MICHIGAN DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY

Guidance for Developing a Sampling and Analysis Plan

Part 22 Groundwater Discharge Permits

Contents

Introduction and Instructions

Michigan's Department of Environment, Great Lakes, and Energy (EGLE) regulates discharges to groundwater under Part 22 Groundwater Quality, (Part 22 Rules), as promulgated pursuant to Part 31, Water Resources Protection, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. The Part 22 Rules include R 323.2201 – 323.2240 of the Michigan Administrative Code.

This document provides guidance for preparing a Sampling and Analysis Plan (SAP) to meet the requirements for sampling in the Part 22 Rules. Sampling is required for most permits authorized under R 323.2210(y), 323.2216, and 323.2218. The SAP must include sampling procedures for all effluent, groundwater, and soil monitoring required in the permit. Also, R 323.2221 of the Part 22 Rules requires an applicant to submit an SAP for groundwater sampling as part of a hydrogeologic report work plan.

SAPs may be formatted using this document's section headers and incorporating example tables and text to ensure all requirements are met. If there are sections of this guidance that do not apply to a particular SAP, it is helpful to include the section header and simply state why the section does not apply.

General Disclaimer to Include in an SAP

The SAP must include the following statement, or an equivalent: "This Sampling and Analysis Plan (SAP), is an enforceable requirement under this site's groundwater discharge permit after it has been approved by the Department of Environment, Great Lakes, and Energy (EGLE). Prior to implementing any modifications to an approved SAP, the permittee must submit a written request for modification to EGLE and receive written approval from EGLE. Modifications are enforceable requirements under this site's groundwater discharge permit upon the date of EGLE's written approval."

Location Description

Site Map and Written Location Description

The SAP must include a map of the site that includes the location of each monitoring point. The map must include a scale bar, north arrow, legend, and labels. Someone unfamiliar with the site should be able to decipher the map. Larger sites may need multiple maps.

The SAP must include a written description of any monitoring point characteristics that are not apparent on the site map so that someone unfamiliar with the site could locate the monitoring point. Examples that need an additional written description include:

- An ambiguous monitoring location, such as a field or lagoon, should have a written description of the point where the sample will be collected during each sampling event to ensure consistency. For a lagoon, this description should also include the depth from which the sample is collected at the point.
- A difficult to find monitoring location, such as a well that may be covered by fast-growing vegetation or snow piles, should include a written description of how to locate or access the sampling point.

The SAP must include all sampling locations at the site, regardless of whether they are included in a permit. Any sampling locations not included in a permit should be marked or noted accordingly.

Monitoring Well Description

This section is only required for SAPs that include sampling from monitoring wells.

The SAP must summarize monitoring well characteristics, including:

- Well depth,
- Drilling method,
- Well construction materials, including well diameter,
- Well development method,
- Screened interval depth, and
- Screened interval. The screened interval must be referenced to United State Geological Survey data.

Generally, this information can be sufficiently incorporated into a table. See Appendix 1: Monitoring Well Description Table Example for an example table.

For an SAP that is part of a hydrogeologic report workplan, monitoring well descriptions will be estimated for monitoring wells to be constructed as part of the hydrogeologic investigation and observed or measured for monitoring wells that have already been constructed. For an SAP that is part of a permit application or reapplication, monitoring well descriptions will be observed or measured.

Sample Description

The SAP must describe each sample that will be collected, including:

- A list of parameters (substances) to be sampled.
- The sample type, identified as grab, composite, measured, or calculated.
    - Grab samples are collected at a discrete time from a discrete monitoring point.
    - Composite samples consist of multiple grab samples combined into one sample.
    - Measured samples are data observed in the field, not through laboratory analysis.
    - Calculated samples are data resulting from a defined equation that includes data collected through laboratory analysis or field observation.
- The sampling frequency.
- The laboratory analysis method.
- Sample handling and preservation methods, including:
    - Whether the sample will be filtered.
    - The maximum sample hold time.
    - The sample preservation methods for each sample. For example, an acid that is added to the sample or storing the sample at a certain temperature.
- The laboratory method detection level.

Generally, this information can be sufficiently incorporated into tables. See Appendix 2: Sample Description Table Example for an example table.

