



Groundwater Under the Direct Influence of Surface Water (GUDI) Guidance for Understanding Workplan Requirements and Evaluating Data

Objective

The Division of Water Supply & Geoscience (Division) is providing guidance to water systems on understanding the requirements of Groundwater Under the Direct Influence of Surface Water (GUDI) Workplan and evaluation of GUDI data.

Overview

All groundwater sources that meet any of the vulnerability criteria at N.J.A.C. 7:10-9.3(a)1-6 must monitor the raw water source as indicated at N.J.A.C. 7:10-9.4. If a groundwater source is not in a low risk formation¹ and meets any of the vulnerability criteria, and a GUDI evaluation is triggered, the Division will notify the system that they must submit a Workplan. Once the Workplan is approved, the system must conduct monitoring, evaluate results, and submit reports to the Division in order for a GUDI determination to be made. This guidance document was created to assist systems in understanding the requirements of a comprehensive Workplan and evaluating test results.

Recommendations and Requirements

Workplan Submittal

Once the Division notifies a water system via written correspondence that the groundwater source meets one or more GUDI vulnerability criteria, a detailed Workplan is due within 60 days. The Workplan must include a detailed discussion indicating the methods, instruments, and techniques to be used for collecting data and results. Specifically, the Workplan must identify proposed procedures for obtaining precipitation data and monitoring physical/chemical parameters and Microscopic Particulate Analysis (MPA). The Workplan should include a sampling schedule and identify who the responsible party is for testing.

¹ In accordance with N.J.A.C. 7:10-1.3 a low risk formation means:

1. An aquifer which the Department determines to be confined by an overlying layer or bed of distinctly lower permeability, based upon an acceptable pump test report, or on published reports and/or technical memoranda of the New Jersey Geological Survey or published reports of the U.S. Geological Survey; or

2. An unconsolidated geologic formation, in which the raw water source is a well screened at a depth of at least 200 feet.

Workplan Requirements

Physical/chemical parameter monitoring

The following physical/chemical parameters are required to be analyzed:

- pH;
- Temperature;
- Turbidity;
- Conductivity; and
- Total coliform bacteria (if a sample result is total coliform positive, the water shall be tested for fecal coliform or E. coli).

The above parameters must be sampled at the raw water source in four series of six weekly tests, at a minimum, with each series separated by at least 30 calendar days and one of the series performed during the period of peak production for the source. More frequent monitoring than weekly is encouraged for better observation of potential patterns/correlations. This can be achieved either by additional sampling events or by use of continuous analyzers.

Precipitation data/weather conditions are required to be collected along with the above-named parameters to make a correlation between the source and surface water and/or precipitative conditions. Procedures for obtaining precipitation data must be documented (e.g., log /track observed weather conditions, including temperature, surrounding, and including monitoring dates, rain events measured by rain gauge, stream gauge, and/or regional meteorological agency).

Nearby surface water bodies should be sampled concurrently and for the same parameters as the ground water physical/chemical parameter monitoring. These surface water bodies, and their sampling locations, are to be identified in the Workplan.

If the identified well is a seasonal source or is not run on a regular basis, contact the Bureau of Water System Engineering at 609-292-2957 or watersupply@dep.nj.gov (include "GUDI Inquiry" in the subject line of the email) to determine the best approach for data collection.

The Workplan shall specify the sampling equipment, collection procedures, methods, selected laboratory, and the proposed timeline/schedule with specific proposed sampling dates.

Physical/ Chemical Parameter Data Evaluation

If any of the physical/chemical parameter results show significant variance at any time during the one-year monitoring period, Microscopic Particulate Analysis (MPA) must be conducted.

The following variations are considered to be significant:

- Raw water turbidity fluctuates more than 0.5 NTU over any one month;
- Raw water turbidity exceeds 1.0 NTU at any time;
- Raw water temperature fluctuates more than 5°F over any one month or 15°F over the course of one year;

- Raw water pH, conductivity, or temperature varies by more than 20 percent of the annual average during any one month; and
- Raw water result of fecal coliform bacteria present.

If a system fails to switch to MPA monitoring following one or more significant variations of physical/chemical parameter monitoring, the source will be considered GUDI.

If no significant variations were identified for a minimum of four series of weekly monitoring, then the source is not considered GUDI.

MPA Monitoring

Physical/chemical monitoring should be performed before MPA sampling for the following reasons:

1. Data correlation between the source and surface water and/or precipitation events can be used to estimate a site-specific time of travel, which in turn can be used to create a MPA sample schedule. Alternately, a site-specific time of travel can be calculated as part of a hydrogeological assessment. If this approach is elected, the Department needs to review prior to sample commencement.
2. If no significant variations are found during the physical/chemical monitoring, MPA monitoring is not required as the source is not considered GUDI.

