

Attachment 4 - Groundwater Monitoring Plan



Sampling and Analysis Plan

2 0 GROUND WATER MONITORING WELLS

2 1 Monitoring Well Construction

The ground water monitoring well system shall be designed, installed and utilized for the purpose of collecting representative ground water quality samples from and detecting the presence or absence of contaminants in the uppermost aquifer. The proposed monitoring well design shall be submitted to the Division of Water Quality. Ground water monitoring wells are constructed at each farm site according to the guidance in the *RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (RCRA TEGD) (1986)* and the National Water Well Association's *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells (1989)*. Additional guidance in the construction of ground water monitoring wells is available in *RCRA Ground-Water Monitoring Draft Technical Guidance* and *ASTM Standard D 5092-90 (1995) Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers*. Consideration will be given to the possible impact the drilling method (i.e. mud rotary) may have on the quality of ground water samples. Steps will be taken to minimize negative impacts to the ground water quality (e.g. avoid drilling mud with nitrogen-species additives, thoroughly develop well).

Copies of the well driller's field reports for each monitoring well constructed during a quarter will be submitted to the Division with the next quarterly monitoring report. The elevation and location of each monitoring well will also be submitted to the Division. The locations will be submitted in three formats: meters and bounds, latitude and longitude relative to NAD83, and latitude and longitude relative to NAD27. Upon request, reference maps for each farm site will be made available to the Division that show the locations of ground water monitoring wells, lagoons, barn facilities, and underground waste transfer piping.

2 2 Background Ground Water Quality Monitoring

Accelerated background monitoring is performed during the first year after a monitoring well is installed and commences before manure is introduced into the lagoon system.

2 2 1 Data Quality Objectives

The objective of background ground water monitoring is to characterize the constituent concentrations and to identify the degree of temporal (seasonal) and spatial variability in the constituent concentrations in the ground water of the uppermost aquifer underlying each farm facility. Laboratory analysis of the water samples must be performed by an analytical laboratory certified by the State of Utah under UAC R444-14 Rule for the Certification of Environmental Laboratories. The analytical methods will have method detection limits (MDLs) no greater than the protection levels as they are presented in the Administrative Rules for Ground Water Quality Protection, R317-6, of the Utah Administrative

Code These protection levels are based on the expected class of ground water based on the TDS content. Once the background ground water quality data have been collected, permit limits will be established for those constituents, which would be most indicative of a leak from the farm site facilities. Temporal variability will be incorporated in the establishment of the permit limits by adding twice the standard deviation to the mean background concentration of each constituent. If the background and quarterly data exhibit a distinctive seasonal signature as identified employing the methods of the USEPA or other approved methods, permit limits will be adjusted on a case-by-case basis.

2.2.2 Sampling Design, Schedule, and Analytes of Concern

The background ground water sampling protocol will ensure that valid, representative ground water samples will be collected and preserved, if necessary, in the field and delivered to the analytical laboratory in an unaltered state such that the background concentrations of major anions and cations and any other constituent indicative of leakage from the farm site facility may be accurately characterized. Properly purging the well, properly sampling the well, and properly preserving the ground water sample according to the parameters to be analyzed will achieve this requirement. Purging the stagnant ground water from the well will follow the purging protocol presented in Section 2.3.4 – Purging and Measurement of Field Parameters of this SAP. Sampling will be conducted in such a way as to minimize turbulence and aeration during the sampling process that could alter the chemical composition of the sample and will follow the monitoring well sampling protocol presented in Section 2.4.5 – Monitoring Well Sampling. Ground water samples will not be field-filtered. Ground water samples will be preserved and/or refrigerated according to the protocols that accompany the associated analytical methods for each parameter unless otherwise explicitly stated in this SAP. At least eight background-sampling events performed at 6-week intervals occur in the first year after installation for upgradient wells. In the same time period, at least one background sampling event occurs for the downgradient well. The analyses from the upgradient wells will be used to establish background concentrations and permit limits. The sample locations, frequency, and the field and laboratory analytes of concern are listed in Appendix A. The analytical methods for the laboratory analytes of concern are listed in Appendix C.