Sample description must match details identified in the permit. Reach out to EGLE's Groundwater Discharge Permit Unit for sample description support if the SAP is for a permit that has not been issued yet.

Check each parameter's Laboratory Analysis Method to ensure sampling procedures are appropriate.

The SAP must include the following statement, or an equivalent, about the frequency of sampling: "Results from any monitoring that is conducted more frequently than required by the permit, using approved analytical methods, must be included in Discharge Monitoring Report calculations and reporting. Such increased frequency must be clearly indicated in reporting notes."

Quality Assurance and Quality Control

Calibration and Maintenance

If the sampling procedures include monitoring instrumentation, such as a multi-parameter meter, the SAP must include the following statement, or an equivalent, about calibration and maintenance: "All monitoring instrumentation will be properly calibrated and maintained to ensure accuracy." Your SAP must identify all monitoring instrumentation that must be calibrated and maintained. Provide a blank calibration log for all instrumentation in this section or as an appendix.

Calibration and maintenance records must be maintained as described in the Data Records and Reporting Section, below.

Blank Collection and Analysis

The purpose of a blank sample is to determine whether samples have been contaminated during the data-collection process.

Trip Blank

A trip blank is prepared in a laboratory or office setting prior to a field sampling event. The trip blank is kept with the sample bottles before and after sample collection. A trip blank is required when samples are analyzed for volatile organic compounds (VOCs).

Equipment Blank

An equipment blank is a blank solution collected after contact with any equipment that has come into contact with a sample. Equipment blanks are collected to evaluate decontamination procedures. An equipment blank is required for at least the first sampling event, unless the SAP shows that the equipment and sampling method are well-established for this type of sampling.

Field Blank

A field blank is a sample of analyte-free water or soil poured into the container in the field, preserved and shipped to the laboratory with field samples. A field blank is required when there are suspected background contaminants at a site that may impact a sample.

Laboratory Equipment Blank

Laboratory equipment blanks are prepared at the laboratory to document that the materials provided by the laboratory are free of contamination and that the field environment did not contaminate the samples. Laboratory equipment blanks are performed at the discretion of the laboratory and do not need to be included in the SAP.

Field Duplicate Collection and Analysis

The purpose of duplicate samples is to characterize the variability of the data introduced through the collection and analysis. A field duplicate is defined as a second sample from the same location, collected in immediate succession, and using identical techniques. Duplicate samples are handled and analyzed in the same manner as the primary sample. Duplicates must be submitted "blind" to the laboratory.

Duplicates are required for effluent and groundwater sampling. Duplicates are not required for soil sampling.

Duplicate frequency must be at least once per quarter or, if a single sampling event has more than 20 samples, once per 20 samples. If sampling occurs less than once per quarter, a duplicate must be taken during every sampling event. In limited cases the duplicate frequency may be reduced if historical sampling has been shown to be relatively consistent. Any exception must be approved by EGLE Groundwater Permits Unit staff.

The SAP must state whether duplicates are collected either sequentially or as split samples. Sequential duplicates are collected one after the other, using the same method and equipment. Split duplicates are collected in one sample and split into subsamples, e.g. two subsamples from one large container.

Duplicate samples must be evaluated for acceptability. One method for determining acceptability is to ensure the Relative Percent Difference (RPD) between the sample and duplicate is less than the maximum acceptable RPD. For field duplicate precision, an RPD of 20% is a standard rule of thumb for aqueous samples.

When the following equation is true, the duplicate is acceptable; when it is false, the sampler should evaluate, report, and address possible causes for the disagreement.

$$RPD < 20$$

- Where,

$$RPD = \left| \frac{(X_1 - X_2)}{\left(\frac{(X_1 + X_2)}{2}\right)} \right| \times 100$$

  - Where,
    - RPD is the Relative Percent Difference (%),
    - X_1 is the sample concentration, and
    - X_2 is the duplicate concentration.
  - Or, if $X_1 = X_2$, RPD is 0.

Matrix Spike Collection and Analysis

The purpose of spike samples is to establish the applicability of the analytical approach to the specific matrix from the site of interest by adding known quantities of an analyte to a sample prior to analysis. Generally, the laboratory adds the analyte. Spike samples are performed at the discretion of the laboratory and do not need to be included in the SAP.

