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REPORT ON

TOWN OF FALCONBRIDGE
SOIL SAMPLING PROGRAM
COMPREHENSIVE FALCONBRIDGE SURVEY

Submitted to:

Falconbridge Limited
Sudbury Smelter Business Unit
Falconbridge, Ontario
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September 11, 2001

011-9233-5000

EXECUTIVE SUMMARY

Falconbridge Limited (Falconbridge) has initiated a program to assess the environmental significance of metals in soils on lands adjacent to and beyond Falconbridge's smelter located in the City of Greater Sudbury, Ontario. The initial activity of this program consisted of soils collection and analysis, the results of which are provided in this report. Future program activities will include a comprehensive review of all metals data, including those collected over the past 30 years by the Ontario Ministry of the Environment (MOE), an assessment of the degree to which these metals are available for uptake by plants and animals and potentially therefore by local residents, coupled with an active program of community consultation. This program is currently being developed by Falconbridge.

Golder Associates Ltd. (Golder) was retained by Falconbridge to conduct the soils sampling activities and prepare this report. This sampling program was developed with input from the Ministry of the Environment to ensure consistency with previous soils programs conducted within the Sudbury Basin. The MOE identified all procedures relating to sample collection, sample preparation and laboratory analyses. At the request of the MOE, Laurentian University was retained to prepare the soil samples for laboratory analysis and Lakefield Research Ltd. were retained to conduct all chemical analyses. The MOE provided quality assurance of these activities.

Soils were collected from 33 locations chosen as representative of lands owned either by Falconbridge or Inco, public lands within the Town of Falconbridge, and of undisturbed lands within 2 km of the town. Sampled sites included parks, wooded areas, residential yards, a school, playgrounds, grassy areas, vacant lots, gravel lots and grass medians. At each location, soils were collected from approximately 15 to 30 discrete points and then sectioned over 3 depth intervals; from 0 - 5 cm, 5 - 10 cm and 10 - 20 cm. A second set of soil cores was collected at each sample location. Consistent with MOE procedures, this second sample is identified as a 'duplicate'. The general land use at each sample location was noted and the possible use of fertilizer identified. Each sample location was photographed.

All samples were prepared for analysis by Laurentian University, using the same protocol as used previously for samples collected elsewhere in the Sudbury Basin by the MOE. Each sample was completely air dried at room temperature, twigs, stones and aggregated matter were removed and the sample passed through a 2.0 mm sieve. A portion of the sieved sample was ground to pass through a 355μm sieve and placed in a glass jar.

The prepared samples were then forwarded to the Environmental Analytical Services Division of Lakefield Research Ltd. for analysis. The analytical methodology and the metals parameter list were determined by the MOE, again to be consistent with earlier soils programs completed by the

MOE. Approximately 0.5 g of homogenized sample was acidified, heated in a MARS 5 MAW2 microwave oven, diluted with deionized water, and analysed by Inductively Coupled Plasma Optical Emission Spectrometer. This parameter list consisted of 20 metals including arsenic, cobalt, copper and nickel as well as pH, carbonate, total inorganic carbon and electrical conductivity.

The observed concentrations in soils range up to 297 µg/g for arsenic, 150 µg/g for cobalt, 1,600 µg/g for copper and 1,600 µg/g for nickel. The distribution of metals concentrations does not show a trend with distance from the smelter stack or with depth. The metals concentrations in some duplicate samples also display obvious variations. The data obtained indicate that the metals concentrations in soil vary substantially both laterally and with depth.

The results obtained from this program were compared with the generic soil criteria developed by the Ministry of the Environment in the “Guideline for Use at Contaminated Sites in Ontario” (1997) to provide a preliminary assessment of the significance of the observed metals concentrations. Of the 20 metals analysed, the concentrations of four metals, arsenic, cobalt, copper and nickel exceeded generic soil criteria at some locations. It is to be noted that generic soil criteria were developed for soils with pH values in the range of 5 to 9. The observed pH in soil includes some values in the pH range of 4 and, as such, lies outside the range considered for generic soil criteria development. Site specific soil criteria may therefore need to be developed and applied to assess the environmental significance of metals in soils at Falconbridge. In addition, the Sudbury Basin is underlain by mineralized bedrock and hence local soils contain elevated metals concentrations relative to other areas of Ontario. As such, the background concentration of metals within soils of the Sudbury Basin may also need to be determined as part of this assessment.

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by Falconbridge Limited (Falconbridge) to undertake a soil sampling program within and adjacent to the Town of Falconbridge, located in the City of Greater Sudbury, Ontario (Figure 1). The objective of this program was to determine metals concentrations in surficial soils on lands adjacent to and beyond Falconbridge's Smelter site. This program is an initial step (first phase) in a soil sampling program that will in future, include areas further afield and also on the Falconbridge Smelter site. To ensure consistency with the many soil sampling programs conducted within the Sudbury Basin, the MOE hosted a workshop to present the soil sampling methodology. Golder attended this workshop and the sample methods employed herein, follow those prescribed by the MOE. The methodology for sample preparation, undertaken by Laurentian University, follows the procedure set out by the MOE. The metals parameters list included in the laboratory analytical program is consistent with the parameter list developed by the MOE for earlier soil sampling programs in the Sudbury Basin.

This soil sampling program comprises the initial activity in a program currently being developed by Falconbridge to assess the environmental significance of metals in soils. This program likely will include:

- detailed historical review of smelter operations and metals releases;
- review of historical sampling programs (air, soil, water, vegetation, etc.) conducted by various groups (Falconbridge, Inco, Ministry of the Environment, etc.) in the Sudbury Basin;
- determination of probable background concentrations for metals of concern applicable to the Sudbury Basin;
- further sampling of soils and vegetation;
- speciation analysis for metals of concern;
- assessment of bioavailability to plants, animals and humans; and
- a human health and ecological risk assessment.

This report provides the factual results of the analyses of soil samples collected by Golder from within and adjacent to the Town of Falconbridge.

1.1 Background

Since 1971, soil sampling programs have been conducted by the Ministry of the Environment (MOE) and Inco Limited (Inco) to determine the concentrations of metals in soils and vegetation across the Sudbury Basin. These data are understood to have been developed to assess the effects of operation of the Inco 'Superstack' that was constructed in 1972. It is understood that the MOE will be publishing a report in the fall of 2001 that will include the results of all their soil sampling programs to date.

Although soil sampling has been conducted over a period of 30 years, the MOE recognize that numerous gaps still remain to be addressed. Therefore, the MOE, with Falconbridge and Inco, have jointly developed a soil sampling program to address some of these gaps. This program is to be implemented in the summer and fall of 2001 and consists of the following:

- The MOE will collect soil samples from all schools, parks and beaches across the Sudbury Area and at selected residential properties in areas closest to the smelter sites.
- Falconbridge and Inco will each collect soil samples in remote areas and conduct studies to determine background concentrations of metals of concern in soils.
- Falconbridge will collect soil samples within and adjacent to the Town of Falconbridge, the results of which are provided in this report.

Mining activities have been conducted at the site by Falconbridge beginning in 1929 and smelting activities commenced in 1930. The Town of Falconbridge was developed immediately west of the smelter to serve the local workforce. Over the years, a variety of activities have been conducted on the Falconbridge site including: exploration, mining, milling, smelting and disposal of waste products from the mineral processing (i.e., tailings, pyrrhotite concentrate and slag). Mining was discontinued with the closing of the East Mine in 1990. Ore milling and concentrating began in 1932 and continued until 1988. Smelting operations are ongoing.

2.0 SAMPLING AND ANALYTICAL PROGRAM

The following sections describe the methodology used by Golder for the collection of soil samples, the subsequent processing of these samples by Laurentian University (Laurentian) and the laboratory analysis of the samples by Lakefield Resources Ltd. (Lakefield). Soil sampling was conducted between July 9th and July 12th and on July 27th, 2001.

All field work was supervised and carried out by staff of Golder's Environmental Group. Falconbridge personnel facilitated access to the sampling sites.

2.1 Sampling Site Selection

Soil sampling sites were selected based on discussions between Golder and Falconbridge and a reconnaissance of the area. For purposes of ensuring access, sampling sites were limited to properties owned by Falconbridge and Inco, as well as municipal and crown lands. In areas outside of the Town of Falconbridge, sample sites were selected at a distance of more than 100 metres of roadways, railway and power right-of-ways.

Sample locations were selected to provide for spatial coverage and representation of different terrain types including disturbed and native (undisturbed) areas. A total of thirty-three sites were sampled, including parks (3 sites), wooded areas (14 sites), residential yards (3 sites), schools (1 site), playgrounds (2 sites), grassy areas (4 sites), vacant lots (3 sites), gravel lots (1 site) and grass medians (2 sites). Sampling sites were numbered GSS-1 through GSS-33 and are shown on Figure 2. Table 1 lists the UTM coordinates of each sampling site. Photographs of each sampling site are included in Appendix A. It should be noted that sample sites GSS-3 and GSS-33 were located in a former tailings deposition area (Ballpark Tailings) that has been reclaimed and developed into sports fields and playground areas.

2.2 Soil Sampling

Soil samples were collected according to standard protocol in the MOE publication "*Field Investigation Manual, Part 1, General Methodology*" (MOE, May 1993). In addition, a sampling clinic was conducted by the MOE on June 20, 2001, and attended by Golder, Laurentian and MOE sampling crews to ensure consistency in sampling methodologies for all soil sampling activities to be completed in this program.

At each sampling site, an appropriate sample location was determined. In residential areas, samples were collected from the least disturbed areas. Disturbed areas and structures that could compromise the results were avoided. These included septic systems, metal walls, painted walls, peeling paint, hydro lines, chain link fences, sidewalks, driveways, walkways and roads. The approximate age of the home and potential use of fertilizers was noted. In parks and schoolyards, well-worn areas of most exposure and a representative area of large fields were sampled. Areas of fill, woodchips, fences and painted lines on fields were avoided.

In wooded areas, sampling was conducted in a 10 m circle of soil, scraping away duff (leaf/grass litter) with a boot or hand. Wet areas, dense moss and lichen cover, or areas all under one tree type were avoided.

Once an appropriate sample location was chosen at a sampling site, the UTM (Universal Transverse Mercator, Canada Mean NAD 27) coordinates were taken with a GPS unit (Garmin GPS 12XL) and recorded on station description forms provided by the MOE. On the form, the sample name and location were recorded, a sketch of the area and the sample location drawn and sample labels for the lab (provided by MOE) were recorded. The station description forms are included in Appendix B. Each site was also photographed.

Soil cores were collected using either of two stainless steel augers: an Oakfield Soil Sampler with a footjack and a larger diameter Star Quality Soil Sampler. The augers were cleaned with distilled water and brushes and flushed with sample soil between sample locations. Soil was cored by pushing the auger into the soil to 20 cm or the maximum attainable depth, rotating to the right to break off the core, enlarging the hole slightly and removing the auger from the soil taking care to maintain the bottom of the sample. At each sampling site, a digital photo of a representative core in the auger with a label and scale was taken (Appendix A) and a written description of a representative core obtained. According to MOE procedure, a large "W" pattern was walked and cores collected along this pattern until a full sample was obtained. A full sample was considered to be 30 Oakfield cores or 15 of the larger diameter cores. In sites where gravel fill was encountered and where coring was difficult, samples were collected by digging a pit with a stainless steel trowel and collecting depth samples from the sides of the pit with the trowel, as per MOE protocol.

Duplicate samples (see Section 2.5) were collected during a second pass over each sampling site where an additional 30 small soil cores or 15 larger soil cores were collected. These samples are identified as 'duplicates' to agree with MOE protocols for this program. It is to be noted that the 'duplicate' sample is not a split from the first sample, but rather a separate sample, or replicate, collected from the same area.

Each core was sectioned according to MOE depth protocol: from 0 to 5 cm depth, from 5 to 10 cm depth and from 10 to 20 cm depth. Cores were sectioned using a stainless steel spatula. Each depth interval was placed in a plastic bag, which included lab labels provided by MOE. Original samples were labelled with even numbers and duplicate samples with odd numbers, as per MOE protocol. If a full section was not collected (e.g., the total soil depth was less than 20 cm), the portion available was collected and a note was made. The bags were tied shut and stored at room temperature until shipped for processing.

2.3 Sample Preparation

Soil samples were processed at Laurentian. Soils were processed according to Standard Operating Procedure by the Ontario Ministry of the Environment Standards Development Branch/ Laboratory Services Branch (Appendix C). Soils were laid out on plastic trays and completely air dried at room temperature. The fully dried samples were disaggregated and twigs, rocks and stones removed. The remaining soil was passed through a 2.0 mm sieve (Number 10 mesh) and any material not passing through the sieve discarded. A sub-sample of the portion less than 2.0 mm was ground with a mortar and pestle or mechanical grinder until it passed through a 355 um sieve (Number 45 mesh). The sieve and mortar and pestle were cleaned between samples. The portion of soil smaller than 355 µm was stored in a 125 mL glass jar until analysis.

After processing, samples were shipped by Laurentian to Lakefield for chemical analysis.

2.4 Laboratory Analysis

The prepared soil samples were analysed at the Environmental Analytical Services Division of Lakefield according to Method #9-2-37 (June 2000). The sample was mixed thoroughly to ensure sub-samples would be homogenous. Between 0.5 and 0.505 g of the sample was weighed into a Teflon sleeve and was treated with 5 ml each of concentrated HNO_3 and HCl. The vessels were placed in a MARS 5 MAW2 Microwave Oven, put through a heat cycle and allowed to cool to less than 60^{o}C. The contents were poured into 50 ml volumetric flasks and diluted to volume with deionized water. Chemical analysis was by Inductively-Coupled Plasma-Optical Emission Spectrometer (ICP-OES).

2.5 Quality Assurance/Quality Control

Several quality assurance / quality control measures were followed in both the field and laboratory programs of this study.

In the field, a second sample was taken at each soil sampling site. According to MOE procedure, two separate passes were made over a large “W” pattern and 30 smaller cores or 15 larger cores collected during each pass. The soils from each pass were stored and managed separately. The soil from the second pass was considered as the ‘duplicate’ sample, and the samples were sectioned and stored separately from the original. It is to be noted that the duplicate sample is not a sub-sample of the original but rather a second sample from the same site.

The original and duplicate samples were analysed separately and concentrations compared. The minimum, maximum, and mean differences in duplicate concentrations were calculated. Table 2 summarizes the duplicate analysis for each depth interval. The concentration of some duplicates was exactly the same, and the mean difference between duplicate concentrations was generally low. The mean difference between duplicates decreases with depth in the soil profile.

The samples were analysed at Lakefield, which is certified by the Standards Council of Canada (accredited ISO/IEC Guide 25 level) and the Canadian Association of Environmental Analytical Laboratories. The calibration and testing activities at Lakefield follow the requirements of the ISO/IEC 900 series standards. According to the Lakefield Research Analytical Services Description of Quality Control and Accreditation (Appendix D), quality control measures include duplicate samples, spiked blanks, spiked replicates, reagent/instrument blanks, preparation control samples, certified reference material analysis and instrument control samples. Lakefield indicates that at least 20% of samples analysed are quality control samples.

3.0 INVESTIGATIVE RESULTS

3.1 Physical Characteristics

The soils in the Sudbury area are glacially-derived, sandy and loamy classification, and vary greatly in texture and organic matter content across the area (Dudka et al., 1995). The soils sampled in and around the Town of Falconbridge varied in structure, texture, colour and profile thickness from one site to the next. Also some general differences were observed between soil cores in disturbed sites and those collected from undisturbed wooded or grassy sites. Soils sampled at disturbed sites (in parks, residential yards, schools, gravel lots, vacant lots and grass medians) tended to be more difficult to core which resulted in a shallower average sample depth than soils sampled in wooded or grassy sites. Soil cores from developed sites were generally less than 20 cm in total thickness and, as a result, the 10 to 20 cm increment was often not a full sample. Cores in these areas were also compacted and horizons were more consolidated than those observed at undisturbed wooded/grassy areas.

Soil cores generally consisted of a dark brown, thin organic matter cover (average ~3 cm thick) underlain by light to dark brown, fine- to medium-textured sandy horizons. Gravel fill and pebbles and cobbles were encountered more often in developed sites than in wooded sites. Soil cores from wooded sites generally contained thicker organic horizons (average ~5 cm) were underlain by sand horizons with an observed higher fraction of organic material than that at developed sites. In wooded and grassy sites, the average grain size was finer and a lighter grey, silty horizon was sometimes encountered relative to developed sites. Detailed soil core descriptions are included in Table 2 and a photograph of a typical core at each site is included in Appendix A.

3.2 Chemical Characteristics

All soil samples were analysed for total inorganic carbon, carbonate, soil pH, conductivity, and trace metals including aluminium, arsenic, barium, beryllium, cadmium, calcium, cobalt, copper, chromium, iron, magnesium, manganese, molybdenum, nickel, lead, strontium, vanadium, zinc, antimony and selenium. The chemical results are provided in Table 4.

Based on previous studies undertaken by the MOE, metals of particular concern in the Sudbury area are arsenic (As), copper (Cu) and nickel (Ni). In addition, as discussed in Section 3.2.1, the observed concentrations of cobalt appear to be a concern. Table 5 lists the Arsenic, Cobalt, Copper and Nickel concentrations for the three depth intervals and duplicates, at each sampling site. For the purposes of this study, duplicate samples were treated separately and concentrations were not averaged.

Spatial variations in soil concentrations at the three depth intervals for the four metals of concern are presented on Figures 3 – 50. These maps were produced using the Golden Software Surfer 7 software package (contour maps, kriging grid method). These maps are statistical approximations of the spatial distribution of the different parameters. These maps should only be used as an interpretative tool to provide information on approximate areas and/or patterns of metals concentrations and cannot be used to infer parameter concentrations at locations not directly sampled. Soil concentrations are only known with certainty at those sites for which soil was actually sampled and chemically analysed. The mapping of concentrations is significantly affected by the spatial distribution of the sampling sites and the software used to generate the contours. The reliability of the contours diminishes at the edges of the map as well as in large areas where there are no or very few samples.

Variations in soil concentrations with depth for the four metals of concern at each sampling point are presented graphically on Figures 51 – 58.

3.2.1 Regulatory Criteria

Generic soil and groundwater remediation criteria for various land uses are presented in the MOE document "Guideline for Use at Contaminated Sites in Ontario, February, 1997" and can be used for comparison purposes. These generic soil criteria were developed to encompass a wide variety of soil conditions and environmental variables, so that the Ministry can be certain that these soil criteria are protective of human and ecological health throughout the province.

The Ontario Ministry of the Environment Guideline document also allows for the development of site-specific criteria using specific site information. These criteria are developed through a site-specific risk assessment and offer the same level of protection as the generic criteria. The generic soil criteria were developed to be applicable in cases where soil pH ranges from 5 to 9. The data in this report indicate that surface soil pH ranges from approximately 4 to 7. As a result, the generic criteria will not be applicable to some portions of the Study area and it may be necessary to develop site-specific criteria that reflect local environmental conditions for this Study area.

For comparison purposes, the analytical results were compared to the criteria for coarse grained soils where groundwater is used for drinking water supplies (Table A of the above Guideline document). Results for arsenic, cobalt, copper and nickel were observed to exceed these criteria at several locations. In addition, the criteria for lead was exceeded at two locations (GSS-10 and GSS-19) and the criteria for chromium was exceeded at one location (GSS-31). As noted above, for the observed pH conditions, these criteria are not everywhere applicable and site-specific criteria may need to be developed.

3.2.2 Metals of Concern

The surface soil criteria for residential and parkland use presented in the MOE document "Guideline for Use at Contaminated Sites in Ontario, February, 1997" are exceeded for arsenic, cobalt, copper, and nickel at locations in the Town of Falconbridge. The maximum, minimum and mean concentrations for these metals are listed below.

Depth	Minimum	Maximum	Mean
Arsenic:			
0 - 5 cm	5	220	33 (n=66)
5 - 10 cm	5	280	26 (n=65)
10 - 20 cm	5	297	18 (n=63)
Cobalt:			
0 - 5 cm	5.5	120	22 (n=66)
5 - 10 cm	1.9	150	12 (n=65)
10 - 20 cm	2.2	75	9.5 (n=64)
Copper:			
0 - 5 cm	46	1600	322 (n=66)
5 - 10 cm	15	1200	180 (n=65)
10 - 20 cm	9.5	800	111 (n=63)
Nickel:			
0 - 5 cm	60	1600	316 (n=66)
5 - 10 cm	22	850	157 (n=65)
10 - 20 cm	17	980	103 (n=64)

The areas of high and low metal concentrations correlate between these metals. In general, high copper, cobalt, nickel, and arsenic concentrations occur in the same areas (GSS-33, GSS-10, GSS-21, GSS-24, and GSS-7). Low concentrations of all metals are seen along Longyear Road from Falconbridge to Garson and in the central section of town.

Arsenic

The concentrations of arsenic in soil varies spatially. The highest surface (0 – 5 cm) soil Arsenic concentration within the Town of Falconbridge is observed at GSS-10 (220 µg/g). GSS-10 was collected from a vacant lot next to #5 Morlock Street. GSS-32, collected from the Parkinson Street playground adjacent to GSS-10, shows an arsenic concentration approximately 10 times lower (24 µg/g). Concentrations were also high at GSS-33 (160 µg/g), the playground at the Lindsley Street ballfield. Three sites on the edge of town, GSS-7, GSS-13 and GSS-24, also show high concentrations of arsenic (210, 193 and 144 µg/g, respectively). GSS-7 is from a wooded area at the end of Lindsley Street, GSS-13 is from a grassy area off a dirt road from Lakeshore Street and GSS-24 is from a wooded area off Longyear Street. The arsenic concentration from most of the samples collected within the town is below 100 µg/g. In general, surface soil arsenic concentrations are lower in town than just outside town. Concentrations on Longyear Road to Garson are also lower (between 5 and 74 µg/g).

The highest intermediate (5 – 10 cm) soil arsenic concentration is just outside the Town of Falconbridge, at GSS-7 (280 µg/g), and is also high at GSS-13 (160 µg/g). Within the Town of Falconbridge, the highest intermediate soil concentration is at GSS-10 (190 µg/g). Most arsenic concentrations in soil collected from sites within the town are below 50 µg/g. In general, intermediate soil arsenic concentrations are lower in town than just outside town. The higher concentrations just outside town grade to lower concentrations on Longyear Road toward Garson (between 5 and 41 µg/g).

The highest deep (10 – 20 cm) soil arsenic concentration is just outside the Town of Falconbridge, at GSS-7 (297 µg/g) and is also high at GSS-13 (190 µg/g). Within the Town of Falconbridge, the highest deep soil concentration is at GSS-10 (160 µg/g). In general, deep soil arsenic concentrations are lower in town than just outside town. Most town soil concentrations fall below 50 µg/g. Concentrations along Longyear Road toward Garson are also lower (between 5 and 16 µg/g).

Arsenic concentrations generally decrease or do not change significantly with depth in the soil profile. Exceptions to this trend include significant increases in already high concentrations with depth at GSS-7 and GSS-13, and an increase from low to higher concentrations with depth at GSS-1, GSS-4, GSS-9 and GSS-19. GSS-1 is from a park at Lindsley Street and Parkinson Street, GSS-4 is from the backyard of the lodge on Edison Street, GSS-9 is from a grassy area at Lakeshore Street and Morlock Street and GSS-19 is from a gravel lot at the Edison Street fire hall.

Cobalt

The concentration of cobalt in soils varies spatially. The highest surface (0 – 5 cm) soil cobalt concentration is in the Town of Falconbridge at GSS-9 (120 µg/g), a grassy area at Lakeshore and Morlock Streets. Cobalt concentration is also elevated at GSS-21 (76 µg/g), the grassy area between the church and rink at Mott and Franklin Streets. Most sites in town have concentrations below 60 µg/g, with many below 40 µg/g. In general, surface soil cobalt concentrations are lower in the centre of town and increase to the town edge. Concentrations further from town, on Longyear Road to Garson, are also lower (between 5 and 16 µg/g).

The highest intermediate (5 – 10 cm) soil cobalt concentration is in the Town of Falconbridge at GSS-9 (150 µg/g), a grassy area at Lakeshore and Morlock Streets. With the exception of GSS-9, most sites in town have concentrations that are low, with many below 21 µg/g. Concentrations on Longyear Road toward Garson are lower (between 1.9 and 7.6 µg/g).

The highest deep (10 – 20 cm) soil cobalt concentration is within the Town of Falconbridge at GSS-11 (75 µg/g), the vacant lot next to #33 Rix Street, and is also high at GSS-12 (57 µg/g), the vacant lot at Lakeshore and MacDonnell Streets. In general, deep (10 – 20 cm) soil cobalt concentrations are lower in the north end of town than the south. With the exception of GSS-12 and GSS-11, sites in town have concentrations below 40 µg/g, with many below 21 µg/g. Concentrations along Longyear Road toward Garson are low (between 2.2 and 5.1 µg/g).

Cobalt concentrations generally decrease or do not change significantly with depth in the soil profile. Exceptions to this trend include increases at GSS-1 and GSS-11.

Copper

The concentration of copper in soils varies spatially. The highest surface (0 – 5 cm) soil copper concentration is within the Town of Falconbridge at GSS-33 (1,600 µg/g), the playground at the Lindsley Street ballfield. Copper concentrations are also high at GSS-10 (1,400 µg/g), the vacant lot next to #5 Morlock Street and GSS-21 (1500 µg/g), the grassy area between the church and rink near Mott and Franklin Streets. A site on the edge of town, GSS-24, also shows high concentrations (1,200 µg/g). In general, surface (0 – 5 cm) soil copper concentrations are lower on the east side of town and increase to the west. Concentrations further from town, on Longyear Road to Garson, are lower (between 49 and 470 µg/g).

The highest intermediate (5 – 10 cm) soil copper concentration is within the Town of Falconbridge, at GSS-10 (1,200 µg/g). One site on the edge of town, the wooded area GSS-7, also shows high concentrations (1,100 µg/g). In general, intermediate soil copper concentrations are lower in town than just outside town. Most sites in town have concentrations below 500 µg/g. The higher concentrations just outside town grade to lower concentrations on Longyear Road toward Garson (between 15 and 200 µg/g).

The highest deep (10 – 20 cm) soil copper concentration is just outside the Town of Falconbridge, at GSS-7 (800 µg/g). Within the Town of Falconbridge, the highest deep soil concentration is at GSS-1 (650 µg/g), the park at Lindsley and Parkinson Streets and GSS-10 (530 µg/g), the vacant lot next to #5 Morlock Street. In general, deep soil copper concentrations are lower in town than just outside town. Most sites in town have concentrations below 500 µg/g, with many below 225 µg/g. Concentrations along Longyear Road toward Garson are low (9 to 110 µg/g).

Copper concentrations generally decrease or do not change significantly with depth in the soil profile. The exception to this trend is a significant increase at GSS-1 with depth.

Nickel

The concentration of nickel in soils varies spatially. The highest surface (0 – 5 cm) soil nickel concentration is on the edge of Town of Falconbridge at GSS-21 (1,600 µg/g), a grassy area between the United Church and Memorial Rink off Lindsley Street. Within the Town of Falconbridge, the highest concentration is at GSS-33 (1,200 µg/g), the playground at the Lindsley Street ballfield, with additional high concentrations at GSS-14 (1200 µg/g), #6 Cobalt Street and GSS-10 (960 µg/g), a vacant lot next to #5 Morlock Street. On the edge of town, GSS-24 shows high nickel concentrations (820 µg/g). Most sites in town have samples that are below 1,000 µg/g, with many below 500 µg/g. In general, surface soil nickel concentrations are lower on the east side of town and increase to the west. Concentrations further from town, on Longyear Road to Garson, are lower (160 to 280 µg/g).

The highest intermediate (5 – 10 cm) soil nickel concentration is within the Town of Falconbridge at GSS-10 (850 µg/g), the vacant lot next to #5 Morlock Street and an elevated concentration is also present at GSS-33 (750 µg/g), the playground at the Lindsley Street ballfield. Concentrations are also high on the edge of town at GSS-21 (580 µg/g). In general, intermediate soil nickel concentrations are higher surrounding these sites, and lower with increasing distance from the sites. Many sites in town have concentrations below 500 µg/g. Concentrations on Longyear Road toward Garson are lower (22 to 140 µg/g).

The highest deep (10 – 20 cm) soil nickel concentration is within the Town of Falconbridge at GSS-10 (980 µg/g), the vacant lot next to #5 Morlock Street and at GSS-12 (700 µg/g), the vacant lot at Lakeshore and MacDonnell Streets. In general, deep soil nickel concentrations are lower in the north end of town than the south. Most sites in town have concentrations below 500 µg/g. Concentrations along Longyear Road toward Garson are low (17 to 54 µg/g).

Nickel concentrations generally decrease or do not change significantly with depth in the soil profile. Exceptions to this trend include increases at GSS-1 and GSS-12.

4.0 CLOSURE

We trust that this is sufficient for your current needs. We are prepared to review the contents of this report at your convenience.

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Table 1: Site Descriptions

Sampling Site	UTM Zone	Easting	Northing	Location Description
GSS-1	17T	514457	5157956	Park at Lindsley St. and Parkinson St.
GSS-2	17T	514409	5158331	Wooded area off Edison St. near legion
GSS-3	17T	514442	5158154	Park (field), Lindsley St. entrance
GSS-4	17T	514220	5158314	Yard (back) of Lodge on Edison St.
GSS-5	17T	514076	5158166	Field at Falconbridge School on Edison St.
GSS-6	17T	514054	5158373	Yard (back) at #115 Lindsley St.
GSS-7	17T	513836	5158493	Wooded area at end of Lindsley St.
GSS-8	17T	514663	5157819	Park on Hardy St. between Longyear St. and Lakshore St.
GSS-9	17T	514626	5157692	Grassy area at Lakeshore St. and Morlock St.
GSS-10	17T	514568	5157764	Vacant lot next to #5 Morlock St.
GSS-11	17T	514494	5157660	Vacant lot next to #33 Rix St.
GSS-12	17T	514474	5157533	Vacant lot at Lakeshore St. and MacDonnell St.
GSS-13	17T	514220	5157462	Grassy area off dirt road off Lakeshore St.
GSS-14	17T	514129	5157829	Yard (back) at #6 Cobalt St. (at Cobalt St. and Chesser St.)
GSS-15	17T	513862	5158134	Wooded area off Lindsley St. (at turn in road)
GSS-16	17T	514076	5157818	Wooded area off MacMillan St. near Cobalt St.
GSS-17	17T	513794	5157337	Grassy area off Longyear St. (between Edison St. turnoff and town)
GSS-18	17T	513443	5157479	Wooded area off Edison St (between Longyear turnoff and old gravel road)
GSS-19	17T	514454	5158091	Gravel lot behind Fire Hall off Edison St.
GSS-20	17T	513595	5158182	Wooded area off old gravel road off Edison St. (at turn in road)
GSS-21	17T	514094	5157984	Grassy area between United Church and Memorial Rink near Mott St. and Franklin St.
GSS-22	17T	514509	5157870	Grass median at Longyear St. and Morlock St.
GSS-23	17T	514283	5157755	Grass median at Longyear St. and Hodge St./MacDonnell St.
GSS-24	17T	514096	5157567	Wooded area off Longyear St. near Auto Port
GSS-25	17T	513594	5157251	Wooded area off Longyear St. (between Edison St. turnoff and town)
GSS-26	17T	513098	5157386	Wooded area off Longyear St. (near Edison St. turnoff)
GSS-27	17T	513031	5157292	Wooded area off Longyear St. (past Edison St. turnoff towards Garson)
GSS-28	17T	512645	5157177	Wooded area off Longyear St. (past Edison St. turnoff towards Garson)
GSS-29	17T	512515	5157324	Wooded area off Longyear St. (past Edison St. turnoff towards Garson)
GSS-30	17T	511952	5157242	Wooded area off Longyear St. (past Edison St. turnoff towards Garson)
GSS-31	17T	511944	5157091	Wooded area off Longyear St. (past Edison St. turnoff towards Garson)
GSS-32	17T	514519	5157740	Playground on Parkinson St. between Longyear St. and Lakeshore St.
GSS-33	17T	514310	5158161	Playground near ballfield and community center, Lindsley St. entrance

Table 2: Duplicate Analysis

Species		Depth Interval		
		0-5 cm	5-10 cm	10-20 cm
Arsenic:				
	minimum difference between duplicates	0	0	0
	maximum difference between duplicates	62	97	73
	mean difference between duplicates	7.5 (n=29)	8.6 (n=29)	7.0 (n=23)
	duplicates with no difference	4	3	4
Cobalt:				
	minimum difference between duplicates	0	0	0
	maximum difference between duplicates	44	117	30
	mean difference between duplicates	2.8 (n=30)	2.3 (n=29)	1.2 (n=27)
	duplicates with no difference	3	4	5
Copper:				
	minimum difference between duplicates	0	0	0
	maximum difference between duplicates	423	280	410
	mean difference between duplicates	54 (n=29)	42 (n=30)	23 (n=30)
	duplicates with no difference	4	2	2
Nickel:				
	minimum difference between duplicates	0	0	0
	maximum difference between duplicates	440	270	480
	mean difference between duplicates	58 (n=30)	35 (n=31)	22 (n=28)
	duplicates with no difference	3	2	4

TABLE 3
DETAILED SOIL CORE DESCRIPTIONS

Site	Soil Core Description
GSS-1	• Thin horizon of clipped grass at top of core underlain by a ~3 cm dark brown, rooted, matted organic horizon and a mottled sandy horizon to 20 cm. • Sand is medium to light brown, fine-grained and well packed. • Average sample depth is ~15 cm. • Landscaped and very compacted, probable fertilizer use.
GSS-2	• Thin organic horizon (~1 cm) at top of core underlain by a medium brown to grey sand horizon to 20 cm. • Sand is unconsolidated and fine-grained to very fine-grained. • Average sample depth is ~20 cm.
GSS-3	• Thin grass and organic horizon (~1 cm) at top of core underlain by light to dark brown sand. • Sand is very compact and dense and certain cores are dark brown and muddy at depth. • Tailings are encountered at ~15 cm depth, accompanied by a change in colour from dark brown to orange. • Average sample depth is ~20 cm.
GSS-4	• Thin grass at top of core underlain by ~5 cm dark brown, rooted, matted organic horizon and a sand horizon. • Sand is medium-grained texture and grades in colour from dark brown to light brown with depth. • Average sample depth is ~15 cm. • Landscaped, probable fertilizer use.
GSS-5	• Grass underlain by a ~2 cm, fairly loose, unrooted organic horizon, underlain by a 1 cm thick dark brown, medium-grained sand horizon and a very fine-grained, light brown, unconsolidated sand horizon to depth. • Average sample depth is ~5 to 10 cm. • Landscaped, probable fertilizer use.

TABLE 3 (CONTINUED)
DETAILED SOIL CORE DESCRIPTIONS

Site	Soil Core Description
GSS-6	• Grass and a 2 cm dark brown, rooted organic horizon grades into a 3 cm thick fungal, dark brown sand horizon, a 2 cm thick fine-grained, light brown sand horizon and a dark brown sand horizon to depth. • Dark brown sand is medium-grained grading to coarse at depth and certain cores include woody fragments and possible charcoal. • Cores are very compact and soil is easily compressed in the core. • Average sample depth is ~15 cm. • Landscaped residence yard, probable fertilizer use.
GSS-7	• Thin (~2 cm) rooted organic mat at top of core is underlain by fine-grained, dark brown sand horizon to depth. • Certain cores contain light grey, silty-textured sand in the bottom 5 cm of the cores; certain cores contain orange-brown sand in the bottom 5 cm. • Average sample depth is ~20 cm. • Near gravel and slag chip parking lot.
GSS-8	• Grass and a dark brown, rooted organic mat horizon ~3 cm thick is underlain by a dark brown muddy sand horizon to ~8 cm and lighter brown, coarser-grained sand to depth. • Certain cores contain fine-grained, grey silt at depth. • Average sample depth is ~15 cm (less for silty-bottomed cores). • Landscaped, probable fertilizer use.
GSS-9	• Thin (~2 cm) organic horizon mixed with gravel at top of core underlain by coarse-grained, gravelly grey to brown sand to ~5 cm, underlain by more compacted, finer-grained, lighter brown sand to depth. • Average sample depth is ~15 cm. • Sample area was long and thin, so sampled in a transect pattern.
GSS-10	• Litter and organic mat ~2 cm at top of core underlain by a 15 cm thick horizon of organic-rich, dark brown, fine-grained sand to depth. • Certain cores contain a few cm of light brown, coarse-grained sand near 20 cm. • Average sample depth is 20 cm. • Definite fertilizer and liming use. • Neighbour commented that grass will not grow on this vacant lot despite multiple fertilizing attempts.

TABLE 3 (CONTINUED)
DETAILED SOIL CORE DESCRIPTIONS

Site	Soil Core Description
GSS-11	• Thin grass and 3 cm of dark brown, organic mat at top of core underlain by a horizon of very fine-grained, light grey to light brown, dry, unconsolidated sand to ~10 cm depth. • Between 10 and 12 cm depth, sand is coarser-grained to gravelly and unconsolidated. • Average sample depth is 12 cm. • Landscaped and freshly cut grass, probable fertilizer use. • Sampling area was narrow, took samples in a transect pattern to avoid fences, pathways and other structures.
GSS-12	• Sample location is on gravel fill. • Gravel is medium grey to brown, coarse-grained with pebbles and cobbles (up to 6 cm diameter) at depth and very unconsolidated. • Average sample depth is ~15 cm; below this depth is only large cobbles. • Site was too gravelly for coring, so sampled by pit using a stainless steel trowel.
GSS-13	• Core is entirely composed of sand, very fine-grained and medium to dark brown colour. • Sand is muddy and very compacted at depth. • In certain cores, charcoal is encountered between 15 and 20 cm depth and in other cores a grey, metallic sheet silcate is encountered between 5 and 10 cm depth. • Cores contain a coarser-grained, orange-brown sand between 15 and 20 cm depth. • Average sample depth is 20 cm. • Site is gravelly and washout/muddy in places.
GSS-14	• Grass and a rooted organic mat (~3 cm) underlain by an organic-rich horizon of dark brown, unconsolidated, fine-grained silty sand to 15 cm depth. • Certain cores contain lighter brown sand at depth. • Average sample depth is 15 to 17 cm. • Landscaped residence yard, probable fertilizer use.
GSS-15	• Organic, rooted mat 4 cm thick underlain by a 5 cm thick horizon of lighter brown-grey sand and a horizon of light brown, fine-grained, unconsolidated sand to 20 cm depth. • In certain cores, charcoal is encountered between 5 and 7 cm depth. • Average sample depth is 20 cm.

TABLE 3 (CONTINUED)
DETAILED SOIL CORE DESCRIPTIONS

Site	Soil Core Description
GSS-16	• Organic rooted mat from top of core to 5 cm underlain by either a dark brown, medium-grained, muddy sand horizon or a more unconsolidated, light orange-brown medium-grained sand horizon. • Average sample depth is between 15 and 20 cm.
GSS-17	• Organic-rich, rooted, dark brown soil horizon from top of core to ~12 cm depth underlain by a horizon of consolidated, lighter brown-orange, fine-grained sand to depth. • Average sample depth is between 15 and 20 cm.
GSS-18	• Cores variable at this sample location. • Cores contain a thick (~10 cm) organic muddy soil underlain by either a light-grey, marl-looking sand or an orange-brown, fine-grained, very wet sand to depth. • Core samples are very wet and muddy, may be some slight cross-contamination. • Average sample depth is 20 cm. • Site is quite wet and boggy, some cross-contamination may occur.
GSS-19	• Sample location is on gravel fill. • Gravel is medium grey to brown, coarse-grained, very unconsolidated and persists to depth. • Some darker brown soil is mixed in with gravel and large cobbles. • Average sample depth is 20 cm. • Site is too gravelly to sample by coring, so sampled by pit using a stainless steel trowel.
GSS-20	• A mossy, muddy, dark brown organic horizon (~3 to 5 cm) is underlain by a horizon of orange-brown, medium-grained, fairly consolidated sand to depth. • Certain core had mottled sand at depth, with thin horizons of light-grey, medium-grained sand. • Average sample depth is 20 cm.
GSS-21	• Entire core is organic-rich and fairly consolidated, with very little sand at depth in certain cores. • Gravel is interspersed throughout many cores. • Average sample depth is 15 to 17 cm. • Site is very gravelly.

TABLE 3 (CONTINUED)
DETAILED SOIL CORE DESCRIPTIONS

Site	Soil Core Description
GSS-22	• A 5 cm thick grass and organic, consolidated mat horizon underlain by a horizon of fine-grained, light brown, unconsolidated sand to a maximum core depth of 10 cm. • Deeper cores contain between 5 and 10 cm of light grey silt under the organic horizon, with a darker brown, fine-grained sand at depth. • Average sample depth is 10 to 15 cm. • Site is a narrow median, so sampled in a transect pattern. • Landscaped, probable fertilizer use.
GSS-23	• A ~3 cm thick horizon of grass and organic mat underlain by a horizon of medium brown, silty sand to depth. • Average sample depth is 15 cm, with some to 20 cm. • Site is a narrow median, so sampled in a transect pattern. • Landscaped, probable fertilizer use.
GSS-24	• Grass, thin moss, and organic dark brown, rooted, consolidated mat from top of core to 5 cm depth underlain by an orange-brown, medium-grained sand that grades from dark to light with depth. • Average sample depth is between 15 and 20 cm.
GSS-25	• Very thin organic horizon (~1 cm) underlain by light brown, medium-grained, very dry, unconsolidated sand to 15 cm depth and lighter brown, unconsolidated sand to depth. • Average soil depth is 20 cm.
GSS-26	• Thin (~2 cm), fairly unconsolidated organic horizon underlain by light brown, fine-grained sand to depth which grades slightly from darker to lighter brown with increasing depth. • Average sample depth is 20 cm.
GSS-27	• Thin (~2 cm), fairly unconsolidated organic horizon underlain by a medium orange-brown, fine-grained sand which grades in colour to light brown sand at depth. • Average sample depth is 20 cm.
GSS-28	• Unconsolidated organic horizon from top of core to ~3 cm underlain by fine-grained, unconsolidated sand to depth. • Sand varies from mottled light grey and light brown in certain cores to orange-brown and light brown mottled in other cores. • Average sample depth is 20 cm.

TABLE 3 (CONTINUED)
DETAILED SOIL CORE DESCRIPTIONS

Site	Soil Core Description
GSS-29	• Thin (~2 cm), rooted, dark brown organic mat at top of core underlain by ~2 cm of organic-rich, dark brown sand that grades to light brown, fine-grained sand persisting to depth. • In certain cores, lighter brown sand is present at depth. • Average sample depth is 15 to 20 cm.
GSS-30	• Thick organic-rich, dark brown, rooted mat from top of core to 5 cm depth underlain medium brown, fine- to medium-grained, consolidated sand to depth. • Between 15 and 20 cm, sand is very wet and muddy. • Certain cores contained light grey sand at depth. • Average sample depth is 20 cm.
GSS-31	• Organic-rich, dark brown medium-grained sand from top of core to ~10 cm depth underlain by light brown to light grey sand, to orange-brown, medium-grained soil at depth. • Average sample depth is 20 cm.
GSS-32	• Thin (~2 cm) grassy, rooted organic horizon at top of core underlain by up to 15 cm of light brown, unconsolidated, fine-grained sand. • Average sample depth 10-15 cm. • Playground, landscaped, probable fertilizer use.
GSS-33	• Thin (~3 cm), rooted, dark brown organic horizon at top of core underlain by up to 15 cm of medium brown, unconsolidated, fine-grained sand. • Average sample depth 10-15 cm. • Playground, landscaped, probable fertilizer use.

Table 4: Analytical Results

Sample ID	Site	Depth		C(t)	CO3	Soil pH	Conductivity	Al	As ICP	As hydride
Detection Limit				---	---	0.25	25	100	5	5
MOE Guideline									**20**	**20**
		cm		**%**	**%**	**units**	**µmhos/cm**	**µg/g**	**µg/g**	**µg/g**
2001-12001	GSS-1	0-5	d	6.01	< 0.05	6.34	353	9000	---	6
2001-12007	GSS-2	0-5	d	2.35	0.85	6.53	68	11000	---	42
2001-12013	GSS-3	0-5	d	2.11	< 0.05	6.4	94	9800	---	56
2001-12019	GSS-4	0-5	d	6.06	0.08	5.54	99	7100	---	70
2001-12025	GSS-5	0-5	d	3.51	< 0.05	5.97	191	8200	---	< 5
2001-12031	GSS-6	0-5	d	4.58	0.55	6.84	204	6700	---	15
2001-12037	GSS-7	0-5	d	5.73	0.78	6.48	327	14000	210	---
2001-12043	GSS-8	0-5	d	3.8	< 0.05	6.28	115	9400	---	6
2001-12049	GSS-9	0-5	d	5.13	0.75	6.77	330	9800	---	23
2001-12055	GSS-10	0-5	d	5.58	0.13	5.48	128	7100	220	---
2001-12061	GSS-11	0-5	d	7.17	< 0.05	5.65	391	9200	---	16
2001-12067	GSS-12	0-5	d	1.15	< 0.05	7.25	178	6600	---	15
2001-12073	GSS-13	0-5	d	2.74	0.2	5.37	96	11000	140	---
2001-12079	GSS-14	0-5	d	9.46	0.51	6.3	506	7000	---	27
2001-12085	GSS-15	0-5	d	2.73	< 0.05	4.64	65	9700	110	---
2001-12091	GSS-16	0-5	d	3.34	< 0.05	5.38	58	12000	---	75
2001-12097	GSS-17	0-5	d	6.44	< 0.05	4.89	78	10000	---	58
2001-12103	GSS-18	0-5	d	4.27	0.1	4.53	88	6800	---	59
2001-12109	GSS-19	0-5	d	0.89	0.2	6.86	128	7200	---	61
2001-12115	GSS-20	0-5	d	2.84	0.25	4.95	52	8900	120	---
2001-12121	GSS-21	0-5	d	10.1	0.05	5.52	83	8300	---	80
2001-12127	GSS-22	0-5	d	2.99	< 0.05	6.82	109	9200	---	8
2001-12133	GSS-23	0-5	d	2.95	< 0.05	5.94	87	8300	---	21
2001-12139	GSS-24	0-5	d	3.62	0.2	5.25	86	9700	193	---
2001-12145	GSS-25	0-5	d	1.13	< 0.05	6.18	34	8500	---	9
2001-12151	GSS-26	0-5	d	1.4	0.05	5.75	60	6500	---	26
2001-12157	GSS-27	0-5	d	1.51	< 0.05	4.55	36	6400	---	55
2001-12163	GSS-28	0-5	d	1.77	< 0.05	4.33	22	6600	---	39
2001-12169	GSS-29	0-5	d	1.52	0.27	7.28	73	7200	---	8
2001-12175	GSS-30	0-5	d	5.59	0.1	5.2	65	5500	---	74
2001-12181	GSS-31	0-5	d	2.43	< 0.05	4.6	22	4900	---	32
2001-12187	GSS-32	0-5	d	1.69	< 0.05	5.9	87	6800	---	13
2001-12193	GSS-33	0-5	d	6.86	0.1	5.2	102	9800	160	---
2001-12000	GSS-1	0-5		6.54	< 0.05	6.05	420	9200	---	< 5
2001-12006	GSS-2	0-5		1.98	0.65	6.41	130	8500	---	50
2001-12012	GSS-3	0-5		1.99	< 0.05	6.3	88	8400	---	57
2001-12018	GSS-4	0-5		4.25	0.05	5.86	169	8300	---	14
2001-12024	GSS-5	0-5		3.16	< 0.05	5.84	81	11000	---	< 5
2001-12030	GSS-6	0-5		6.33	0.55	6.95	324	5500	---	15
2001-12036	GSS-7	0-5		5.14	0.55	6.49	197	13000	200	---
2001-12042	GSS-8	0-5		4.47	< 0.05	6	228	11000	---	7
2001-12048	GSS-9	0-5		4.85	1.1	6.84	389	11000	---	17
2001-12054	GSS-10	0-5		7.06	0.24	5.36	105	8000	200	---
2001-12060	GSS-11	0-5		6.72	< 0.05	5.48	360	9100	---	16
2001-12066	GSS-12	0-5		1.08	< 0.05	6.6	86	6200	---	8.5
2001-12072	GSS-13	0-5		3.22	0.89	5.24	61	12000	158	---
2001-12078	GSS-14	0-5		8.29	0.17	6.3	318	6800	---	23
2001-12084	GSS-15	0-5		2.98	0.1	4.82	59	9400	131	---
2001-12090	GSS-16	0-5		3.92	< 0.05	4.95	62	9200	110	---
2001-12096	GSS-17	0-5		6.54	< 0.05	4.62	127	9200	---	52
2001-12102	GSS-18	0-5		4.82	0.09	4.08	80	7000	121	---

Sample ID	Site	Depth		C(t)	CO3	Soil pH	Conductivity	Al	As ICP	As hydride
Detection Limit				---	---	0.25	25	100	5	5
MOE Guideline									**20**	**20**
		cm		**%**	**%**	**units**	**µmhos/cm**	**µg/g**	**µg/g**	**µg/g**
2001-12108	GSS-19	0-5		0.16	< 0.05	7.17	80	9300	---	8
2001-12114	GSS-20	0-5		4.26	< 0.05	4.65	65	9800	120	---
2001-12120	GSS-21	0-5		6.71	0.15	5.62	125	6200	---	81
2001-12126	GSS-22	0-5		3.1	0.05	6.52	158	8000	---	< 5
2001-12132	GSS-23	0-5		2.67	< 0.05	6.38	112	8200	---	< 5
2001-12138	GSS-24	0-5		3.75	0.25	5.14	72	9600	144	---
2001-12144	GSS-25	0-5		0.88	< 0.05	6.63	152	8200	---	< 5
2001-12150	GSS-26	0-5		1.48	< 0.05	5.63	56	6400	---	24
2001-12156	GSS-27	0-5		2	< 0.05	4.66	40	6100	---	56
2001-12162	GSS-28	0-5		0.92	0.15	4.45	36	6600	---	23
2001-12168	GSS-29	0-5		1.41	0.4	6.79	62	8600	---	6
2001-12174	GSS-30	0-5		4.2	0.05	5.3	55	4800	---	64
2001-12180	GSS-31	0-5		3.31	< 0.05	4.39	21	4400	---	36
2001-12186	GSS-32	0-5		2.55	< 0.05	5.6	91	6600	---	21
2001-12192	GSS-33	0-5		5.97	0.08	5.3	97	8800	130	---
2001-12005	GSS-1	10-20	d	1.9	< 0.05	5.8	83	7500	---	24
2001-12011	GSS-2	10-20	d	0.71	< 0.05	5.62	55	10000	---	< 5
2001-12017	GSS-3	10-20	d	1.54	< 0.05	5.47	152	16000	---	29
2001-12023	GSS-4	10-20	d	3.06	0.05	5.6	94	11000	---	45
2001-12035	GSS-6	10-20	d	2.95	< 0.05	6.54	65	8700	---	7
2001-12041	GSS-7	10-20	d	4.01	0.11	4.54	69	12000	297	---
2001-12047	GSS-8	10-20	d	1.19	< 0.05	6.38	34	8400	---	9
2001-12053	GSS-9	10-20	d	3.63	0.05	4.56	101	11000	---	34
2001-12059	GSS-10	10-20	d	2.96	0.05	6.68	114	8100	150	---
2001-12065	GSS-11	10-20	d	4.5	< 0.05	6.07	72	10000	---	33
2001-12071	GSS-12	10-20	d	3.6	< 0.05	6.62	175	6800	---	19
2001-12077	GSS-13	10-20	d	1.88	0.17	5.03	63	16000	190	---
2001-12083	GSS-14	10-20	d	3.65	< 0.05	6.78	127	8300	---	21
2001-12089	GSS-15	10-20	d	0.97	< 0.05	4.88	74	15000	---	5.5
2001-12095	GSS-16	10-20	d	1.69	< 0.05	5.19	128	21000	---	15
2001-12101	GSS-17	10-20	d	1.98	< 0.05	5.85	98	9100	---	24
2001-12107	GSS-18	10-20	d	1.43	< 0.05	4.29	70	8500	---	7
2001-12113	GSS-19	10-20	d	0.5	< 0.05	6.73	99	11000	---	11
2001-12119	GSS-20	10-20	d	2.24	0.05	4.55	67	10000	---	57
2001-12125	GSS-21	10-20	d	7.56	< 0.05	4.86	58	7500	---	18
2001-12131	GSS-22	10-20	d	1.52	< 0.05	6.58	79	9100	---	< 5
2001-12137	GSS-23	10-20	d	2.71	< 0.05	6.2	110	7600	---	12
2001-12143	GSS-24	10-20	d	1.58	< 0.05	5.23	87	15000	---	9
2001-12149	GSS-25	10-20	d	0.42	< 0.05	6.24	54	6600	---	< 5
2001-12155	GSS-26	10-20	d	0.68	< 0.05	5.99	108	8200	---	6
2001-12161	GSS-27	10-20	d	0.99	< 0.05	4.8	54	9100	---	16
2001-12167	GSS-28	10-20	d	0.8	< 0.05	4.69	44	11000	---	6
2001-12173	GSS-29	10-20	d	0.67	< 0.05	7.2	71	8000	---	< 5
2001-12179	GSS-30	10-20	d	0.95	< 0.05	5.52	57	7200	---	< 5
2001-12185	GSS-31	10-20	d	0.9	< 0.05	4.43	36	10000	---	< 5
2001-12191	GSS-32	10-20	d	1.37	< 0.05	5.7	55	6600	---	21
2001-12197	GSS-33	10-20	d	3.02	< 0.05	5.1	50	7500	---	16
2001-12004	GSS-1	10-20		3.01	< 0.05	5.78	123	8500	---	97
2001-12010	GSS-2	10-20		0.62	< 0.05	5.78	84	9700	---	13
2001-12016	GSS-3	10-20		1.34	< 0.05	5.6	152	15000	---	37
2001-12022	GSS-4	10-20		2.87	< 0.05	5.21	93	9400	---	89

Sample ID	Site	Depth		C(t)	CO3	Soil pH	Conductivity	Al	As ICP	As hydride
Detection Limit				---	---	0.25	25	100	5	5
MOE Guideline									**20**	**20**
		cm		**%**	**%**	**units**	**µmhos/cm**	**µg/g**	**µg/g**	**µg/g**
2001-12034	GSS-6	10-20		3.79	0.05	6.79	79	8800	---	< 5
2001-12040	GSS-7	10-20		3.81	0.15	4.84	85	12000	270	---
2001-12046	GSS-8	10-20		1.15	< 0.05	6.43	56	8300	---	< 5
2001-12052	GSS-9	10-20		2.38	0.12	6.5	139	11000	---	45
2001-12058	GSS-10	10-20		3.14	0.17	6.35	90	8600	160	---
2001-12070	GSS-12	10-20		2.21	0.25	6.36	61	8500	---	17
2001-12076	GSS-13	10-20		2.08	0.2	5.28	83	12000	190	---
2001-12082	GSS-14	10-20		4.08	0.06	6.79	86	7200	---	19
2001-12088	GSS-15	10-20		1.32	< 0.05	5.01	145	16000	---	10
2001-12094	GSS-16	10-20		3.86	0.1	5.06	91	15000	---	61
2001-12100	GSS-17	10-20		1.54	< 0.05	6.13	60	8100	---	22
2001-12106	GSS-18	10-20		1.33	< 0.05	4.42	65	8200	---	7
2001-12112	GSS-19	10-20		0.98	0.3	8.29	214	9400	---	42
2001-12118	GSS-20	10-20		1.53	< 0.05	4.31	54	11000	---	69
2001-12124	GSS-21	10-20		9.93	< 0.05	4.81	75	6400	---	40
2001-12130	GSS-22	10-20		1.42	< 0.05	6.84	42	8000	---	7
2001-12136	GSS-23	10-20		1.53	0.15	6.55	89	6800	---	15
2001-12142	GSS-24	10-20		1.85	< 0.05	5.31	67	14000	---	13
2001-12148	GSS-25	10-20		0.37	< 0.05	7.01	50	7000	---	< 5
2001-12154	GSS-26	10-20		0.8	< 0.05	5.73	64	7700	---	< 5
2001-12160	GSS-27	10-20		1.11	< 0.05	4.97	56	8300	---	16
2001-12166	GSS-28	10-20		0.74	< 0.05	4.44	30	12000	---	< 5
2001-12172	GSS-29	10-20		0.75	< 0.05	6.2	84	7800	---	< 5
2001-12178	GSS-30	10-20		0.94	< 0.05	5.29	41	8300	---	< 5
2001-12184	GSS-31	10-20		1.02	< 0.05	4.36	33	8900	---	< 5
2001-12190	GSS-32	10-20		0.76	< 0.05	5.9	34	6100	---	11
2001-12196	GSS-33	10-20		7.88	< 0.05	5.8	NSS	8800	---	14
2001-12003	GSS-1	5-10	d	1.73	< 0.05	6.15	88	8300	---	9
2001-12009	GSS-2	5-10	d	1.21	0.1	6.26	74	13000	---	24
2001-12015	GSS-3	5-10	d	1.77	< 0.05	6.31	54	9100	---	74
2001-12021	GSS-4	5-10	d	3.31	0.22	6.1	137	7900	---	63
2001-12027	GSS-5	5-10	d	2.13	< 0.05	NSS	NSS	12000	---	< 5
2001-12033	GSS-6	5-10	d	2.73	< 0.05	6.75	122	8200	---	13
2001-12039	GSS-7	5-10	d	4.56	0.06	5.52	84	12000	280	---
2001-12045	GSS-8	5-10	d	2.4	< 0.05	6.12	48	8900	---	7
2001-12051	GSS-9	5-10	d	5.34	0.24	5.35	296	14000	---	28
2001-12057	GSS-10	5-10	d	3.72	0.25	6.69	222	9100	160	---
2001-12063	GSS-11	5-10	d	3.94	0.05	5.71	85	8400	---	24
2001-12069	GSS-12	5-10	d	1.19	< 0.05	6.76	81	6200	---	9
2001-12075	GSS-13	5-10	d	1.47	0.23	5.39	56	10000	160	---
2001-12081	GSS-14	5-10	d	8.05	0.28	6.67	277	9400	---	24
2001-12087	GSS-15	5-10	d	2.5	< 0.05	5	135	14000	---	62
2001-12093	GSS-16	5-10	d	2.14	< 0.05	5.34	75	16000	---	43
2001-12099	GSS-17	5-10	d	4.82	< 0.05	5.96	67	10000	---	28
2001-12105	GSS-18	5-10	d	2.45	< 0.05	4.24	59	5700	---	28
2001-12111	GSS-19	5-10	d	1.07	0.2	6.44	46	8700	---	57
2001-12117	GSS-20	5-10	d	3.4	< 0.05	4.2	62	11000	140	---
2001-12123	GSS-21	5-10	d	7.08	< 0.05	5.23	69	7500	---	29
2001-12129	GSS-22	5-10	d	1.52	< 0.05	6.33	75	9100	---	9
2001-12135	GSS-23	5-10	d	2.48	0.1	6.25	73	8200	---	8
2001-12141	GSS-24	5-10	d	2.75	< 0.05	4.87	37	12000	120	---

