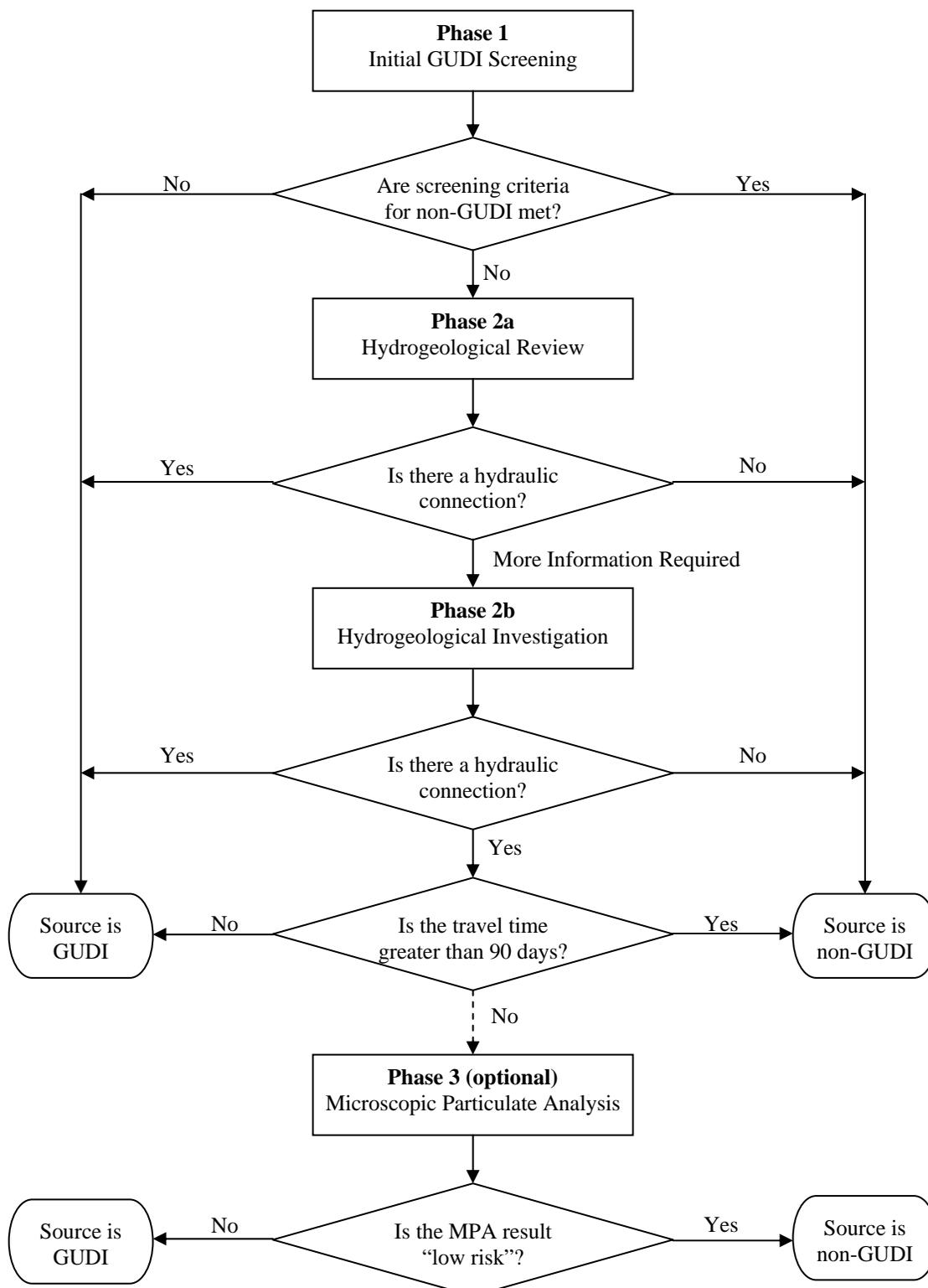


**General**

Well water or groundwater under the direct influence of surface water (GUDI) refers to groundwater supply sources that are hydraulically connected to nearby surface waters, and are thus vulnerable to contamination by pathogens. The vulnerability to contamination means that well water sources that are determined to be GUDI require treatment equivalent to that required for surface water sources.

This assessment guideline describes the protocol for determining whether a water well or groundwater source is GUDI or non-GUDI. The written documentation of the assessment and the conclusions derived from it must be sealed by a Professional Engineer who is licensed to practice in Yukon. The assessment is divided into three phases as outlined in the flow chart in Figure 1. The overall concept of the assessment guideline is to initially identify potential GUDI sources through a screening process and, depending on the results of the screening process, follow up with more detailed reviews and investigations to determine whether a source is GUDI or non-GUDI.

**Figure 1 - GUDI Assessment Flowchart**



The following describes the assessment phases and criteria shown in overview fashion in Figure 1.