Chain of Custody

The SAP must state that a chain of custody will be maintained for each sample. The chain of custody should include the following items:

- Date and time of collection
- Site identification
- Sample matrix
- Number of containers
- Preservative used
- Analyses required
- Name of collector
- Custody transfer signatures and date and time of transfer
- Name of laboratory admitting the sample

Sampling Procedures

General Guidelines for all Sampling Procedures

This section should be written as instructions for the sample collector and not as an explanation to EGLE. EGLE reviews these instructions, and may require edits, to ensure monitoring is conducted in a manner necessary to assess compliance with Part 22 Rules.

The SAP must include clear, concise, and comprehensive sampling procedures that ensure samples are properly collected in a reproduceable manner by anyone with an appropriate level of training, regardless of their prior experience at the site.

The SAP must include sampling procedures for all effluent, groundwater, and soil monitoring required in the permit.

The SAP must include an equipment list with the sampling procedures.

Effluent Sampling Procedure Requirements

In addition to the general guidelines, the effluent sampling procedure must include sufficient detail to ensure effluent samples are collected from the precise location as described in the Monitoring Location section above.

Low Flow Groundwater Sampling Procedure Requirements

Low flow sampling procedures at monitoring wells must address the following items.

- Static water level collection is included in the sampling methods. Water levels must be collected before any wells are purged for sampling.
- Water levels must be precise to 0.01 ft.
- Include calibration procedures for the multi-meter and any other relevant equipment. Check the owner's manual, or the manufacturer's website, for information on proper calibration procedures.
- The pump intake location should be the middle of the screened interval unless otherwise specified in the hydrogeologic report.
- The pump, multi-parameter meter, and flow-through cell must be connected correctly.
- Limit total drawdown to less than 0.3 ft. Methods should detail what to do if drawdown exceeds 0.3ft., generally: reduce flow rate or, if that is not possible, pump the well dry and sample within 24 hours, allowing for recovery.
- Flow rate from pump is specified to be 0.1 – 0.5 L/min.
- Prior to sample collection, stabilization criteria are achieved by purging when taken at 3 to 5 minute intervals in the flow-through cell, at least 4 of the following: Temperature (3%), Dissolved Oxygen (DO) (10%), pH (±0.1 unit), Specific Conductance (3%), Turbidity (10% or <10 Nephelometric Turbidity Units (NTU)), Oxidation Reduction Potential (ORP) (±10 millivolts).
- If stabilization criteria have been achieved and a Turbidity of less than 10 NTU cannot be achieved, both total and dissolved metals may be requested by EGLE. Sampling guidance should adequately address this requirement, if applicable.
- The sample must be collected from tubing prior to the flow-through cell.
- Drawdown, pumping rate, purge volume, stabilization criteria, and sample collection time will be recorded. Typically, the SAP should include a blank field sheet that will be used.
- The disposal method for purge water must be identified.
- Remove equipment and close and lock each well after sampling.
- Equipment decontamination procedures must be sufficient to prevent cross-contamination from sampling equipment or the environment

Appendix 3: Low Flow Sampling Equipment and Procedures Example is an example of sampling procedures that can be adapted to specific site conditions to meet these requirements.

Bailer Groundwater Sampling Procedure Requirements

Bailer sampling may only be used when the parameters being sampled are not affected by turbidity. Bailers have been shown to increase the turbidity of the water sample, causing sampling results that are unrepresentative of groundwater conditions. Unrepresentative samples can lead to mischaracterization or necessitate resampling.

If the bailer method is used instead of the low flow method, the SAP must provide justification that bailer sampling is necessary and that the sample parameters are not impacted by turbidity. This justification will be evaluated by EGLE Groundwater Permit unit staff. A previous version of this SAP guidance included additional acceptable justifications for bailer sampling; however, further investigation revealed this previous version could lead to issues with unrepresentative samples.

