COVER SHEET
STANDARD OPERATING PROCEDURE

Operation Title: **GROUNDWATER SAMPLE COLLECTION FOR SITE INVESTIGATION AND ASSESSMENT MONITORING**

Originator: **Becky Blais**
Quality Assurance Coordinator
Division of Remediation
Bureau of Remediation and Waste Management

APPROVALS:

Division of Remediation Director:

Print name	Signature	Date
Carla J. Hopkins		Dec 17, 2021

Bureau of Remediation and Waste Management Director:

Print name	Signature	Date
Susanne Miller		Dec 22, 2021

QMSC Chair:

Print name	Signature	Date
Kevin Martin		Dec 23, 2021

Department Commissioner:

Print name	Signature	Date
Melanie Loyzim		Dec 23, 2021

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( ) Division of Remediation……...By:_____Date:_____

1.0 APPLICABILITY

This Standard Operating Procedure (SOP) applies to all programs in the Maine Department of Environmental Protection's (MEDEP) Division of Remediation (DR). It is also applicable to all parties that may submit data that will be used by the MEDEP/DR.

This SOP is not a rule and is not intended to have the force of law, nor does it create or affect any legal rights of any individual, all of which are determined by applicable statutes and law. This SOP does not supersede statutes or rules.

2.0 PURPOSE

The purpose of this document is to describe the MEDEP/DR procedure for collecting groundwater samples that are not part of a long-term groundwater monitoring program.

MEDEP/DR has two SOPs for collection of groundwater samples from monitoring wells. This SOP will outline the collection of groundwater samples from Newly Installed Wells or from Existing Wells (See definitions, Section 3.0) that are not part of a long-term groundwater monitoring program designed to monitor long-term contaminant concentration trends. MEDEP/DR SOP# RWM-DR-003 (Groundwater Sampling Using Low Flow Purging and Sampling for Long-term Monitoring) describes the MEDEP/DR's procedure for collection of samples that are part of a long-term groundwater monitoring program utilizing the preferred "low flow" sampling method. Site specific Data Quality Objectives (DQOs) should be reviewed to determine which SOP and sampling methods are applicable.

3.0 DEFINITIONS

3.0 Newly Installed Well – For the purpose of this SOP, a Newly Installed Well is a well that has been installed for less than 48 hours. These wells typically have not yet developed a stagnation zone in the Well Riser Pipe. These wells may also be temporary, being abandoned immediately after initial sampling. See additional discussion in Section 7.2 of this SOP.

3.1 Existing Monitoring Well – For the purpose of this SOP, an Existing Well is a well that has been in place for greater than 48 hours. These wells typically have developed a stagnation zone in the water column which may influence sampling methodology. See additional discussion in Section 7.2 of this SOP.

3.2 Low Flow Purging – For the purpose of this SOP, Low Flow Purging is defined as pumping a well at a rate equal to the recharge rate of the formation such that a stable drawdown of the water level is achieved at a constant pumping rate.

3.3 Variable Speed Pump – A mechanical device specifically manufactured to remove water from a well at selected rates that are equal to or lower than the recharge rate of the well. For the purposes of this SOP it is limited to bladder or

peristaltic type positive displacement pumps and submersible type rotodynamic pumps.

3.4 Reciprocating Type Positive Displacement Pump - All positive placement type pumps that rely on the use of a cylinder or piston arrangement with a foot valve to displace water. This includes all WaTerra™ inertial type pumps.

3.5 Bailer - A long narrow cylinder or bucket-like device with an open top and a check valve at the bottom that is used to remove water from a monitoring well.

3.6 Equipment Blank – A type of sample collected for QA/QC. Involves running de-ionized water through a piece of sampling equipment and collected for analysis to determine if equipment may be a source of contamination.

3.7 Purging - The process of evacuating standing water from a monitoring well prior to sample collection.

3.8 Trip Blank – A type of sample collected for QA/QC. Involves placing de-ionized water in the appropriate containers under laboratory conditions which is then transported along with site specific samples obtained during a monitoring event.

3.9 Well Riser Pipe - A length of solid pipe which extends from the screened interval of a monitoring well to the ground surface where the well is accessed.

4.0 RESPONSIBILITIES

All MEDEP/DR Staff must follow this procedure when performing this task. All Managers and Supervisors are responsible for ensuring that their staff are familiar with and adhere to this procedure. MEDEP/DR staff reviewing data by outside parties are responsible for assuring that the procedure (or an approved equivalent) was utilized appropriately.