Table 4: Analytical Results

Sample ID	Site	Depth		C(t)	CO3	Soil pH	Conductivity	Al	As ICP	As hydride
Detection Limit				---	---	0.25	25	100	5	5
MOE Guideline									**20**	**20**
		cm		**%**	**%**	**units**	**µmhos/cm**	**µg/g**	**µg/g**	**µg/g**
2001-12147	GSS-25	5-10	d	0.77	0.05	6.46	56	7800	---	< 5
2001-12153	GSS-26	5-10	d	0.9	< 0.05	5.92	55	8100	---	12
2001-12159	GSS-27	5-10	d	1.12	< 0.05	4.62	57	8800	---	36
2001-12165	GSS-28	5-10	d	1.3	< 0.05	4.42	36	9500	---	19
2001-12171	GSS-29	5-10	d	0.68	< 0.05	6.88	36	7000	---	< 5
2001-12177	GSS-30	5-10	d	1.74	< 0.05	5.48	43	7600	---	10
2001-12183	GSS-31	5-10	d	1.86	< 0.05	4.34	41	8400	---	10
2001-12189	GSS-32	5-10	d	1.52	< 0.05	5.8	57	7200	---	20
2001-12195	GSS-33	5-10	d	8.43	< 0.05	5.2	68	10000	---	44
2001-12002	GSS-1	5-10		2.04	0.5	5.95	63	8600	---	9
2001-12008	GSS-2	5-10		1.52	0.4	6.38	129	11000	---	32
2001-12014	GSS-3	5-10		1.84	< 0.05	6.26	92	9500	---	52
2001-12020	GSS-4	5-10		3.47	0.05	5.45	74	9300	---	56
2001-12032	GSS-6	5-10		3.9	0.15	7.1	152	9200	---	8.6
2001-12038	GSS-7	5-10		4.58	0.13	5.01	73	13000	254	---
2001-12044	GSS-8	5-10		1.96	< 0.05	6.4	64	8600	---	5
2001-12050	GSS-9	5-10		6.13	0.88	4.5	190	10000	---	26
2001-12056	GSS-10	5-10		3.44	0.15	6.01	63	9700	190	---
2001-12062	GSS-11	5-10		3.79	< 0.05	5.78	71	9000	---	26
2001-12068	GSS-12	5-10		1.79	0.15	6.75	122	7800	---	17
2001-12074	GSS-13	5-10		1.75	0.39	5.48	92	11000	133	---
2001-12080	GSS-14	5-10		9.08	0.32	6.75	174	8700	---	19
2001-12086	GSS-15	5-10		1.51	< 0.05	4.74	55	11000	---	39
2001-12092	GSS-16	5-10		3.34	0.05	4.9	54	14000	140	---
2001-12098	GSS-17	5-10		3.48	< 0.05	5.84	50	8100	---	40
2001-12104	GSS-18	5-10		2.38	< 0.05	4.95	63	6700	---	10
2001-12110	GSS-19	5-10		0.77	0.05	7.35	130	7800	---	33
2001-12116	GSS-20	5-10		3.34	< 0.05	4.48	60	11000	140	---
2001-12122	GSS-21	5-10		7.05	< 0.05	5.27	90	9800	---	51
2001-12128	GSS-22	5-10		1.24	< 0.05	6.19	82	9400	---	< 5
2001-12134	GSS-23	5-10		1.47	< 0.05	6.02	58	8600	---	12
2001-12140	GSS-24	5-10		2.16	0.05	6.44	51	11000	---	70
2001-12146	GSS-25	5-10		0.52	< 0.05	6.2	43	8200	---	10
2001-12152	GSS-26	5-10		0.9	< 0.05	6.33	52	6900	---	16
2001-12158	GSS-27	5-10		1.49	< 0.05	4.64	45	8300	---	41
2001-12164	GSS-28	5-10		1.01	< 0.05	4.4	38	10000	---	6
2001-12170	GSS-29	5-10		1.01	< 0.05	6.66	81	6800	---	< 5
2001-12176	GSS-30	5-10		1.78	< 0.05	5.18	43	7000	---	9
2001-12182	GSS-31	5-10		2.1	< 0.05	4.31	41	7300	---	27
2001-12188	GSS-32	5-10		2.55	< 0.05	5.5	64	8800	---	21
2001-12194	GSS-33	5-10		6.53	< 0.05	5.4	70	12000	---	37

Sample ID	Site	Depth		Ba	Be	Cd	Ca	Co	Cu	Cr	Fe	Mg	Mn	Mo
Detection Limit				20	1	0.8	50	10	20	20	100	50	50	1.5
MOE Guideline				**750**	**1.2**	**12**		**40**	**225**	**750**				**40**
		cm		**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**
2001-12001	GSS-1	0-5	d	38	< 0.5	< 0.8	5200	11	83	57	12000	2000	160	1.5
2001-12007	GSS-2	0-5	d	56	< 0.5	1	6200	22	300	44	21000	4700	230	2.4
2001-12013	GSS-3	0-5	d	33	< 0.5	1.2	2800	41	690	41	14000	2600	140	< 1.5
2001-12019	GSS-4	0-5	d	38	< 0.5	1.2	4400	38	900	45	17000	2500	170	1.9
2001-12025	GSS-5	0-5	d	39	< 0.5	< 0.8	4500	8.9	51	52	21000	2900	210	< 1.5
2001-12031	GSS-6	0-5	d	32	< 0.5	1.3	8200	32	490	39	15000	2700	170	< 1.5
2001-12037	GSS-7	0-5	d	100	< 0.5	1.1	10000	25	1100	43	29000	2300	150	1.6
2001-12043	GSS-8	0-5	d	35	< 0.5	< 0.8	4900	10	79	42	11000	2300	160	2.5
2001-12049	GSS-9	0-5	d	73	< 0.5	1.8	9000	120	460	150	27000	5400	260	17
2001-12055	GSS-10	0-5	d	44	< 0.5	1.9	2900	68	1400	74	32000	2000	110	4.5
2001-12061	GSS-11	0-5	d	35	< 0.5	1.7	6000	29	210	55	15000	2400	190	5.3
2001-12067	GSS-12	0-5	d	37	< 0.5	< 0.8	3800	55	240	110	22000	3600	200	8
2001-12073	GSS-13	0-5	d	43	< 0.5	< 0.8	2700	38	730	53	28000	2900	170	3
2001-12079	GSS-14	0-5	d	44	< 0.5	2	8400	49	830	40	16000	3400	180	1.7
2001-12085	GSS-15	0-5	d	53	< 0.5	< 0.8	2100	26	660	38	20000	1500	120	< 1.5
2001-12091	GSS-16	0-5	d	45	< 0.5	1	2900	22	470	59	22000	2400	160	1.8
2001-12097	GSS-17	0-5	d	52	< 0.5	1.6	3500	35	800	41	22000	2000	280	1.7
2001-12103	GSS-18	0-5	d	33	< 0.5	< 0.8	1400	16	390	26	17000	1100	74	< 1.5
2001-12109	GSS-19	0-5	d	45	< 0.5	< 0.8	3100	41	470	86	31000	3500	190	4.1
2001-12115	GSS-20	0-5	d	46	< 0.5	< 0.8	1400	20	520	39	23000	1900	130	1.8
2001-12121	GSS-21	0-5	d	49	< 0.5	2.5	5100	70	1300	81	24000	2600	180	5.4
2001-12127	GSS-22	0-5	d	36	< 0.5	< 0.8	4700	9.9	52	43	11000	2300	160	< 1.5
2001-12133	GSS-23	0-5	d	30	< 0.5	< 0.8	3500	26	210	46	14000	1900	140	3.1
2001-12139	GSS-24	0-5	d	52	< 0.5	1.3	3100	44	1200	60	28000	2400	150	2.6
2001-12145	GSS-25	0-5	d	26	< 0.5	< 0.8	2200	8.8	93	27	11000	1700	120	< 1.5
2001-12151	GSS-26	0-5	d	20	< 0.5	< 0.8	1800	11	200	26	12000	1300	92	< 1.5
2001-12157	GSS-27	0-5	d	23	< 0.5	< 0.8	1500	11	260	29	13000	1400	120	< 1.5
2001-12163	GSS-28	0-5	d	27	< 0.5	< 0.8	1600	6.4	160	27	11000	1000	100	< 1.5
2001-12169	GSS-29	0-5	d	23	< 0.5	< 0.8	5200	6.2	66	29	9700	1800	96	< 1.5
2001-12175	GSS-30	0-5	d	48	< 0.5	< 0.8	910	13	470	28	16000	870	67	< 1.5
2001-12181	GSS-31	0-5	d	27	< 0.5	< 0.8	1200	7	220	26	10000	760	82	< 1.5
2001-12187	GSS-32	0-5	d	29	< 0.5	0.9	2600	19	170	43	14000	2600	160	3.6
2001-12193	GSS-33	0-5	d	48	< 0.5	2.7	3500	54	1600	60	29000	3000	150	2.9
2001-12000	GSS-1	0-5		41	< 0.5	< 0.8	5600	11	73	48	12000	2100	190	< 1.5
2001-12006	GSS-2	0-5		54	< 0.5	0.8	5300	19	320	49	17000	4100	180	1.6
2001-12012	GSS-3	0-5		31	< 0.5	1.4	3000	45	790	39	22000	2800	150	< 1.5
2001-12018	GSS-4	0-5		33	< 0.5	1	3900	25	530	46	17000	2000	160	< 1.5
2001-12024	GSS-5	0-5		43	< 0.5	< 0.8	5000	7.8	46	65	15000	3100	230	< 1.5
2001-12030	GSS-6	0-5		31	< 0.5	1.4	8900	38	550	33	14000	2600	160	< 1.5
2001-12036	GSS-7	0-5		96	< 0.5	1.2	7200	25	1100	50	28000	2100	150	1.5
2001-12042	GSS-8	0-5		39	< 0.5	1.2	5900	18	93	53	12000	2600	180	5.1
2001-12048	GSS-9	0-5		68	< 0.5	2.4	13000	76	390	130	27000	5900	260	15
2001-12054	GSS-10	0-5		50	< 0.5	2.5	3000	62	1400	82	31000	1900	130	5.3
2001-12060	GSS-11	0-5		32	< 0.5	2.1	5500	30	210	56	15000	2500	170	5.4
2001-12066	GSS-12	0-5		27	< 0.5	< 0.8	2800	41	180	63	20000	3800	190	4.9
2001-12072	GSS-13	0-5		48	< 0.5	0.9	2500	37	720	60	28000	3400	160	4.1
2001-12078	GSS-14	0-5		43	< 0.5	1.7	7900	38	630	34	14000	2400	150	< 1.5
2001-12084	GSS-15	0-5		55	< 0.5	< 0.8	2400	28	660	37	20000	1700	120	1.6
2001-12090	GSS-16	0-5		47	< 0.5	1	2600	28	740	56	21000	2900	150	2.8
2001-12096	GSS-17	0-5		46	< 0.5	1.4	2700	33	760	41	20000	1800	270	2.3
2001-12102	GSS-18	0-5		40	< 0.5	< 0.8	1700	15	440	36	17000	1400	72	< 1.5

Sample ID	Site	Depth		Ba	Be	Cd	Ca	Co	Cu	Cr	Fe	Mg	Mn	Mo
Detection Limit				20	1	0.8	50	10	20	20	100	50	50	1.5
MOE Guideline				**750**	**1.2**	**12**		**40**	**225**	**750**				**40**
		cm		**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**
2001-12108	GSS-19	0-5		46	< 0.5	< 0.8	3500	13	47	77	18000	5400	260	1.6
2001-12114	GSS-20	0-5		45	< 0.5	< 0.8	1600	23	620	42	25000	2100	130	1.5
2001-12120	GSS-21	0-5		39	< 0.5	2.6	4700	76	1500	66	22000	2400	160	4.4
2001-12126	GSS-22	0-5		30	< 0.5	< 0.8	4000	10	56	38	10000	2000	140	1.5
2001-12132	GSS-23	0-5		26	< 0.5	< 0.8	3300	14	68	39	11000	1900	140	2.5
2001-12138	GSS-24	0-5		43	< 0.5	1.2	2500	37	1000	49	25000	2400	150	2
2001-12144	GSS-25	0-5		25	< 0.5	< 0.8	2300	8.6	83	28	9200	2300	110	< 1.5
2001-12150	GSS-26	0-5		19	< 0.5	< 0.8	1600	12	230	23	11000	1200	89	< 1.5
2001-12156	GSS-27	0-5		23	< 0.5	< 0.8	1600	14	310	25	15000	1300	110	< 1.5
2001-12162	GSS-28	0-5		21	< 0.5	< 0.8	1500	5.5	87	19	9600	950	95	< 1.5
2001-12168	GSS-29	0-5		21	< 0.5	< 0.8	4800	6.1	49	31	11000	2100	100	< 1.5
2001-12174	GSS-30	0-5		38	< 0.5	< 0.8	860	12	400	26	13000	780	59	< 1.5
2001-12180	GSS-31	0-5		29	< 0.5	< 0.8	1100	9.2	300	21	11000	820	74	< 1.5
2001-12186	GSS-32	0-5		27	< 0.5	1.1	2300	25	300	46	14000	2500	150	3.5
2001-12192	GSS-33	0-5		42	< 0.5	2.8	3300	54	1500	56	28000	3000	150	2.5
2001-12005	GSS-1	10-20	d	29	< 0.5	< 0.8	2700	16	240	43	15000	2200	130	< 1.5
2001-12011	GSS-2	10-20	d	41	< 0.5	< 0.8	2100	8.6	70	35	16000	3100	190	< 1.5
2001-12017	GSS-3	10-20	d	45	< 0.5	< 0.8	3600	16	310	83	47000	6500	280	< 1.5
2001-12023	GSS-4	10-20	d	56	< 0.5	< 0.8	3400	15	320	42	18000	1900	210	< 1.5
2001-12035	GSS-6	10-20	d	27	< 0.5	< 0.8	4100	4.8	47	33	12000	1600	120	< 1.5
2001-12041	GSS-7	10-20	d	110	< 0.5	< 0.8	2200	19	800	44	29000	2200	130	< 1.5
2001-12047	GSS-8	10-20	d	30	< 0.5	< 0.8	2600	5.4	42	29	11000	2300	140	< 1.5
2001-12053	GSS-9	10-20	d	56	< 0.5	< 0.8	5200	43	350	63	32000	4400	200	4.2
2001-12059	GSS-10	10-20	d	45	< 0.5	1.2	3700	33	440	37	14000	1600	120	< 1.5
2001-12065	GSS-11	10-20	d	48	< 0.5	< 0.8	4900	75	490	69	39000	4200	240	< 1.5
2001-12071	GSS-12	10-20	d	36	< 0.5	1.2	4000	57	280	100	22000	4200	210	8
2001-12077	GSS-13	10-20	d	54	< 0.5	< 0.8	2700	13	370	53	25000	2300	170	< 1.5
2001-12083	GSS-14	10-20	d	35	< 0.5	< 0.8	5100	8.4	100	33	10000	2800	160	< 1.5
2001-12089	GSS-15	10-20	d	57	< 0.5	< 0.8	2000	7.6	77	37	16000	2200	140	< 1.5
2001-12095	GSS-16	10-20	d	57	< 0.5	< 0.8	2800	6.9	130	51	21000	2200	170	< 1.5
2001-12101	GSS-17	10-20	d	31	< 0.5	< 0.8	2600	6.2	100	30	11000	1200	120	< 1.5
2001-12107	GSS-18	10-20	d	18	< 0.5	< 0.8	1100	2.7	67	23	10000	1400	69	< 1.5
2001-12113	GSS-19	10-20	d	45	< 0.5	< 0.8	2900	12	100	130	20000	5100	240	3.1
2001-12119	GSS-20	10-20	d	42	< 0.5	< 0.8	1300	6.8	240	34	16000	1400	110	< 1.5
2001-12125	GSS-21	10-20	d	44	< 0.5	< 0.8	3300	13	140	55	13000	2700	120	3.1
2001-12131	GSS-22	10-20	d	38	< 0.5	< 0.8	4000	6.6	31	32	11000	2400	190	< 1.5
2001-12137	GSS-23	10-20	d	33	< 0.5	< 0.8	3100	16	180	37	13000	2200	120	< 1.5
2001-12143	GSS-24	10-20	d	54	< 0.5	< 0.8	1800	7.1	130	45	17000	2200	170	< 1.5
2001-12149	GSS-25	10-20	d	23	< 0.5	< 0.8	1900	4.4	20	22	8700	1800	120	< 1.5
2001-12155	GSS-26	10-20	d	25	< 0.5	< 0.8	1900	5.1	54	27	11000	1700	110	< 1.5
2001-12161	GSS-27	10-20	d	32	< 0.5	< 0.8	2000	4.6	110	25	12000	1400	140	< 1.5
2001-12167	GSS-28	10-20	d	37	< 0.5	< 0.8	2000	4.3	41	28	12000	1700	140	< 1.5
2001-12173	GSS-29	10-20	d	19	< 0.5	< 0.8	1400	4.4	12	22	11000	1500	97	< 1.5
2001-12179	GSS-30	10-20	d	23	< 0.5	< 0.8	1300	3	20	22	8100	1200	77	< 1.5
2001-12185	GSS-31	10-20	d	25	< 0.5	< 0.8	1400	3.9	17	1100	12000	1200	120	< 1.5
2001-12191	GSS-32	10-20	d	31	< 0.5	< 0.8	2700	17	230	45	13000	2200	150	< 1.5
2001-12197	GSS-33	10-20	d	29	< 0.5	< 0.8	2400	12	69	34	13000	3400	140	< 1.5
2001-12004	GSS-1	10-20		47	< 0.5	0.9	3300	31	650	52	21000	2200	160	< 1.5
2001-12010	GSS-2	10-20		40	< 0.5	< 0.8	2000	9	90	41	16000	3000	170	< 1.5
2001-12016	GSS-3	10-20		42	< 0.5	< 0.8	2900	16	290	95	55000	7700	300	< 1.5
2001-12022	GSS-4	10-20		51	< 0.5	< 0.8	2800	16	360	41	17000	2300	160	< 1.5

Table 4: Analytical Results

Sample ID	Site	Depth		Ba	Be	Cd	Ca	Co	Cu	Cr	Fe	Mg	Mn	Mo
Detection Limit				20	1	0.8	50	10	20	20	100	50	50	1.5
MOE Guideline				**750**	**1.2**	**12**		**40**	**225**	**750**				**40**
		cm		**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**
2001-12034	GSS-6	10-20		27	< 0.5	< 0.8	4100	4.9	58	35	12000	1900	120	< 1.5
2001-12040	GSS-7	10-20		110	< 0.5	< 0.8	2100	16	770	38	29000	1700	130	< 1.5
2001-12046	GSS-8	10-20		28	< 0.5	< 0.8	2600	5.4	40	31	11000	2200	140	< 1.5
2001-12052	GSS-9	10-20		54	< 0.5	< 0.8	5000	24	230	55	26000	4300	200	4
2001-12058	GSS-10	10-20		48	< 0.5	1.3	3700	41	530	50	14000	1700	140	< 1.5
2001-12070	GSS-12	10-20		39	< 0.5	< 0.8	3500	27	200	70	20000	3200	190	4.2
2001-12076	GSS-13	10-20		47	< 0.5	< 0.8	1700	13	390	39	21000	1800	140	< 1.5
2001-12082	GSS-14	10-20		31	< 0.5	< 0.8	5100	9.1	130	31	10000	2700	160	< 1.5
2001-12088	GSS-15	10-20		67	< 0.5	< 0.8	2500	7.9	84	42	16000	2700	160	< 1.5
2001-12094	GSS-16	10-20		57	< 0.5	< 0.8	1900	10	450	42	20000	1800	180	< 1.5
2001-12100	GSS-17	10-20		23	< 0.5	< 0.8	1800	5.3	120	23	12000	1100	100	< 1.5
2001-12106	GSS-18	10-20		17	< 0.5	< 0.8	1000	2.9	69	24	12000	1200	68	< 1.5
2001-12112	GSS-19	10-20		48	< 0.5	< 0.8	6200	26	360	120	21000	4100	230	3.6
2001-12118	GSS-20	10-20		43	< 0.5	< 0.8	1600	6.6	190	30	15000	1800	160	< 1.5
2001-12124	GSS-21	10-20		42	< 0.5	< 0.8	3800	15	140	54	12000	1700	93	4.2
2001-12130	GSS-22	10-20		34	< 0.5	< 0.8	3800	6.4	32	34	11000	2500	180	< 1.5
2001-12136	GSS-23	10-20		29	< 0.5	< 0.8	2600	16	150	34	15000	2000	120	< 1.5
2001-12142	GSS-24	10-20		47	< 0.5	< 0.8	1800	7.5	150	49	18000	2400	160	< 1.5
2001-12148	GSS-25	10-20		20	< 0.5	< 0.8	1600	5.4	42	25	9600	1700	100	< 1.5
2001-12154	GSS-26	10-20		22	< 0.5	< 0.8	1800	4.6	59	22	10000	1200	98	< 1.5
2001-12160	GSS-27	10-20		31	< 0.5	< 0.8	2000	5.1	80	27	10000	1500	150	< 1.5
2001-12166	GSS-28	10-20		34	< 0.5	< 0.8	2000	4.8	28	32	13000	1700	150	< 1.5
2001-12172	GSS-29	10-20		20	< 0.5	< 0.8	1700	4.3	9.5	24	9800	1500	100	< 1.5
2001-12178	GSS-30	10-20		23	< 0.5	< 0.8	1300	2.2	17	26	5500	1000	72	< 1.5
2001-12184	GSS-31	10-20		24	< 0.5	< 0.8	1500	4.4	45	30	11000	1400	110	< 1.5
2001-12190	GSS-32	10-20		22	< 0.5	< 0.8	2300	7.7	71	28	11000	2400	130	< 1.5
2001-12196	GSS-33	10-20		50	< 0.5	< 0.8	5000	20	93	27	10000	2300	110	< 1.5
2001-12003	GSS-1	5-10	d	26	< 0.5	< 0.8	2600	9.3	95	34	12000	1800	110	< 1.5
2001-12009	GSS-2	5-10	d	51	< 0.5	< 0.8	3000	12	150	48	20000	3200	240	< 1.5
2001-12015	GSS-3	5-10	d	36	< 0.5	< 0.8	2600	15	380	32	19000	2000	110	< 1.5
2001-12021	GSS-4	5-10	d	38	< 0.5	< 0.8	3600	26	490	43	15000	2200	130	< 1.5
2001-12027	GSS-5	5-10	d	43	< 0.5	< 0.8	4800	7.1	38	41	17000	3600	270	< 1.5
2001-12033	GSS-6	5-10	d	24	< 0.5	< 0.8	5100	8.9	110	39	10000	2600	130	< 1.5
2001-12039	GSS-7	5-10	d	110	< 0.5	< 0.8	2800	23	1000	44	33000	1800	130	< 1.5
2001-12045	GSS-8	5-10	d	31	< 0.5	< 0.8	3600	5.2	54	33	10000	2200	140	< 1.5
2001-12051	GSS-9	5-10	d	86	< 0.5	< 0.8	12000	150	380	110	74000	6900	250	7.3
2001-12057	GSS-10	5-10	d	51	< 0.5	1.5	4400	45	1200	47	17000	1700	150	< 1.5
2001-12063	GSS-11	5-10	d	34	< 0.5	< 0.8	4100	18	230	44	15000	2400	220	< 1.5
2001-12069	GSS-12	5-10	d	41	< 0.5	< 0.8	2600	38	140	86	19000	3600	190	5.1
2001-12075	GSS-13	5-10	d	44	< 0.5	< 0.8	2400	22	500	44	24000	2300	150	< 1.5
2001-12081	GSS-14	5-10	d	46	< 0.5	< 0.8	9500	20	280	42	12000	3300	240	< 1.5
2001-12087	GSS-15	5-10	d	65	< 0.5	< 0.8	2400	11	310	47	18000	1700	150	< 1.5
2001-12093	GSS-16	5-10	d	42	< 0.5	< 0.8	2300	8.6	260	52	21000	1900	150	< 1.5
2001-12099	GSS-17	5-10	d	64	< 0.5	1	5000	17	200	35	15000	1400	350	< 1.5
2001-12105	GSS-18	5-10	d	26	< 0.5	< 0.8	800	3.3	170	18	9000	670	53	< 1.5
2001-12111	GSS-19	5-10	d	44	< 0.5	< 0.8	2600	25	460	120	26000	3500	210	2.7
2001-12117	GSS-20	5-10	d	67	< 0.5	< 0.8	2100	12	450	45	22000	1700	150	< 1.5
2001-12123	GSS-21	5-10	d	41	< 0.5	< 0.8	4100	28	410	68	16000	2800	130	3.4
2001-12129	GSS-22	5-10	d	33	< 0.5	< 0.8	4100	5.5	30	32	10000	2100	160	< 1.5
2001-12135	GSS-23	5-10	d	30	< 0.5	< 0.8	3400	18	150	34	15000	1800	140	< 1.5
2001-12141	GSS-24	5-10	d	53	< 0.5	< 0.8	2400	13	370	43	22000	1600	190	< 1.5

Table 4: Analytical Results

Sample ID	Site	Depth		Ba	Be	Cd	Ca	Co	Cu	Cr	Fe	Mg	Mn	Mo
Detection Limit				20	1	0.8	50	10	20	20	100	50	50	1.5
MOE Guideline				**750**	**1.2**	**12**		**40**	**225**	**750**				**40**
		cm		**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**
2001-12147	GSS-25	5-10	d	25	< 0.5	< 0.8	2300	5.1	42	28	9400	1700	130	< 1.5
2001-12153	GSS-26	5-10	d	23	< 0.5	< 0.8	1600	7.6	140	26	12000	1300	100	< 1.5
2001-12159	GSS-27	5-10	d	27	< 0.5	< 0.8	1900	6.6	160	27	13000	1400	160	< 1.5
2001-12165	GSS-28	5-10	d	33	< 0.5	< 0.8	1500	3.8	92	29	12000	1000	150	< 1.5
2001-12171	GSS-29	5-10	d	21	< 0.5	< 0.8	1800	3.8	19	21	9800	1200	91	< 1.5
2001-12177	GSS-30	5-10	d	24	< 0.5	< 0.8	1300	2.9	75	21	8700	840	83	< 1.5
2001-12183	GSS-31	5-10	d	28	< 0.5	< 0.8	1800	3.2	76	22	11000	910	120	< 1.5
2001-12189	GSS-32	5-10	d	32	< 0.5	< 0.8	2800	14	200	37	13000	2300	150	< 1.5
2001-12195	GSS-33	5-10	d	48	< 0.5	1.3	4200	27	500	51	17000	2800	130	< 1.5
2001-12002	GSS-1	5-10		27	< 0.5	< 0.8	3100	14	96	35	12000	1900	120	< 1.5
2001-12008	GSS-2	5-10		57	< 0.5	< 0.8	4300	12	210	44	19000	3500	220	< 1.5
2001-12014	GSS-3	5-10		37	< 0.5	< 0.8	2900	19	340	44	20000	3500	150	< 1.5
2001-12020	GSS-4	5-10		39	< 0.5	< 0.8	3200	15	430	42	17000	1900	150	< 1.5
2001-12032	GSS-6	5-10		26	< 0.5	< 0.8	6000	9.9	150	41	13000	2000	130	< 1.5
2001-12038	GSS-7	5-10		120	< 0.5	< 0.8	2700	25	1100	43	31000	2400	140	< 1.5
2001-12044	GSS-8	5-10		30	< 0.5	< 0.8	3500	5.3	36	36	10000	2200	130	< 1.5
2001-12050	GSS-9	5-10		55	< 0.5	0.8	10000	33	250	69	23000	5400	190	4.7
2001-12056	GSS-10	5-10		54	< 0.5	1.7	3400	37	1200	45	17000	1700	160	< 1.5
2001-12062	GSS-11	5-10		41	< 0.5	< 0.8	4200	23	240	47	19000	2600	250	1.6
2001-12068	GSS-12	5-10		39	< 0.5	< 0.8	3500	45	280	100	22000	3800	230	6.6
2001-12074	GSS-13	5-10		44	< 0.5	< 0.8	2300	24	580	46	23000	3000	160	< 1.5
2001-12080	GSS-14	5-10		44	< 0.5	< 0.8	9300	19	280	40	12000	3200	200	< 1.5
2001-12086	GSS-15	5-10		41	< 0.5	< 0.8	1500	6.6	150	43	17000	1500	170	< 1.5
2001-12092	GSS-16	5-10		60	< 0.5	< 0.8	2600	15	540	48	25000	2200	170	< 1.5
2001-12098	GSS-17	5-10		47	< 0.5	< 0.8	3700	14	140	32	13000	1200	260	< 1.5
2001-12104	GSS-18	5-10		20	< 0.5	< 0.8	830	2.2	130	21	9300	920	55	< 1.5
2001-12110	GSS-19	5-10		48	< 0.5	< 0.8	3800	18	190	120	19000	3700	220	3.4
2001-12116	GSS-20	5-10		59	< 0.5	< 0.8	1700	12	500	37	23000	1800	150	< 1.5
2001-12122	GSS-21	5-10		46	< 0.5	< 0.8	4200	21	280	88	19000	2500	150	4.4
2001-12128	GSS-22	5-10		34	< 0.5	< 0.8	3600	6.2	38	31	11000	3000	160	< 1.5
2001-12134	GSS-23	5-10		27	< 0.5	< 0.8	2800	6.7	47	32	11000	1600	120	< 1.5
2001-12140	GSS-24	5-10		44	< 0.5	< 0.8	1700	11	320	44	20000	1800	160	< 1.5
2001-12146	GSS-25	5-10		24	< 0.5	< 0.8	1900	4.9	33	25	10000	1800	110	< 1.5
2001-12152	GSS-26	5-10		21	< 0.5	< 0.8	1500	7.6	140	22	10000	970	81	< 1.5
2001-12158	GSS-27	5-10		31	< 0.5	< 0.8	2000	6.4	200	25	13000	1200	150	< 1.5
2001-12164	GSS-28	5-10		28	< 0.5	< 0.8	1800	3.2	51	28	13000	1200	150	< 1.5
2001-12170	GSS-29	5-10		19	< 0.5	< 0.8	1800	4.2	15	27	8100	1400	90	< 1.5
2001-12176	GSS-30	5-10		22	< 0.5	< 0.8	1100	1.9	74	19	9900	790	68	< 1.5
2001-12182	GSS-31	5-10		26	< 0.5	< 0.8	1600	6.4	160	21	12000	930	110	< 1.5
2001-12188	GSS-32	5-10		36	< 0.5	< 0.8	3600	17	280	34	14000	2100	180	< 1.5
2001-12194	GSS-33	5-10		45	< 0.5	1	4400	27	270	66	21000	4700	200	< 1.5

Table 4: Analytical Results

Sample ID	Site	Depth		Ni	Pb	Se	Sb	Sr	V	Zn
Detection Limit				20	20	1	0.8	20	20	25
MOE Guideline				**150**	**200**		**13**		**200**	**600**
		cm		**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**
2001-12001	GSS-1	0-5	d	130	14	< 10	< 0.8	28	26	23
2001-12007	GSS-2	0-5	d	270	34	< 10	< 0.8	26	34	40
2001-12013	GSS-3	0-5	d	830	40	< 10	< 0.8	19	27	36
2001-12019	GSS-4	0-5	d	730	57	< 10	< 0.8	26	27	47
2001-12025	GSS-5	0-5	d	95	53	< 10	< 0.8	32	29	30
2001-12031	GSS-6	0-5	d	550	29	< 10	< 0.8	28	24	36
2001-12037	GSS-7	0-5	d	460	120	< 10	< 0.8	42	35	53
2001-12043	GSS-8	0-5	d	140	12	< 10	< 0.8	33	25	29
2001-12049	GSS-9	0-5	d	910	40	< 10	< 0.8	37	42	77
2001-12055	GSS-10	0-5	d	960	180	< 10	< 0.8	17	25	60
2001-12061	GSS-11	0-5	d	320	37	< 10	< 0.8	34	30	41
2001-12067	GSS-12	0-5	d	390	26	< 10	< 0.8	25	29	47
2001-12073	GSS-13	0-5	d	550	120	< 10	< 0.8	26	38	47
2001-12079	GSS-14	0-5	d	1200	44	< 10	< 0.8	27	33	62
2001-12085	GSS-15	0-5	d	450	58	< 10	< 0.8	26	32	35
2001-12091	GSS-16	0-5	d	340	46	< 10	< 0.8	28	40	37
2001-12097	GSS-17	0-5	d	630	71	< 10	< 0.8	26	38	41
2001-12103	GSS-18	0-5	d	300	56	< 10	< 0.8	17	23	18
2001-12109	GSS-19	0-5	d	470	2600	< 10	< 0.8	24	34	51
2001-12115	GSS-20	0-5	d	310	68	< 10	< 0.8	17	32	32
2001-12121	GSS-21	0-5	d	1400	63	< 10	< 0.8	28	34	55
2001-12127	GSS-22	0-5	d	100	10	< 10	< 0.8	35	27	26
2001-12133	GSS-23	0-5	d	220	33	< 10	< 0.8	32	27	24
2001-12139	GSS-24	0-5	d	820	89	< 10	< 0.8	27	40	47
2001-12145	GSS-25	0-5	d	100	11	< 10	< 0.8	18	24	17
2001-12151	GSS-26	0-5	d	180	26	< 10	< 0.8	16	24	19
2001-12157	GSS-27	0-5	d	190	37	< 10	< 0.8	16	23	21
2001-12163	GSS-28	0-5	d	100	26	< 10	< 0.8	21	24	16
2001-12169	GSS-29	0-5	d	80	11	< 10	< 0.8	15	24	14
2001-12175	GSS-30	0-5	d	280	82	< 10	< 0.8	12	23	20
2001-12181	GSS-31	0-5	d	150	25	< 10	< 0.8	15	21	14
2001-12187	GSS-32	0-5	d	210	23	< 10	< 0.8	20	25	25
2001-12193	GSS-33	0-5	d	1100	130	< 10	< 0.8	25	32	66
2001-12000	GSS-1	0-5		130	15	< 10	< 0.8	29	26	25
2001-12006	GSS-2	0-5		230	26	< 10	< 0.8	15	30	33
2001-12012	GSS-3	0-5		870	40	< 10	< 0.8	20	29	38
2001-12018	GSS-4	0-5		410	43	< 10	< 0.8	27	26	35
2001-12024	GSS-5	0-5		81	89	< 10	< 0.8	40	32	31
2001-12030	GSS-6	0-5		710	36	< 10	< 0.8	21	21	36
2001-12036	GSS-7	0-5		470	110	< 10	< 0.8	36	35	54
2001-12042	GSS-8	0-5		200	14	< 10	< 0.8	40	28	32
2001-12048	GSS-9	0-5		640	33	< 10	< 0.8	42	41	74
2001-12054	GSS-10	0-5		900	220	< 10	< 0.8	22	25	61
2001-12060	GSS-11	0-5		320	35	< 10	< 0.8	32	29	38
2001-12066	GSS-12	0-5		280	22	< 10	< 0.8	20	31	38
2001-12072	GSS-13	0-5		520	110	< 10	< 0.8	26	40	51
2001-12078	GSS-14	0-5		760	38	< 10	< 0.8	28	25	50
2001-12084	GSS-15	0-5		520	60	< 10	< 0.8	30	32	33
2001-12090	GSS-16	0-5		430	70	< 10	< 0.8	26	36	36
2001-12096	GSS-17	0-5		580	66	< 10	< 0.8	21	34	39
2001-12102	GSS-18	0-5		270	63	< 10	< 0.8	22	25	20

Table 4: Analytical Results

Sample ID	Site	Depth		Ni	Pb	Se	Sb	Sr	V	Zn
Detection Limit				20	20	1	0.8	20	20	25
MOE Guideline				**150**	**200**		**13**		**200**	**600**
		cm		**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**
2001-12108	GSS-19	0-5		88	20	< 10	< 0.8	30	34	35
2001-12114	GSS-20	0-5		380	72	< 10	< 0.8	19	32	45
2001-12120	GSS-21	0-5		1600	61	< 10	< 0.8	24	30	56
2001-12126	GSS-22	0-5		100	11	< 10	< 0.8	27	24	20
2001-12132	GSS-23	0-5		120	11	< 10	< 0.8	31	26	20
2001-12138	GSS-24	0-5		670	77	< 10	< 0.8	24	37	42
2001-12144	GSS-25	0-5		98	10	< 10	< 0.8	19	24	17
2001-12150	GSS-26	0-5		200	25	< 10	< 0.8	15	23	19
2001-12156	GSS-27	0-5		240	51	< 10	< 0.8	17	23	22
2001-12162	GSS-28	0-5		60	13	< 10	< 0.8	20	22	12
2001-12168	GSS-29	0-5		72	10	< 10	< 0.8	19	26	15
2001-12174	GSS-30	0-5		250	70	< 10	< 0.8	12	24	17
2001-12180	GSS-31	0-5		180	34	< 10	< 0.8	13	20	14
2001-12186	GSS-32	0-5		310	66	< 10	< 0.8	17	25	31
2001-12192	GSS-33	0-5		1200	110	< 10	< 0.8	20	30	70
2001-12005	GSS-1	10-20	d	230	30	< 10	< 0.8	19	26	26
2001-12011	GSS-2	10-20	d	50	4.8	< 10	< 0.8	21	31	24
2001-12017	GSS-3	10-20	d	280	21	< 10	< 0.8	26	61	43
2001-12023	GSS-4	10-20	d	260	32	< 10	< 0.8	31	34	28
2001-12035	GSS-6	10-20	d	64	8.3	< 10	< 0.8	29	28	14
2001-12041	GSS-7	10-20	d	330	140	< 10	< 0.8	28	39	51
2001-12047	GSS-8	10-20	d	40	7.1	< 10	< 0.8	21	23	16
2001-12053	GSS-9	10-20	d	290	31	< 10	< 0.8	28	36	48
2001-12059	GSS-10	10-20	d	800	71	< 10	< 0.8	26	22	64
2001-12065	GSS-11	10-20	d	430	40	< 10	< 0.8	30	39	52
2001-12071	GSS-12	10-20	d	700	39	< 10	< 0.8	21	33	54
2001-12077	GSS-13	10-20	d	190	49	< 10	< 0.8	33	47	36
2001-12083	GSS-14	10-20	d	140	11	< 10	< 0.8	31	43	20
2001-12089	GSS-15	10-20	d	53	4.8	< 10	< 0.8	25	31	28
2001-12095	GSS-16	10-20	d	61	11	< 10	< 0.8	34	46	35
2001-12101	GSS-17	10-20	d	100	12	< 10	< 0.8	20	27	18
2001-12107	GSS-18	10-20	d	26	5.9	< 10	< 0.8	13	26	8
2001-12113	GSS-19	10-20	d	110	7	< 10	< 0.8	25	36	27
2001-12119	GSS-20	10-20	d	92	31	< 10	< 0.8	16	32	25
2001-12125	GSS-21	10-20	d	210	12	< 10	< 0.8	23	31	18
2001-12131	GSS-22	10-20	d	49	12	< 10	< 0.8	28	25	22
2001-12137	GSS-23	10-20	d	210	23	< 10	< 0.8	23	25	21
2001-12143	GSS-24	10-20	d	72	7.7	< 10	< 0.8	20	38	31
2001-12149	GSS-25	10-20	d	26	3.2	< 10	< 0.8	20	22	11
2001-12155	GSS-26	10-20	d	46	5.3	< 10	< 0.8	16	24	15
2001-12161	GSS-27	10-20	d	49	11	< 10	< 0.8	24	25	18
2001-12167	GSS-28	10-20	d	22	4.6	< 10	< 0.8	24	28	17
2001-12173	GSS-29	10-20	d	19	3.3	< 10	< 0.8	12	25	12
2001-12179	GSS-30	10-20	d	26	4.6	< 10	< 0.8	16	24	8.4
2001-12185	GSS-31	10-20	d	24	3.7	< 10	< 0.8	16	26	15
2001-12191	GSS-32	10-20	d	290	22	< 10	< 0.8	22	24	24
2001-12197	GSS-33	10-20	d	290	6.5	< 10	< 0.8	17	29	39
2001-12004	GSS-1	10-20		460	87	< 10	< 0.8	25	29	48
2001-12010	GSS-2	10-20		61	8.8	< 10	< 0.8	19	30	21
2001-12016	GSS-3	10-20		260	22	< 10	< 0.8	20	66	41
2001-12022	GSS-4	10-20		310	42	< 10	< 0.8	27	30	30

Table 4: Analytical Results

Sample ID	Site	Depth		Ni	Pb	Se	Sb	Sr	V	Zn
Detection Limit				20	20	1	0.8	20	20	25
MOE Guideline				**150**	**200**		**13**		**200**	**600**
		cm		**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**
2001-12034	GSS-6	10-20		72	8.6	< 10	< 0.8	23	27	13
2001-12040	GSS-7	10-20		280	120	< 10	< 0.8	26	38	49
2001-12046	GSS-8	10-20		47	5.6	< 10	< 0.8	22	23	16
2001-12052	GSS-9	10-20		220	35	< 10	< 0.8	28	36	39
2001-12058	GSS-10	10-20		980	62	< 10	< 0.8	25	23	73
2001-12070	GSS-12	10-20		220	27	< 10	< 0.8	25	33	41
2001-12076	GSS-13	10-20		200	43	< 10	< 0.8	20	38	32
2001-12082	GSS-14	10-20		220	14	< 10	< 0.8	28	36	20
2001-12088	GSS-15	10-20		54	7.8	< 10	< 0.8	30	36	31
2001-12094	GSS-16	10-20		160	32	< 10	< 0.8	23	41	32
2001-12100	GSS-17	10-20		85	13	< 10	< 0.8	15	26	15
2001-12106	GSS-18	10-20		25	5.4	< 10	< 0.8	12	25	9.9
2001-12112	GSS-19	10-20		340	790	< 10	< 0.8	40	33	62
2001-12118	GSS-20	10-20		67	23	< 10	< 0.8	20	32	26
2001-12124	GSS-21	10-20		210	13	< 10	< 0.8	23	30	45
2001-12130	GSS-22	10-20		62	6.8	< 10	< 0.8	24	23	22
2001-12136	GSS-23	10-20		130	20	< 10	1.1	19	24	19
2001-12142	GSS-24	10-20		84	8.8	< 10	< 0.8	18	38	31
2001-12148	GSS-25	10-20		47	5.3	< 10	< 0.8	17	21	11
2001-12154	GSS-26	10-20		54	6.4	< 10	< 0.8	19	24	14
2001-12160	GSS-27	10-20		47	7.7	< 10	< 0.8	22	27	20
2001-12166	GSS-28	10-20		26	4.3	< 10	< 0.8	23	29	17
2001-12172	GSS-29	10-20		17	3.1	< 10	< 0.8	16	25	12
2001-12178	GSS-30	10-20		20	4.4	< 10	< 0.8	17	25	7.7
2001-12184	GSS-31	10-20		35	5.9	< 10	< 0.8	17	26	12
2001-12190	GSS-32	10-20		100	9.2	< 10	< 0.8	19	23	15
2001-12196	GSS-33	10-20		380	8.8	< 10	< 0.8	23	26	17
2001-12003	GSS-1	5-10	d	110	15	< 10	< 0.8	20	24	17
2001-12009	GSS-2	5-10	d	100	14	< 10	< 0.8	24	36	33
2001-12015	GSS-3	5-10	d	240	39	< 10	< 0.8	18	26	24
2001-12021	GSS-4	5-10	d	510	45	< 10	< 0.8	21	27	32
2001-12027	GSS-5	5-10	d	67	12	< 10	< 0.8	36	35	31
2001-12033	GSS-6	5-10	d	210	9	< 10	< 0.8	31	28	17
2001-12039	GSS-7	5-10	d	390	140	< 10	< 0.8	24	36	53
2001-12045	GSS-8	5-10	d	60	11	< 10	< 0.8	25	22	19
2001-12051	GSS-9	5-10	d	540	28	< 10	< 0.8	46	52	100
2001-12057	GSS-10	5-10	d	850	97	< 10	< 0.8	29	24	81
2001-12063	GSS-11	5-10	d	250	36	< 10	< 0.8	24	28	38
2001-12069	GSS-12	5-10	d	240	16	< 10	< 0.8	19	29	37
2001-12075	GSS-13	5-10	d	350	66	< 10	< 0.8	24	35	40
2001-12081	GSS-14	5-10	d	470	18	< 10	< 0.8	37	50	36
2001-12087	GSS-15	5-10	d	170	28	< 10	< 0.8	29	36	36
2001-12093	GSS-16	5-10	d	110	22	< 10	< 0.8	28	45	31
2001-12099	GSS-17	5-10	d	420	17	< 10	< 0.8	25	38	38
2001-12105	GSS-18	5-10	d	62	18	< 10	< 0.8	12	23	8.1
2001-12111	GSS-19	5-10	d	310	110	< 10	< 0.8	20	32	40
2001-12117	GSS-20	5-10	d	210	73	< 10	< 0.8	28	37	33
2001-12123	GSS-21	5-10	d	580	23	< 10	< 0.8	24	31	26
2001-12129	GSS-22	5-10	d	49	7.9	< 10	< 0.8	33	25	19
2001-12135	GSS-23	5-10	d	180	19	< 10	< 0.8	29	26	21
2001-12141	GSS-24	5-10	d	230	36	< 10	< 0.8	29	42	38

Table 4: Analytical Results

Sample ID	Site	Depth		Ni	Pb	Se	Sb	Sr	V	Zn
Detection Limit				20	20	1	0.8	20	20	25
MOE Guideline				**150**	**200**		**13**		**200**	**600**
		cm		**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**
2001-12147	GSS-25	5-10	d	45	4.7	< 10	< 0.8	20	23	18
2001-12153	GSS-26	5-10	d	120	12	< 10	< 0.8	16	24	16
2001-12159	GSS-27	5-10	d	86	19	< 10	< 0.8	22	25	19
2001-12165	GSS-28	5-10	d	36	13	< 10	< 0.8	20	27	15
2001-12171	GSS-29	5-10	d	26	3.7	< 10	< 0.8	13	25	11
2001-12177	GSS-30	5-10	d	40	12	< 10	< 0.8	18	24	8.3
2001-12183	GSS-31	5-10	d	41	8.5	< 10	< 0.8	24	28	13
2001-12189	GSS-32	5-10	d	220	20	< 10	< 0.8	20	25	26
2001-12195	GSS-33	5-10	d	750	38	< 10	< 0.8	23	30	42
2001-12002	GSS-1	5-10		110	15	< 10	< 0.8	22	25	19
2001-12008	GSS-2	5-10		110	16	< 10	< 0.8	25	36	31
2001-12014	GSS-3	5-10		370	30	< 10	< 0.8	21	32	26
2001-12020	GSS-4	5-10		280	45	< 10	< 0.8	25	27	31
2001-12032	GSS-6	5-10		240	12	< 10	< 0.8	28	28	18
2001-12038	GSS-7	5-10		400	140	< 10	< 0.8	29	39	54
2001-12044	GSS-8	5-10		61	8.3	< 10	< 0.8	22	21	19
2001-12050	GSS-9	5-10		270	27	< 10	< 0.8	34	32	48
2001-12056	GSS-10	5-10		670	100	< 10	< 0.8	29	24	70
2001-12062	GSS-11	5-10		280	47	< 10	< 0.8	29	32	43
2001-12068	GSS-12	5-10		370	36	< 10	< 0.8	25	34	50
2001-12074	GSS-13	5-10		370	64	< 10	< 0.8	24	36	39
2001-12080	GSS-14	5-10		440	19	< 10	< 0.8	34	36	33
2001-12086	GSS-15	5-10		79	13	< 10	< 0.8	19	37	25
2001-12092	GSS-16	5-10		240	60	< 10	< 0.8	28	44	35
2001-12098	GSS-17	5-10		360	17	< 10	< 0.8	22	31	31
2001-12104	GSS-18	5-10		30	8.4	< 10	< 0.8	11	20	7.5
2001-12110	GSS-19	5-10		240	230	< 10	< 0.8	28	31	44
2001-12116	GSS-20	5-10		200	73	< 10	< 0.8	22	38	33
2001-12122	GSS-21	5-10		380	27	< 10	< 0.8	27	35	27
2001-12128	GSS-22	5-10		49	7.9	< 10	< 0.8	30	27	20
2001-12134	GSS-23	5-10		57	11	< 10	< 0.8	28	25	14
2001-12140	GSS-24	5-10		200	25	< 10	< 0.8	19	40	30
2001-12146	GSS-25	5-10		36	4.6	< 10	< 0.8	20	23	12
2001-12152	GSS-26	5-10		140	13	< 10	< 0.8	12	22	17
2001-12158	GSS-27	5-10		100	22	< 10	< 0.8	25	25	24
2001-12164	GSS-28	5-10		22	6.1	< 10	< 0.8	22	32	16
2001-12170	GSS-29	5-10		23	3.6	< 10	< 0.8	14	23	11
2001-12176	GSS-30	5-10		26	7.6	< 10	< 0.8	16	28	6.6
2001-12182	GSS-31	5-10		98	20	< 10	< 0.8	21	26	12
2001-12188	GSS-32	5-10		290	23	< 10	< 0.8	30	28	30
2001-12194	GSS-33	5-10		720	20	< 10	< 0.8	24	41	47

C (t) = Total Inorganic Carbon; CO_3 = Carbonate;
Al = Aluminum; As = Arsenic; Ba = Barium; Be = Beryllium; Cd = Cadmium; Ca = Calcium; Co = Cobalt; Cu = Copper;
Cr = Chromium; Fe = Iron; Mg = Magnesium; Mn = Manganese;
Mo = Molybdenum; Ni = Nickel; Pb = Lead; Se = Selenium;
Sb = Antimony; V = Vanadium; Z = Zinc
d = duplicate sample

Table 5: Analytical Results
Arsenic, Cobalt, Copper, and Nickel

Sample	Easting	Northing	0-5 cm				0-5 cm duplicate			
			As	Co	Cu	Ni	As	Co	Cu	Ni
			(μg/g)	(μg/g)	(μg/g)	(μg/g)	(μg/g)	(μg/g)	(μg/g)	(μg/g)
GSS-1	514457	5157956	5	11	73	130	6	11	83	130
GSS-2	514409	5158331	50	19	320	230	42	22	300	270
GSS-3	514442	5158154	57	45	790	870	56	41	690	830
GSS-4	514220	5158314	14	25	530	410	70	38	900	730
GSS-5	514076	5158166	5	7.8	46	81	5	8.9	51	95
GSS-6	514054	5158373	15	38	550	710	15	32	490	550
GSS-7	513836	5158493	200	25	1100	470	210	25	1100	460
GSS-8	514663	5157819	7	18	93	200	6	10	79	140
GSS-9	514626	5157692	17	76	390	640	23	120	460	910
GSS-10	514568	5157764	200	62	1400	900	220	68	1400	960
GSS-11	514494	5157660	16	30	210	320	16	29	210	320
GSS-12	514474	5157533	8.5	41	180	280	15	55	240	390
GSS-13	514220	5157462	158	37	720	520	140	38	730	550
GSS-14	514129	5157829	23	38	630	760	27	49	830	1200
GSS-15	513862	5158134	131	28	660	520	110	26	660	450
GSS-16	514076	5157818	110	28	740	430	75	22	470	340
GSS-17	513794	5157337	52	33	760	580	58	35	800	630
GSS-18	513443	5157479	121	15	440	270	59	16	390	300
GSS-19	514454	5158091	8	13	47	88	61	41	470	470
GSS-20	513595	5158182	120	23	620	380	120	20	520	310
GSS-21	514094	5157984	81	76	1500	1600	80	70	1300	1400
GSS-22	514509	5157870	5	10	56	100	8	9.9	52	100
GSS-23	514283	5157755	5	14	68	120	21	26	210	220
GSS-24	514096	5157567	144	37	1000	670	193	44	1200	820
GSS-25	513594	5157251	5	8.6	83	98	9	8.8	93	100
GSS-26	513098	5157386	24	12	230	200	26	11	200	180
GSS-27	513031	5157292	56	14	310	240	55	11	260	190
GSS-28	512645	5157177	23	5.5	87	60	39	6.4	160	100
GSS-29	512515	5157324	6	6.1	49	72	8	6.2	66	80
GSS-30	511952	5157242	64	12	400	250	74	13	470	280
GSS-31	511944	5157091	36	9.2	300	180	32	7	220	150
GSS-32	514519	5157740	21	25	300	310	13	19	170	210
GSS-33	514310	5158161	130	54	1500	1200	160	54	1600	1100

As = Arsenic;
Co = Cobalt;
Cu = Copper;
Ni = Nickel

Table 5: Analytical Results
Arsenic, Cobalt, Copper, and Nickel

Sample	Easting	Northing	5-10 cm				5-10 cm duplicate			
			As	Co	Cu	Ni	As	Co	Cu	Ni
			(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)
GSS-1	514457	5157956	9	14	96	110	9	9.3	95	110
GSS-2	514409	5158331	32	12	210	110	24	12	150	100
GSS-3	514442	5158154	52	19	340	370	74	15	380	240
GSS-4	514220	5158314	56	15	430	280	63	26	490	510
GSS-5	514076	5158166					5	7.1	38	67
GSS-6	514054	5158373	8.6	9.9	150	240	13	8.9	110	210
GSS-7	513836	5158493	254	25	1100	400	280	23	1000	390
GSS-8	514663	5157819	5	5.3	36	61	7	5.2	54	60
GSS-9	514626	5157692	26	33	250	270	28	150	380	540
GSS-10	514568	5157764	190	37	1200	670	160	45	1200	850
GSS-11	514494	5157660	26	23	240	280	24	18	230	250
GSS-12	514474	5157533	17	45	280	370	9	38	140	240
GSS-13	514220	5157462	133	24	580	370	160	22	500	350
GSS-14	514129	5157829	19	19	280	440	24	20	280	470
GSS-15	513862	5158134	39	6.6	150	79	62	11	310	170
GSS-16	514076	5157818	140	15	540	240	43	8.6	260	110
GSS-17	513794	5157337	40	14	140	360	28	17	200	420
GSS-18	513443	5157479	10	2.2	130	30	28	3.3	170	62
GSS-19	514454	5158091	33	18	190	240	57	25	460	310
GSS-20	513595	5158182	140	12	500	200	140	12	450	210
GSS-21	514094	5157984	51	21	280	380	29	28	410	580
GSS-22	514509	5157870	5	6.2	38	49	9	5.5	30	49
GSS-23	514283	5157755	12	6.7	47	57	8	18	150	180
GSS-24	514096	5157567	70	11	320	200	120	13	370	230
GSS-25	513594	5157251	10	4.9	33	36	5	5.1	42	45
GSS-26	513098	5157386	16	7.6	140	140	12	7.6	140	120
GSS-27	513031	5157292	41	6.4	200	100	36	6.6	160	86
GSS-28	512645	5157177	6	3.2	51	22	19	3.8	92	36
GSS-29	512515	5157324	5	4.2	15	23	5	3.8	19	26
GSS-30	511952	5157242	9	1.9	74	26	10	2.9	75	40
GSS-31	511944	5157091	27	6.4	160	98	10	3.2	76	41
GSS-32	514519	5157740	21	17	280	290	20	14	200	220
GSS-33	514310	5158161	37	27	270	720	44	27	500	750

As = Arsenic;
Co = Cobalt;
Cu = Copper;
Ni = Nickel

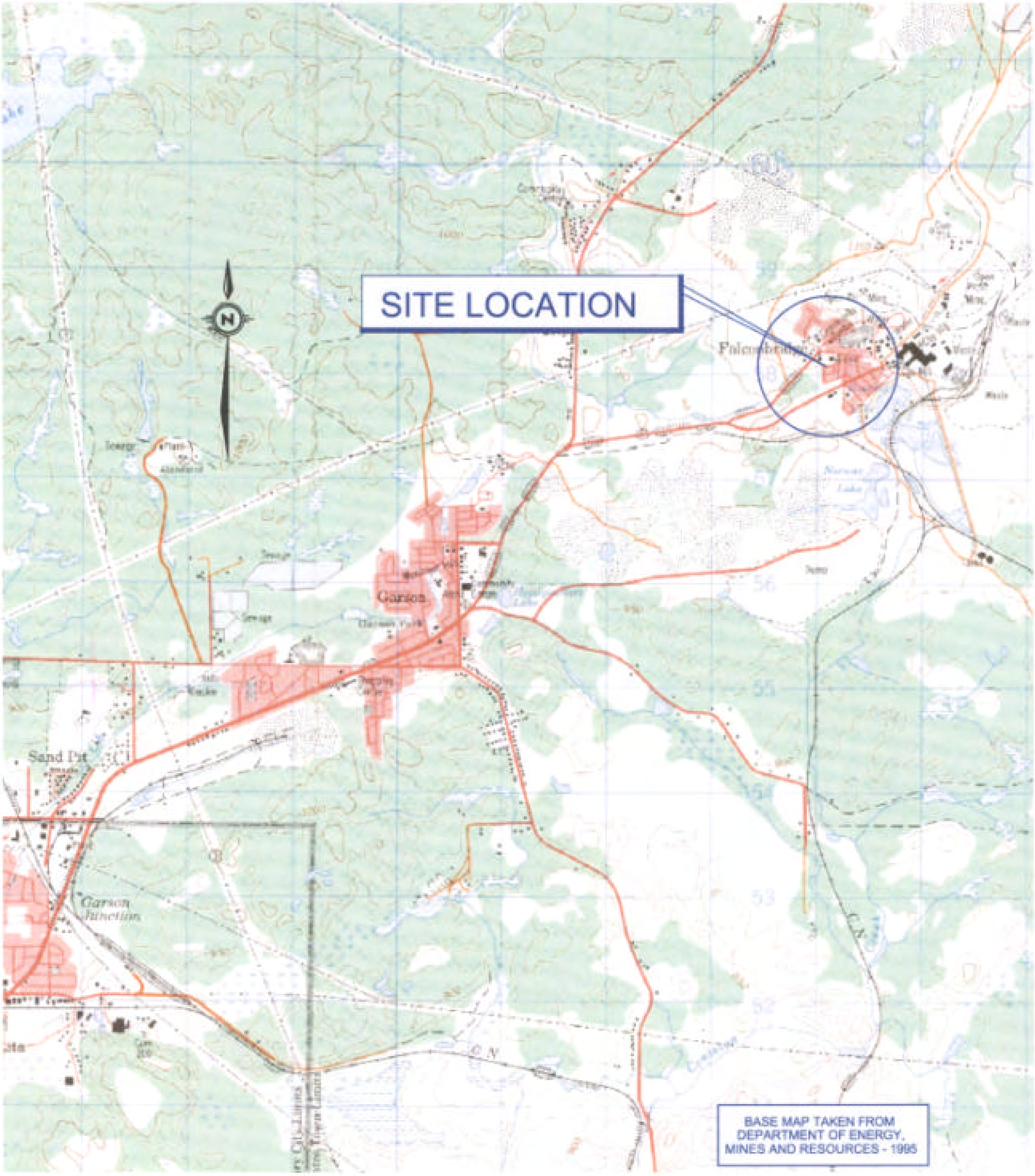
Table 5: Analytical Results
Arsenic, Cobalt, Copper, and Nickel

Sample	Easting	Northing	10-20 cm				10-20 cm duplicate			
			As	Co	Cu	Ni	As	Co	Cu	Ni
			(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)
GSS-1	514457	5157956	97	31	650	460	24	16	240	230
GSS-2	514409	5158331	13	9	90	61	5	8.6	70	50
GSS-3	514442	5158154	37	16	290	260	29	16	310	280
GSS-4	514220	5158314	89	16	360	310	45	15	320	260
GSS-5	514076	5158166								
GSS-6	514054	5158373	5	4.9	58	72	7	4.8	47	64
GSS-7	513836	5158493	270	16	770	280	297	19	800	330
GSS-8	514663	5157819	5	5.4	40	47	9	5.4	42	40
GSS-9	514626	5157692	45	24	230	220	34	43	350	290
GSS-10	514568	5157764	160	41	530	980	150	33	440	800
GSS-11	514494	5157660					33	75	490	430
GSS-12	514474	5157533	17	27	200	220	19	57	280	700
GSS-13	514220	5157462	190	13	390	200	190	13	370	190
GSS-14	514129	5157829	19	9.1	130	220	21	8.4	100	140
GSS-15	513862	5158134	10	7.9	84	54	5.5	7.6	77	53
GSS-16	514076	5157818	61	10	450	160	15	6.9	130	61
GSS-17	513794	5157337	22	5.3	120	85	24	6.2	100	100
GSS-18	513443	5157479	7	2.9	69	25	7	2.7	67	26
GSS-19	514454	5158091	42	26	360	340	11	12	100	110
GSS-20	513595	5158182	69	6.6	190	67	57	6.8	240	92
GSS-21	514094	5157984	40	15	140	210	18	13	140	210
GSS-22	514509	5157870	7	6.4	32	62	5	6.6	31	49
GSS-23	514283	5157755	15	16	150	130	12	16	180	210
GSS-24	514096	5157567	13	7.5	150	84	9	7.1	130	72
GSS-25	513594	5157251	5	5.4	42	47	5	4.4	20	26
GSS-26	513098	5157386	5	4.6	59	54	5	5.1	54	46
GSS-27	513031	5157292	16	5.1	80	47	16	4.6	110	49
GSS-28	512645	5157177	5	4.8	28	26	6	4.3	41	22
GSS-29	512515	5157324	5	4.3	9.5	17	5	4.4	12	19
GSS-30	511952	5157242	5	2.2	17	20	5	3	20	26
GSS-31	511944	5157091	5	4.4	45	35	5	3.9	17	24
GSS-32	514519	5157740	11	7.7	71	100	21	17	230	290
GSS-33	514310	5158161	14	20	93	380	16	12	69	290

As = Arsenic;
Co = Cobalt;
Cu = Copper;
Ni = Nickel

SITE LOCATION
TOWN OF FALCONBRIDGE
SUDBURY, ONTARIO

FIGURE 1



Date ..AUGUST. 2001

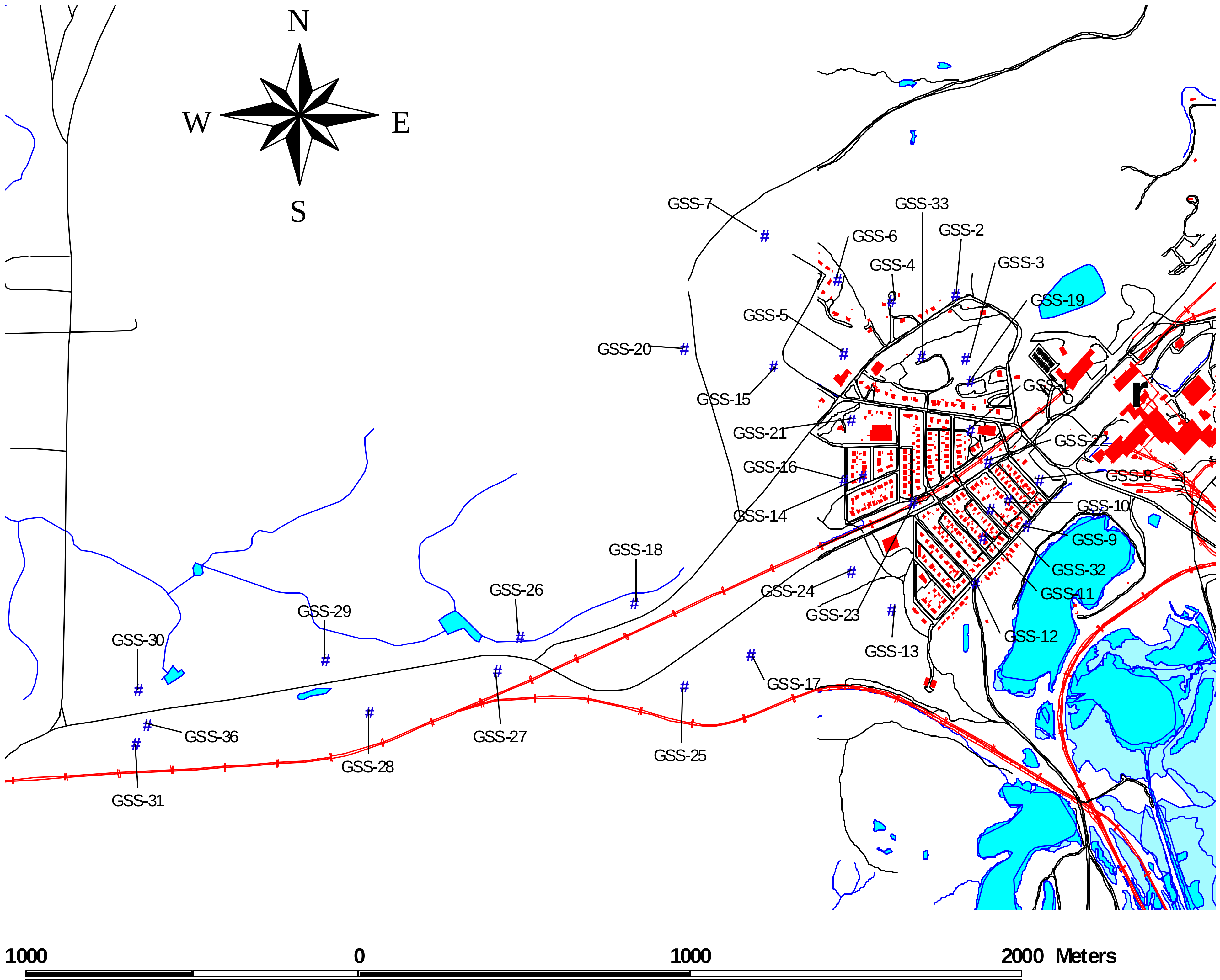
Project 001-9233 (5000)

Golder Associates

Drawn ...RN.....