Bailer sampling procedures at monitoring wells must address the following items:

- Static water level collection is included in the sampling methods. Water levels must be collected before any wells are purged for sampling.
- Water levels must be precise to 0.01 ft.
- Adequate purge volume (at least 3 well volumes) prior to sample collection. Include how this volume is calculated.
- Sample collection methodologies must be developed to minimize contamination and turbidity.
- The disposal method for purge water must be identified.
- Wells must be properly closed and locked to prevent contamination.
- Equipment decontamination procedures must be sufficient to prevent cross-contamination from sampling equipment or the environment.

Appendix 4: Bailer Sampling Equipment and Procedures Example is an example of sampling procedures that can be adapted to specific site conditions to meet these requirements.

Soil Sampling Procedure Requirements

Soil sampling of a field used for land application of wastewater involves collecting a composite sample from multiple points in a field. This is the most common type of soil sampling in a permit. Per R 323.2233 of the Part 22 Rules, sampling must be in accordance with the publication "Michigan State University Extension Bulletin E- 498" or other EGLE-approved method. Appendix 5: Soil Sampling Equipment List and Procedures Example is an example of sampling procedures that can be adapted to specific site conditions to meet these requirements.

Soil sampling can also be conducted at soil borings, most commonly when completing a hydrogeologic report. Follow general sampling procedure guidelines to meet SAP requirements.

Laboratory Analysis

The SAP must state whether the permittee is performing analysis in their own laboratory or contracting the analysis to an external laboratory.

Permittees who perform their own laboratory analysis should review EGLE's Laboratory guidance in the Permit Compliance Self Checklist for the National Pollutant Discharge Elimination System Program, found on EGLE's website at: NPDES Permit Compliance Self-Checklist.

If a permittee performs their own laboratory analysis, the SAP must include the following statement, or an equivalent, about calibration and maintenance: "All analytical instrumentation will be properly calibrated and maintained to ensure accuracy." Your SAP must identify all analytical equipment that must be calibrated and maintained. Provide a blank calibration log for all instrumentation in this section or as an appendix.

Data Records and Reporting

Required Records

The SAP must include the following statement, or an equivalent, identifying records that must be kept: "The following information will be recorded for each measurement or sample taken:

- The exact place, date, and time of measurement or sampling.
- The person(s) who performed the measurement or sample collection.
- The dates the analyses were performed.
- The person(s) who performed the analyses.
- The analytical techniques or methods used.
- The date of and person responsible for equipment calibration.
- The results of all required analyses."

Information about sample collection and collection equipment calibration is generally included in field logs.

Information about sample analysis, results, and analysis equipment calibration is generally included in laboratory results.

Records Retention

The SAP must include the following statement, or an equivalent, about SAP availability: "The permittee must keep a copy of the approved SAP, including any approved modifications, at the facility permanently and shall be provided to the Department of Environment, Great Lakes, and Energy upon request."

The SAP must include the following statement, or an equivalent, about records retention: "All records and information resulting from the monitoring activities in this sampling and analysis plan, including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation, will be retained for a minimum of three (3) years, or longer if requested by the Department of Environment, Great Lakes, and Energy."

Reporting and Presentation

An SAP that is part of a hydrogeologic report workplan must describe how groundwater quality and water level data will be presented and evaluated. This description should include groundwater maps that will be developed and the techniques used to develop them.

An SAP that is part of a permit application, or reapplication, must state that all water quality sampling results will be reported through MiEnviro and compared to permit limits.

Appendix 1: Monitoring Well Description Table Example

Monitoring Well ID	Well Depth (ft.)	Drilling Method	Well Construction Materials	Well Development Method	Screened Interval Depth (ft)	Screened Interval (ft. amsl)
MW-1S	10	HSA	2" SS	Bailer	5-10	811.0 – 806.0
MW-1D	25	Direct Push	2" PVC	Surging	20-25	796.2 – 791.2
MW-2	15	Direct Push	2" PVC	Surging	10-15	808.0 – 803.0

Notes:

- HSA: Hollow Stem Auger
- Direct Push: Direct Push Drilling or Geoprobe
- SS: Structural Steel
- PVC: Polyvinyl Chloride
- Ft amsl: Feet above mean sea level, referenced to United States Geological Survey data

Appendix 2: Sample Description Table Example

The following table should be used for each distinct monitoring location or set of monitoring locations. Generally, you will find monitoring locations with similar sample descriptions grouped together in your permit.

