Water Security Agency

Saskatchewan Ministry of Environment

Groundwater Under the Direct Influence of Surface Water (GUDI) Assessment Guideline EPB 284

Note: As of October 1, 2012 The Water Security Agency and Saskatchewan Ministry of Environment share responsibility and authority for the administration of The Environmental Management and Protection Act, 2002, and The Water Regulations, 2002 as pertaining to prescribed waterworks or sewage works in Saskatchewan. Therefore, all material contained within this document applies to waterworks or sewage works governed by the Water Security Agency or the Saskatchewan Ministry of Environment in accordance with their assigned responsibility.

To reduce the risk to human health, Saskatchewan has specified minimum treatment requirements for waterworks.

To ensure appropriate treatment is provided, the goal of this guideline is to assess if a communal well should be managed as Groundwater Under the Direct Influence of Surface Water (GUDI).

General

GUDI refers to groundwater sources (wells, springs, infiltration galleries, etc.) where microbial pathogens are able to travel from nearby surface water to the groundwater source. All GUDI municipal waterworks and wells and other waterworks, such as pipelines, which are regulated by Saskatchewan Ministry of Environment (Environment), shall meet the standards and requirements of a surface water source system as observed in *The Environmental Management and Protection Act 2002*, *The Waterworks Regulations 2002*, A Guide to Waterworks Design EPB 201 and other relevant Acts, regulations and publications.

This guideline presents a method for determining if a water source is GUDI or non-GUDI, as defined by *The Water Regulations, 2002:*

- Part 1 s 2 (3) For the purposes of these regulations, water beneath the surface of the ground is considered under the direct influence of surface water if that water, in the opinion of the minister, exhibits:
  - (a) a significant occurrence of insects or other macro-organisms, algae or large diameter pathogens, including *Giardia lamblia* and *Cryptosporidium*; or
  - (b) significant and relatively rapid shifts in water characteristics, including turbidity, temperature, conductivity or pH factors, that closely correlate to climatological or surface water conditions.

Part (a) of the definition is aimed at determining if there are particles present that are indicative of surface water. This may be determined using Microscopic Particulate Analysis (MPA) which analyzes for number of large macro-organisms, algae and other surrogate indicators of surface water.

Part (b) of the definition is aimed at establishing if a hydraulic connection exists between a groundwater and surface water sources. If groundwater is rapidly recharged by surface water, then microbial pathogens can enter the groundwater source.

The guideline should be carried out by, or under the supervision of, a qualified hydrogeologist. This would be a person with hydrogeology training and experience and licensed to practice in Saskatchewan by the Association of Professional Engineers and Geoscientists of Saskatchewan (APEGS). The assessment of water quality and water treatment should be

