on recharge. In addition to the hydrogeology, bacteriological and chemistry information indicates the supply is GUDI.

#### **1.1.5 Water Rights Act**

The RM's initial Water Rights Act Licence in 1993 had a maximum annual withdrawal of 31 dam<sup>3</sup> and a maximum instantaneous rate of 6 L/s. As a result of Kenton connecting to the rural supply system in 1996, this licence was modified with a maximum annual withdrawal of 55 dam<sup>3</sup>. In 2009 the licence was modified with a maximum annual withdrawal of 107.31 dam<sup>3</sup>. Records for 2007 and 2008 show an annual withdrawal of 97.7 and 96.2 dam<sup>3</sup> respectively. Based on projected water usage from the existing and proposed connections, the RM would require increasing its Licence to 145 dam<sup>3</sup> for total quantity of water and 0.0093 cubic metres per second for instantaneous flow rate. An application to increase the withdrawal rate needs to be submitted.

#### **1.1.6 Water Quality**

The Office of Drinking Water (ODW) currently conducts annual audits of all public water systems which includes sampling and chemistry analysis every three years for secure groundwater sources and once per year for surface water and GUDI supply systems. The following table outlines water quality parameters of concern which include hardness, iron, manganese, total dissolved solids (TDS), total organic carbon (TOC), trihalomethanes (THM) and colour. In addition the operator takes daily turbidity on both the raw and treated water. Raw water turbidity of 3 – 4 NTU is often observed (personal communication – Danica Wotton, DWO).

The raw water has high hardness, iron, manganese, TDS, and turbidity. The treatment system does not soften water or remove dissolved minerals. Treated water quality parameters exceeding the GCDWQ include hardness and TDS. Manganese occasionally exceeds the aesthetic objective (AO). Hardness and TDS are not considered a health concern but these aesthetic elements can make water undesirable.

Controlling turbidity in public drinking water supplies is important for both health and aesthetic reasons. Turbidity can interfere with the disinfection process and can be associated

with unacceptable taste and odours. Turbidity, particularly those associated with organic matters can serve as a food source for bacteria, viruses and protozoa and can cause serious health problems. Turbidity is consistently above the standard for the raw water.

Turbidity standards apply to surface water and GUDI supplies. The standard indicates where possible, filtration systems should be designed and operated to reduce turbidity levels as low as possible, with a treated water turbidity target of less than 0.1 NTU at all times. Where this is not achievable, the treated water turbidity levels from individual filters:

1. For **chemically assisted filtration**, shall be less than or equal to **0.3 NTU** in at least 95% of the measurements made, or at least 95% of the time each calendar month, and shall not exceed 1.0 NTU at any time.
2. For **slow sand or diatomaceous earth filtration**, shall be less than or equal to **1.0 NTU** in at least 95% of the measurements made, or at least 95% of the time each calendar month, and shall not exceed 3.0 NTU at any time.
3. For **membrane filtration**, shall be less than or equal to **0.1 NTU** in at least 99% of the measurements made, or at least 99% of the time each calendar month, and shall not exceed 0.3 NTU at any time. If membrane filtration is the sole treatment technology employed, some form of virus inactivation\* should follow the filtration process.

Raw water quality data indicates high concentrations of total organic carbon (TOC) up to 12.9 mg/L. The current treatment process is ineffective in reducing TOC concentrations. When disinfectants such as sodium hypochlorite react with organics they form disinfection by-products (DBPs) which may pose health risks. Common compounds formed are THMs and haloacetic acids. THMs are carcinogenic and short term exposure can lead to dizziness, headaches as well as problems related to the central nervous system. To ensure THM levels of less than 100 µg/L based on a quarterly sample average are met, total organic levels in treated water prior to chlorination need to be reduced to less than 2.0 mg/L. THM results from 2010 to 2011 varied from 150 to 453 µg/L with the high 453 µg/L result from a sample taken on the rural system where greater organic-chlorine reaction will occur in long pipelines with longer retention times. The treatment system is ineffective in reducing dissolved organics and therefore incapable of meeting regulated THM levels.

**Table 1.2 Water Quality Results (2006, 2009, 2010 & 2011 Samples)**

Parameter	Unit	Raw Water	Treated Water	GCDWQ
Hardness (Total) as CaCO <sub>3</sub>	mg/L	<b>312 - 359</b>	<b>308 - 345</b>	≤ 200/500 <sup>a</sup>
Iron	mg/L	<b>0.186 - 0.54</b>	< 0.02 - 0.15	≤ 0.3
Manganese	mg/L	<b>0.415 - 0.58</b>	0.00213 - <b>0.202</b>	≤ 0.05
Total Dissolved Solids (TDS)	mg/L	<b>751 - 887</b>	<b>745 - 887</b>	≤ 500
Total Organic Carbon (TOC)	mg/L	7.1 - 12.9	7.3 - 12.2	
Trihalomethanes (THM)	µg/L	-	<b>150 - 453</b>	100 <sup>b</sup>
True Colour	CU	7.0 - 20	< 5.0 - 15	≤ 15
Turbidity	NTU	<b>1.2 - 5.06</b>	0.13 - <b>1.2</b>	≤ 0.3

<sup>a</sup> Hardness levels greater than 200 are considered poor but tolerable. Hardness levels greater than 500 are generally considered unacceptable.

<sup>b</sup> THM limit is expressed as a running annual average of quarterly samples

### 1.1.7 Compliance Plan

An engineering assessment was completed by Genivar in March 2011. The assessment concluded that the Kenton WTP is not capable of producing water in compliance with Provincial regulations and has inadequate reservoir capacity for meeting current system demands. The groundwater source was determined to be GUDI. A compliance plan indicating the plans to build a new treatment system needs to be submitted.

## 2.0 Description of proposed Development

### 2.1 Project Description

The proposed development includes the construction of a new 7.2 L/s membrane WTP located next to the existing WTP in the Community of Kenton. The treatment system will be required to have a 500 m reject pipeline whereby highly mineralized reject water will be discharged to a third order drain located on the east side of Kenton. The drain flows into Brierwood Creek (fourth order) and then into the Oak River (sixth order). The proposed plant will have a minimum reservoir capacity of 350 m<sup>3</sup> including the existing 110 m<sup>3</sup> plus an additional 250 m<sup>3</sup> to be newly constructed. This size of reservoir would meet both Kenton's fire storage and rural water storage requirements. Since the existing 100 mm raw water pipeline is undersized to provide flows for the upgraded WTP, a 6.5 km 150 mm raw water pipeline must be constructed along PR259 to the new WTP. A preliminary floor plan for the WTP is included in Appendix A.



FIGURE 2.1 - LOCATION OF WTP

#### 2.1.1 Operation and Maintenance

The RM of Woodworth will be responsible for the operation and maintenance of the WTP and distribution pipelines. The existing WTP in Kenton is classified as a Class 1 facility. An application for classification will be filled out for the new WTP which will determine the class

of facility. The RM must ensure that all WTP operators are certified with the appropriate classification level.

The operator(s) will be required to operate the WTP and distribution system in a safe and efficient manner in accordance with relevant operations manuals and Drinking Water Safety Act regulations. Operation requirements will include measurements, monitoring, sampling, testing, record-keeping and reporting. The operator(s) must ensure the equipment is inspected and properly maintained. The operator(s) will receive training during the commissioning phase. As currently required, periodic inspection, maintenance, bacteriological sampling and chlorine residual testing of the distribution pipelines will be necessary. Additional sampling for turbidity and trihalomethanes (THMs) of the treated water will be required by the Drinking Water Safety Act regulations for systems on wells classified as GUDI.

## **2.2 Certificate of Title**

It is proposed to locate the raw water pipeline within municipal and provincial road right of ways which are owned by the Crown. The existing raw water line is on private easement for approximately 500 metres to reach the WTP in the community. The same pipeline alignment will be utilized on the same easement for the new 150 mm pipeline. The WTP will be located on municipal owned land in the N ½ 6-12-23 W. This is the location of the existing WTP. The Certificates of Title are provided in Appendix F.

## **2.3 Existing and Adjacent Land Use**

The proposed land for the development will be on municipal owned land at the existing WTP property. Adjacent land is used for agriculture. Existing and adjacent land use will not change as a result of this development.

## **2.4 Land Use Designation and Zoning**

Zoning designation for the pipelines on municipal owned land is not applicable.

## **2.5 Project Schedule**

The project is scheduled to commence and be completed in 2013 depending on the receipt of all approvals.

## **2.6 Project Funding**

This project is eligible for cost sharing between the MWSB and the RM of Woodworth subject to all approvals in place and availability of funding.

## **2.7 Regulatory Approvals**

The following branches/departments will be provided with copies of plans and specifications for information purposes and for the purposes of approvals and agreements:

Manitoba Conservation and Water Stewardship  
Office of Drinking Water

The contractor will be required to contact MTS, Hydro and gas utilities for utility locations and approvals.

## **2.8 Public Consultation**

A public consultation was held on January 29, 2013 and discussed the proposed plant upgrades to the citizens of the RM of Woodworth.

## **2.9 Storage of Petroleum Products and Other Chemicals**

Fuel will not be stored on-site at any time or location along the proposed construction route or near any well. Fuel will be supplied by fuelling trucks which are regulated under The Storage and Handling of Petroleum Products and Allied Products Regulation. Records of fuel volumes and an emergency response plan which includes spill prevention, notification and response will be implemented. No fuelling activities will be permitted within 100 m of watercourses during construction. During construction, the contractors will be required to ensure that all equipment is properly maintained to prevent leaks of fuel and motor fluids.

