Faro Water Treatment Plant Geotechnical Design Report Addendum, 2013 Borrow Source and Quarry Investigation, Faro Mine Remediation Project

PREPARED FOR: Government of Yukon

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DATE: August 27, 2014

PROJECT NUMBER: 472645.13.WT.DD.03.GT

Introduction

CH2M HILL Limited Canada (CH2M HILL) was retained by the Government of Yukon (YG) and the Government of Canada as Represented by Aboriginal Affairs and Northern Development Canada to conduct remedial investigations and associated activities at the Faro Mine Complex (FMC), located near the town of Faro, Yukon. These phased activities are conducted to support the overall long-term goal of remediating the FMC and reducing environmental impacts including those associated with acid rock drainage entering nearby watercourses.

It is understood that a variety of earthen and rock materials are needed for construction of structures at the site to support the clean-up operations and long-term maintenance activities.

Project Background

The existing Faro mill Water Treatment Plant (WTP) will no longer be operated because of health and safety problems. A temporary WTP is planned to be constructed in 2014. Ultimately, a permanent replacement Water Treatment Plant will be required to replace the temporary WTP.

The proposed replacement Faro WTP will treat contaminated water at the FMC and is anticipated to include a 33-metre (m) by 37-m Water Treatment Building, a 55-m-diameter thickener, and a 25-m by 15-m Lime Silo/Grit Building. Additionally, a 30- by 85-m Filter Building may be constructed later, south of the thickener.

The replacement Faro WTP will be designed for year-round operation; however, it is expected that there will be a winter shutdown for most years. Additional design information is available in the Detailed Design Report (CH2M HILL, 2013a) and the Faro Water Treatment Plant Detailed Design Summary (CH2M HILL, 2014).

Site Description

The FMC is located at 62°18'39.74"N and 133°18'18.06"W in south-central Yukon, 15 kilometres (km) north of the town of Faro and nearly 200 km northeast of the city of Whitehorse (see Figure 1). Figures are located at the end of this technical memorandum. The FMC has a footprint of more than 25 square kilometres (km^2) and consists of three distinct areas:

- Faro Mine Area, including Faro Pit, a disused mill, and associated buildings
- The Rose Creek Tailings Area (RCTA) and its impoundment, which is located in Rose Creek Valley
- The Vangorda/Grum Area, which is located on the Vangorda Plateau and includes the Grum Pit and Vangorda Pit

A 16-km haul road connects the Faro Mine Area with the Vangorda/Grum Area. This road was used to truck ore from the Vangorda and Grum pits to the Faro Mill Area for processing.

The RCTA encompasses the Rose Creek tailings impoundment, which is located at the base of Rose Creek Valley, about 2.5 km southwest of the Faro Mine Area (see Figure 2). The impoundment comprises more than 55 million tonnes of tailings within an unlined containment area that is approximately 4 km long and 1 km wide. Tailings

were deposited in the RCTA between 1969 and 1992. A series of three dams hold the tailings in place; the Original Impoundment, the Second Impoundment, and the Intermediate Dam. Rose Creek flows around the RCTA in a rock-lined Rose Creek Diversion.

The specific areas discussed in this technical memorandum are the Haul Road Borrow, the Rose Creek Haul Road Borrow, and The Rose Creek Borrow (see Figures 2 through 5). These areas were investigated to characterize the quality of the potential borrow material for construction of the new Faro WTP.

Purpose

The purpose of this technical memorandum is to describe the collection and interpretation of geologic and geochemical information to determine if the earthen and rock materials in the proposed borrow areas can support the construction of the proposed Faro WTP and the grading of the associated access and parking lot areas.

Construction of the WTP requires materials that meet specifications related to those types of structures. Previous field investigation programs needed to be supplemented with additional bedrock and overburden investigations to adequately evaluate and confirm the appropriate sources for borrow materials. It is understood that for the WTP alone, more than 20,000 m^3 of materials are needed. This investigation describes the borrow material sources.

Data Gaps

Field activities were carried out to characterize new potential areas within FMC to obtain appropriate earthen and rock material for construction. The field investigation herein described was designed to address data gaps to further characterize site conditions. The following data gaps were addressed during the 2013 investigation activities:

- Selecting fill material
- Determining the presence of material usable for concrete aggregate
- Evaluating suitable materials for riprap and armourstone

Scope of Work

To support the construction of the Faro WTP, in addition to filling data gaps, additional soil and rock geotechnical and geochemistry data were required. The following targeted field investigations were performed during and following the 2013 field season:

- A pionjar backpack drilling and sample collection program in Rose Creek Haul Road Borrow and Rose Creek Borrow areas.
- Test pit excavations and sample collection program in Rose Creek Borrow, Rose Creek Haul Road Borrow, and Haul Road Borrow.
- Sampling for geochemical and soil fertility testing in Rose Creek Haul Road Borrow, and Rose Creek Borrow area to determine the suitability of the materials to allow revegetation if used at other locations.
- Sampling for geotechnical testing in Rose Creek Borrow, Rose Creek Haul Road Borrow, and Haul Road Borrow.
- Laboratory testing of geochemical and geotechnical samples.

Previous Investigations

CH2M HILL prepared two reports for YG to summarize 2012 site activities and providing recommendations for future work:

1. Geotechnical Data, Faro Water Treatment Plant (CH2M HILL, 2012a)
2. Water Treatment Plant Geotechnical Design Report (CH2M HILL, 2012b)

The first report describes all onsite field activities to carry out an investigation program that included (1) drilling of 10 shallow soil boreholes, (2) completion of two shallow soil boreholes as open standpipe piezometers, (3) observation and documentation of subsurface conditions while drilling soil boreholes and (4) sampling for geotechnical field classification and laboratory testing.

The second report was published after the completion of the field program to provide geotechnical design criteria and specific evaluations and recommendations for the replacement Faro WTP.

The following reports are also available for the characterization of the borrow areas:

- *Anvil Range Mining Corporation Interim Receivership Phase 1 Borrow Source Survey* (SRK Consulting Engineers and Scientists, Inc. (SRK) (2002)
- *Phase 2 Borrow Source Survey Faro Mine, Yukon* (SRK, 2003)
- *Additional Borrow Studies* 2004/05 Task 11a (SRK, 2006a)
- *Anvil Range Mining Complex Additional Borrow Studies 2005/06 Task 17a* (SRK, 2006b)

These reports give an overview of the field investigations and results and provide recommendations for further studies appropriate at the time the field programs, depending on the details of the final closure plan.

Screening Criteria

The following sections discuss criteria that provided a level of comparison for solids data collected across the borrow areas. It was not used to identify regulatory exceedance.

Solids

The International Network for Acid Prevention (INAP) is an organization of international mining companies dedicated to reducing liabilities associated with sulphide mine materials and to meeting the challenges of acid drainage. The GARD Guide (INAP, 2013) was sponsored by INAP with the support of the Global Alliance and was developed to deal with the prediction, prevention, and management of drainage from mineral oxidation, commonly referred to acid rock drainage.

Soil analytical results from field activities summarized in this report are compared with the GARD Guide.

Acid–Base Accounting

The acid–base accounting (ABA) dataset for the borrow areas investigation was compiled to evaluate the potential for the soil and rock materials to generate (or neutralize) acid. For the evaluation, acid potential (AP) was determined based on the sulphide sulphur content in the material converted to units of calcium carbonate ($CaCO_3$) per tonne. The sulphide content of the borrow area samples was determined by using the total sulphur content, and subtracting the acid-soluble sulphate sulphur, the barium sulphate sulphur, and the amount of theoretical sulphur associated with non-acid-generating metal sulphides (i.e., lead and zinc). This complex calculation used concentrations of barium, lead, and zinc to estimate the sulphur content not associated with highly reactive iron sulphides. The calculations generally followed Equation 2 (Steffen Robertson and Kirsten Consulting Engineers and Scientists, 2004):

$$SF_{Fe}(\%) = S_{total}(\%) - 32.15 * \left[\frac{Zn\ (\%)}{65.4} + \frac{Pb\ (\%)}{207} + \frac{Ba(\%)}{137}\right] - S_{sulphate}\ (\%) \quad (2)$$

Where:

SF_{FE} = sulphide sulphur content associated with iron sulphide sources
S_{total} = total sulphur content
Zn = zinc
Pb = lead
Ba = barium
$S_{sulphate}$ = sulphate sulphur content

Neutralizing potential (NP) values were determined by using the modified Sobek method (MEND, 1991; Lawrence et al, 1989). Analyzing NP by the modified Sobek method generally provides a more realistic indication of the readily available carbonate minerals than do other NP determination methods, such as the standard Sobek method (MEND, 1991).

Although static testing methods provide a fast and cost-effective means of measuring the ABA properties of a material, the interpretations may be limited by the following factors, which static tests do not measure (MEND, 1991):

- Rates of acid generation and NP depletion
- Actual sample stoichiometries
- Presence of long-term, acid-consuming materials versus highly reactive and readily available acid consuming materials
- Sample variability

ABA testing is generally used to predict the tendency of a material to generate or neutralize acid by providing a "snapshot" (in time) of the balance between the acid production and acid neutralization, based on the sulphur content and presence of neutralizing species, such as carbonate minerals. Numerous interpretive indices are used to evaluate ABA data, including paste pH, NP to AP (NP:AP) ratio and net NP.

The relative amount of NP and AP is typically assessed through the NP:AP ratio (calculated by dividing the NP by the AP) and the net neutralization potential (NNP) (calculated by subtracting the AP from the NP). Various guidance criteria are published and used in decision making. Generally, these criteria are divided into categories of "potentially acid-generating," "non-acid-generating," and "intermediate" for the ABA characteristics and provide the following threshold values (United States Environmental Protection Agency [USEPA], 1999):

- NP:AP values greater than 3:1 suggest non-acid-generating material
- NP:AP values less than 1:1 suggest potentially acid-generating material
- NP:AP values between 1:1 and 3:1 suggest intermediate or "uncertain" material
- NNP values greater than zero suggests net acid-neutralizing material
- NNP values less than zero suggests net acid-generating material

These criteria provide the basis for determining the net potential for the borrow materials to generate or neutralize acid.