## **Phase 1 – Initial GUDI Screening**

The purpose of the initial GUDI screening is to identify, where possible, non-GUDI sources that do not require a detailed assessment. The screening criteria are as follows:

1. Vulnerable location or type – the water source shall not be:
  - (a) a spring, infiltration gallery, shallow collector system or artificial recharge system;
  - (b) a well with a production zone located less than 15m below the ground surface;
  - (c) a well in an unconfined aquifer; or
  - (d) a well completed in fractured or karst bedrock exposed at or near the land surface.
2. Proximity to surface water – the water source shall not be located within 60m of any permanent, intermittent or seasonal surface water body, including ponds, sloughs, lakes, rivers, streams, canals, lagoons, reservoirs, or other surface water features.
3. Well construction – At a minimum, the well shall meet the requirements of the most recent version of the *Guidelines for Water Well Construction*, published by the Canadian Ground Water Association.
4. Water quality – The raw water from the source shall not exhibit evidence of contamination by or from surface water (i.e., significant occurrences of insects, insect parts, microorganisms such as *E.coli*, algae, *Giardia*, *Cryptosporidium*, or viruses; or significant and rapid shifts in water characteristics such as turbidity, temperature, conductivity, pH or chemistry that closely correlate to either weather events or surface water conditions).

Should a water source not meet any one of the above criteria, the source shall be either identified as GUDI, or as potentially GUDI with a further confirmatory assessment to be carried out under Phase 2. If the criteria under items 1 and 2 above are met, but not the criteria under 3 and/or 4, the system owner may, instead of proceeding to Phase 2, modify the well construction to ensure that the criteria under 3 and 4 are met.

## **Phase 2 – Hydrogeological Assessment**

The Phase 2 detailed hydrogeological assessment is divided into two parts – (a) a review of existing information; and (b) additional site investigations, data collection and analysis. The two phases may be carried out either separately or together.

### **Phase 2a –Hydrogeological Review**

The objective of the Phase 2a hydrogeological review is to determine if a water source can be designated as GUDI or non-GUDI based on existing data and factors that may not have been considered in the Phase 1 screening process. The following information is normally required for the Phase 2a review:

- geological / lithological data, including depth and thickness of production zones, overlying confining beds and other subsurface units;
- depth of surface water bodies, and penetration of any confining units by surface water bodies;
- cross-section(s) showing site stratigraphy in relation to surface water bodies;
- any history of flooding;
- pumping test results establishing recharge boundaries, recovery characteristics and hydraulic connections to surface water;
- hydraulic conductivity testing of confining units;
- historic groundwater and surface water elevation monitoring;
- historic groundwater and surface water quality data;
- calculations of groundwater gradients and flow direction; and
- estimates of time-of-travel between nearby surface water and the water supply source (where possible).

If the Phase 2a review establishes that there is no direct hydraulic connection or little likelihood of a direct hydraulic connection between the water source and surface waters, then the water source may be considered to be non-GUDI.

If there is reasonable uncertainty as to whether the source is GUDI or non-GUDI, the water source may either be declared GUDI or the assessment shall proceed to Phase 2b.

## **Phase 2b –Hydrogeological Investigation**

The objective of the Phase 2b hydrogeological investigation is to determine through additional data collection if there is an existing or potential direct hydraulic connection that could allow rapid recharge of the water source by surface water.

The hydrogeological investigation should lead to the identification and characterization of any direct hydraulic connection between the water source and surface water, and the time-of-travel between the surface water and the source. Various methods are available to determine time-of-travel, including, but not limited to, water quality analysis, computer modeling, pumping tests, surface and groundwater elevation monitoring, analytical methods and tracer tests. The choice of method(s) should take into account the proximity of the surface water body and/or anticipated travel times. For instance, analysis of water quality parameters such as temperature, conductivity and pH may be the best option for surface waters that are very close to a groundwater source in the same aquifer. It is recommended that monitoring of such parameters be collected on a weekly basis for a minimum of one year, unless a hydraulic connection is recognized early in the program.

If the Phase 2b investigation establishes that there is no direct hydraulic connection between the water source and surface waters, or if the time-of-travel between the surface water and the source is greater than 90 days, then the water source may be considered to be non-GUDI. Otherwise the source shall be identified as GUDI.

## **Phase 3 – Microscopic Particulate Analysis (optional)**

In a case where the Phase 1 and 2 assessments have identified a water source as GUDI, a third phase of assessment involving Microscopic Particulate Analysis (MPA) may be carried out at the option of the person seeking the determination of the water source as being non-GUDI.

The MPA is used to determine if there is sufficient natural filtration to remove most surface water organisms and debris, thus mitigating risks to human health. If used, MPA must be conducted according to the *Consensus Method for Determining Groundwater Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis* (US EPA, 1992). This document is may be obtained from Environmental Health Services.

Under this method, a “low risk” determination may be used to exempt the water source from the GUDI designation. A “medium risk” or “high risk” determination will require the water source to be designated GUDI.

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