

# **Groundwater Monitoring Wells Standard Operating Procedures**

**FOR**

**The City of Bozeman  
Water Treatment Plant  
Groundwater Discharge Permit MTX000224**



Revised 09/25/15

# STANDARD OPERATING PROCEDURES FOR:

## Groundwater Monitoring Wells

### Overview

To comply with the Groundwater Monitoring requirements set forth in the City of Bozeman Water Treatment Plant's Groundwater Discharge Permit MTX000224, three groundwater monitoring wells were installed during construction of the new WTP prior to any discharge from the new WTP. The locations of the wells are labeled on the Site Plan Drawing in the Appendix of this SOP. Also located in the Appendix is a copy of the sample event check list, and table of parameters to be sampled from each well.

Each groundwater monitoring well must be purged before taking samples in order to evacuate stagnant water from the casing. This will be accomplished using a dedicated submersible pump hooked up to a vehicle battery. At least three times the volume of the casing must be purged before samples can be collected. Monitoring wells should not be pumped dry, if possible.

For sampling at each monitoring well a checklist will be used to document the methodology, equipment used, water temperature, and static water level for each sampling event.

All employees assigned to work in the Lab will be trained on how, where, and when to collect samples for the groundwater monitoring wells.

### Equipment Used

All equipment used to purge and sample each well will be inspected before each use for loose or missing parts, cracks, breaks, chips, stains, abrasions, good working condition, and proper function. Replace parts and equipment as needed. Do not use defective or damaged equipment.

**Electronic Water Level Indicator** will be used to measure the Static Water Level prior to purging each well. The Static water level will be recorded to the hundredth of a foot. Follow all manufacturer instructions for cleaning and maintenance. In the absence of manufacturer instructions, operators will be required to disinfect the steel tape with hypochlorite wipes (0.525%), or a 0.005% chlorine bleach solution, then rinsed with DI water before and after measuring the water level on each monitoring well. Dry tape with a clean cloth before rewinding the tape.

If oil is present on the tape, use a non-phosphate, laboratory detergent on a sponge or brush to remove the oil. Rinse the tape with DI water and dry with a cloth before rewinding it.

**Disposable Gloves and Disinfecting Wipes** will be available to samplers to use when sampling to help prevent cross contamination of sampling equipment and bottles, and for cleaning equipment. Change gloves between sampling each well and after cleaning equipment.

**Peristaltic or Submersible Pump** will be used to purge each well. When using submersible pumps, the pump is lowered into the top of the water column, but not deep into the

water. The entire water column must be purged. The pump may have to be lowered as the well recovery rate dictates.

To prevent cross contamination the pump and all wetted hoses will be cleaned before and after each monitor well is purged using a non-phosphate detergent solution. Using a bucket, circulate the solution through the pump several times then rinse the outside of the pump with DI water. A thorough final rinse of DI water through the pump will complete the cleaning process. All rinse waters should be contained in buckets as to not contaminate the sample site. Do not recirculate rinse waters.

The pump will also be used for collecting the sample after the well has been purged for a volume of at least three boreholes.

**Contract Laboratory Sample Bottles** will be kept in their shipping container (cooler) until needed. All sample coolers will be inspected upon receipt at the Water Treatment Plant to ensure the appropriate bottles and shipping labels are present. Sample bottles will be handled in accordance to the contract laboratory sampling recommendations.

**In-House Sample Bottles** will be a dedicated set of sample bottles used only for groundwater monitoring. These bottles will be inspected before each use for cracks, chips, breaks, and other deformities. All defective sample bottles will be replaced with new bottles immediately.

## **Equipment Care**

### **Laboratory**

All equipment will be inspected and cleaned in the laboratory prior to and after being used in the field using the same techniques as above. This will remove any residual from manufacturing, shipping, usage, or storage; and will ensure the equipment works properly. All solutions and rinse water from cleaning will be discarded in accordance with the City of Bozeman Laboratory Best Management Practices Plan.

Contract laboratory sample coolers will be inspected and inventoried upon receipt and stored in the laboratory until used.

In-house sample bottles will be cleaned using the laboratory washer and stored in a designated cabinet until each sampling event.

### **Field**

New plastic sheeting will be placed on the ground around the wellhead to prevent contamination of equipment in the event it has to be laid on the ground. All equipment will be kept in the proper storage containers until it is used.

### **Storage**

Equipment, sample bottles, sample coolers, and spare parts will be stored in the Laboratory in designated cabinets. All equipment must be clean, dry, and protected from contamination prior to being placed in storage.

## **Purging Technique**

### **Purging the Entire Water Column**

The pump and hose assembly used in purging will be lowered into the top of the standing water column and not deep into the column. This is done so the purging pulls water from the formation into the screened area of the well and up through the casing so the entire static water volume can be removed. If the pump is placed deep into the water column, the water above the pump may not be removed and the subsequent collected samples may not represent the true ground water. No more than 3 to 5 feet of hose will be lowered into the water column to ensure the full water column is purged and will limit cross contamination. If the recovery rate of the well is faster than the pump rate, the pump may be left at the initial level until an adequate volume has been purged. If the pump rate is faster than the recovery rate of the well, the pump must be lowered into the water column to keep up with drawdown.

# **Groundwater Monitoring Wells Sampling and Analysis Plan**

**FOR**

**The City of Bozeman  
Water Treatment Plant  
Groundwater Discharge Permit MTX000224**



Revised 09/25/15

# **SAMPLING AND ANALYSIS PLAN FOR:**

## **Groundwater Monitoring Wells**

### **Overview**

To comply with the Groundwater Monitoring requirements set forth in the City of Bozeman Water Treatment Plant's Groundwater Discharge Permit MTX000224, three groundwater monitoring wells were installed during construction of the new WTP and prior to any discharge from the new WTP. The locations of the wells are labeled on the Site Plan Drawing in the Appendix of this SAP. Also located in the Appendix is a copy of the sample event check list and table of parameters to be sampled from each well.