There will be no storage of petroleum products or other chemicals at any of the well sites during operation of the proposed development. Maintenance activities for the wells do not require refuelling on-site. Chemicals associated with the operation of the plant (sodium hypochlorite & potassium permanganate) will be stored in designated areas within the plant complete with spill containment. General household cleaning products will also be stored at this site.



## 3.0 Physical Environment

### 3.1 Physiographic Setting and Climate

The RM of Woodworth is located in southwest Manitoba immediately north of the Trans Canada Highway approximately 50 km west of the City of Brandon. Topography varies with elevations of near 500 metres in the northeast to 370 metres along the Assiniboine River in the southeast. Within the project area, elevations vary from 450 m at the WTP to 470 m at the well site.

Based on Environment Canada climatic data, the mean annual temperature in the area is 2.8 degrees Celsius with below zero average daily temperatures from November through March. Mean annual precipitation as recorded at Virden, MB is 474.3 mm.

### 3.2 Hydrogeology

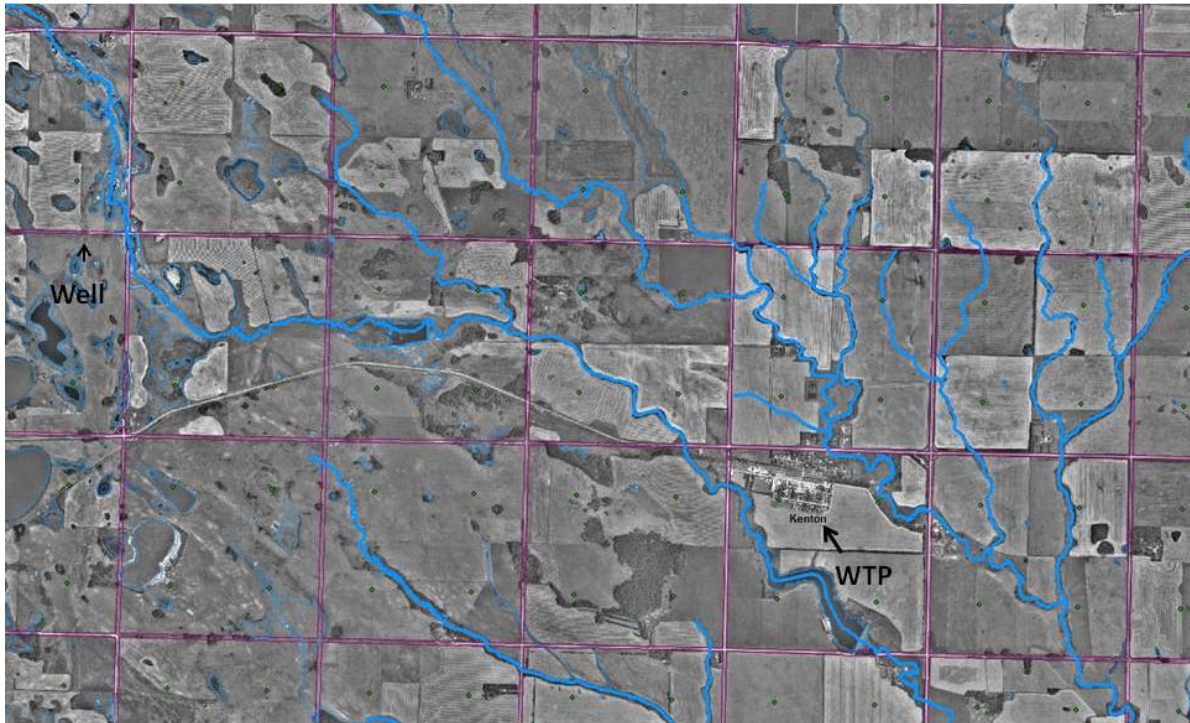
The investigations of the hydrogeology of the area have identified an unconfined aquifer with properties suitable for use as a water supply for the RM of Woodworth. The aquifer is described as glacio-fluvial in origin comprised of a sand and gravel channel that extends at least 10 km from the northwest corner of the RM to south of the Kenton west loading station in 3-12-24W. The channel reaches 200 to 300 m wide and a depth of at least 14 m. It is suspected that this aquifer is interconnected with the Odanah shale aquifer. The channel serves as a collecting point for surface runoff such that recharge is much higher than if only from precipitation on land directly above the aquifer. The storage in the aquifer is roughly estimated as 590 dam<sup>3</sup> per 1.6 km in channel length. Recorded groundwater elevations since 1991 vary from 0.2 m above to 1.3 m below ground with an average water table level of 0.57 m below ground (Appendix G).

### 3.3 Hydrology

The Assiniboine River flows along the western and southern portion of the RM with tributaries flowing in a southeast direction for most of the RM except near the Assiniboine River along the western border where tributaries flow southwest. In the project area, there are no large watercourse pipeline crossings proposed.

Within the immediate area of the well and proposed WTP site, all lands amenable to agricultural use have been cultivated. The exception is the numerous potholes that exist through the area and associated drainage courses (Figure 3.1). These features are not amenable to agriculture and are therefore, in a near natural vegetative state. The accumulation of water is common in these depressions and supports a “wetland” type of vegetative community. The water in these depressions is the result of the aquifer’s high water table and therefore groundwater at the production well site has an interaction between the

surface environment and would be classified as GUDI according to the Drinking Water Safety Act.



**FIGURE 3.1 – HYDROLOGY FEATURES NEAR THE PROPOSED DEVELOPMENT**

### **3.4 Fish and Fish Habitat**

Potential fish habitat in the project area includes the Assiniboine River and associated tributaries. The area around the well site and pipeline is within the prairie pothole region. These potholes are important for waterfowl production but fish habitat is negligible.

### **3.5 Wildlife Habitat and Vegetation**

The project area is located within the Aspen Parkland Ecoregion of the Prairies ecozone (Agriculture and Agri-Food Canada). The ecoregion is classified as having a transitional grassland ecoclimate. Most of the ecoregion is now farmland but in its native state, the landscape was characterized by trembling aspen, oak groves, mixed tall shrubs, and intermittent fescue grasslands. The ecoregion provides a major breeding habitat for waterfowl and includes habitat for white-tailed deer, coyote, snowshoe hare, cottontail, red fox, northern pocket gopher, Franklin's ground squirrel, and bird species like sharp-tailed grouse and black-billed magpie. It produces a wide diversity of crops, including spring wheat and other cereals, oilseeds, as well as forages and several specialty crops. The project area has been developed for agricultural resulting in reduction of habitat for several of these species.

The proposed WTP site and pipeline are located within an area containing numerous potholes which are part of the prairie pothole region extending from southern Alberta to western Manitoba and south into South Dakota. This is the most important waterfowl production area in North America. In Manitoba, water fowl conservation efforts through the North American Waterfowl Management Plan (NAWMP) are concentrated in the prairie pothole region. NAWMP programs target lands with high capacity for waterfowl production, which includes lands classified as 1 to 3 by the Canada Land Inventory (CLI) Land Capability for Waterfowl classification system. The WTP and pipelines are located within lands generally classified CLI 3 and 4 which have slight to moderate limitations to the production of waterfowl (National Resources Canada).

### **3.6 Socioeconomic**

The project area is located within the RM of Woodworth. The RM has an area of approximately 818 km<sup>2</sup> and a population of approximately 860 (2011 Census). There are no urban centres, however, small communities consist of Kenton, Harding, Lenore and Maskawata. The main economic base is agriculture which includes both crop and livestock production.

### **3.7 Heritage Resources**

Project activities will occur in previously disturbed provincial right of ways and on easement previously disturbed by the installation of existing raw water pipeline. The reservoir excavation will be within the community limits adjacent to the existing reservoir. The proponent will work with Heritage Resources Branch to mitigate any concerns as required.

## 4.0 Potential Environmental Effects

An environmental effect includes any change that the project may cause to the environment. Environmental effects were identified from interactions between proposed project activities and environmental components. Mitigation measures and follow-up activities were identified for environmental effects determined to be adverse.

### 4.1 Air Quality

During construction, dust will be raised by construction equipment and there will be gaseous and particulate emissions from the construction equipment. Water spraying is an important, common and practical procedure that would be applied as required to alleviate potential dust problems. Emissions of gases and particulates would be minimized by keeping machinery in good working order. Any effects would be localized, temporary and insignificant. During operation of the development there will be no releases of pollutants to the air.

### 4.2 Soils

During construction, there is a risk of fuel or lubricant spills from heavy equipment and vehicle operation. The storage of fuel or lubricants within the area of the well construction site will not be allowed. Therefore, the potential spills will be very small in size and standard construction spill clean-up procedures, including the removal of any impacted soil, will be used to prevent impact.

During operation, project activities are limited to regular monitoring and maintenance activities that have a negligible effect on soil disturbance and compaction because of low vehicle traffic and the use of established routes to access the wells and water treatment plant. Regular monitoring and maintenance activities will have a negligible effect on soil contamination since fuel trucks and other hazardous substances will not be brought on-site on a regular basis. The potential adverse effect on soil quality is assessed to be minor.