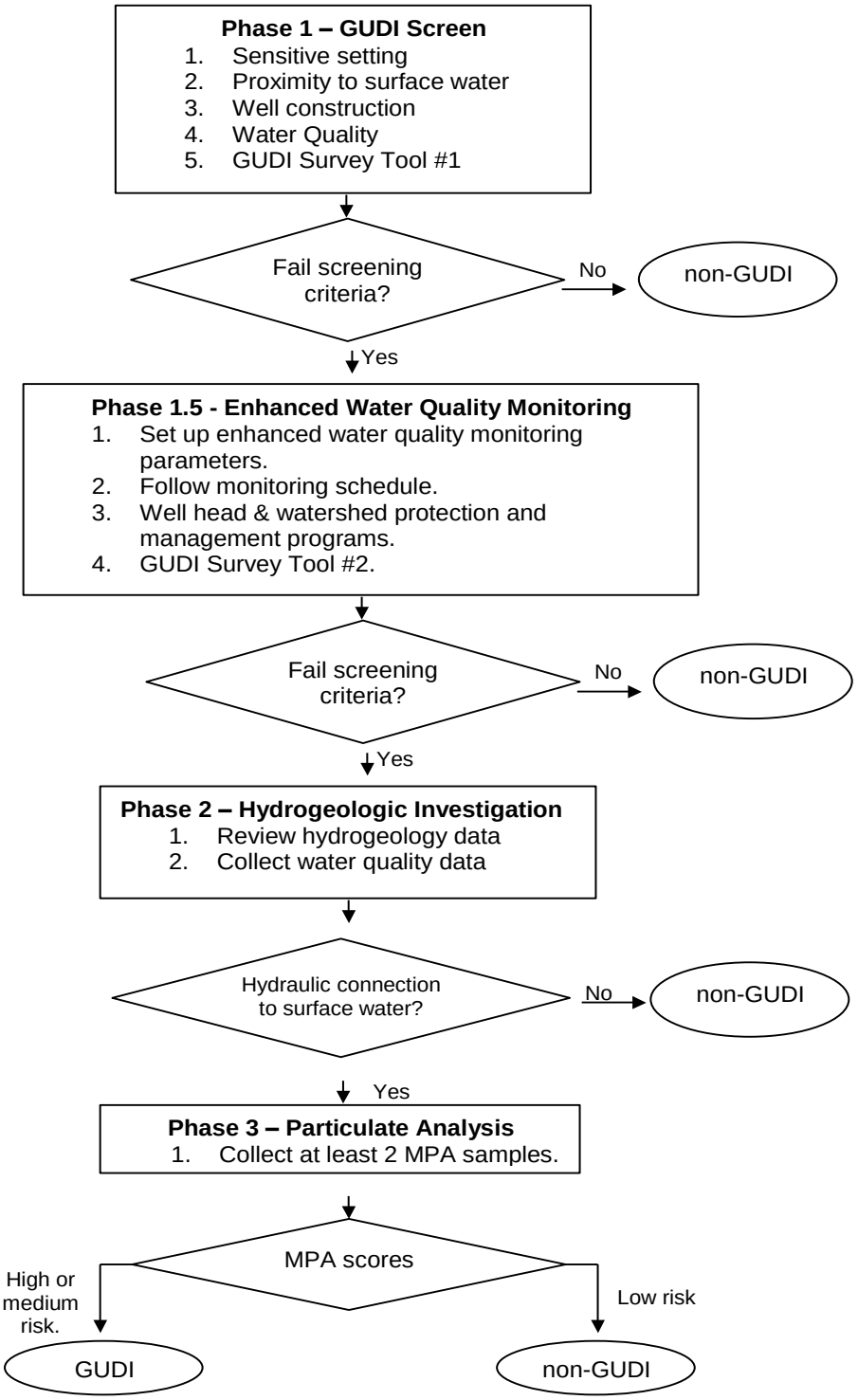
carried out by a person with municipal drinking water training and experience, and licensed to practice in Saskatchewan by APEGS. A qualified consultant can modify this document with permission by Environment.

The guideline consists of three phases, beginning with a screening phase that provides a method to rapidly identify obvious non-GUDI sources that do not require a detailed investigation. Sources that fail the screening are considered potentially GUDI and proceed to Phase 1.5, which is a period of enhanced monitoring for specific indicators. After the period of enhanced monitoring, sources that fail must self declare GUDI or proceed to Phase 2.0 to determine whether there is a hydraulic connection that allows rapid recharge between the groundwater source and surface water. If there is no hydraulic connection the source is non-GUDI. If a hydraulic connection exists, Phase 3 is completed to determine if there are particles present in the groundwater source that are indicative of surface water. Figure 1 is a flowchart for the GUDI assessment protocol.

Phase 1.0: GUDI Screening Assessment

This phase identifies obvious non-GUDI sources that do not need further investigation. After this phase, the well should be classified as either non-GUDI or potentially GUDI. Phase 1 can involve a file search, review of well construction details, a site visit and remedial recommendations that would typically be carried out prior to Phase 2.

Figure 1 – GUDI (Groundwater Under the Direct Influence) Assessment Flowchart



For a groundwater source to be considered non-GUDI it must satisfy all of the criteria below. If the source does not meet these criteria it is considered potentially GUDI.