Values in this table are examples and are not meant to be representative of your Groundwater Discharge Permit. Update the values to reflect your permit requirements.

- For columns "Parameter," "Sample Type," and "Sampling Frequency," refer to your permit.
- For the column "Filtered or Unfiltered", samples must be unfiltered or both an unfiltered and filtered sample must be collected, if conditions require it, unless otherwise instructed by a Groundwater Permit Unit geologist.
- For the columns "Analysis Method," "Maximum Hold Time," Sample Preservation Methods," and "Detection Limit," you should generally consult your in-house laboratory staff or contracted laboratory.

Parameter	Sample Type	Sampling Frequency	Analysis Method	Filtered or Unfiltered	Maximum Hold Time	Sample Preservation Methods	Detection Limit (mg/L)
Static Water Elevation	Measured	Quarterly	NA	NA	NA	NA	NA
pH	Grab	Quarterly	EPA 150.2 by pH Meter	Unfiltered	NA	NA	NA
Specific Conductance	Grab	Quarterly	EPA 120.1 by Conductivity Meter	Unfiltered	NA	NA	NA
Total Inorganic Nitrogen	Calculation	Quarterly	NA	Unfiltered	NA	NA	NA
Ammonia Nitrogen	Grab	Quarterly	EPA 350.1 by Automated Colorimetric Detection	Unfiltered	28 days	H_2SO_4 preserved to pH<2; cooled to 4°C	0.01
Nitrate Nitrogen	Grab	Quarterly	EPA 300.0 by Ion Chromatography	Unfiltered	28 days	H_2SO_4 preserved to pH<2; cooled to 4°C	0.01
Nitrite Nitrogen	Grab	Quarterly	EPA 300.0 by Ion Chromatography	Unfiltered	28 days	H_2SO_4 preserved to pH<2; cooled to 4°C	0.01

Appendix 2: Sample Description Table Example

Parameter	Sample Type	Sampling Frequency	Analysis Method	Filtered or Unfiltered	Maximum Hold Time	Sample Preservation Methods	Detection Limit (mg/L)
Chloride	Grab	Quarterly	SM 4500Cl-E by Automated Ferricyanide	Unfiltered	28 days	Cooled on ice	4
Sodium	Grab	Quarterly	EPA 200.7 by ICP-OES	Unfiltered	180 days	1:1 HNO_3 preserved to pH<2	1
Total Phosphorus	Grab	Quarterly	EPA 365.1 by Automated Colorimetry	Unfiltered	28 days	H_2SO_4 preserved to pH<2; cooled to 4°C	0.01
Calcium	Grab	Quarterly	EPA 200.7 by ICP-OES	Unfiltered	180 days	1:1 HNO_3 preserved to pH<2	1
Iron	Grab	Annually	EPA 200.7 by ICP-OES	Unfiltered	180 days	1:1 HNO_3 preserved to pH<2	0.02
Magnesium	Grab	Annually	EPA 200.7 by ICP-OES	Unfiltered	180 days	1:1 HNO_3 preserved to pH<2	0.5
Manganese	Grab	Annually	EPA 200.8 by ICP-MS	Unfiltered	180 days	1:1 HNO_3 preserved to pH<2	0.005
Potassium	Grab	Quarterly	EPA 200.7 by ICP-OES	Unfiltered	180 days	1:1 HNO_3 preserved to pH<2	0.2
Dissolved Oxygen	Grab	Quarterly	SM 4500-O by Electrode	Unfiltered	15 minutes	NA	NA
Bicarbonate	Grab	Quarterly	SM 2320B by Phenolphthalein Titration	Unfiltered	14 days	none	5
Sulfate	Grab	Quarterly	ASTM D516-16 by Turbidimetric	Unfiltered	28 days	Cooled on ice	5

Appendix 3: Low Flow Sampling Equipment and Procedures Example

This is an example of sampling equipment and procedures that can be adapted to specific site conditions to meet SAP requirements.