Field Investigation Activities

The field investigation activities documented in this technical memorandum include activities completed at the borrow areas in 2013. Field investigation activities and laboratory testing were generally completed in accordance with *Develop and Decommission Faro-Grum-Vangorda Borrow Sources* (CH2M HILL, 2013b) and according to the Field Health and Safety Plan (CH2M HILL, 2013c). The investigation program included the following activities:

- Pionjar drilling and sampling in Rose Creek Haul Road Borrow and Rose Creek Borrow
- Test pitting and sampling in Rose Creek Haul Road Borrow, Rose Creek Borrow, and Haul Road Borrow
- Borings and test pits GPS elevation survey
- Collecting shovel/hand samples

The following CH2M HILL standard operating procedures (SOP) (see Table 1; tables are located at the end of this technical memorandum) were used to conduct the sampling:

- Drilling was conducted in accordance with SOP INV013, Pionjar Drilling (CH2M HILL, 2013d)
- Test pitting was conducted in accordance with SOP INV017, Logging and Sampling of Test Pits (CH2M HILL, 2013e)
- Soil samples were collected in accordance with SOP INV003, Borehole Sampling and Testing (CH2M HILL, 2013f)

- Soil, rock, and solids samples were collected from drill cuttings for geochemical and geotechnical testing by using methods generally consistent with those described in SOP SMP006, Surface and Subsurface Soil Sampling (CH2M HILL, 2013g)
- Soil and rock samples were collected and labeled in accordance with SOP SMP011, Sample Nomenclature (CH2M HILL, 2013h), and shipped to the testing laboratory in accordance with SOP PCS002, Sample Packing and Shipping – Environmental (CH2M HILL, 2013i), and SOP PCS016, Sample Packing, Shipping, and Storage (Geotechnical) (CH2M HILL, 2013j)

Drilling Activities

Four boreholes were advanced under Task Authorization 013 borrow investigations at selected locations in the Rose Creek Haul Road Borrow and Rose Creek Borrow by using a Pionjar backpack drill rig (see Figures 3 and 4). Boreholes were completed in unconsolidated materials to refusal depth, or to the depth of 2.0 metres below ground surface (mbgs), whichever was reached first. The samples were visually examined to confirm similar grain size distribution and for logging of the materials encountered.

Kryotek Ltd. completed borehole drilling August 20 and August 22, 2013. CH2M HILL personnel were on site, identified the proposed location of each borehole using a hand held GPS unit, supervised the drilling and logged the stratigraphy encountered. Attachment 1 contains the borehole logs.

Test Pit Activities

Twenty-six test pits were excavated at selected locations in the Haul Road Borrow, Rose Creek Haul Road Borrow, and Rose Creek Borrow by using a CAT345CL excavator. The test pits were excavated through the overburden material and reached depths ranging from 0.6 to 6.0 mbgs. The samples were visually examined to confirm similar grain size distribution and to make a preliminary field soil classification; the observations were logged.

The test pit excavation program was performed by Tlicho Environmental Engineers, Inc. (TEES), who provided the excavator and operator. Excavation was completed between July 17 and August 13, 2013. CH2M HILL staff determined the proposed test pit locations by using a handheld GPS instrument, supervised the crew operating the excavator, and logged the stratigraphy encountered.

Surface Soil Sampling Activities

Five manual and shovel sampling locations were sampled across the Rose Creek Borrow. Samples were collected from road cuts and pit walls that had been previously excavated and that showed clear stratigraphy features.

Surface soil sampling was carried out by CH2M HILL by using a shovel and grab sampling the exposed materials; sampling was completed on July 13, 2013. CH2M HILL field staff determined the sampling locations and obtained the location coordinates by using a handheld GPS instrument.

Soil Sampling in the Borrow Areas

Geotechnical Samples

Soil and rock samples were collected from the Haul Road Borrow, Rose Creek Haul Road Borrow, and Rose Creek Borrow and submitted to Golder Associates Ltd. (Golder) for geotechnical analysis. The samples were collected from shallow pionjar borings, test pits, and exposed lithology at available road cuts. Samples were collected from selected spots at each sampling location and placed in laboratory prepared bags. Select samples were sent to Golder for testing for the following laboratory determinations:

- Gradation: ASTM International (ASTM) D6913
- Organic impurities: Canadian Standards Association (CSA) A23.2-15A
- Flat and elongated particles: CSA A23.2-13A
- Resistance to degradation by abrasion: CSA A23.2-23A (fine) and CSA A23.2-29A (course)

- Relative density and absorption: CSA A23.2-6A (fine) and CSA A23.2-12A (coarse) Soundness (magnesium sulphate): ASTM D5240
- Detection of alkali-silica reactive aggregate by accelerated expansion of mortar bars: CSA A23.2-25A
- Petrography: ASTM C295 (rock), CSA A23.2-15A (aggregate)

All samples were collected, logged, prepared, and shipped according to the applicable CH2MHILL SOPs mentioned previously.

Geochemical Samples

Soil and rock samples were collected from the Rose Creek Borrow, Haul Road Borrow, and Rose Creek Haul Borrow and submitted to ALS Laboratory Group (ALS) for geochemical analysis. Samples were collected from shallow pionjar borings, test pits, and by shovel and manually sampling exposed lithology at available road cuts. Samples were collected from selected spots at each sampling location and placed in laboratory prepared bags. Select samples, including rock to be crushed, were sent to ALS for the following analyses:

- Paste pH testing: Sobek et al., 1978
- Total metal analysis: prepared using United States Environmental Protection Agency (USEPA) 3050B or equivalent and analyzed using USEPA SW6010B/SW6020 or equivalent for the following analytes:
  - aluminum
  - antimony
  - arsenic
  - barium
  - calcium
  - cadmium
  - cobalt
  - copper
  - iron
  - lead
  - magnesium
  - manganese
  - molybdenum
  - nickel
  - potassium
  - selenium
  - silver
  - sodium
  - strontium
  - sulphur
  - thallium
  - titanium
  - uranium
  - zinc
- ABA analysis to characterize the material's propensity to generate or neutralize acid; the analysis included the following tests:
  - Total inorganic carbon (American Public Health Association SM5310C)
  - Total sulphur (Leco Combustion)
  - Modified neutralization potential (Modified Sobek)
  - Acid-soluble sulphate-S (Method E600/2-78-054)
  - Ba (Li-Metaborate)
- Moisture: ASTM D2216

Soil Fertility Samples

Sixteen soil fertility samples were collected in the Rose Creek Haul Road Borrow and Rose Creek Borrow to assess the potential suitability of the borrow material to be used as soil that can support vegetation covers.

Soil samples were collected from the Rose Creek Haul Road Borrow and Rose Creek Borrow and submitted to ALS for fertility analysis. The samples were collected from shallow pionjar borings. Samples were collected from selected spots at each sampling location and placed in laboratory prepared bags. Select samples were sent to ALS for testing for the following laboratory analysis:

- pH (1:2 calcium chloride)
- Shoemaker-McLean-Pratt (SMP) buffer method; buffer pH (for pH less than 6.0)
- 1 Normal (N), pH 7.0 ammonium acetate extractable calcium, magnesium, potassium, and sodium
- Available phosphorus (Mehlich 3)

- Calcium dihydrogen phosphate extractable sulphate-sulphur
- Available micronutrients (copper, iron, manganese, and zinc) (Mehlich 3 Extraction)
- Soluble salts (1:1 paste as initial screening)
- Electrical conductivity of the soil saturation extract (EC_e) (saturation paste) (run on any sample with soluble salts greater than 0.5 deciSiemens per metre [dS/m])
- SAR, based on calcium, manganese, and sodium in soil saturation extract (run on any sample with soluble salts greater than 0.5 dS/m)
- Calcium carbonate equivalent (run on any sample with pH greater than 7.5; gravimetric method for loss of carbon dioxide)
- Total N (Leco Combustion)
- Total organic carbon (Walkley-Black)
- Cation exchange capacity (estimated from ammonium acetate-exchangeable cations)
- Ammonium-N (2N potassium chloride extraction)
- Nitrate nitrogen (2N potassium chloride extraction)

Transportation of Samples to the Laboratories

Sample Handling

The onsite sample manager, in coordination with the project chemist and project geotechnical and geochemistry teams, determined which samples to send to the laboratory and the analytical methods when field decisions were required.

Specific laboratory methods, bottle requirements, field preservation requirements, and sample volumes for the analyses are described in the project quality assurance project plan (QAPP) (CH2M HILL, 2012c). Samples were assigned a unique identifier (an alpha-numeric code in accordance with SOP SMP011). Quality assurance and quality control (QA/QC) samples were collected in accordance with the QAPP.

Sample handling procedures were in accordance with SOPs PCS002 and PCS003 (CH2M HILL, 2013k). Soil samples for geochemical analysis were collected in sealable plastic bags and placed in a second plastic bag after labeling to provide added protection from tears, label removal, and melted ice.

Laboratory Testing Methodology

Laboratory testing for geotechnical characterization was completed by Golder under subcontract to CH2M HILL. Thirty samples were collected between July 17, 2013 and August 22, 2013 and submitted to Golder in Burnaby, British Columbia (see Attachment 2 for laboratory reports). Analyses were performed in accordance with the QAPP (CH2M HILL, 2012c).

Laboratory analysis for geochemical characterization was completed by ALS, under subcontract to CH2M HILL, for crushed rock and soil samples. Samples were collected between July 17, 2013 and August 22, 2013 and submitted to ALS in Whitehorse, Yukon and Vancouver, British Columbia (see Attachment 2 for laboratory reports). Analyses were performed in accordance with the QAPP (CH2M HILL, 2012c).