1. **Sensitive settings:** The source must not fall into any of the following categories: spring, infiltration gallery, horizontal collection well, wells in karst aquifers, wells in unconfined aquifers and wells that are part of an enhanced recharge/infiltration project.
2. **Proximity to surface water:** The source must be greater than 50 days horizontal travel time from surface water and overburden wells must be greater than 100 metres from the nearest surface water body (i.e. water open to the atmosphere and subject to surface runoff such as ponds, lakes, wetlands, lagoons, reservoirs, estuaries, rivers, streams, brooks, ditches).
3. **Well construction:** The well must meet the current A Guide to Waterworks Design EPB 201 and *The Water Regulations 2002* and *The Ground Water Conservation Act*. The well must be properly constructed, located and capped so as to prevent surface water entering the well or the annulus.
4. **Water Quality:** Available data must show the raw well water does not regularly or periodically contain Total Coliform or *E. coli*.

Well owners may undertake repair and maintenance of wells prior to the GUDI evaluation. In the case of well repairs or maintenance made just prior to Phase 1.0 assessment, well owners are to coordinate with persons conducting subsequent GUDI assessments to ensure the assessment will represent typical well operating conditions. Assessors must differentiate between GUDI problems and historic maintenance problems. A survey for Phase 1.0 assessment is found in Appendix 1.

Wells may fail Phase 1.0 due to not meeting well construction requirements. It is acceptable to modify well construction to meet Phase 1.0 standards rather than declare the well GUDI or potentially GUDI. If well construction improvements are completed and the well still fails Phase 1.0, then Phase 1.5 may be completed. Wells may be declared GUDI without completing the GUDI guideline. This may be due to failure of a part of Phase 1.0, such as proximity to a surface water body, bacteria record, well construction, etc.

The information collected in Phase 1.5 and Phase 2.0 is needed to make a GUDI determination. Bypassing these and proceeding to the MPA analysis of Phase 3.0 is not recommended. The Phase 3.0 MPA analysis relies on the system lag time that is determined in Phase 1.5 Phase 2.0. Performing the MPA analysis during Phase 1.5 or 2.0 would significantly increase the number of MPA samples needed.

Options available if a well fails Phase 1.0 of the GUDI protocol include:

- declare the well as potentially GUDI and proceed to Phase 1.5;
- if the well failed Phase 1.0 because of well construction then modifications can be made; and
- declare the well as GUDI, Phase 2.0 and 3.0 study are not required and the standards and requirements of a surface water source will apply to the water system.

Phase 1.5: Water Quality Monitoring for GUDI Determination

This Phase identifies sources that need further investigation. After this Phase, the well should be classified as either non-GUDI or potentially GUDI. Phase 1.5 involves a comprehensive review of well construction details, a prolonged monitoring regime, site visits and identifies what must be done during Phase 2.0, if further investigation is needed. The enhanced monitoring during this Phase of the study provides the information needed to properly complete Phase 2.0, the Hydrogeologic Assessment.

The Water Regulations, 2002, do not require source water quality monitoring, which means that there is seldom an adequate amount of data for a proper hydrogeologic evaluation of the source water. Systems that are suspect for GUDI will be requested by Environment to enter into a period of raw water monitoring and well evaluation.

Hydraulic Connection to Surface Water

Water quality monitoring is a method of determining whether or not groundwater is hydraulically connected to surface water. In general, the closer a groundwater source is to surface water, the greater the likelihood of a hydraulic connection. This hydraulic connection to surface water means that water provided by a well or spring

is actually coming from a nearby surface water source and the water pathway from the surface source to the well or spring is a short enough time span that pathogens can survive the trip.

Any contamination present in the surface water can travel through the subsurface soil and emerge in water drawn from the well or spring. This is how *Giardia lamblia*, *Cryptosporidium*, viruses, and other microbial organisms contaminate what appear to be groundwater sources. This section will describe the general process and field methodology for determining hydraulic conductivity through water quality monitoring.

A monitoring program for water quality would require measurement of specific parameters at the potential GUDI source and each of the associated surface water bodies for at least one year. Several parameters including turbidity, temperature and conductivity need to be collected at a minimum of once a week for duration. This data would then need to be analyzed for statistical correlation and time trends, which would indicate or confirm hydraulic connection.

If a hydraulic connection is determined to exist, the source will be designated as groundwater under direct influence with surface water (GUDI). This will require treatment to surface water standards or other measures to ensure the safety of the water

If a hydraulic connection is determined not to exist, the source is no longer designated a potential GUDI source. It is instead designated as groundwater and is subject to the groundwater source monitoring and treatment requirements. The source will remain noted as susceptible, however, and may be subject to additional monitoring requirements including extra bacteriological sampling.