Chkd ....

SCALE: NTS FILE: 0019233(5000)FIG1.DWG



Golder Associates
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DESIGN	XXX		
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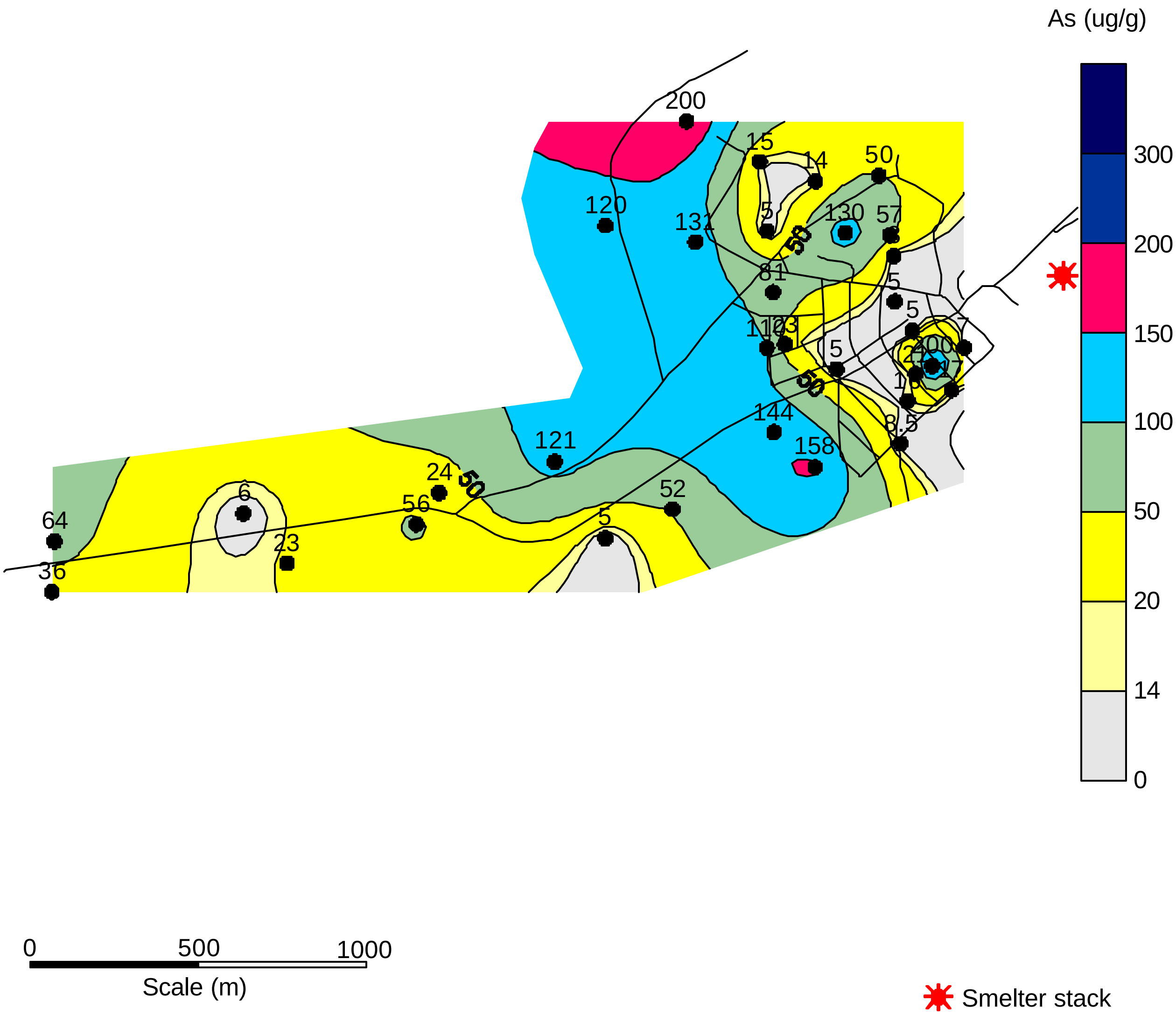
FILE No. 02-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 2



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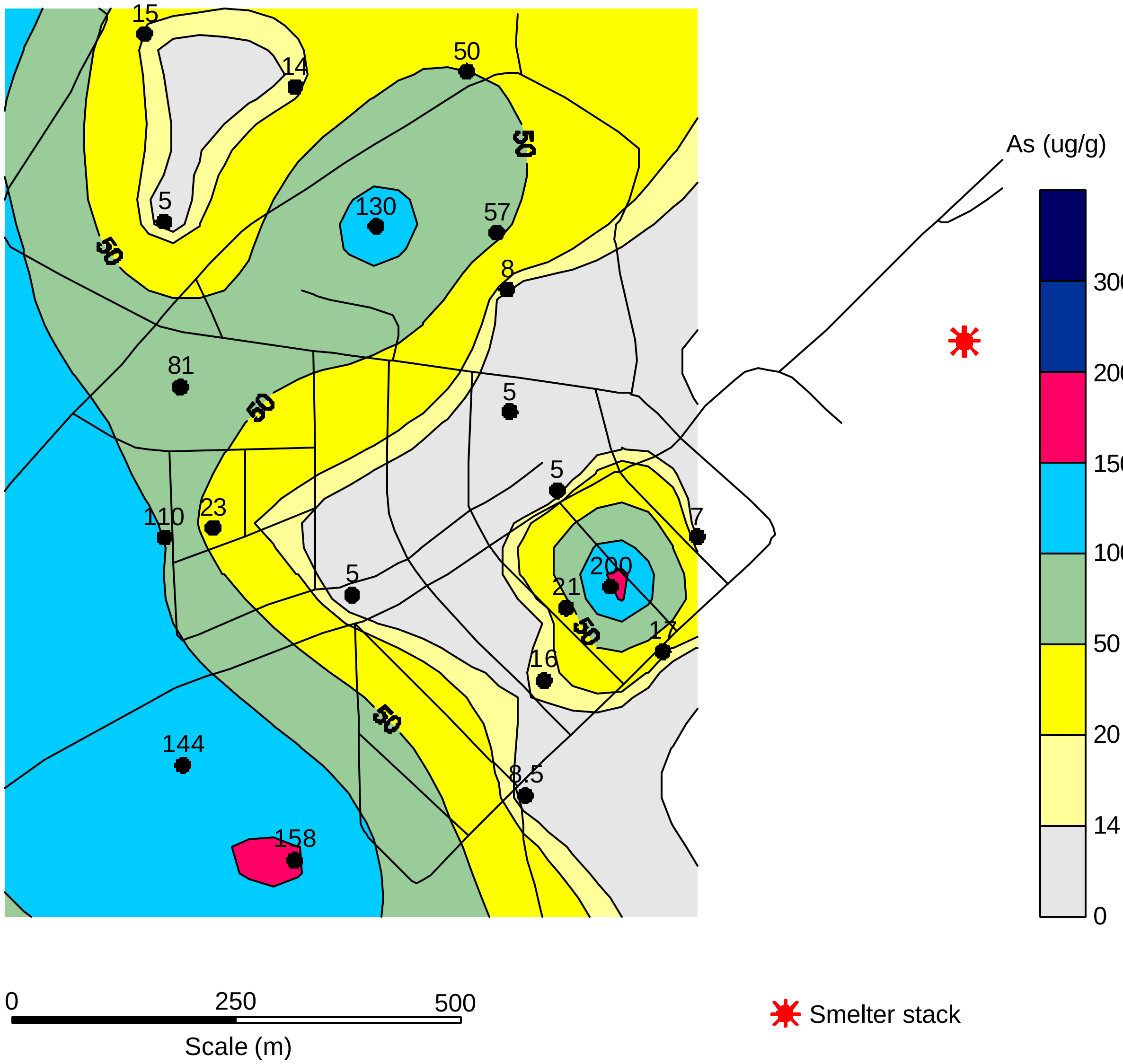
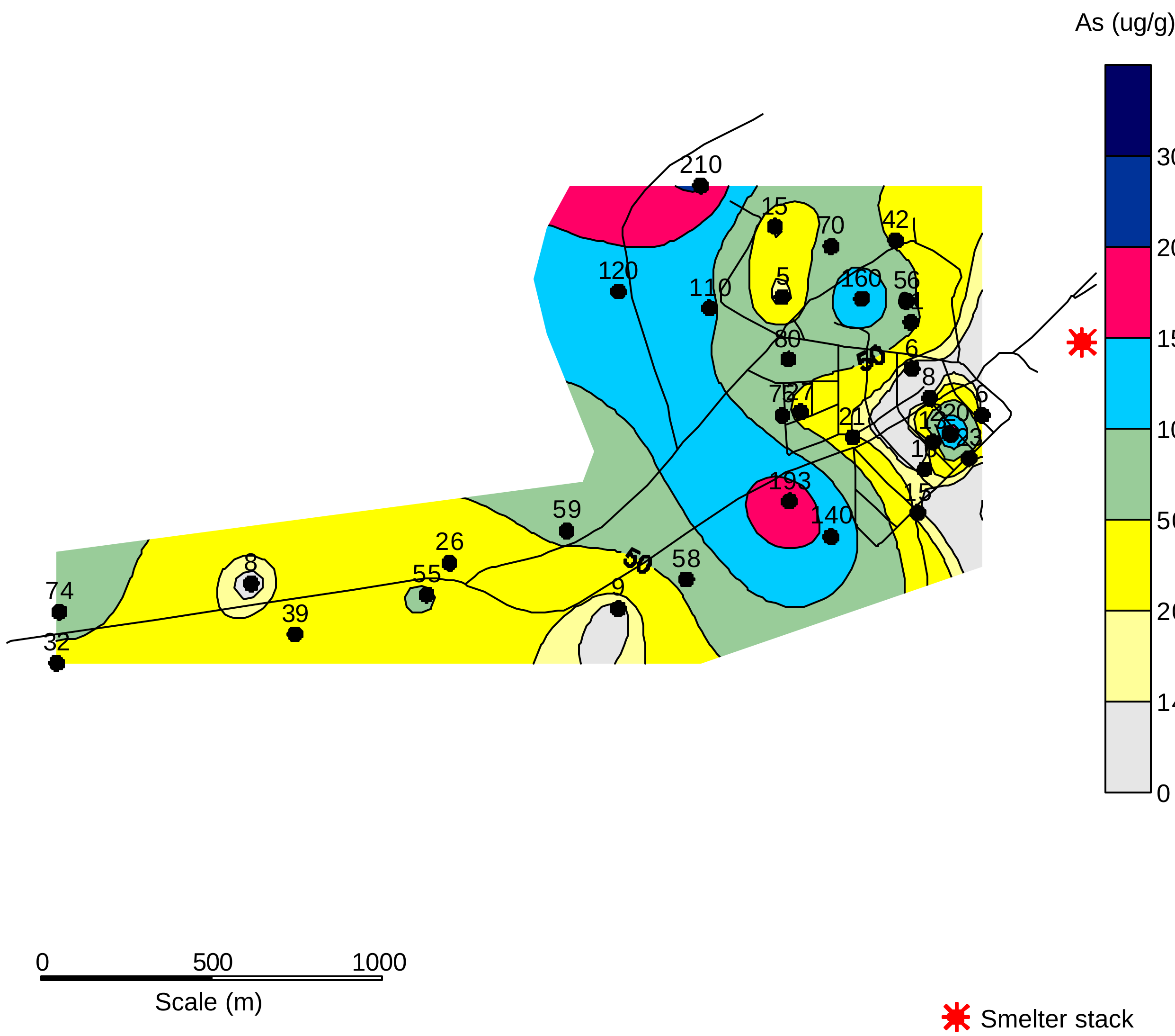
DATE	09/09/01	SOIL ARSENIC, 0-5 CM	
DESIGN	XXX		
CADD	XXX		
FILE No. 03-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 3

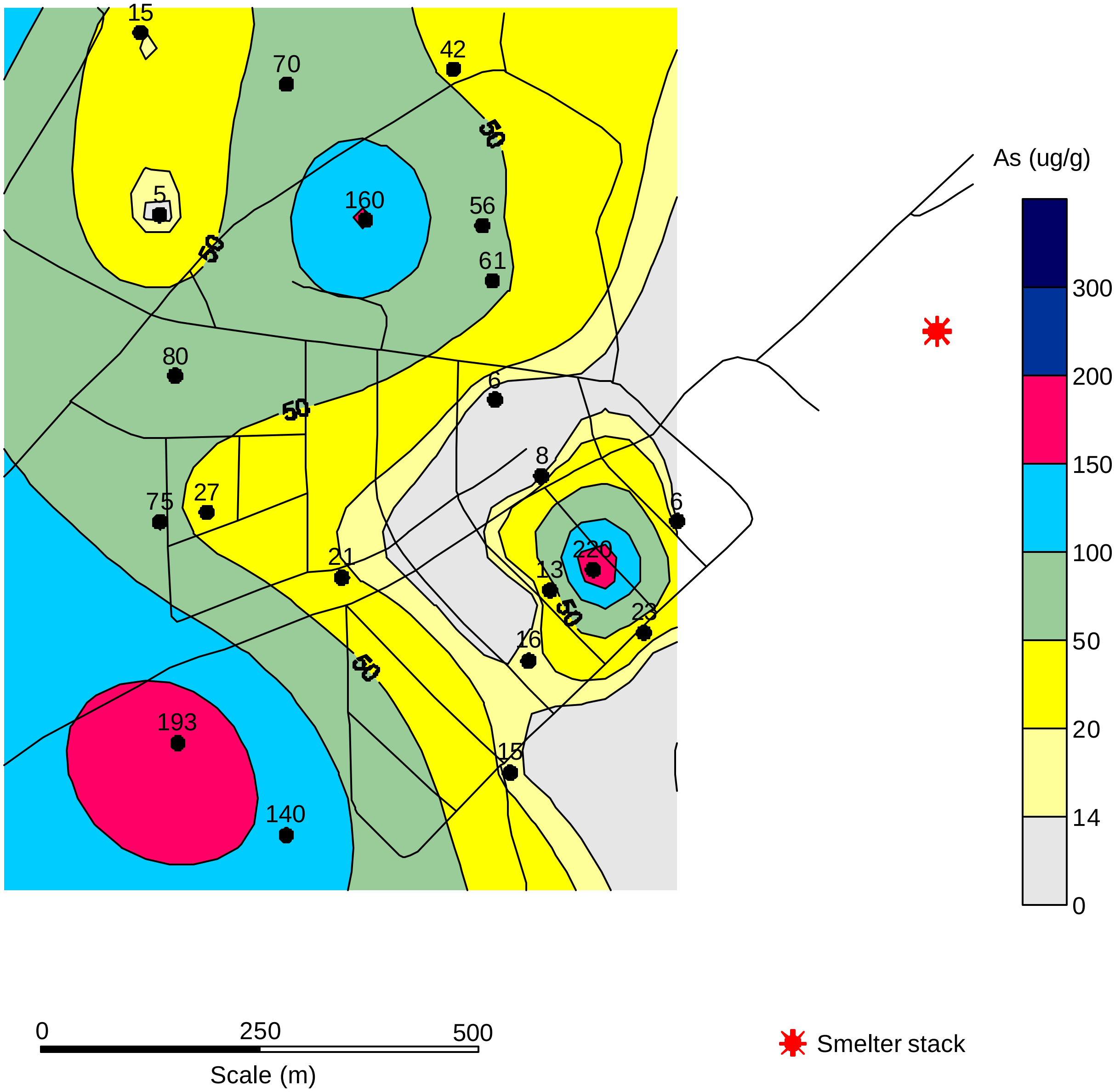


Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE SOIL ARSENIC, 0-5 CM	
	DATE 09/09/01		
	DESIGN XXX		
	CADD XXX		
FILE No. 04-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 4



Sudbury, Ontario

SCALE	AS SHOWN	TITLE	
DATE	09/09/01	SOIL ARSENIC, 0-5 CM DUPLICATE	
DESIGN	XXX		
CADD	XXX		
FILE No. 05-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 5



Golder Associates
Sudbury, Ontario

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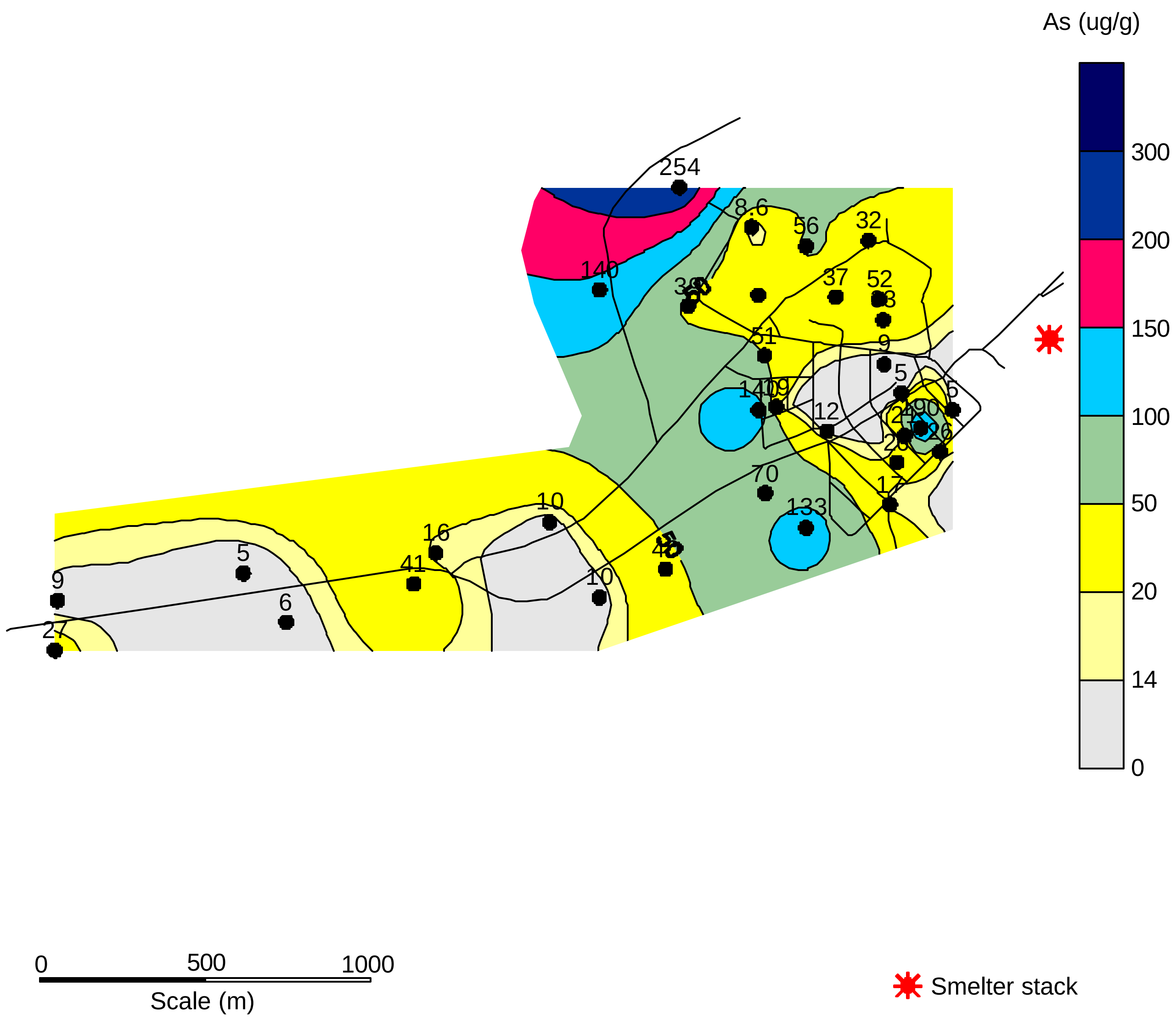
DESIGN	XXX		
CADD	XXX		
FILE No. 06-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 6



Golder Associates, Sudbury, Ontario		SCALE AS SHOWN	TITLE	
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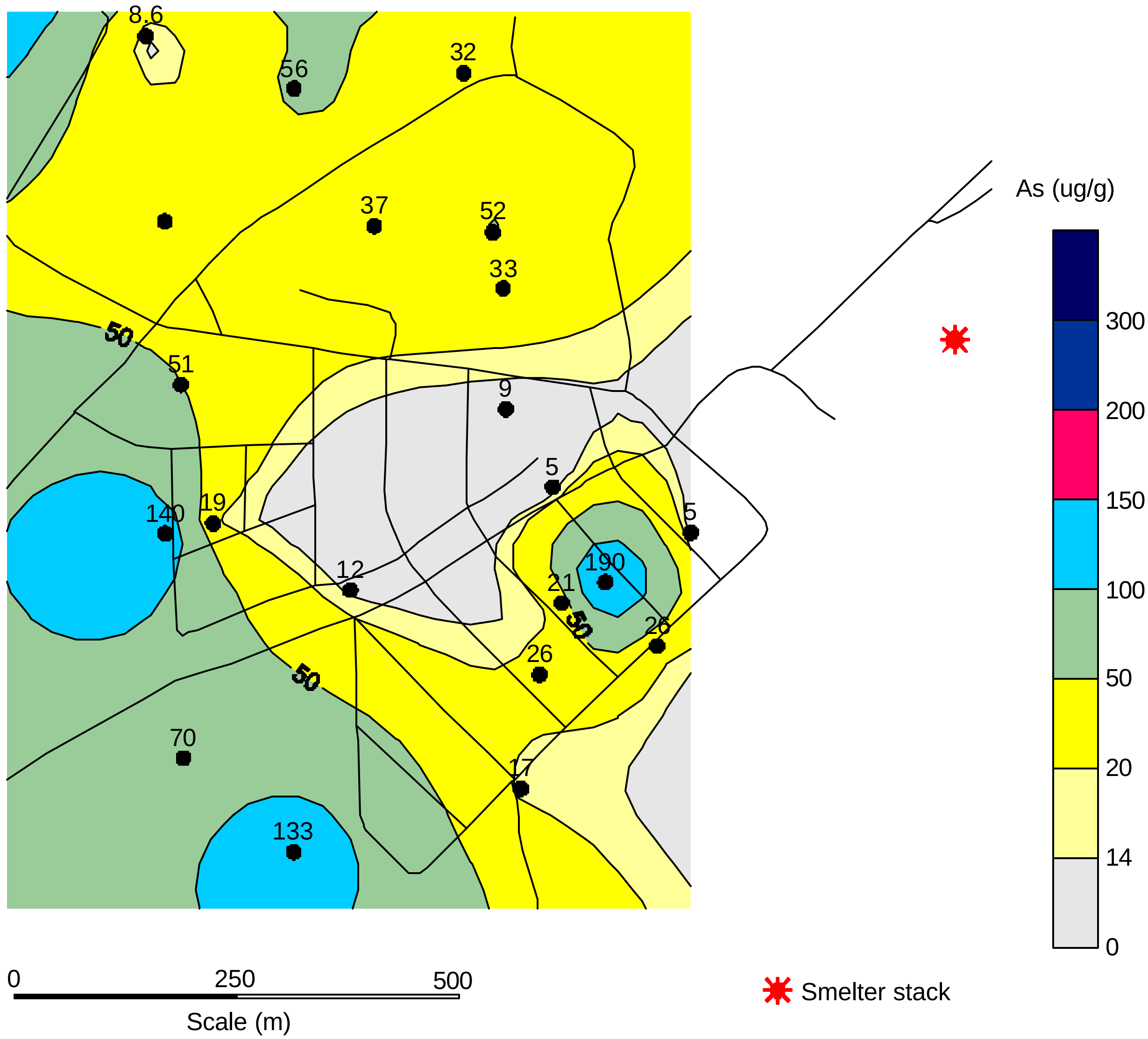
		DESIGN XXX		
		CADD XXX		
FILE No. 07-011-9233		CHECK	FALCONBRIDGE SOIL SAMPLING	FIGURE 7
PROJECT No. 011-9233-5000	REV. 0	REVIEW		



Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE	
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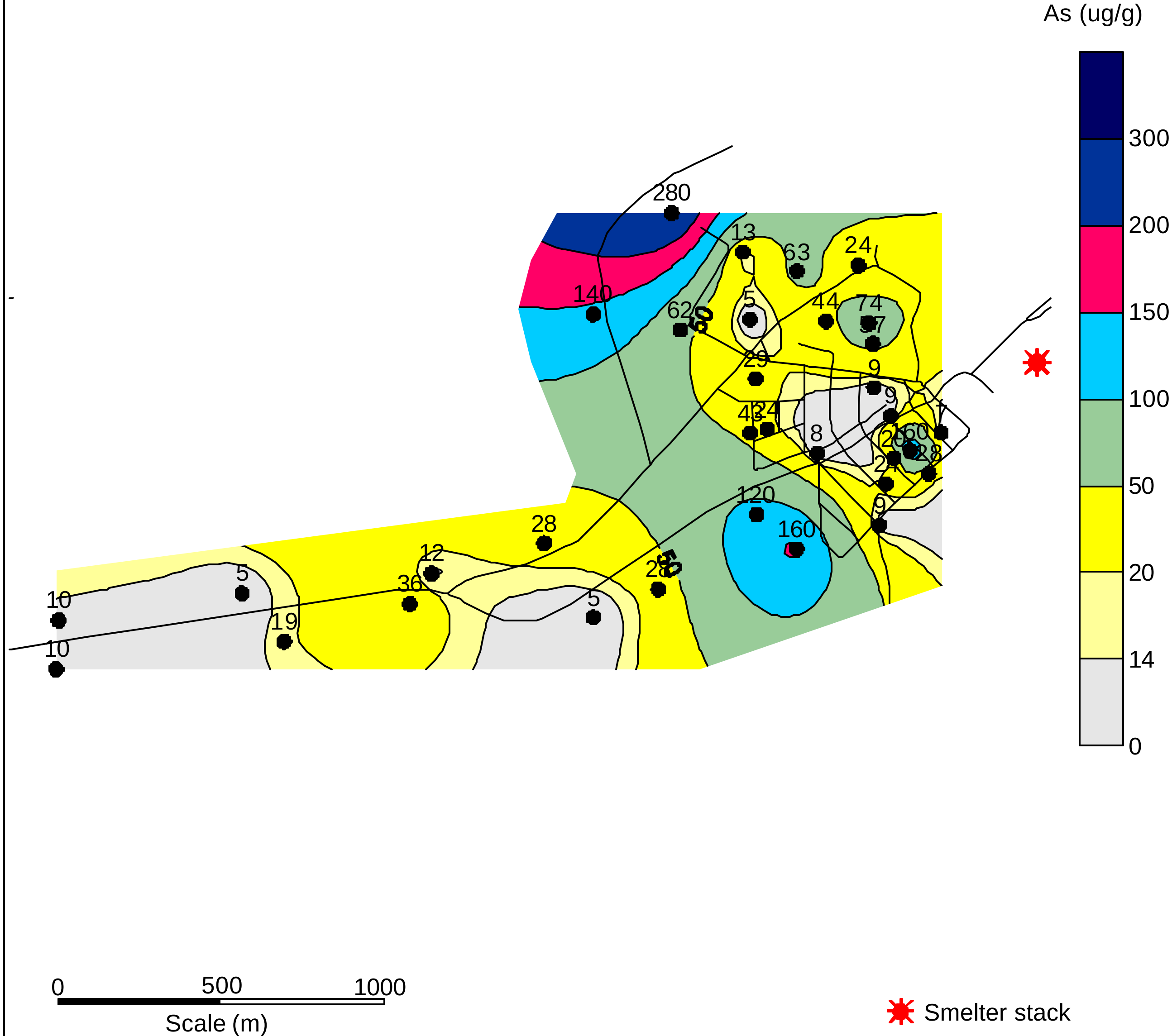
	DESIGN XXX		
	CADD XXX		
FILE No. 08-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 8



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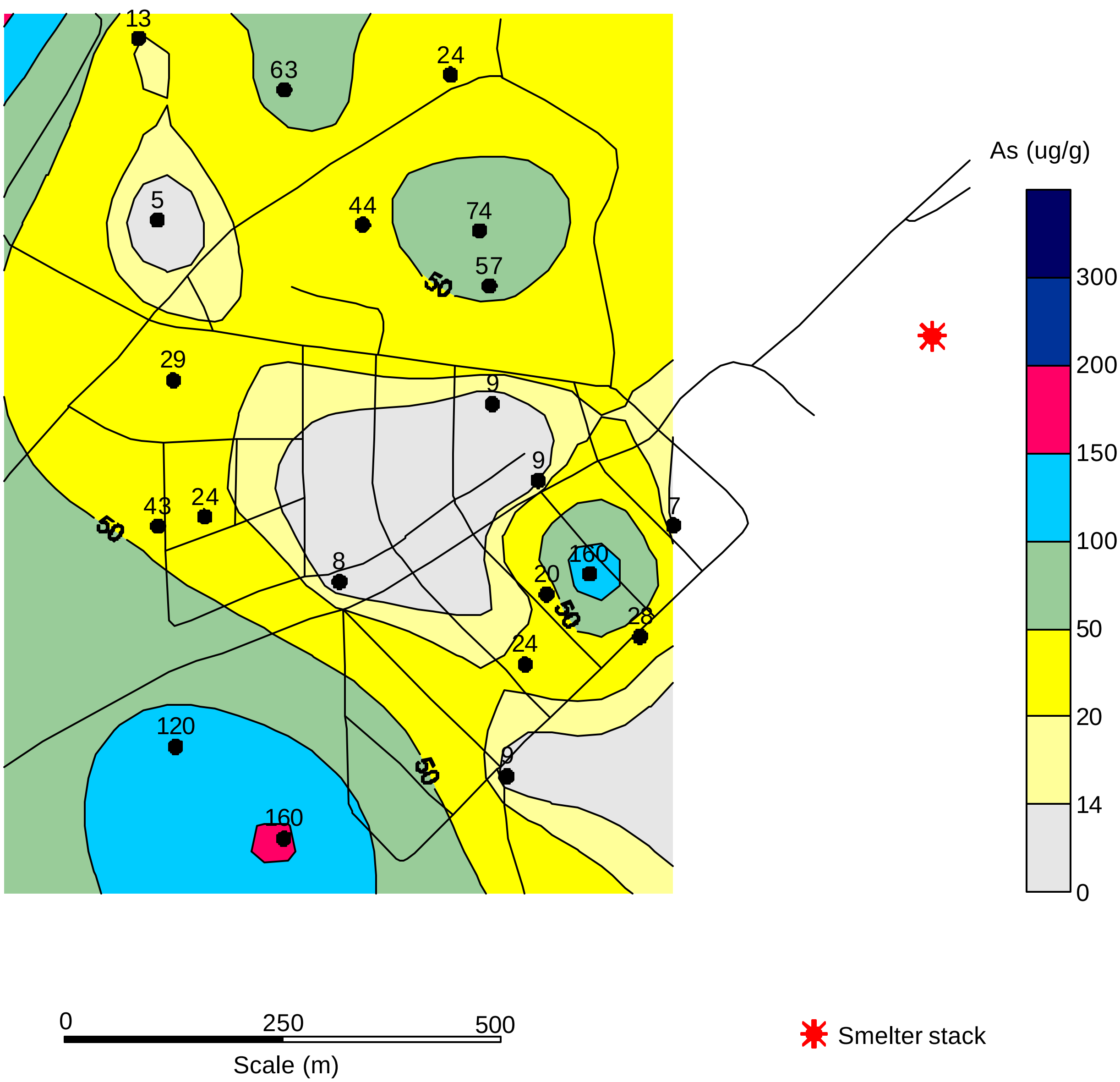
	DESIGN XXX			
	CADD XXX			
FILE No. 09-011-9233	CHECK			
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE	9



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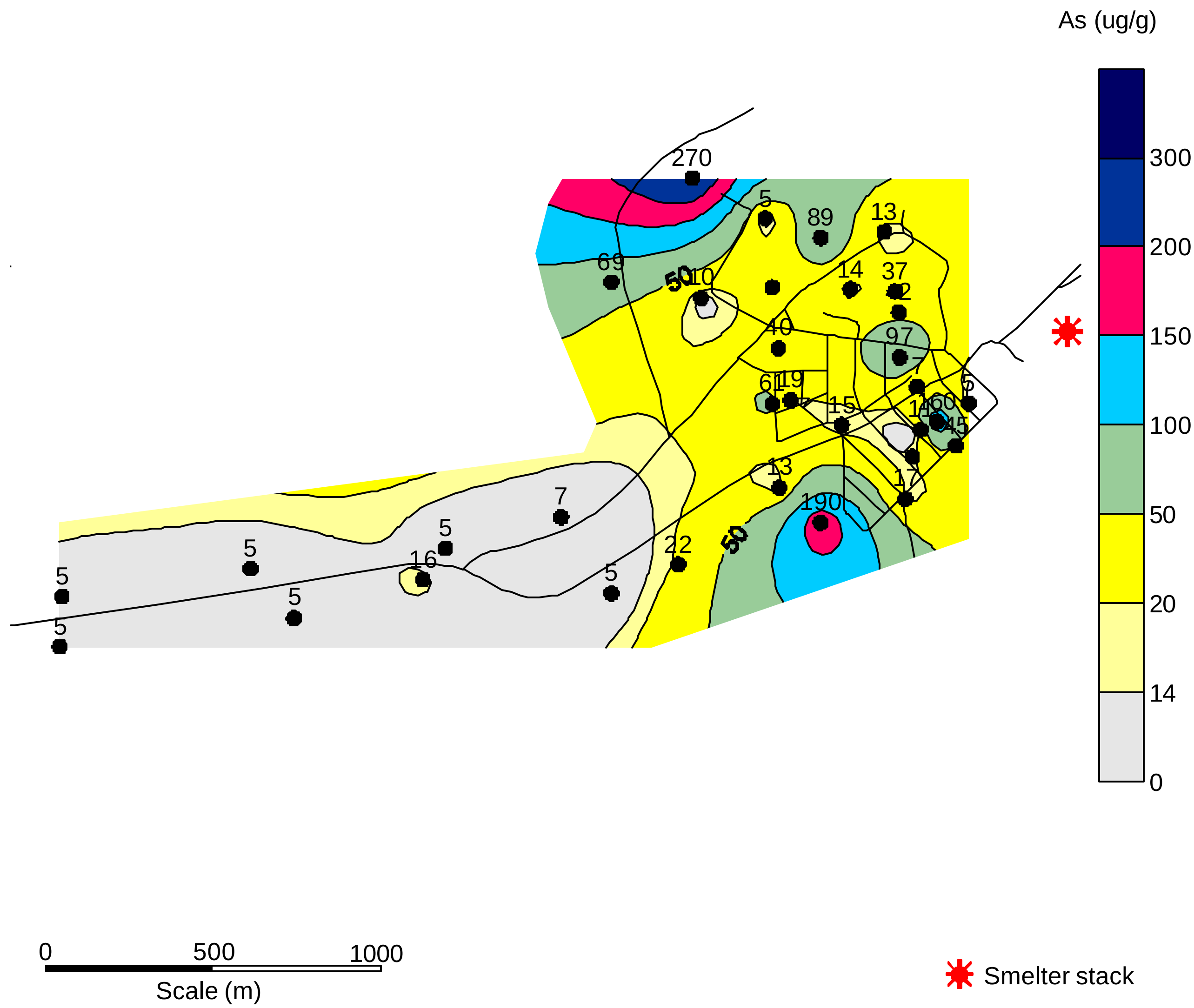
	DESIGN	XXX	
	CADD	XXX	
FILE No. 10-011-9233	CHECK		FALCONBRIDGE SOIL SAMPLING
PROJECT No. 011-9233-5000 REV. 0	REVIEW		FIGURE 10



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SCALE	AS SHOWN	TITLE	
DATE	09/09/01	SOIL ARSENIC, 10-20 CM	
DESIGN	XXX		
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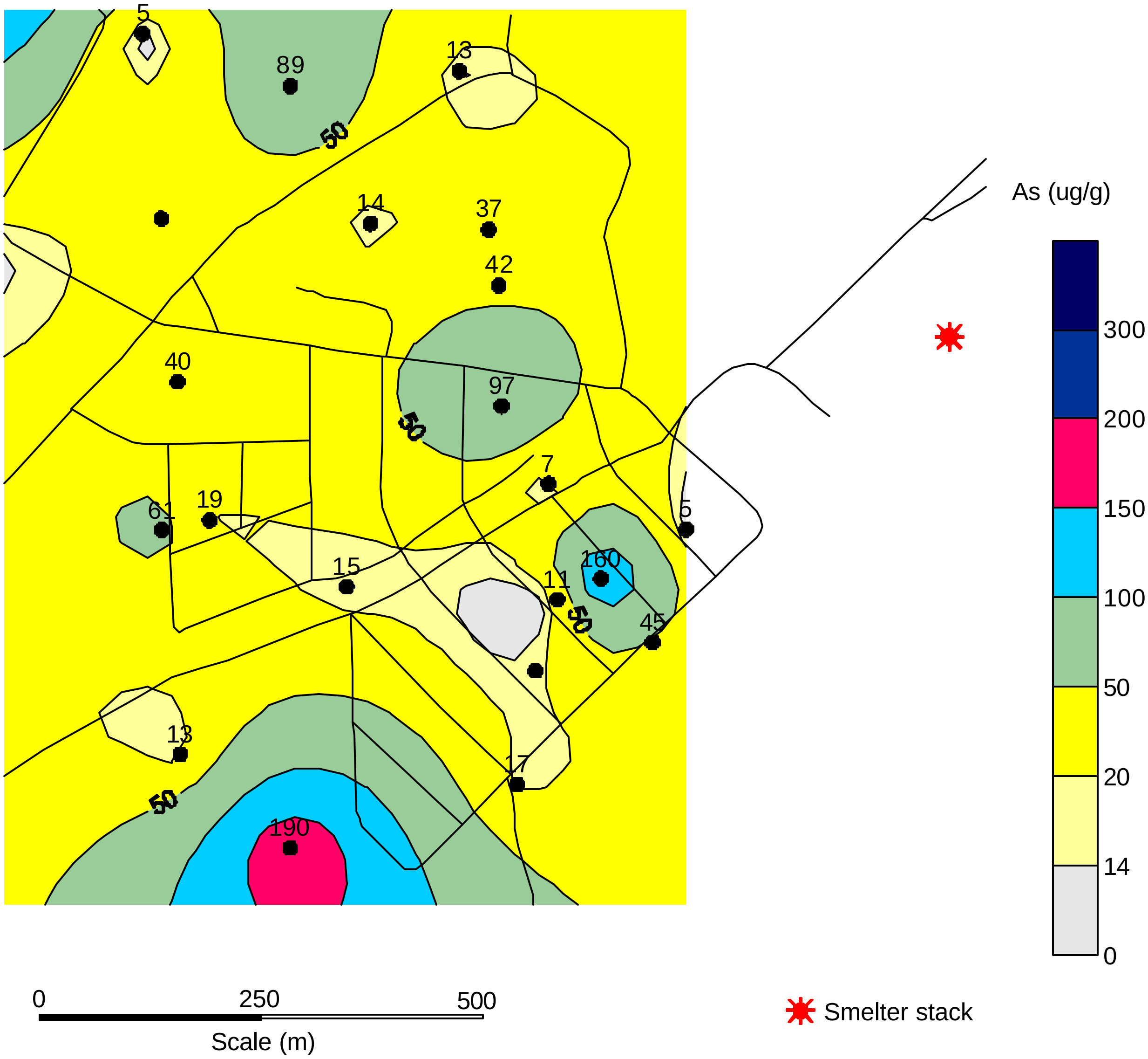
FILE No. 11-011-9233	CHECK	FALCONBRIDGE SOIL SAMPLING	FIGURE 11
PROJECT No. 011-9233-5000 REV. 0	REVIEW		



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SCALE	AS SHOWN	TITLE	
DATE	09/09/01		SOIL ARSENIC, 10-20 CM
DESIGN	XXX		
CADD	XXX		
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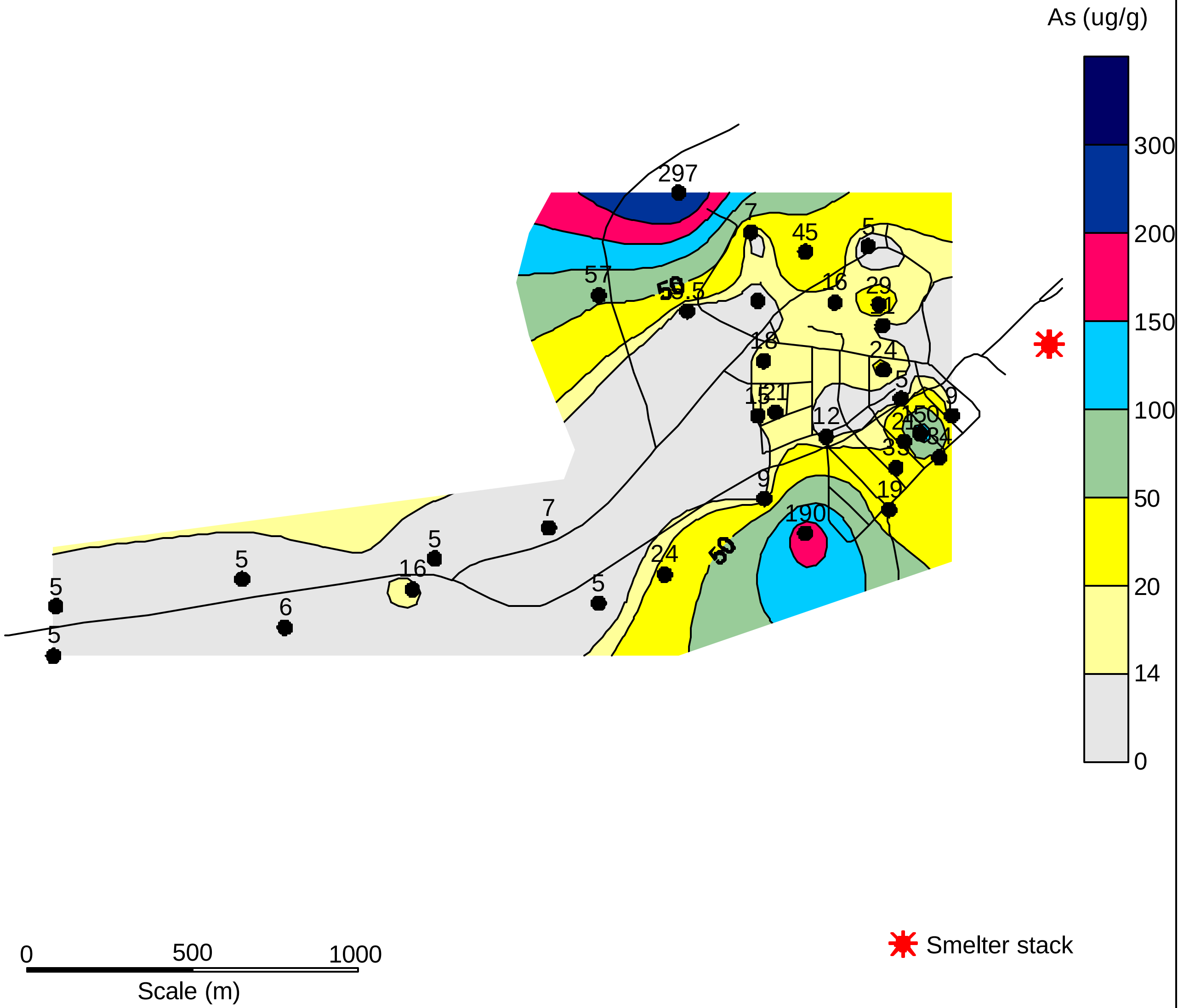
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 12



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SCALE	AS SHOWN	TITLE	SOIL ARSENIC, 10-20 CM DUPLICATE
DATE	09/09/01		
DESIGN	XXX		
CADD	XXX		
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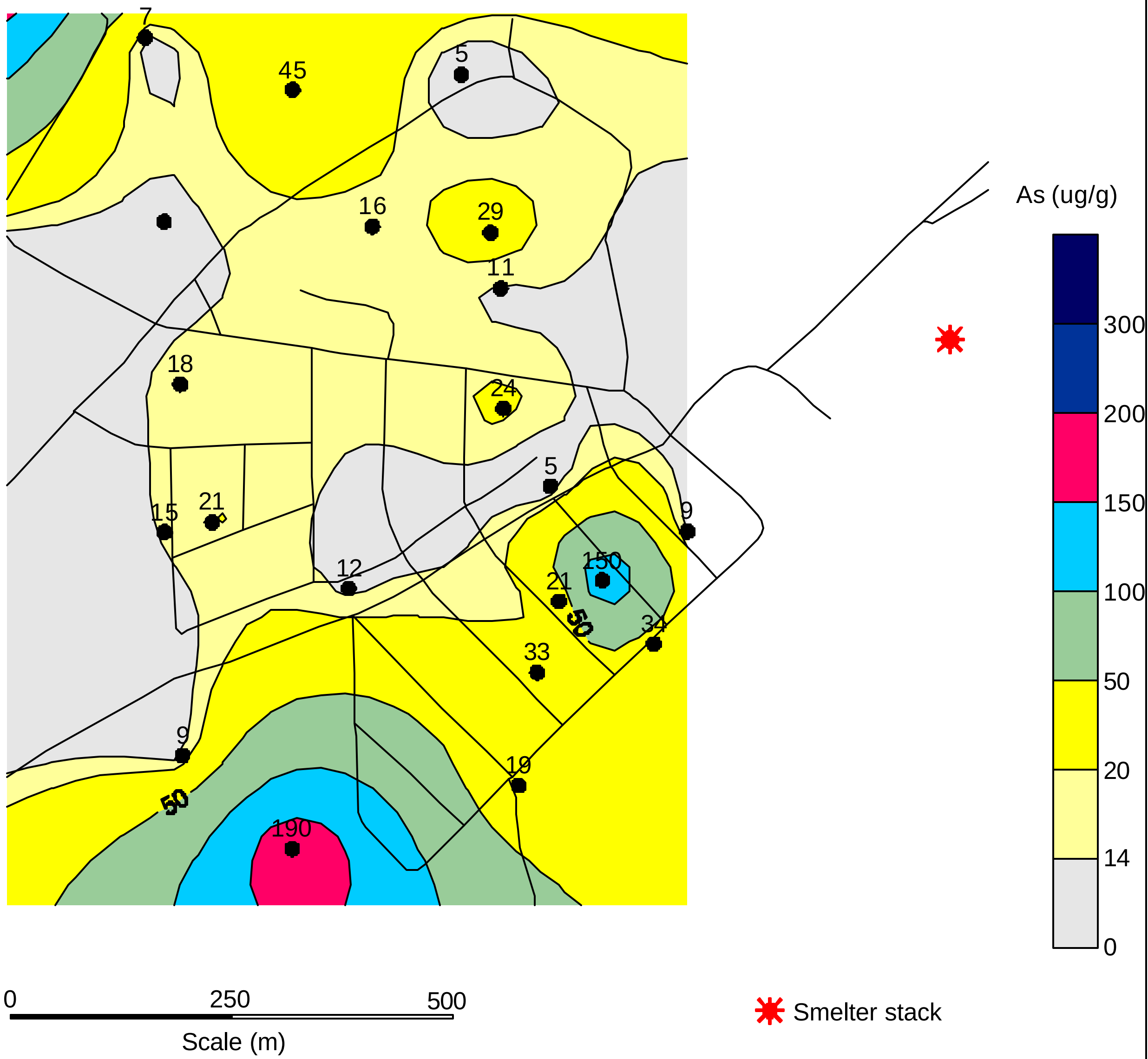
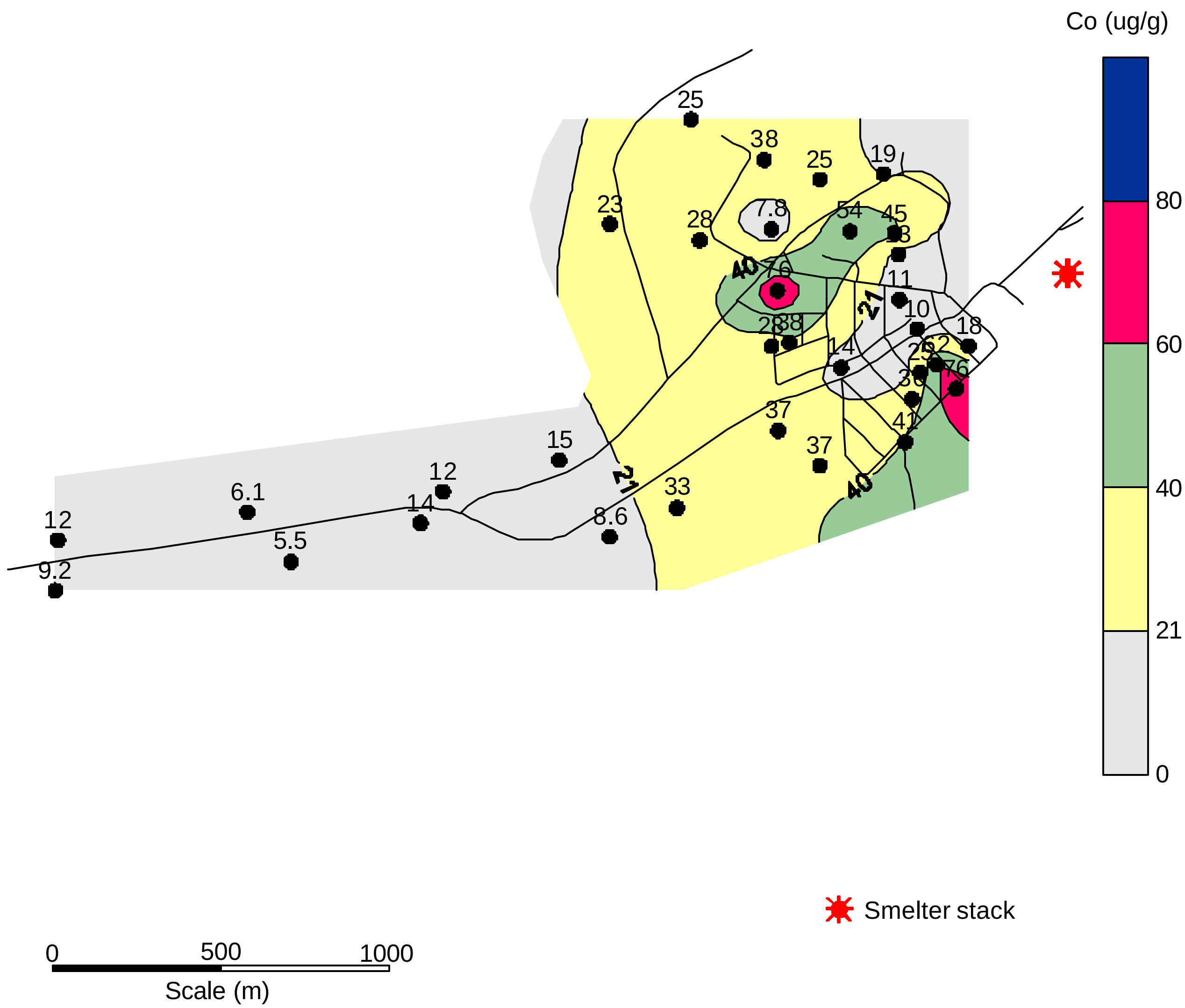
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 13



Golder Associates
Sudbury, Ontario

SCALE	AS SHOWN	TITLE	SOIL ARSENIC, 10-20 CM DUPLICATE
DATE	09/09/01		
DESIGN	XXX		
CADD	XXX		
FILE No. 14-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 14



Golder Associates
Sudbury, Ontario

SCALE	AS SHOWN	TITLE	
DATE	09/09/01		SOIL COBALT, 0-5 CM
DESIGN	XXX		
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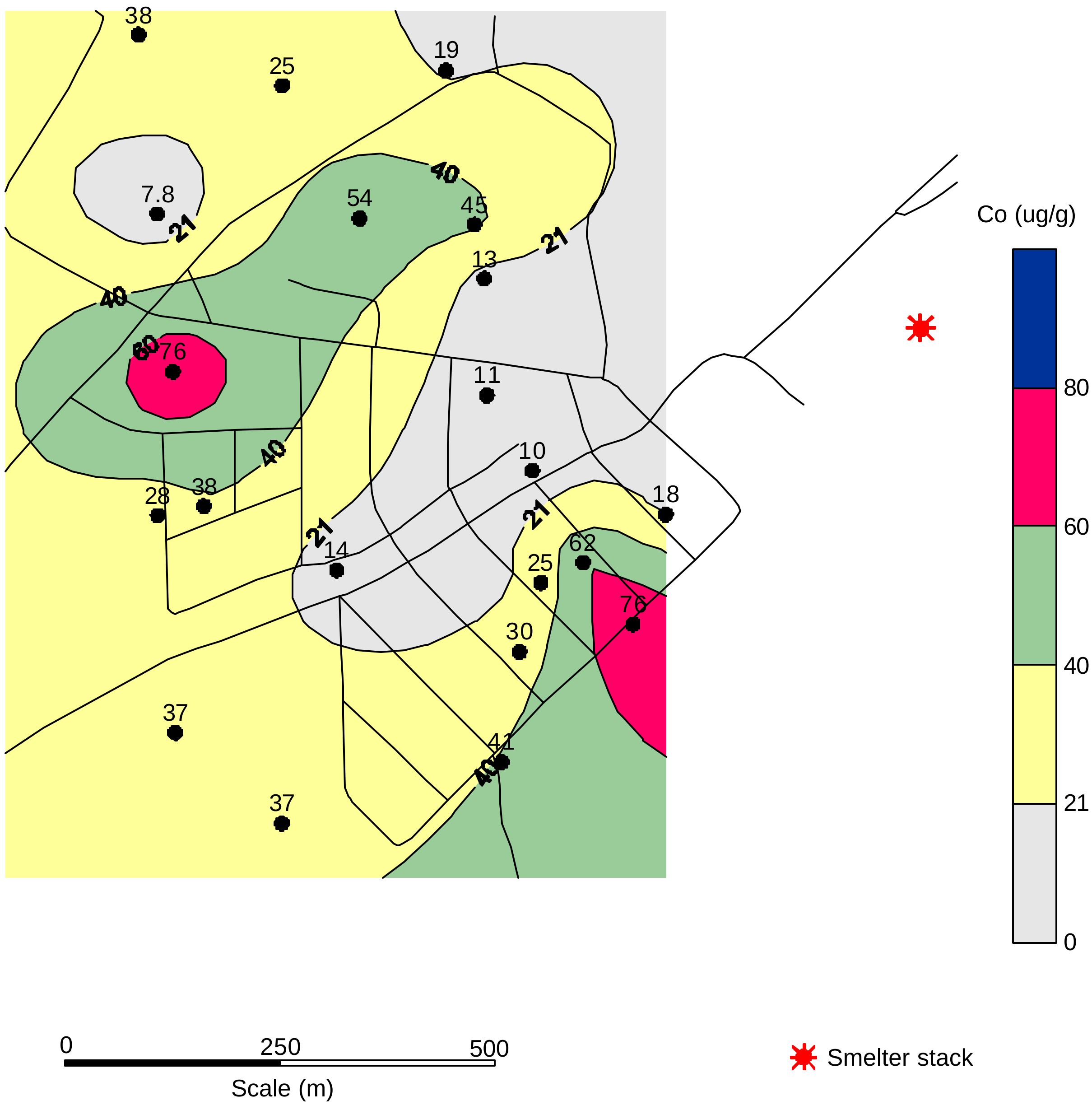
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 15



Golder Associates
Sudbury, Ontario

SCALE	AS SHOWN	TITLE	
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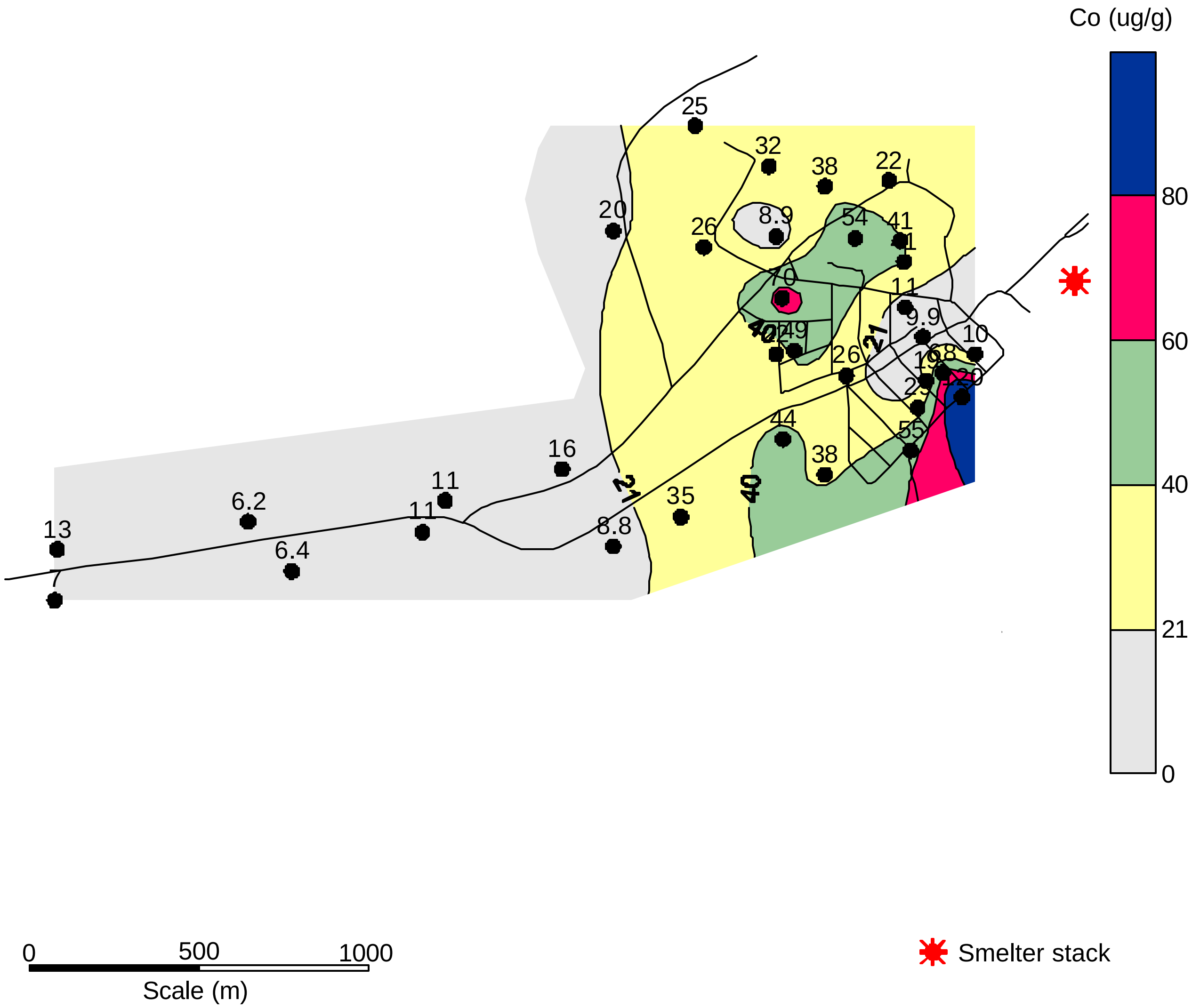
DESIGN	XXX		
CADD	XXX		
FILE No. 16-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 16