### 4.3 Surface Water, Fish and Fish Habitat

Photographs of the third order drain and the Brierwood Creek are provided in the following figures. Although discharge receiving drain is only a third order drain, it is characterized by having a deep ravine and a 40 m wide channel bottom until it meets up with PTH 21 approximately 1.5 km downstream. In addition, an old unused railway concrete crossing exists about 750 m downstream. This ravine will act as an adequate retention area for discharge storage over winter. It is not anticipated that the membrane discharge will result in a blockage of the stream crossing at PTH 21.





**FIGURE 4.1 THIRD ORDER DRAIN NEAR KENTON, MB – MARCH 15, 2012**



**FIGURE 4.2 THIRD ORDER DRAIN NEAR KENTON, MB – MARCH 15, 2012**



**FIGURE 4.3 BRIERWOOD CREEK FOURTH ORDER DRAIN - APRIL 2, 2012**

No water level or inflow data was available for the drain that would be used for the disposal of reject water. Discharge data for the Oak River can be found in Table 4.2. Surface water quality samples were taken from the 3<sup>rd</sup> order drain and the Oak River on April 2, 2012. The results are summarized in Table 4.1 below. Complete results of the sample are attached in Appendix I.

Membrane concentrate consists mainly of hardness causing minerals such as calcium and magnesium. The projected concentrate water quality is summarized in Table 4.1 and the complete results are displayed in Appendix H. The annual estimated concentrate discharged to the 3<sup>rd</sup> order drain is approximately 31,000 m<sup>3</sup> (31 dam<sup>3</sup>). Membrane concentrate has been discharged to surface water bodies in other locations across Manitoba without having significant adverse effects to water quality. Concentrate discharged to the drain will cause slight increases in hardness to the surface water in the mixing zone at the point of discharge. The RM of Woodworth will perform long term sampling of the drain water to verify water quality impacts.

**Table 4.1 Water quality results (April 2012)**

Parameter	Unit	Projected Reject	Oak River	3 <sup>rd</sup> Order Drain
Hardness	mg/L as CaCO <sub>3</sub>	1571.3	865	982
TDS	mg/L	5059.8	1930	1810
Sodium	mg/L	806.8	241	179
Sulphate	mg/L		1130	742
Fluoride	mg/L	0.3	<0.50	<0.50
Chloride	mg/L	307.5	74.0	225

The manganese greensand filter backwash water will also have minimal impacts on the water quality of the drain. The backwash water will consist of filtered iron and manganese removed from the water supply and will be discharged through membrane concentrate reject pipeline. It is important to note that the filter backwashing will only occur once every other day (3 times per week) for approximately 10 - 15 minutes. The volume of filter backwash is approximately 3% of the membrane concentrate volume.

Minor and short term impacts on surface water may occur as a result of construction activity in road allowance ditches during runoff events. The impact on surface water would include sediment that may be eroded from excavation activities, minor engine leaks and potential fuel spills should runoff events occur during construction. Horizontal directional drilling will be conducted to install the pipeline at the drain outlet. This will eliminate excavation within the riparian zone and minimize impacts. There is potential for some loss of drilling mud to surface water.

Impacts to fisheries and fish habitat are considered minor.

There is a hydrometric flow station (05MG004) located on the Oak River near Rivers, MB. Table 4.2 provides the monthly average flows from 2000-2010. As expected the flows are highest in April with an average flow of approximately 3800 L/s and flow decreases in most years to 0 L/s by fall.

The operation of a RO membrane plant will result in minor impacts to Oak River as a result of concentrate being wasted during water production. The impacts are considered minor given the poor water quality of this drain and the low flow rate of the membrane concentrate. Based on the proposed design treatment capacity, the concentrate flow rate to Oak River is estimated as 25% of the average raw water demand (0.25 x 8.4 L/s) which equals 2.1 L/s.

Table 4.3 provides the impact of the RO membrane concentrate disposal on Oak River during periods of low and high flow. The low and high flows are based on the monthly averages over an 11 year period as previously shown in Table 4.2. During high flow conditions, the impact of



concentrate disposal is negligible. During low flow conditions there is a small measurable impact. For example, TDS is increased approximately 1.2%.

**Table 4.2 Monthly Mean Discharge (m<sup>3</sup>/s)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000	-	-	0.072	0.042	0.008	0.003	0.766	0.042	0.091	0.088	-	-
2001	-	-	0.046	7.63	7.36	1.51	1.11	0.224	0.002	0.001	-	-
2002	-	-	0	0.323	0.018	0.013	0.068	0.004	0.002	0.013	-	-
2003	-	-	0.334	1.12	0.054	0.001	0	0	0	0	-	-
2004	-	-	0.095	1.23	0.113	0.276	0.011	0.006	0.016	0.08	-	-
2005	-	-	0	10.4	1.79	12.6	4.09	0.394	0.075	0.067	-	-
2006	-	-	0.016	3.84	1.43	0.355	0.092	0	0	0	-	-
2007	-	-	1.48	3.85	1.92	1.29	1.08	0.118	0.001	0.002	-	-
2008	-	-	0	0.68	0.08	0.112	0.186	0.136	0.053	0.02	-	-
2009	-	-	0.641	12.7	3.36	0.523	0.127	0.011	0.015	0.001	-	-
2010	-	-	0.217	0.243	0.407	1.18	0.733	0.248	0.048	0.26	-	-

**Table 4.3 Effects of Reject on River Quality**

	Reject (mg/L)	River (mg/L)	Low Flow (mg/L)	High Flow (mg/L)
Hardness	1571.3	865	871	865
TDS	5059.8	1930	1954	1932
Sodium	806.8	241	245	241
Fluoride	3	0.5	0.5	0.5
Chloride	307.5	74	76	74

#### 4.4 Groundwater Quality

Groundwater quality can be impacted by surface activities and surface water quality. Mitigation measures are necessary to protect groundwater quality during construction activities. The proposed withdrawals are unlikely to result in adverse changes to water quality.

#### 4.5 Groundwater Levels

The available information indicates that the proposed withdrawal of groundwater is unlikely to result in adverse changes to groundwater levels. Nevertheless, the potential still exists and continued monitoring of the groundwater levels will identify any such adverse effects and allow the appropriate adjustments in the system operation to be made.

#### **4.6 Vegetation**

Construction will occur primarily within municipal right of ways that are previously disturbed, regularly managed and comprised primarily of grasses. As the areas are already disturbed, they are unlikely to contain rare plant species. The amount of vegetation disturbance is expected to be minimal.

During operation, monitoring and maintenance activities including access to the well sites will be restricted to designated and previously disturbed areas. Potential effects to vegetation are considered to be negligible.

#### **4.7 Wildlife Habitat and Vegetation**

The construction and operation activities associated with this project will be limited to areas already developed for urban or agricultural uses. The potential adverse effects of wildlife habitat loss were assessed to be negligible to minor.

#### **4.8 Noise and Vibration**

During the construction phase of the project, there will be several sources of sound emissions including equipment used for construction. The types of noises heard due to construction are dominated by equipment engines. However, miscellaneous short term impact noises (ie: dump truck gates, back hoe buckets) are often heard. The noise will be in addition to regular community and highway activities, and the effects are considered minor.

Scheduling of various site activities can minimize the impact of noise. This would include scheduling construction for day-time hours to avoid sleep disturbance and the disruption of evening domestic activities. All equipment used on site will be fitted with appropriate mufflers and will be maintained in good working order to minimize noise levels.

#### **4.9 Employment/Economy**

Socio-economic implications are not expected as a result of environmental impacts as impacts are considered minor and short-term. Some economic implications may exist for the Municipality due to the costs of developing the water system, however, the Municipality will have a sustainable potable water supply to meet future demands. There may be some local economic benefit during construction.

The proposed project will address a chronic issue of poor water quality and limited water quantity for the area targeted for rural water pipelines which has had an effect on employment opportunities and the economy. The potential effects of the project on employment and the economy were assessed to be positive.

#### **4.10 Human Health and Well Being**

The potential adverse effects of the project on human health are assessed to be negligible to minor. Short term temporary increases in noise and dust emissions will occur during construction that are considered to be minor effects. During operation, there will be a minor increase in vehicular traffic associated with monitoring and maintenance activities. The potential effects are considered minor.

The project will result in the construction of a water treatment plant designed and operated to produce a treated water supply to meet current water quality standards. The effects of this on human health and well being are considered positive.

#### **4.11 Climate Change**

There are no predicted impacts to climate as a result of the project activities.

## 5.0 Environmental Management Measures

Environmental management practices proposed to prevent or mitigate environmental effects that were determined to be adverse are identified and described below.

### 5.1 Air Quality

Emissions resulting from construction and transportation equipment may be mitigated by the utilization of well maintained and operating vehicles while reducing unnecessary vehicle idling.

The impact of dust may be mitigated by the use of an approved dust suppressant, limiting construction during high wind periods, and re-establishment of vegetation as soon as possible.

### 5.2 Soils

Mitigation to potential impacts to soil by contamination from petroleum products include preparation of an emergency response plan for potential spills, use of spill clean-up equipment and materials, using properly maintained equipment, and using appropriate fuelling equipment.

Re-establishment of vegetation as soon as possible after disturbance will limit loss of soil due to wind or water erosion. Backfilling with soil stockpiles as soon as possible and minimizing the amount of soil disturbance can be implemented.

### 5.3 Surface Water

Mitigation of surface water issues may be achieved by limiting open cut trenching to within 30 m ahead or behind the pipe laying, redirecting surface water runoff, pumping accumulated water to adjacent ditches and providing erosion control practices as required.