Purpose of Monitoring

The purpose of the monitoring program is to establish a baseline for the water quality, which includes seasonal changes in key physical, chemical, and biological parameters in both the groundwater and nearby surface water sources. Analysis of this baseline data (statistical and graphical) should determine the existence of hydraulic connection between the surface and groundwater sources. This process will identify groundwater that is need of further evaluation by methods such as the Microscopic Particulate Analysis (MPA) to identify specific organisms typically found in surface water, in the groundwater source.

Monitoring Parameters

Temperature

All systems conducting water quality monitoring to determine hydraulic conductivity must monitor water temperature. Monitoring water temperature is the most useful indicator of potential surface water influence and it is relatively easy to measure with inexpensive equipment. Both the surface water and the groundwater source in question must be monitored. These readings should be correlated to atmospheric temperatures taken at the same time and location. This will help identify changes in water temperature due to seasonal changes in air temperature.

Conductivity

Since temperature variations in some cases, (shallow wells and springs), may be due to seasonal changes, more parameters must be monitored to determine hydraulic connectivity. Conductivity is the next best indicator and must be monitored at the same time as the temperature. Again, both the groundwater and the surface waters must be monitored.

pH and Turbidity

Circumstances may exist that require more parameters than temperature and conductivity to be monitored for positive identification of surface water connection to the groundwater source. In such cases, pH and turbidity may be monitored. Turbidity monitoring should be easily added to the program, as turbidimeters are standard equipment for most drinking water treatment facilities. This should be discussed with the local Environmental Project Officer (EPO) or the Environmental Protection Branch.

Other Parameters

In some cases, the surface water or groundwater in question may have a distinct parameter that can be used as a marker for the water quality monitoring. For example, high iron, manganese, chloride, etc., which are easily monitored may be used. Again, this should be discussed with the local EPO.

Coliform Bacteria
The presence of fecal coliform bacteria in the source water indicates that recent contamination has occurred. This may be from well construction deficiencies, failing to properly disinfect pump components upon installation or repair or it may indicate that the source is under the direct influence of surface water. For the purposes of a water quality monitoring program, coliform or heterotrophic plate count (HPC) samples from the source may be used as an additional data set for determining direct influence of surface water. However, presence or absence of total coliform or fecal coliform does not preclude the possibility of direct surface water influence.

Rainfall Events / Water Levels
Any system participating in a monitoring program must record precipitation (rainfall and snowfall) with the rest of the data. An inexpensive rain gauge may be sufficient if there are no local weather stations that would be representative of the source site. Systems also should record information about stream flow, surface water levels, groundwater levels, and pumping activity. Relative changes in flow or levels over time are the primary interest.

Monitoring Equipment

Specifications

- Temperature measurements must be made with a digital thermometer and recorded to the nearest 0.1 degree Centigrade.

- Conductivity measurement must be made with a temperature-compensated conductivity meter with a digital readout. The meter must be able to measure conductivity to the nearest 1 micromho/centimeter over a range of 0 – 200 Micromho/cm.

- Sources monitoring pH must use a meter with a digital readout that is capable of measurement to the nearest 0.1 pH unit

- Turbidity measurements must be made with a turbidimeter with a digital readout over a range of 0 – 1000 NTUs. The meter must be able to measure to the nearest 0.1 NTU (nephelometric turbidity units).

Equipment
For systems that need to purchase equipment to conduct the monitoring program, relatively inexpensive models are available. Since the more expensive equipment tends to be more accurate, the less expensive equipment is acceptable for baseline monitoring since the interest is in relative changes over time, not absolute values.

Companies that handle equipment such as Cole-Parmer, Hach, etc. for environmental analysis would be good sources of needed equipment. All instruments and meters must be properly maintained and calibrated as in accordance with the manufacturer's specifications and instructions. Records of maintenance and calibration must be kept with the monitoring data files.

Monitoring Locations

Potential GUDI Source Sampling
Water samples and monitoring data from a potential GUDI source must be collected from the source (or as close to the source as practical) and prior to storage or treatment. If the system has more than one source well/spring, then each source must be sampled and monitored independently.