Geotechnical Samples

Soil samples were analyzed for gradation (20 samples) and Atterberg Limits (3 samples). Grain size distribution was determined by using a combination of laboratory techniques that followed Canadian Society of Soil Science Method 47.2 (1993) and Burt (2009). These methods include dry sieving for the coarse fraction, wet sieving for the sand fraction, and using the pipette sedimentation method for clay particles. Gradations were determined by the Canadian System of Soil Classification and the Unified Soil Classification System. The division between grain

size fractions differs for the two gradation determinations. Atterberg Limits include the Liquid Limit (the point at which the soil becomes semi-fluid), and the Plastic Limit (the water content at which soil begins to crumble while being rolled into a 3-mm-diameter thread). The Plastic Index is calculated as the difference between the Liquid Limit and the Plastic Limit.

Moisture content was determined in the laboratory on material less than 1 centimeter in diameter by following ASTM D2974. Moisture content (as a percent of dry unit weight) was determined by drying the samples at 105 degrees Celsius for at least 6 hours. Samples were also analyzed for Micro-Deval abrasion to determine the resistance of coarse aggregate to degradation by abrasion in the Micro-Deval apparatus: CSA A23.2-23A (fine) and Canadian Standards Association Group (CSA) A23.2-29A (course).

Other tests were performed to determine the following properties:

- Specific gravity and absorption to evaluate the material's ability to absorb water: ASTM D6473 (results less than 1 to 0.5 percent are considered suitable for use as riprap)
- Detection of alkali-silica reactive aggregate to evaluate potential expansion of materials: ASTM C227-10
- Aggregate soundness using magnesium sulphate to evaluate resistance to weathering and freeze-thaw cycles: ASTM D5240 (3)
- Petrographic examination to identify deleterious minerals: ASTM C295 (4)
- Particle shape to determine the material's mechanical behaviour based on the shape of the single grains: ASTM CSA A23.2-13A
- Standard Test Method for Organic Impurities in Fine Aggregates for Concrete, following ASTM C40 and ASTM C40M-11

Geochemical Samples

Seventeen samples were submitted for geochemical laboratory analysis for the following:

- Paste pH testing: Sobek et al., 1978
- Total metal analysis for aluminum, antimony, arsenic, barium, calcium, cadmium, cobalt, copper, iron, lead, magnesium, manganese, molybdenum, nickel, potassium, selenium, silver, strontium, sulphur, thallium, titanium, uranium, and zinc: prepared using USEPA 3050B or equivalent and analyzed using USEPA SW6010B/SW6020 or equivalent
- Leachable constituents; 14 samples were submitted for ABA analysis (in accordance with Price, 2005) to characterize the material's propensity to generate or neutralize acid, including the following:
- Total inorganic carbon: American Public Health Association Standard Method 5310C
- Total sulphur: Leco Combustion
- Modified neutralization potential: modified Sobek
- Acid-soluble sulphate-S
- Barium: Li-Metaborate

Soil Fertility Samples

Four samples were collected at the Rose Creek Haul Road Borrow and Rose Creek Borrow and submitted to the laboratory for soil fertility analyses.

A wide range in soil fertility values and variations in salinity were expected. The most limiting criteria for most sites are pH and salinity; if these conditions are extreme compared to the needs of the target vegetation, the availability of plant nutrients is not a factor. Many plants are only adapted to a relatively narrow range of pH and

can tolerate salinity only up to a species-specific threshold. Extremes of pH and salinity can directly prevent germination and limit growth.

Salinity Screening. Even sensitive plants can commonly tolerate up to 1,500 microsiemens per centimeter (µS/cm) salinity (saturation extract) (Maas, 1996). Soil salinity guidelines for unrestricted land use in Alberta suggest soil quality is good if soil salinity is less than 2,000 µS/cm, fair at 2,000 to 4,000 µS/cm; poor at 4,000 to 8,000 µS/cm; and unsuitable if greater than 8,000 µS/cm (Alberta Environment, 2001).

- The expected range in salinity is 100 to 2,000 µS/cm.
- Screening criteria were set at 1,000 to 2,000 µS/cm (salinity could be an issue for sensitive plants) and greater than 2,000 µS/cm (salinity could be an issue for a wider range of plants).

pH Screening. Soil pH is a master variable that affects the availability and uptake of many nutrients and potential toxicants. Generally, root growth for many plants is not greatly affected within a pH range of 5.0 to 7.5 (Marschner, 1995). Soil pH values below 5.0 can indicate potential for toxic levels of aluminum or manganese (McBride, 1994), even in uncontaminated soils. Alkaline soils typically have very low levels of available metal nutrients, such as zinc. Soil pH values above 8.5 typically indicate excess sodium (McBride, 1994).

The expected range is very wide, ranging from extremely acidic (pH as low as 2) because of acid mine drainage to 8.5 for highly alkaline, calcareous, unleached soils.

Screening criteria were set at a pH of less than 5.5 or greater than 7.5. Soils within these values should support a wide range of plants with modest if any soil amendments for pH.

Boron Screening. Boron is somewhat unusual among the essential nutrients because the desirable concentration range is narrow; higher concentrations can mean toxicity and or lower concentrations can mean nutrient deficiency. Most crop requirements for boron are met with 0.5 to 1.0 milligrams per kilogram (mg/kg) of hot water-extractable boron, with toxicity a problem at levels above 5 mg/kg (Johnson and Fixen, 1990).

- The expected range was 0.1 to 5 mg/kg.
- Screening criteria were set at less than 0.3 and greater than 1 mg/kg to identify deficient and potentially phytotoxic levels.

Cation Exchange Capacity. The soil cation exchange capacity (CEC) influences the availability of nutrients such as calcium, magnesium, and potassium. If soil chemistry needs to be adjusted with amendments, lower rates are required for low-CEC soils, and higher rates for high-CEC soils. A typical range for CEC is 3 to 5 milliequivalent per 100 grams (meq/100g) for sands to 50 to 100 meq/100g for organic soils, such as mucks)

- The expected range was approximately 4 to 30 meq/100g.
- A screening criteria of less than 10 meq/100g was set as a means to identify more infertile soils.

Exchangeable Sodium Percentage and Sodium Adsorption Ratio. Excess sodium is problematic for soils, primarily because of its adverse impact on soil structure (dispersion of soil clay particles) but also for potential extremes of pH (above 8.5), nutrient imbalances, and potential toxicity for some plants. The most commonly used traditional threshold to characterize soils as ‘sodic’ is an exchangeable sodium percentage (ESP) of 15 percent or more. Studies in some areas have shown that sodium can adversely affect soils at much lower ESP values (Sumner, 1993). Soil sodium adsorption ratio (SAR) is easier to accurately measure than ESP but can be converted by using a standard equation as a reasonable estimate of ESP. The values of ESP and SAR are typically numerically similar for most soil conditions.

- Expected values for SAR and ESP varied over a wide range, from 0.1 to 50.
- A screening criteria of greater than 5 percent ESP was set as a conservative means of identifying soils affected by sodium.

Quality Assurance and Quality Control

CH2M HILL has incorporated a QA/QC plan (CH2M HILL, 2012c) into field sampling programs. QA/QC field samples were collected during soil sampling activities and were used to evaluate the quality of the analytical data generated. QA/QC measures during the 2013 field program included the collection and analysis of (1) duplicate samples amounting to at least 10 percent of the samples collected and (2) equipment blank samples. The laboratory data were validated in accordance with the QAPP (CH2M HILL, 2012c). Analytical data are stored in the Environmental Quality Information System (EQuIS) database.

Field QA/QC samples identify potential matrix interferences; evaluate sources of sample contamination (equipment blanks) and variation introduced by the process of sample collection, handling, and analysis (duplicate field samples); and verify the effectiveness of analytical methods (matrix spike/matrix spike duplicate samples).

Data Quality Evaluation Report

The Data Quality Evaluation (DQE) Report (see Attachment 3) was prepared by the project chemist. The DQE Report summarizes the results of the QA/QC activities prescribed in the QAPP (CH2M HILL, 2012c) and provides a complete data usability assessment. The QAPP identifies the method-specific QC requirements for each analytical parameter and matrix and defines a plan to test that the correct sampling, analytical, and data reduction procedures are followed using audits and data validation. The DQE Report is intended as a general data quality assessment and summary of data issues. The DQE Report is provided in Attachment 3.

Data Summary

Subsurface Conditions

The subsurface profile at the investigated borrow areas is random native overburden soils (alluvium and glaciofluvial) that overlie moderately to highly weathered bedrock. The investigation involved the exposed ground and the shallow overburden in the borrow areas within depths from 0.6 to 6.0 mbgs.

In the Haul Road Borrow the overburden generally consisted of silty sand, silty gravel, graded gravel with sand, and sand with gravel. The thicknesses ranged from 0.5 to 5.0 m.

In the Rose Creek Haul Road Borrow, the subsurface consisted of silty sand/sandy silt, silty clayey sand, and sand and gravel. The thicknesses ranged from 0.5 to 4.0 m.

In the Rose Creek Borrow the material was predominantly graded gravel with sand, sand with gravel and minor presence of silty sand/sandy silt, and silty gravel encountered during the subsurface investigation. The thicknesses ranged from 0.3 to 6.0 m.

Given the purpose of this investigation and the methods used, no bedrock was intercepted during the subsurface characterization.

Geotechnical Results

One-hundred-eight samples were collected for geotechnical analysis and submitted to Golder and ALS for analysis. Laboratory results are summarized in the following subsections.

Moisture Content and Atterberg Limits. Soil moisture content of the samples ranged from 3.4 to 50.7 percent by weight; the average moisture is 13.7 percent by weight. The Plastic Index of the three samples tested ranged from 6 to 18 (average 11.7), indicating the soil is slightly plastic. The Liquid Limit of samples ranged from 20 to 110 (average 61) (see Table 2).