Golder Associates
Sudbury, Ontario

SCALE	AS SHOWN
DATE	09/09/01
DESIGN	XXX
CADD	XXX
CHECK	
REVIEW	

FILE No. 17-011-9233

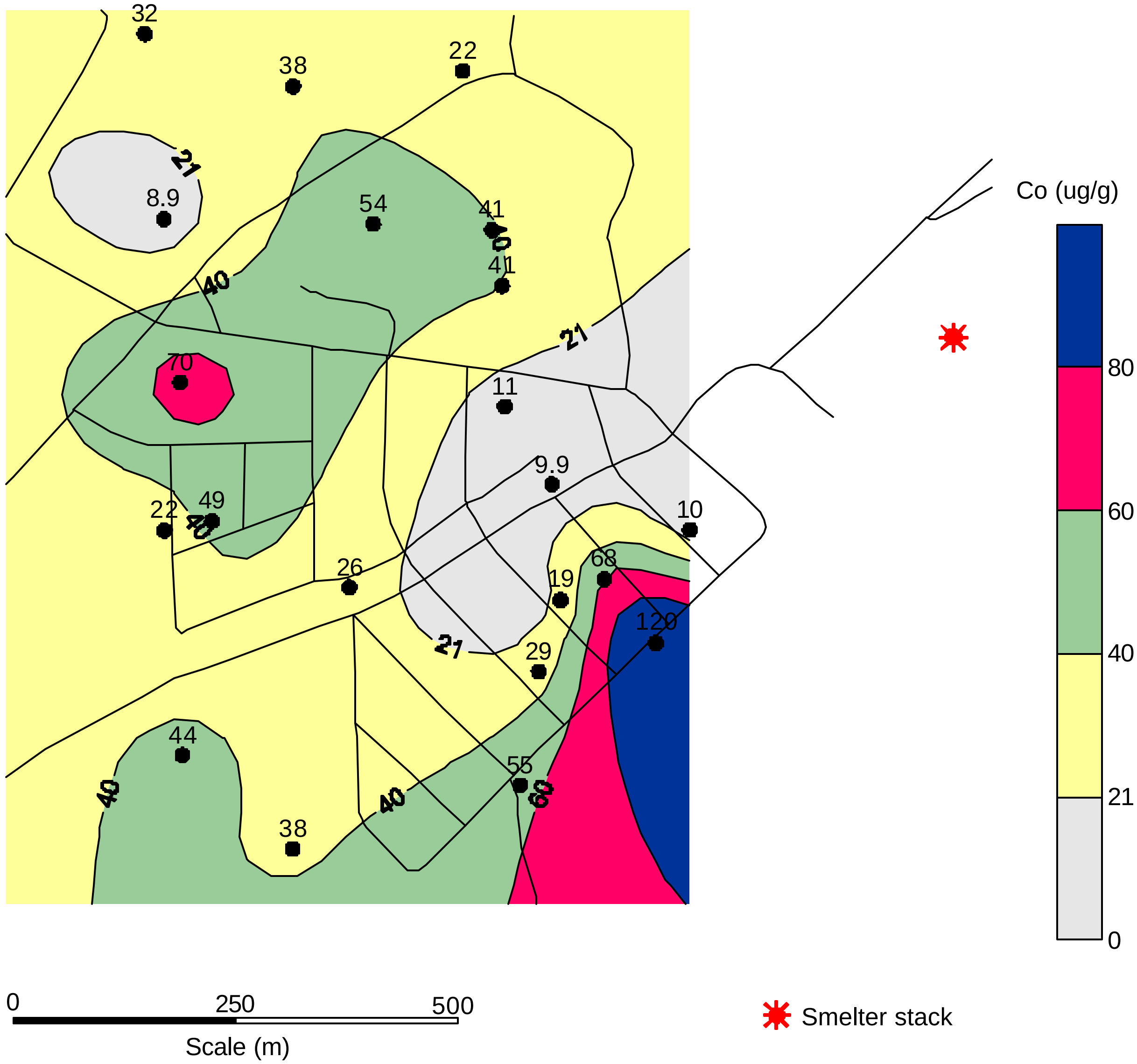
PROJECT No. 011-9233-5000 REV. 0

TITLE

SOIL COBALT, 0-5 CM DUPLICATE

FALCONBRIDGE SOIL SAMPLING

FIGURE 17



Golder Associates, Sudbury, Ontario	SCALE AS SHOWN	TITLE		
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	DESIGN XXX			
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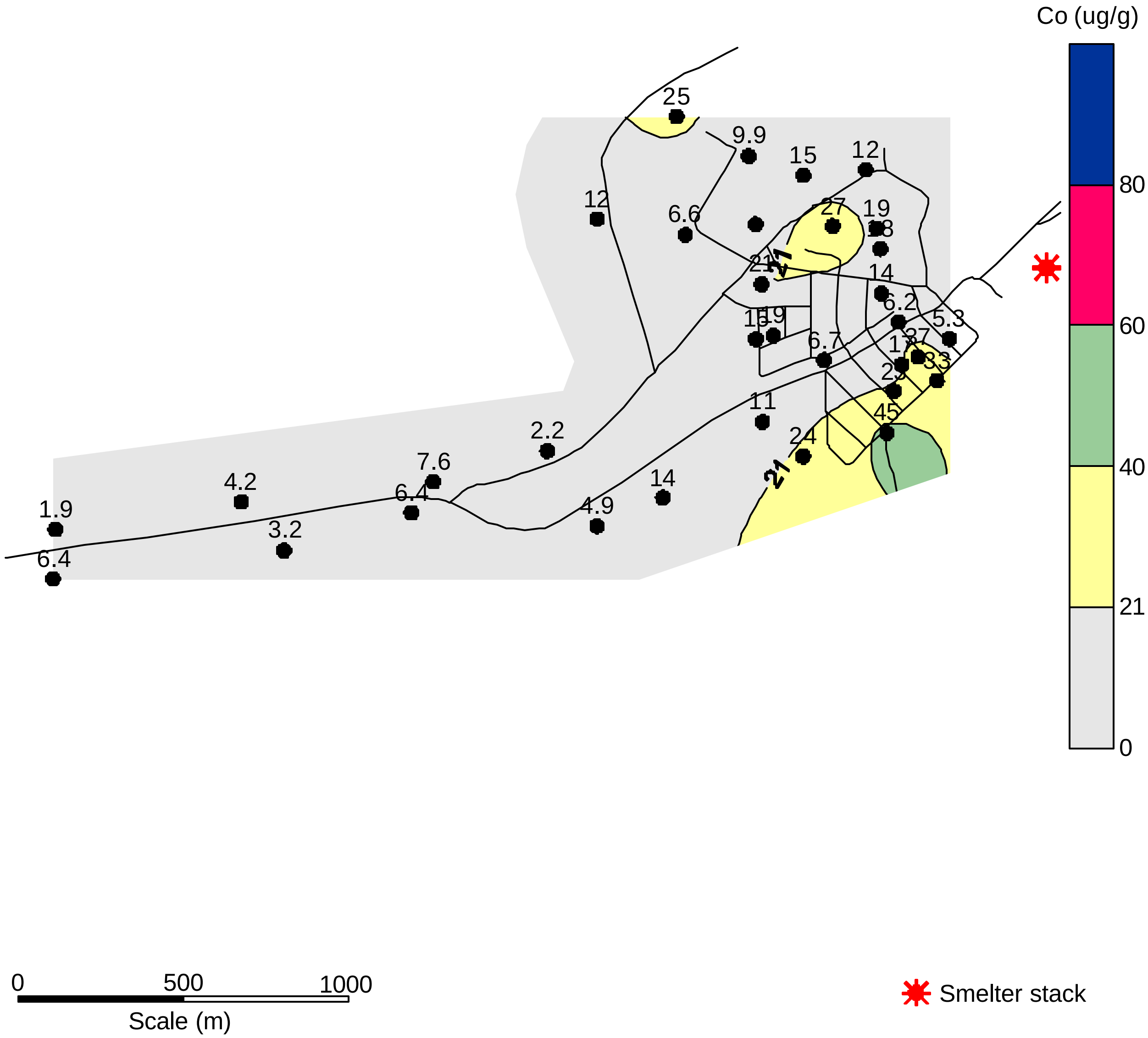
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 18	



Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE	
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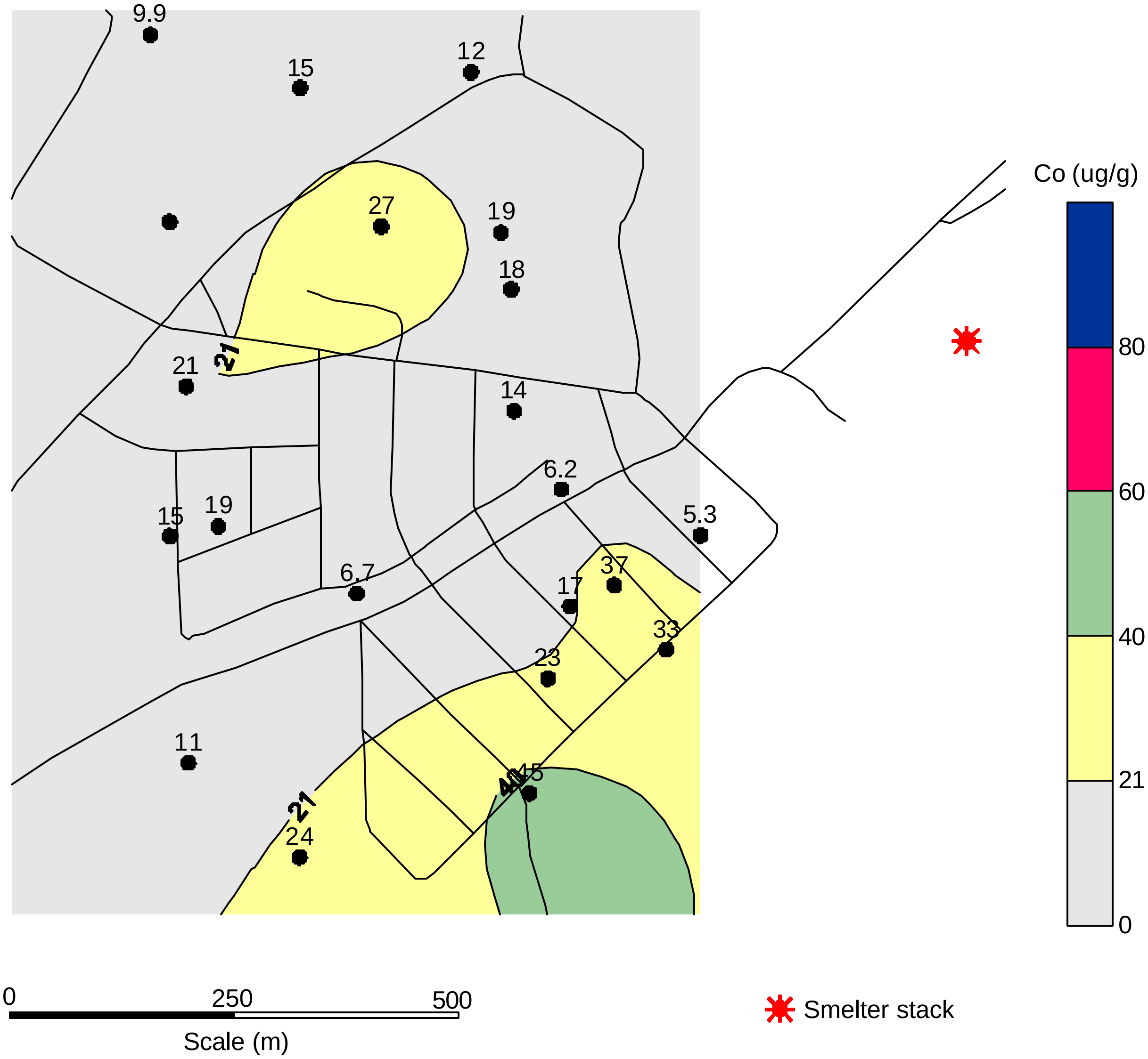
	CADD XXX		
FILE No. 19-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 19



Golder Associates, Sudbury, Ontario	SCALE: AS SHOWN	TITLE	
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	DESIGN: XXX		
	CADD: XXX		
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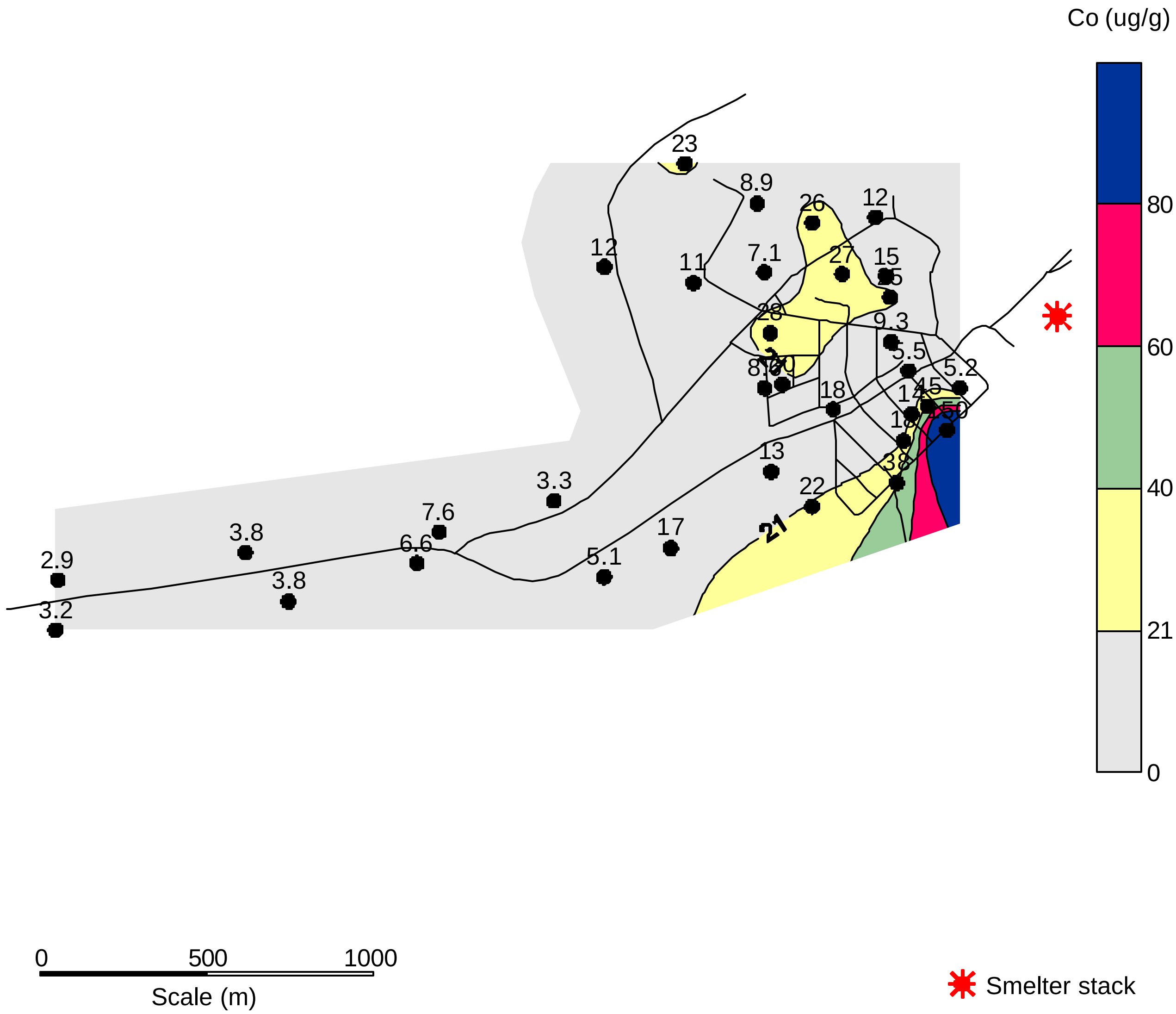
PROJECT No. 011-9233-5000 / REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 20



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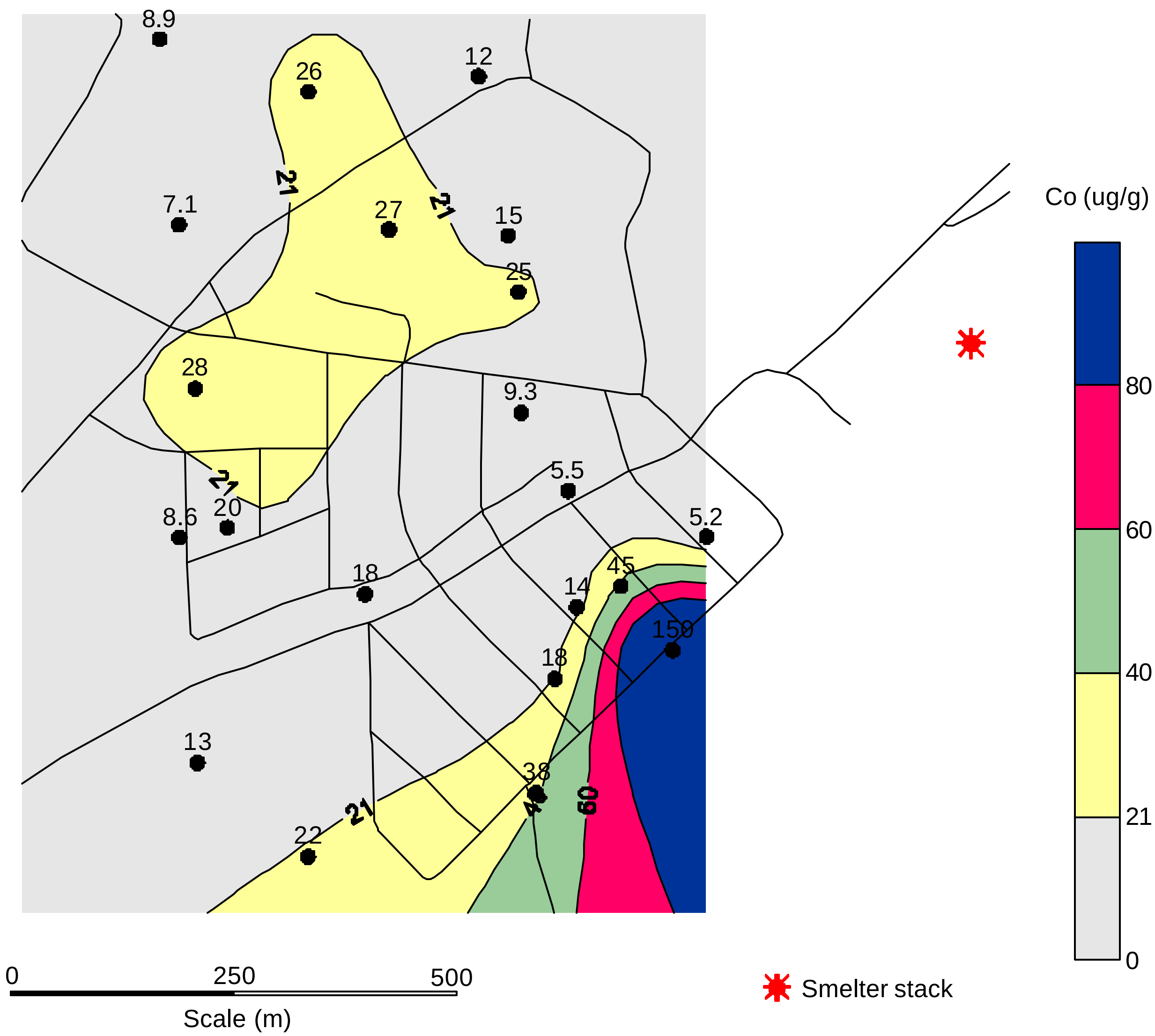
SCALE	AS SHOWN	TITLE	
DATE	09/09/01	SOIL COBALT, 5-10 CM DUPLICATE	
DESIGN	XXX		
CADD	XXX		
FILE No. 21-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 21



Golder Associates, Sudbury, Ontario	SCALE AS SHOWN	TITLE	
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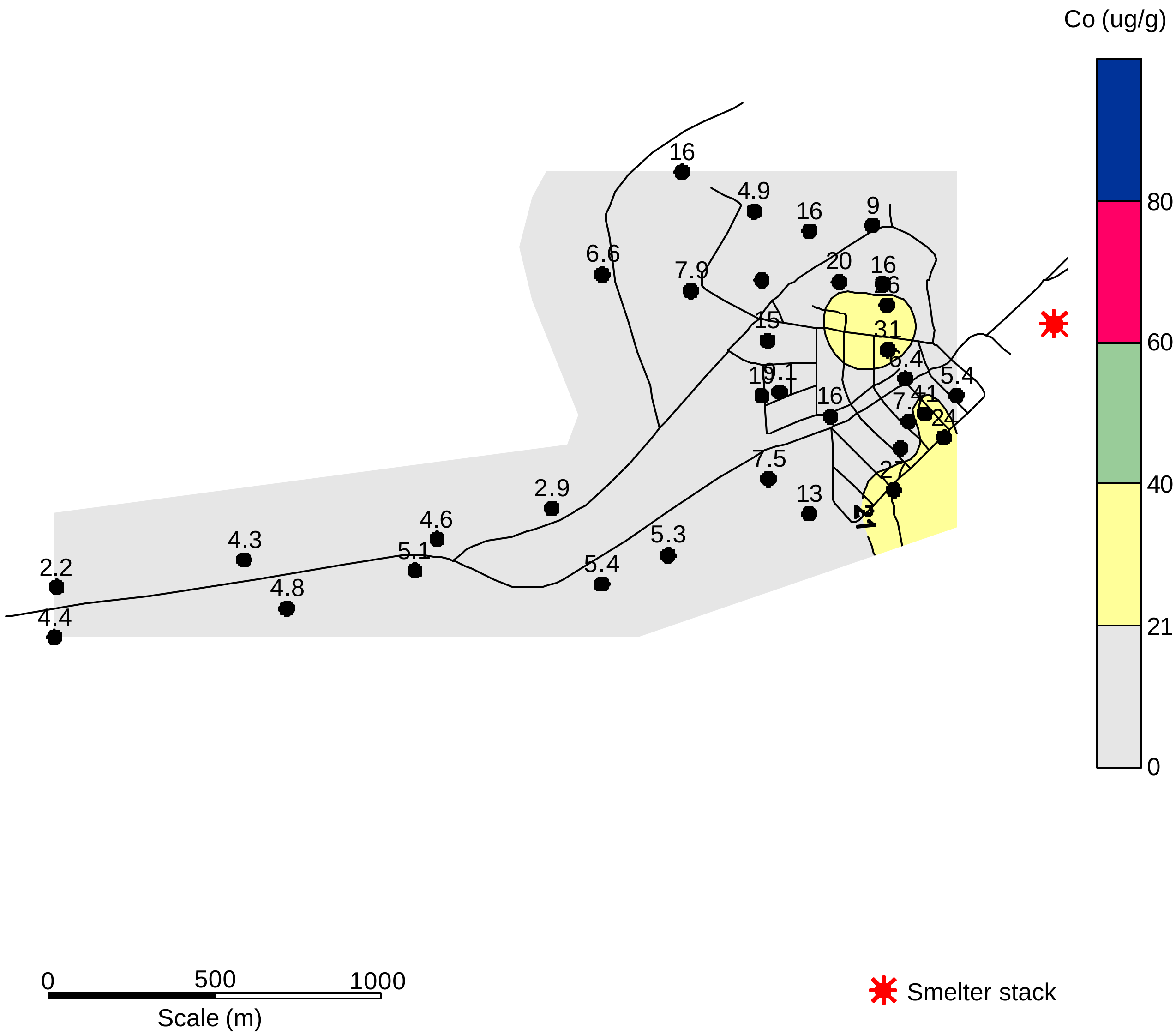
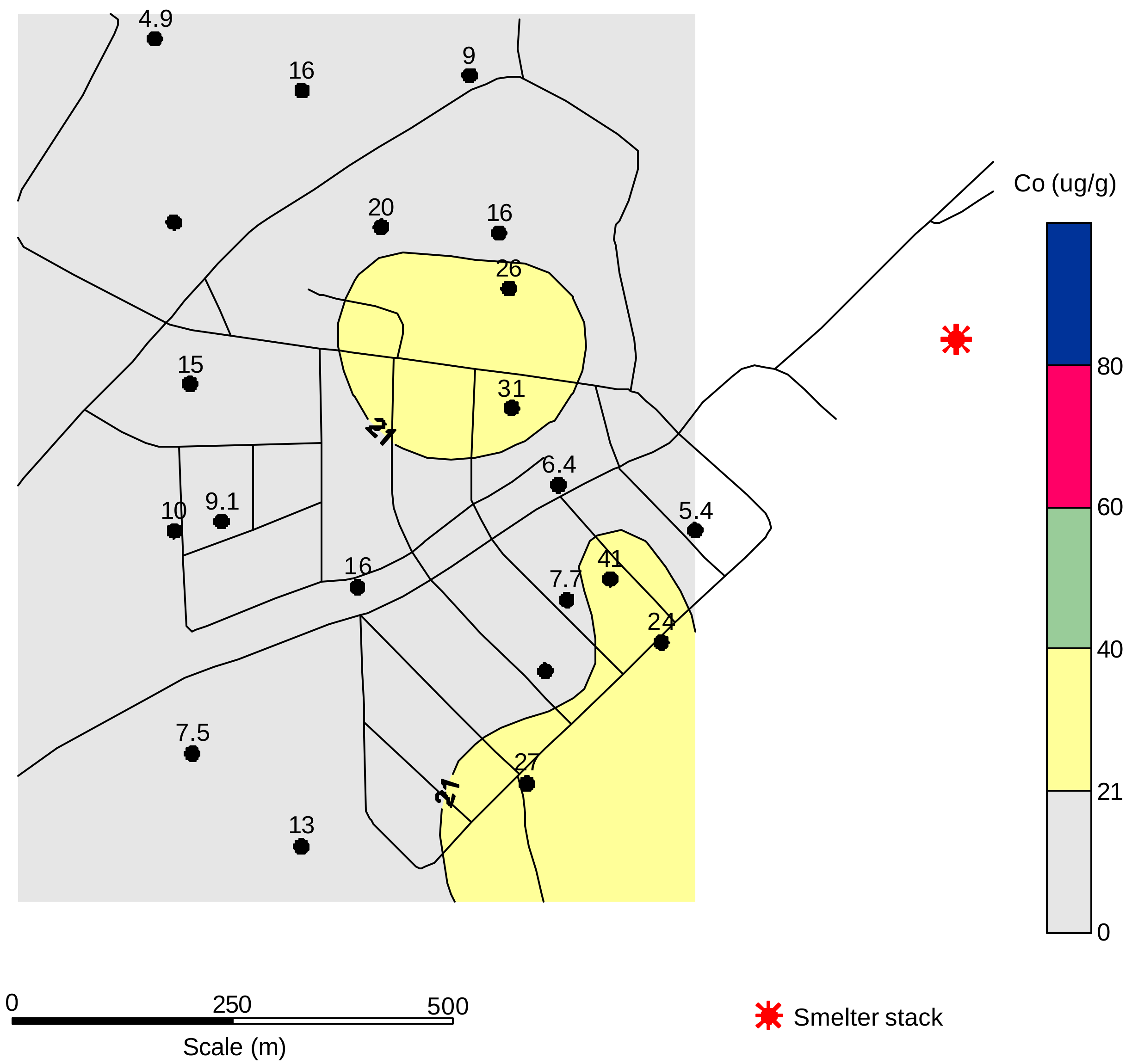
	CADD XXX		
FILE No. 22-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 22



Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE SOIL COBALT, 10-20 CM	
	DATE 09/09/01		
	DESIGN XXX		
	CADD XXX		
FILE No. 23-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 23



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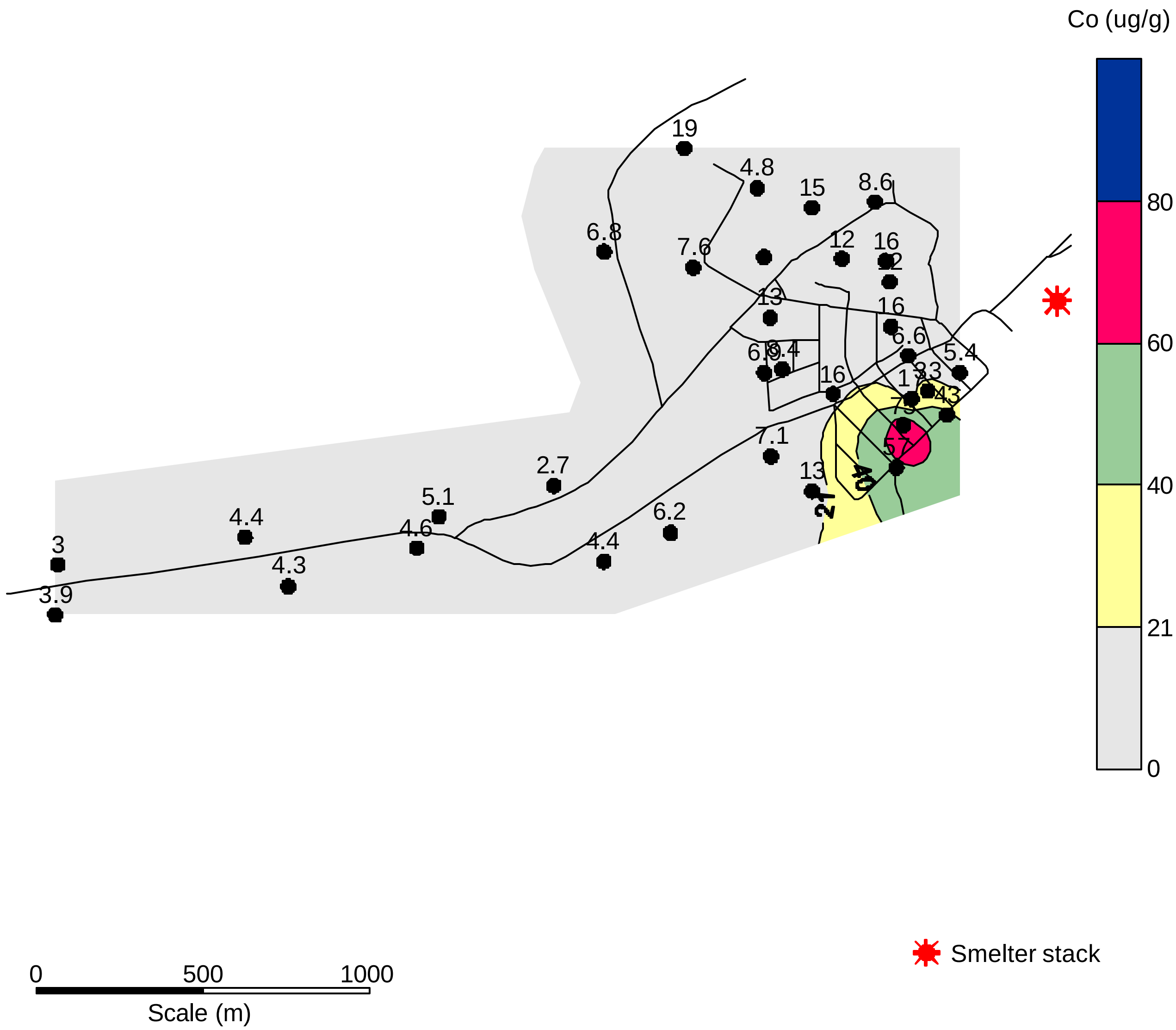
SCALE	AS SHOWN	TITLE	SOIL COBALT, 10-20 CM
DATE	09/09/01		
DESIGN	XXX		
CADD	XXX		
FILE No.	24-011-9233	CHECK	
PROJECT No.	011-9233-5000	REV.	0
REVIEW		FALCONBRIDGE SOIL SAMPLING	FIGURE 24



Golder Associates, Sudbury, Ontario	SCALE AS SHOWN	TITLE		
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	DESIGN XXX			
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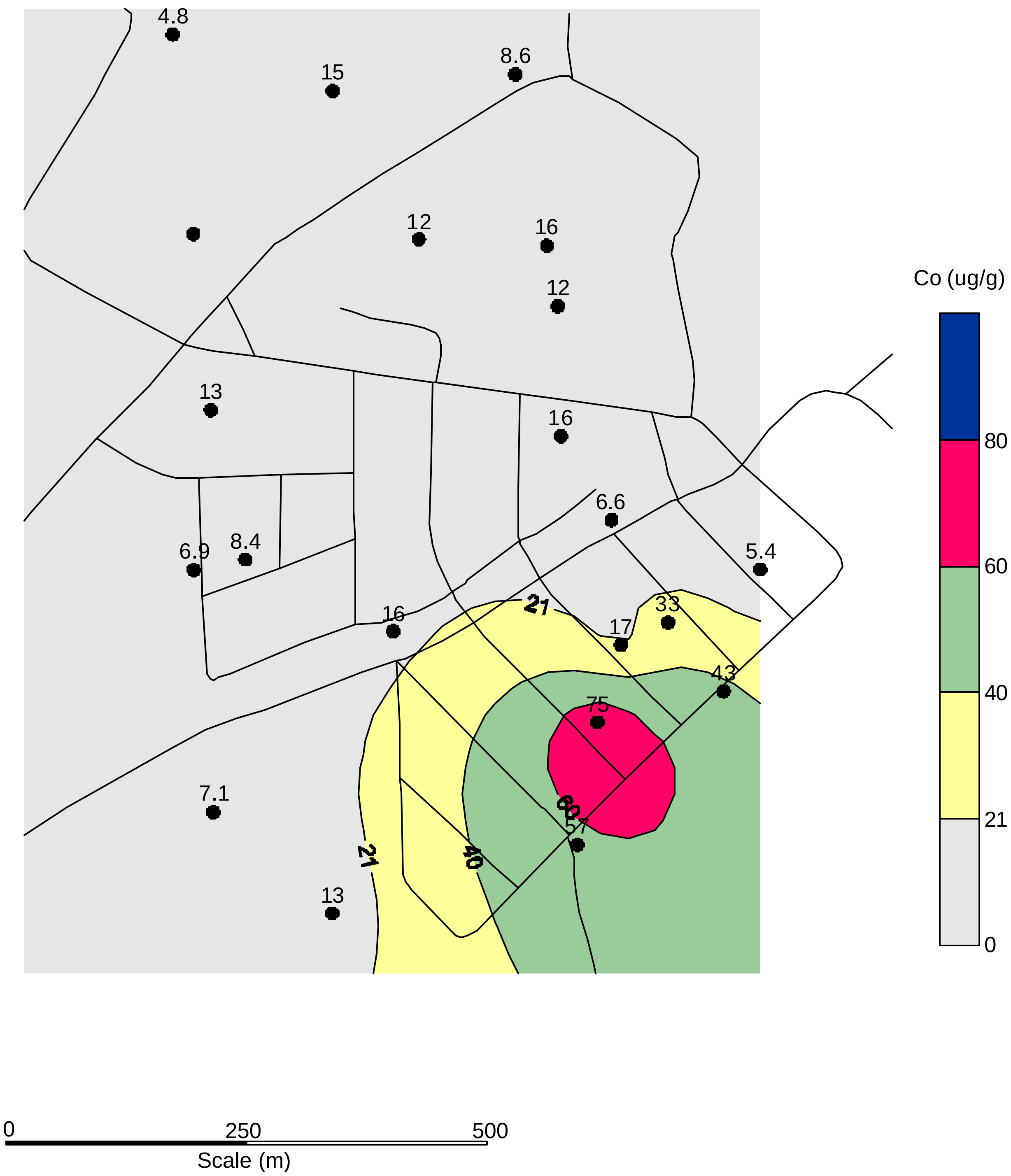
FILE No. 25-011-9233	CHECK			
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 25	



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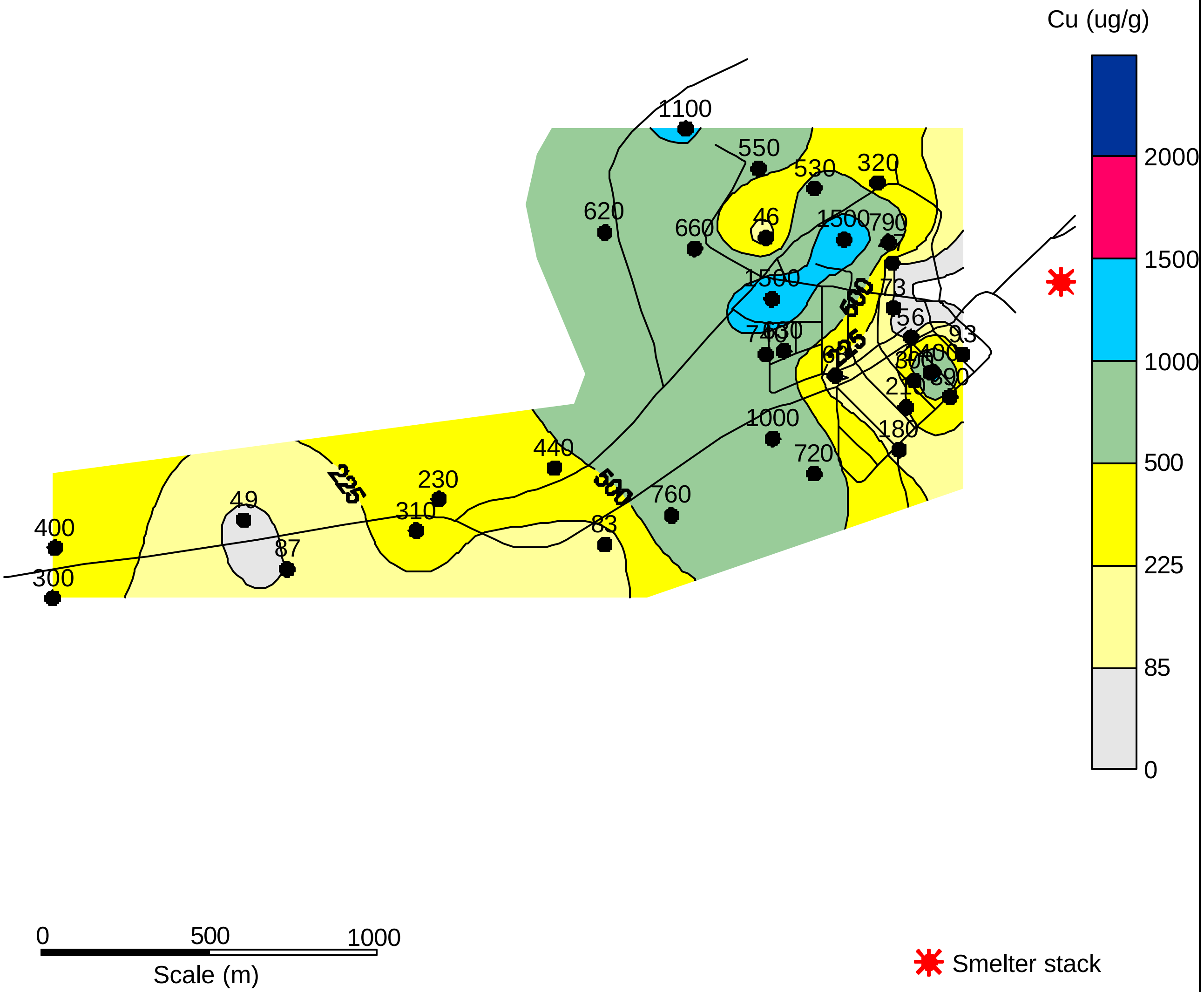
	DESIGN XXX		
	CADD XXX		
FILE No. 26-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 26



Golder Associates, Sudbury, Ontario	SCALE AS SHOWN	TITLE
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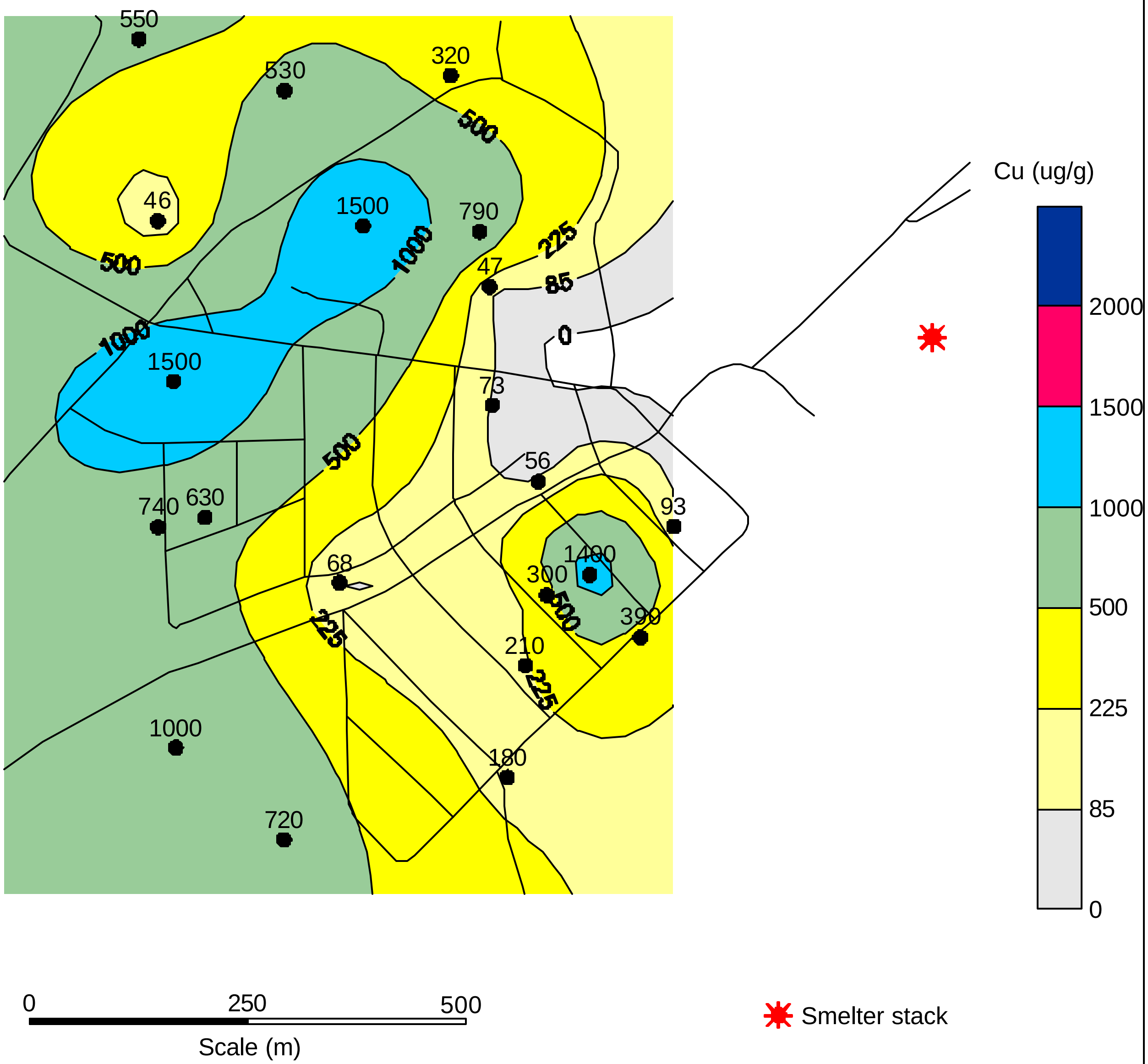
	DESIGN XXX	
	CADD XXX	
FILE No. 27-011-9233	CHECK	FALCONBRIDGE SOIL SAMPLING
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FIGURE 27



Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE	
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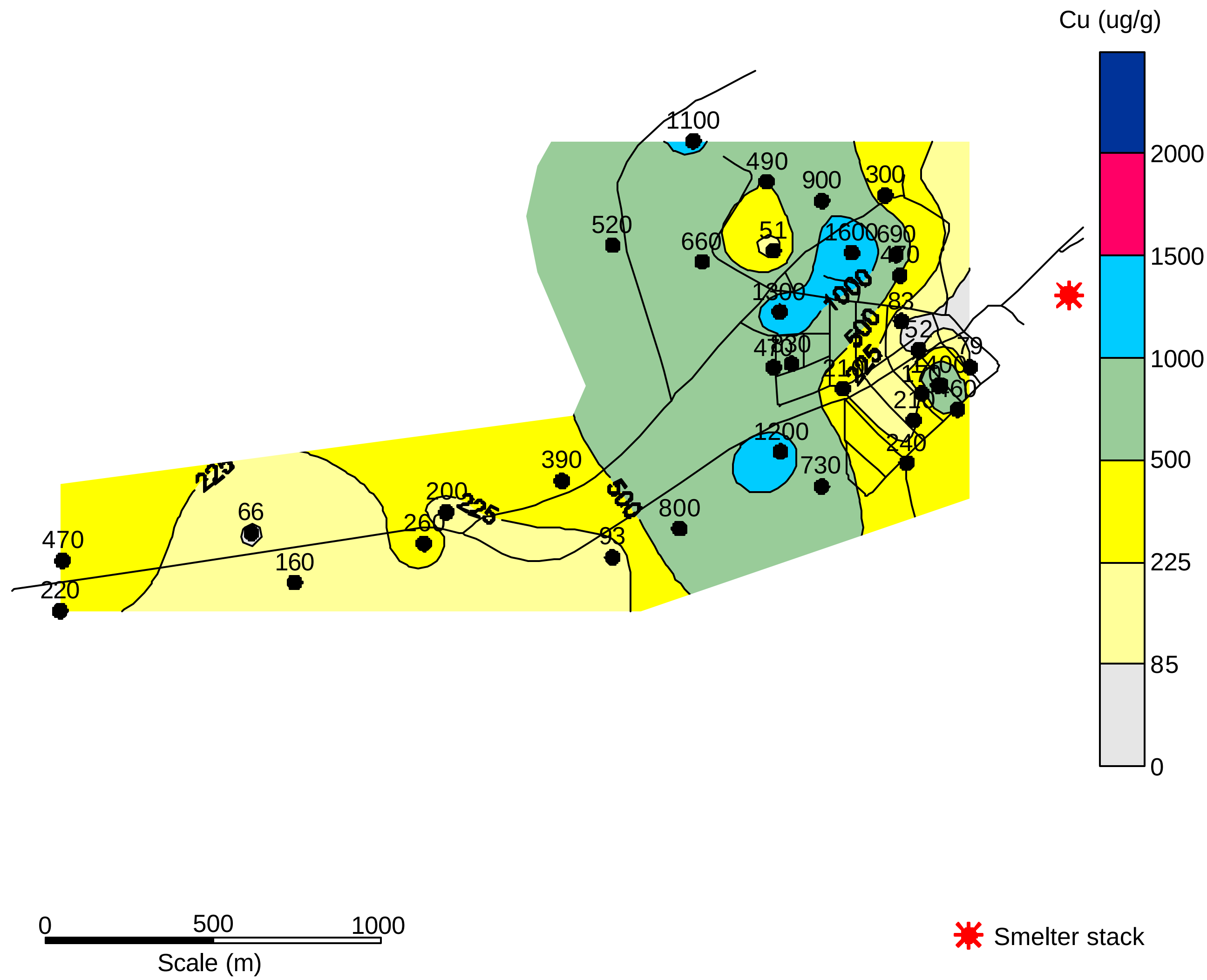
	DESIGN XXX		
	CADD XXX		
FILE No. 28-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 28



Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE	
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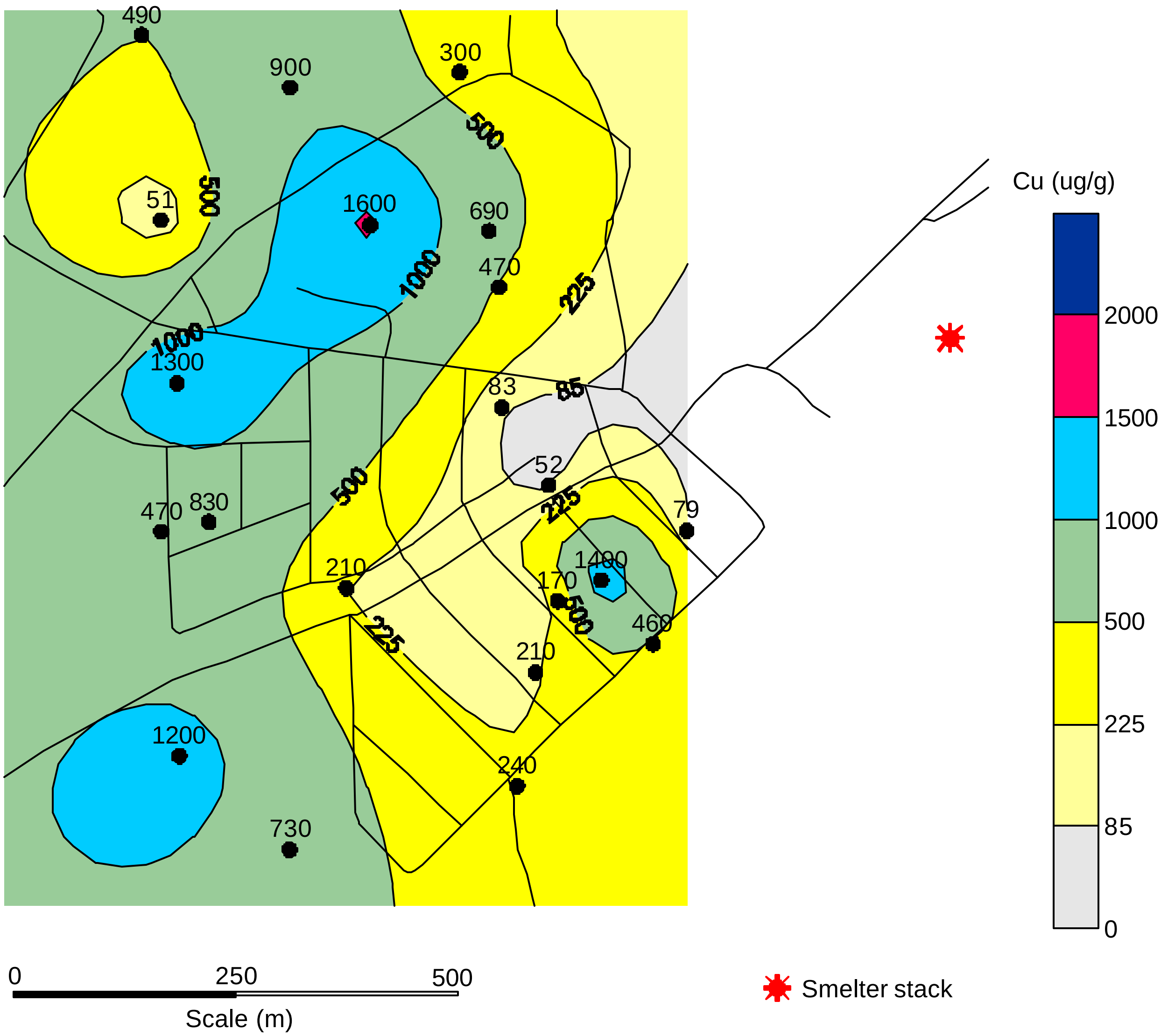
	DESIGN XXX		
	CADD XXX		
FILE No. 29-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 29



Golder Associates
Sudbury, Ontario

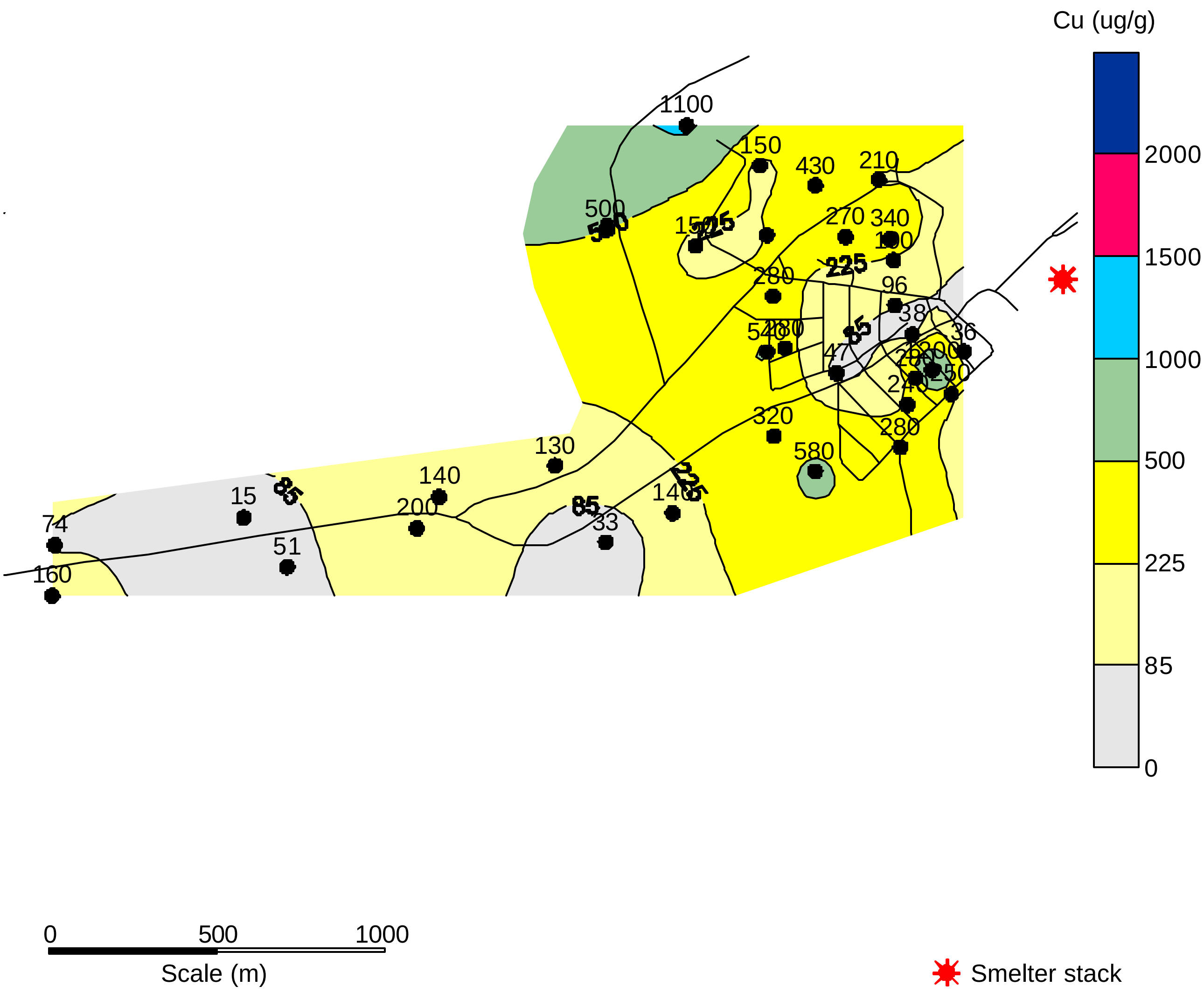
FILE No.	30-011-9233	SCALE	AS SHOWN
PROJECT No. 011-9233-5000	REV. 0	DATE	09/09/01
		DESIGN	XXX
		CADD	XXX
		CHECK	
		REVIEW	

TITLE

SOIL COPPER, 0-5 CM DUPLICATE

FALCONBRIDGE SOIL SAMPLING

FIGURE 30



Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE	
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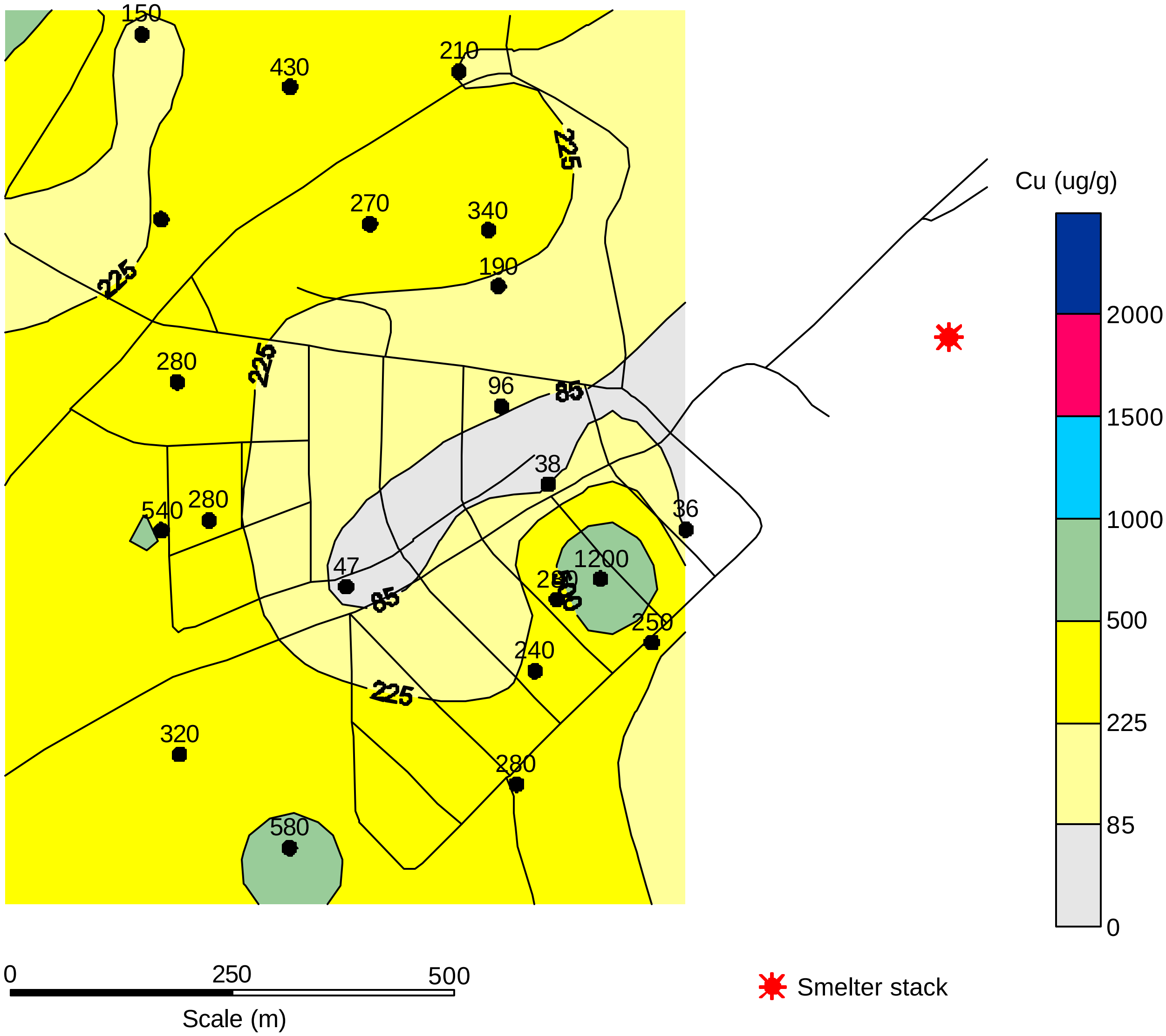
FILE No. 31-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 31



Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE	
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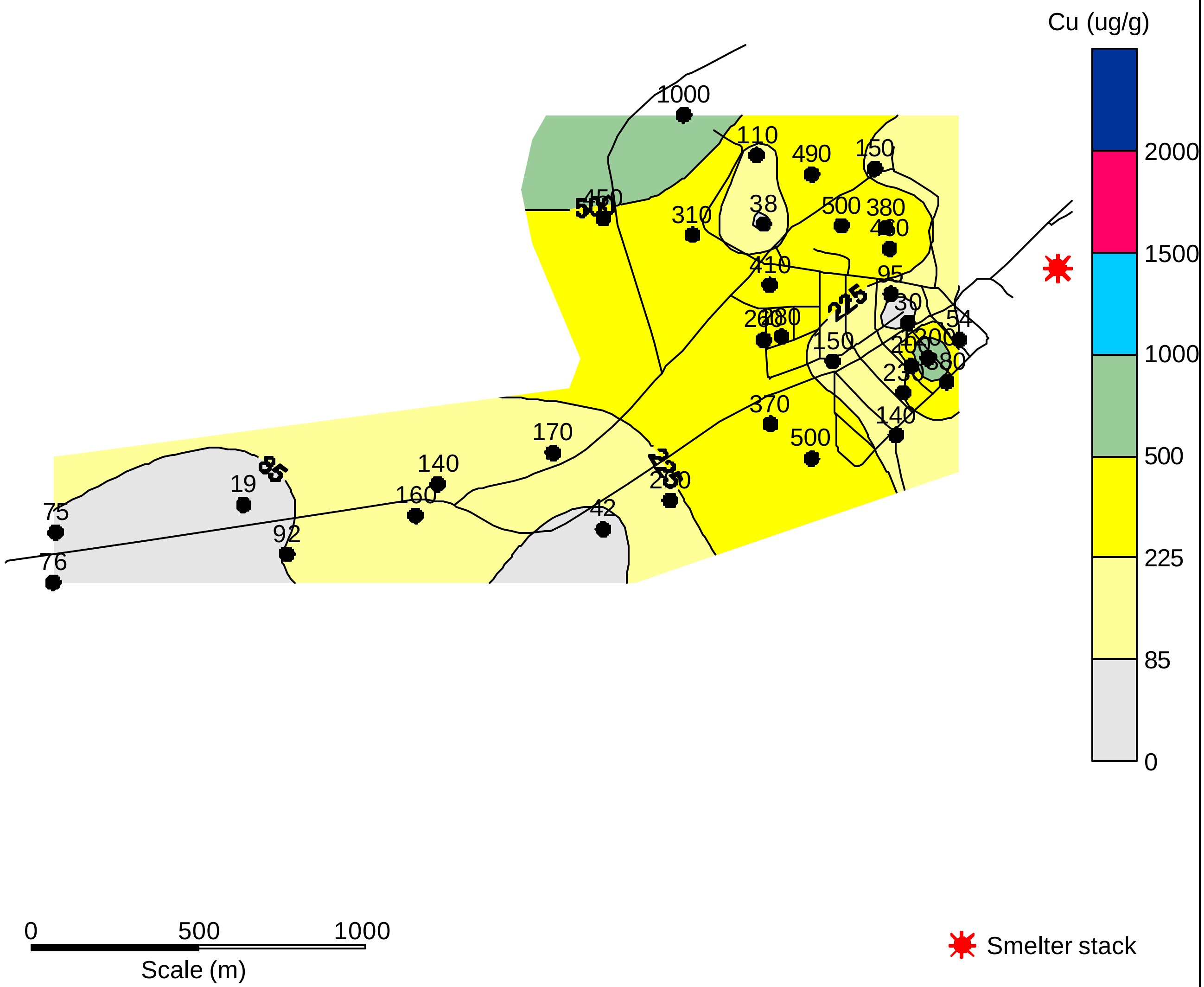
FILE No. 32-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 32



Golder Associates, Sudbury, Ontario	SCALE AS SHOWN	TITLE	
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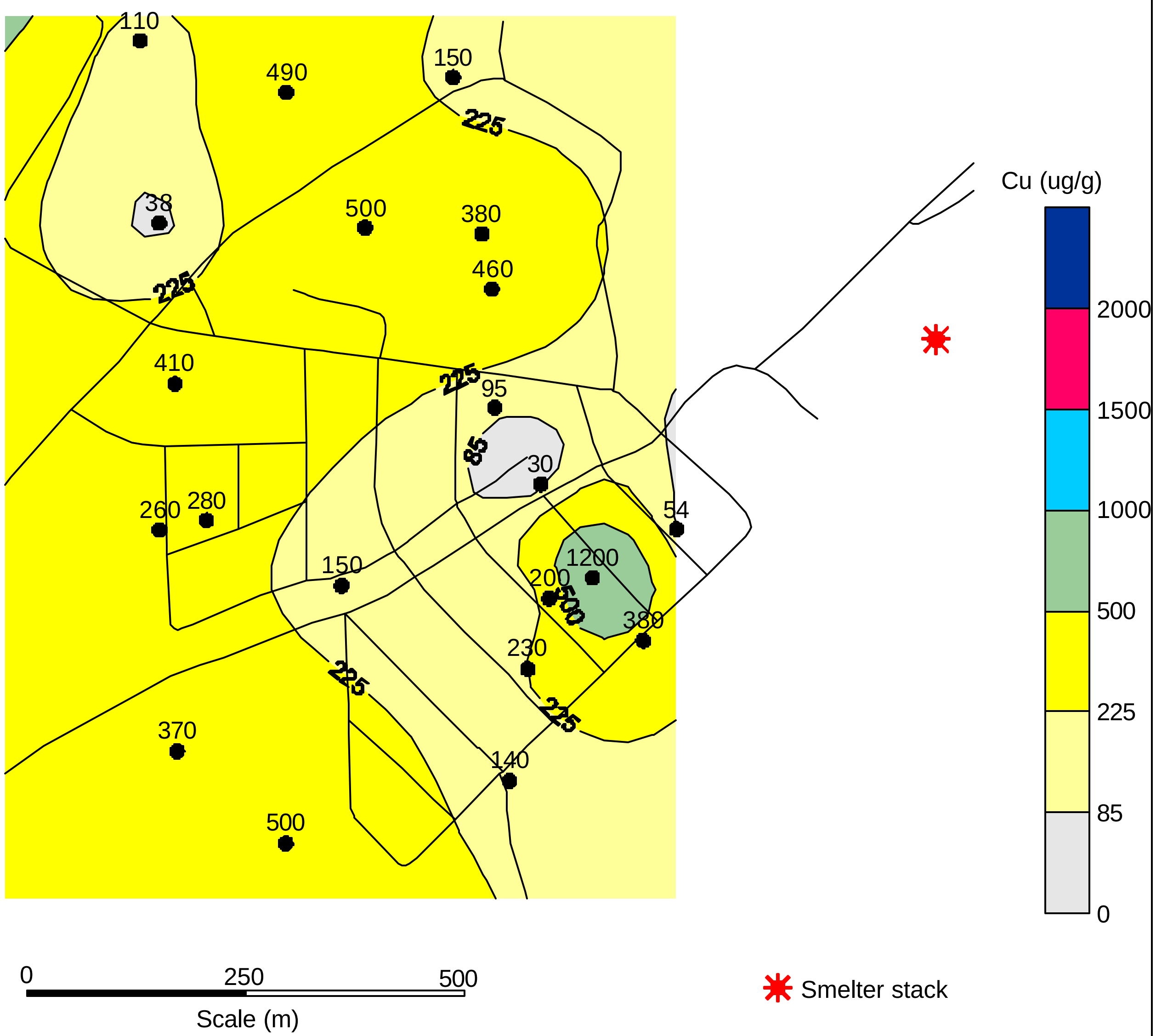
FILE No. 33-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 33



Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE
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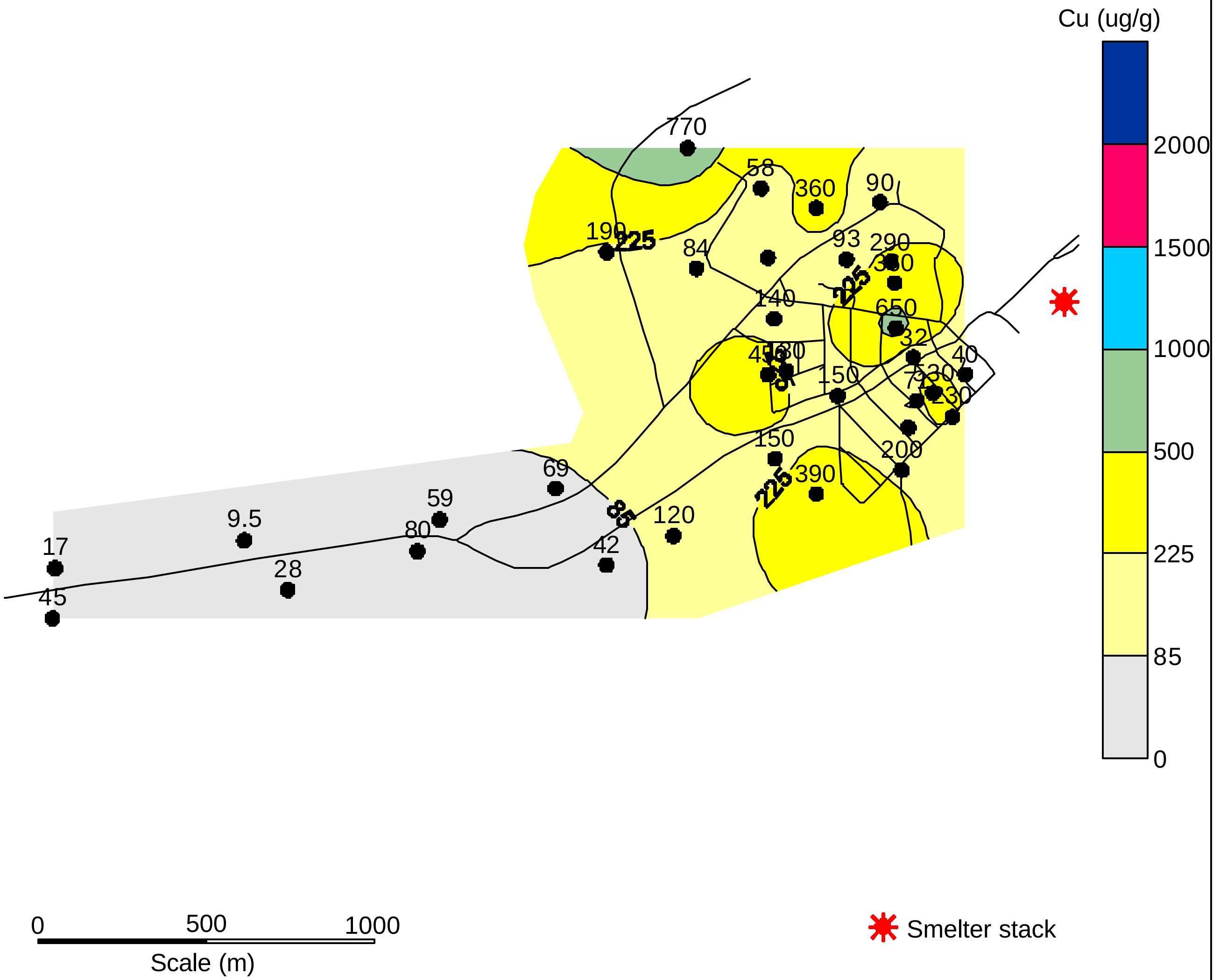
	DESIGN XXX	
	CADD XXX	
FILE No. 34-011-9233	CHECK	
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING — FIGURE 34



Golder Associates
Sudbury, Ontario

SCALE	AS SHOWN
DATE	09/09/01
DESIGN	XXX
CADD	XXX
CHECK	
REVIEW	

FILE No. 35-011-9233

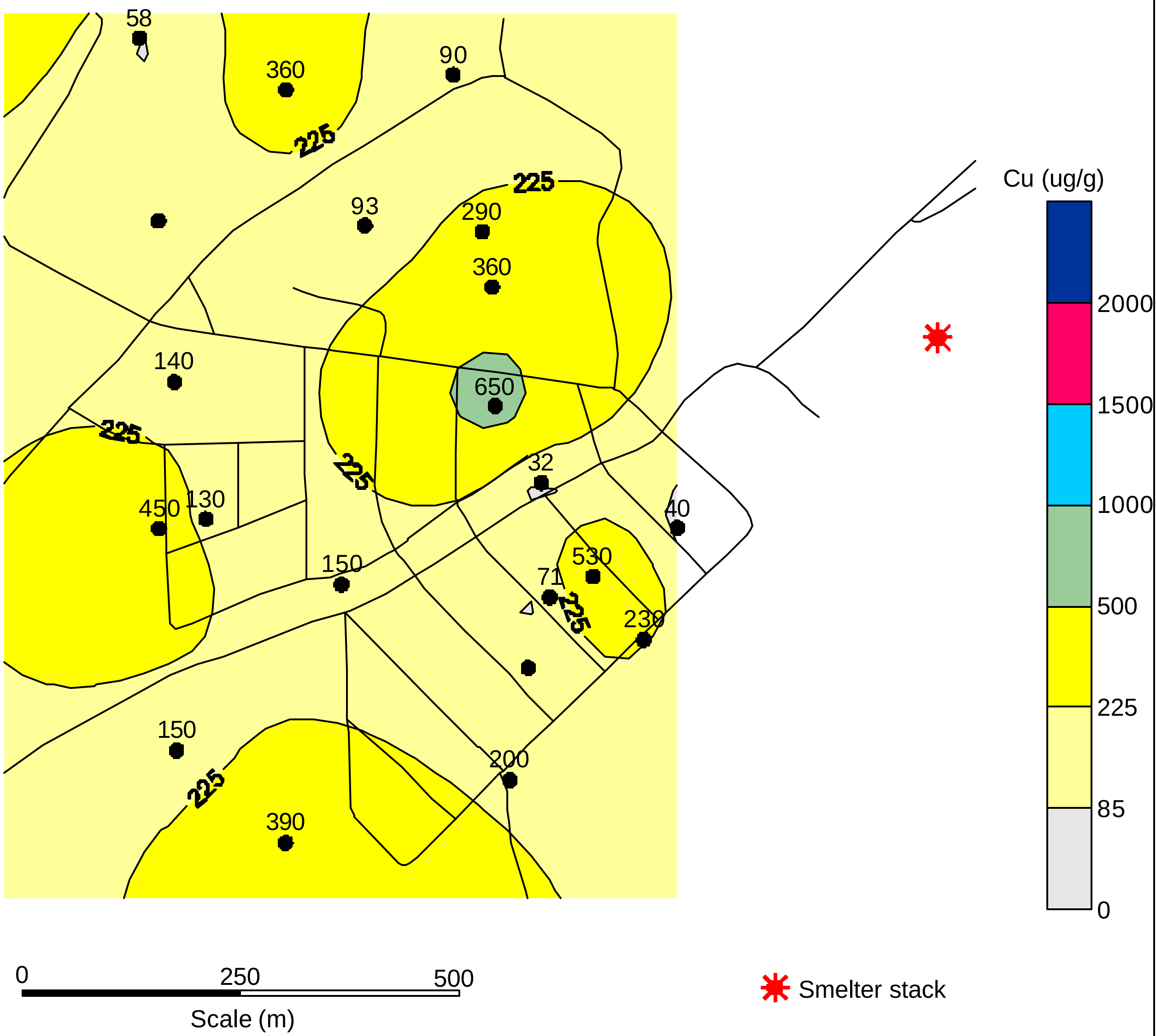
PROJECT No. 011-9233-5000 REV. 0

TITLE

SOIL COPPER, 10-20 CM

FALCONBRIDGE SOIL SAMPLING

FIGURE 35



Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE	
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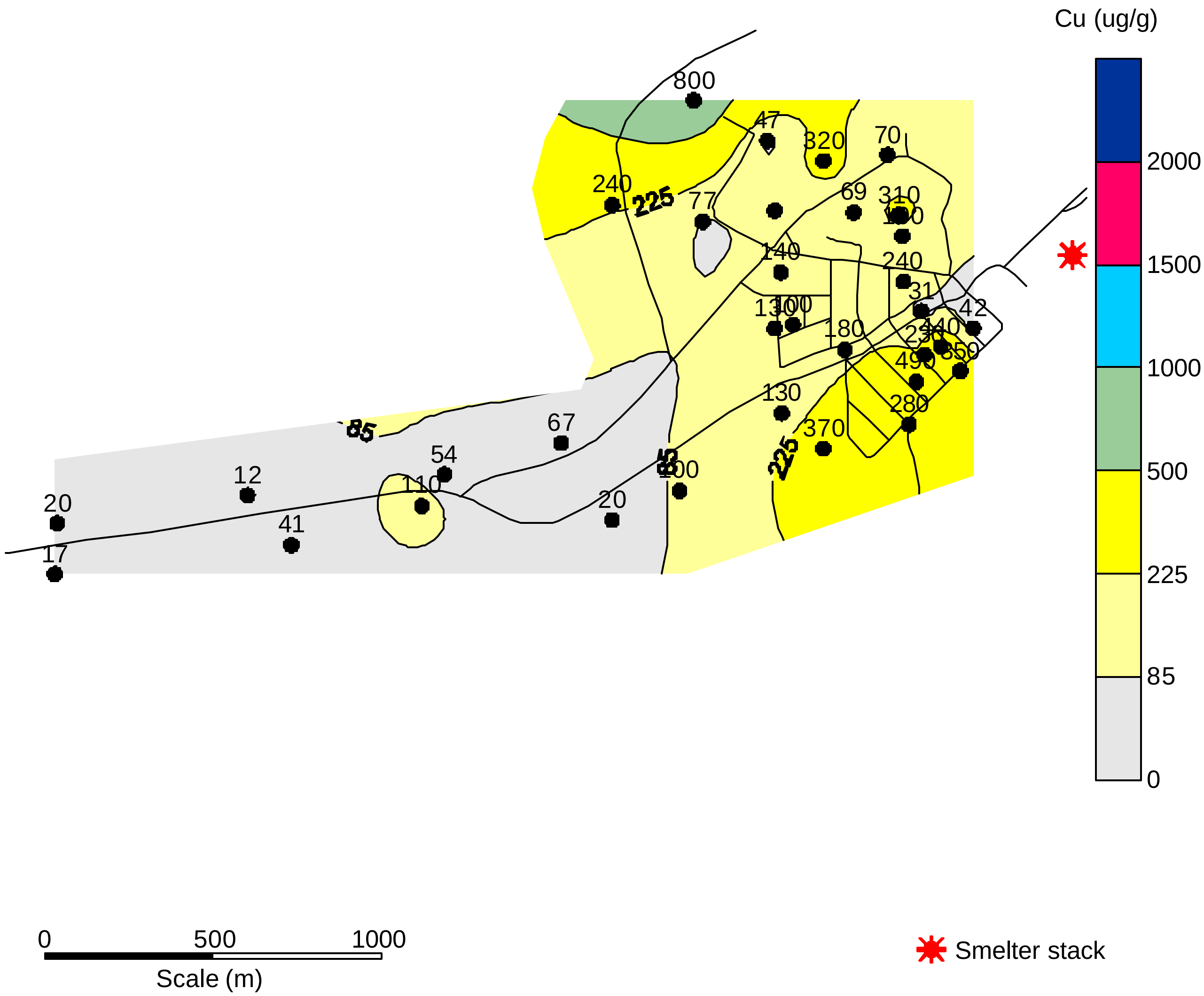
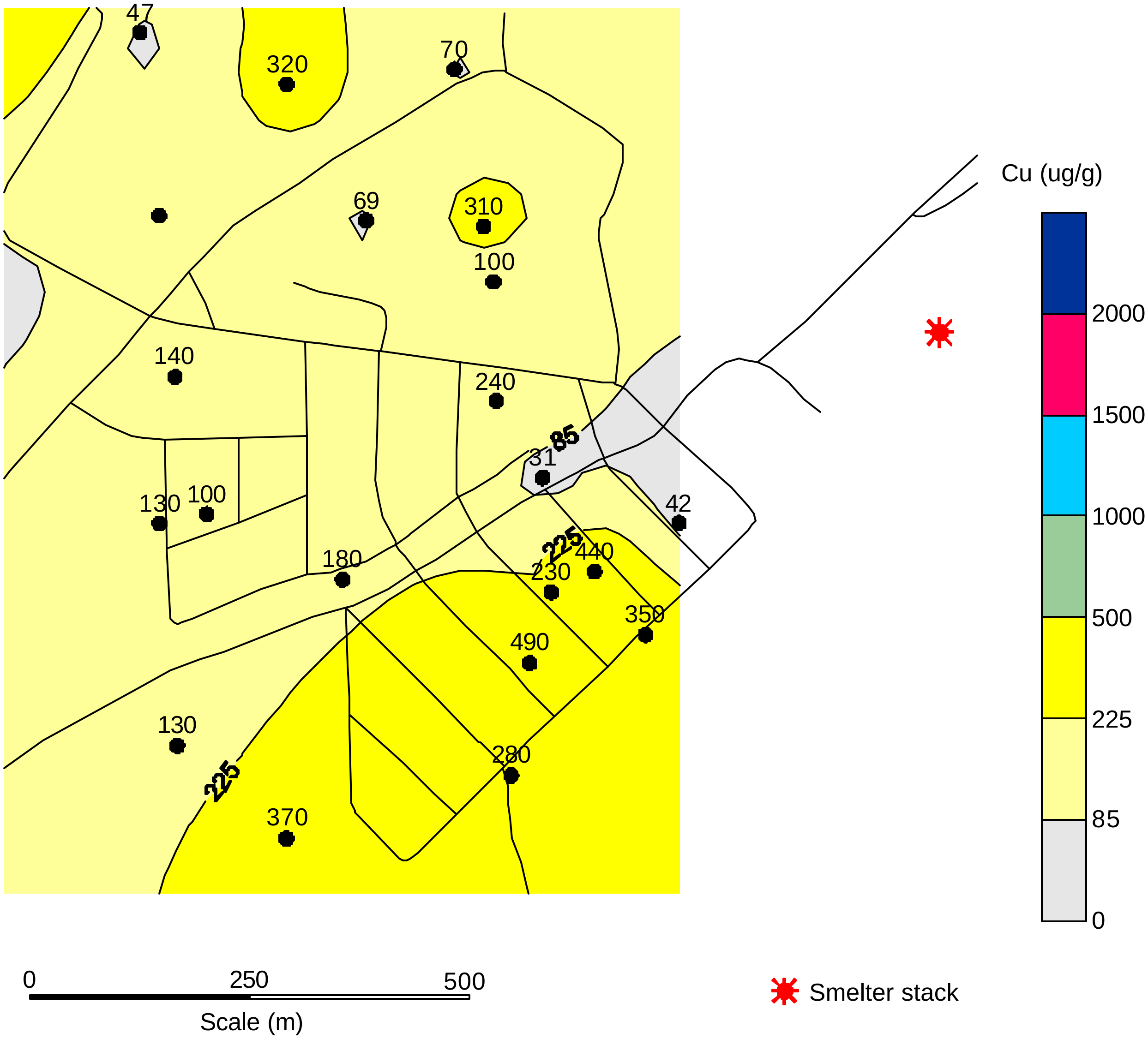
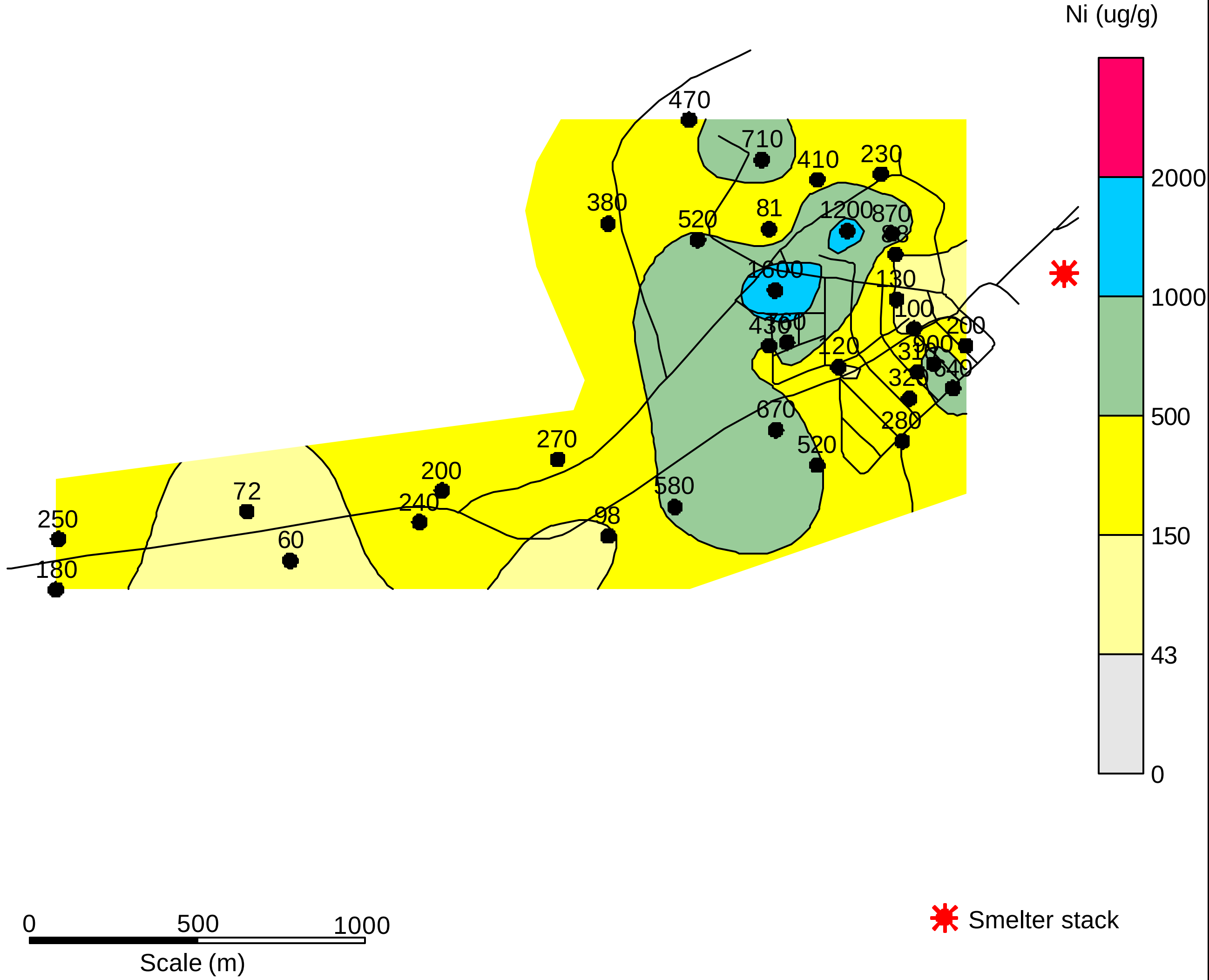
	DESIGN XXX		
	CADD XXX		
FILE No. 36-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 36



Golder Associates Sudbury, Ontario		SCALE AS SHOWN	TITLE	
		DATE 09/09/01	SOIL COPPER, 10-20 CM DUPLICATE	
		DESIGN XXX		
		CADD XXX		
FILE No. 37-011-9233		CHECK		
PROJECT No. 011-9233-5000	REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 37



Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE	
	DATE 09/09/01	SOIL COPPER, 10-20 CM DUPLICATE	
	DESIGN XXX		
	CADD XXX		
FILE No. 38-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 38



Golder Associates
Sudbury, Ontario

SCALE	AS SHOWN	TITLE	
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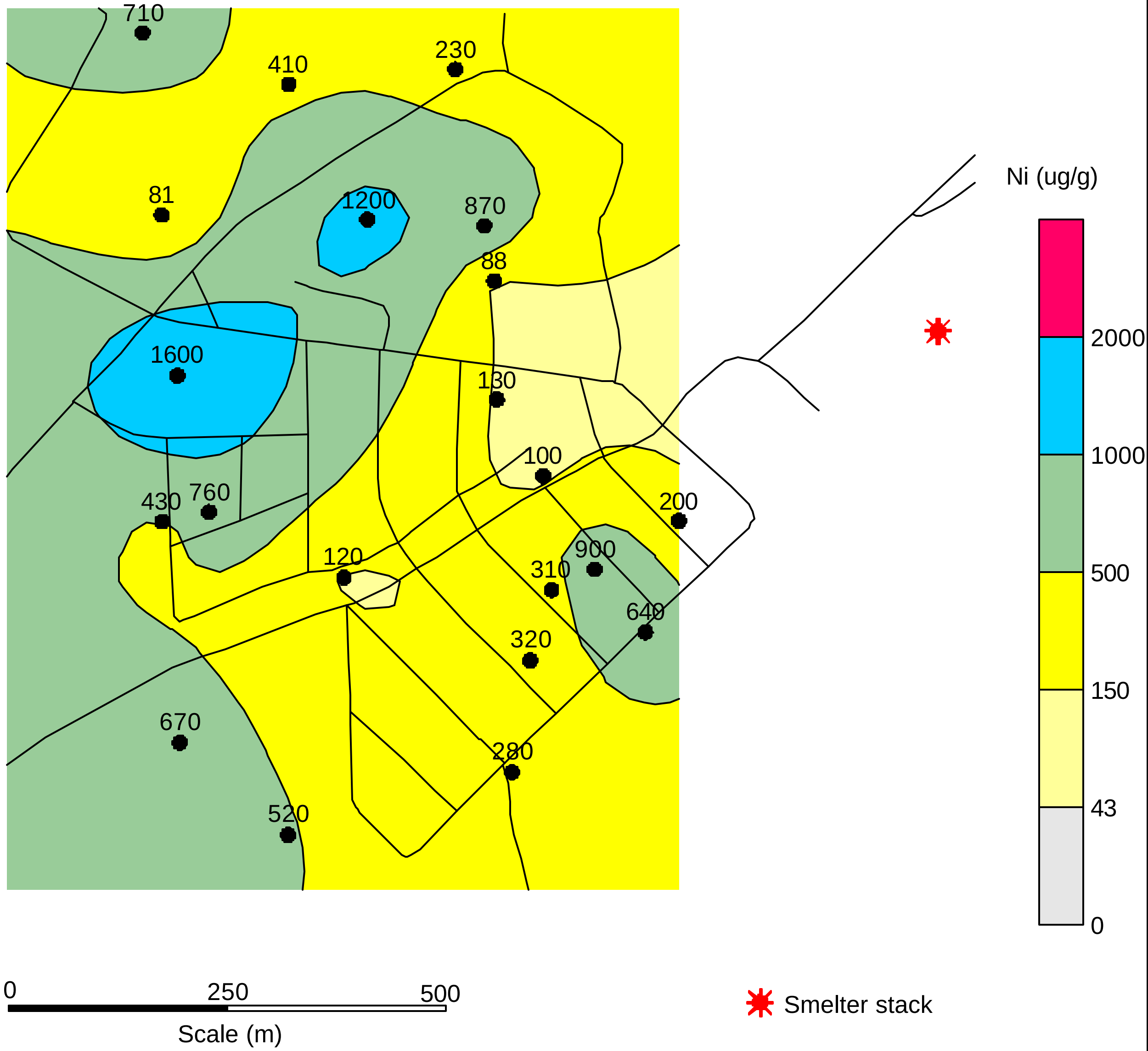
DESIGN	XXX		
CADD	XXX		
FILE No. 39-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 39



Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE	
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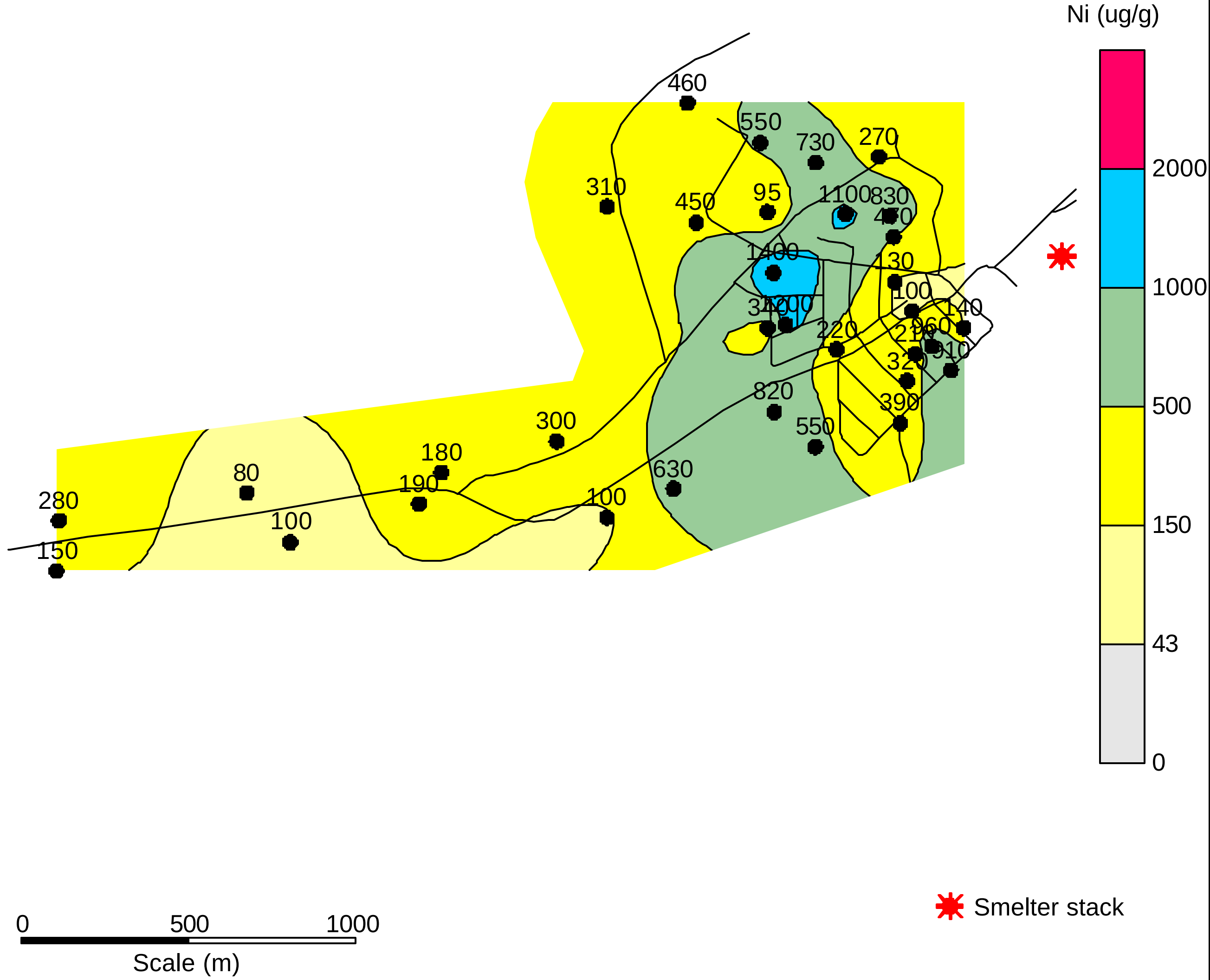
	DESIGN XXX		
	CADD XXX		
FILE No. 40-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 40



Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE	
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	DESIGN XXX		
	CADD XXX		
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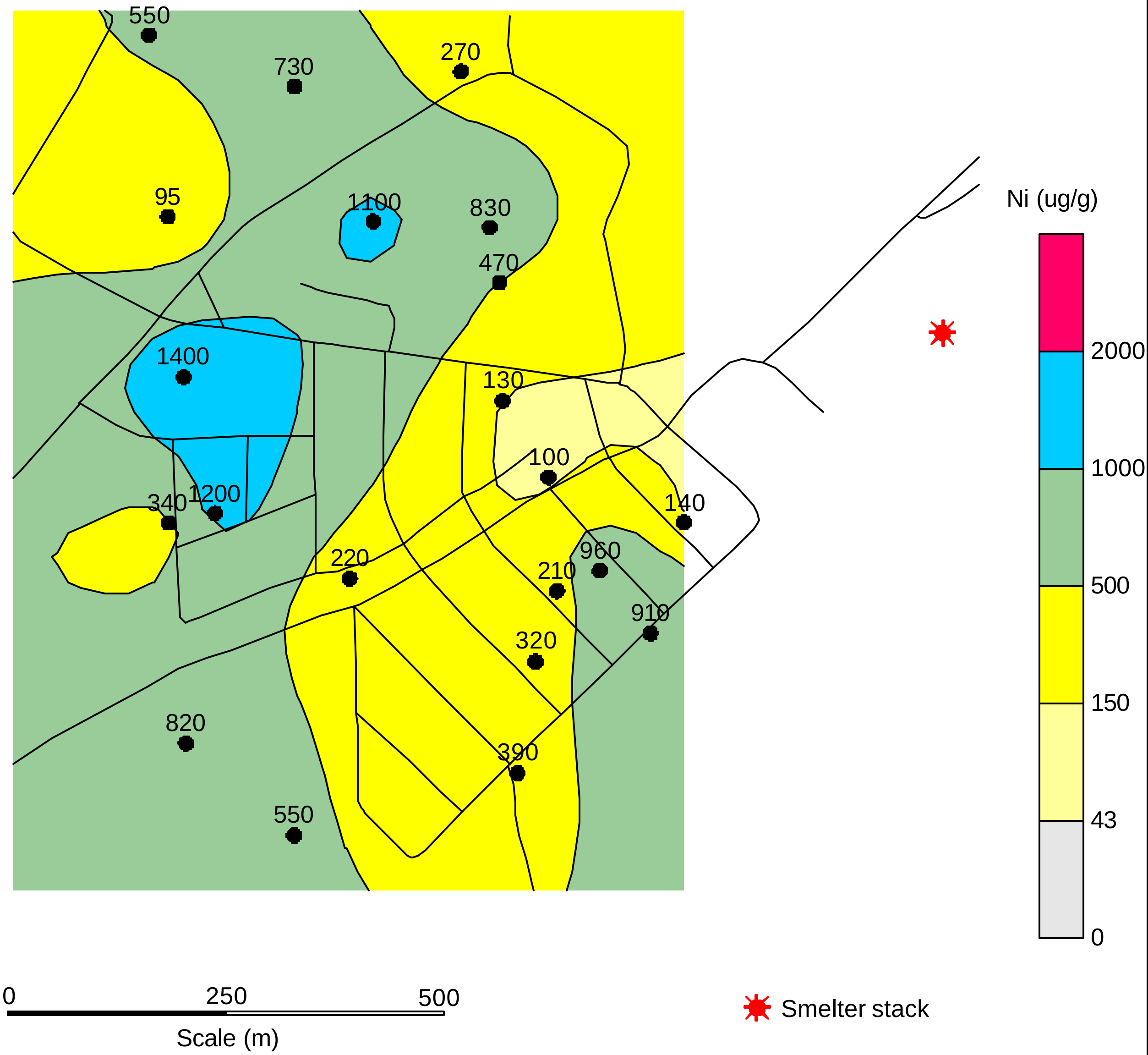
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 41



Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE	
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	DESIGN XXX		
	CADD XXX		
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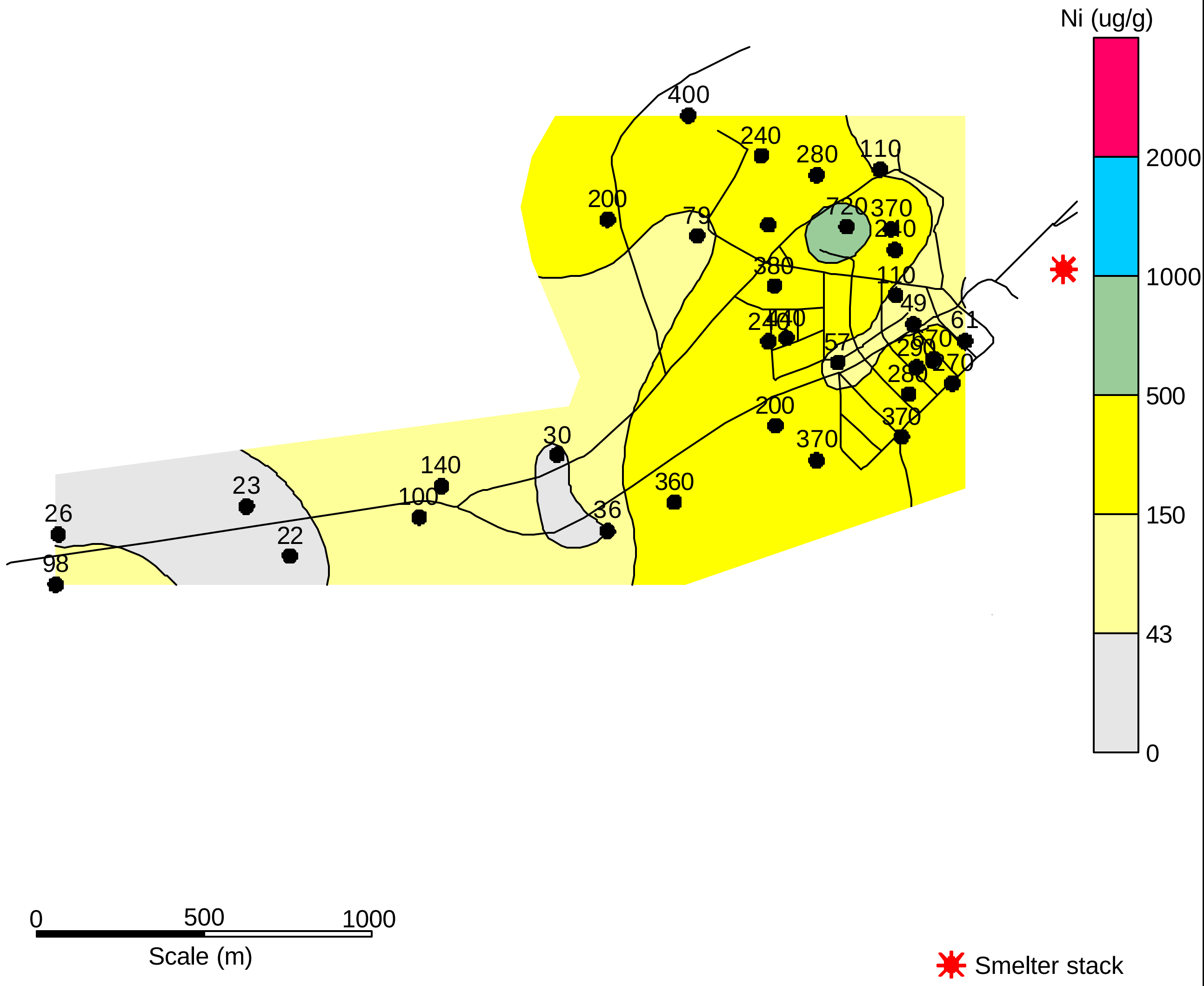
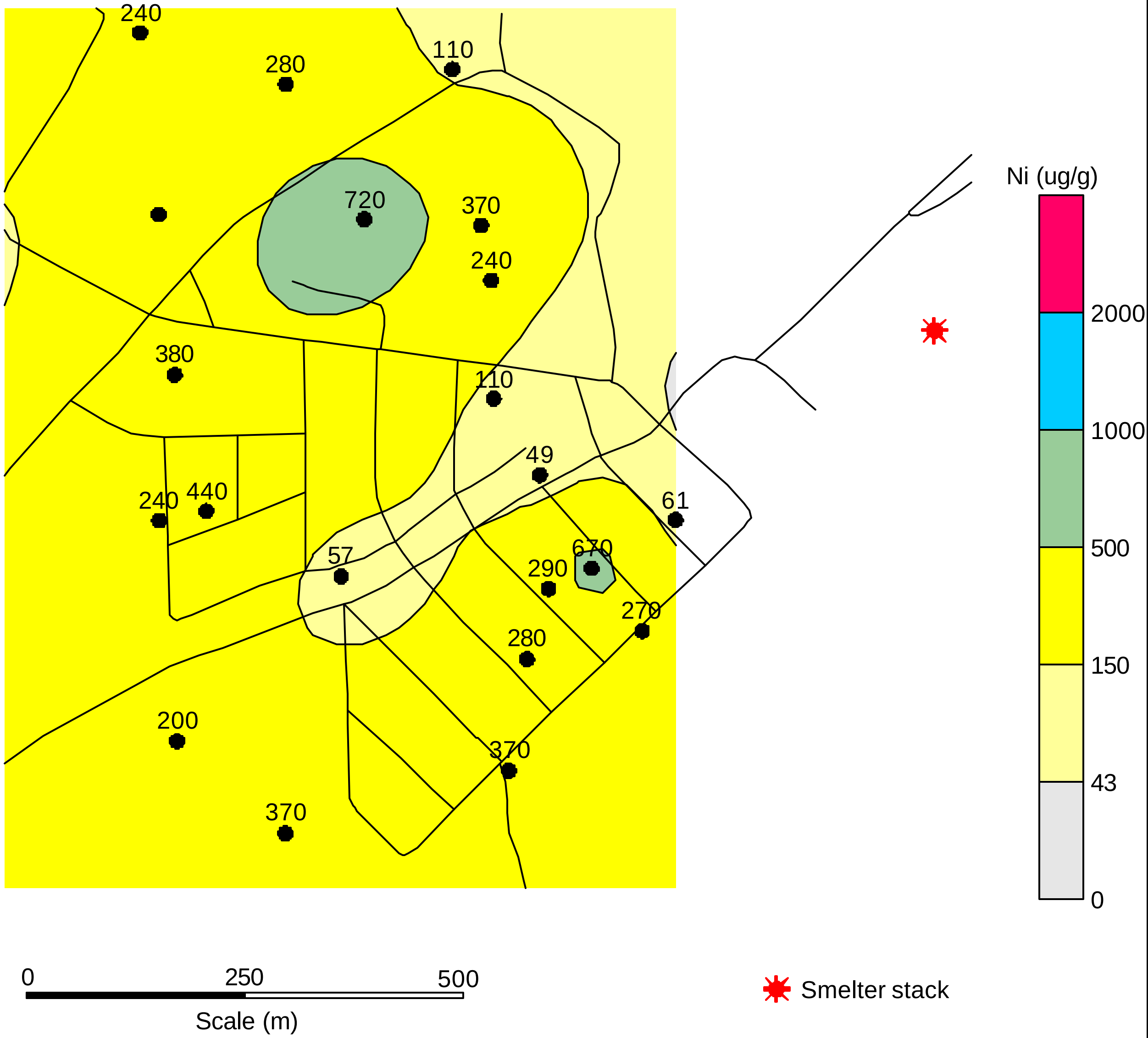
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 42



Golder Associates
Sudbury, Ontario

SCALE	AS SHOWN	TITLE	SOIL NICKEL, 5-10 CM
DATE	09/09/01		
DESIGN	XXX		
CADD	XXX		
FILE No. 43-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 43



Golder Associates, Sudbury, Ontario	SCALE AS SHOWN	TITLE	
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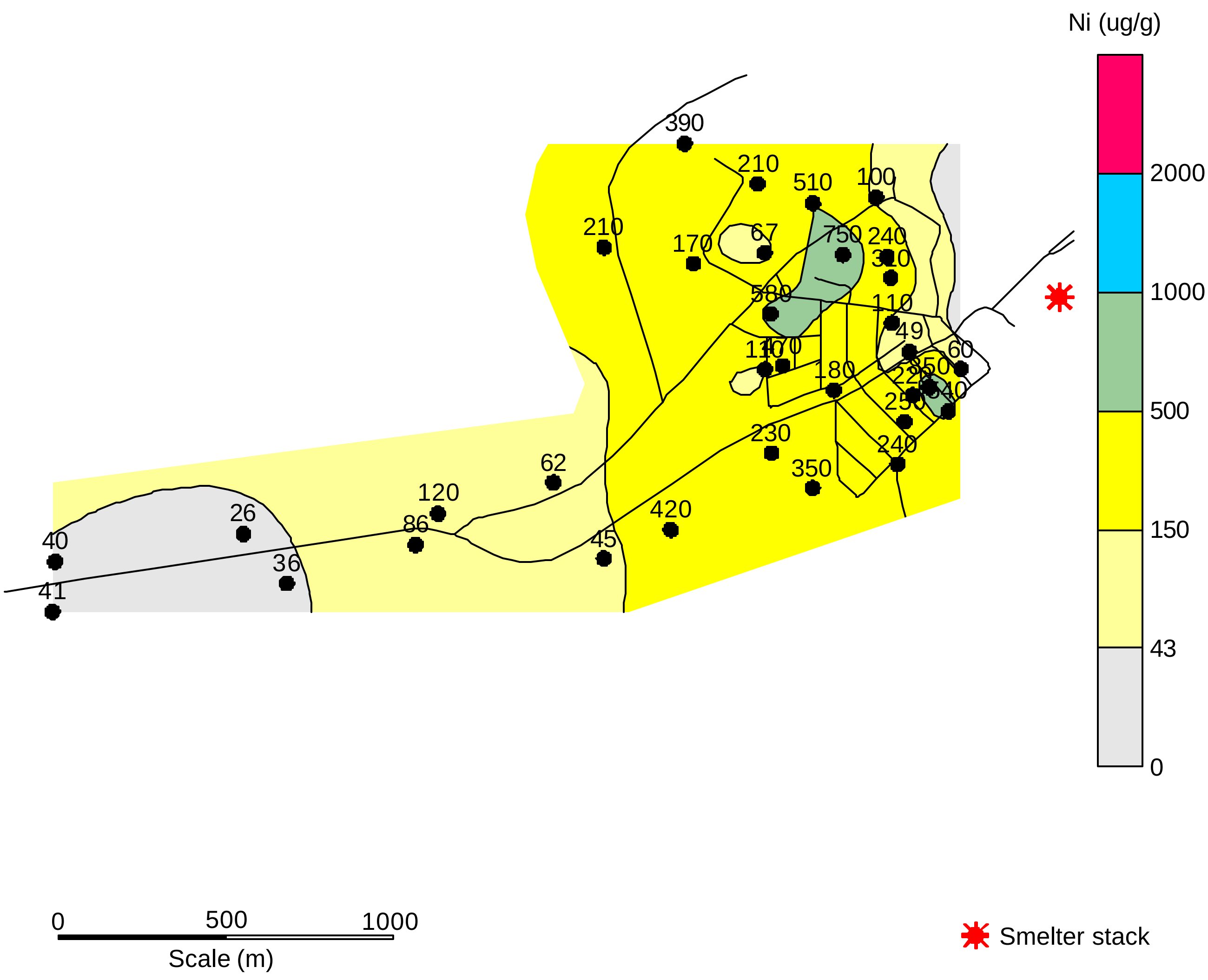
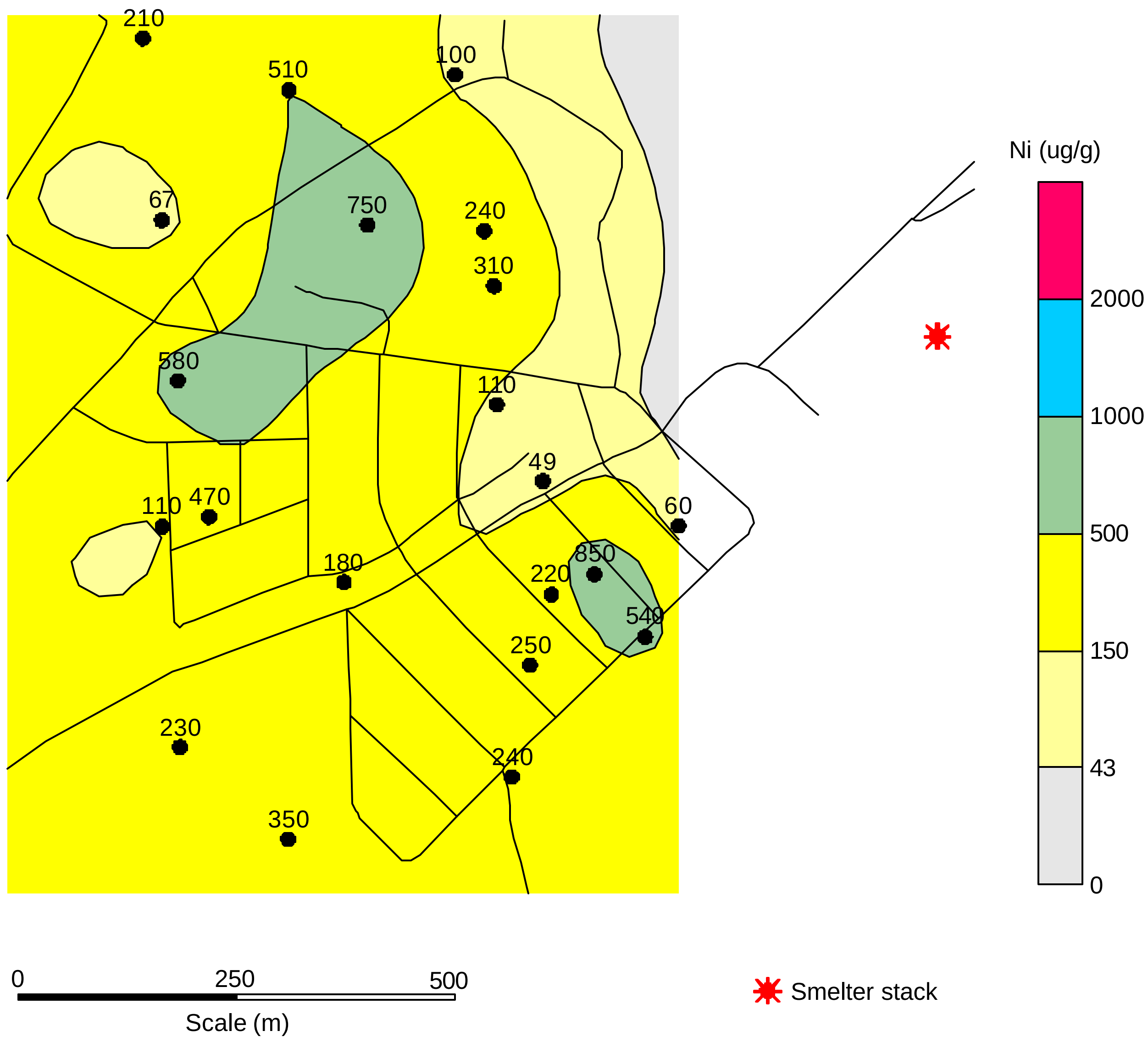
	DESIGN XXX		
	CADD XXX		
FILE No. 44-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 44



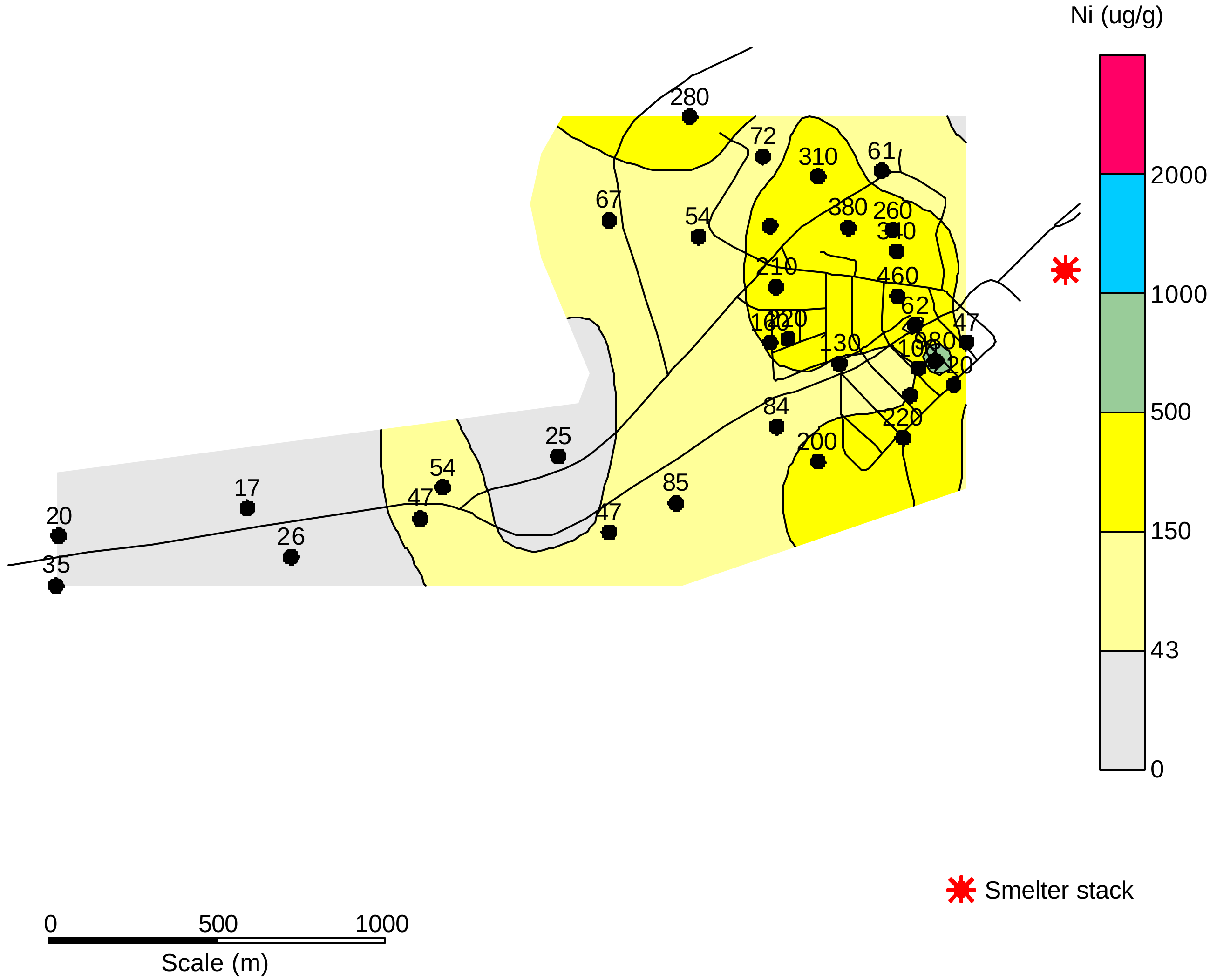
Golder Associates
Sudbury, Ontario

SCALE	AS SHOWN	TITLE	SOIL NICKEL, 5-10 CM DUPLICATE
DATE	09/09/01		
DESIGN	XXX		
CADD	XXX		
FILE No. 45-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 45



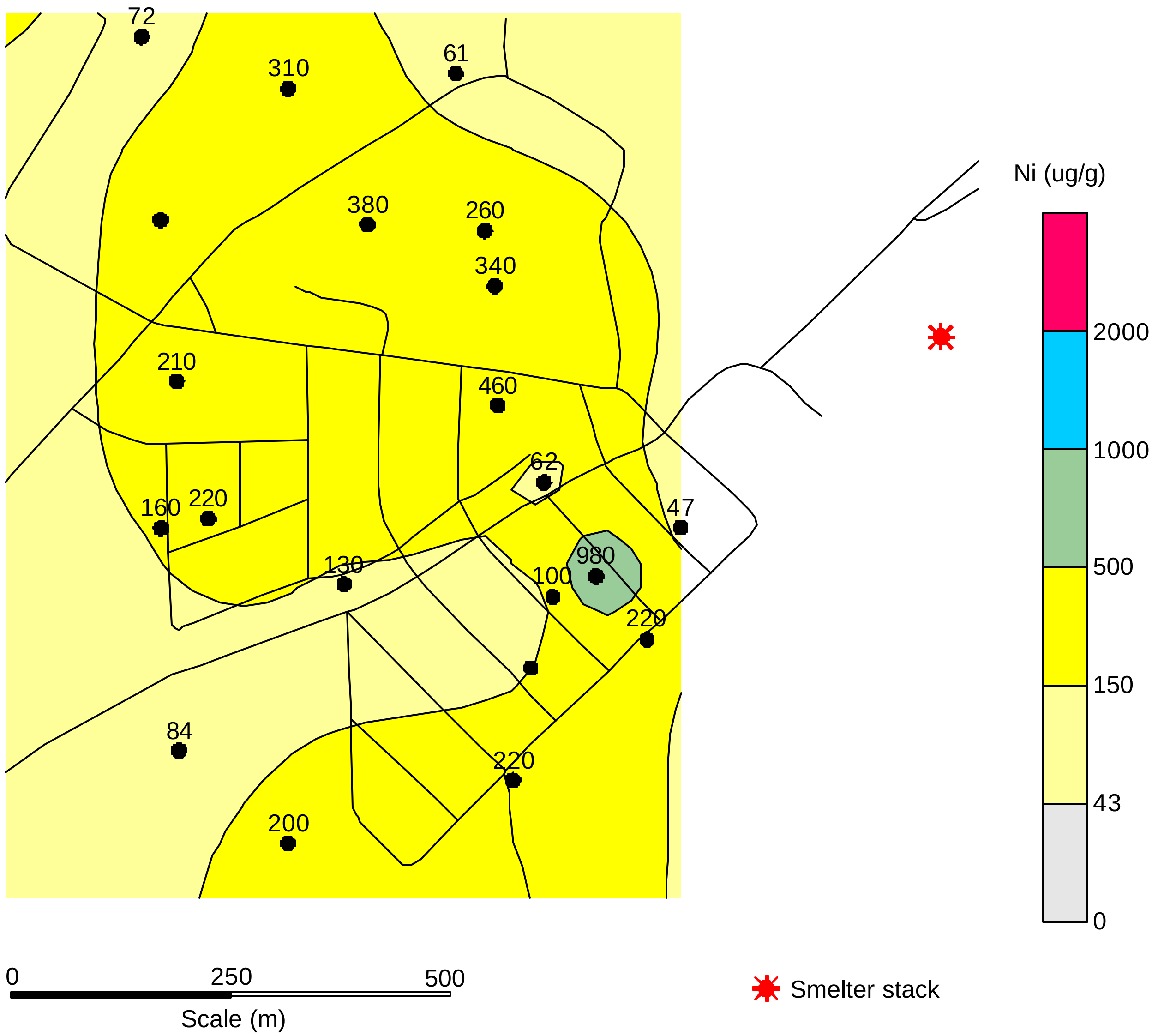
Sudbury, Ontario

SCALE	AS SHOWN	TITLE	SOIL NICKEL, 5-10 CM DUPLICATE
DATE	09/09/01		
DESIGN	XXX		
CADD	XXX		
FILE No. 46-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 46



Golder Associates
Sudbury, Ontario

SCALE	AS SHOWN	TITLE	
DATE	09/09/01		SOIL NICKEL, 10-20 CM
DESIGN	XXX		
CADD	XXX		
FILE No. 47-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 47