Petroleum leaks or spills will be mitigated by use of properly maintained equipment, use of spill clean-up equipment and materials, and use of appropriate fuelling equipment. A prepared emergency response plan can be implemented in the event of a significant spill. In the event of a reportable spill, Manitoba Conservation and Water Stewardship will be notified through the emergency response line and appropriate measures will be taken according to Manitoba Conservation and Water Stewardship requirements.

A 100 m setback to watercourses will be maintained for fuelling activities.

Horizontal directional drilling will be implemented at watercourse crossings. Vehicles will avoid entering the riparian zones. Re-establishment of vegetation will occur as soon as possible on areas of disturbed soil.

The raw water pipeline and reject pipeline will not require disinfection pipelines or de-chlorinated when flushing.

## **5.4 Groundwater**

Mitigation of potential groundwater impacts from petroleum products can be mitigated as described in Section 5.3. Any long term changes in groundwater quality will be observed from periodic WTP raw water samples.

Continued monitoring of groundwater levels will ensure potential adverse impacts are detected in advance such that potential future impacts can be resolved through operational adjustments. The availability of groundwater usage for this proposal and potential future users will be assessed through the Water Rights Act Licensing process.

## **5.5 Vegetation and Wildlife**

Re-establishment of vegetation will occur as soon as possible on disturbed areas. Impacts to wildlife habitat can be limited by minimizing the area of construction, soil disturbance and vegetation disturbance. Other impacts resulting from dust or smoke will be minimized as previously indicated. Noise disturbance will be limited by use of muffling vehicles and equipment, limiting idling and limiting the construction area.

## **5.6 Fisheries**

Fisheries impacts will be minimized by implementing practices to reduce soil and contaminate runoff as previously mentioned in Sections 5.3 and 5.5. In addition, horizontal directional drilling will occur under all watercourses containing water. The required excavation needed to introduce the drilling equipment will be maintained outside watercourse riparian zones.

## **5.7 Noise and Vibration**

Limiting any noise-creating activities, including regular maintenance and monitoring activities to normal working hours, and limiting unnecessary long-term idling can mitigate any potential increased noise and vibration effects.

## **5.8 Water Conservation**

Water conservation measures include metering and pricing of water. Water conservation information in water bill mailings can be implemented. Leak detection will consist of reconciling on a quarterly basis the volume of water pumped and charged to ratepayers. Since these services are metered, abnormalities can be identified and rectified.

## **5.9 Socio-Economic Implications**

There are no known negative environmental socio-economic impacts that need mitigation. Since the proposed development would provide a reliable healthy drinking water supply, it would be expected to enhance quality of life and economic viability for the Municipality. The proposed project may provide some economic benefits to the area for local businesses and employment opportunities during construction phase.

## 6.0 References

Agriculture and Agri-Food Canada. A National Ecological Framework for Canada 13 June 2012  
<<http://sis.agr.gc.ca/cansis/nsdb/ecostrat/index.html>>

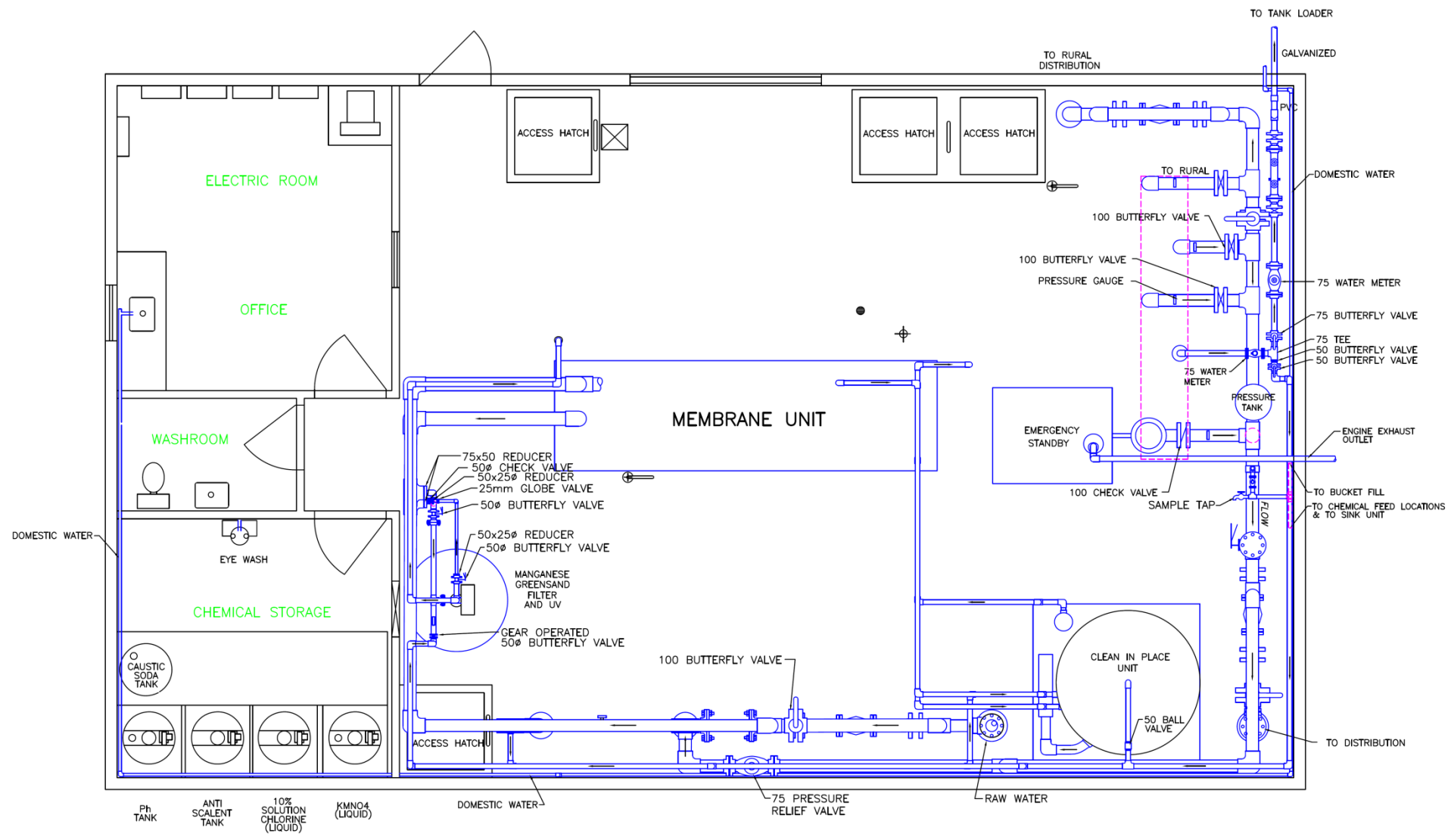
National Resources Canada. Canada Land Inventory. Waterfowl Capability Class. 13 June 2012  
<<http://geogratis.cgdi.gc.ca/geogratis/en/option/select.do?id=CB6E057B-0D85-9B22-29DE-6351369A8B02>>

Pedersen, Arnie, P.Eng. RM of Woodworth Test Drilling Report. Manitoba Water Services Board files, 1991.