Surface Water Sampling
The samples for surface water ideally should be collected from mid-channel at the shortest horizontal distance from the potential GUDI source. Since mid-channel collection can be difficult, they may be collected upstream (up to ~1 km) or downstream (up to ~0.5 km) from bridges, docks or boats. (Ensure there are no tributaries entering between the sampling station and the ideal point.) Near shore sampling could be used for streams or water bodies (lakes, sloughs, etc.) if deemed okay by Environment.

Samples should not be taken from backwater eddies or stagnant areas since these would not represent the conditions in the bulk of the stream. Systems with multiple nearby surface water sources must monitor the required parameters at all sources. Once the groundwater and surface water sampling stations have been chosen, these locations must be used for all subsequent monitoring.

Method of Sampling

Field Measurements

Coliform or HPC samples must be collected in the field and sent to a certified laboratory for analysis. Temperature, conductivity, turbidity and other parameters must be measured in the field. Special consideration may be given to parameters which cannot be measured in field if deemed needed by Environment.

Groundwater Sampling

Monitoring of groundwater needs to be performed in a manner that ensures the sample is representative of the water quality of the aquifer rather than the well casing or the borehole. This will require that the sample collected be taken under flowing water conditions. The rule of thumb is a minimum of three well casing volumes. Typically 15 to 30 minutes is ample time to ensure fresh aquifer water is present for the sample. Wells used for seasonal sources should be on-line for several days to a week and sampled after the well has been purged for 30 minutes.

Surface Water Sampling

Collection of surface water samples requires a clean four-litre container such as a bucket. The container should be rinsed at least three times with the surface water taking care to not stir up the bottom sediments of the stream or pond. Metal containers need to be brought to the ambient temperature of the water by letting each rinse sit in the bucket several minutes. The sample should be taken from a depth greater than 0.4 meters if possible.

When taking reading for temperature, conductivity, pH, etc. make sure the probe is within the middle of the container. Collect fresh water samples and repeat the measurements at least three times until they are the same or closely agree.

Coliform Samples

Bacteriological samples must be collected, transported and analyzed in accordance with SMOE standards for analysis by an accredited laboratory. Results must be reported counts/100 ml. If the sample result is positive for total coliform, it must be analyzed for fecal coliform and results reported as counts/ 100 ml.

Records

All sampling and monitoring data must be recorded with respect to time date and parameters tested. They must be available for review at any time by Environment. (The development and provision of forms for data collection could be done, or authorized by Environment.)

The data must be reviewed by a person qualified in hydrogeology, as outlined in this document. If the review indicates hydraulic connection, the study needs to proceed to Phase 2.0.

Follow-up

If the well is deemed groundwater but is still suspect, the EPO may require increased water quality monitoring for an indefinite time period. The long-term monitoring may satisfy any present health concerns and reduce the need for water treatment upgrade until such time that new technologies improve the feasibility of upgrades. The implementation of a wellhead protection plan and/or watershed protection plan may also be required to decrease the possibility of groundwater contamination. A wellhead protection plan must follow the guidelines set out in Environment's Wellhead Protection EPB 299.

If the data collected shows definite correlations between the groundwater quality and parameters linked to surface water or hydrometerological events, this will require Proceeding to Phase 2.0, Hydrogeological Assessment, self-declaring GUDI and proceeding to upgrade the existing water treatment facility or advance to Phase 3.0, Water Particulate Analysis.

When a hydraulic connection is determined or highly suspected and is within the 50 day horizontal travel time from surface to groundwater source, proceed to Phase 3.0 Water Quality Particulate Analysis described in this document. The data collected during Phase 1.5 should assist in determining the best possible time to collect samples for Microscopic Particulate Analysis (MPA).

Phase 2.0: Hydrogeological Assessment

The objective of this phase is to determine if there is either an existing or potential hydraulic connection that could allow rapid recharge of the well by surface water or precipitation. Phase 2.0 will normally involve a review of available hydrogeologic information and monitoring during Phase 1.5, of water level and water quality data (such as temperature, conductivity, turbidity, pH). Additional hydrogeologic data may also be collected if the review of available data indicates there is insufficient information. At the end of this Phase, the well can be classified as either:

- non-GUDI (no hydraulic connection with surface water/precipitation);
- in hydraulic connection with surface water/precipitation; or
- potentially in hydraulic connection, if there is significant uncertainty.