A minimum of four particulate analyses shall be performed during the one-year monitoring period. The sampling shall be conducted immediately following significant precipitation events and/or during the period of peak production for the source and shall be separated by at least 60 calendar days.

The analyses shall determine the presence, if any, of the following:

- i. Diatoms;
- ii. Rotifers;
- iii. Coccidia;
- iv. Insect parts and larvae;
- v. Cryptosporidium; and
- vi. Giardia cysts.

To represent significant precipitation, MPA sample collection can either follow discrete precipitation events (e.g., two inches of rain within the prior week, or one or more days following an event of two inches within 24 hours) or can take place during a typical seasonal/wet period (e.g., spring period of heavy rainfall, snowmelt, high stream flow conditions) if supported by documentation (e.g., local climatological data, stream flow hydrographs). A surrogate measure such as source turbidity or depth to water may be useful in the decision when to collect MPA samples.

To represent peak production period/worst case scenario, MPA sample collection can coincide with the end of highest use pumping period for the source (demonstrated by historical pumping data for individual wells) and/or late summer or an extended period of little or no rainfall.

If a time of travel has been determined either as a result of the physical/chemical monitoring or a hydrogeological assessment, sample collection conducted after a significant precipitation event or peak production period should be taken based on the estimated time of travel to the surface water source.

If a site-specific time of travel cannot be determined prior to MPA sampling, the Division recommends that at least two of the minimum required four MPA samples be collected during periods of significant precipitation and at least two samples be collected during the period of peak production or the worst case scenario for the source.

The Workplan shall specify the sampling equipment, collection procedures, methods, selected laboratory, and the proposed timeline/schedule.

Data Evaluation

Evaluating MPA Results

The Division has developed the below guidance to evaluate MPA results based on USEPA's Consensus Method *for Determining Groundwaters Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis* dated October 1992 (Consensus Method). This guidance outlines below more specific guidelines to be followed when evaluating MPA results.

Giardia / Cryptosporidium / Coccidia:

These organisms are considered as definitive indicators of direct surface water influence, so if as little as one organism (Giardia or Crypto cysts and/or Coccidia bacterium) is found in one sample, then the well will be considered GUDI.

Diatoms / Rotifers / Insect Parts and Larvae:

The below chart was prepared based on the risk rating tables presented in the Consensus Method (Tables 1 and 2 of Section 12.11). It assigns numerical values for what is considered low, medium and large amounts of organisms in a sample. All values are in number of particles counted per 100 gallons of water.

Particle/Organism	Small	Medium	Large
Diatoms*	1-10	11-40	>40
Rotifers (free swimming)	1-20	21-60	>60
Insects Parts and Larvae**	1-15	16-30	>30

* Make sure that the diatoms counted are actual pigment-bearing organisms, not just the empty shells (frustules)

** Be aware that flying insects may be present in some sources (i.e., springs) that are not subject to surface water influence

Possible Scenarios in determining GUDI (Diatoms / Rotifers / Insect Parts and Larvae):

Scenario	Action
No amounts are found in any samples.	The source in these cases would be considered <u>not</u> GUDI.
Small amounts of one organism found in one sample	
Small amounts of one organism found in multiple samples	The source in these cases would require additional sampling to make a definitive decision on GUDI status. If additional sampling is performed, the new monitoring period will be for one year, with the original requirements (i.e., 4 tests at least 60 days apart) to be repeated. The new results are to be treated as a new set of data, and interpreted as indicated in this procedure. If the new results indicate the need for additional sampling, then the source will be considered as GUDI.
Small amounts of multiple organisms found in one or different samples	
Medium amounts of one organism found in one sample	
Medium amounts of one organism found in multiple samples	The source in these cases would be considered as GUDI.
Medium amounts of multiple organisms found in one or different samples.	
Large amounts of one or multiple organisms found in any samples	

Reporting

The GUDI evaluation must be completed on each well within one year from approval of the Work plan (or within two years if additional MPA analyses are triggered). A comprehensive written sampling report must be submitted within 30 days of the completion of conducted monitoring. The report must include the following:

- Analytical reports and chain of custody documents associated with all sampling events
- Detailed collection procedures, methods of analysis, sampling equipment used (if applicable) for all parameters
- Operational logs verifying source production
- Precipitation data/weather conditions and procedure for obtaining data
- Precipitation data to verify significant precipitation
- Raw water monitoring results in tabular and graphical form
- Written description of the monitoring results
- Conclusions drawn from the monitoring supported by substantive evidence

In addition to the required final report, periodic progress reports (e.g., quarterly or after each series of testing) should be submitted to communicate the status of monitoring and any developments or trending observations.