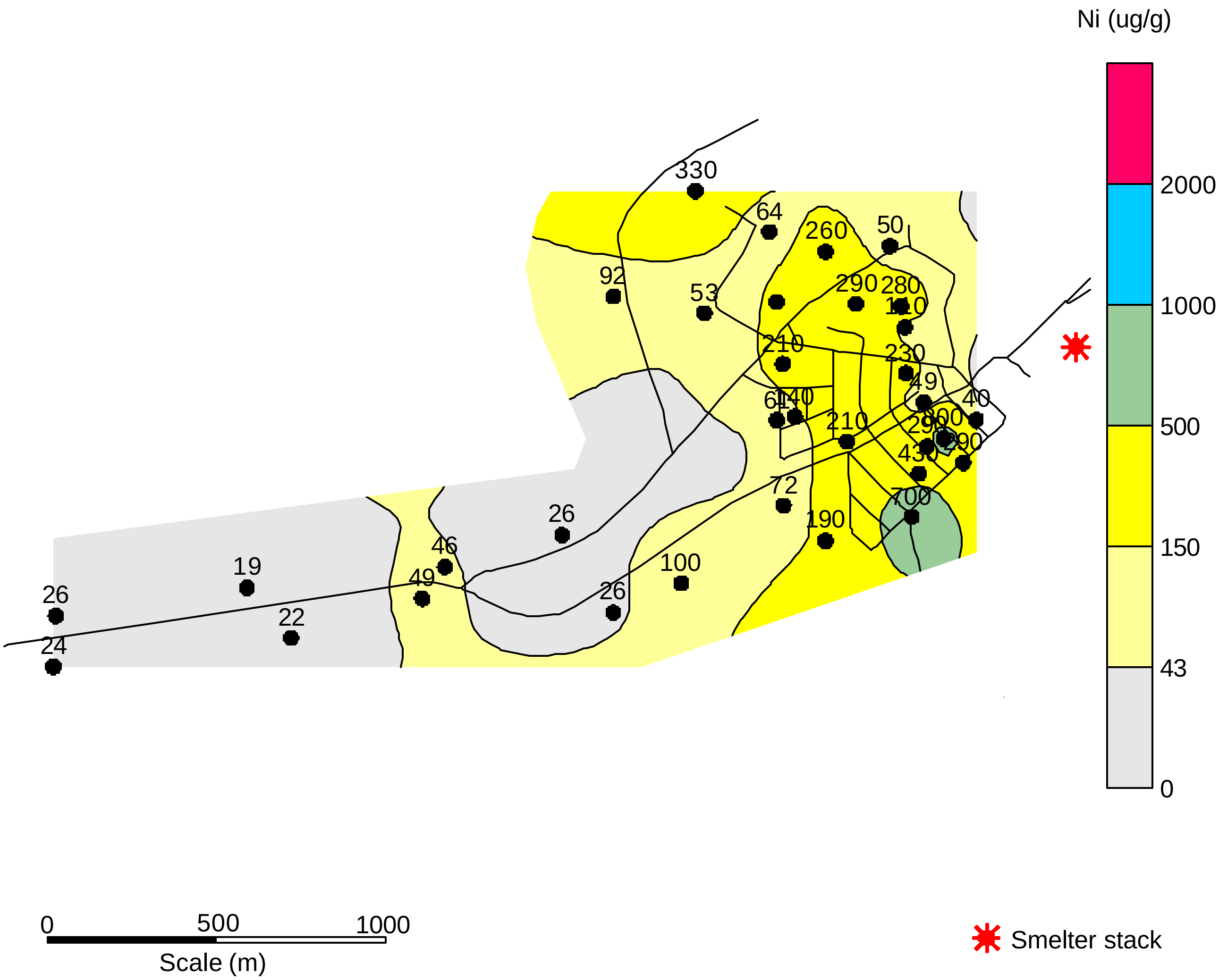


Golder Associates
Sudbury, Ontario

SCALE	AS SHOWN	TITLE	
DATE	09/09/01		SOIL NICKEL, 10-20 CM
DESIGN	XXX		
CADD	XXX		
FILE No.	48-011-9233	CHECK	
PROJECT No.	011-9233-5000	REV. 0	REVIEW

FALCONBRIDGE SOIL SAMPLING

FIGURE 48



Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE	
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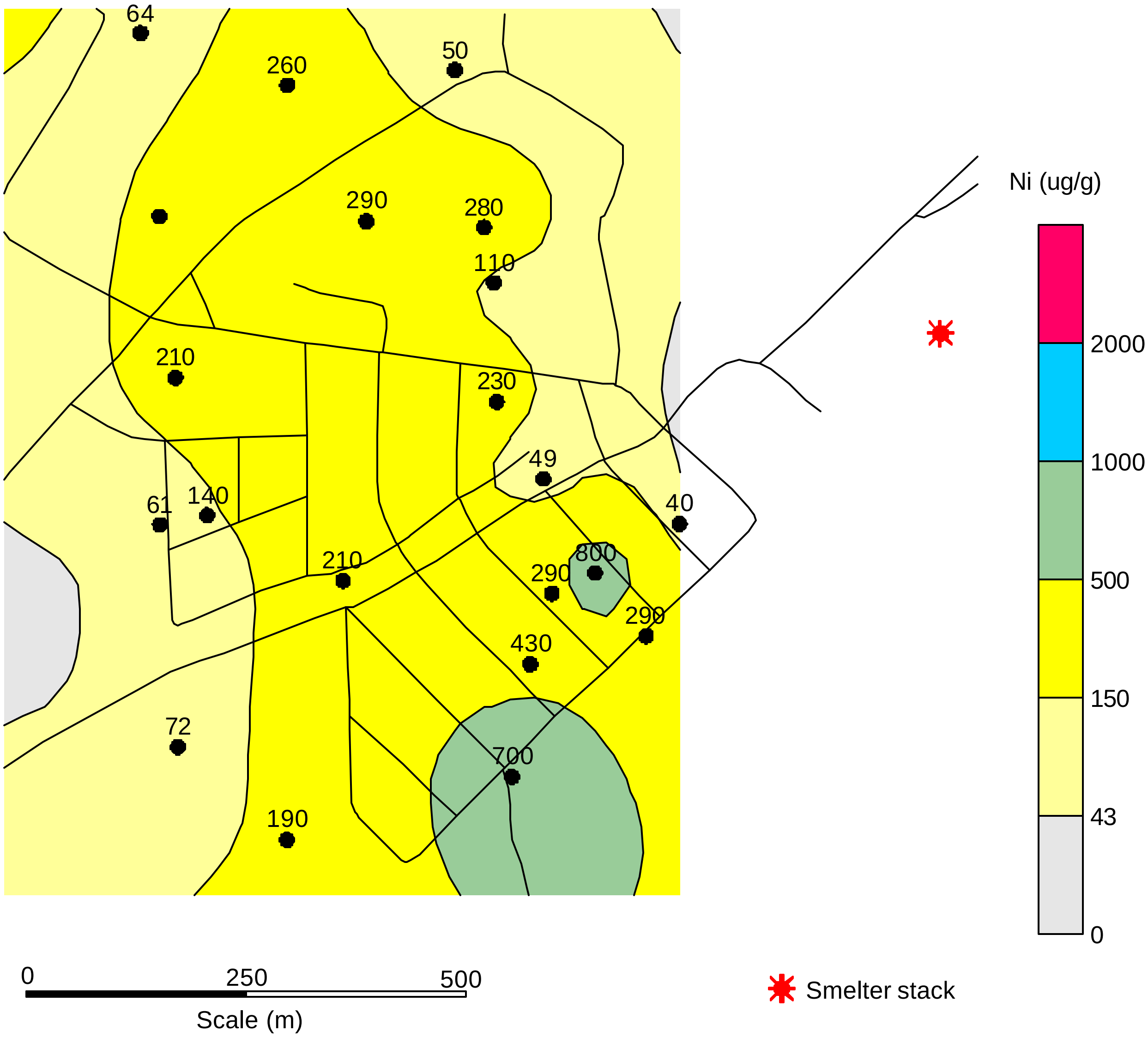
	DESIGN XXX		
	CADD XXX		
FILE No. 49-011-9233	CHECK		
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE 49



Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE		
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	DESIGN XXX			
	CADD XXX			
FILE No. 50-011-9233	CHECK			
PROJECT No. 011-9233-5000 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE	50

Figure 51: Soil Arsenic with Depth

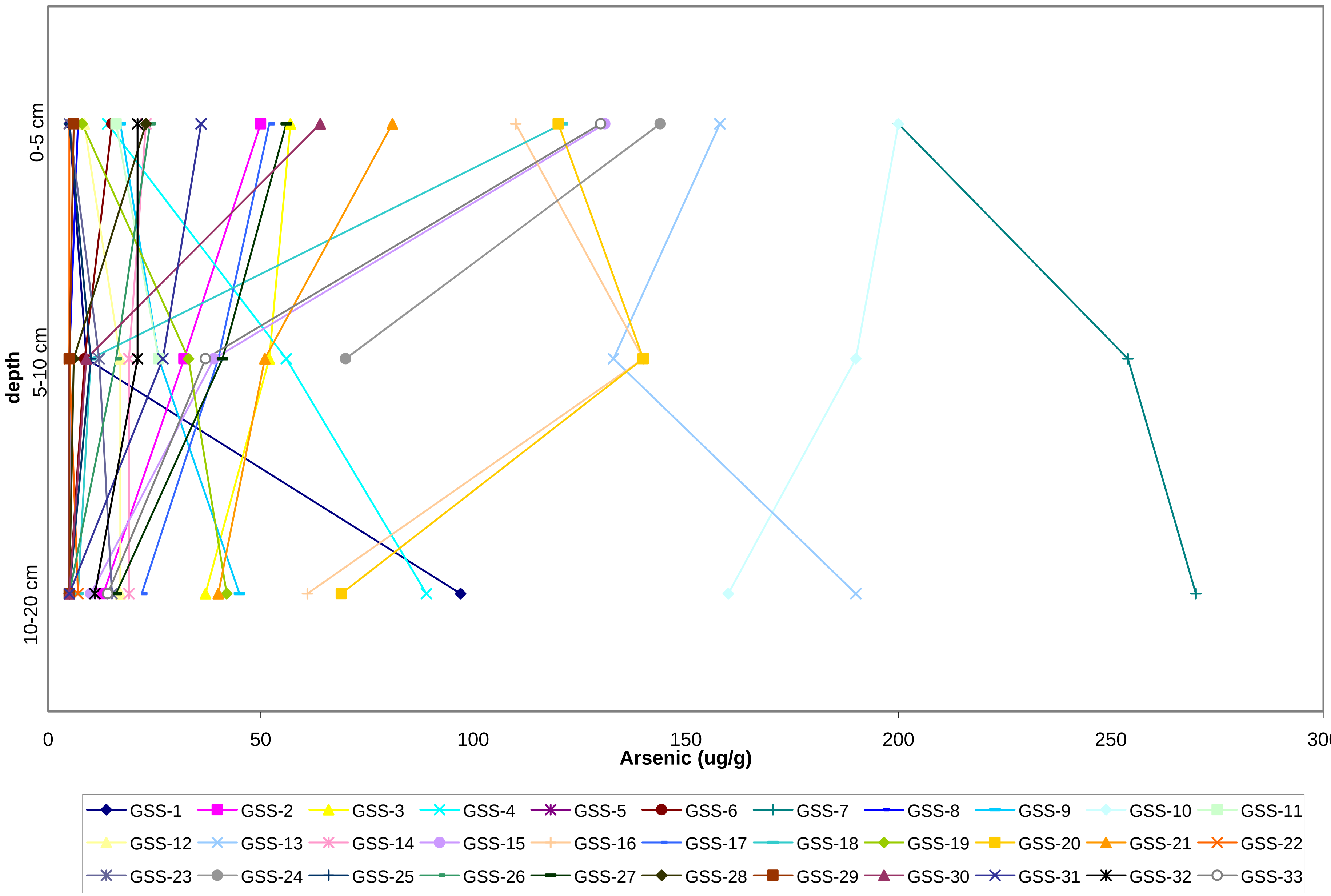


Figure 52: Soil Arsenic with Depth

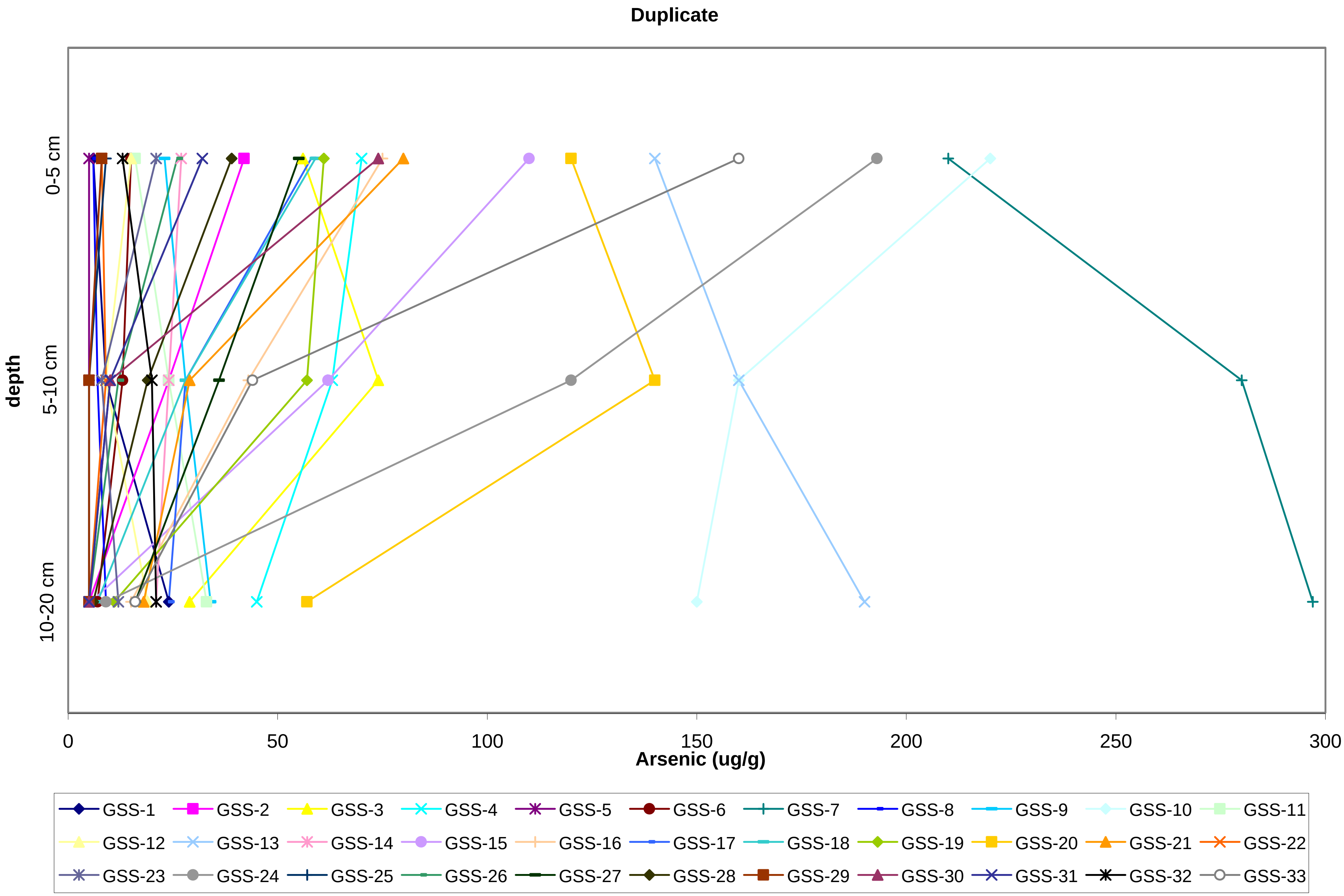


Figure 53: Soil Cobalt with Depth

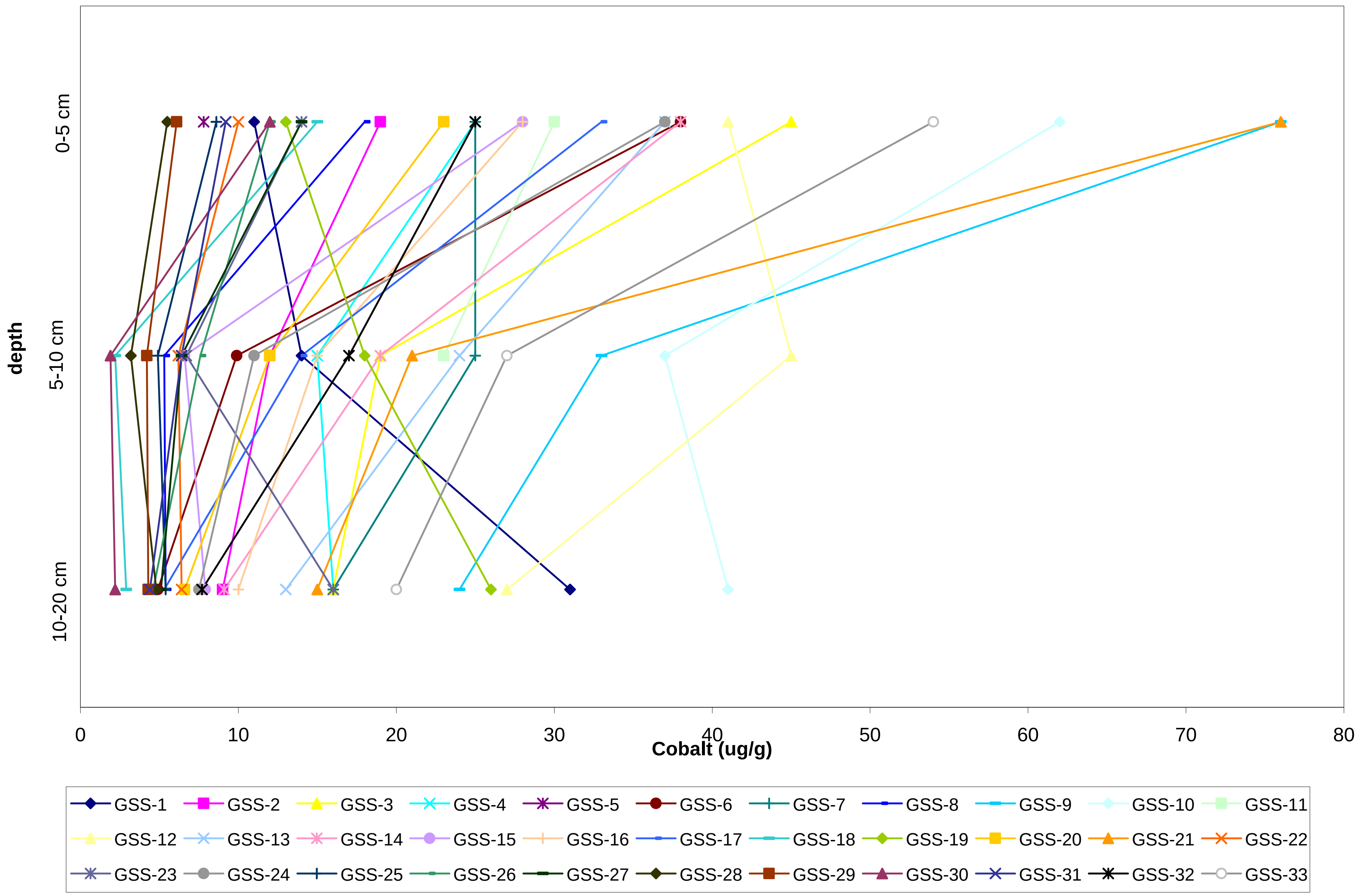
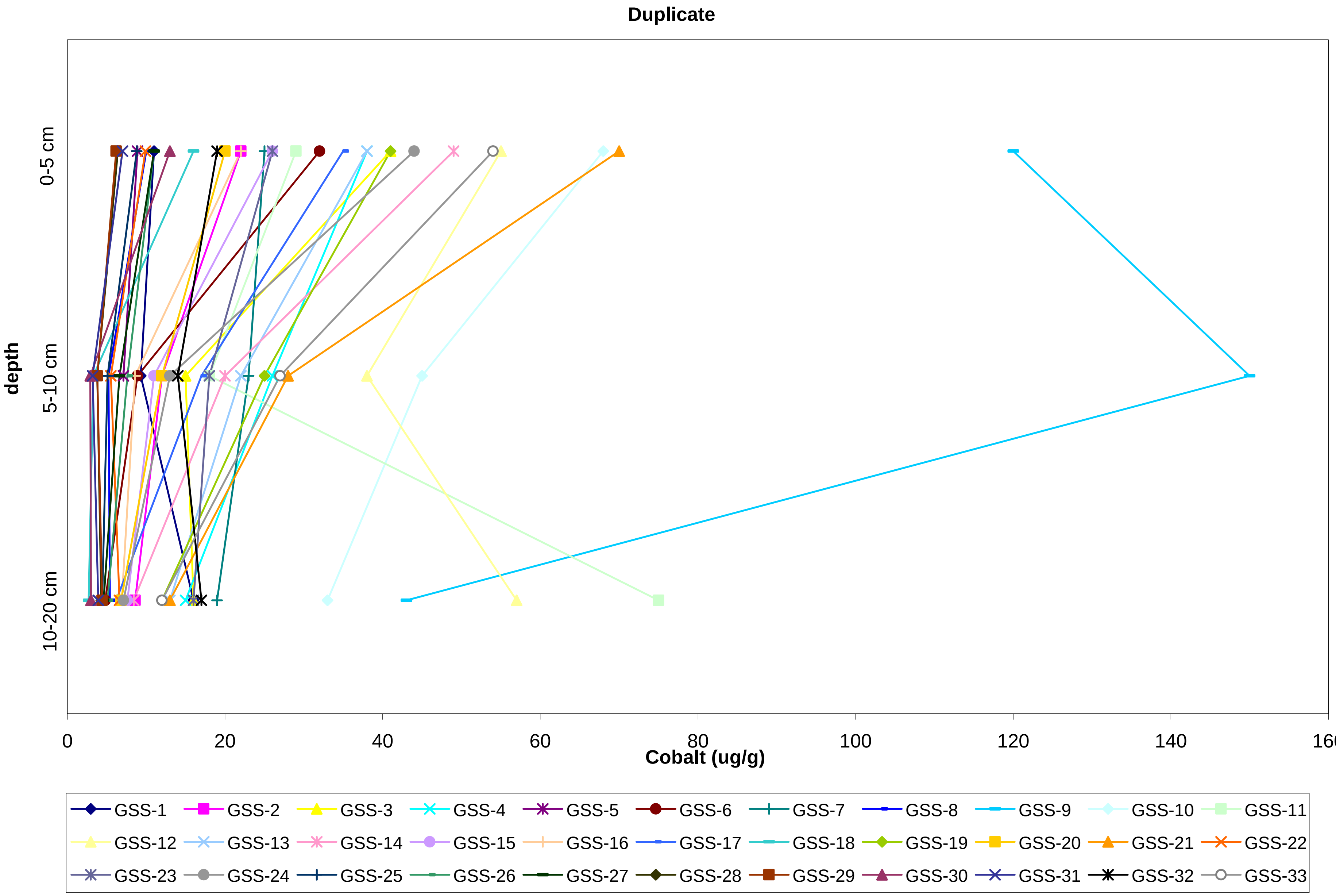


Figure 54: Soil Cobalt with Depth



September 2001

Figure 55: Soil Copper with Depth

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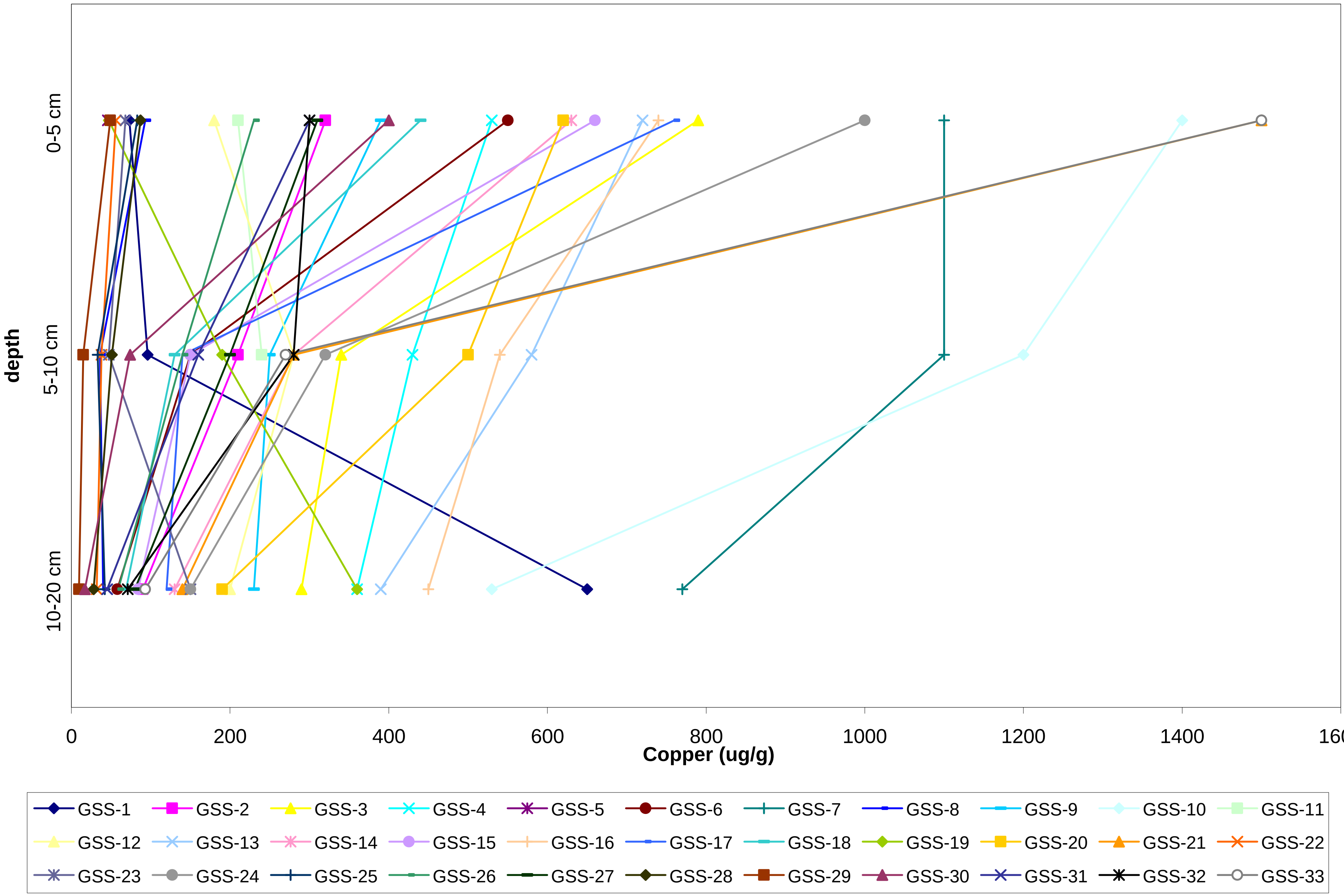


Figure 56: Soil Copper with Depth

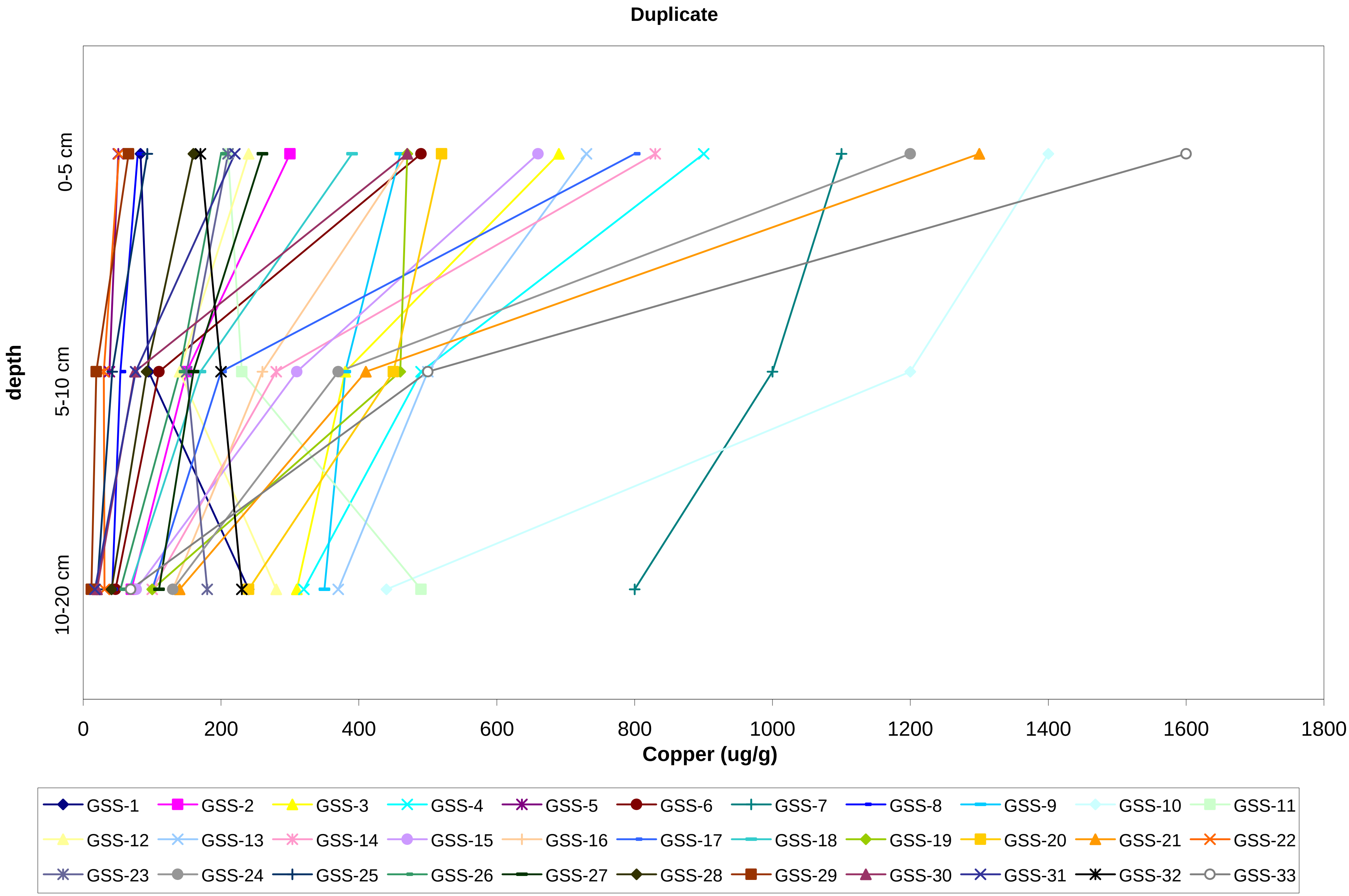


Figure 57: Soil Nickel with Depth

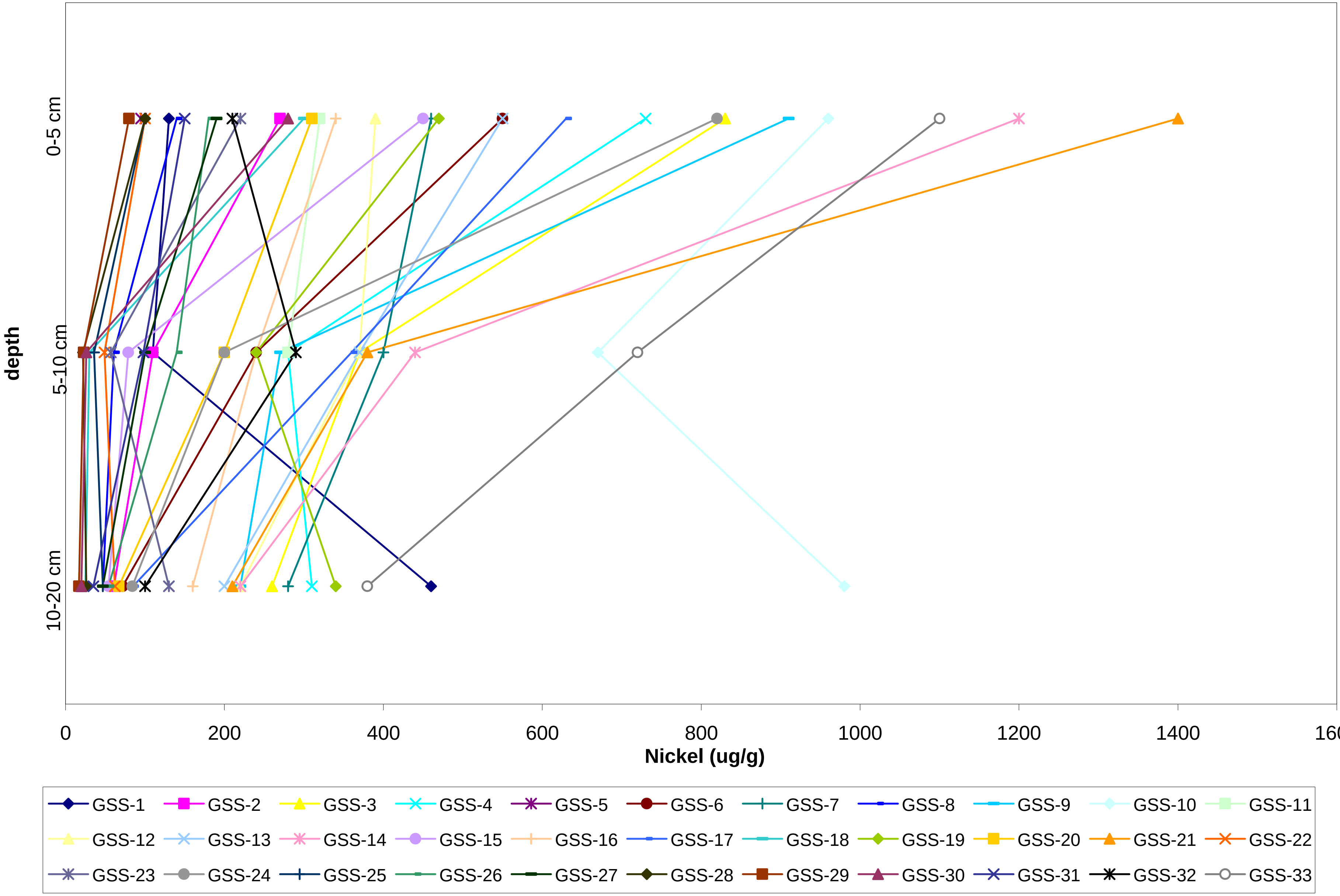
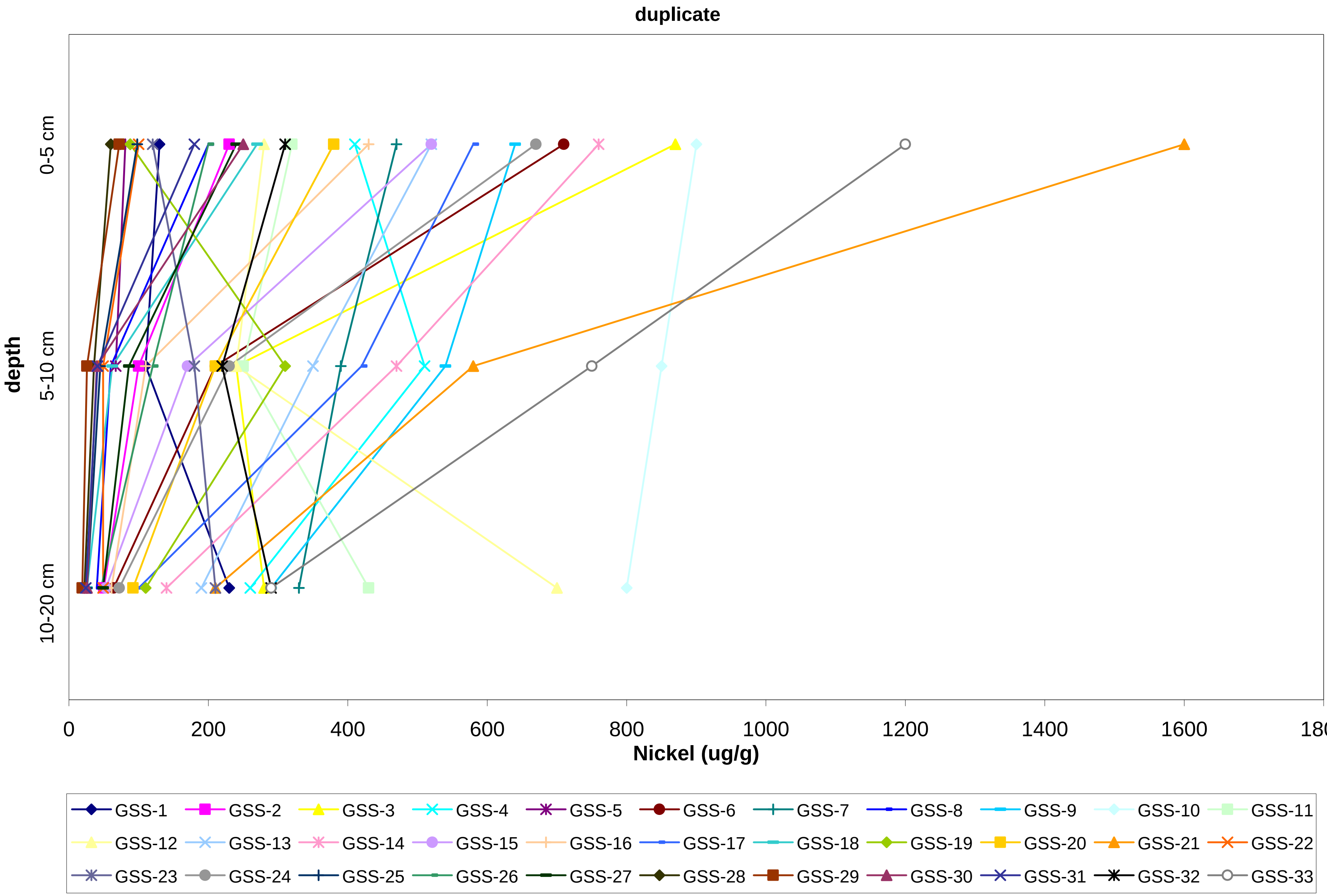


Figure 58: Soil Nickel with Depth



APPENDIX A

FIELD PHOTOGRAPHS
SAMPLING SITES AND TYPICAL SOIL CORES

Golder Associates Sudbury, Ontario	SCALE	AS SHOWN	TITLE	
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	CADD	XXX		
FILE No. 011923304	CHECK			
PROJECT No. 011-9233 REV. 0	REVIEW		FALCONBRIDGE SOIL SAMPLING	FIGURE A1

Golder Associates Sudbury, Ontario			SCALE AS SHOWN	TITLE	
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			DESIGN XXX		
			CADD XXX		
FILE No.	011923305		CHECK		
PROJECT No.	011-9233	REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE A2

Golder Associates Sudbury, Ontario		SCALE AS SHOWN	TITLE	
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		DESIGN XXX		
		CADD XXX		
FILE No. 011923306		CHECK		
PROJECT No. 011-9233	REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE A3

Golder Associates Sudbury, Ontario		SCALE AS SHOWN	TITLE	
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		DESIGN XXX		
		CADD XXX		
FILE No. 011923307		CHECK		
PROJECT No. 011-9233	REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE A4

Golder Associates Sudbury, Ontario	SCALE	AS SHOWN	TITLE	
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	DESIGN	XXX		
	CADD	XXX		
FILE No. 011923308	CHECK			
PROJECT No. 011-9233 REV. 0	REVIEW		FALCONBRIDGE SOIL SAMPLING	FIGURE A5

Golder Associates, Sudbury, Ontario	SCALE	AS SHOWN	TITLE
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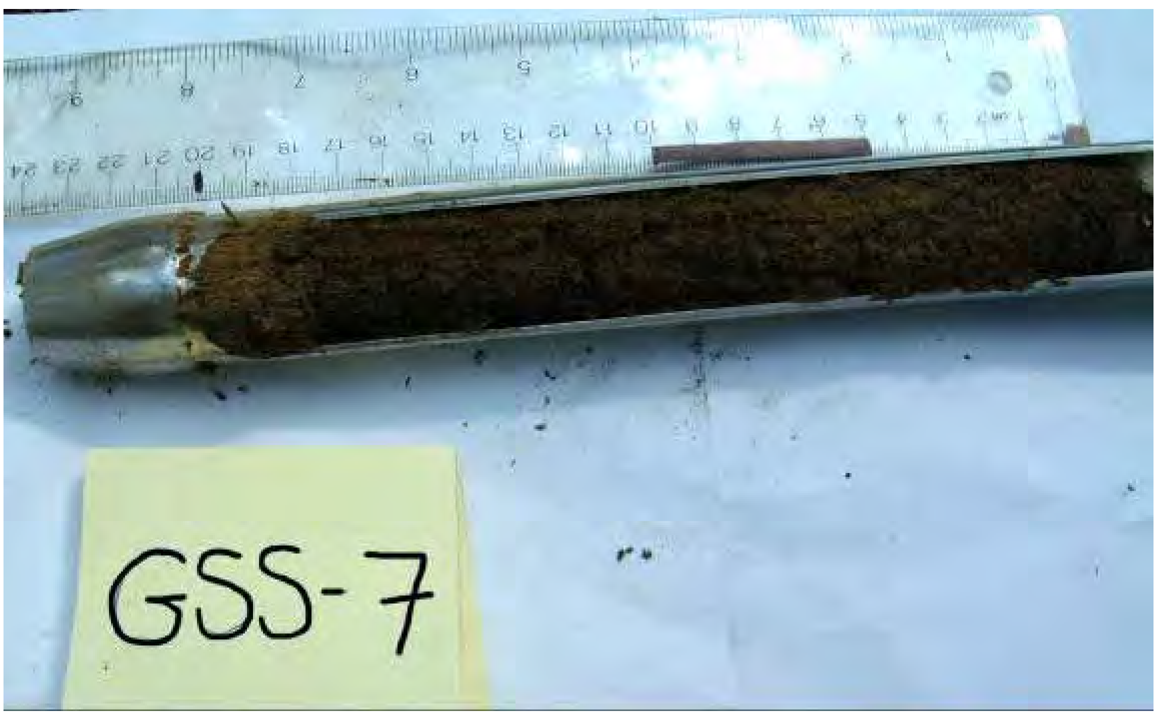
	DESIGN	XXX	
	CADD	XXX	
FILE No. 011923309	CHECK		
PROJECT No. 011-9233 REV. 0	REVIEW		FALCONBRIDGE SOIL SAMPLING — FIGURE A6



Golder Associates Sudbury, Ontario	SCALE	AS SHOWN	TITLE	
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	DESIGN	XXX		
	CADD	XXX		
FILE No. 011923310	CHECK			
PROJECT No. 011-9233 REV. 0	REVIEW		FALCONBRIDGE SOIL SAMPLING	FIGURE A7

Golder Associates Sudbury, Ontario		SCALE AS SHOWN	TITLE	
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		CADD XXX		
FILE No. 011923311		CHECK		
PROJECT No. 011-9233	REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE A8

Golder Associates, Sudbury, Ontario	SCALE AS SHOWN	TITLE		
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FILE No. 011923312	CHECK			
PROJECT No. 011-9233 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE	A9

Golder Associates Sudbury, Ontario		SCALE	AS SHOWN	TITLE	
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FILE No.	011923313	CHECK			
PROJECT No. 011-9233	REV. 0	REVIEW		FALCONBRIDGE SOIL SAMPLING	FIGURE A10

Golder Associates Sudbury, Ontario	SCALE	AS SHOWN	TITLE	
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FILE No. 011923314	CHECK			
PROJECT No. 011-9233 REV. 0	REVIEW		FALCONBRIDGE SOIL SAMPLING	FIGURE A11

Golder Associates Sudbury, Ontario		SCALE AS SHOWN	TITLE	
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		CADD XXX		
FILE No. 011923315		CHECK		
PROJECT No. 011-9233	REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE A12

Golder Associates, Sudbury, Ontario	SCALE AS SHOWN	TITLE	
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	CADD XXX		
FILE No. 011923316	CHECK		
PROJECT No. 011-9233 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE A13

Golder Associates Sudbury, Ontario		SCALE AS SHOWN	TITLE	
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FILE No. 011923317		CHECK		
PROJECT No. 011-9233	REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE A14

Golder Associates Sudbury, Ontario		SCALE AS SHOWN	TITLE	
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FILE No. 011923318		CHECK		
PROJECT No. 011-9233	REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE A15

Golder Associates Sudbury, Ontario		SCALE	AS SHOWN	TITLE
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PROJECT No.	011-9233 REV. 0	REVIEW		FALCONBRIDGE SOIL SAMPLING — FIGURE A16

Golder Associates Sudbury, Ontario			SCALE	AS SHOWN	TITLE	
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PROJECT No.	011-9233	REV. 0	REVIEW		FALCONBRIDGE SOIL SAMPLING	FIGURE A17

Golder Associates Sudbury, Ontario		SCALE AS SHOWN	TITLE	
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		CADD XXX		
FILE No. 011923321		CHECK		
PROJECT No. 011-9233	REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE A18

Golder Associates Sudbury, Ontario		SCALE AS SHOWN	TITLE	
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		CADD XXX		
FILE No. 011923322		CHECK		
PROJECT No. 011-9233	REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE A19

Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE	
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	DESIGN XXX	FIELD PHOTOS OF GSS-20	
	CADD XXX		
FILE No. 011923323	CHECK		
PROJECT No. 011-9233 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE A20

Golder Associates Sudbury, Ontario		SCALE AS SHOWN	TITLE
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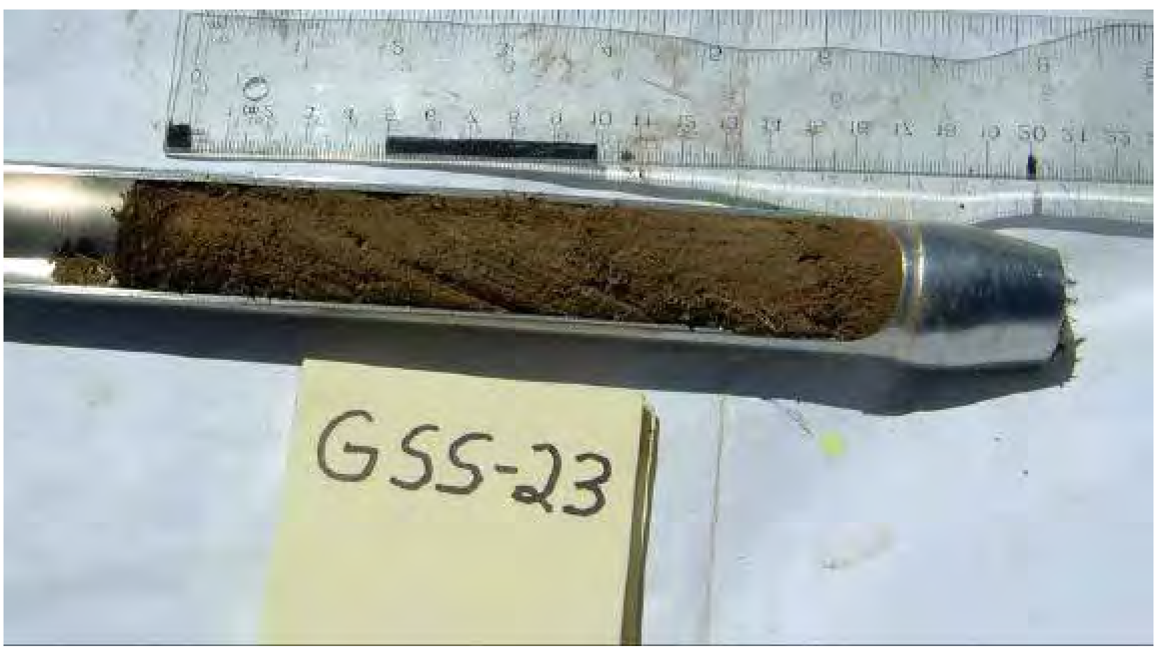
		CADD XXX	
FILE No. 011923324		CHECK	
PROJECT No. 011-9233	REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING — FIGURE A21

Golder Associates Sudbury, Ontario	SCALE AS SHOWN DATE 25/07/01 DESIGN XXX CADD XXX	TITLE	
FILE No. 011923325	CHECK	FIELD PHOTOS OF GSS-22	
PROJECT No. 011-9233 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE A22



Golder Associates Sudbury, Ontario		SCALE	AS SHOWN	TITLE	
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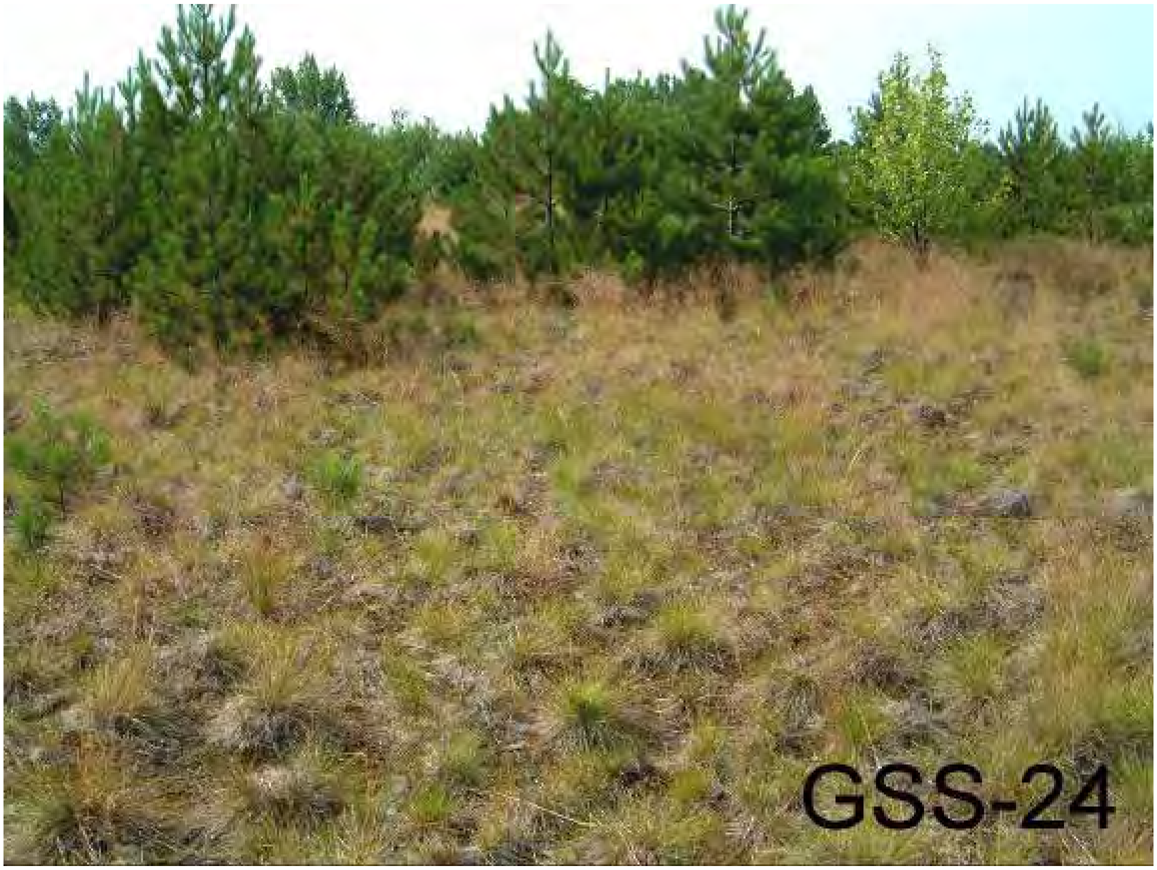
FILE No.	011923326	CHECK			
PROJECT No.	011-9233 REV. 0	REVIEW		FALCONBRIDGE SOIL SAMPLING	FIGURE A23



Golder Associates Sudbury, Ontario		SCALE AS SHOWN	TITLE	
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		CADD XXX		
FILE No. 011923327		CHECK		
PROJECT No. 011-9233	REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE A24

Golder Associates
Sudbury, Ontario

FILE No.	011923328	CHECK		
PROJECT No.	011-9233	REV. 0	REVIEW	

SCALE	AS SHOWN
DATE	25/07/01
DESIGN	XXX
CADD	XXX

TITLE

FIELD PHOTOS OF GSS-25

FALCONBRIDGE SOIL SAMPLING

FIGURE A25

Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE		
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	CADD XXX			
FILE No. 011923329	CHECK			
PROJECT No. 011-9233 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE	A26

Golder Associates Sudbury, Ontario	SCALE AS SHOWN		TITLE	
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	CADD XXX			
FILE No. 011923330	CHECK			
PROJECT No. 011-9233	REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE A27

Golder Associates Sudbury, Ontario	SCALE	AS SHOWN	TITLE	
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	CADD	XXX		
FILE No. 011923331	CHECK			
PROJECT No. 011-9233 REV. 0	REVIEW		FALCONBRIDGE SOIL SAMPLING	FIGURE A28

Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE	
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	DESIGN XXX		
	CADD XXX		
FILE No. 011923332	CHECK		
PROJECT No. 011-9233 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE A29

Golder Associates, Sudbury, Ontario	SCALE AS SHOWN	TITLE		
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	CADD XXX			
FILE No. 011923333	CHECK			
PROJECT No. 011-9233 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE	A30

Golder Associates Sudbury, Ontario		SCALE	AS SHOWN	TITLE
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FILE No.	011923334	CHECK		
PROJECT No.	011-9233 REV. 0	REVIEW		FALCONBRIDGE SOIL SAMPLING FIGURE A31

Golder Associates Sudbury, Ontario	SCALE AS SHOWN	TITLE	
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	CADD XXX		
FILE No. 011923334	CHECK		
PROJECT No. 011-9233 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE A32

Golder Associates
Sudbury, Ontario

SCALE	AS SHOWN	TITLE		
DATE	25/07/01	FIELD PHOTOS OF GSS-33		
DESIGN	XXX			
CADD	XXX			
FILE No. 011923334	CHECK			
PROJECT No. 011-9233 REV. 0	REVIEW	FALCONBRIDGE SOIL SAMPLING	FIGURE	A33

APPENDIX B

STATION DESCRIPTION FORMS

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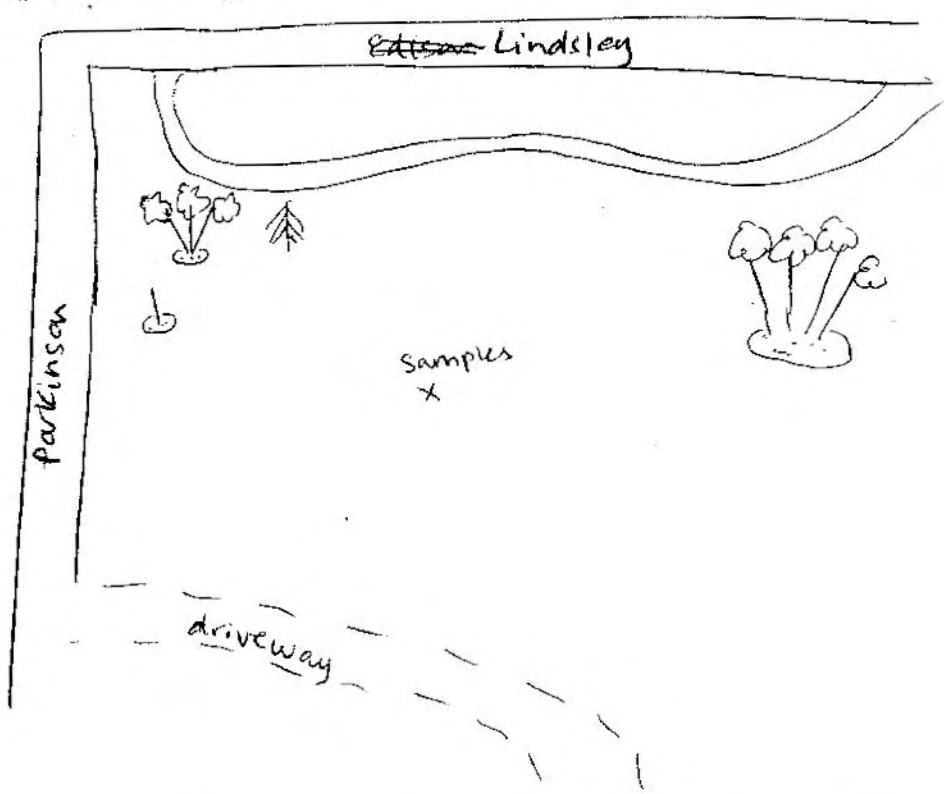
STATION DESCRIPTION FORMS

Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	Station Number (3 digits): GSS - 1		Land Use:
UTM Zone 17 NAD 27	Easting 0514457	Northing 5157957	Error [illegible]

Location (park name, school name, lot concession):
Park at ~~Edison~~ Lindsley St. and Parkinson St.
cut grass – fertilizer

Site Map (North at Top)

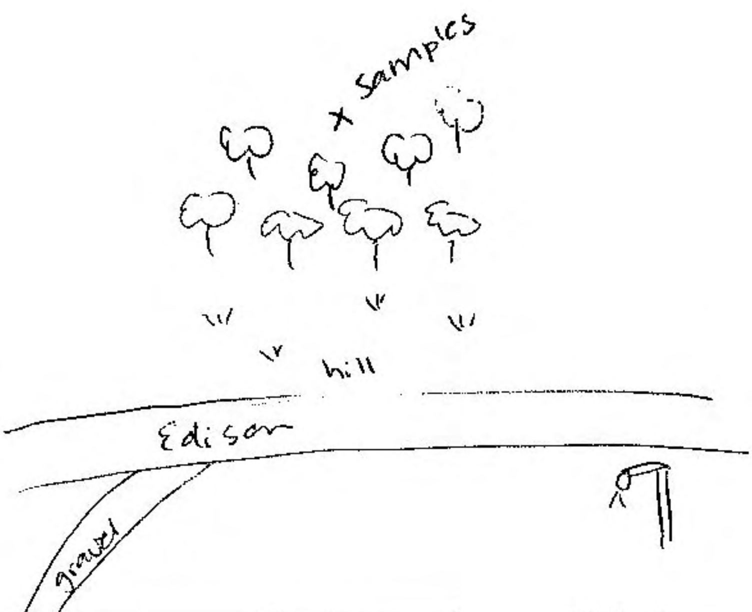


Samp 0-5 2001 12000	5- 2001 12002	10-20 2001 12004	
0-5 2001 12001	5-10 2001 12003	10-20 2001 12005	Date: July 9 2001.
Prepared by:		Notes: cut grass – fertilizer very compacted only to ~ 15 cm	

Sudbury Soil Survey 2001- FALCONBRIDGE			
Code : 5039	**Station Number (3 digits):** GSS-2		**Land Use:**
UTM Zone 17 NAD 27	**Easting** 0514410	**Northing** 5158331	**Error**

Location (park name, school name, lot concession):
Woods off Edison across from Legion

Site Map (North at Top)



Samp' 0-5 2001 12006	**5-10** 2001 12008	**10-20** 2001 12010	
0-5 2001 12007	**5-10** 2001 12009	**10-20** 2001 12011	**Date:** July 9 2001.