Grain Size Distribution. Grain size analyses were conducted using both the Canadian System of Soil Classification and the Unified Soil Classification System methodologies. Analyzed samples indicated the prevalent texture of the materials collected at Haul Road Borrow, Rose Creek Haul Borrow, and Rose Creek Borrow were generally coarse-grain materials consisting of sands and gravels (see Table 3).

At the Rose Creek Borrow area, the material encountered consisted of the following (listed from the most frequent to the least):

- Well graded sand (GW)
- Silty gravel (GM)
- Poorly graded sand with gravel (GP)
- Poorly graded sand (SP)
- Well graded sand (SW)
- Silty sand (SM)
- Well graded sand with silt and gravel (SW-SM)

At the Rose Creek Haul Road Borrow, the following materials were generally encountered:

- Silty clayey sand and silty clayey sand with gravel (SC/SM)
- Silty sand and silty sand with gravel (SM)
- Silt and sandy silt (MH)
- Well graded sand (GW)
- Poorly graded sand with silty clay (SP-SC)

At the Haul Road Borrow, the following materials were the most represented:

- Well graded gravel with sand (GW)
- Silty gravel with sand (GM)
- Well graded sand with gravel (SW)
- Silty sand (SM)
- Poorly graded sand (SP)
- Well graded sand with silt and gravel (SW-SM)

Resistance to Degradation by Abrasion. Micro-Deval abrasion tests were conducted on five samples to evaluate the material's resistance to abrasion. The results show a loss of material at the end of the tests ranging from 12.7 to 17.5 percent in fine material and a from 14 to 16.8 percent in coarse material (see Table 4)

Specific Gravity and Absorption. The following are the average values for five samples tested for specific gravity and absorption for fine material (see Table 5):

- Specific gravity dry basis: 2.441 to 2.598
- Saturated surface dry basis: 2.498 to 2.631
- Apparent specific gravity: 2.588 to 2.695
- Absorption: 1.27 to 2.33 percent, respectively for fine material

The range of average values for coarse material were as follows (see Table 5):

- Specific gravity dry basis: 2.633 to 2.651
- Saturated surface dry basis: 2.665 to 2.694
- Apparent specific gravity: 2.722 to 2.780
- Absorption: 1.22 to 1.75 percent

Rock Soundness. The percent loss for the five samples tested for rock soundness (by magnesium sulphate) showed a weighted average loss between 3.8 to 8.0 percent for fine material and between 1.8 to 4.6 percent for coarse material (see Table 6).

Petrographic Description and Physical Quality. Five samples were selected for petrographic analysis, two from the Haul Road Borrow and three from the Rose Creek Borrow. The results of the analysis indicated that samples contained 6 to 16 percent volcanic rock, 14 to 35 percent plutonic rock, 2 to 11 percent gneissic rock, 37 to 58 percent schist, 2 to 6 percent chert, 1 to 2 percent quartzite, 0 to 2 percent arenite and grewacke, and 0.3 to 1 percent material weathered beyond recognition.

Samples were assigned petrographic numbers ranging from 133 to 163, indicating that the material is considered unsuitable for use in most concrete applications including high-strength concrete. The examination also noted that all samples were potentially alkali-reactive and might contribute to alkali-aggregate reaction (see Table 7).

Detection of Alkali–Silica Reactive Aggregate by Accelerated Expansion of Mortar Bars. This determination was performed for five samples, two from the Haul Road Borrow and three from the Rose Creek Borrow. The results of these tests indicate potential alkali reactivity in aggregates that could cause deleterious expansion, cracking, and loss in serviceability of the concrete due to alkali–aggregate reactivity. The average expansion ranged from 0.034 percent on the third day to 0.628 percent on the twenty-eighth day (see Table 8).

Particle Shape. Five samples were submitted for particle shape determinations, two from the Haul Road Borrow and three from the Rose Creek Borrow. The results of these tests indicate that the average for flat particles range from 0.2 to 1.1 percent and the average for flat and elongated particles vary from 1.1 to 8.3 percent (see Table 9).

Organic Impurities. Five samples were submitted for organic impurities determinations, two from the Haul Road Borrow and three from the Rose Creek Borrow. This method determines the presence of organic compounds in fine aggregates for use in cement mortar or concrete to quickly determine if further tests of the fine aggregate are necessary before approval for use. Three samples had colour plate values of 2, 3, and 4; the other samples where lighter than colour plate value 1 (see Table 10).

Geochemical Results. Seventeen soil and rock samples including two field duplicates (CH13-108-BH903_SOb and CH13-108-BH904_SOb) were collected from the Haul Road Borrow, Rose Creek Haul Road Borrow, and Rose Creek Borrow during the 2013 field investigation. These samples were submitted to ALS for several analyses; the results are summarized by parameter in the following sections.

Solid Analytical Results

Seventeen samples from the pionjar drilling, test pit and hand/shovel sampling (including three duplicates) were submitted for analysis during the borrow material characterization program. The following sections summarize solids analytical results by parameter; data are presented in Tables 11 to 15.

Total Metal Analyses. Analysis of the solid materials collected from the borrow areas was determined by inductively coupled plasma-atomic emission spectroscopy. In the analysis, the material is digested (leached and dissolved) and the liquid is analyzed for elemental content. The degree of digestion depends on the particular method, but it is assumed that the digestion is complete enough to be representative of the bulk composition of the sample material. The elemental composition of the soil and rock material provides a screening tool to indicate the presence and abundance of selected constituents. However, the analysis does not indicate the potential for a particular constituent to be mobilized or the timeframe in which the constituent may become mobile. The reactivity of the material will control the availability or release and, over the longer term, how the reactivity of the material changes through weathering.

The results from this analysis were used to identify the geochemical characteristics of the proposed borrow area materials. Results were compared to the GARD Guide and MEND screening criteria (see Table 11). The median soil content concentrations are reported from the GARD Guide (INAP, 2013). Concentrations of elemental crustal abundance are sourced from Price (1997) and presented as 10 times the average value in the continental crust. Concentrations that are 12 to 24 times the median soil content are considered elevated and have a geochemical abundance index of 3, calculated by using Equation 3:

$$GAI = log_2\ (element\ concentration / 1.5 * median\ soil\ concentration) \quad (3)$$

Where:

GAI = geochemical abundance index

According to these criteria, the samples collected from the borrow areas contained constituent concentrations that were greater than the guideline values for bismuth in all the samples collected, and for arsenic content in one discrete sample interval (0.5 to 1.0 mbgs in CH13-108-BH001_SOb) (see Table 11).

Acid-Base Accounting Parameters. The calculated percentage of sulphide present in the borrow materials from Rose Creek Haul Road Borrow and Haul Road Borrow were about 0.02 and 0.05 percent (average), respectively (which correlates to AP values of about 0.77 and 1.71 kilogram of $CaCO_3$ per tonne, respectively). The NP measured in the material of the two areas altogether ranged from 9 to 48 kg $CaCO_3$ per tonne. According to the

interpretive indices, NP:AP, and NNP, the material is characterized as mildly acidic, with a low potential to further generate acid and mobilize metals (see Tables 12 and 13).

Leachate Analysis. Three samples were collected at the borrow areas and submitted to ALS for leachate analysis. All samples exceeded the Protection of Aquatic Life Criteria (Canadian Council of Ministers of the Environment, 2007) for aluminum, arsenic, cadmium, copper, iron, lead, silver, and sulphate. The remainder of the parameters in the samples analyzed had detected concentrations, with the exception of beryllium boron, lithium, mercury, selenium, sodium, and thallium (see Table 14)

Soil Fertility Analyses. Four samples and two duplicates from the Rose Creek Haul Road Borrow were analyzed for soil fertility. In general, the samples had low fertility, but there were no indications of any parameters being extremely high. The material had low available phosphorus and CEC, indicating overall low fertility. Soil organic matter was variable, ranging from below the detection limit of 0.7 to 12.2 percent. Only limited nitrogen data were collected (from two samples), but values for all nitrogen parameters were very low. Available boron, copper, and zinc levels were variable, ranging from low to high.

The following are results relative to the screening criteria:

- **Salinity** – all samples met the screening criteria, and this parameter should not significantly affect revegetation planning.
- **pH** – pH values met the screening criteria for all samples, and this parameter should not significantly affect revegetation planning.
- **ESP/SAR** – data met the screening criteria, and these parameters should not significantly affect revegetation planning.
- **Available boron, nitrate, and phosphorus** – values were all below the screening criteria (not detected in most samples), with the exception of boron at location CH13-108-BH002. Fertilization may be beneficial. Organic amendments are often the best means of supplying additional nutrients required in small quantities. Native species may be tolerant of very low levels of boron.
- **Available copper, manganese, and zinc** – values were low in some samples. Fertilization may be beneficial. Organic amendments are often the best means of supplying additional nutrients. Native species may be tolerant of very low levels.
- **CEC** – Of the five samples, two tested below the screening criteria. Soil amendments could be used to increase the CEC (see Tables 15 and 16).

Summary

The information provided in this technical memorandum supports the basis of the design for the replacement Faro WTP. During the investigation, soil and rock data was collected from the alluvium and weathered bedrock at the Rose Creek Borrow, Rose Creek Haul Road and Haul Road Borrow areas in order to determine the suitability of the in-situ materials to serve as backfill and engineered fill for the construction of the replacement Faro WTP.