5.0 GUIDELINES AND PROCEDURES

5.1 INTRODUCTION

The purpose of this MEDEP/DR SOP (RWM-DR-002) is for collecting groundwater samples from Existing Monitoring Wells that are not part of a long-term groundwater monitoring program. It also applies to Newly Installed Wells where data quality objectives (DQOs) do not require the establishment of long-term contaminant concentration trends. Site specific DQOs should be reviewed to ensure the sampling methods are appropriate.

Low Flow Purging and Sampling (LFS) is the preferred method for obtaining groundwater samples from monitoring wells as part of a long-term monitoring program designed to establish long-term contaminant concentration trends (see MEDEP/DR

SOP# RWM-DR-003 - Groundwater Sampling Using Low Flow Purging and Sampling for Long-term Monitoring).

5.2 PLANNING

A thoroughly developed Conceptual Site Model (CSM) is imperative for effective groundwater sampling. Prior to conducting any sampling event, a Sampling and Analysis Plan (SAP) should be developed (see MEDEP/DR SOP# RWM-DR-014 - Development of a Sampling and Analysis Plan). The sampling plan should include specifics regarding DQOs, as DQOs will be part of determining which groundwater sampling procedure is required (this SOP or RWM-DR-003), as well as the method of sample collection outlined in this SOP.

5.3 SAMPLING PROCEDURES AND EQUIPMENT

5.3.1 OVERVIEW

The collection of groundwater samples can be achieved in several ways. This SOP focuses on collecting samples from Newly Installed Wells or Existing Wells for the purposes of an initial site investigation or assessing the current water quality at a site with existing monitoring wells where the data is not used to establish long-term trends in contaminant concentrations. Additionally, site specific DQOs may allow for a lower quality of data collection than outlined in MEDEP/DR SOP RWM-DR-003 in exchange for a more efficient sampling method while still meeting the DQOs of the sampling event.

5.3.2 MONITORING WELL TYPES

For the purposes of this SOP well types will be divided into two general categories; Existing and Newly Installed Wells (See definitions, Section 3.0). Both types of wells may include micro-wells (less than 2-inch diameter), monitoring wells (2-4-inch diameter) and bedrock water supply wells (6-inch diameter). Newly installed wells can include those installed with direct push methods where no drilling fluids are used or with more traditional methods that utilize drilling fluids. Depending on site specific DQOs, both Existing Wells and Newly Installed Wells may be properly abandoned (according to MEDEP Guidance) once the sampling and assessment are complete OR may remain at the site once the sampling and assessment are complete. All of these variations, including DQOs, will influence the pump selection and the methods used to obtain a groundwater sample.

5.3.2.1 NEWLY INSTALLED WELLS

Wells are frequently installed as part of a site investigation or assessment and sampled within 48-hours of installation. The well diameter, particularly the smaller diameter of micro wells, as well as the depth to water influences pump selection. Newly Installed Wells do not have time to develop a stagnation zone in the well riser pipe and field parameters are not needed to monitor mixing in the well. However, selected field parameters may be useful for characterizing the groundwater conditions. DQOs will

dictate the selection of field parameters and the method of collection (open flow cell, closed flow cell, colorimetric field kits, meters, etc.).

5.3.2.2 EXISTING WELLS

It may be desirable to sample Existing Wells during a site investigation or site assessment where DQOs do not meet the requirements for long-term monitoring. The wells may be former bedrock water supply wells, wells from a previous site investigation, or wells installed for monitoring water levels during aggregate mining (sand and gravel pits). Existing Wells may have water in the well riser pipe or cased portion of the well that is not in direct contact with the formation (including bedrock fractures). Care should be used in pump selection to limit disturbance of the stagnant water in the well riser pipe. It may be desirable to monitor select field parameters to determine when to sample an existing well. DQOs will dictate the selection of field parameters and the method of collection (e.g. open flow cell, closed flow cell, colorimetric field kits, meters, etc.).

5.3.3 SAMPLE COLLECTION PROCEDURE

The groundwater sampling pumps included in this SOP include variable speed pumps, bailers, and reciprocating positive displacement pumps (See definitions, Section 3.0). The type of pump selected, and associated method of sampling will impact the quality of the results. The order of preferred pump selection is based on the order of declining quality of results beginning with variable speed pumps, bailers, and then reciprocating positive displacement pumps. Use of reciprocating pumps is only recommended as a last resort. Single speed submersible pumps such as a 12-volt purge pump (e.g. Whale pump, GeoSub, Cyclone, Water Spout, etc.) may be used in certain situations if the pump discharge is less than the yield of the formation, and a constant drawdown can be achieved without dewatering screens or water bearing fractures. In this case, the use of the single speed pump would provide results of similar quality to a variable speed pump. The following sections discuss the sampling pumps in decreasing order of sample quality.