Once the first background ground water sample has been analyzed, subsequent sampling events will be ordered such that the lowest TDS waters will be collected at the beginning of the day and the highest TDS waters at the end of the day. However, going from the lowest TDS to the highest TDS will only be done if the difference in TDS is greater than 500 mg/L between the wells. If both upgradient and downgradient wells at a

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farm site are to be sampled on the same day, the upgradient well should be sampled before downgradient well. Decontamination of the reusable field sampling equipment will be conducted after the collection of a ground water sample at each well according to Section 2.4.7 - Decontamination of Field Equipment of this SAP.

2.3 Quarterly

2.3.1 Data Quality Objectives

The objective of quarterly ground water monitoring is the detection of those constituents most likely to be indicative of a leak from the farm site facilities and to demonstrate compliance with each Ground Water Discharge Permit and the Utah Water Quality Act. As with the background sampling, laboratory analysis of the water samples must be performed by an analytical laboratory certified by the State of Utah under UAC R444-14 Rule for the Certification of Environmental Laboratories. The analytical methods will have method detection limits (MDLs) no greater than the permit limits as established from the background ground water quality monitoring and presented in each Ground Water Discharge Permit. The results of the quarterly sampling will be reported as indicated in the Ground Water Discharge Permit. The results of the quarterly ground water monitoring will be compared to the permit limits established from the background ground water quality monitoring. Actions required as the result of the identification of any exceedances of permit limits are detailed in each Ground Water Discharge Permit.

2.3.2 Sampling Design, Schedule, and Analytes of Concern

The quarterly ground water sampling protocol will ensure that valid, representative ground water samples will be collected and preserved, if necessary, in the field and delivered to the analytical laboratory in an unaltered state such that the concentrations of the quarterly ground water monitoring parameters may be accurately characterized. This requirement will be achieved by purging the stagnant ground water from the well following the purging protocol presented in Section 2.4.3 - Purging and Measurement of Field Parameters in this SAP, sampling in such a way as to minimize turbulence and aeration during the sampling process which could alter the chemical composition of the sample following the monitoring well protocol presented in Section 2.4.4 - Monitoring Well Sampling, and immediate preservation and/or refrigeration of the samples according to the protocols that accompany the associated analytical methods. Grab samples will be collected with the aid of a sampling pump or an approved alternative sampling device from the upgradient and downgradient ground water monitoring wells at each farm site. Ground water samples will not be field-filtered. Quarterly ground water sampling events will occur within four three-month periods beginning with January 1

of each year. Subsequent quarterly sampling events will occur not less than 1 month apart. The sample locations, frequency, and the field and laboratory analytes of concern are listed in Appendix A. The analytical methods for the laboratory analytes of concern are listed in Appendix C.

Daily sampling events will be ordered such that the lowest TDS waters will be collected at the beginning of the day and the highest TDS waters at the end of the day. However, going from the lowest TDS to the highest TDS will only be done if the difference in TDS is greater than 500 mg/L between the wells. If both upgradient and downgradient wells at a farm site are to be sampled on the same day, the upgradient well will be sampled before downgradient well. Decontamination of the reusable field-sampling pump will be conducted according to Section 2.4.7 - Decontamination of Field Equipment of this SAP.

2.4 Field Sampling Methods and Procedures

2.4.1 Data Quality Objectives

The objective of maintaining a series of clearly defined field sampling methods and procedures is to ensure consistency in the sample collection and transference process and to ensure that all conditions required for the collection and transference of representative samples are met. Data quality objectives specific to each field sampling procedure are discussed in the corresponding section below.

2.4.2 Field Instruments

2.4.2.1 Data Quality Objectives

The objectives of maintaining procedures relating to field instruments are to ensure that the field instruments are maintained in properly functioning condition and that data collected with the field instruments is comparable from one sampling event to another.