Equipment List

- Depth-to-water measuring device (add specific type of device)
- Decontamination supplies (add specific products)
- Sample bottles (add specific number and type of bottles)
- Preservation supplies for sample bottles, unless SAP specifies bottles are pre-preserved by laboratory (add specific supplies)
- Container, e.g. cooler, for filled sample bottles
- Ice or cold packs
- Chain of custody for samples
- Field notebook or log
- Personal protective equipment (add specific equipment)
- Container for purged water
- Sampling pump: typically, a peristaltic, submersible, or bladder pump
- Tubing: the SAP should state whether tubing is reused between sampling events or if new tubing is used for each event. The SAP should state whether tubing is dedicated to one well (most likely) or is reused at multiple wells (uncommon). If tubing is reused at multiple wells, the SAP must include decontamination procedures for the tubing, and an equipment blank must be taken using distilled/deionized water after the tubing has been decontaminated after being used on the well with the expected highest concentrations.
- Power source for pump
- Flow (rate) measurement supplies
- Multi-Parameter meter with flow-through-cell, including parameters for pH, oxidation reduction potential (ORP), dissolved oxygen (DO), specific conductance, and temperature
- Turbidity meter

Procedures

1. **Calibrate instrumentation**

   Note: SAPs should include calibration requirements, as identified by the manufacturer's instructions for any applicable sensors.

2. **Open wells**

   - Open or uncap all wells where the water level will be measured to allow them to equilibrate to atmospheric pressure.
   - Ensure that no surface water enters or has entered the well. If the cap is flooded, bail out below casing before opening.

3. **Decontaminate Equipment**

   - Decontaminate equipment by washing equipment with a non-contaminating detergent (such as Alconox) then rinsing with distilled or deionized water.
   - Review all equipment prior to a sampling event and decontaminate any equipment that may contact samples to ensure it was not contaminated from a previous sampling event or while in storage. Equipment that is dedicated to a single monitoring point, e.g. dedicated pump tubing, does not need to be decontaminated.

4. **Measure water levels**

   Collect static water level readings to the nearest 0.01 ft. from all wells prior to pumping.

5. **Install the pump**

   - Lower the pump or pump intake, tubing and electrical lines slowly into the well (to minimize disturbance) to the midpoint of the zone to be sampled. When possible, keep the pump intake at least two feet above the bottom of the well to minimize mobilization of particulates present in the bottom of the well.
   - Do not allow tubing to contact the ground.

6. **Measure the water level**

   Before starting the pump, measure the water level.

7. Purge the well

- Start the pump at its lowest speed setting and slowly increase the speed until discharge occurs.
- Connect the pump to the flow-through cell.
- Check the water level. Adjust the pump speed until there is little or no water level drawdown (less than 0.3 feet). If the minimal drawdown that can be achieved exceeds 0.3 feet but remains stable, continue purging until indicator field parameters stabilize.
- Monitor and record the water level and pumping rate every three to five minutes (or as appropriate) during purging. Record any pumping rate adjustments (both time and flow rate). Pumping rates should be between 0.1 – 0.5 L/min to ensure stabilization of indicator parameters. Adjustments are best made in the first fifteen minutes of pumping to help minimize purging time.
- Do not allow the water level to fall to the intake level (if the static water level is above the well screen, avoid lowering the water level into the screen).
- Wells with low recharge rates may require the use of special pumps capable of attaining very low pumping rates (bladder, peristaltic), and/or the use of dedicated equipment.
- If the recharge rate of the well is less than the minimum extraction rate capabilities of the pumps, the drawdown will not stabilize, and the well must be dewatered during purging. When this occurs, the well should be sampled as soon as the water level has recovered sufficiently to collect the appropriate volume needed for all anticipated samples (the intake should not be moved during this recovery period). The sampling must be completed within 24 hours of beginning the initial drawdown. Samples may be collected even though the indicator field parameters have not stabilized.

