

# **Assessing Innovative Soil Sampling Technology in Relation to Biosolids Application within Halton Region**

## **Halton SCIA Tier 1 Grant**

### Introduction

The push for utilizing Nutrient Management Plans or NASM Plans in respect to the 4R's is the reality of our future in agriculture. We need to look into soil sampling technologies that support a grower to apply nutrients in a sustainable manner. The goal of this project was to assess new soil sampling technologies that have come to the market in comparison with accepted sampling protocols that we have used for decades within the industry. More specifically, we compared the Soil Information System (SIS) from Trimble Agriculture to the Non-Agriculture Source Material (NASM) Plan soil sampling protocols regulated in the Nutrient Management Act.

### Project Objectives

- To assess the potential of new soil sampling technologies and how they compare with current practices as regulated under the Nutrient Management Act.
- To identify the improvements to soil sampling techniques to ensure compliance.
- To provide additional soil management information (physical, chemical and hydrological) and recommendations to the operator/producer which will provide further benefit to their operation.
- To demonstrate emerging soil management technologies to the Soil and Crop members across Ontario.

### Description of Current Practices

When sampling using the Nutrient Management Act (NMA) Protocols, it is difficult to get a representative sample. Human error in equally spacing the required amount of sub samples used for the composite sample will undoubtedly occur over the NASM application areas. The NMA protocols also states that samples should be taken to a depth of 15 centimetres. It is likely that samples taken are not always taken at exactly 15 centimetres. In addition, it is very hard to avoid bias while sampling, especially if the farmer cannot provide an accurate history of the management practices. The mixing of samples may also make it more difficult to get a representative sample. When soil is wet and/or has high clay content, it is very difficult to break up and mix the soil cores. This could cause some cores to not be included in the sample sent to the laboratory. All of these factors make it difficult to provide samples that are representative of the whole field. With NMA sampling there is also a higher chance of sample contamination. If a non-sterilized clean bucket or pail is used or if the auger has rusted, there is potential to cause sample contamination.

## Description of SIS Potential

SIS provides more accurate information regarding characteristics of a site. SIS sampling can measure the soil types within a field at a much smaller scale (1:35 versus 1: 63360 on the soils survey maps) For example, the site that was sampled was listed as a clay loam (hydrological soil group D). The SIS sampling method classified the site as sandy loam (hydrological soil group A) from the probing profile and also the physical soil test in the laboratory. During certain times of the year, to reduce the chance of biosolid runoff, the hydrological soil group greatly effects the application rate. Having a more accurate soil type will allow for application rates to be adjusted based off of the actual true runoff potential and reduce the chance of biosolids runoff.

SIS also uses RTK GPS to survey the field, thus creating a sub-inch elevation map. It is very difficult in the field to test for slopes, especially without a reference point in regard to NMA sampling. Accepted methods for slope determination often utilise a clinometer, only as accurate as the user. Using the SIS slope map that was created, slopes, slope length and slope direction taken in the field can be verified and adjusted to be more representative of the site.

SIS could also provide a more accurate depth to bedrock. In some cases, the depth to bedrock is not readily available. Available resources such as AgMaps do not provide this information and industry often looks at point information like well data to make the determination. This makes it very difficult to determine if a site has enough soil depth to be eligible for biosolids application. Using the SIS Horizon Thickness there is a respectable estimate of the soil depth to bedrock over the entire study area, and could determine areas of concern.

SIS sampling data also gives a good indication of where soil would become saturated, thus providing a more accurate idea of where pre-application test holes should be drilled before application. Currently there is very little direction in the NMA as to where test holes should be taken. The only requirement is that there must be 30cm of unsaturated soil before application. Regulators often like to see the test hole in NASM setback areas where groundwater contamination isn't possible during the application, not always indicative of the soil saturation throughout the entire application area. The Drainage Potential map generated by SIS is more accurate in determining where saturated soil could be present and can greatly reduce the risk of groundwater contamination and soil compaction during biosolids application.

When looking phosphorus soil levels, SIS can identify the variable chemistry within the soil in different geospatial zones. This information is beneficial for biosolids applicator because it allows them to utilize variable rate applications. This allows for areas that need more nutrients to receive more, and the areas that do not need the nutrients to receive less, therefore reducing input costs to the producer. From an environmental standpoint, it can potentially reduce P runoff rates from over applying in one area. Similarly, utilising the SIS data, improves accuracy on the pH levels throughout the application areas and biosolids applicators could adjust the application areas to avoid low pH areas that may not be captured under the NASM

sampling protocols. Current biosolids applications rates and areas are determined through the averaging of P and pH results within the application area. However, the current NMAN software for creating land application schedules or post application reports for a NASM plan does not allow for biosolids applications or other nutrient sources applications at variable rates.

SIS sampling data can also be utilised by the producer to make better management decisions based on soil variability of potassium (K) and other micronutrients such as copper, calcium, iron, magnesium, manganese, zinc and sulphate. Many of these micronutrients are not regulated or observed through the NASM sampling protocols at the degree of accuracy required for sound management decisions by the producer.

### Conclusions and Next Steps

Within this project, we have learned many ways we can apply biosolids more effectively and in a sustainable manner. In this report, we have highlighted how the soil chemistry, texture, slope, horizon thickness and hydrology maps SIS can aid the application of municipal biosolids. Moving forward in examining this technology would include a post biosolids application soil sample, examine yield data and to replicate this on more fields to make better data correlations. The more data to compare and ground truth new emerging soil technologies enables growers to hopefully use this data to make better informed decisions on their Nutrient Management Plans or Non Agricultural Source Material Plans.

### Description of the Educational Component

Initial discussions and trial layout documents were developed and circulated to the Halton Soil and Crop Improvement Association (HSCIA) board members for project consideration under the Tier-One grant program in the late fall of 2014. The SIS project team provided a power point presentation on the SIS technology to our membership at the 2015 Halton Soil and Crop Improvement Associations, Annual General Meeting on January 22<sup>nd</sup> of last year, outlining the Tier-One grant approval and project details. In October of 2015, the HSCIA hosted at SIS field day at the field where the SIS assessment had taken place. This was announced on the GHSCIA website and newsletter, and was open to all OSCIA members. Invitations were also extended to representatives from Halton Regional Council, the Ontario Ministry of Agriculture, Food and Rural Affairs and Ministry of the Environment and Climate Change. The field day outlined the project progress to date and included a hands-on demonstration of all aspects of data collection used by the SIS sampling technology. A presentation followed the equipment demonstration and lunch that provided members a view of the initial data that was collected from this project. An open discussion on the technology was then initiated among the members and the SIS project team. Shortly after the SIS field day the HSCIA was then invited to the Harvest Halton event hosted by the Region of Halton. The SIS sampling equipment was demonstrated to the general public and members of the agricultural community, along with the details of the SIS project. The OSCIA provincial display was also set up in the education tent at

this event along with pictorial slide show of the NASM sampling, SIS assessment and biosolids application that occurred at the project field.

The final report of this project was delivered to members at the HSCIA annual general meeting on January 13<sup>th</sup>, 2016, in Georgetown, Ontario and will be provided to all members attending OSCIA annual meeting in London, Ontario, February 9<sup>th</sup>, 2016.

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