The following field activities and material testing were completed under Task Authorization 013 at the borrow areas during 2013:

- Four boreholes (CH13-108-BH001 through CH13-108-BH004) were advanced at selected locations in the Rose Creek Borrow and Rose Creek Haul Road Borrow areas by using a Pionjar backpack drill rig (see Figures 3 and 4). Boreholes were completed in unconsolidated materials to refusal depth, or to the depth of 2.0 mbgs, whichever was reached first. The samples were visually examined to classify the material and confirm similar grain size distribution. The boreholes were drilled by Kryotek Ltd., August 20–22, 2013. CH2M HILL staff were onsite to supervise and log the stratigraphy.
- Twenty-six test pits were excavated at selected locations in the Haul Road Borrow, Rose Creek Haul Road Borrow, and Rose Creek Borrow by using a CAT345CL excavator. The test pits were excavated through the

overburden material and reached depths ranging from 0.6 to 6.0 mbgs. The samples were screened in the field to confirm similar grain size distribution and for a preliminary soil classification. The test pit program was carried out by TEES between July 17 and August 13, 2013. CH2M HILL staff were onsite to determine the proposed test pit locations, supervise the crew operating the excavator, and log the stratigraphy.

- Five manual and shovel sampling locations (CH13-108-SS001 through CH13-108-SS005) located across the Rose Creek Borrow were sampled. The samples were recovered from road cuts and the walls of pits that had been previously excavated and that showed clear stratigraphy features. Surface soil sampling was carried out by CH2M HILL by using a shovel or manually collecting grab samples from exposed materials on July 13, 2013. CH2M HILL staff were onsite to determine the sampling locations by using a GPS instrument.
- Surface and subsurface conditions at the borrow areas consisted of random native soils (alluvium and glaciofluvial) overlying moderately to highly weathered bedrock. The investigation involved the exposed ground and the shallow overburden in the borrow areas and depths ranged from 0.6 to 6.0 mbgs:
  - Overburden in the Haul Road Borrow generally consisted of silty sand, silty gravel, graded gravel with sand, and sand with gravel.
  - Subsurface materials in the Rose Creek Haul Road Borrow consisted of silty sand/sandy silt, silty clayey sand, and sand and gravel.
  - Subsurface materials in the Rose Creek Borrow were predominantly graded gravel with sand, sand with gravel and minor presence of silty sand/sandy silt, and silty gravel.
- Samples collected from the Haul Road Borrow and the Rose Creek Borrow areas were submitted to Golder for geotechnical tests and to ALS for soil fertility testing. Samples collected in the Rose Creek Haul Borrow and Rose Creek Borrow were submitted to ALS for geochemical testing.
- Other samples were submitted to Golder to determine expansion, particle shape, and organic content.
- The material from the Rose Creek Haul Road has a low soil fertility and would benefit from organic amendments.

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Tables

TABLE 1

CH2M HILL SOP List

Faro Mine Remediation Project

SOP Number	Title
INV013	Pionjar Drilling
INV017	Logging and Sampling of Test Pits
MSR006	Geographic Land Surveying and Field Surveying Procedures
PCS002	Sample Packing and Shipping – Environmental
PCS016	Sample Packing, Shipping, and Storage - Geotechnical
SMP006	Surface and Subsurface Soil Sampling

TABLE 2
Moisture and Atterberg Limits
Faro Mine Remediation Project

	Location	CH13-108-BH001	CH13-108-BH002	CH13-108-SS006
	Sample ID	CH13-108-BH001_SOb	CH13-108-BH002_SOb	CH13-108-SS006_SOa
	Sampling Depth (feet)	0.5–1	0.5–1	0–0.5
Analyte	Sampling Date	8/22/2013	8/22/2013	8/22/2013
Moisture	%	21.1	50.7	7.02
Moisture at the Liquid Limit	%	53	110	20
Plasticity Index		11	18	6

TABLE 3
Sieve Analysis of Fine and Coarse Aggregate
Faro Mine Remediation Project

Sample ID	Sieve Analysis				
	Sieve Size (mm)	Retained (%)	Passing (%)	Individual % Retained (split values)	
				5	-5
CH13-108-TP041_SOa	80	0.0	100.0	0.0	-
	56	1.7	98.3	3.6	-
	40	5.6	92.7	12.0	-
	28	7.4	85.4	15.8	-
	20	8.2	77.2	17.6	-
	14	6.2	71.0	13.2	-
	10	5.9	65.1	12.6	-
	5	11.8	53.4	25.2	-
	2.50	13.2	40.1	-	24.8
	1.25	14.9	25.2	-	28.0
	0.630	14.6	10.6	-	27.4
	0.315	6.5	4.2	-	12.1
	0.160	1.8	2.3	-	3.4
	0.080	1.1	1.2	-	2.0
	PAN	1.2	0.0	-	2.3
	Total	100.0		100.0	100.0
CH13-108-TP042_SOa	40	0.0	100.0	0.0	-
	28	0.8	99.2	7.1	-
	20	0.0	99.2	0.0	-
	14	2.2	97.0	18.4	-
	10	2.4	94.6	21.0	-
	5	6.3	88.3	53.5	-
	2.50	7.3	81.0	-	8.3
	1.25	13.7	67.3	-	15.5
	0.630	21.2	46.1	-	24.0
	0.315	20.9	25.2	-	23.7
	0.160	14.5	10.7	-	16.5
	0.080	6.6	4.1	-	7.5
	PAN	4.1	0.0	-	4.6
	Total	100.0		100.0	100.0
CH13-108-TP043_SOa	100	0.0	100.0	0.0	-
	80	11.9	88.1	22.9	-
	56	7.8	80.3	14.9	-
	40	8.5	71.8	16.2	-
	28	5.6	66.2	10.7	-
	20	4.5	61.7	8.6	-
	14	4.0	57.7	7.7	-
	10	3.2	54.5	6.2	-
	5	6.6	47.9	12.7	-
	2.50	3.8	44.1	-	8.0
	1.25	5.0	39.1	-	10.3
	0.630	5.1	34.0	-	10.6
	0.315	4.5	29.5	-	9.4
	0.160	3.9	25.6	-	8.2
	0.080	4.2	21.4	-	8.7
	PAN	21.4	0.0	-	44.8
	Total	100.0		100.0	100.0

TABLE 3
Sieve Analysis of Fine and Coarse Aggregate
Faro Mine Remediation Project

Sample ID	Sieve Analysis				
	Sieve Size (mm)	Retained (%)	Passing (%)	Individual % Retained (split values)	
				5	-5
CH13-108-TP044_SOa	80	0.0	100.0	0.0	-
	56	8.5	91.5	16.5	-
	40	8.6	82.9	16.7	-
	28	5.0	77.8	9.8	-
	20	9.3	68.5	18.1	-
	14	6.7	61.8	12.9	-
	10	3.9	57.9	7.5	-
	5	9.5	48.4	18.4	-
	2.50	7.7	40.8	-	15.8
	1.25	9.3	31.5	-	19.2
	0.630	10.6	20.9	-	21.9
	0.315	6.8	14.0	-	14.1
	0.160	3.1	10.9	-	6.5
	0.080	2.0	8.9	-	4.1
	PAN	8.9	0.0	-	18.3
	Total	100.0		100.0	100.0
CH13-108-SS001_SOa	28	0.0	100.0	0.0	-
	20	7.7	92.3	25.7	-
	14	2.2	90.0	7.3	-
	10	6.1	83.9	20.4	-
	5	14.0	69.9	46.6	-
	2.50	16.4	53.5	-	23.4
	1.25	22.1	31.4	-	31.6
	0.630	21.6	9.8	-	30.9
	0.315	6.9	2.9	-	9.8
	0.160	1.1	1.9	-	1.5
	0.080	0.5	1.4	-	0.7
	PAN	1.4	0.0	-	2.0
	Total	100.0		100.0	100.0
CH13-108-SS002_SOa	56	0.0	100.0	0.0	-
	40	4.1	95.9	15.6	-
	28	0.0	95.9	0.0	-
	20	4.2	91.7	16.1	-
	14	4.6	87.1	17.8	-
	10	4.8	82.2	18.4	-
	5	8.4	73.8	32.1	-
	2.50	8.0	65.9	-	10.8
	1.25	13.9	51.9	-	18.8
	0.630	15.7	36.2	-	21.3
	0.315	12.3	23.9	-	16.6
	0.160	7.4	16.6	-	10.0
	0.080	4.7	11.9	-	6.3
	PAN	11.9	0.0	-	16.1
	Total	100.0		100.0	100.0

TABLE 3
Sieve Analysis of Fine and Coarse Aggregate
Faro Mine Remediation Project

Sample ID	Sieve Analysis				
	Sieve Size (mm)	Retained (%)	Passing (%)	Individual % Retained (split values)	
				5	-5
CH13-108-SS003_SOa	56	0.0	100.0	0.0	-
	40	0.8	99.2	2.6	-
	28	3.0	96.2	9.0	-
	20	4.3	91.9	13.0	-
	14	5.6	86.3	17.0	-
	10	6.3	80.0	19.1	-
	5	12.9	67.1	39.3	-
	2.50	13.3	53.9	-	19.8
	1.25	14.6	39.3	-	21.7
	0.630	13.1	26.2	-	19.5
	0.315	8.8	17.4	-	13.1
	0.160	5.6	11.8	-	8.3
	0.080	3.3	8.6	-	4.9
	PAN	8.6	0.0	-	12.8
	Total	100.0		100.0	100.0
CH13-108-SS004_SOa	56	0.0	100.0	0.0	-
	40	4.6	95.4	8.7	-
	28	5.2	90.1	9.9	-
	20	8.3	81.8	15.7	-
	14	8.6	73.3	16.1	-
	10	9.0	64.3	17.0	-
	5	17.4	46.9	32.7	-
	2.50	13.1	33.8	-	28.0
	1.25	10.1	23.7	-	21.5
	0.630	7.7	16.0	-	16.4
	0.315	4.9	11.1	-	10.5
	0.160	2.8	8.2	-	5.9
	0.080	2.0	6.3	-	4.2
	PAN	6.3	0.0	-	13.5
	Total	100.0		100.0	100.0
CH13-108-SS005_SOa	40	0.0	100.0	0.0	-
	28	1.8	98.2	5.2	-
	20	4.3	93.9	12.8	-
	14	6.3	87.6	18.5	-
	10	7.7	79.9	22.7	-
	5	13.9	66.0	40.8	-
	2.50	12.9	53.1	-	19.5
	1.25	14.7	38.4	-	22.3
	0.630	13.5	25.0	-	20.4
	0.315	11.2	13.8	-	16.9
	0.160	6.9	6.9	-	10.4
	0.080	2.8	4.1	-	4.2
	PAN	4.1	0.0	-	6.2
	Total	100.0		100.0	100.0