This review should be used to assess whether there is potential for a hydraulic connection and to estimate the time-of-travel between the well and surface water. This review should characterize the hydrogeologic conditions of the site and should include, but not be limited to, an evaluation of the following:

Groundwater features:

- Well characteristics (well depth, casing depth, annular seal, casing type, well cap, connection to supply system, etc.);
- Hydrogeologic setting including stratigraphic correlation, depth to the aquifer, aquifer parameters including hydraulic conductivity, transmissivity, storage coefficient, nature and thickness of any confining layers, groundwater levels, aquifer water quality, static water levels, pumping water levels and the potential for connection between the surface water and aquifer (does the surface water body penetrate the aquifer);
- Pump test results and analysis (recharge boundary effects, recovery characteristics, etc.);
- Vertical and lateral hydraulic gradients and flow directions under pumping conditions. Groundwater level variations with time and precipitation;

Surface water features:

- Elevation of normal pool
- Elevation of 100-year floodplain
- Elevation of the lake bed, bottom of river channel, or streambed
- Approximate sampling point elevations
- Slope of the land surface between the source and the associated surface water

Including:

- Water quality; and
- Potential time-of-travel between the surface water and the well.

Raw water quality data should be collected at the well and at nearby surface water bodies for a period up to one year to determine if there is a close relationship between changes in the surface water quality and the well. Patterns are best recognized from one-year hydrographs; however, a shorter duration may be sufficient if a hydraulic connection is recognized early on in the monitoring program. Water quality parameters should include, but not be limited to, temperature, conductivity and pH measured on a weekly basis at a minimum. A rainfall gauge can be used to measure cumulative rainfall each week. Groundwater level monitoring is also required in determining potential connections.

The water quality data should be plotted and the graphs inspected for rapid changes and obvious similarities between surface water and groundwater. The time lag between peaks or inflection points of the surface water and groundwater temperature and conductivity graphs can be used to estimate the time-of travel. If the horizontal time-of travel is less than 50 days, this is considered to be a rapidly recharged well. The GUDI assessment water sampling must be completed for individual wells in a tested well field. Combined raw water samples are not recommended.

Phase 3.0: Water Quality Particulate Analysis

The results of the Hydrogeological Assessment in Phase 2.0 may determine that there is a hydraulic connection between the well and surface water. However, if the aquifer provides sufficient natural filtration to remove surface water organisms and debris, the well is not under the direct influence of surface water. The objective of Phase 3.0 is to determine if there are significant particulates present in the well that are indicative of surface water. This is determined using Microscopic Particulate Analysis (MPA).

The MPA test involves filtering approximately 4,500 litres of water to concentrate organisms and debris, which are then identified, and quantified using a microscope. At the end of this Phase, the MPA score is used to classify the well as a low, medium or high risk.

A minimum of two MPA samples should be collected. The samples are to be collected during periods when there is the greatest probability that surface water is impacting groundwater. The results from Phase 2 should be used to help select the most appropriate MPA sampling times (if there is a 15 day time-of-travel, then the well should be sampled 15 days after a surface water event). It is recommended that one sample be collected in the spring after a heavy rainfall or snowmelt and one sample be collected in the fall after a prolonged dry period. The MPA scores should be evaluated based on the risk factors specified by the USEPA (1992) as follows:

- low risk = MPA score < 10
- medium risk = MPA score 10 to 19
- high risk = MPA score >20

If any of the MPA samples fall into the medium or high risk categories, the well should be considered GUDI unless remedial action and/or further sampling demonstrates otherwise.

There are currently no laboratories in Saskatchewan offering MPA analysis. At the date of publication, Hyperion Research (telephone 403-529-0847) of Medicine Hat, Alberta offers the MPA analysis and also rents the sampling equipment. Additional laboratories may also conduct the testing. Environment does not endorse any product or service.

The MPA analysis should be based on the most recent version of the USEPA's guideline Consensus Method for Determining Groundwater Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis. MPA analysis based on other guidelines must provide that guideline and justification of usage with the assessment.