Prepared by:

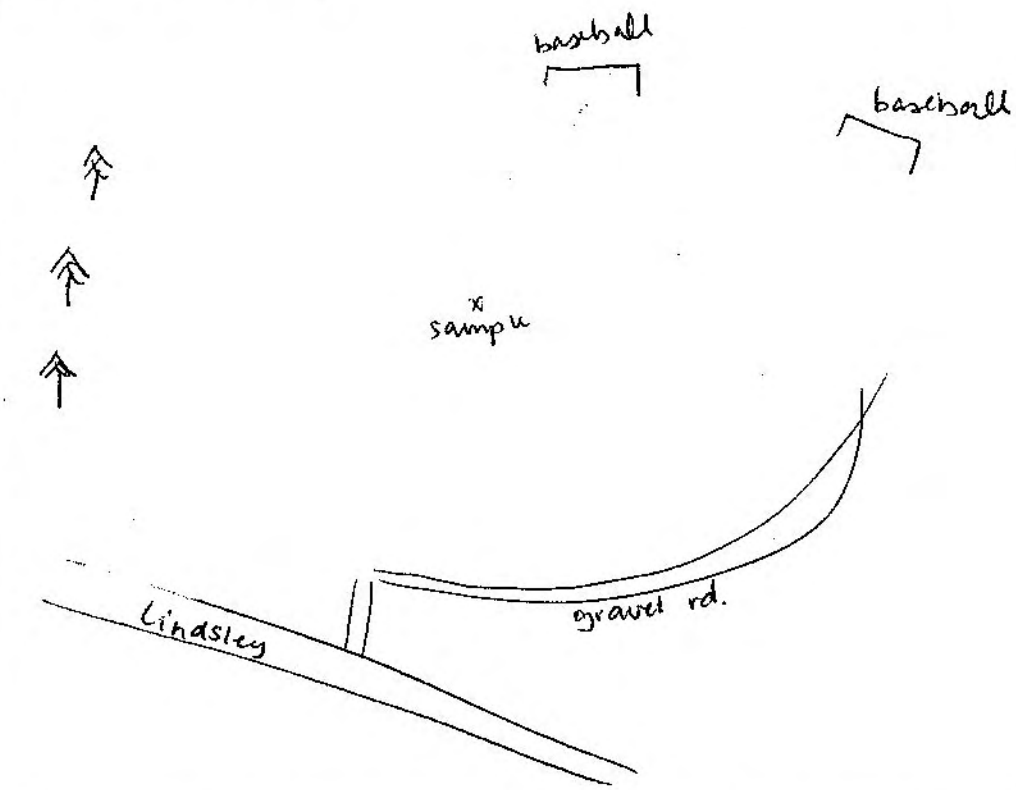
Notes:

Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	Station Number (3 digits): GSS-3		Land Use:
UTM Zone 17 NAD 27	Easting 0514442	Northing 5158154	Error

Location (park name, school name, lot concession):
Park (field) - entrance off Lindsley
(between trees and baseball diamond

Site Map (North at Top)



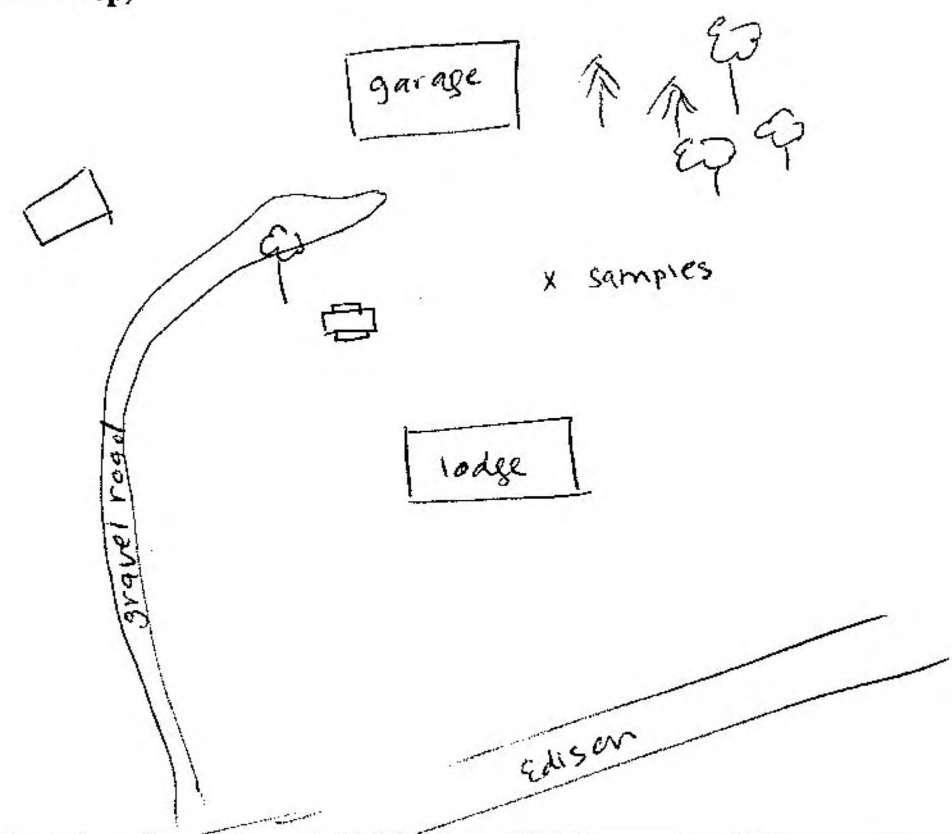
Samp' 0-5	5-10	10-20	
2001 12012	2001 12014	2001 12016	
0-5 2001 12013	5-10 2001 12015	10-20 2001 12017	Date: July 9 2001.

Prepared by:	Notes:
N. Boudreau	Encounter tailings at ~15cm

Sudbury Soil Survey 2001- FALCONBRIDGE			
Code : 5039	**Station Number (3 digits):** GSS - 4		**Land Use:**
UTM Zone 17 NAD 27	**Easting** 0514220	**Northing** 5158314	**Error**

Location (park name, school name, lot concession):
Lodge on Edison
(back yard)

Site Map (North at Top)



Samp' **0-5** 2001 12018	**5-10** 2001 12020	**10-2** 2001 12022	
0-5 2001 12019	**5-10** 2001 12021	**10-20** 2001 12023	**Date:** July 9 **2001.**

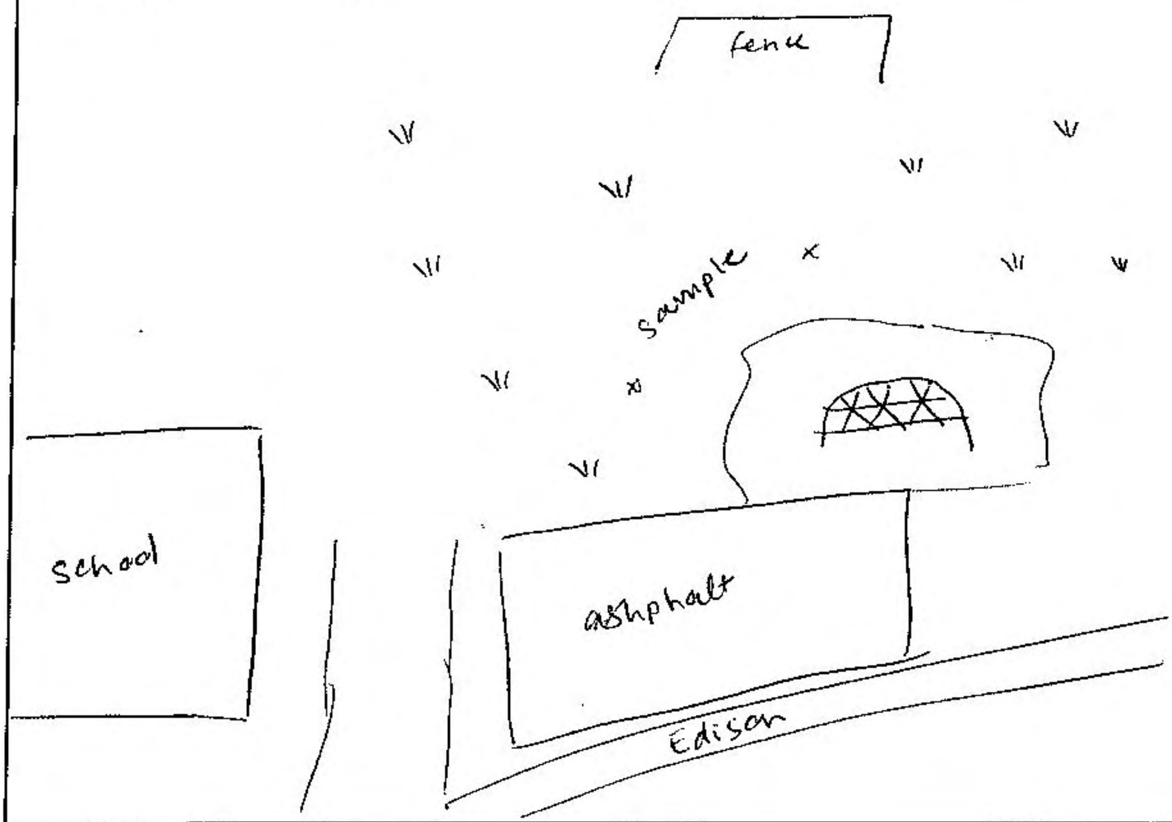
Prepared by: N. Boudreau	**Notes:** Only ~15 cm usually Cut grass - fertilizer use

Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	**Station Number (3 digits):** GSS - 5		**Land Use:**
UTM Zone 17 **NAD 27**	**Easting** 0514076	**Northing** 5158166	**Error**

Location (park name, school name, lot concession):
Falconbridge school (Edison St.) (Block G)
- grass field

Site Map (North at Top)



Samp' 0-5 2001 12024	**5-10** 2001 12026	**10-20** 2001 12028
0-5 2001 12025	**5-10** 2001 12027	**10-2** 2001 12029

Date: July 9 **2001.**

Prepared by: N. Boudreau

Notes: Probable fertilizer
Usually only ~5-10cm

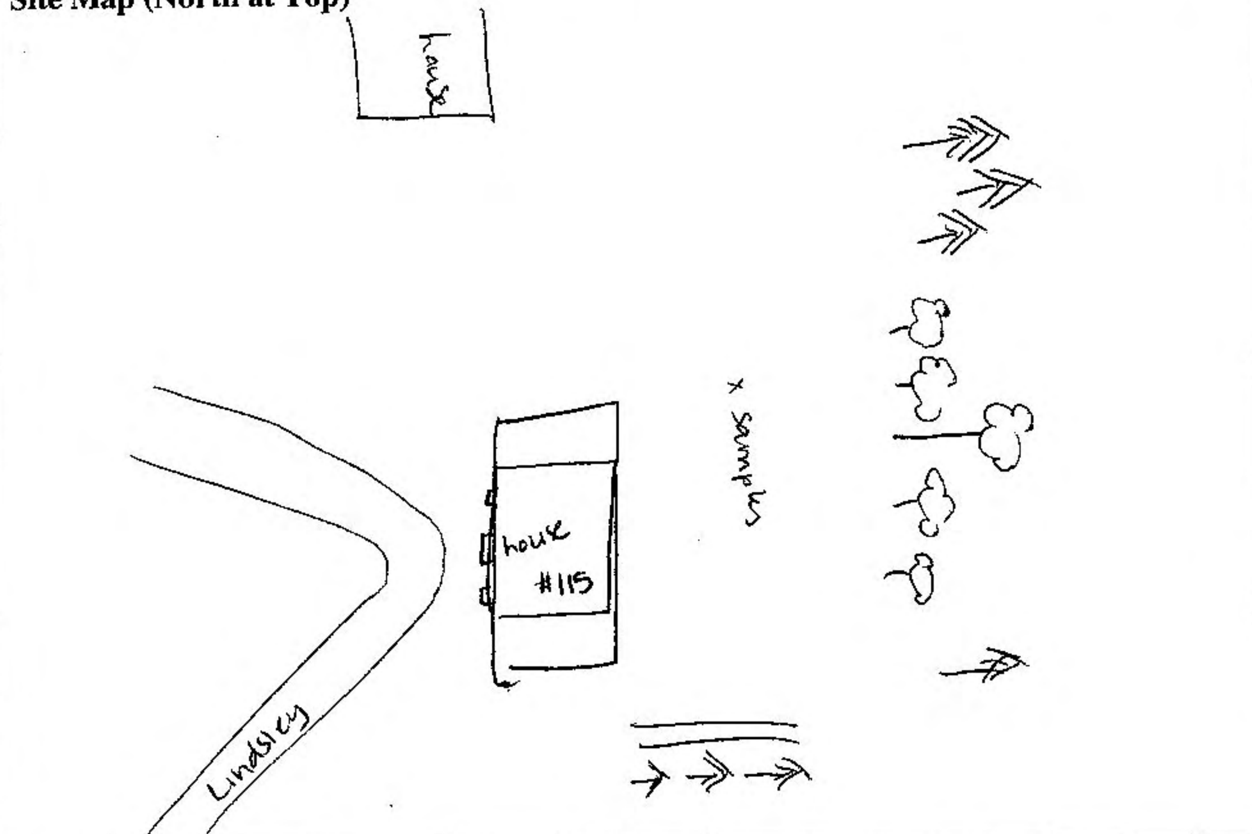
Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	**Station Number (3 digits):** GSS-6		**Land Use:**
UTM Zone 17 **NAD 27**	**Easting** 54 05140	**Northing** 373 5158	**Error**

Location (park name, school name, lot concession):

#115 Lindsley (back yard) (Lot 274)

Site Map (North at Top)



Samp 0-5 2001 12030	**5-10** 2001 12032	**10-20** 2001 12034	
0-5 2001 12031	**5-10** 2001 12033	**10-20** 2001 12035	**Date:** July 9 2001.

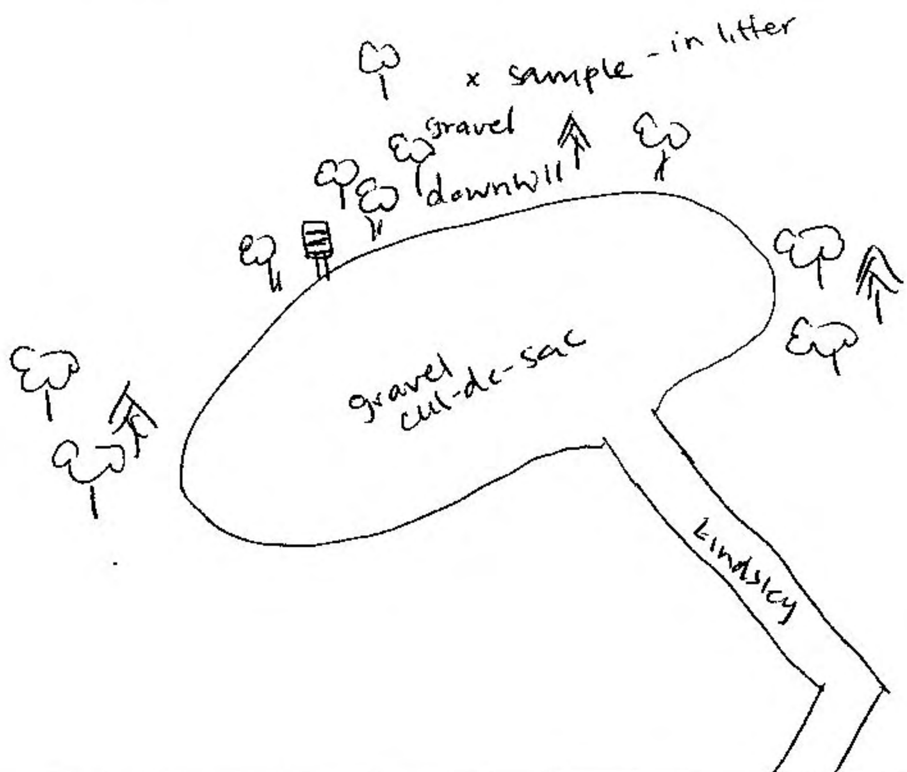
Prepared by: N. Boudreau	**Notes:** may be fertilizer Only ~15 cm

Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	**Station Number (3 digits):** GSS - 7		**Land Use:**
UTM Zone 17 NAD 27	**Easting** 0513836	**Northing** 5158493	**Error**

Location (park name, school name, lot concession):
End of Lindsley St. (dead end, gravel parking lot leading downhill to woods)

Site Map (North at Top)



Sam 0-5 2001 12036	5-1(2001 12038	10-20 2001 12040	
0-5 2001 12037	5-10 2001 12039	10-20 2001 12041	**Date:** July 9 2001.

Prepared by: N. Boudreau

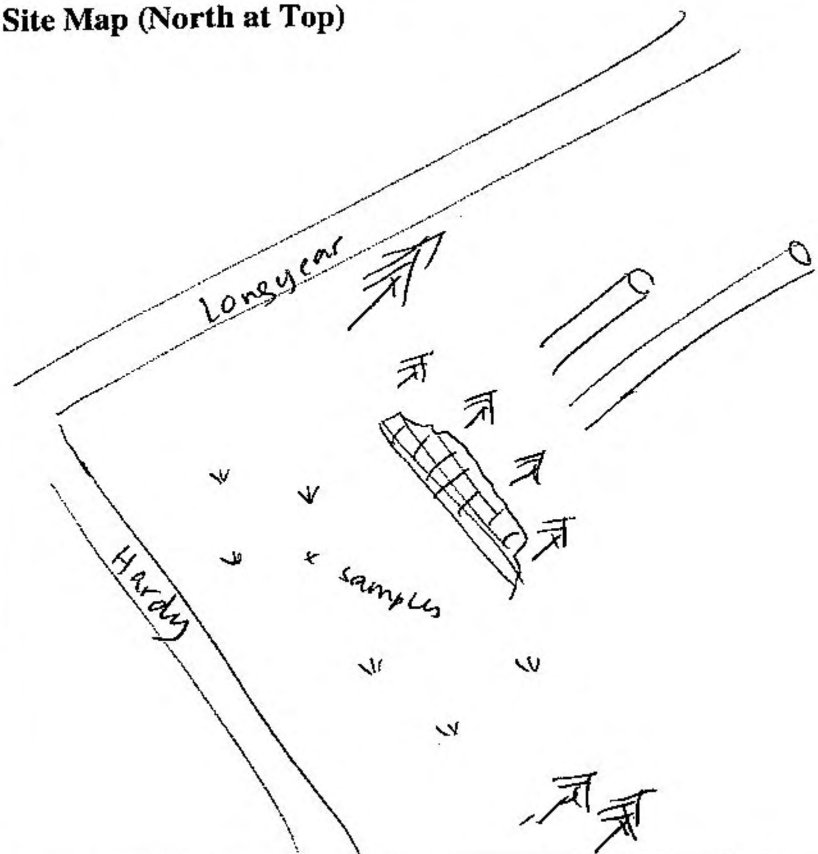
Notes:

Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	Station Number (3 digits): GSS-8		Land Use:
UTM Zone 17 NAD 27	Easting 0514663	Northing 5157819	Error

Location (park name, school name, lot concession):
Small park on Hardy St. near smelter

Site Map (North at Top)



Sam[illegible] 0-5 2001 12042	5-10 2001 12044	10-2[illegible] 2001 12046	
0-5 2001 12043	5-10 2001 12045	10-20 2001 12047	Date: July 10 2001.

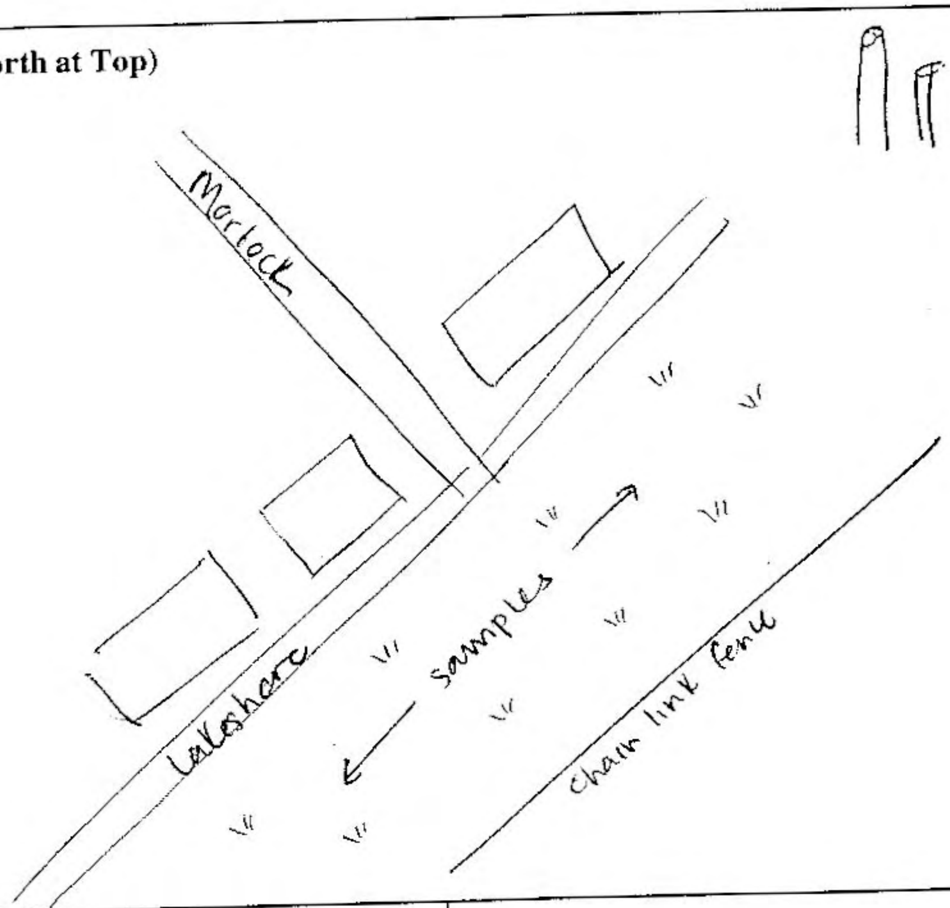
Prepared by:	Notes:
N. Boudreau	landscape - fertilizer use

Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	**Station Number (3 digits):** GSS-9		**Land Use:**
UTM Zone 17 NAD 27	**Easting** 0514626	**Northing** 5157692	**Error**

Location (park name, school name, lot concession):
Grassy area near fence at Lakeshore + Morlock

Site Map (North at Top)



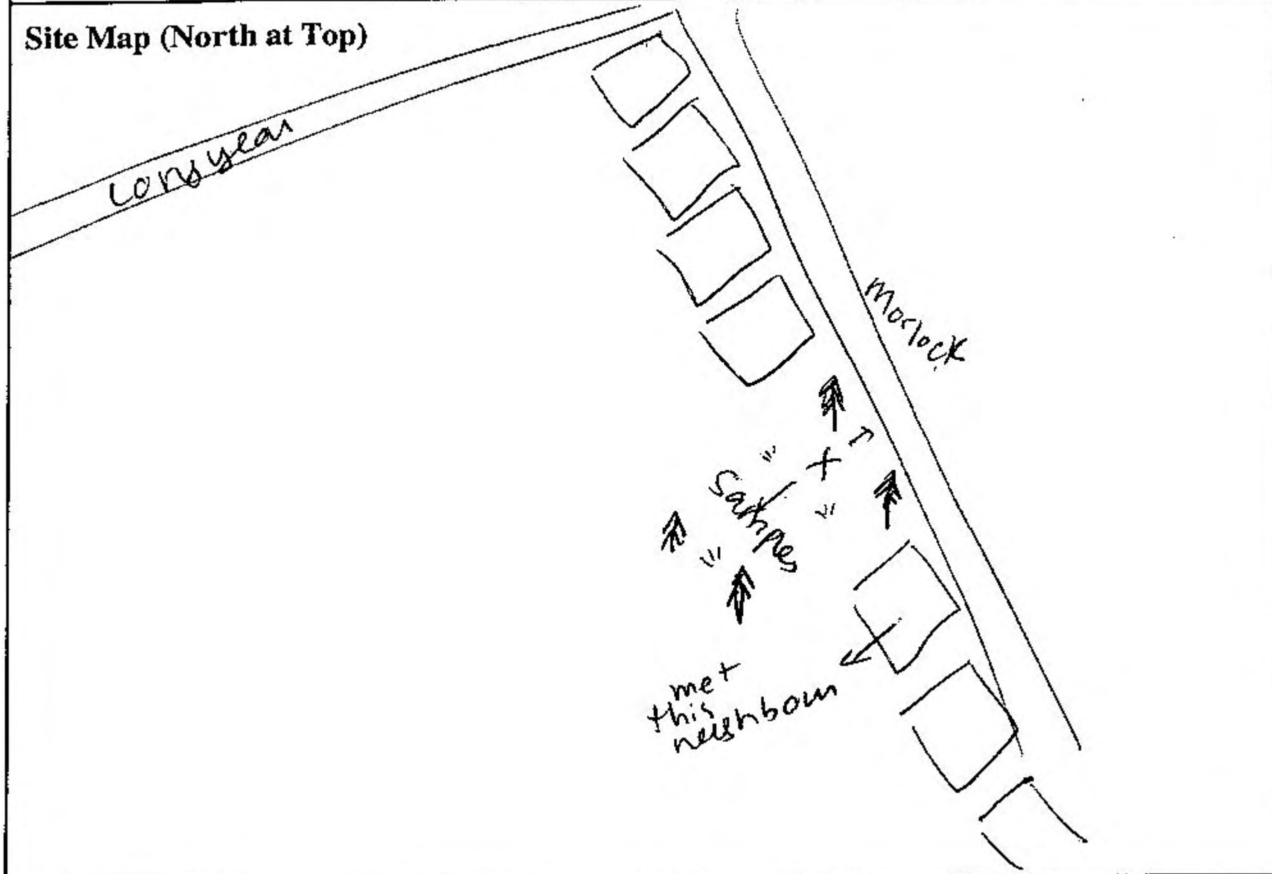
Samp 0-5 2001 12048	**5-10** 2001 12050	**10-2** 2001 12052	
0-5 2001 12049	**5-10** 2001 12051	**10-2** 2001 12053	**Date:** July 10 **2001.**
Prepared by: N. Boudreau		**Notes:** Sampled in transect only ~15 cm	

Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	**Station Number (3 digits):** GSS-10		**Land Use:**
UTM Zone 17 NAD 27	**Easting** 0514568	**Northing** 5157764	**Error**

Location (park name, school name, lot concession):
Vacant lot on Morlock St. (next to #5)
(Lot 25)

Site Map (North at Top)



Samples 0-5 2001 12054	**5-1** 2001 12056	**10-20** 2001 12058
0-5 2001 12055	**5-10** 2001 12057	**10-20** 2001 12059

Date: July 10 2001.

Prepared by: N. Boudreau

Notes: fertilizer, liming (by neighbour)

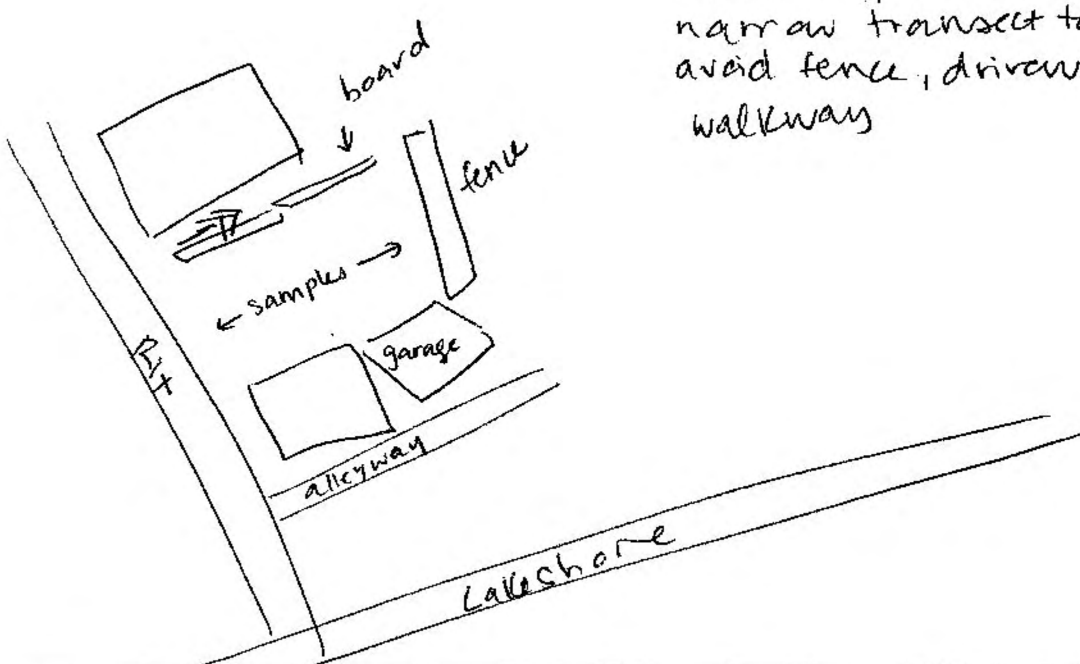
Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	Station Number (3 digits): GSS-11		Land Use:
UTM Zone 17 NAD 27	Easting 494 0514	Northing 660 5157	Error

Location (park name, school name, lot concession):
Vacant lot next to 33 Rix (Lot 57)

Site Map (North at Top)

take samples in a narrow transect to avoid fence, driveway, walkway



Samp 0-5	5-10	10-20	
2001 12060	2001 12062	2001 12064	
0-5 2001 12061	5-10 2001 12063	10-20 2001 12065	Date: July 10 2001.

Prepared by:	Notes:
N. Boudreau	only ~ 12 cm fertilizer, freshly cut

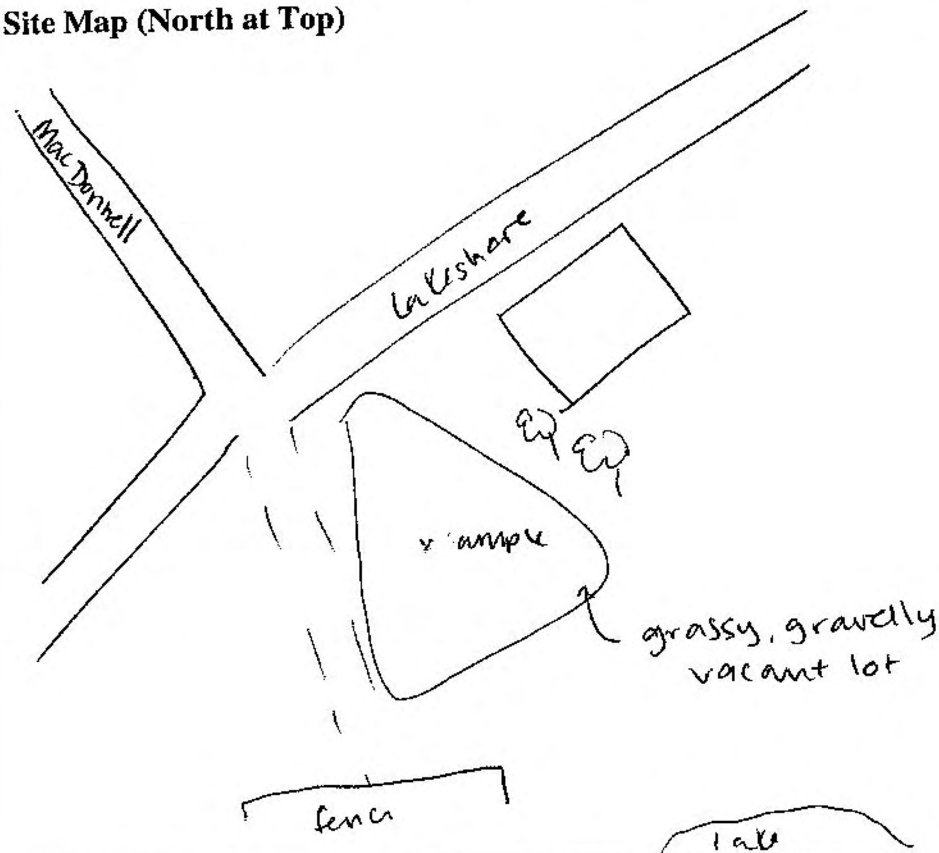
Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	Station Number (3 digits): GSS-17		Land Use:
UTM Zone 17 NAD 27	Easting 0514474	Northing 5157 533	Error

Location (park name, school name, lot concession):

Vacant lot at Lakeshore and MacDonnell (Block G)

Site Map (North at Top)



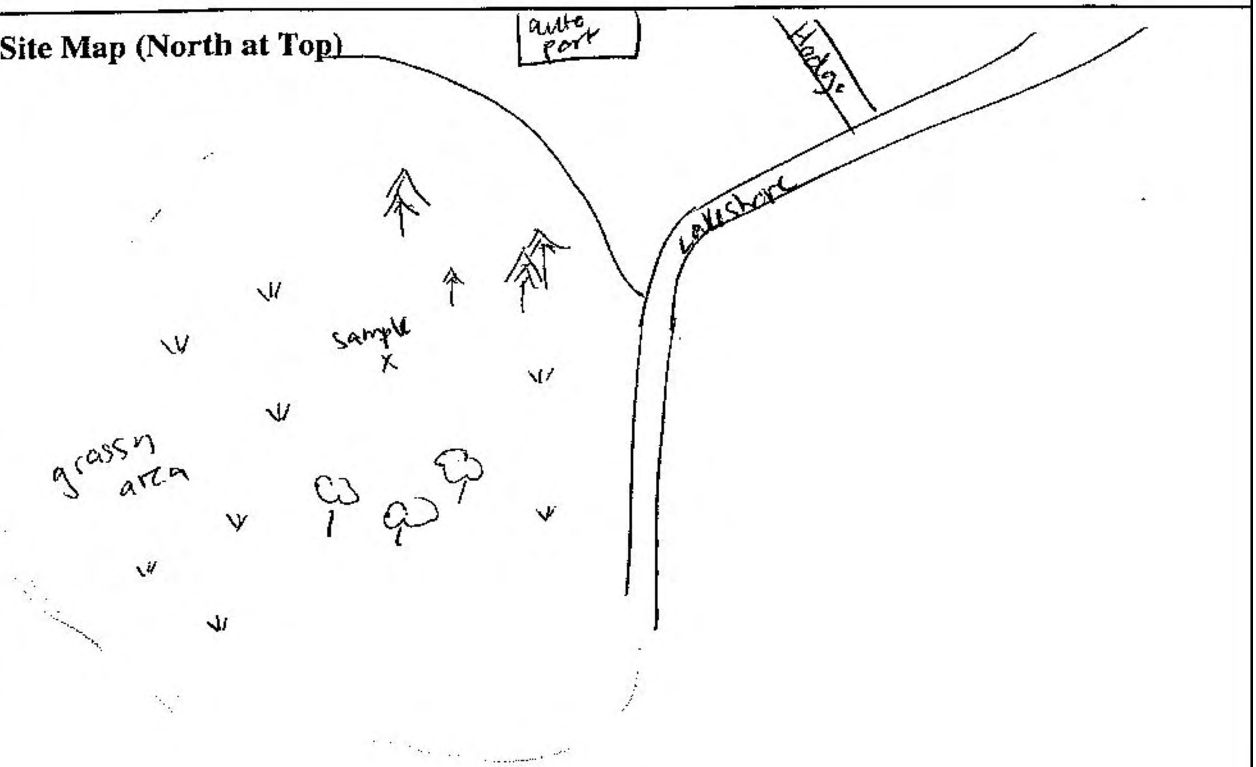
Samp 0-5	5-10	10-20	
2001 12066	2001 12068	2001 12070	
0-5 2001 12067	5-10 2001 12069	10-20 2001 12071	Date: July 10 2001.

Prepared by:	Notes:
N. Boudreau	all gravel fill, to 15 cm - sampled by pit w/ trowel

Sudbury Soil Survey 2001- FALCONBRIDGE			
Code : 5039	**Station Number (3 digits):** GSS-13		**Land Use:**
UTM Zone 17 NAD 27	**Easting** 220 0514	**Northing** 462 5157	**Error**

Location (park name, school name, lot concession):
Grassy area on dirt road off Lakeshore (east end)

Site Map (North at Top)



Sample 0-5	5-10	10-20	
2001 12072	2001 12074	2001 12076	
0-5 2001 12073	**5-10** 2001 12075	**10-20** 2001 12077	**Date:** July 10 2001.

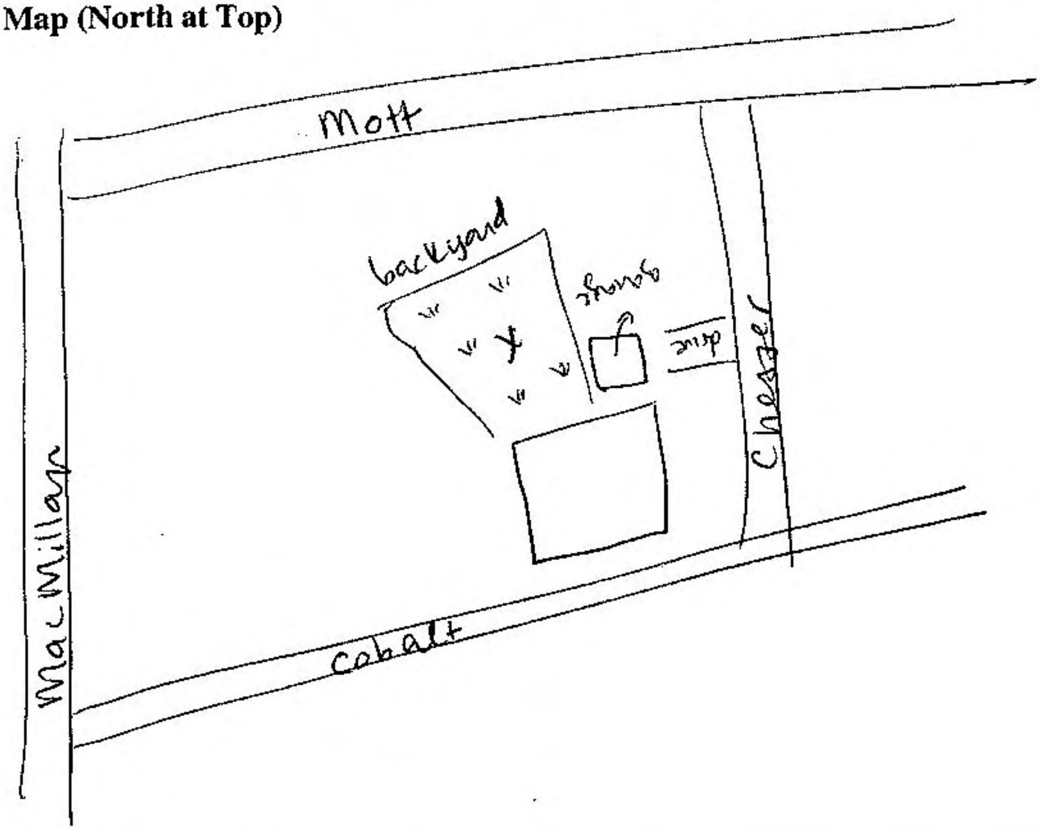
Prepared by:	**Notes:**
N. Boudreau	gravelly/washout muddy in places

Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	Station Number (3 digits): GSS-14		Land Use:
UTM Zone 17 NAD 27	Easting 0514129	Northing 5157828	Error

Location (park name, school name, lot concession):
House at #6 Cobalt (at Cobalt + Chesser) (Lot 207) in backyard

Site Map (North at Top)



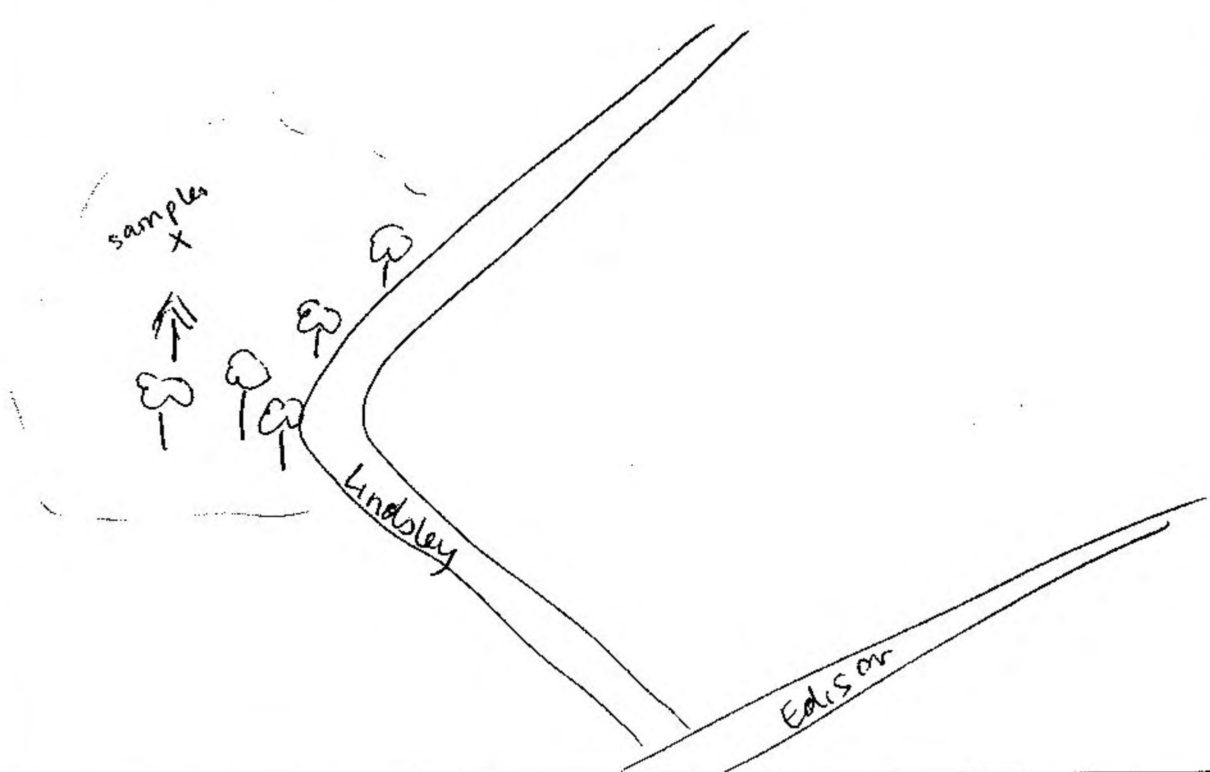
Samples 0-5	5-10	10-20	
2001 12078	2001 12080	2001 12082	
0-5 2001 12079	5-10 2001 12081	10-20 2001 12083	Date: July 10 2001.

Prepared by:	Notes:
N. Boudreau	avg. 15-20 cm (~17 cm) grass looks healthy - fertilizer?

Sudbury Soil Survey 2001- FALCONBRIDGE			
Code : 5039	**Station Number (3 digits):** GSS -15		**Land Use:**
UTM Zone 17 NAD 27	**Easting** 0513862	**Northing** 5158134	**Error**

Location (park name, school name, lot concession):
vacant lot off Lindsley (at turn)
(wooded area)

Site Map (North at Top)



Sam 0-5 2001 12084	5-10 2001 12086	10-20 2001 12088	
0-5 2001 12085	5-10 2001 12087	10-2 2001 12089	**Date:** July 10 2001.

Prepared by: N. Boudreau

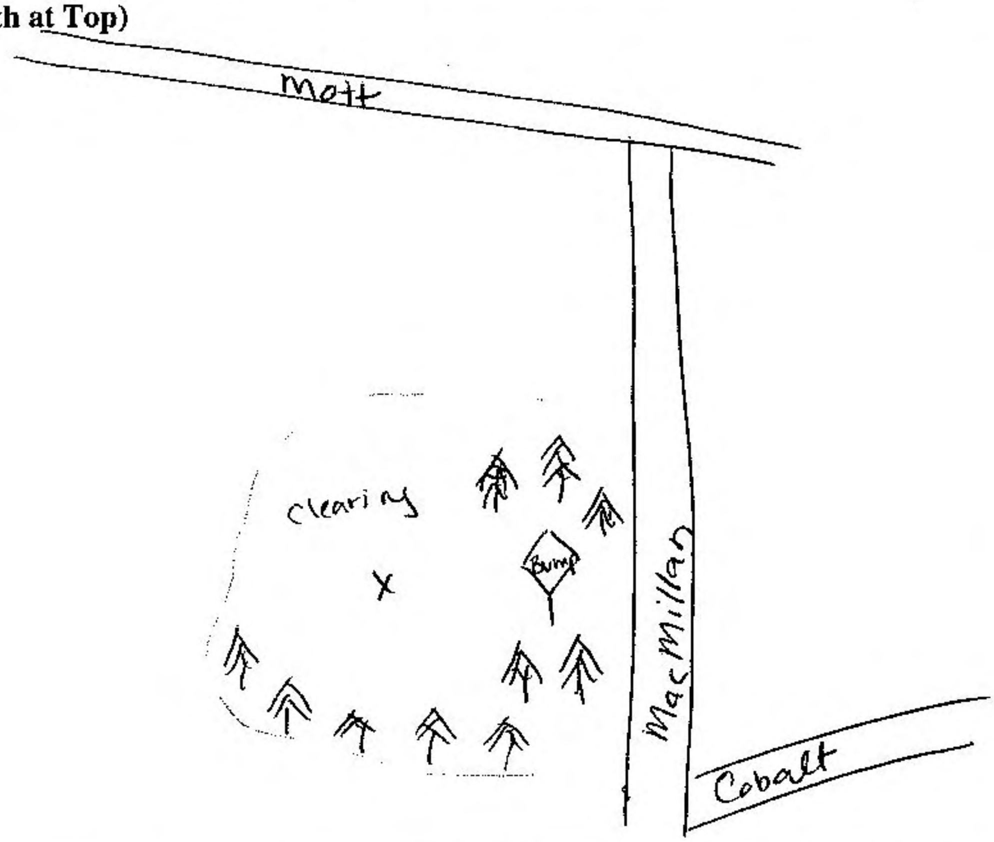
Notes: charcoal at ~5-7 cm in some cores

Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	Station Number (3 digits): GSS-16		Land Use:
UTM Zone 17 NAD 27	Easting 0514076	Northing 5157818	Error

Location (park name, school name, lot concession):
Wooded area off MacMillan near Cobalt

Site Map (North at Top)



Sam' 0-5 2001 12090	5-10 2001 12092	10-20 2001 12094	
0-5 2001 12091	5-10 2001 12093	10-20 2001 12095	Date: July 10 2001.

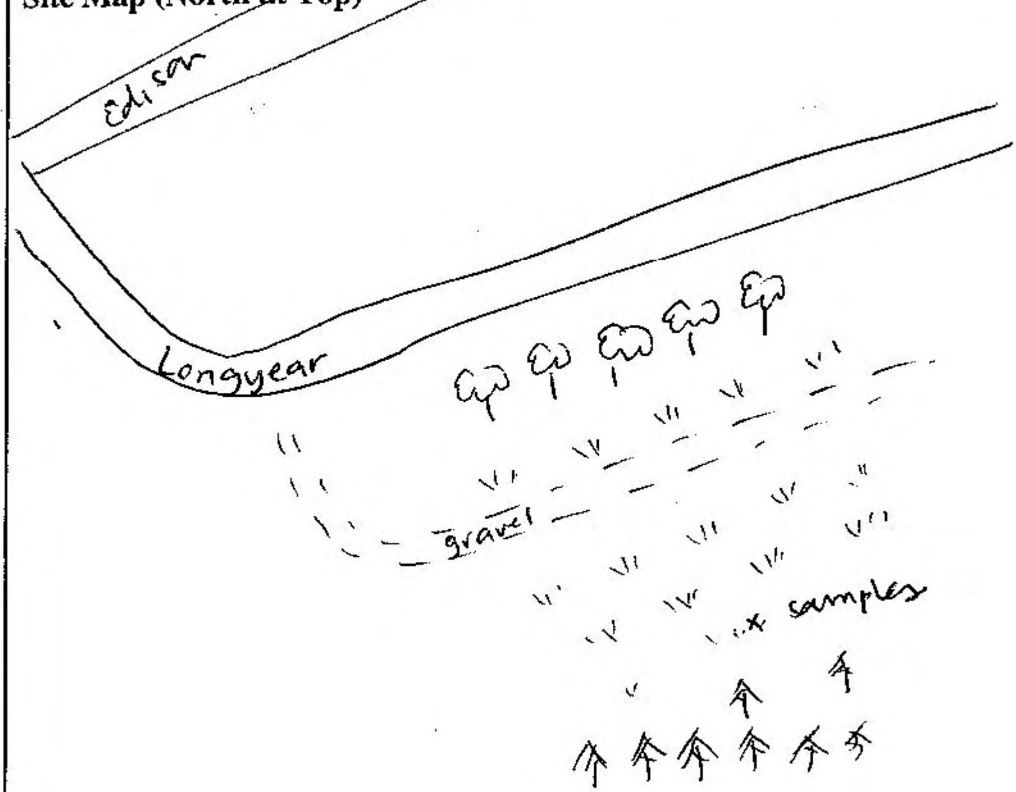
Prepared by:	Notes:
N. Boudreau	Some cores only to 15cm

Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	**Station Number (3 digits):** GSS-17		**Land Use:**
UTM Zone 17 **NAD 27**	**Easting** 3794 051	**Northing** 337 515 7	**Error**

Location (park name, school name, lot concession):
Grassy area off Longyear (between Edison and town)

Site Map (North at Top)



Sam 0-5 2001 12096	**5-10** 2001 12098	**10-20** 2001 12100

0-5 2001 12097	**5-10** 2001 12099	**10-20** 2001 12101	**Date:** July 11 **2001.**

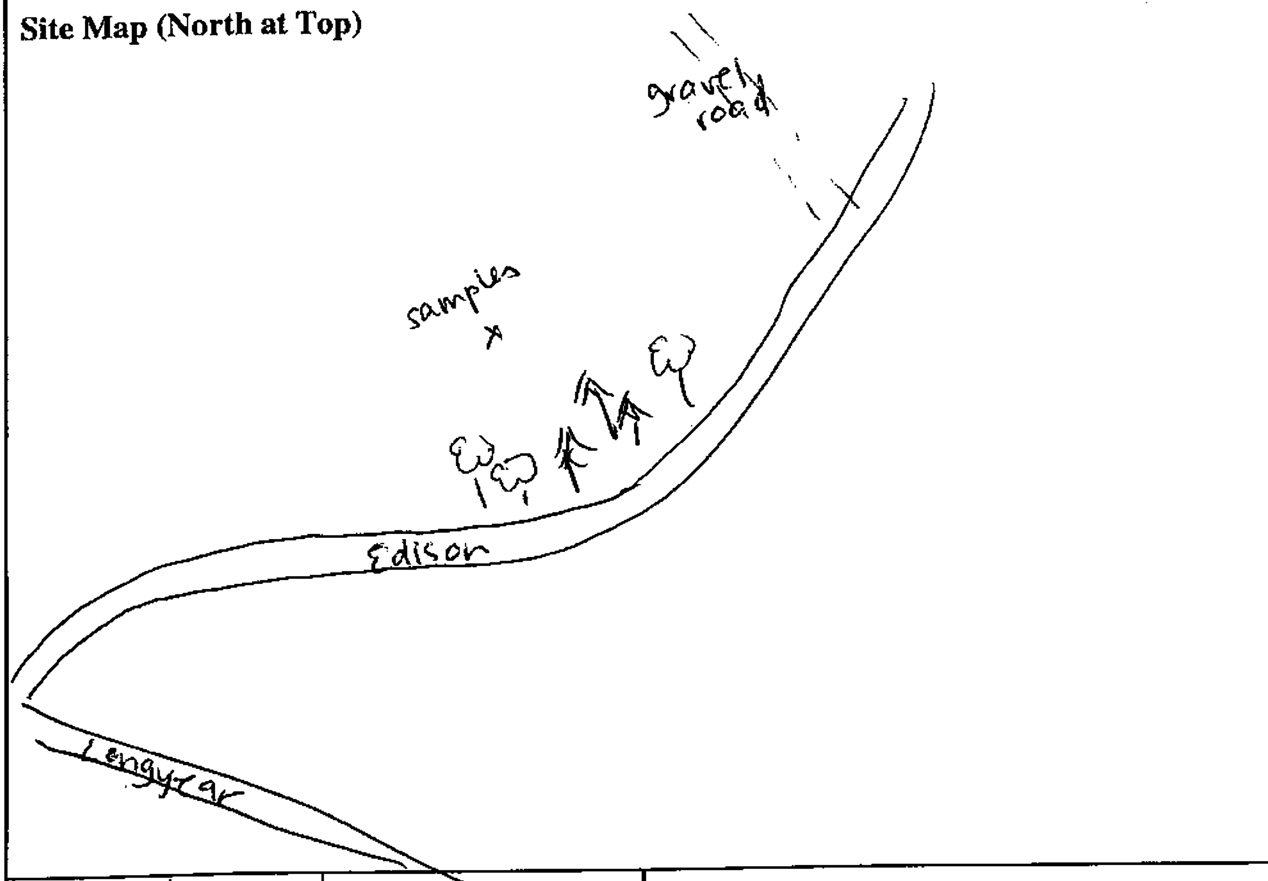
Prepared by: N. Boudreau	**Notes:** average depth ~17 cm

Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	Station Number (3 digits): GSS-18		Land Use:
UTM Zone 17 NAD 27	Easting 0513443	Northing 5157479	Error

Location (park name, school name, lot concession): Wooded area off Edison, between Longyear and old gravel road (at curve)

Site Map (North at Top)



Samp 0-5 2001 12102	5-10 2001 12104	10-20 2001 12106	
0-5 2001 12103	5-10 2001 12105	10-20 2001 12107	Date: July 11 2001.

Prepared by: N. Boudreau

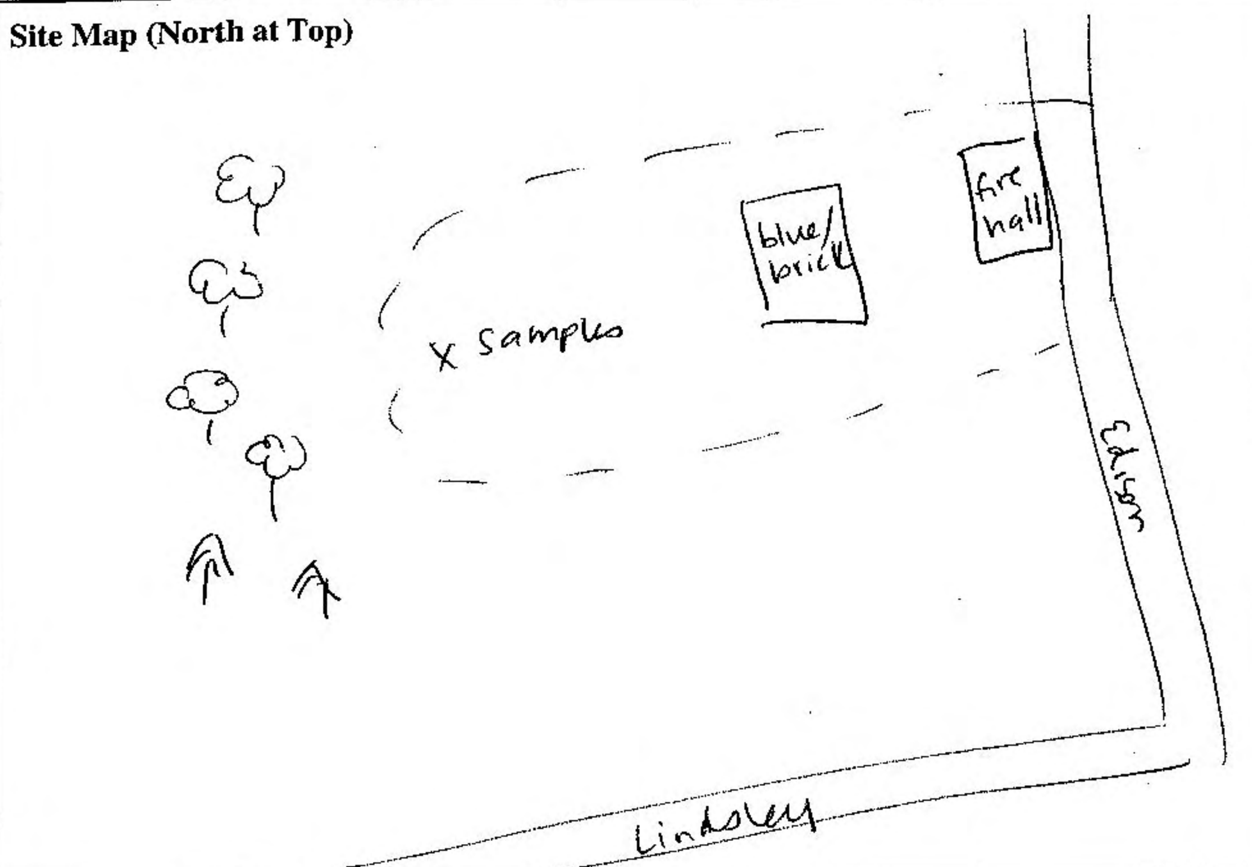
Notes: Muddy past ~10 cm site is quite wet / boggy

Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	Station Number (3 digits): GSS-19		Land Use:
UTM Zone 17 NAD 27	Easting 4454 051[redacted]	Northing 8091 515[redacted]	Error

Location (park name, school name, lot concession):
Behind Fire Hall off Edison (near ballfield)

Site Map (North at Top)



Samp' 0-5 2001 12108	5-10 2001 12110	10-20 2001 12112	
0-5 2001 12109	5-10 2001 12111	10-20 2001 12113	Date: July 11 2001.

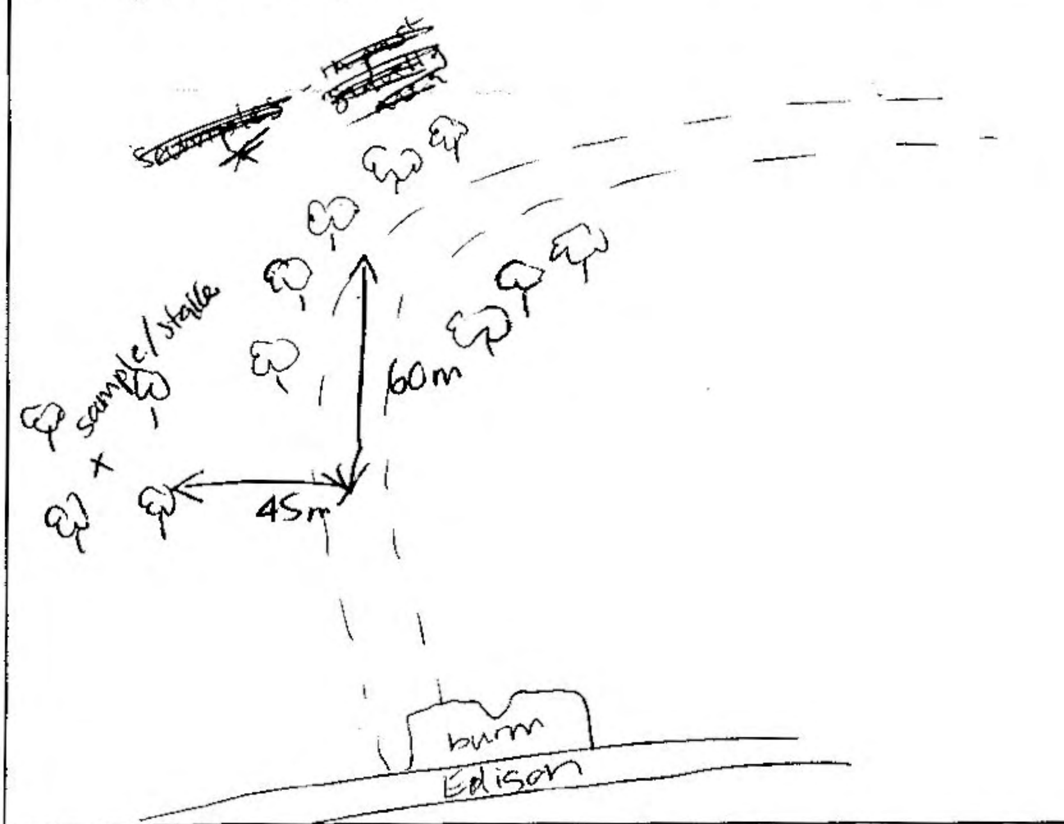
Prepared by: N. Boudreau	**Notes:** gravel fill - sampled by pit with a trowel

Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	Station Number (3 digits): GSS-20		Land Use:
UTM Zone 17 NAD 27	Easting 0513595	Northing 5158182	Error

Location (park name, school name, lot concession):
Wooded area on gravel road off Edison
(at turn in road)

Site Map (North at Top)



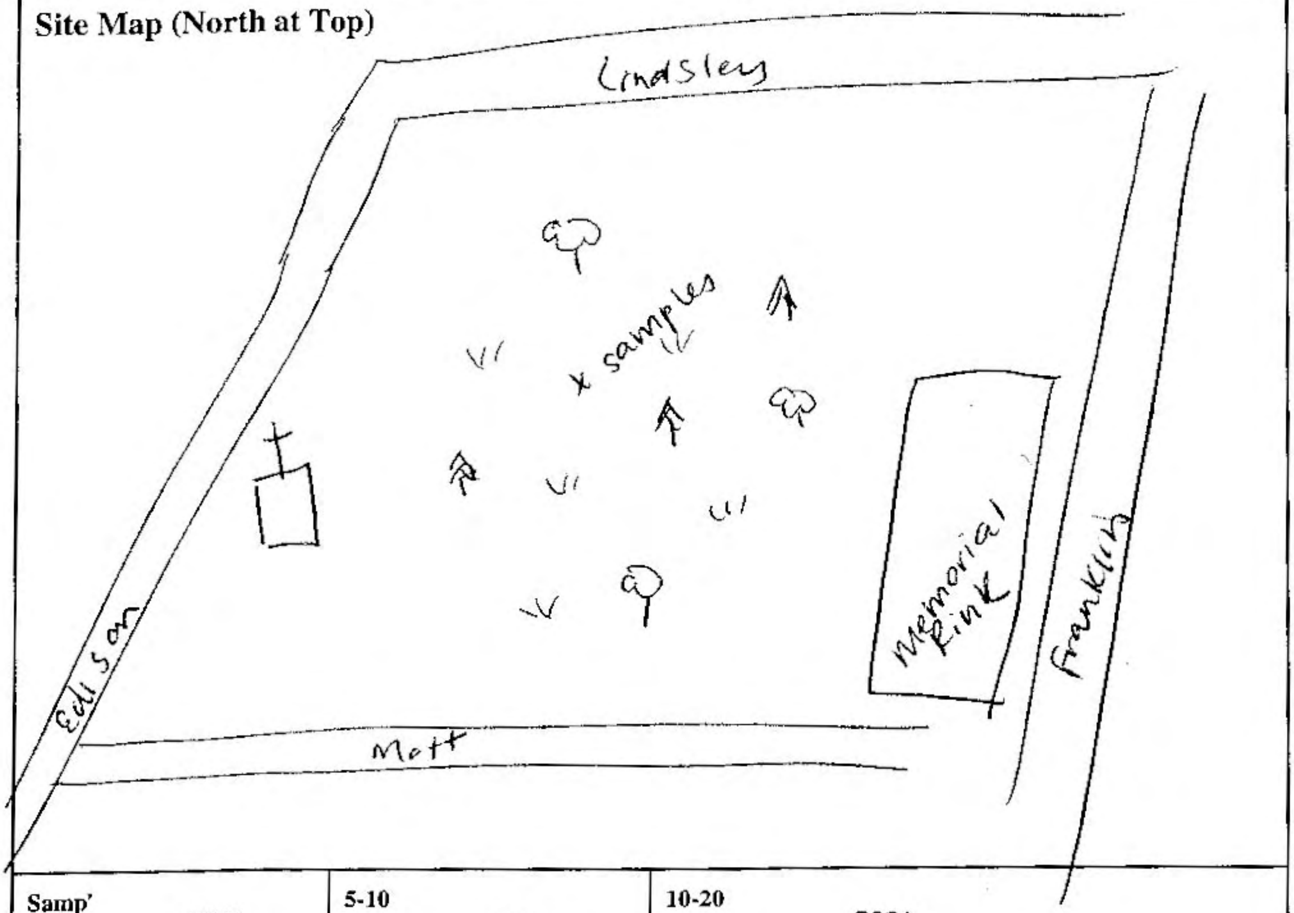
Samp 0-5 2001 12114	5-10 2001 12116	10 2001 12118	
0-5 2001 12115	5-10 2001 12117	10-2 2001 12119	Date: July 11 2001.