TABLE 3
Sieve Analysis of Fine and Coarse Aggregate
Faro Mine Remediation Project

Sample ID	Sieve Analysis				
	Sieve Size (mm)	Retained (%)	Passing (%)	Individual % Retained (split values)	
				5	-5
CH13-108-TP022_SOa	80	0.0	100.0	0.0	-
	56	6.9	93.1	8.2	-
	40	17.9	75.2	21.4	-
	28	23.5	51.6	28.1	-
	20	16.0	35.6	19.1	-
	14	8.4	27.2	10.0	-
	10	5.2	22.0	6.2	-
	5	5.8	16.2	7.0	-
	2.50	3.1	13.0	-	19.4
	1.25	2.8	10.2	-	17.2
	0.630	2.5	7.7	-	15.5
	0.315	2.0	5.8	-	12.3
	0.160	1.3	4.5	-	8.0
	0.080	0.9	3.5	-	5.9
	PAN	3.5	0.0	-	21.7
	Total	100.0		100.0	100.0
CH13-108-TP022A_SOa	28	0.0	100.0	0.0	-
	20	1.5	98.5	6.5	-
	14	5.0	93.5	22.0	-
	10	5.2	88.3	22.6	-
	5	11.2	77.1	49.0	-
	2.50	11.9	65.2	-	15.4
	1.25	12.8	52.5	-	16.6
	0.630	10.8	41.7	-	14.0
	0.315	9.2	32.5	-	11.9
	0.160	8.7	23.8	-	11.2
	0.080	7.2	16.6	-	9.3
	PAN	16.6	0.0	-	21.6
	Total	100.0		100.0	100.0
CH13-108-TP022B_SOa	40	0.0	100.0	0.0	-
	28	1.3	98.7	3.5	-
	20	5.0	93.7	13.8	-
	14	6.5	87.2	17.7	-
	10	7.3	79.9	20.1	-
	5	16.5	63.4	45.0	-
	2.50	14.2	49.2	-	22.4
	1.25	13.6	35.6	-	21.5
	0.630	11.7	23.9	-	18.4
	0.315	8.4	15.5	-	13.3
	0.160	4.7	10.8	-	7.3
	0.080	2.7	8.1	-	4.3
	PAN	8.1	0.0	-	12.8
	Total	100.0		100.0	100.0

TABLE 3
Sieve Analysis of Fine and Coarse Aggregate
Faro Mine Remediation Project

Sample ID	Sieve Analysis				
	Sieve Size (mm)	Retained (%)	Passing (%)	Individual % Retained (split values)	
				5	-5
CH13-108-TP022C_SOa	28	0.0	100.0	0.0	-
	20	3.4	96.6	11.1	-
	14	4.6	92.0	15.2	-
	10	7.5	84.5	24.6	-
	5	15.0	69.5	49.1	-
	2.50	15.2	54.3	-	21.9
	1.25	16.8	37.5	-	24.1
	0.630	13.2	24.3	-	19.0
	0.315	8.7	15.6	-	12.6
	0.160	4.7	10.8	-	6.8
	0.080	3.3	7.5	-	4.8
	PAN	7.5	0.0	-	10.8
	Total	100.0		100.0	100.0
CH13-108-TP025_SOa	56	0.0	100.0	0.0	-
	40	3.0	97.0	6.7	-
	28	4.9	92.0	11.1	-
	20	8.4	83.6	18.8	-
	14	7.6	76.0	17.0	-
	10	8.1	67.9	18.1	-
	5	12.7	55.3	28.3	-
	2.50	9.8	45.5	-	17.6
	1.25	8.8	36.7	-	16.0
	0.630	9.9	26.8	-	18.0
	0.315	8.5	18.2	-	15.4
	0.160	5.6	12.6	-	10.1
	0.080	3.9	8.7	-	7.1
	PAN	8.7	0.0	-	15.8
	Total	100.0		100.0	100.0
CH13-108-TP026_SOa	56	0.0	100.0	0.0	-
	40	2.9	97.1	15.1	-
	28	4.6	92.5	24.1	-
	20	0.8	91.7	4.2	-
	14	3.6	88.2	18.6	-
	10	2.8	85.2	14.7	-
	5	4.5	80.9	23.4	-
	2.50	4.8	76.1	-	5.9
	1.25	10.2	65.9	-	12.6
	0.630	22.4	43.5	-	27.7
	0.315	21.2	22.2	-	26.3
	0.160	5.8	16.4	-	7.2
	0.080	2.5	13.9	-	3.1
	PAN	13.9	0.0	-	17.2
	Total	100.0		100.0	100.0

TABLE 3
Sieve Analysis of Fine and Coarse Aggregate
Faro Mine Remediation Project

Sample ID	Sieve Analysis				
	Sieve Size (mm)	Retained (%)	Passing (%)	Individual % Retained (split values)	
				5	-5
CH13-108-TP027_SOa	40	0.0	100.0	0.0	-
	28	4.2	95.8	9.8	-
	20	2.9	92.9	6.7	-
	14	5.7	87.2	13.3	-
	10	8.0	79.2	18.8	-
	5	22.0	57.2	51.3	-
	2.50	22.9	34.3	-	40.0
	1.25	18.9	15.4	-	33.0
	0.630	9.0	6.4	-	15.7
	0.315	2.9	3.5	-	5.0
	0.160	0.9	2.7	-	1.5
	0.080	0.4	2.2	-	0.8
	PAN	2.2	0.0	-	3.9
	Total	100.0		100.0	100.0
CH13-108-TP027A_SOa	80	0.0	100.0	0.0	-
	56	7.9	92.1	13.3	-
	40	9.6	82.5	16.1	-
	28	10.9	71.6	18.3	-
	20	8.9	62.7	14.9	-
	14	6.8	55.9	11.4	-
	10	6.0	49.9	10.1	-
	5	9.5	40.3	16.0	-
	2.50	6.2	34.1	-	15.4
	1.25	7.7	26.4	-	19.0
	0.630	6.5	20.0	-	16.1
	0.315	5.6	14.4	-	13.8
	0.160	4.0	10.4	-	9.9
	0.080	2.5	7.9	-	6.3
	PAN	7.9	0.0	-	19.6
	Total	100.0		100.0	100.0
CH13-108-TP027B_SOa	40	0.0	100.0	0.0	-
	28	6.4	93.6	14.4	-
	20	6.9	86.7	15.7	-
	14	8.1	78.6	18.2	-
	10	8.1	70.6	18.2	-
	5	14.8	55.8	33.4	-
	2.50	16.6	39.2	-	29.8
	1.25	16.7	22.5	-	30.0
	0.630	10.2	12.2	-	18.3
	0.315	4.1	8.1	-	7.3
	0.160	2.3	5.8	-	4.2
	0.080	1.6	4.2	-	2.9
	PAN	4.2	0.0	-	7.5
	Total	100.0		100.0	100.0

TABLE 3
Sieve Analysis of Fine and Coarse Aggregate
Faro Mine Remediation Project

Sample ID	Sieve Analysis				
	Sieve Size (mm)	Retained (%)	Passing (%)	Individual % Retained (split values)	
				5	-5
CH13-108-TP027C_SOa	56	0.0	100.0	0.0	-
	40	3.1	96.9	6.3	-
	28	16.2	80.8	33.2	-
	20	12.4	68.3	25.5	-
	14	6.5	61.8	13.3	-
	10	4.4	57.5	9.0	-
	5	6.2	51.3	12.6	-
	2.50	5.7	45.6	-	11.1
	1.25	5.6	40.0	-	10.9
	0.630	4.0	36.0	-	7.9
	0.315	3.7	32.3	-	7.1
	0.160	5.5	26.8	-	10.8
	0.080	5.8	21.0	-	11.2
	PAN	21.0	0.0	-	40.9
	Total	100.0		100.0	100.0
CH13-108-TP028_SOa	40	0.0	100.0	0.0	-
	28	3.9	96.1	17.6	-
	20	1.6	94.4	7.3	-
	14	4.3	90.2	19.2	-
	10	4.4	85.7	19.9	-
	5	8.0	77.7	36.0	-
	2.50	7.4	70.3	-	9.5
	1.25	10.4	59.8	-	13.4
	0.630	13.2	46.7	-	17.0
	0.315	14.8	31.8	-	19.1
	0.160	9.4	22.4	-	12.2
	0.080	5.2	17.2	-	6.7
	PAN	17.2	0.0	-	22.2
	Total	100.0		100.0	100.0

TABLE 4

Resistance to Degradation by Abrasion in the Micro-Deval Apparatus

Faro Mine Remediation Project

Sample ID	Fine/Coarse Aggregate	Grading	Loss at Conclusion of Test (%)
CH13-108-TP041_SOa	Fine	Fines, 5 x 0.08mm sieve fractions	12.7
	Coarse	Section 6.2 – 20 x 14, 14 x 10 mm sieve fractions	14.5
CH13-108-TP043_SOa	Fine	Fines, 5 x 0.08mm sieve fractions	16.8
	Coarse	Section 6.2 – 20 x 14, 14 x 10 mm sieve fractions	14.0
CH13-108-TP022_SOa	Fine	Fines, 5 x 0.08mm sieve fractions	17.5
	Coarse	Section 6.2 – 20 x 14, 14 x 10 mm sieve fractions	16.8
CH13-108-TP025_SOa	Fine	Fines, 5 x 0.08mm sieve fractions	16.8
	Coarse	Section 6.2 – 20 x 14, 14 x 10 mm sieve fractions	15.0
CH13-108-TP027A_SOa	Fine	Fines, 5 x 0.08mm sieve fractions	13.9
	Coarse	Section 6.2 – 20 x 14, 14 x 10 mm sieve fractions	14.6