Proper sampling protocols must be used for the GUDI assessment. To obtain correct sampling protocols, contact laboratories or relevant Provincial and Federal agencies. Submittal of a GUDI assessment where sampling protocol is suspect may result in invalidation of the findings.

GUDI Determination

The final determination of whether a well is GUDI or non-GUDI will be a matter of professional judgement based on all of the evidence collected. In general, wells that have no evidence of existing or potential hydraulic connection with surface water will be considered non-GUDI. Wells that have a hydraulic connection and a medium or high risk MPA score will be considered GUDI. Evidence that a well is GUDI is usually more conclusive than evidence that a well is non-GUDI. If there is significant uncertainty, it is appropriate to err on the side of public health and safety and consider the well to be GUDI.

References

- Ontario Ministry of the Environment, 2001. Terms of Reference, Hydrogeological Study to Examine Groundwater Sources Potentially Under Direct Influence of Surface Water, October 2001.
- United States Environmental Protection Agency, Office of Drinking Water, 1991. Guidance Manual for Compliance with the Filtration and Disinfection Requirements for Public Water Systems Using Surface Waters, March 1991.
- United States Environmental Protection Agency, October 1992. Consensus Method for Determining Groundwater Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA). EPA 910/9-92-029.
- American Water and Wastewater Association, 1996. Determining Groundwater Under the Direct Influence of Surface Water.

- American Water and Wastewater Association, 2001. Investigation of Criteria for GWUDI Determination.
- Nova Scotia Department of Environment and Labour, 2002. Protocol for Determining Groundwater Under the Direct Influence of Surface Water.

Appendix A - GUDI Survey Tool #1

1. Indicate the depth of the well casing	_____	m
2. Is the well greater than 60 meters from the nearest surface water?	Yes	No
If not, indicate the distance between the well and surface water, and describe the source of surface water.	_____	m

_____

_____

_____

3. Is the well properly sealed?	Yes	No
4. Is the well in a pit?	Yes	No
5. Does the casing extend at least 0.45 m above the surroundings?	Yes	No
6. Does the well casing penetrate consolidated (slowly permeable) material?	Yes	No
7. Is the well casing only perforated or screened below consolidated (slowly permeable) material?	Yes	No
8. Attach a copy of the well log.	Yes	No
9. Is the well properly grouted for at least 3 meters?	Yes	No
10. Is the well subject to flooding?	Yes	No
If it is, does the casing extend at least 1 meter above the highest flood elevation, or the 100-year flood elevation, whichever is higher?	Yes	No
11. Are there any sewage disposal pits, leach beds, or improperly abandoned wells within 60 meters of the well?	Yes	No
12. Are there any septic tanks and subsurface septic tanks effluent disposal tile within 25 meters of the well?	Yes	No
13. Are there any livestock, grazing areas of feedlots, within 15 meters of the well?	Yes	No
14. Are there any sewers of non-watertight construction within 15 meters of the well?	Yes	No
15. Does the well have a history of total coliform or fecal coliform contamination in untreated samples collected over the past 3 years?	Yes	No
If yes, describe the sampling frequency and number of unsatisfactory samples.		

_____

_____

_____

16. Attach a summary of raw water coliform samples for the well over the last 3 years.	Yes	No
17. Does the well have a history of significant and relatively rapid water quality shifts? (e.g. turbidity, temperature, pH, taste & odour)	Yes	No
18. Has the well ever been associated with a disease outbreak?	Yes	No

_____

_____

_____

_____

Appendix B - GUDI Survey Tool #2

Preliminary Assessment of Ground Water Sources that may be Under the Direct Influence of Surface Water

System Name _____ **ID#** _____

Source Name _____ **R.M.** _____

Date _____ **Population** _____

Index Points

A. Type Of Structure (Circle ONE that Applies)

Well	Go To Section B
Spring	40
Infiltration Gallery/Horizontal Well	40

B. Historical Pathogenic Organism Contamination

History or suspected outbreak of Giardia, or other pathogenic organisms associated with surface water, with current system configuration;	40
No history or suspected outbreak of Giardia or other pathogenic organisms	0

C. Historical Microbiological Contamination

Record of acute (boil order or fecal positive sample) violations of the Total Coliform Sampling during the last three years (Circle ONE that Applies)