2.4.2.2 Identification of Field Equipment

A list of the equipment, including the name of the manufacturer and model designation, used to sample the ground water monitoring wells is included in the Standard Operating Procedures of Appendix B that are relevant to sampling the monitoring wells.

It is inevitable that, in time, equipment will need to be replaced. When this happens, appropriate portions of the manuals accompanying the pump, meter, and depth sounder will be included in Appendix D.

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2 4 2 3 Operating Instructions

All operating instructions can be found in the operation and maintenance manuals for each individual piece of field equipment provided by the manufacturer and are included in Appendix D

2 4 2 4 Calibration Procedures & Frequency

The field instruments will be calibrated according to the procedures and frequencies recommended by the manufacturer included in Appendix D. Field measurements shall be made only with instruments calibrated prior to sampling.

2 4 2 5 Maintenance & Function Checks

Field instruments will be maintained in optimum operating condition according to the maintenance recommendations of the manufacturer included in Appendix D. The Utah Division of Water Quality will not require the submittal of records of routine maintenance procedures. For each instrument, a permanent logbook for recording calibrations and repairs shall be maintained. Reviewing the logbook prior to leaving for the field site will help to troubleshoot potentially time consuming problems.

2 4 2 6 Record-Keeping Procedures (e.g. Calibration Logs)

Calibration logs will be maintained for each field parameter - pH, electrical conductivity, temperature, etc. Calibration logs will be made available to representatives of DWQ at their request.

2 4 2 7 Field Data Log Book and/or Sheets

Field data logbooks will be made available to representatives of the Division of Water Quality at their request. Copies of blank field data sheets are included with Standard Operating Procedure B3 - Collecting Ground Water Samples from Ground Water Monitoring Wells in Appendix B.

2 4 3 Water Level Measurements

The objectives of collecting ground water elevation measurements is to ensure the proper placement of the monitoring wells and to detect any ground water mounding that may be occurring in the vicinity of the waste storage facilities indicating leakage from those facilities.

Water level measurements will be made in all monitoring wells prior to purging. Water level measurements will follow Standard Operating Procedure B2 - Determination of Static Ground Water Level in Monitoring Wells in Appendix B.

2.4.4 Purging and Measurement of Field Parameters The objective of purging is either to remove all stagnant water from the monitoring well or to ensure stagnant water will not enter the sampling device during sample collection. Removal of stagnant water will be ensured by either purging three well casing volumes or monitoring of the purge indicator parameters pH, temperature, and specific conductance. Of these three parameters, specific conductance is the best indicator that stagnant water has been replaced by formation ground water. Stabilization of specific conductance to within 10% over three or more consecutive readings spaced at approximately 2 minutes or 0.5 well volumes or more apart will indicate the end of purging. Monitoring wells that purge dry and that require approximately an hour or more to return to their pre-purging water level may require the implementation of low-flow purging and sampling techniques which are not discussed in this SAP.

Following the measurement of the static ground water level and prior to the sampling of the ground water monitoring wells, they will be purged according to the Standard Operating Procedure in Appendix B for Purging Ground Water Monitoring Wells. The measurement of ground water temperature, pH, and specific conductance in the field will follow the Standard Operating Procedure in Appendix B for Field Measurement of Groundwater Temperature, pH, and Specific Conductance.

2.4.5 Monitoring Well Sampling

The objective of proper ground water monitoring well sampling is to collect a representative sample, which has not been altered by the sampling process. This objective will be met by minimizing turbulence and aeration of the sample stream which may require reduction of the pump flow rate below that of the purge rate, filling the sample bottles by placing the discharge tube from the pump as close to the side of sample bottle without touching it such that the sample stream flows down the side of the bottle, and properly preserving the samples. Samples that will be analyzed for nitrogen species will be collected in sample bottles that contain the appropriate preservatives or will be immediately preserved upon arrival at the analytical laboratory. All sample bottles will be immediately refrigerated such that they arrive at the analytical laboratory at or below the temperature of the groundwater when they were collected.