5.3.3.1 VARIABLE SPEED PUMPS

Variable speed pumps include bladder, submersible, and peristaltic pumps that are manufactured with a control mechanism that allows the user to mechanically change the speed of the pump discharge without the use of flow restrictors on the pipe or tubing. These pumps allow for high quality sample collection when following procedures outlined in Section 5.3.3.2 of this SOP.

All pumps should be operated according to the manufacturer's instructions to assure proper use of the equipment. If a gasoline powered generator is used as a power supply, care should be taken to eliminate cross-contamination. Any equipment that comes into contact with groundwater and is used at more than one sample location should be properly decontaminated between sample locations according to the Site-Specific Quality Assurance Project Plan (QAPP).

5.3.3.2 PROCEDURE FOR VARIABLE SPEED PUMPS

1) Utilizing a water level indicator, obtain and record the water level. If water levels will be utilized for determining groundwater flow, it is recommended that water levels be obtained before the insertion of tubing or pumps into the well, as this will displace water, initially raising the water level of the well and giving a false water level.

2) Insert submersible pumps and/or tubing into the well. Place intake at desired monitoring zone, and record depth if required by Sampling and Analysis Plan (SAP).

3) Purge and sample the well. Efforts should be made to purge and sample the well at a rate equal to the yield of the formation. This is determined by observing the water level with a meter for draw down. Stabilized drawdown is not a requirement of this SOP, but it is encouraged for obtaining a sample representative of the most permeable portion of the screened zone and will improve the overall quality of the data if the static and drawdown levels are recorded. If a constant drawdown level is not achievable, then a modified no-purge option (See MEDEP/DR SOP# RWM-DR-003) can be used as long as it meets the DQOs for the site. Modifications to the no-purge procedure will depend on the type of well that is being sampled.

5.3.3.3 NEWLY INSTALLED WELLS PURGE REQUIREMENTS

It is recommended that Newly Installed Wells be purged (if rate of recharge allows) to remove silt that may have been introduced into the well during construction. Once sufficient water has been removed from the well to meet the DQOs for the site, field parameter collection may be desirable to determine aquifer conditions. Field parameters are not required for stabilization prior to sampling because Newly Installed Wells have not developed a stagnant water column. Site specific DQOs will determine the purpose for collecting field parameters.

5.3.3.4 EXISTING WELLS PURGE REQUIREMENTS

Depending on site specific DQOs, it may be desirable to monitor select field parameters to determine when to sample an Existing Well. DQOs will dictate the selection of field parameters and the method of collection (e.g. open flow-cell, closed flow-cell, colorimetric field kits, meters, etc.). In general, any field parameters that are monitored will increase the overall quality of the sampling event.

5.3.3.5 BAILERS

Bailers produce lower quality groundwater samples due to 1) the uncontrolled filling rate of the bailer each time it is lowered below the water level, 2) the physical disturbance of water in the solid riser portion of the well, 3) the impacts of slug removal on the formation and sand pack each time the bailer is filled, and 4) the potential composite nature of the sample from within and above the screened zone. Prior to purging and collecting a groundwater sample with a bailer, the water in the well riser pipe must be purged in order to assure that fresh groundwater in the well is being sampled. To ensure that all

riser water is replaced with formation water, USEPA protocol recommends that three to five well volumes be evacuated from the well prior to sample collection.

The reason for the use of bailers instead of Variable Speed Pumps should be outlined in the SAP or Sampling Event Trip Report (SETR) developed for the specific activity. The use of dedicated or disposable bailers is encouraged for each well to avoid cross-contamination.

5.3.3.6 BAILER SAMPLING PROCEDURE

1) Calculate the water volume in a given well. Begin by using the water level indicator to measure depth to water. Use a clean weighted tape measure to determine the overall depth of the well if it is not known. Whenever possible, measure from the top of the well riser pipe and not from the top of the steel outer casing. Then calculate the height of the water column by subtracting the height of water in the well from the total depth of the well, in feet.

Use the formula and chart below to calculate well volume in gallons. Again, at least three volumes should be purged from the well. When this is not possible, as in the case of purging a slow recharge well until dry, it is acceptable to sample the well as soon as enough water (assumed to be fresh groundwater) has entered the well to obtain a sample.

FORMULA FOR CALCULATION OF WELL VOLUME:
Gal. H_2O/Ft. of well casing x Height of H_2O Column (Ft.) = Vol. of H_2O in Well (Gallons)

Gallons H_2O per foot of well casing by casing diameter
2-inch diameter well casing = 0.1632 gal H_2O per foot of casing
4-inch diameter well casing = 0.6528 gal H_2O per foot of casing
6-inch diameter well casing = 1.469 gal H_2O per foot of casing

2) Purge the well. Attach clean line to the bailer and lower it into the well until it touches the bottom. Then secure the end of the line or cord to an anchor on the well casing that will hold the bailer in the event that it may be accidentally dropped down the well. Raise the bailer up the well while keeping the line off the ground. Empty the bailer water into a graduated bucket and repeat this procedure until the desired purge volume has been extracted.

