INTRODUCTION

Drill cuttings are small rock or soil fragments produced when the drill bit breaks the subsurface material during drilling. They are carried to the surface by:

- **Drilling fluid (mud),**
- **Air (air rotary / DTH), or**
- **Water**

Cuttings provide indirect information about subsurface geology.
The main goals of drill cutting collection are to:

1. **Identify lithology** (rock/soil type)
2. **Detect changes** with depth
3. **Identify aquifers**
4. **Support geological interpretation**
5. **Create a drill log**

Drillers should collect representative samples at measured depths and at intervals that will show the complete lithologic character of the borehole.

Formation samples should be collected at 3 m (10 ft) intervals and every time there is a change in the formation.

DRILLING METHOD AFFECTING SAMPLES

The drilling method, the depth of the borehole, the penetration rate, and the type of drilling fluid have significant influences on the representativeness and quality of the sample.

When drilling in unconsolidated geological units it is important to avoid over grinding the cuttings–or they could get to the surface much smaller than they were in their natural state, thus biasing the sample quality.

In mud drilling, bentonitic clays, when viscous, tend to form part of the sample although there might be no clay present in the aquifer. Oftentimes the viscosity from the drilling fluid keeps some of the cuttings (especially fine grained particles) from settling during the short time that the fluid is circulated in the mud pit. Thus, the collected samples could exclude an important percentage of fine material. It is important to take note of these conditions as samples are being collected.

COLLECTION OF DRILL CUTTING SAMPLES

It is important to first establish a logging work area around the drill site, preferably away from the drilling operations. The samples should be collected in a consistent fashion to ensure that they are representative of the interval penetrated. The position of collection is critical to obtain a representative sample of the formation. It is important to note that the deeper the hole, the longer it takes for cuttings to reach the surface. This is especially important in mud drilling. Sometimes it takes 2-3 minutes for cuttings to reach the surface, therefore collection should be after that time period.

Air Drilling

In air drilling, a sample can be collected using a sieve or strainer just above the hole as cuttings are being air lifted to the surface as depicted in Fig 2 below.

Fig 2: Demonstration of drill cutting sample collection in air drilling

Mud Drilling

In mud drilling, a sample can be collected using a sieve or strainer at the point the mud comes to the surface before entering other equipment such as the settling pits and hydrocyclones. This is to ensure a representative sample of the formation is taken without mixing with other cuttings or material.

Fig 3: Demonstration of drill cutting sample collection in mud drilling

Thereafter, drill cuttings should be washed with water to remove drilling fluid from the cuttings and allow proper analysis of the cuttings when wet for more accurate colour identification.

During the washing, care is required so that a significant amount of fines are not removed. After washing, the samples can be more visible and the information documented in the drill log. It is also essential to take pictures of the washed samples, and these can be saved as an electronic data bank.

Fig 4a & 4b: Drill cutting samples before and after washing

STORING THE SAMPLES

Once documented/recorded, the samples should be placed in well labelled resealable bags. Care should be taken to label the bags in advance with permanent markers (sharpies) as it may be difficult to label wet bags during drilling operations. The label should contain the name of the drill site and the depth at which the sample was collected.

Fig 5: Transferring drill cutting samples into a resealable bag

Samples should be stored away from the drilling operations where they can be easily accessed and referenced. Where possible, these samples should be kept as long as possible. This serves as a bank of geological data of a particular area. The data is critical for remedying challenges with the water well or informing future drilling activities.

Fig 6: An example of well labeled bags stored away from drilling operations

RECORDING OF THE SAMPLES

The samples should be recorded in a driller's log according to basic classifications (sand, clay, or granite) and describe their color and consistency (coarse or free) when possible.

In general, the collection of hydrogeologic data from boreholes drilled for water wells is not consistent. An example of a consistent method is the Hydrogeologic Classification System for Water Well Boreholes (Hanna, 2006) which provides a methodology to identify and record consistent hydrogeologic data from boreholes. The HCSWB was developed to establish a framework for creating uniform borehole logs that leads to consistent interpretation. It incorporates important aspects of geologic description for distinguishing formation and aquifer characteristics, and documents important hydrologic characteristics that control groundwater flow. The two main parts of the HCSWB are a classification system and a field guide.

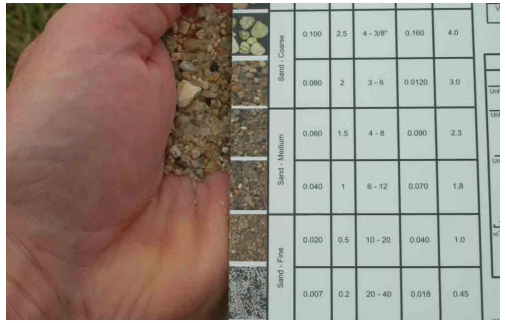

Fig 7: Demonstration of use of the HCSWB Field Guide for formation identification

CONCLUSIONS

Sample collection is an essential part of drilling where information about the lithology being drilled into is provided. This information serves to guide the design of the borehole.

It is important that the collection is done properly to yield the important data required.

Storing, logging and reporting is as important as sample collection as this builds a database for groundwater development and management.