8. Monitor the indicator field parameters

- Using a multi-parameter flow-through cell, monitor the indicator field parameters during well purging. Stabilization is achieved when three consecutive readings, taken at three- to five-minute intervals, are within the following limits for at least four of the six parameters:
    - Temperature (3%),
    - Dissolved Oxygen (D.O.) (10%),
    - pH (±0.1 unit),
    - Specific Conductance (3%),
    - Turbidity (10% or <10 NTU),
    - Oxidation Reduction Potential (ORP) (±10 millivolts)

- If stabilization criteria have been achieved and a Turbidity of less than 10 NTU cannot be achieved, both total and dissolved metals may be required to be collected in Step 9, below. Preference should be given to collecting a sample with Turbidity of less than 10 NTU, rather than collecting dissolved metals, when possible.
- All measurements, except turbidity, must be obtained using a flow-through cell. Transparent flow-through cells are preferred, because they allow field personnel to watch for particulate build-up within the cell. This build-up may affect indicator field parameter values measured within the cell and may also cause an underestimation of turbidity values measured after the cell.
- If the cell needs to be cleaned during purging operations, continue pumping and disconnect the cell for cleaning, then reconnect after cleaning and continue monitoring activities. The flow-through-cell must be designed in a way that prevents air bubble entrapment in the cell. When the pump is turned off or when cycling on/off (when using a bladder pump), water in the cell must not drain out. Monitoring probes must always be kept moist.
- Record indicator field parameters readings on a field form.
- Field observations of water clarity, color, and odor will also be recorded on a field form.

9. Collect the water samples

- Water samples for laboratory analyses must be collected before water has passed through the flow-through-cell (use a by-pass assembly or disconnect the cell to obtain a sample).
- Do not change the flow rate while sampling.
- Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence. During purging and sampling, the tubing should remain filled with water to minimize possible changes in water chemistry upon contact with the atmosphere.
- Label each sample as collected. Samples requiring cooling will be placed into a cooler with ice or refrigerant for delivery to the laboratory as soon as possible.
- If dissolved metals must be collected, attach a 0.45 micrometer (µm) filter to the tubing and purge an additional 750 mL before collecting the sample to be analyzed for dissolved metals. The filter must not be used during the collection of other samples. A new filter must be used at each well.

10. Remove the pump and close the well

Ensure that all well caps and coverings are properly in place and locked so that substances cannot enter the aquifer through the monitoring well.

11. Dispose of purged water

- Observation or monitoring well development or evacuation water is exempted from a Part 22 permit under Rule 2210(h), provided it complies with Rule 2204 of the Part 22 Rules, including that it is not injurious, does not cause runoff to adjacent property, is more than 100 feet inside a property boundary, is isolated from water supply wells, and does not create a facility under Part 201 (R 324.20101 to 324.20141).
- Purged water is dealt with by disposal on the ground, returning it back into the well, or containerizing for disposal.

12. Decontaminate equipment

- Decontaminate equipment by washing equipment with a non-contaminating detergent (such as Alconox) then rinsing with distilled or deionized water.
- Decontaminate equipment that may contact water samples in between every sample collection (typically: water level meter and gloves). Decontaminate any non-disposable equipment that does not contact samples after each field sampling event (typically: multi-parameter meter, turbidity meter, flow-through cell, and purge water container).

13. Repeat steps 5-12 for each monitoring well.

14. Sample handling and analysis

Samples will be packed and transported to the laboratory on ice. Samples will be dispatched to the laboratory for analysis with a signed chain of custody record.

Appendix 4: Bailer Sampling Equipment and Procedures Example

This is an example of sampling equipment and procedures that can be adapted to specific site conditions to meet SAP requirements.

Equipment List

- Depth-to-water measuring device (add specific type of device)
- Decontamination supplies (add specific products)
- Sample bottles (add specific number and type of bottles)
- Preservation supplies for sample bottles, unless SAP specifies bottles are pre-preserved by laboratory (add specific supplies)
- Container, e.g. cooler, for filled sample bottles
- Ice or cold packs
- Chain of custody for samples
- Field notebook or log
- Personal protective equipment (add specific equipment)
- Container for purged water
- Disposable bailers. Use only new, disposable, certified-clean high-density polyethylene or polytetrafluoroethylene bailers or laboratory-cleaned stainless steel bailers for sampling. Reusable PVC bailers can be used for purging only.
- String. Use a new retrieval line for each sampling point.

Procedures

1. **Calibrate instrumentation**

   Note: SAPs should include calibration requirements, as identified by the manufacturer's instructions for any applicable sensors.

2. **Open wells**

   Open or uncap all wells where the water level will be measured to allow them to equilibrate to atmospheric pressure.