3) Sample the well. Once purged, the well may be sampled by lowering the bailer slowly below the water level and pouring the contents directly into the appropriate laboratory containers.

5.3.3.7 RECIPROCATING POSITIVE DISPLACEMENT PUMPS

Reciprocating-Positive Displacement Pumps, of which WaTerra™ is a specific example, produce the lowest quality sample due to the physical movement of the pump in the well. The reciprocating action disturbs the sediment in the bottom of the well, generates friction between the well materials and the pump, and partially mixes water in the screen

zone with water in the well riser pipe. Additionally, the hydraulic forces exhibited by the pump disturb the equilibrium the aquifer has with the filter sand and acts to re-develop the equilibrium (re-develop the well) during the sampling event. The reason for using Reciprocating-Positive Displacement Pumps instead of Variable Speed Pumps or bailers should be outlined in the SAP or SETR developed for the specific activity. If this type of pump is used at a site, it should be used according to the manufacturer's instructions.

5.3.4 SAMPLE CONTAINER

Container requirements, including size and preservation method, should be stated in the project SAP, as required by the laboratory conducting the sample analysis.

5.4 DECONTAMINATION

Decontamination of sampling equipment should be conducted following procedure outlined in MEDEP/DR SOP# RWM-DR-017 – Equipment Decontamination Protocol, and as outlined in the project specific SAP.

6.0 QUALITY ASSURANCE/QUALITY CONTROL

Data Quality Objectives (DQOs) should be stated in the SAP. Quality Assurance/Quality Control (QA/QC) samples may be collected if needed to meet DQOs. The following are typical types of QA/QC samples that may be collected as part of the QA/QC program for groundwater sample collection utilizing this SOP. Other QA/QC samples may be collected as stated in the SAP. For an additional discussion of QA/QC, please refer to the MEDEP/DR Quality Assurance Plan, Section 4 and Section 8. All analytical data should be reviewed and assessed to determine if DQOs have been met. If review indicates DQOs have not been met, corrective action will be recommended by the reviewer.

6.1 TYPICAL QA/QC SAMPLES

6.1.1 EQUIPMENT BLANKS

If using non dedicated or disposable equipment, equipment blanks should be collected at a rate of 5%, which is equivalent to one equipment blank per twenty samples collected. The equipment blank will consist of purging de-ionized water through submersible pumps and piping, and/or rinsing equipment with de-ionized water, and collection for appropriate sample analysis.

6.1.2 DUPLICATE SAMPLES

It is recommended that the total number of duplicate samples collected should be equivalent to 5% of total sample size. Duplicates assist in determining sample analysis variability.

6.1.3 TRIP BLANK

A trip blank may be necessary when sampling for volatile organic compounds (i.e. EPA 8260 analysis). The need for a trip blank will be outlined in the SAP.

6.1.4 BACKGORUND SAMPLES

The need for background groundwater samples will be outlined in the SAP.

6.2 SPECIAL CONSIDERATIONS FOR METALS ANALYSIS

Temporary Monitoring Wells or wells that have been installed and constructed improperly may not allow for the collection of a silt free (low turbidity) sample. This silt does not represent the natural mobile load in the aquifer, and samples that include the silt (elevated turbidity) may introduce non-mobile elements into the water sample. Therefore, it is recommended that samples collected for metals analysis utilizing this SOP be filtered with an in-line 0.2-0.45 µm particulate filter. The filter should be purged (approximately 25 - 50 mL) with the groundwater being sampled prior to sample collection, or per the filter manufacturer's instructions. Site specific DQOs will determine if unfiltered samples are necessary under this SOP.

7.0 DOCUMENTATION/ CHAIN OF CUSTODY

All site visits, including groundwater sampling events must be documented as described in the MEDEP/DR SOP# RWM-DR-013 - Documentation of Field Activities and Development of A Trip Report. Use of specialized sampling forms is allowed, following the procedure outlined in DR-013. Sample custody must be followed as outlined in MEDEP/DR SOP# RWM-DR-012 – Chain of Custody Protocol.

002-Groundwater Sample Collection for Site Investigation and Assessment Monitoring-Final 2021 - B Blais

Final Audit Report 2021-12-23

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By:	Lindsay Caron (LINDSAY.ER.CARON@MAINE.GOV)
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