## **Appendix A**

### Preliminary Floor Plan

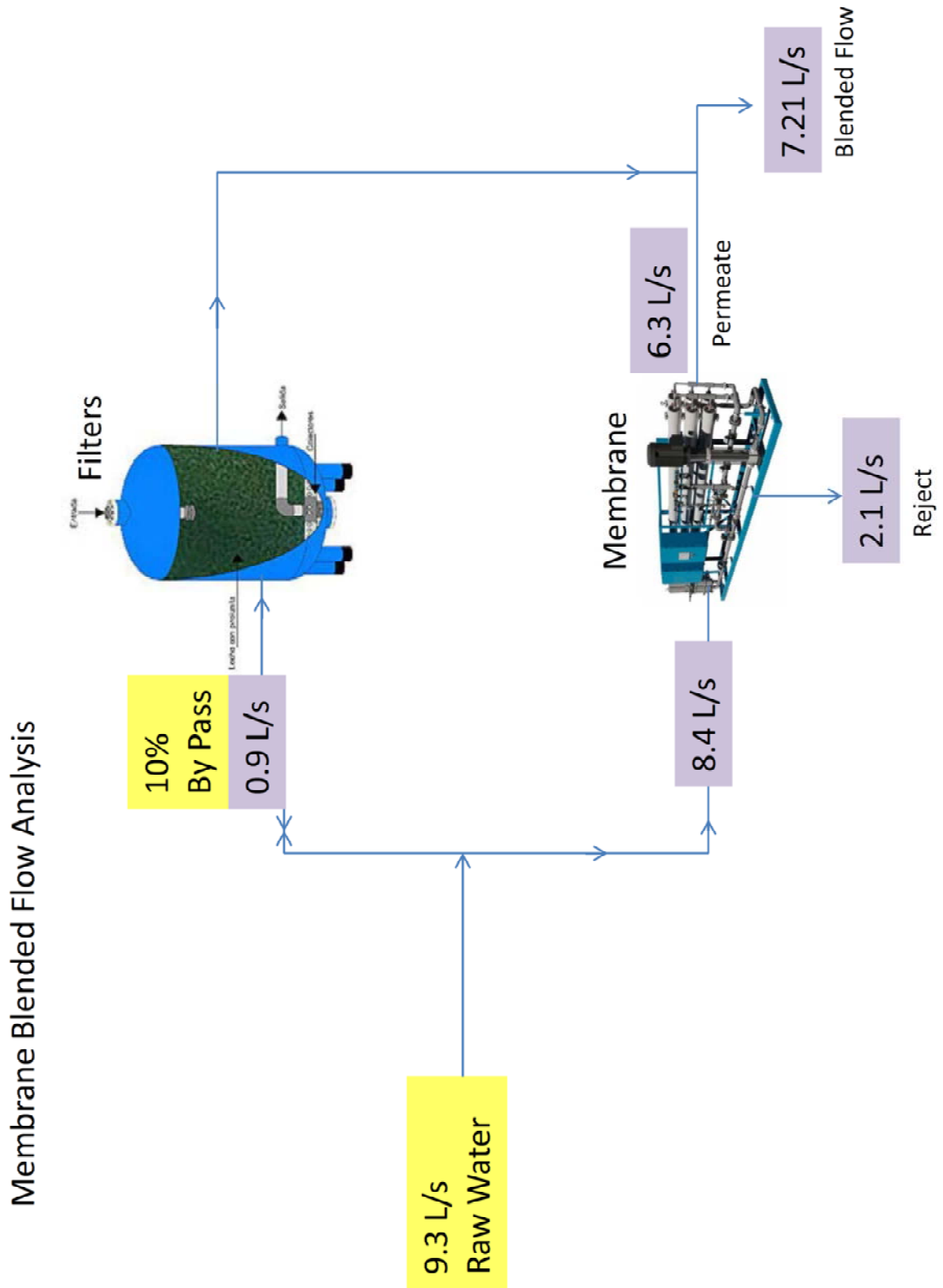


PUMPHOUSE FLOOR PLAN

			SUBMITTED: _____ DRAWN: R. NASON DESIGNED: T. PARSONS CHECKED: T. PARSONS REVIEWED: _____		PROVINCE OF MANITOBA <b>THE MANITOBA WATER SERVICES BOARD</b> MANITOBA LOCAL GOVERNMENT		R.M. WOODWORTH KENTON 250,000L RESERVOIR & PUMPHOUSE <b>PROPOSED PUMPHOUSE FLOOR PLAN</b>				
			SUBMITTED: _____ DATE: _____ GENERAL MANAGER: _____		APPROVED: _____ DATE: _____		SCALE: AS SHOWN	DATE: 12-03-20	PROJECT NUMBER: _____	REVISION: _____	SHEET: 1 of 1
NO.	DESCRIPTION	BY	DATE								

## **Appendix B**

### Membrane Flow Diagram



## **Appendix C**

### Water Rights Licence

MG-14854 (English)

**Licence to Use Water for  
Municipal Distribution System  
Purposes**



Project: Village of Kenton

Issued in accordance with the provisions of  
**The Water Rights Act** and regulations made thereunder.

Licence No.: **2009-032**  
(Original Lic. No.: 93-09)  
U.T.M.: Zone 14 378565 E  
5540509 N

Know all men by these presents that in consideration of and subject to the provisos, conditions and restrictions hereinafter contained, the Minister of Water Stewardship for the Province of Manitoba does by these presents give full right and liberty, leave and licence to

**R. M. of Woodworth** of the **The Postal District of Kenton** in the Province of Manitoba (hereinafter called "the LICENSEE") to divert water from a **sand and gravel** aquifer by means of two water wells, pumps, pipeline(s) and other appurtenances (hereinafter called "the WORKS"), located on the following described lands:

**the municipal road allowance lying to the North of the Northeast Quarter of Section 9, in Township 12 and Range 24, West of the Principal Meridian in Manitoba,**

and more particularly shown on a plan filed in the office of the Executive Director, Regulatory and Operational Services Division, a copy of which plan is hereto attached and marked Exhibit "A" for **municipal distribution system** purposes on the following described lands:

**the Northwest Quarter of Section 6, in Township 12 and Range 23, West of the Principal Meridian in Manitoba.**

This licence is issued upon the express condition that it shall be subject to the provisions of The Water Rights Act and Regulations and all amendments thereto and, without limiting the generality of the aforesaid, to the following terms and conditions, namely:

1. The water shall be used solely for **municipal distribution system** purposes.
2. The WORKS shall be operated in accordance with the terms herein contained.
3. a) The maximum rate at which water may be diverted pursuant hereto shall not exceed **0.0053 cubic metres per second (0.2 cubic feet per second)**  
b) The total quantity of water diverted in any one year shall not exceed **107.31 cubic decametres (87.00 acre feet)**
4. The LICENSEE does hereby remise, release and forever discharge Her Majesty the Queen in Right of the Province of Manitoba, of and from all manner of action, causes of action, claims and demands whatsoever which against Her Majesty the LICENSEE ever had, now has or may hereafter have, resulting from the use of water for **municipal distribution system** purposes.
5. In the event that the rights of others are infringed upon and/or damage to the property of others is sustained as a result of the operation or maintenance of the WORKS and the rights herein granted, the LICENSEE shall be solely responsible and shall save harmless and fully indemnify Her Majesty the Queen in Right of the Province of Manitoba, from and against any liability to which Her Majesty may become liable by virtue of the issue of this Licence and anything done pursuant hereto.
6. This Licence is not assignable or transferable by the LICENSEE and when no longer required by the LICENSEE this Licence shall be returned to the Executive Director, Regulatory and Operational Services Division, for cancellation on behalf of the Minister.
7. Upon the execution of this Licence the LICENSEE hereby grants the Minister or the Minister's agents the right of ingress and egress to and from the lands on which the WORKS are located for the purpose of inspection of the WORKS and the LICENSEE shall at all times comply with such directions and/or orders that may be given by the Minister or the Minister's agents in writing from time to time with regard to the operation and maintenance of the WORKS.
8. This Licence may be amended, suspended or cancelled by the Minister in accordance with The Water Rights Act by letter addressed to the LICENSEE at **Box 148, Kenton, MB, R0M 0Z0, Canada** and thereafter this Licence shall be determined to be at an end.
9. Notwithstanding anything preceding in this Licence, the LICENSEE must have legal control, by ownership or by rental, lease, or other agreement, of the lands on which the WORKS shall be placed and the water shall be used.
10. The term of this Licence shall be **five (5) years** and this Licence shall become effective only on the date of execution hereof by a person so authorized in the Department of Water Stewardship. The LICENSEE may apply for renewal of this Licence not more than 365 days and not less than 90 days prior to the expiry date.
11. This Licence expires automatically upon the loss of the legal control of any of the lands on which the WORKS are located or on which water is used, unless the Licence is transferred or amended by the Minister upon application for Licence transfer or amendment.

12. The LICENSEE shall keep records of daily and annual water use and shall provide a copy of such records to the Executive Director, Regulatory and Operational Services Division, not later than February 1st of the following year.
13. A flow meter must be installed, positioned to accurately measure instantaneous pumping rate and accumulative withdrawals from the water source.
14. The LICENSEE does hereby agree to correct, to the satisfaction of the Minister, any water supply problems to wells or other forms of supply, which were constructed and operating prior to the date of application for the original Licence (No. 93-09), and which are partly or wholly attributable, in the opinion of the Minister, to the diversion of water as authorized by this Licence.
15. The LICENSEE shall hold and maintain all other regulatory approvals that may be required and shall comply with all other regulatory requirements for the construction, operation, or maintenance of the WORKS or to divert or use water as provided by this Licence.

In witness whereof I the undersigned hereby agree to accept the aforesaid Licence on the terms and conditions set forth therein and hereby set my hand and seal this \_\_\_\_\_ day of \_\_\_\_\_ A.D. 20 \_\_\_\_\_.

SIGNED, SEALED AND DELIVERED  
in the presence of

\_\_\_\_\_ } \_\_\_\_\_ (Seal)  
Witness Licensee

Canada, PROVINCE OF MANITOBA To Wit:

I, \_\_\_\_\_ of the \_\_\_\_\_  
of \_\_\_\_\_ in the Province of Manitoba, MAKE OATH AND SAY:

1. That I was personally present and did see \_\_\_\_\_,  
the within named party, execute the within Instrument.
2. That I know the said \_\_\_\_\_  
and am satisfied that he/she is of the full age of eighteen years.
3. That the said Instrument was executed at \_\_\_\_\_  
aforesaid and that I am subscribing witness thereto.

SWORN BEFORE me at the \_\_\_\_\_  
in the Province of Manitoba this \_\_\_\_\_ day of \_\_\_\_\_ A.D. 20 \_\_\_\_\_.

\_\_\_\_\_ } \_\_\_\_\_  
A COMMISSIONER FOR OATHS Witness  
in and for the Province of Manitoba

My Commission expires \_\_\_\_\_

Issued at the City of Winnipeg, in the Province of Manitoba, this \_\_\_\_\_ day of \_\_\_\_\_ A.D. 20 \_\_\_\_\_.