No violations	0
One violation	5
Two violations	10
Three violations	15

Record of microbiological violations during the last 3 years (Circle ONE that Applies)

One violation or none	0
Two violations	5
Three violations	10
Complaints about turbidity	5

D. Hydrological Features

Horizontal distance between surface water and the source greater than 100 meters	0
60 - 100 meters	5
30 - 60 meters	10
less than 30 meters	15

E. Well Construction

Poorly constructed well (uncased, or annular space not sealed to depth of at least six meters below land surface), or casing construction is unknown ..……..……	15
In wells tapping unconfined or semi-confined aquifers, depth below land surface to top of perforated interval or screen greater than 30 meters	0
15 – 30 meters	5
8 – 15 meters	10
0 – 8 meters	15
Unknown	15

F. Well Intake Construction

In wells tapping unconfined or semi-confined aquifers, depth to static water level below land surface greater than 30 meters	0
15 – 30 meters	5
0 – 15 meters	10
Unknown	10

G. Well Cap Construction

Poor sanitary seal, seal without acceptable material, or unknown sanitary seal type	15

TOTAL SCORE _____

H. Preliminary Assessment Determination (Circle ONE that Applies)

1. PASS: Well is classified as ground water.
2. FAIL: Well must undergo further GUDI analysis.
3. FAIL: Spring or Infiltration Gallery; must undergo further GUDI analysis.
4. FAIL: Well will PASS if well construction deficiencies (section E or F) are repaired.
5. FAIL: Well may PASS if well construction details (section E or F) become available.

Analyst _____

Analyst Affiliation _____

Comments: _____

_____

_____

_____

_____

Directions for Completing Preliminary Assessment of Groundwater Sources That May be Under the Direct Influence of Surface Water

A. Type of Structure

1. If the structure is classified as a Spring or Infiltration Gallery, do not fill out sections B through G. Give a score of 40 and circle option 3 in section H.

2. A well with collection laterals is classified as an Infiltration Gallery. Give score of 40 and circle option 3 in section H.

B. Historical Pathogenic Organism Contamination

Self-explanatory.

C. Historical Microbiological Contamination

Base the acute and non-acute MCL violations on MOE records for the three years preceding the date the PA form is being filled out. Acute violations typically are related to Precautionary Drinking Water Advisories and Emergency Boil Water Orders issued because of fecal or E-coli presence. Non-acute violations are typically failure to sample violations.

D. Hydrological Features

Use available information to determine nearest surface water. Surface water is defined as any water that is open to the atmosphere and is subject to surface runoff. This includes perennial streams, intermittent streams, rivers, ponds, lakes, ditches, some wetlands, and natural or artificial impoundments that receive water from surface runoff. In cases of doubt, the deciding factor will be whether the MOE determines that the surface source may contribute surface organisms to the ground water source.

E. Well Construction

If well construction is unknown, score 30 points and go to section F. However, if the data is available to answer at least one of the two questions in this section, do not score 30 points for "unknown well construction" and score the two questions in this section. A confined aquifer would score 0 under the depth to screened interval portion of this section.

F. Well Intake Construction

If well intake construction is unknown, score 10 points and go to section G. However, if the data is available to answer at least one of the two questions in this section, do not score 10 points for "unknown intake construction" and score the two questions in this section. A confined aquifer would score 0 under this section.

G. Well Cap Construction

Is the top of the well properly sealed and vented to prevent contamination from entering the well? If not, score 15 points.

TOTAL SCORE _____

Add up all the points accumulated in sections A through G and enter the sum here.

Preliminary Assessment Determination

1. Well scored less than 40 points, and therefore is classified as ground water.

2. Well scored 40 points or more and could not mathematically score less than 40 points even if:
   a. Information not available to answer questions in sections E and/or F becomes available and that information indicates the lowest point penalty should be applied; or
   b. Well intake construction (section F) deficiencies are repaired.

3. Source automatically fails if it is a spring or infiltration gallery.

4. Well scored 40 points or more, but will score under 40 points if well intake construction deficiencies are repaired.

5. Well scored 40 points or more, and could mathematically score under 40 points if unknown information in section E becomes available.