Each groundwater monitoring well must be purged before taking samples in order to evacuate stagnant water from the casing. This will be accomplished using a dedicated submersible pump hooked up to a vehicle battery. At least three times the volume of the casing must be purged before samples can be collected. Monitoring wells should not be pumped dry, if possible.

For sampling at each monitoring well a checklist will be used to document the methodology, equipment used, water temperature, and static water level for each sampling event.

All employees assigned to work in the Lab will be trained on proper techniques for collecting samples from the groundwater monitoring wells.

### **Procedure**

Refer to the Groundwater Monitoring Wells Standard Operating Procedure for equipment available and cleaning instructions to complete the testing procedures.

#### **Measuring Static Water Level**

The static water level must be measured on all three groundwater monitoring wells before any purging is started. Using the clean and disinfected measuring device determine the static water level by measuring down from the top of the well casing to the top of the water level and record to the hundredth of a foot on the check list.

#### **Purging**

All wells must have at least three times the volume of water in the well casing removed by purging before samples can be collected.

In order to purge wells, the volume of water in the well must be known. To determine use the following equation:

$$V = 0.0408d^2h$$

Where: V = Volume of water (in gallons)  
d = diameter of well (in inches)  
h = height of water column in well (in feet)

Measure the distance from the bottom of the well to the static water level, then measure the inside diameter of the well casing. Alternately, from the drilling log, the depth of each well from the top of the wellhead to the bottom of the well and inside diameter of the casing will be a known constant. Therefore, it will only be necessary to measure down to the static water level. It can then be calculated to find the depth of water in the casing.

The well pumping rate must also be determined to know how long it will take to achieve an adequate volume of water purged from the well. The pumping rate of a pump can be determined by collecting the flow of water from the pump in a bucket of a known volume and timing how long it takes to fill the bucket. The pumping rate will be in gallons per minute. The time necessary to purge at least three volumes of the casing can then be calculated from the pumping rate.

### **Sample Collection**

Following purging, samples will be collected using the submersible pump. The water temperature will be measured while water is being purged and has stabilized.

Care will be taken by the samplers so that sample bottles are not contaminated or damaged by the environment, the sampler, or transport.

The list of parameters to be sampled in each monitoring well is listed in the Appendix in Table 1. The check list will also contain the parameters to be collected from each well and where they are to be analyzed.

All sample bottles used for in-house samples will be rinsed with sample water at least twice before samples are collected. The sample bottles used will be BOD bottles due to their ability to keep atmospheric interferences out of the sample. Each in-house sample bottle will be labeled as to which monitoring well it represents.

All contracted out samples will be collected directly into the provided sample bottles without rinsing the bottle or in accordance to contract lab sampling instructions. These bottles will remain in the shipping cooler until ready to be filled. The contract sample bottles will be labeled with the well number from which it was taken and the discharge permit number.

Once a year there will be equipment blanks tested to ensure there are no contaminants entering the water samples from the testing equipment. These tests will be analyzed by a contracted laboratory.

### **Sample Handling**

All **in-house samples**, from all three monitoring wells, will be analyzed immediately after collection in accordance with 40 CFR 136 methods and the City of Bozeman Water Treatment Plant Laboratory Procedures. When the ambient air temperature is above 40 degrees F, samples will be placed on ice until samples are analyzed. Once samples are analyzed, they must be disposed of in accordance with the Best Management Practices Plan for the Laboratory.

The **samples to be contracted out** will be collected and immediately preserved (if necessary) according to the requirements of the contract laboratory. These samples will be placed on ice immediately to maintain an acceptable temperature between 2 and 6 degrees Celsius. A clear and concise chain of custody will be completed for each sampling event. The contracted out samples will be packaged securely in the shipping cooler that will include the COC, shipping label, ice, sample, and custody seal. The sample coolers will be shipped immediately to the contract laboratory. The samples will be collected so the holding time is as short as possible between collection and analysis.

### **Calibration of Sampling and Analysis Equipment**

All equipment will be calibrated or calibration confirmed during each sampling event or as the manufacturer requires. A record of calibrations and calibration confirmations will be maintained in the Water Treatment Plant Laboratory as a hard copy.

### **Recording and Reporting of Results**

#### **Recording**

When analytical results are completed in-house or are received from the contract lab, the results will be entered into the electronic spreadsheet for the discharge permit. Hard copies of the analytical results will also be kept on file for a minimum of three years from the sample date, the length of the permit, or as directed by the Montana DEQ, whichever is longer.

#### **Reporting**

The Discharge Monitoring Reports will be submitted within 28 days of the end of each quarter as directed by the Montana DEQ. A copy of the DMR will be kept on file as a hard copy for a minimum of three years from the report date, the length of the permit, or as directed by the Montana DEQ, whichever is longer.

# Appendix

Table of Parameters

<b>Quarterly Samples For Groundwater Monitoring Requirements</b>	<b>MW1</b>	<b>MW2</b>	<b>MW3</b>	<b>In-House Tests</b>
DISSOLVED ALUMINUM	X		X	
CHLORIDE	X	X	X	
E. COLI		X	X	
FLUORIDE	X		X	
DISSOLVED IRON	X		X	
DISSOLVED MANGANESE	X		X	
NITRATE , NITRITE	X		X	
pH	X	X	X	X
SPECIFIC CONDUCTIVITY	X	X	X	X
STATIC WATER LEVEL	X	X	X	X
SULFATE	X		X	
TDS	X		X	X
TOTAL KJELDAHL	X		X	