\_\_\_\_\_  
The Honourable the Minister of Conservation and Water Stewardship

## **Appendix D**

### Well Logs



Manitoba Environment Act Proposal  
 RM of Woodworth Rural Water Supply System Expansion

June 2012

LOCATION: NE9-12-24W

Well\_PID: 71815  
 Owner: RM OF WOODWORTH  
 Driller: Paddock Drilling Ltd.  
 Well Name: WELL NO. 1  
 Well Use: PRODUCTION  
 Water Use: Municipal  
 UTMX: 378501  
 UTM Y: 5540503  
 Accuracy XY: 1 EXACT [<5M] [GPS]  
 UTMZ:  
 Accuracy Z: UNKNOWN  
 Date Completed: 1991 Jul 12

WELL LOG

From (ft.)	To (ft.)	Log
0	11.0	FINE SAND
11.0	23.0	SHALE GRAVEL AND FINE TO MEDIUM SAND
23.0	27.0	COARSE SHALE GRAVEL AND SHALE BOULDERS
27.0	30.0	CLAYEY SHALE GRAVEL, SAND AND SHALE BOULDERS

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0	17.0	casing	30.00			CORRUGATED	FIBERGLASS
17.0	27.0	perforations	30.00		0.060	SAW CUT	FIBERGLASS
27.0	29.0	casing	30.00			CORRUGATED	FIBERGLASS
4.0	30.0	gravel pack	30.00	42.00		3.0 MM	GRAVEL
0	4.0	casing grout	30.00	42.00			

Top of Casing: 1.0 ft. below ground

PUMPING TEST

Date: 1991 Jul 12  
 Pumping Rate: 199.9 Imp. gallons/minute  
 Water level before pumping: 12.0 ft. below ground  
 Pumping level at end of test: 18.0 ft. below ground  
 Test duration: hours, 35 minutes  
 Water temperature: ?? degrees F

REMARKS

KENTON - PUBLIC WATER SYSTEM WELL (COMMUNITY CODE 102.00). KENTON HARDING PIPELINE, LOCATED ON RD. ALLOW. 280 M. WEST OF N-S RD; 130 M. FROM OBS. WELL, ELEVATION OF TOP OF CASING (WEST SIDE) = 471.584 M. EC=400, HARD=19 GPG, IRON=0.5 MG/L. WELL INVENTORY/GPS COMPLETED BY OFFICE OF DRINKING WATER IN DECEMBER 2003.

Manitoba Environment Act Proposal  
 RM of Woodworth Rural Water Supply System Expansion

June 2012

LOCATION: NE9-12-24W

Well\_PID: 148637  
 Owner: RM OF WOODWORTH  
 Driller: M & M Drilling Rivers Ltd.  
 Well Name: WELL NO. 2  
 Well Use: PRODUCTION  
 Water Use: Municipal  
 UTMX: 378565  
 UTM Y: 5540509  
 Accuracy XY: 1 EXACT [<5M] [GPS]  
 UTMZ: 468  
 Accuracy Z: 4 FAIR - Shuttle at Centroid  
 Date Completed: 2007 Sep 17

WELL LOG

From (ft.)	To (ft.)	Log
0	1.0	TOPSOIL
1.0	20.0	COARSE SHALE GRAVEL
20.0	40.0	FINER SHALE SAND

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0	15.0	CASING	5.00			INSERT	PVC
15.0	31.0	PERFORATIONS	5.00		0.018	WIRE WOUND	S. S.
13.0	31.0	GRAVEL PACK				PEA SIZE	GRAVEL
10.0	13.0	CASING GROUT					BENTONITE

Top of Casing: 2.0 ft. above ground

PUMPING TEST

Date: 2007 Sep 17  
 Pumping Rate: 60.0 Imp. gallons/minute  
 Water level before pumping: 7.3 ft. below ground  
 Pumping level at end of test: 8.5 ft. below ground  
 Test duration: 1 hours, minutes  
 Water temperature: ?? degrees F

REMARKS

KENTON - PUBLIC WATER SYSTEM WELL (COMMUNITY CODE 102.00). LOCATED APPROX 210 FEET EAST OF WELL NO. 1. WELL INVENTORY/GPS COMPLETED BY OFFICE OF DRINKING WATER IN DECEMBER 2008.

## **Appendix E**

### MWSB Guidelines for Watercourse Crossings

# WATERCOURSE CROSSINGS

---

## *Mitigation Measure*

1. All watercourse crossings will be directionally drilled.
2. A minimum undisturbed buffer zone of 15 metre will be maintained between directional drill entry/exit areas and banks of watercourse.
3. Heavy equipment (caterpillars, tractors) shall not be allowed within the buffer zone.
4. Enforce measures regarding fuelling or servicing equipment within 100 metre of watercourse.
5. Waste drill mud and cuttings will be prevented from entering surface water.
6. Should erosion control measures be implemented, post construction monitoring shall be conducted to ensure effectiveness.
7. Further erosion control measures will be implemented as necessary.

## **Reclamation**

1. Restore all disturbed areas to original contours.
2. Install erosion control measures, if warranted, and maintain until vegetation becomes established.

## **Pressure Loss/Fluid Loss Response**

To avoid or minimize the potential for drilling fluids and drill cuttings from entering watercourses because of a frac-out, the following monitoring and response plan will be followed:

1. A record of drilling progress will be maintained to always know the location of the drill head relative to the point of entry.
2. A record of drilling component usage (type and quantity) will be maintained throughout each drilling operation.
3. A record of drilling fluid volume used and returned will be maintained to detect any significant fluid losses. Drilling fluid pump pressure will be continuously monitored. Abnormal loss of returned fluids or loss of fluid pressure that may be indicative of a frac-out will be reported immediately to MWSB/PFRA construction field supervisor.
4. At watercourse crossings where water clarity permits, a view of the stream bottom, an observer will continuously check for signs of mud escapement to the watercourse.

## **Loss of Fluid and Frac-out Response Plan**

1. If an abnormal loss of fluid, drop in pressure or visible plume is observed indicating a frac-out or possible frac-out, drilling is to stop immediately.
2. The contractor will notify the MWSB/PFRA construction field supervisor of the frac-out condition or potential condition and decide on the appropriate action as follows:
  - a) Assign a person to visually monitor for the presence of muddy plume.

- b) Make adjustments to the mud mixture; add lost circulation material (LCM) to the drilling fluid in an attempt to prevent further loss of fluid to the ground formation and/or watercourse.
- c) Where conditions warrant and permit (i.e., shallow depth, clear water, low water velocity, potentially sensitive habitat) and where a frac-out has been visually detected, attempt to isolate the fluid release using a large diameter short piece of culvert.
- d) Under circumstances where a frac-out has occurred, and where conditions do not permit containment and the prevention of drilling fluids release to the watercourse, attempts to plug the fracture by pumping LCM are not to continue for more than 10 minutes of pumping time.
- e) If the frac-out is not contained within this time, MWSB/PFRA construction supervisor will halt any further attempts until a course of action (either abandon directional drilling or further consultation with MWSB engineers) is decided upon.

## **Appendix F**

### Certificates of Title

DATE: 2012/04/23  
 TIME: 14:04

**MANITOBA**  
**STATUS OF TITLE**

TITLE NO: 2002024/2  
 PAGE: 1

STATUS OF TITLE.....	ACCEPTED	PRODUCED FOR..	RURAL MUNICIPALITY OF
ORIGINATING OFFICE...	BRANDON	ADDRESS.....	WOODWORTH
REGISTERING OFFICE...	BRANDON		KENTON, MB
REGISTRATION DATE....	2004/03/04		
COMPLETION DATE.....	2004/03/10		
		CLIENT FILE...	NA
		PRODUCED BY...	A.WOOD

**LEGAL DESCRIPTION:**

RURAL MUNICIPALITY OF WOODWORTH  
 IS REGISTERED OWNER SUBJECT TO SUCH ENTRIES RECORDED HEREON  
 IN THE FOLLOWING DESCRIBED LAND  
 LOTS 7 AND 8 PLAN 544 BLTO  
 IN N 1/2 6-12-23 WPM

**ACTIVE TITLE CHARGE(S):**

R77450/2	ACCEPTED	CAVEAT	REG'D: 1970/08/25
	FROM/BY:	STANLEY T. HUNT	
	TO:		
	CONSIDERATION:	NOTES: N 10 FT OF W 44 FT LOT 7	

**ADDRESS(ES) FOR SERVICE:**

EFFECT	NAME AND ADDRESS	POSTAL CODE
ACTIVE	R.M. OF WOODWORTH KENTON MB	ROM OZO

**ORIGINATING INSTRUMENT(S):**

REGISTRATION NUMBER	TYPE	REG. DATE	CONSIDERATION	SWORN VALUE
1142350/2	EREQ	2004/03/04	\$0.00	\$0.00
PRESENTED BY:	BLTO			
FROM:	BLTO			
TO:				

**FROM TITLE NUMBER(S):**

61714/2 ALL

**LAND INDEX:**

LOT	BLOCK	SURVEY PLAN
7		544
NOTE:	N 1/2	6-12-23W

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA  
 STORAGE SYSTEM ON 2012/04/23 OF TITLE NUMBER 2002024/2



DATE: 2012/04/23  
TIME: 14:04

**MANITOBA**  
**STATUS OF TITLE**

TITLE NO: 2002024/2

PAGE: 2

STATUS OF TITLE..... ACCEPTED  
ORIGINATING OFFICE... BRANDON  
REGISTERING OFFICE... BRANDON  
REGISTRATION DATE.... 2004/03/04  
COMPLETION DATE..... 2004/03/10

PRODUCED FOR.. RURAL MUNICIPALITY OF  
ADDRESS..... WOODWORTH  
KENTON, MB *ROM OZO*

CLIENT FILE... NA  
PRODUCED BY... A.WOOD

---

**LAND INDEX:**

LOT	BLOCK	SURVEY PLAN
8		544
NOTE:	N 1/2	6-12-23W

DUPLICATE PRODUCED FOR.. HOLD FOR PROD OF DUPL CT NO(S) ON 2004/03/11  
ADDRESS..... 61714

POSTAL CODE.....