TABLE 5
Specific Gravity and Absorption
Faro Mine Remediation Project

Sample ID	Aggregate or Size Fraction	Trial Number	Mass (g)	Relative Density (dry basis)	Relative Density (SSD basis)	Apparent Relative Density	Absorption (%)
CH13-108-TP041_SOa	Fine [a]	1	500.5	2.573	2.615	2.686	1.65
		2	500.6	2.577	2.622	2.700	1.77
		Average		2.575	2.619	2.693	1.71
	Coarse	1	4516.2	2.635	2.665	2.717	1.14
		2	4189.6	2.630	2.664	2.722	1.29
		Average	-	2.633	2.665	2.720	1.22
CH13-108-TP043_SOa	Fine [a]	1	500.0	2.434	2.493	2.585	2.40
		2	500.1	2.448	2.503	2.591	2.25
		Average	-	2.441	2.498	2.588	2.33
	Fine [b]	1	500.4	2.548	2.585	2.646	1.46
		2	500.4	2.545	2.582	2.643	1.46
		Average	-	2.547	2.584	2.695	1.46
CH13-108-TP022_SOa	< 20 mm	1	2731.5	2.673	2.705	2.754	1.13
		2	2932.1	2.671	2.702	2.757	1.16
		Average	-	2.672	2.704	2.756	1.15
	> 20mm	1	6964.9	2.713	2.732	2.767	0.73
	Fine [a]	1	500.9	2.570	2.614	2.688	1.71
		2	500.1	2.574	2.620	2.698	1.79
		Average	-	2.572	2.617	2.693	1.75
CH13-108-TP025_SOa	Fine [a]	1	500.8	2.550	2.593	2.666	1.71
		2	500.1	2.557	2.601	2.674	1.71
		Average	-	2.553	2.597	2.670	1.71
	Coarse	1	3873.2	2.656	2.701	2.782	1.71
		2	3587.5	2.647	2.694	2.779	1.79
		Average	-	2.651	2.698	2.780	1.75

TABLE 5
Specific Gravity and Absorption
Faro Mine Remediation Project

Sample ID	Aggregate or Size Fraction	Trial Number	Mass (g)	Relative Density (dry basis)	Relative Density (SSD basis)	Apparent Relative Density	Absorption (%)
CH13-108-TP027A_SOa	< 20 mm	1	2572.8	2.639	2.677	2.744	1.46
		2	2754.2	2.642	2.678	2.742	1.39
		Average	-	2.641	2.678	2.743	1.43
	> 20 mm	1	3546.0	2.682	2.704	2.743	0.82
		2	3866.4	2.688	2.711	2.750	0.83
		Average	-	2.685	2.708	2.747	0.83
	Fine [a]	1	500.7	2.600	2.632	2.688	1.25
		2	500.3	2.596	2.629	2.685	1.28
		Average	-	2.598	2.631	2.686	1.27

[a] Sample test condition: as received (unwashed)

[b] Sample test condition: washed

Notes:
< = less than
> = greater than
SSD = saturated surface dry

TABLE 6

Soundness by Use of Magnesium Sulphate

Faro Mine Remediation Project

Sample ID	Fine/Coarse Aggregate	Sieve Fraction (mm)	Original Grading (%)	Mass/Fraction Before Test (g)	Loss (%)	Weighted Loss (%)
CH13-108-TP041_SOa	Fine	5.0–2.5	8.0	100.0	12.1	1.0
		2.5–1.25	10.3	100.0	9.3	1.0
		1.25–0.630	10.6	100.0	9.9	1.0
		0.630–0.315	9.4	100.0	8.1	0.8
		< 0.315	61.7	100.0	0.0 [c]	0.0
					Weighted Average Loss	3.8
	Coarse	80 x 56	15.6	1960.8 [b]	0.1	0.0
		56 x 40				
		40 x 28	33.4	1504.3	2.9	1.0
		28 x 20				
		20 x 14	25.8	1000.7	9.0	2.3
		14 x 10				
		10 x 5	25.2	302.6	5.2	1.3
		Total	100.0	-	**Total**	4.6
CH13-108-TP043_SOa	Coarse	> 80 [a]	22.9	-	0.3	0.1
		80 x 56	31.2	3031.3	0.3	0.1
		56 x 40				
		40 x 28	19.3	1506.5	2.3	0.4
		28 x 20				
		20 x 14	13.9	1002.1	3.5	0.5
		14 x 10				
		10 x 5	12.7	300.5	5.5	0.7
		Total	100.0	-	**Total**	1.8
CH13-108-TP022_SOa	Fine	5.0–2.5	19.4	100.0	16.8	3.3
		2.5–1.25	17.2	100.0	13.3	2.3
		1.25–0.630	15.5	100.0	9.3	1.4
		0.630–0.315	12.3	100.0	7.9	1.0
		< 0.315	35.6	-	0.0 [c]	0.0
					Weighted Average Loss	8.0
	Coarse	80 x 56	29.6	3005.9	0.8	0.2
		56 x 40				
		40 x 28	47.2	1506.3	3.2	1.5
		28 x 20				
		20 x 14	16.2	1005.9	4.8	0.8
		14 x 10				
		10 x 5	7.0	304.0	6.1	0.4
		Total	100.0	-	**Total**	2.9

TABLE 6

Soundness by Use of Magnesium Sulphate

Faro Mine Remediation Project

Sample ID	Fine/Coarse Aggregate	Sieve Fraction (mm)	Original Grading (%)	Mass/Fraction Before Test (g)	Loss (%)	Weighted Loss (%)
CH13-108-TP025_SOa	Fine	5.0–2.5	17.6	100.0	17.3	3.0
		2.5–1.25	16.0	100.0	11.5	1.8
		1.25–0.630	18.0	100.0	9.2	1.7
		0.630–0.315	15.4	100.0	8.3	1.3
		< 0.315	33.0	-	0.0 [c]	0.0
					Weighted Average Loss	7.8
	Coarse	80 x 56	6.7	1131.9 [b]	2.5	0.2
		56 x 40				
		40 x 28	29.9	1501.2	1.2	0.4
		28 x 20				
		20 x 14	35.1	1000.7	4.9	1.7
		14 x 10				
		10 x 5	28.3	301.2	7.6	2.2
		Total	100.0	-	**Total**	4.4
CH13-108-TP027A_SOa	Fine	5.0–2.5	15.4	100.0	14.1	2.2
		2.5–1.25	19.0	100.0	8.7	1.7
		1.25–0.630	16.1	100.0	5.3	0.9
		0.630–0.315	13.8	100.0	3.1	0.4
		< 0.315	35.7	-	0.0 [c]	0.0
					Weighted Average Loss	5.2
	Coarse	80 x 56	29.4	3049.6	0.3	0.1
		56 x 40				
		40 x 28	33.1	1509.8	2.0	0.7
		28 x 20				
		20 x 14	21.5	1001.4	6.0	1.3
		14 x 10				
		10 x 5	16.0	302.0	6.1	1.0
		Total	100.0	-	**Total**	3.1

[a] The size fraction greater than 80 mm is not required for testing. The loss was taken from the next smaller sample size for weighted average calculation.

[b] Available sample on this size fraction was insufficient to meet the minimum testing mass requirement.

[c] Size fraction less than 0.315 mm are assumed to have a loss of 0.0% in accordance with the standard.

Notes:

< = less than

> = greater than

g = gram

TABLE 7

Petrographic Examination of Coarse Aggregate (greater than 5 mm)

Faro Mine Remediation Project

	Sample ID	CH13-108-TP041_SOa			CH13-108-TP043_SOa			CH13-108-TP022_SOa			CH13-108-TP025_SOa			CH13-108-TP027A_SOa		
	Petrographic Description/ Physical Quality	Percent by Mass	Multi-plier	PN Contribu-tion	Percent by Mass	Multi-plier	PN Contribu-tion	Percent by Mass	Multi-plier	PN Contribu-tion	Percent by Mass	Multi-plier	PN Contribu-tion	Percent by Mass	Multi-plier	PN Contribu-tion
Good	**Volcanic rock** – black, green, brown, porphyritic, dense, hard, strong	11.0	1	11.0	15.8	1	15.8	11.6	1	11.6	12.5	1	12.5	6.2	1	6.2
	Granite-granodiorite (medium-grained) – dense, hard, strong	23.9	1	23.9	8.0	1	8.0	14.7	1	14.7	7.2	1	7.2	20.0	1	20.0
	Granite-granodiorite (pegmatic) – hard, strong	7.5	1	7.5	4.6	1	4.6	9.4	1	9.4	4.8	1	4.8	12.3	1	12.3
	Gneiss – fine to coarse grained, banded, strong	9.7	1	9.7	6.0	1	6.0	2.3	1	2.3	3.7	1	3.7	1.5	1	1.5
	Schist – medium to coarse grained, foliated, strong	24.2	1	24.2	35.9	1	35.9	32.7	1	32.7	34.3	1	34.3	37.1	1	37.1
	Limestone – grey, brown, fine grained, dense strong	0.0	1	0.0	0.7	1	0.7	0.0	1	0.0	0.5	1	0.5	0.9	1	0.9
	Greywacke, lithic arenite – grey, brown, fine grained, hard strong	1.5	1	1.5	1.8	1	1.8	0.0	1	0.0	0.0	1	0.0	1.9	1	1.9
	Quartzite – white-yellow, fine to med. grained, dense, hard, strong	0.7	1	0.7	1.5	1	1.5	0.0	1	0.0	0.8	1	0.8	0.2	1	0.2
	Chert – black, grey, brown, veined, very dense, very hard, strong	2.4	1	2.4	2.9	1	2.9	1.6	1	1.6	6.4	1	6.4	3.1	1	3.1
	Subtotal	**80.9**	**-**	**80.9**	**77.2**	**-**	**77.2**	**72.3**	**-**	**72.3**	**70.2**	**-**	**70.2**	**83.2**	**-**	**83.2**
Good-Fair	**Schist** – flat/elongated, strong, unweathered	0.8	2	1.6	1.1	2	2.2	3.4	2	6.8	3.5	2	7.0	2.8	2	5.6
	Subtotal	**0.8**	**-**	**1.6**	**1.1**	**-**	**2.2**	**3.4**	**-**	**6.8**	**3.5**	**-**	**7.0**	**2.8**	**-**	**5.6**
Fair	**Volcanic rock** – weathered, oxidized, moderate strength	0.4	3	1.2	0.6	3	1.8	0.3	3	0.9	0.7	3	2.1	0.2	3	0.6
	Granite, medium-grained – weathered, oxidized, moderate strength, brittle	2.3	3	6.9	1.2	3	3.6	0.0	3	0.0	2.8	3	8.4	2.5	3	7.5
	Granite-granodiorite (pegmatic) – brittle	0.5	3	1.5	0.3	3	0.9	0.0	3	0.0	0.8	3	2.4	0.6	3	1.8
	Granite-granodiorite (medium-grained) – weathered, oxidized, moderate strength, brittle	0.0	3	0.0	0.0	3	0.0	3.6	3	10.8	0.0	3	0.0	0.0	3	0.0