Prepared by: N. Boudreau	Notes:

Sudbury Soil Survey 2001- FALCONBRIDGE			
Code : 5039	**Station Number (3 digits):** GSS - 21		**Land Use:**
UTM Zone 17 NAD 27	**Easting** 0514094	**Northing** 5157983	**Error**

Location (park name, school name, lot concession):
Grassy area between United Church and Memorial Rink near Edison + Lindsley

Site Map (North at Top)



Samp' 0-5	5-10	10-20	
2001 12120	2001 12122	2001 12124	
0-5 2001 12121	**5-10** 2001 12123	**10-20** 2001 12125	**Date:** July 11 2001.

Prepared by:	**Notes:** very gravelly average depth ~15 cm
N. Boudreau	

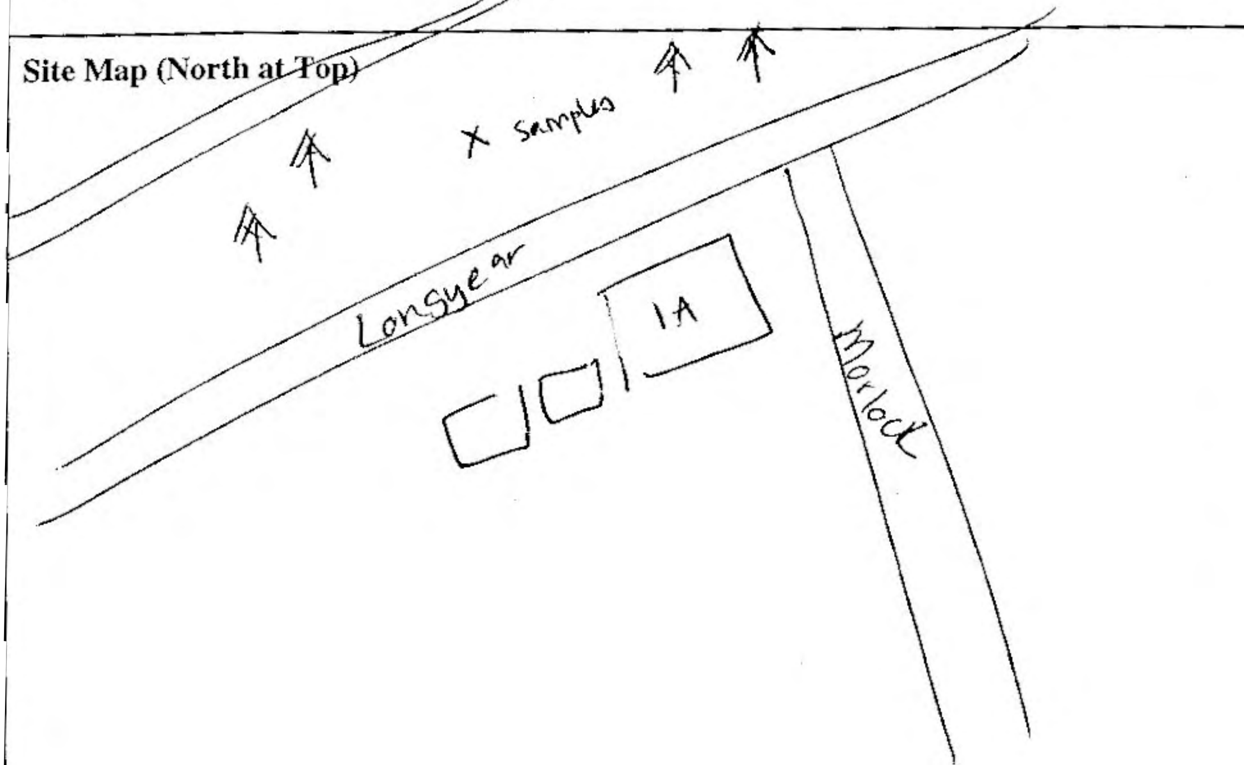
Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	Station Number (3 digits): GSS - 22		Land Use:
UTM Zone 17 NAD 27	Easting 0514509	Northing 5157870	Error

Location (park name, school name, lot concession):

Grass median at Longyear and Morlock (Block J)

Site Map (North at Top)



Sampl 0-5 2001 12126	5-10 2001 12128	10-20 2001 12130	
0-5 2001 12127	5-10 2001 12129	10-20 2001 12131	Date: July 11 2001.

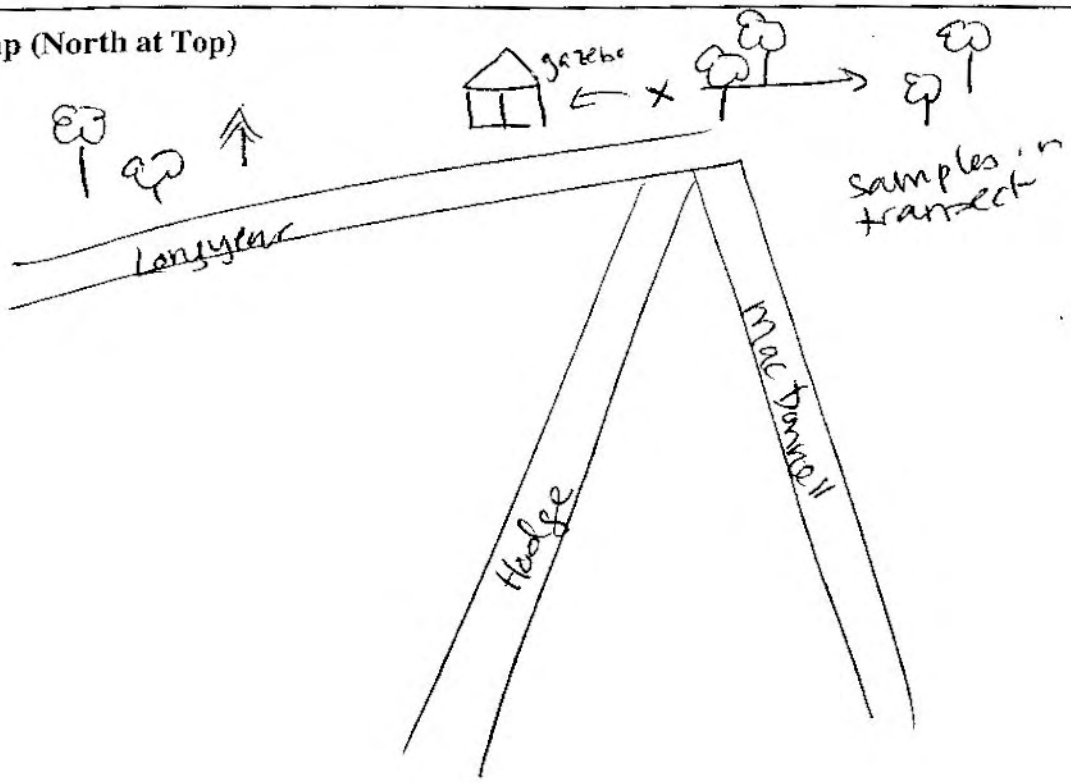
Prepared by: N. Boudreau	Notes: fertilizer narrow median, sampled in transect most cores to 10-15cm

Sudbury Soil Survey 2001- FALCONBRIDGE			
Code : 5039	**Station Number (3 digits):** GSS-23		**Land Use:**
UTM Zone 17 NAD 27	**Easting** 0514283	**Northing** 5157755	**Error**

Location (park name, school name, lot concession): (Block H)

Grass median on Longyear at Hodge/MacDonnell

Site Map (North at Top)



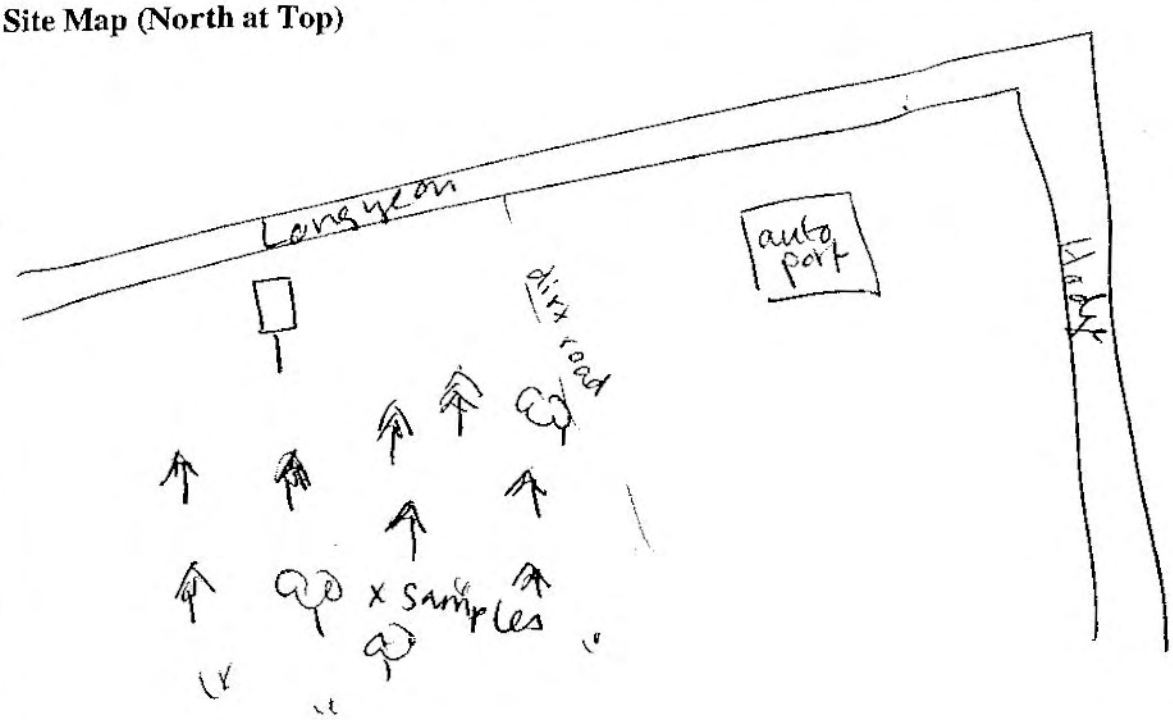
Samp 0-5	5-10	10-20	
2001 12132	2001 12134	2001 12136	
0-5 2001 12133	5-10 2001 12135	10-20 2001 12137	**Date:** July 11 2001.

Prepared by:	**Notes:**
N. Boudreau	fertilizer, most cores to 15cm narrow median, samples in transects

Sudbury Soil Survey 2001- FALCONBRIDGE			
Code : 5039	**Station Number (3 digits):** GSS- 24		**Land Use:**
UTM Zone 17 NAD 27	**Easting** 0514096	**Northing** 5157567	**Error**

Location (park name, school name, lot concession):
Wooded area off Longyear, near Legion sign

Site Map (North at Top)



Samp 0-5 2001 12138	**5-10** 2001 12140	**10-20** 2001 12142	
0-5 2001 12139	**5-10** 2001 12141	**10-20** 2001 12143	**Date:** July 11 **2001.**

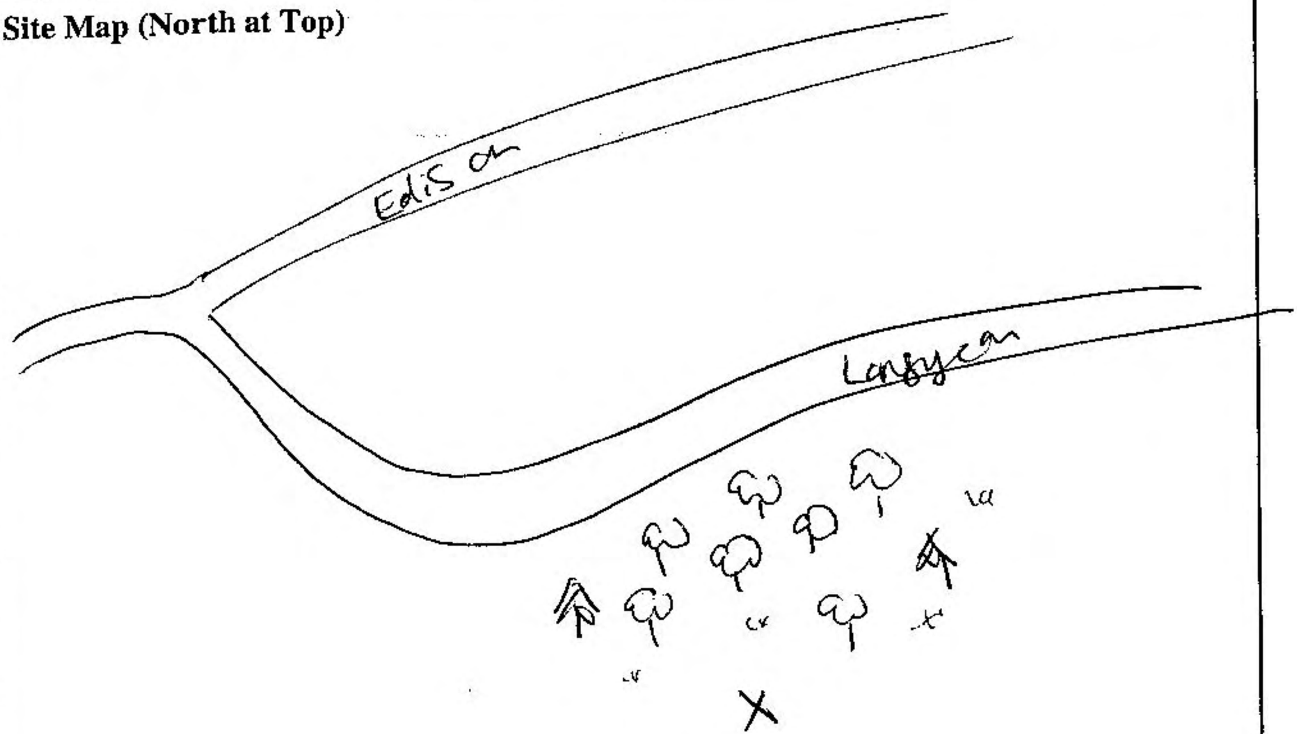
Prepared by: N. Boudreau	**Notes:** Avg. depth 15-20cm

Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	Station Number (3 digits): GSS-25		Land Use:
UTM Zone 17 NAD 27	Easting 0513595	Northing 5157251	Error

Location (park name, school name, lot concession):
Wooded area off Longyear on way out of town (just before curve)

Site Map (North at Top)



Samp 0-5	5-10	10-20	
2001 12144	2001 12146	2001 12148	
0-5 2001 12145	5-10 2001 12147	10-20 2001 12149	Date: July 11 2001.

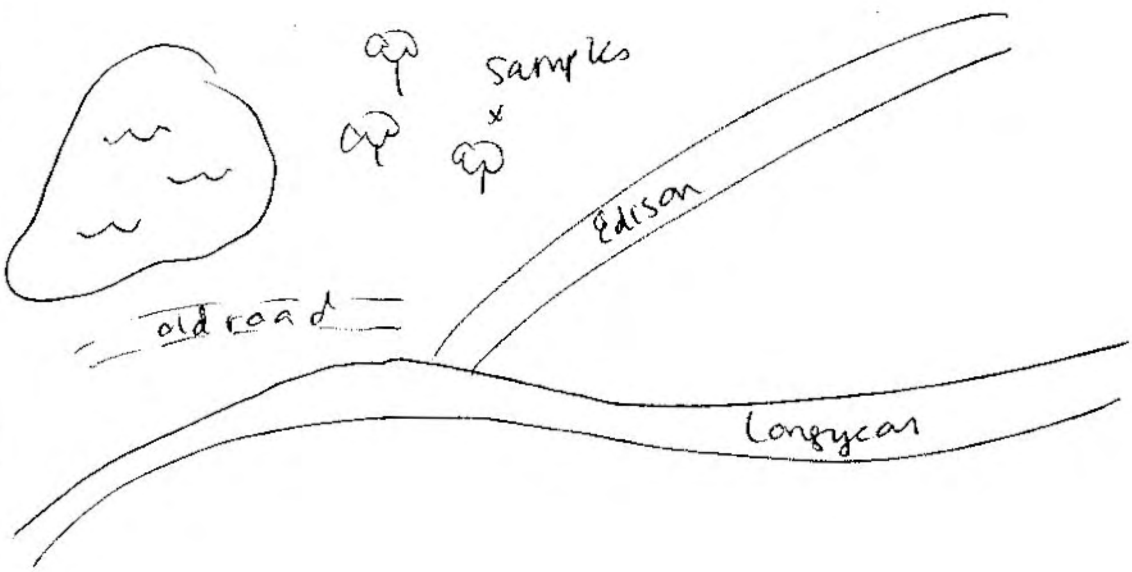
Prepared by:	Notes:
N. Boudreau	

Sudbury Soil Survey 2001- FALCONBRIDGE			
Code : 5039	**Station Number (3 digits):** GSS-26		**Land Use:**
UTM Zone 17 NAD 27	**Easting** 098 0513[redacted]	**Northing** 386 5157[redacted]	**Error**

Location (park name, school name, lot concession):

Wooded area off Longyear near Edison turn off

Site Map (North at Top)



Samp 0-5 2001 12150	5- 2001 12152	10-2 2001 12154	
0-5 2001 12151	5-10 2001 12153	10-2 2001 12155	**Date:** July 12 2001.

Prepared by: N. Boudreau	**Notes:**

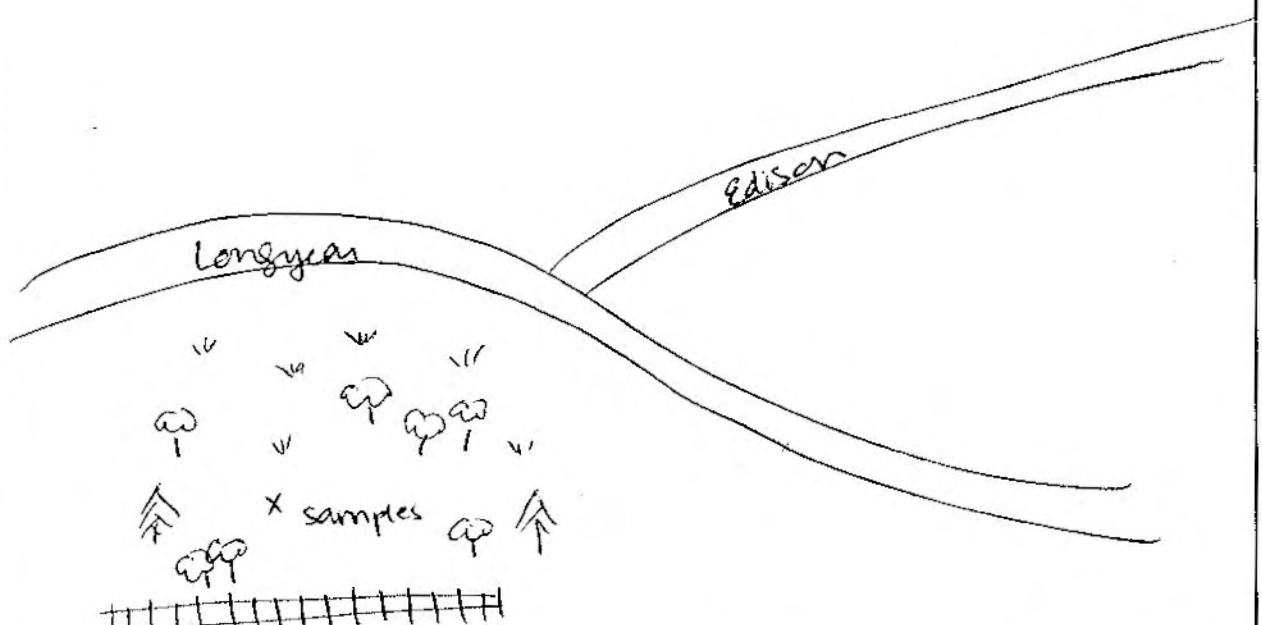
Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	**Station Number (3 digits):** GSS-27		**Land Use:**
UTM Zone 17 NAD 27	**Easting** 031 0513[redacted]	**Northing** 93 5157[redacted]	**Error**

Location (park name, school name, lot concession):

Wooded/grassy area off Longyear near Edison turnoff

Site Map (North at Top)



Samp 0-5 2001 12156	**5-10** 2001 12158	**10-20** 2001 12160	
0-5 2001 12157	**5-10** 2001 12159	**10-20** 2001 12161	**Date:** July 12 **2001.**

Prepared by: N. Boudreau	**Notes:**

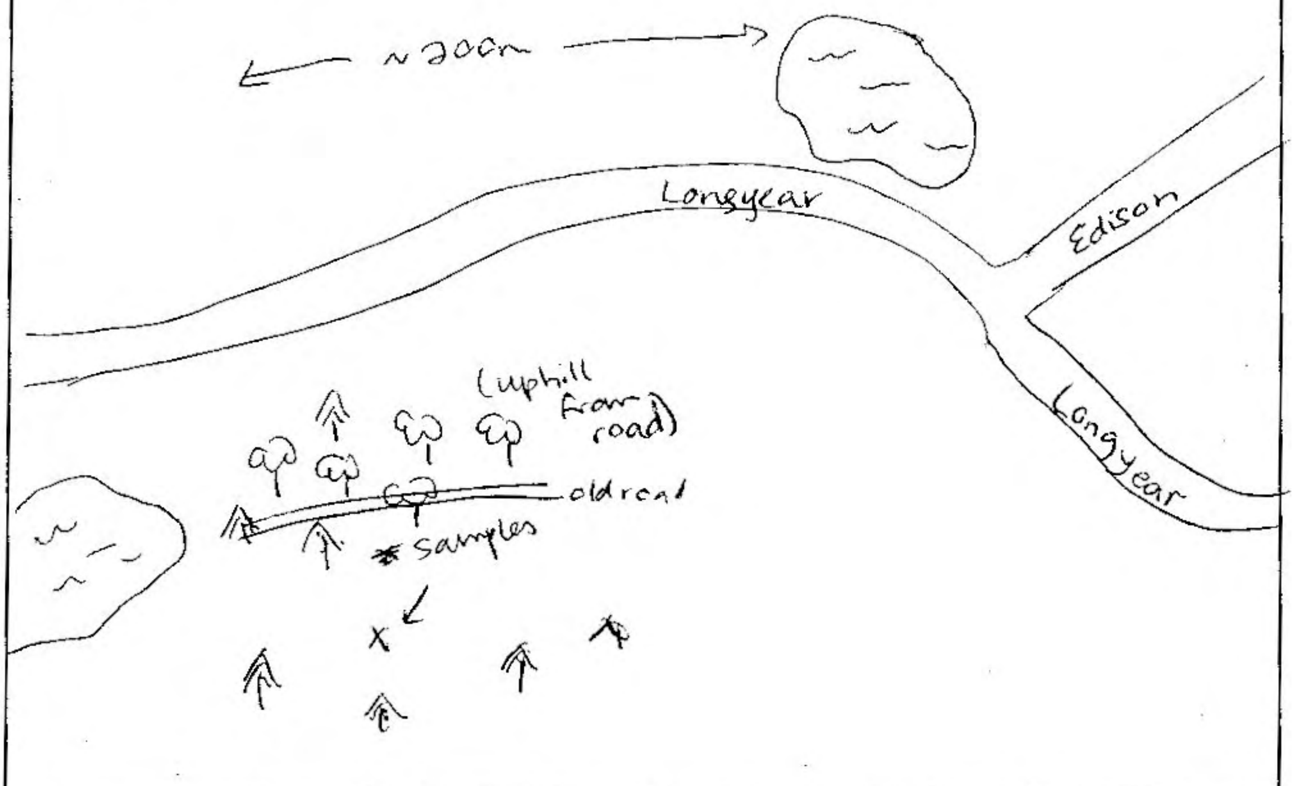
Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	**Station Number (3 digits):** GSS - 28		**Land Use:**
UTM Zone 17 **NAD 27**	**Easting** 2645 051[redacted]	**Northing** 177 5157[redacted]	**Error**

Location (park name, school name, lot concession):

Wooded area off Longyear on way out of town

Site Map (North at Top)



Samp 0-5 2001 12162	**5-10** 2001 12164	**10-20** 2001 12166	
0-5 2001 12163	**5-10** 2001 12165	**10-20** 2001 12167	**Date:** July 12 2001.

Prepared by: N. Boudreau

Notes:

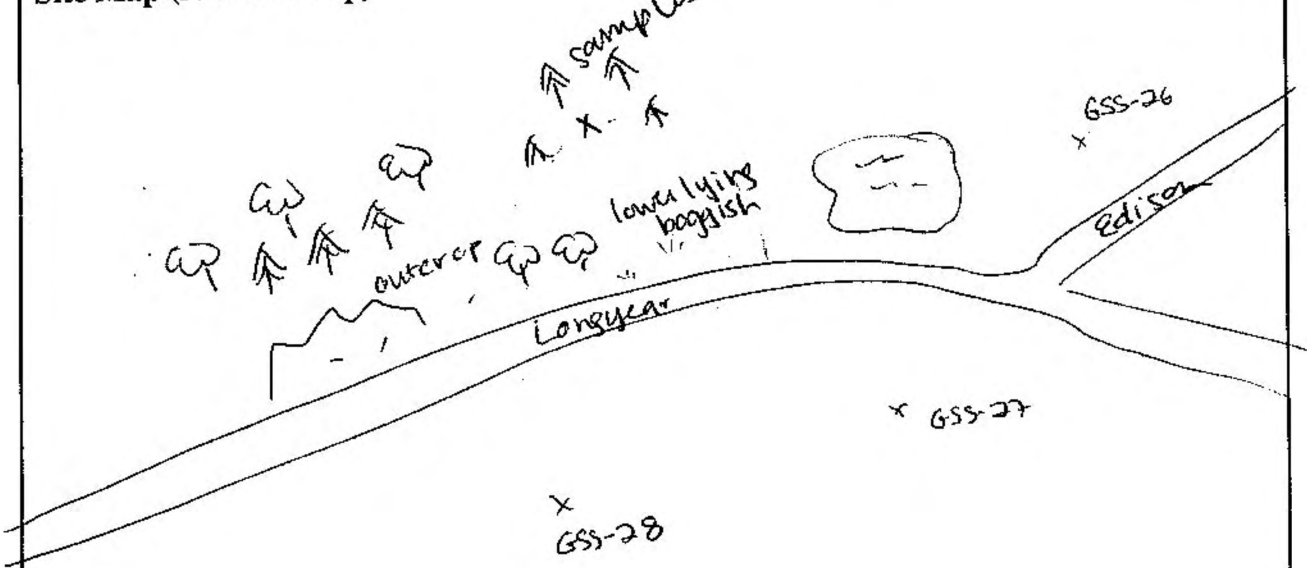
Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	Station Number (3 digits): GSS-29		Land Use:
UTM Zone 17 NAD 27	Easting 2515 051[redacted]	Northing 324 5157[redacted]	Error

Location (park name, school name, lot concession):

Wooded area off Longyear heading out of town

Site Map (North at Top)



Samp 0-5	5-10	10-20	
2001 12168	2001 12170	2001 12172	
0-5 2001 12169	5-10 2001 12171	10-20 2001 12173	Date: July 12 2001.

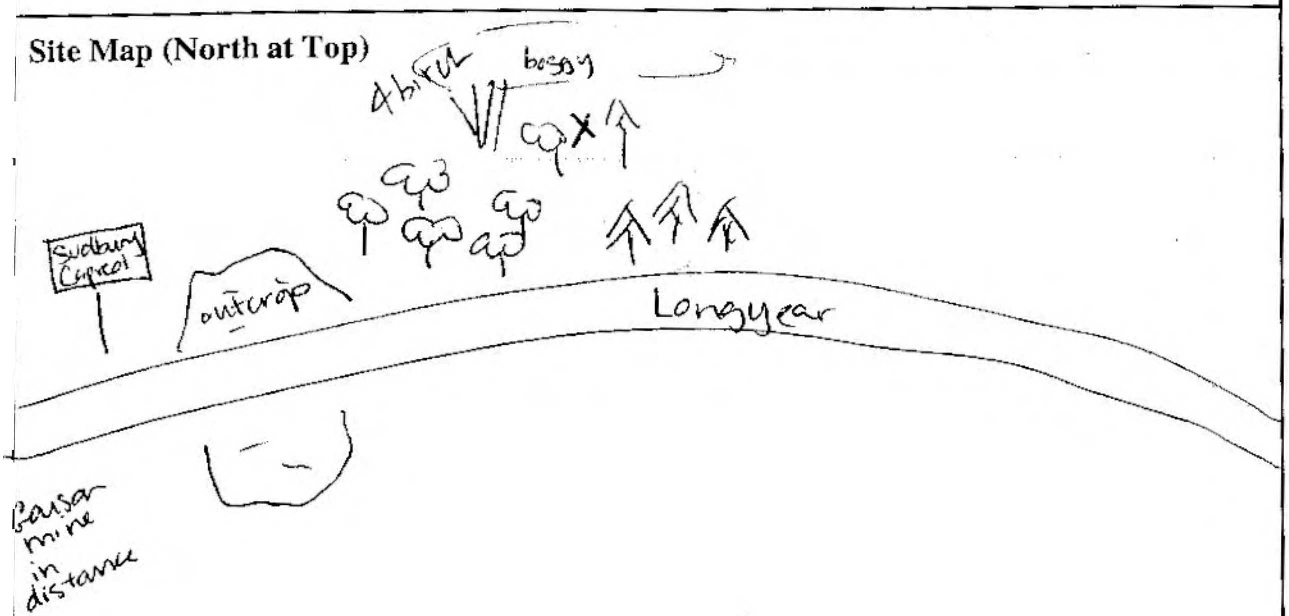
Prepared by:	Notes:
N. Boudreau	Avg. depth 15-20 cm

Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	Station Number (3 digits): GSS - 30		Land Use:
UTM Zone 17 NAD 27	Easting 1952 051[redacted]	Northing 42 51572[redacted]	Error

Location (park name, school name, lot concession):
Wooded area off Longyear heading out of town

Site Map (North at Top)



Samp 0-5	5-10	10-20	
2001 12174	2001 12176	2001 12178	
0-5 2001 12175	5-10 2001 12177	10-20 2001 12179	Date: July 12 2001.

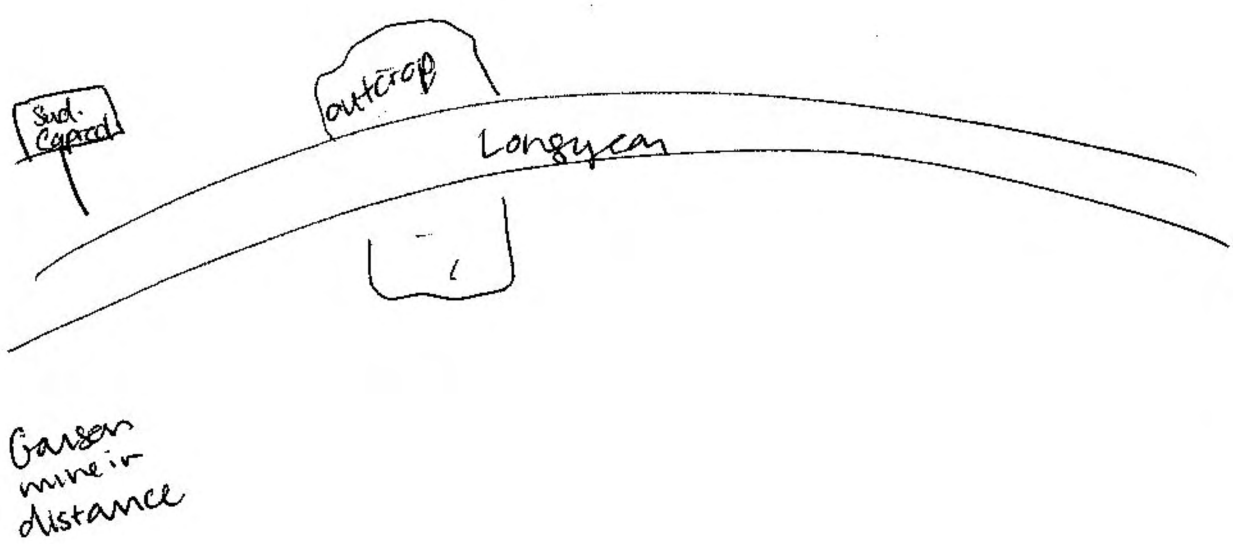
Prepared by:	Notes:
N. Boudreau	

Sudbury Soil Survey 2001- FALCONBRIDGE			
Code : 5039	Station Number (3 digits): GSS-31		Land Use:
UTM Zone 17 NAD 27	Easting 0511944	Northing 5157092	Error

Location (park name, school name, lot concession):

Wooded area off Longyear heading out of town

Site Map (North at Top)



Samples 0-5	5-10	10-20	
2001 12180	2001 12182	2001 12184	
0-5 2001 12181	5-10 2001 12183	10-20 2001 12185	Date: July 12 2001.

Prepared by: N. Boudreau

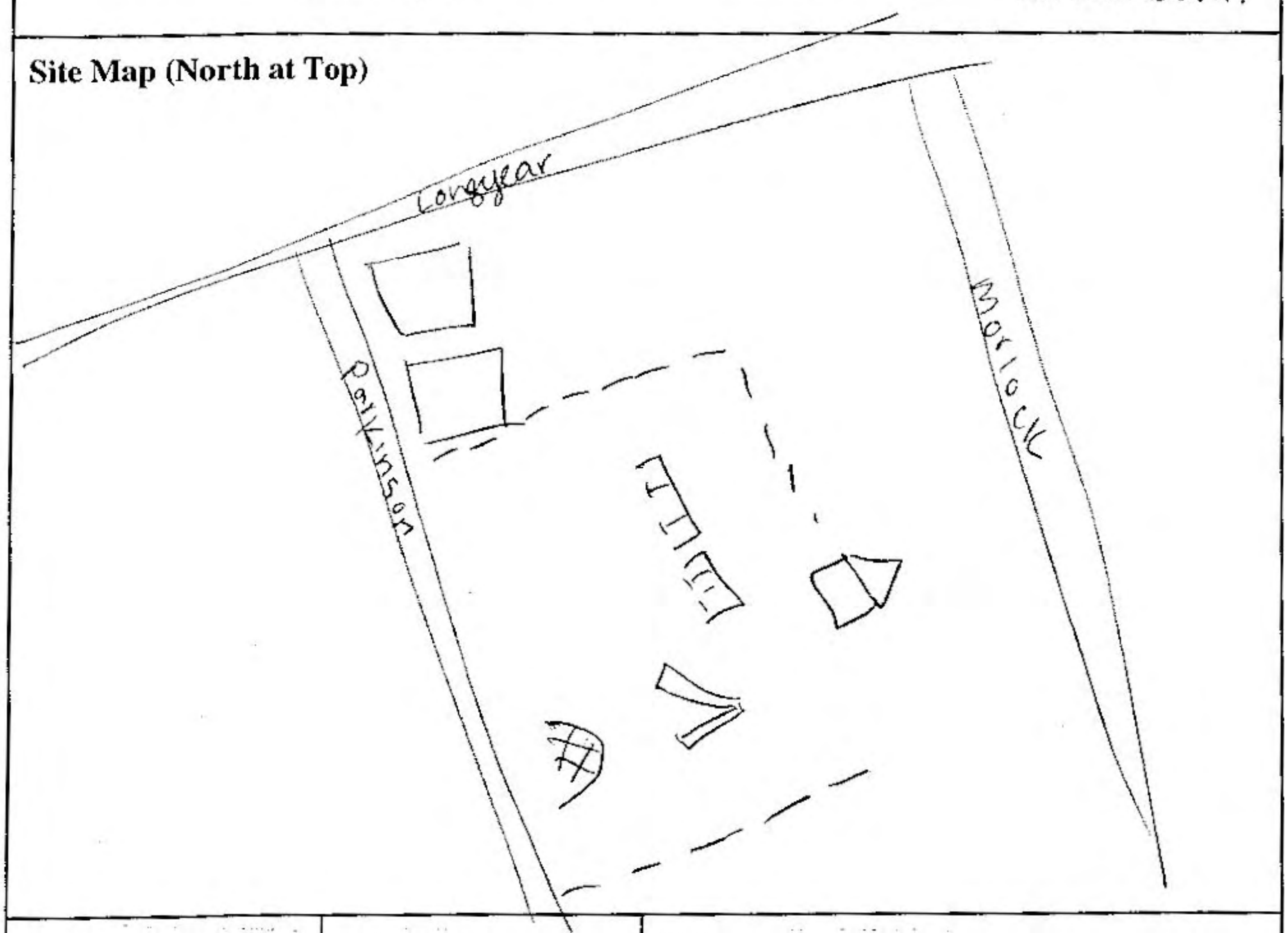
Notes:

Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	Station Number (3 digits): GSS-32		Land Use:
UTM Zone 17 NAD 27	Easting 0514519	Northing 5157740	Error

Location (park name, school name, lot concession):
Parkinson playground on Parkinson St. (across from vacant lot on Morlock).

Site Map (North at Top)



Samp 0-5	5-10	10-20	
2001 12186	2001 12188	2001 12190	
0-5 2001 12187	5-10 2001 12189	10-20 2001 12191	Date: July 27 2001.

Prepared by:	Notes:
N. Boudreau	only 10-15 cm

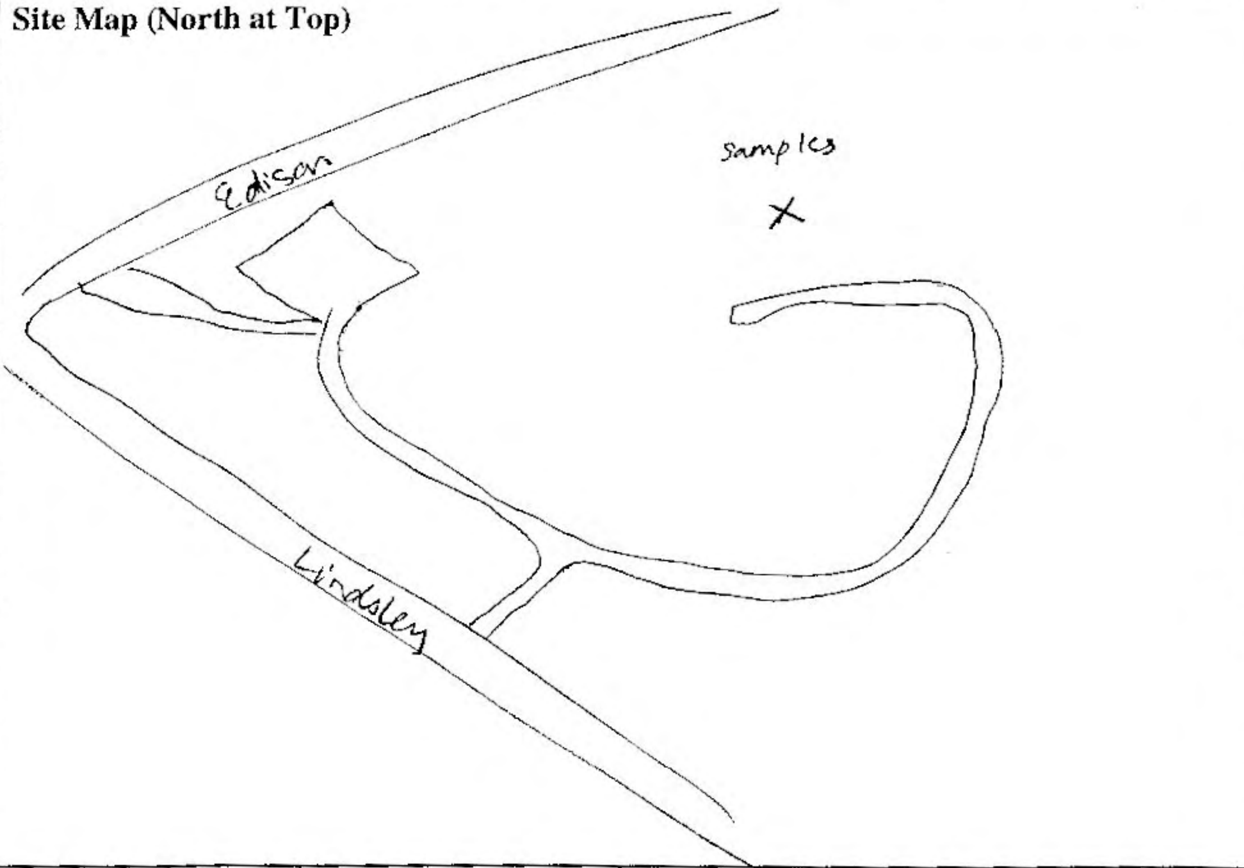
Sudbury Soil Survey 2001- FALCONBRIDGE

Code : 5039	**Station Number (3 digits):** GSS-33		**Land Use:**
UTM Zone 17 NAD 27	**Easting** 0517310	**Northing** 5158161	**Error**

Location (park name, school name, lot concession):

Centennial Park (near ballfield

Site Map (North at Top)



Samp' 0-5 2001 12192	**5-1(** 2001 12194	**10-2** 2001 12196	
0-5 2001 12193	**5-1(** 2001 12195	**10-20** 2001 12197	**Date:** July 27 **2001.**

Prepared by: N. Boudreau	**Notes:** only 10-15 cm

APPENDIX C

SOIL PROCESSING STANDARD OPERATING PROCEDURE

APPENDIX C

SOIL PROCESSING STANDARD OPERATING PROCEDURE

LSB ROUTINE APPROVED
SEPTEMBER 6, 2000

Marc Butler
705 699-3932

MINISTRY OF ENVIRONMENT
LABORATORY SERVICES BRANCH
QUALITY MANAGEMENT UNIT

Please fax to
Graeme Spiers

APPROVAL FORM FOR RELEASE OF
ANALYTICAL METHOD FOR ROUTINE USE

METHOD TITLE: THE DETERMINATION OF TRACE METALS IN VEGETATION BY THE SPECTRO INDUCTIVELY-COUPLED PLASMA-OPTICAL EMISSION SPECTROMETER (ICP-OES)

COMPLETE METHOD CATALOGUE CODE: HMARVEG-E3065

DATE OF LAST REVISION: JUNE 12, 1997

REVISIONS REQUIRED FOR THIS REVIEW?: Y

SECTION: SPECTROSCOPY SECTION

TECHNICAL CONTACT: JIM HOWDEN

AUTHOR(S): LIZ PASTOREK, revised by JIM HOWDEN in 2000.

METHOD REFERENCED UNDER MOE REGULATIONS/GUIDELINES?: Y_____ N __X__

CHECKED BY: _____George Steinke_______

- DESCRIPTION: SLUDGE UTILIZATION:
  MISA:
  SITE CLEAN-UP:
  COMPOST:
  OTHER:

SUPERVISOR APPROVAL:____________________________ DATE:___________

MANAGER APPROVAL:____Rusty Moody_______________ DATE:___September 6, 2000

QM UNIT APPROVAL:__George Steinke________________ DATE:___September 6, 2000

* The approval of this document is valid for two years at which time it will be subject to review to determine if any updates or modifications are warranted.*

NOTE: Equivalent suppliers to those stated in the method are acceptable. Reference to a particular brand does not constitute an endorsement by the Ontario Ministry of the Environment

THE DETERMINATION OF TRACE METALS IN VEGETATION BY THE SPECTRO ICP-OES

1.0 SUMMARY

This method is used for the routine analysis of vegetation materials for 18 elements. Results are reported for aluminum, barium, beryllium, boron, calcium, cadmium, cobalt, chromium, copper, iron, magnesium, manganese, molybdenum, nickel, lead, strontium, vanadium and zinc.
Metals are analyzed in vegetation because of the potential toxic effects certain elements have on plants, animals and humans. Toxic elements that are absorbed by plants can work their way up the food chain through animals to humans.

As well, the presence of certain elements can be an indication of local emission sources. The presence of low levels of essential elements can be an indication of a lack in the soil of necessary nutrition.

1.1 Principle of Method

The samples of dried, ground "washed" or "unwashed" terrestrial vegetation, dried ground mossbags or freeze-dried ground aquatic vegetation are weighed out and ashed. The ash is digested with a mixed hot acid mixture and the resultant solution is analyzed for 18 metals using the Spectro Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES).

The option of "washed" or "unwashed" is designed to provide some measure of determining whether the metals of interest are surface deposits or are incorporated within the plant tissue. Ashing followed by aqua regia digestion removes organic matter which would otherwise interfere in the subsequent analysis. The ICP provides the high temperature conditions required for atomic speciation necessary for the accurate determination of metal concentrations by emission spectrometry.

ICP-OES is a widely used technique for the multi-element analysis of environmental samples. Solutions of vegetation materials are aspirated into an argon plasma which is a high energy source (approximately 8000°C). The plasma desolvates the aerosol, leaving salt particles for vaporization and atomization. The atoms move from a ground state into an excited state. When the atoms return to a lower energy state, photons are emitted at specific wavelengths. A spectrum is thus obtained. Each emitted wavelength is proportional to the concentration of the particular element in the sample solution and is measured by an optical spectrometer. The spectrum is separated into component wavelengths by a diffraction grating and a photomultiplier detector measures the intensity of the light. The intensity of each emitted wavelength is proportional to the concentration of the particular element in solution.

The instrument is calibrated for each element using a set of prepared standards of known analyte concentration. The instrument response to the standards are measured and a calibration curve produced.

1.1.1 Relationship to Other Methods.

As a result of the speed of analysis, comparable or superior detection limits and relative freedom of interferences, ICP-OES has replaced Atomic Absorption Spectrophotometry (AAS) as the method of choice for multi-element analysis. Unlike AAS, many elements may be determined simultaneously. The high temperature of the plasma makes the method free of the chemical and ionization interferences present in AAS.

eliminating the need for suppressants and releasing agents. It is also less susceptible to ionization interferences and generally has better detection limits than Direct Current Plasma-Optical Emission Spectrometry (DCP-OES) (see Reference 1.7.1).

Spectral interferences or overlap does occur in ICP-OES and corrections based on the sample matrix are usually required. This problem is not generally encountered in AAS. For this reason, when a multi-element capability is not required, AAS is often the method of choice.

1.2 Parameters Measured

Eighteen parameters are measured routinely by ICP-OES.

Parameter	Parameter
Aluminium	Iron
Boron	Lead
Barium	Magnesium
Beryllium	Manganese
Cadmium	Molybdenum
Calcium	Nickel
Chromium	Strontium
Cobalt	Vanadium
Copper	Zinc

The LIMS Product Code is MET3065.

1.3 Sample Matrices

Vegetation, terrestrial and aquatic (VE) and mossbags (VM) matrices are analyzed using this method.

1.4 Sample Requirements

1.4.1 Specifications.

1.4.1.1 Terrestrial Vegetation and Mossbag Samples.

Vegetation and mossbag samples are collected and prepared for analysis by the Ministry of Environment, Standards Development Branch, Phytotoxicology Section. No preservative is required. The sample is dried at 80°C, disaggregated and mechanically ground to pass through a 1.0 mm screen. The sample is placed in a glass jar with a plastic lid and submitted to the Laboratory Services Branch.

The jars must be recapped immediately after removing the sample aliquot for analysis. During storage the lids must be secure to prevent absorption of moisture as results are based on the sample weight as received. A minimum of 20 g of sample is required.

There is an indefinite holding time for these samples, once dried and stored at ambient temperature.

1.4.1.2 Aquatic Vegetation

Aquatic vegetation samples are collected and prepared for analysis by the Ministry of Environment, Environmental Monitoring and Reporting Branch or Standards Development Branch. The sample is freeze-dried and mechanically ground to pass through a 1.0 mm screen. A minimum of 5 g of sample is submitted in a glass vial and submitted to the LSB.

There is an indefinite holding time for these samples, once freeze-dried and stored at ambient temperature.

1.4.2 Contingencies.

An extra jar of sample is usually retained by the processing laboratory. In the event of insufficient sample, the originator must resample.

If sample size is limited, a list of analytical priority should be included. If any sample is not analyzed, a LIMS Remark Code is entered to explain the absence of the result. Examples of LIMS Remark Codes are:

CODE	EXPLANATION
NDUA	No Data: Unsuitable for Analysis
NDIS	No Data: Insufficient Sample

Some results will be entered with a LIMS Remark Code to further explain the numeric result. Examples of this type of LIMS Remark Code are:

CODE	EXPLANATION
UNH	Unreliable: Sample Not Homogeneous
UIC	Unreliable: Improper Container

1.5 Shortcomings

1.5.1 Interferences.

Spectral overlap is the main source of determinate error in ICP-OES. This occurs when some of the light emitted by one element has a wavelength within the bandpass of the exit slit of another element. An enhanced signal for the analyte will be measured. This enhancement is offset by applying an inter-element correction factor (IEC) or by finding an alternate wavelength at which to measure the light emitted by the analyte. Large IEC factors should be avoided if possible, as they may result in a deterioration of detection limits and accuracy. Analyte wavelengths used are chosen to avoid optical interference from major elements occurring in the samples (Ca, and Mg) and from base metals (Cr, Cu, Fe, Ti, V and Zn).

The IEC factors used on the Spectro are shown in Appendix IV under SPECTROIEC. They correct for the spectral interferences.

1.5.2 Biases.

[illegible]

Scattered light and molecular emission of light from the plasma itself produces a background emission which enhances the

Standard Operating Procedure for Processing of Soil Samples Prior to Analyses

Author:	_Debbie Terry/Jane Thrush______	Version:	_1.1_______
Signature:	_*Debbie Terry/Jane Thrush*______	Date:	__*April 17, 2000*_
Authorized By:	_*George Crawford*_________________________		
Name:	__George Crawford_________________________		
Title:	__Manager, Ecological Standards and Toxicology Section________		
Date:	__*April 17, 2000*_________________________		

TABLE OF CONTENTS

1 SCOPE

The following protocol is followed by the Ecological Standards and Toxicology Section of Standards Development Branch for drying of soil samples before analyses. This SOP is in support of the following PCLS Section methods: E3012, E3096, E3137, E3138, E3139, E3142, E3263, E3327 and E3328. This SOP is also in support of Spectroscopy Section methods: E3073, E3075, E3215, E3059, E3245 and General Chemistry and Microbiology Section methods: E3005, E3013, E3015 and E3116.

2 OBJECTIVE

To ensure that all soil samples have been dried, sieved and ground in a consistent manner to ensure homogeneity of the samples prior to analysis.

3 TEXT

NOTE: All non-disposable labwares are soaked in tap water, scrubbed with Alconox, rinsed with tap water and a final rinse of pure water, then air-dried between samples to prevent cross-contamination.

Soil samples are usually processed by the Ministry of the Environment, Standards Development Branch, Ecological Standards and Toxicology Section.

3.1 Labwares

3.1.1 Spatula, rubber.
3.1.2 Brush, paint, small (1 inch).
3.1.3 Labels, adhesive.
3.1.4 Pen, marker, permanent.
3.1.5 Bottle, wash, polyethylene.
3.1.6 Kimwipes.
3.1.7 Scoop.
3.1.8 Bag, garbage.
3.1.9 Mask, dust, (3M 8710).
3.1.10 Gloves, disposable.
3.1.11 Dishes, drying (disposable weigh dishes, 120 x 120 mm).
3.1.12 Jars, glass with plastic lids, 125 mL.
3.1.13 Boxes, cardboard (with capacity to hold 24-125 mL jars).

3.2 Reagents

3.2.1 Water, pure.

3.3 Equipment

3.3.1 Mortar and pestle, procelain or agate.
3.3.2 Sieve, brass, 2mm (10 mesh ASTM), 8 inch diameter with bottom pan.
3.3.3 Sieve, brass, <355 µm, (45 mesh ASTM), 8 inch diameter with bottom pan.
3.3.4 Grinder, Retsch, (model RMU), with agate mortar or equivalent.
3.3.5 Fan, 3 speed (optional).

3.4 Procedure

Soil Processing

3.4.1 After soil (SO) type samples are received from Field Investigators, the samples are logged into PIMS (Phytotoxicology Information Management System) and recorded in the Processing log.

3.4.2 The entire contents of each sample bag is spread out on clean, plastic trays, making sure to break the large lumps of soil. The assigned field number is clipped to the tray. This does not apply to samples collected for organic analysis.

3.4.3 The trays are placed in closed shelving cupboards. The soil is allowed to dry at room temperature for a minimum of 48 hours or until no moisture remains. The soil may be turned periodically to aid in the drying process.

NOTE: Wear a dust mask and gloves when handling soil samples.

3.4.4 Under the fumehood, the entire sample is desegregated using a wooden mallet and any twigs, rocks, stones are removed and discarded.

3.4.5 The entire sample is sieved through a Number 10 mesh, (2.0MM sieve) to obtain a soil fraction. Any material not passing through the sieve is discarded.

3.4.6 If pH or conductivity is requested transfer sufficient sample for analysis of the <2.00 mm sample into a glass jar labelled with the field sample number. Place the jars in cardboard storage boxes. Label the outside of the box with the sample numbers and year.

3.4.7 After throughly mixing the sieved sample, a sub-aliquot of < 2.0 mm fraction is taken and the excess sample is discarded.

3.4.8 The sub-sample is further desegregated using a mortar and pestle, or by a mechanical grinder. The **entire** sub-sample is ground until it passes through a Number 45 mesh (355 μm sieve)

3.4.9 Operation of Grinder.

3.4.9.1 Ensure that the agate motor is rotated until locked in position.

3.4.9.2 Place plastic ring over the motor (do not operate grinder without this ring in place).

3.4.9.3 Close lid and tighten latch.

3.4.9.4 Turn timer **ON** for approximately 5 minutes.

3.4.9.5 When grinder has stopped, loosen the latch, open lid and remove mortar.

3.4.9.6 Sieve sample through a Number 45 mesh, (355μm sieve).

3.4.10 Transfer the <355 μm sample into a 125 mL glass jar labelled with the field sample sticker, place in cardboard box. Label the outside of the box with the field numbers and year.

3.5 Cleaning

3.5.1 Clean sieve by inverting over garbage pail and tapping lightly. Use a paint brush to remove sample trapped in the sieve holes by brushing lightly with a paint brush so the particles are pushed back through the mesh. Wipe sieve pan with a Kimwipe. Rinse the mortar and pestle with Pure Water and dry with Kimwipes between samples.

4 PARTS REVISED:

4.1 April 2000
Format change to conform to LSBSOP.001
SOP reviewed and reauthorized.

5 REFERENCES:

6 REFERENCED SUPPLEMENTS:

APPENDIX D

LAKEFIELD RESEARCH
QUALITY CONTROL AND ACCREDITATION

Lakefield Research was granted formal certification by the Standards Council of Canada (SCC) and the Canadian Association of Environmental Analytical Laboratories (CAEAL), in January 1994. In October 1995, the Standards Council of Canada issued Lakefield Research Analytical Services accreditation at the ISO/IEC Guide 25 level for various inorganic and organic parameters.

ISO/IEC Guide 25 is an internationally accepted standard for laboratory operation that covers all aspects of a laboratory's operation. Guide 25 accreditation is available worldwide. The Guide 25 designation automatically signifies that the laboratory has been judged by an independent panel of skilled auditors to be conducting its business at an internationally acceptable level and that the laboratory has *proven* its proficiency with the accredited methods by participating in regular formal proficiency programs. Guide 25 is also dynamic. The auditing criteria for laboratories has evolved over twenty years and will continue to change to take into account new technologies, new management philosophies, new analytical requirements and new challenges to data integrity.

Laboratories seeking accreditation have two choices, they can seek registration to ISO/IEC 9002, an international quality management standard, or they can apply for accreditation under Guide 25. Guide 25 provides a specific assessment of a laboratory's technical capabilities. ISO/IEC 9002 provides a generic system for quality management applicable to any type or size of organization. Guide 25 addresses both quality management and the technical aspects of operating a testing laboratory. For example, Guide 25 includes requirements for the technical competence of personnel, test and calibration procedures and proficiency testing. The calibration and testing activities of Guide 25 accredited laboratories comply with the relevant requirements of the ISO/IEC 9000 series standards. However, accreditation to the ISO/IEC 9000 series standards will not automatically qualify a laboratory for accreditation under Guide 25. ISO/IEC 17025, a proposed new standard is even more explicit. ISO/IEC 17025 will replace Guide 25 early in 2000 and will allow laboratories to establish a single quality system to satisfy the requirements of both ISO/IEC 9000 and ISO/IEC 17025.

The quality assurance system at Lakefield consists of a documented quality system. All appropriate documentation (quality manual, methods, written instructions, standard operating procedures, and data approval criteria) is in place. As required, the Quality Control Co-ordinator is independent of the production area of the laboratory and reports directly to the Manager.

Lakefield Research Limited
P.O. Box 4300, 185 Concession Street, Lakefield, ON, KOL 2HO Canada
Tel: (705) 652-2038 Fax: (705) 652-6441 e-mail: mail@lakefield.com
www.lakefield.com

Quality control procedures are method specific and include duplicate samples, spiked blanks, spiked replicates, reagent/instrument blanks, preparation control samples, certified reference material analysis, and instrument control samples, as appropriate for the individual methods. Matrix matching of reference materials to samples is always attempted. Frequency of insertion of control samples is method specific and follows legislated guidelines. Specific MISA or EPA protocols are followed for all environmentally mandated tests. Of the total samples analyzed at Lakefield Research, a minimum of 20% is quality control and often that percent is exceeded.

Lakefield Research is committed to delivering high quality sample analysis. Methods and method detection limits are reviewed and revalidated annually in order to confirm that data quality objectives are being met and maintained. Lakefield Research also participates in many formal and informal proficiency testing programs. In addition, the laboratory is involved in many informal programs as well as being an active participant in the certification programs for new reference materials with CANMET, NRC, ROCKLABS, NIST, etc.

Lakefield Research Analytical Services strives to be in the forefront of providing quality work. In February of 1998 Lakefield Research was the first commercial analytical lab to be evaluated at ISO/IEC Guide 25 for various mining and mineralogical parameters.

Lakefield Research has been inspected and approved by the Ontario Ministry of the Environment as a MISA analytical facility. Similarly, the Standards Council of Canada and CAEAL audit the Lakefield Research quality control/quality assurance program on a routine basis. Copies of the current scope of testing and accreditation documentation are available upon request. All methods are currently summarized in mini-methods that are available on request and any method specific questions can be addressed at any time. If you have any further questions regarding quality control in the laboratory, please do not hesitate to contact me.

Sincerely,

Diane Wingett
Quality Control Co-ordinator
Phone: 705-652-2006
E-mail: dwingett@lakefield.com

LakefieldResearch

METHOD #: 9-2-37
REV. #: 1.2
DATE: 05 June 00

METHOD SUMMARY

METHOD 9-2-37 Preparation of Sewage Sludges and Soils for the Determination of Various Metals Using the MARS 5 MAW2 Microwave Oven

1. **Parameter(s) measured, unit(s):**
   Various Metals (g/t)

2. **Typical sample size:**
   Dry samples: 0.5000 – 0.5050 g
   Wet samples: 10mL

3. **Type of sample applicable (media):**
   Sewage, sludges, and soils.

4. **Sample preparation technique used:**
   Mix the sample thoroughly to ensure that a homogeneous subsample is taken.

5. **Sample preservation required and holding time:**
   N/A

6. **Method of analysis used:**
   - Weigh 0.5000-0.5050 g or pipette 10 mL of sample into a Teflon sleeve.
   - Add 5 mL each of concentrated HNO_3 and HCl
   - Place the vessels in the microwave carousel. Place in microwave and start first heating cycle.
   - Allow vessels to cool to <60°C (~ approx. 45 min.).
   - Pour contents into 50 mL volumetric flask and dilute to volume with deionized water.
   - Analyze by ICP-OES
   - Calculate Final Concentration (g/t)

METHOD SUMMARY

7. **Data reduction by:**
   Computer, on line, data fed to the Laboratory Information Management System with secure audit trail.

8. **Accreditation:**
   Standards Council of Canada in partnership with the Canadian Association of Environmental Laboratories (CAEAL) at ISO/IEC Guide 25 standards.