ACCEPTED THIS 4TH DAY OF MARCH, 2004  
BY K.SISSON FOR THE DISTRICT REGISTRAR OF  
THE LAND TITLES DISTRICT OF BRANDON.

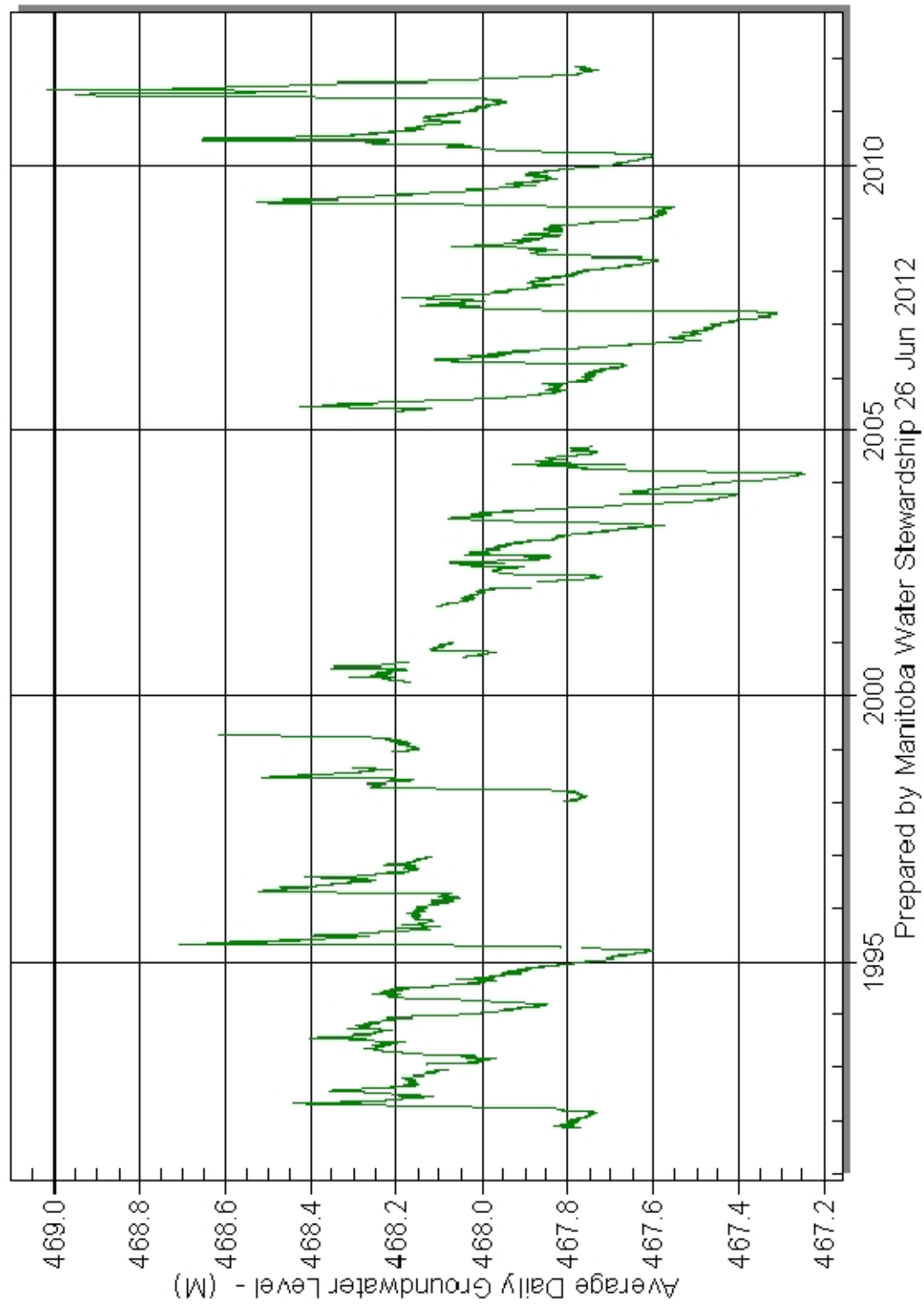
CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA  
STORAGE SYSTEM ON 2012/04/23 OF TITLE NUMBER 2002024/2.

\*\*\*\*\* END OF STATUS OF TITLE 2002024/2 \*\*\*\*\*

## **Appendix G**

### Water Table Elevations

**G05MG012 KENTON #1 NE09-12-24W**  
GROUND LEVEL ELEVATION 468.535 METRES (1537.19 FEET)



Prepared by Manitoba Water Stewardship 26 Jun 2012

## **Appendix H**

Projected Reject Quality

BASIC DESIGN

RO program licensed to:  
 Calculation created by: RMaravich  
 Project name: Kenton WTP  
 HP Pump flow: 138.8 gpm  
 Feed pressure: 117.4 psi  
 Feedwater Temperature: 5.0 C(41F)  
 Feed water pH: 7.79  
 Chem dose, ppm (100%): 0.0 none

Permeate flow: 111.00 gpm  
 Raw water flow: 138.8 gpm  
 Permeate recovery: 80.0 %  
 Element age: 0.0 years  
 Flux decline % per year: 7.0  
 Fouling Factor: 1.00  
 Salt passage increase, %/yr: 10.0  
 Average flux rate: 13.3 gfd  
 Feed type: Well Water

Stage	Perm. Flow gpm	Flow/Vessel Feed gpm	Conc gpm	Flux gfd	Beta	Conc.&Throt. Pressures psi	psi	Element Type	Elem. No.	Array
1-1	75.0	46.3	21.2	15.0	1.16	105.0	0.0	ESNA1-LF-LD	18	3x6
1-2	36.0	31.9	13.9	10.8	1.15	95.0	0.0	ESNA1-LF-LD	12	2x6

Ion	Raw water		Feed water		Permeate		Concentrate	
	mg/l	CaCO3	mg/l	CaCO3	mg/l	CaCO3	mg/l	CaCO3
Ca	86.6	216.0	86.6	216.0	2.644	6.6	422.4	1053.4
Mg	25.8	106.2	25.8	106.2	0.788	3.2	125.8	517.9
Na	183.0	397.8	183.0	397.8	27.043	58.8	806.8	1754.0
K	5.6	7.2	5.6	7.2	1.268	1.6	22.9	29.4
NH4	0.0	0.0	0.0	0.0	0.000	0.0	0.0	0.0
Ba	0.089	0.1	0.089	0.1	0.004	0.0	0.430	0.3
Sr	0.426	0.5	0.426	0.5	0.018	0.0	2.058	2.3
CO3	1.8	3.0	1.8	3.0	0.035	0.1	8.9	14.8
HCO3	631.0	517.2	631.0	517.2	60.202	49.3	2914.2	2388.7
SO4	66.8	69.6	66.8	69.6	1.964	2.0	326.1	339.7
Cl	72.1	101.7	72.1	101.7	13.249	18.7	307.5	433.7
F	0.1	0.3	0.1	0.3	0.045	0.1	0.3	0.8
NO3	0.1	0.1	0.1	0.1	0.020	0.0	0.4	0.3
B	0.17		0.17		0.170		0.17	
SiO2	26.8		26.8		3.09		121.6	
CO2	22.37		22.37		22.37		22.37	
TDS	1100.4		1100.4		110.5		5059.8	
pH	7.79		7.79		6.79		8.41	

	Raw water	Feed water	Concentrate
CaSO4 / Ksp * 100:	2%	2%	16%
SrSO4 / Ksp * 100:	1%	1%	5%
BaSO4 / Ksp * 100:	417%	417%	2914%
SiO2 saturation:	29%	29%	111%
Langelier Saturation Index	0.49	0.49	2.41
Stiff & Davis Saturation Index	0.39	0.39	2.19
Ionic strength	0.02	0.02	0.09
Osmotic pressure	8.9 psi	8.9 psi	40.5 psi

BASIC DESIGN

RO program licensed to:  
 Calculation created by: RMaravich  
 Project name: Kenton WTP  
 HP Pump flow: 138.8 gpm  
 Feed pressure: 117.4 psi  
 Feedwater Temperature: 5.0 C(41F)  
 Feed water pH: 7.79  
 Chem dose, ppm (100%): 0.0 none  
 Permeate flow: 111.00 gpm  
 Raw water flow: 138.8 gpm  
 Permeate recovery: 80.0 %  
 Element age: 0.0 years  
 Flux decline % per year: 7.0  
 Fouling Factor: 1.00  
 Salt passage increase, %/yr: 10.0  
 Average flux rate: 13.3 gfd  
 Feed type: Well Water

Stag	Perm. Flow gpm	Flow/Vessel Feed gpm	Conc gpm	Flux gfd	Beta	Conc.&Throt. Pressures psi	Perm TDS	Element Type	Elem. No.	Array
1-1	75.0	46.3	21.2	15.0	1.16	105.0 0.0	61.2	ESNA1-LF-LD	18	3x6
1-2	36.0	31.9	13.9	10.8	1.15	95.0 0.0	188.	ESNA1-LF-LD	12	2x6