3. **Decontaminate Equipment**

   - Decontaminate equipment by washing equipment with a non-contaminating detergent (such as Alconox) then rinsing with distilled or deionized water.
   - Review all equipment prior to a sampling event and decontaminate any equipment that may contact samples to ensure it was not contaminated from a previous sampling event or while in storage. Equipment that is dedicated to a single monitoring point, e.g. dedicated pump tubing, does not need to be decontaminated.

4. Measure water levels

Collect static water level readings to the nearest 0.01 ft. from all wells prior to pumping. Decontaminate the water level meter between each well.

5. Purge the well

- Do not allow the bailer or line to touch the ground, a dirty ground cloth, or any other potentially contaminated surface.
- Do not allow the bailer to free fall into the water column. The bailer should enter the water column as gently as possible. A knot in the line referencing the groundwater level is useful.
- Try not to submerge the bailer much below the water surface to prevent mixing and to ensure water removal from the top of the water column.
- Withdraw the bailer gently from the water column and bring it to the surface quickly.
- Keep the check valve on the bottom clear of sediment and in proper working order to minimize the amount of water that drips back into the well.
- Purge an amount of water equal to three times the well volume. Record the well volume, height of the water column, well diameter, and amount purged on a field form.

6. Collect the water samples

- If the same bailer is not used for purging and sampling, discard the first two sample bailer volumes as rinse water.
- Do not allow the bailer or line to touch the ground, a dirty ground cloth, or any other potentially contaminated surface.
- Transfer the sample from the bailer to the sample container quickly while minimizing turbulence and exposure to the atmosphere. When possible, use a bottom-emptying device.
- Label each sample as collected. Samples requiring cooling will be placed into a cooler with ice or refrigerant for delivery to the laboratory.

7. Close the well

Ensure that all well caps and coverings are properly in place and locked so that substances cannot enter the aquifer through the monitoring well.

8. Dispose of purged water

- Observation or monitoring well development or evacuation water is exempted from a Part 22 permit under Rule 2210(h), provided it complies with Rule 2204 of the Part 22 Rules, including that it is not injurious, does not cause runoff to adjacent property, is more than 100 feet inside a property boundary, is isolated from water supply wells, and does not create a facility under Part 201 (R 324.20101 to 324.20141).
- Purged water is dealt with by disposal on the ground, returning it back into the well, or containerizing for disposal.

9. Repeat steps 5-8 for each monitoring well.

10. Sample handling and analysis

Samples will be packed and transported to the laboratory on ice. Samples will be dispatched to the laboratory for analysis with a signed chain of custody record.

Appendix 5: Soil Sampling Equipment List and Procedures Example

This is an example of sampling equipment and procedures that can be adapted to specific site conditions to meet SAP requirements.

Equipment List

- Soil probe (alternatively: soil auger or spade)
- Spade (for mixing, if not already included on equipment list for soil core collection)
- Plastic pail
- Sample containers (add specific number and type of containers)
- Chain of custody for samples
- Field notebook or log
- Personal protective equipment (add specific equipment)

Procedures

1. **Clean Equipment**
    - Clean equipment by washing or brushing off any residual soil.
    - Review all equipment prior to a sampling event and clean any equipment that may contact samples to ensure it was not contaminated from a previous sampling event or while in storage.
2. **Collect a composite sample made up of 20 soil cores from the monitoring zone**
    - The cores should be distributed throughout the monitoring location. Record the approximate soil core locations on a field form.
    - Scrape aside crop residue before collecting the soil core. Each soil core should be approximately 0.5 to 0.75 inches thick and 8 inches deep. Collect the soil cores in a clean plastic pail, discarding any stones and crop residue.
    - Mix the 20 soil cores thoroughly. Soils may need to partially dry before they mix.
    - Fill sample container(s) with the mixed soil.
3. **Clean Equipment**

    Clean equipment by washing or brushing off any residual soil.
4. **Repeat steps 2-3 for each soil monitoring zone**
5. **Sample handling and analysis**

    Complete any sample preservation procedures, as instructed by the laboratory. Samples will be dispatched to the laboratory for analysis with a signed chain of custody record.