Ground water samples will be collected from the ground water monitoring wells according to Standard Operating Procedure B3 - Collecting Ground Water Samples from Ground Water Monitoring Wells in Appendix B.

2.4.6 Field Quality Control Samples

A field duplicate will be collected and analyzed for every 10 wells sampled or for each day wells are sampled if fewer than 10 wells are sampled per

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day Ground water field duplicate samples shall be collected in succession, immediately one after another. If any doubt exists regarding the representative nature of the samples collected in this manner, samples shall be collected in a gallon container and then transferred to sample containers. One sample of wash water will be collected and analyzed per quarter.

2.4.7 Decontamination of Field Equipment

The objective for decontaminating reusable field sampling equipment is to prevent cross contamination between ground water samples. The field sampling protocol in combination with the field sampling equipment decontamination protocol are designed to minimize cross contamination while minimizing the amount of effort required to achieve this objective.

After collection of the ground water sample, reusable field sampling equipment will be decontaminated by washing and flushing with clean tap water. If the next well to be sampled has had historically lower concentrations than the well just sampled, flushing of the sampling pump and hosing will be complete when the specific conductance of the flush water is within 10% of that of the clean tap water. At the end of a sampling day, the sampling pump and hosing will be decontaminated with tap water and flushing will be complete when the specific conductance of the flush water is within 10% of that of the clean tap water. The specific conductance of the end-of-the-day decontamination flush water will be recorded on the field data sheet for the last well sampled that day.

The field sampling equipment will be decontaminated according to Standard Operating Procedure B4 - Decontaminating Field Equipment in Appendix B.

3 0 GROUND WATER – CONTAMINATION INVESTIGATION

Requirements for sampling and analysis of the ground water under a source and contamination investigation will be addressed on an individual basis

4 0 GROUND WATER - SUPPLY WELLS

The water supply wells for the Skyline and Blue Mountain Farm Complexes are completed in the deep aquifer. The location of these wells are tabulated in Appendix E and indicated on the accompanying maps

4 1 Data Quality Objectives

The objective of sampling the water supply wells is to establish background concentrations in the deep aquifer of those constituents most likely originating from the farm sites and which may escape detection in the shallower ground water monitoring wells if a strong vertical gradient exists

4 2 Sampling Design, Schedule, and Analytes of Concern

The water supply sampling protocol will ensure that valid, representative ground water samples will be collected and preserved, if necessary, in the field and delivered to the analytical laboratory in an unaltered state such that the concentrations of the monitoring parameters may be accurately characterized. Samples will be taken as close to the wellhead as possible, bypassing as much of the surface piping as possible. Sampling of the water supply systems will be performed on an annual basis. Ground water supply well samples will not be field-filtered. The sample locations, frequency, and the field and laboratory analytes of concern are listed in Appendix A. The analytical methods for the laboratory analytes of concern are listed in Appendix C.

4 3 Field Sampling Methods and Procedures

4 3 1 Field Instruments

4 3 1 1 Identification of Field Equipment

A list of the equipment, including the name of the manufacturer and model designation, used to sample the water supply wells is included in the Standard Operating Procedure B5 - Collecting Ground Water Sample from Water Supply Wells in Appendix B.

No equipment used for sampling the water supply wells requires operating instructions, calibration or maintenance.



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4 3 2 Well Sampling

The sampling of the water supply wells will follow the Standard Operating Procedure B5 - Collecting Ground Water Sample from Water Supply Wells in Appendix B

4 3 3 Field Quality Control Samples

A field duplicate will be collected and analyzed for each 10 wells sampled or for each day wells are sampled if fewer than 10 wells are sampled per day. Ground water field duplicate samples shall be collected sequentially and immediately one after another. If any doubt exists regarding the representative nature of the samples collected in this manner, samples shall be collected in a gallon container and then transferred to sample containers.