Stg	Elem no.	Feed pres psi	Pres drop psi	Perm flow gpm	Perm Flux gfd	Beta	Perm sal TDS	Conc osm pres	CaSO4	Concentrate saturation levels				Lang.
										SrSO4	BaSO4	SiO2		
1-1	1	117.4	3.0	4.5	16.3	1.10	41.6	9.8	2	1	472	32	0.6	
1-1	2	114.4	2.6	4.4	15.8	1.10	46.6	10.9	3	1	540	35	0.7	
1-1	3	111.8	2.2	4.2	15.2	1.11	50.9	12.2	3	1	624	39	0.9	
1-1	4	109.6	1.8	4.1	14.7	1.13	55.3	13.9	4	1	732	44	1.1	
1-1	5	107.8	1.5	3.9	14.2	1.14	60.3	15.9	5	1	873	50	1.2	
1-1	6	106.2	1.2	3.8	13.6	1.16	66.1	18.6	6	2	1063	57	1.4	
1-2	1	102.0	1.8	3.5	12.5	1.11	71.4	21.5	6	2	1223	62	1.6	
1-2	2	100.2	1.5	3.3	11.8	1.10	77.4	24.1	8	2	1417	69	1.7	
1-2	3	98.7	1.3	3.1	11.1	1.13	84.1	27.2	9	3	1660	76	1.9	
1-2	4	97.5	1.0	2.9	10.4	1.13	91.9	31.0	11	3	1966	86	2.1	
1-2	5	96.4	0.9	2.7	9.6	1.14	100.9	35.6	13	4	2354	96	2.2	
1-2	6	95.6	0.7	2.4	8.7	1.15	111.5	41.2	16	5	2847	109	2.4	

Stag	NDP psi
1-1	98.6
1-2	71.9

## **Appendix I**

### Water Quality Results





Manitoba Water Services Board  
ATTN: TRAVIS PARSONS  
Box 22080, 2022 Currie Blvd  
Brandon MB R7A6Y9

Date Received: 04-APR-12  
Report Date: 11-APR-12 15:43 (MT)  
Version: FINAL

Client Phone: 204-726-6085

## Certificate of Analysis

**Lab Work Order #:** L1131109  
**Project P.O. #:** NOT SUBMITTED  
**Job Reference:** WOODWORTH  
**C of C Numbers:**  
**Legal Site Desc:**

A handwritten signature in black ink, appearing to read "Garrett Ronceray", is written over a horizontal line.

GARRETT RONCERAY  
Biology Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 1329 Niakwa Road East, Unit 12, Winnipeg, MB R2J 3T4 Canada | Phone: +1 204 255 9720 | Fax: +1 204 255 9721  
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

Environmental The logo for Environmental, featuring a stylized white bird or leaf shape.

[www.alsglobal.com](http://www.alsglobal.com)

RIGHT SOLUTIONS RIGHT PARTNER

WOODWORTH

L1131109 CONTD....  
 PAGE 2 of 5  
 Version: FINAL

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1131109-1 THE OAK RIVER Sampled By: JAIMEE SCHMIDT on 02-APR-12 @ 15:00 Matrix: WATER - SURFACE - WATER							
<b>Miscellaneous Parameters</b>							
Total Dissolved Solids	1930		5.0	mg/L		05-APR-12	R2348321
<b>Municipal Water Supplies #50</b>							
<b>Alkalinity</b>							
Alkalinity, Total (as CaCO <sub>3</sub> )	284		20	mg/L		04-APR-12	R2347277
Bicarbonate (HCO <sub>3</sub> )	301		24	mg/L		04-APR-12	R2347277
Carbonate (CO <sub>3</sub> )	22		12	mg/L		04-APR-12	R2347277
Hydroxide (OH)	<6.8		6.8	mg/L		04-APR-12	R2347277
<b>Chloride by Ion Chromatography</b>							
Chloride	74.0		2.5	mg/L		05-APR-12	R2349135
<b>Colour, True</b>							
Colour, True	33.8		5.0	CU		05-APR-12	R2347712
<b>Conductivity</b>							
Conductivity	2310		20	umhos/cm		04-APR-12	R2347277
<b>Fluoride by Ion Chromatography</b>							
Fluoride	<0.50		0.50	mg/L		05-APR-12	R2349135
<b>Hardness Calculated</b>							
Hardness (as CaCO <sub>3</sub> )	865		0.30	mg/L		11-APR-12	
<b>Langelier Index 4C</b>							
Langelier Index (4 C)	1.4					11-APR-12	
<b>Langelier Index 60C</b>							
Langelier Index (60 C)	2.2					11-APR-12	
<b>Nitrate as N by Ion Chromatography</b>							
Nitrate-N	<0.25		0.25	mg/L		05-APR-12	R2349135
<b>Nitrate+Nitrite</b>							
Nitrate and Nitrite as N	<0.35		0.35	mg/L		04-APR-12	
<b>Nitrite as N by Ion Chromatography</b>							
Nitrite-N	<0.25		0.25	mg/L		05-APR-12	R2349135
<b>Sodium Adsorption Ratio</b>							
Sodium Adsorption Ratio	3.56		0.030			11-APR-12	
<b>Sulfate by Ion Chromatography</b>							
Sulfate	1130		2.5	mg/L		05-APR-12	R2349135
<b>Total Metals by ICP-MS</b>							
Calcium (Ca)-Total	145		0.20	mg/L	09-APR-12	10-APR-12	R2349096
Iron (Fe)-Total	1.18		0.10	mg/L	09-APR-12	10-APR-12	R2349096
Magnesium (Mg)-Total	122		0.050	mg/L	09-APR-12	10-APR-12	R2349096
Manganese (Mn)-Total	0.285		0.0010	mg/L	09-APR-12	10-APR-12	R2349096
Potassium (K)-Total	24.3		0.10	mg/L	09-APR-12	10-APR-12	R2349096
Sodium (Na)-Total	241	DLA	5.0	mg/L	09-APR-12	10-APR-12	R2349096
<b>Turbidity</b>							
Turbidity	33.4		0.10	NTU		05-APR-12	R2347716
<b>pH</b>							
pH	8.70		0.10	pH units		04-APR-12	R2347277
L1131109-2 KENTON 3RD ORDER DRAIN Sampled By: JAIMEE SCHMIDT on 02-APR-12 @ 15:00 Matrix: WATER - SURFACE - WATER							
<b>Miscellaneous Parameters</b>							
Total Dissolved Solids	1810		5.0	mg/L		05-APR-12	R2348321
<b>Municipal Water Supplies #50</b>							
<b>Alkalinity</b>							
Alkalinity, Total (as CaCO <sub>3</sub> )	367		20	mg/L		04-APR-12	R2347277
Bicarbonate (HCO <sub>3</sub> )	426		24	mg/L		04-APR-12	R2347277
Carbonate (CO <sub>3</sub> )	<12		12	mg/L		04-APR-12	R2347277

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

WOODWORTH

L1131109 CONTD....  
 PAGE 3 of 5  
 Version: FINAL

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1131109-2 KENTON 3RD ORDER DRAIN Sampled By: JAIMEE SCHMIDT on 02-APR-12 @ 15:00 Matrix: WATER - SURFACE - WATER							
<b>Alkalinity</b> Hydroxide (OH)	<6.8		6.8	mg/L		04-APR-12	R2347277
<b>Chloride by Ion Chromatography</b> Chloride	225		2.5	mg/L		05-APR-12	R2349135
<b>Colour, True</b> Colour, True	20.0		5.0	CU		05-APR-12	R2347712
<b>Conductivity</b> Conductivity	2260		20	umhos/cm		04-APR-12	R2347277
<b>Fluoride by Ion Chromatography</b> Fluoride	<0.50		0.50	mg/L		05-APR-12	R2349135
<b>Hardness Calculated</b> Hardness (as CaCO3)	982		0.30	mg/L		11-APR-12	
<b>Langelier Index 4C</b> Langelier Index (4 C)	1.6					11-APR-12	
<b>Langelier Index 60C</b> Langelier Index (60 C)	2.3					11-APR-12	
<b>Nitrate as N by Ion Chromatography</b> Nitrate-N	<0.25		0.25	mg/L		05-APR-12	R2349135
<b>Nitrate+Nitrite</b> Nitrate and Nitrite as N	<0.35		0.35	mg/L		04-APR-12	
<b>Nitrite as N by Ion Chromatography</b> Nitrite-N	<0.25		0.25	mg/L		05-APR-12	R2349135
<b>Sodium Adsorption Ratio</b> Sodium Adsorption Ratio	2.48		0.030			11-APR-12	
<b>Sulfate by Ion Chromatography</b> Sulfate	742		2.5	mg/L		05-APR-12	R2349135
<b>Total Metals by ICP-MS</b> Calcium (Ca)-Total	230		0.20	mg/L	09-APR-12	10-APR-12	R2349096
Iron (Fe)-Total	0.81		0.10	mg/L	09-APR-12	10-APR-12	R2349096
Magnesium (Mg)-Total	99.3		0.050	mg/L	09-APR-12	10-APR-12	R2349096
Manganese (Mn)-Total	3.09		0.0010	mg/L	09-APR-12	10-APR-12	R2349096
Potassium (K)-Total	12.8		0.10	mg/L	09-APR-12	10-APR-12	R2349096
Sodium (Na)-Total	179		0.050	mg/L	09-APR-12	10-APR-12	R2349096
<b>Turbidity</b> Turbidity	8.67		0.10	NTU		05-APR-12	R2347716
<b>pH</b> pH	8.45		0.10	pH units		04-APR-12	R2347277

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.