TABLE 7

Petrographic Examination of Coarse Aggregate (greater than 5 mm)

Faro Mine Remediation Project

	Sample ID	CH13-108-TP041_SOa			CH13-108-TP043_SOa			CH13-108-TP022_SOa			CH13-108-TP025_SOa			CH13-108-TP027A_SOa		
	Petrographic Description/ Physical Quality	Percent by Mass	Multi-plier	PN Contribu-tion	Percent by Mass	Multi-plier	PN Contribu-tion	Percent by Mass	Multi-plier	PN Contribu-tion	Percent by Mass	Multi-plier	PN Contribu-tion	Percent by Mass	Multi-plier	PN Contribu-tion
	Gneiss – weathered, oxidized, moderate strength	1.6	3	4.8	0.4	3	1.2	1.2	3	3.6	0.3	3	0.9	0.2	3	0.6
	Schist – weathered, oxidized, pitted, mod. strength, flat/thin particles	10.1	3	30.3	12.6	3	37.8	14.8	3	44.4	17.0	3	51.0	9.2	3	27.6
	Limestone – moderate strength, medium hard	0.2	3	0.6	0.1	3	0.3	0.0	3	0.0	Trace	3	Trace	0.0	3	0.0
	Quartzite – brittle	0.0	3	0.0	0.0	3	0.0	0.0	3	0.0	0.0	3	0.0	0.3	3	0.9
	Oxidized, undifferentiated metamorphic rock – severely oxidized, stained orange, moderate strength, medium hard surfaces	0.5	3	1.5	0.3	3	0.9	0.4	3	1.2	0.9	3	2.7	0.1	3	0.3
	Encrusted particles – particles with calcareous, sandy encrustation covering >33% particle surface area	0.0	3	0.0	3.7	3	11.1	0.2	3	0.6	0.0	3	0.0	0.2	3	0.6
	Subtotal	**15.6**	**-**	**46.8**	**19.2**	**-**	**57.6**	**20.5**	**-**	**61.5**	**22.5**	**-**	**67.5**	**13.3**	**-**	**39.9**
Poor	**Schist** – flat/thin, fissile, weak, severely weathered	2.2	6	13.2	0.8	6	4.8	3.7	6	22.2	3.6	6	21.6	0.4	6	2.4
	Oxidized, undifferentiated metamorphic rock – friable, soft, weak	0.4	6	2.4	0.2	6	1.2	0.1	6	0.6	0.2	6	1.2	0.2	6	1.2
	Siltstone – soft, porous, weak	0.1	6	0.6	0.0	6	0.0	0.0	6	0.0	0.0	6	0.0	0.0	6	0.0
	Encrusted particles – particles with weak, calcareous, sandy encrustation making up 75% of the particle	0.0	6	0.0	1.1	6	6.6	0.0	6	0.0	0.0	6	0.0	0.1	6	0.6
	Subtotal	**2.7**	**-**	**16.2**	**2.1**	**-**	**12.6**	**3.8**	**-**	**22.8**	**3.8**	**-**	**22.8**	**0.7**	**-**	**4.2**
Del.	**Encrustation fragment/clay lump** – soft, weak, highly absorptive silty, sandy, clay lump	0.0	10	0.0	0.4	10	4.0	0.0	10	0.0	0.0	10	0.0	0.0	10	0.0
	Subtotal	**0.0**	**-**	**0.0**	**0.4**	**-**	**4.0**	**0.0**	**-**	**0.0**	**0.0**	**-**	**0.0**	**0.0**	**-**	**0.0**
TOTAL		**100.0**	**PN**	**145.5**	**100.0**	**PN**	**153.6**	**100.0**	**PN**	**163.4**	**100.0**	**PN**	**167.5**	**100.0**	**PN**	**132.9**

Notes:

> = greater than
PN = Petrographic Number

TABLE 8

Detection of Alkali–Silica Reactive Aggregate by Accelerated Expansion of Mortar Bars

Faro Mine Remediation Project

Sample ID	CH13-108-TP022_SOa	CH13-108-TP025_SOa	CH13-108-TP027A_SOa	CH13-108-TP041_SOa	CH13-108-TP043_SOa
Time (days)	Average Expansion (%)				
0	0.000	0.000	0.000	0.000	0.000
3	0.034	0.051	0.057	0.060	0.082
5	0.084	0.122	0.129	0.139	0.173
7	0.154	0.198	0.205	0.219	0.258
12	0.270	0.308	0.321	0.335	0.386
14	0.305	0.343	0.359	0.370	0.426
17	0.357	0.396	0.414	0.426	0.485
19	0.381	0.423	0.441	0.454	0.513
21	0.408	0.450	0.470	0.483	0.542
24	0.439	0.483	0.505	0.521	0.579
28	0.482	0.529	0.554	0.571	0.628

TABLE 9
Flat and Elongated Particles in Coarse Aggregate
Faro Mine Remediation Project

Sample ID	Particle Size (mm)	Mass of Test Sample (g)	Original Grading (% retained)	Flat (%)	Elongated (%)	Flat and Elongated (%)
CH13-108-TP041_SOa	80 x 56	-	3.6 [a]	0.0	0.0	0.0
	56 x 40	1158.9 [b]	12.0	0.0	0.0	0.0
	40 x 28	2209.0	15.8	0.0	0.0	6.3
	28 x 20	2844.9	17.6	1.2	0.0	5.4
	20 x 14	1122.0	13.2	1.1	0.0	5.7
	14 x 10	327.2	12.6	0.3	0.0	8.8
	10 x 5	153.0	25.2	1.0	0.0	5.9
			Weighted Average	0.6	0.0	5.3
CH13-108-TP043_SOa	> 80	1500.0 [b]	22.9	0.0	0.0	0.0
	80 x 56	1518.3 [b]	14.9	0.0	0.0	0.0
	56 x 40	1513.0 [b]	16.2	0.0	0.0	0.0
	40 x 28	4455.5	10.7	0.6	0.0	2.2
	28 x 20	-	8.6 [a]	0.0	0.0	2.2
	20 x 14	-	7.7 [a]	0.3	0.0	2.5
	14 x 10	-	6.2 [a]	0.3	0.0	2.5
	10 x 5	153.5	12.7	0.3	0.0	2.5
			Weighted Average	0.2	0.0	1.1
CH13-108-TP022_SOa	80 x 56	-	8.2 [a]	0.0	0.0	0.0
	56 x 40	3925.3	21.4	0.0	0.0	0.0
	40 x 28	4764.7	28.1	0.0	0.0	0.8
	28 x 20	3503.0	19.1	0.2	0.0	2.6
	20 x 14	1105.1	10.0	1.1	0.0	5.6
	14 x 10	-	6.2 [a]	1.1	0.0	5.6
	10 x 5	-	7.0 [a]	1.1	0.0	5.6
			Weighted Average	0.3	0.0	2.0
CH13-108-TP025_SOa	56 x 40	-	6.7 [a]	0.0	0.0	3.0
	40 x 28	2406.3	11.1	0.0	0.0	3.0
	28 x 20	2680.1	18.8	0.0	0.0	6.4
	20 x 14	1042.6	17.0	2.6	0.0	8.8
	14 x 10	788.8	18.1	2.2	0.0	14.1
	10 x 5	227.5	28.3	0.9	0.0	9.0
			Weighted Average	1.1	0.0	8.3
CH13-108-TP027A_SOa	80 x 56	1543.5 [b]	13.3	0.0	0.0	0.0
	56 x 40	1506.1 [b]	16.1	0.0	0.0	0.0
	40 x 28	5628.0	18.3	0.0	0.0	1.5
	28 x 20	3935.8	14.9	0.7	0.0	2.4
	20 x 14	874.4	11.4	0.0	0.0	2.0
	14 x 10	426.7	10.1	1.3	0.0	5.4
	10 x 5	159.6	16.0	1.4	0.0	7.7
			Weighted Average	0.5	0.0	2.6

[a] The size fractions less than 10% do not need to be tested. The percentages were taken from the next smaller size for weighted average calculation.
[b]Available sample on this size fraction was insufficient to meet the minimum testing mass requirement.

Note:
> = greater than

TABLE 10
Organic Impurities in Fine Aggregate for Concrete
Faro Mine Remediation Project

Sample ID	Colour Plate Value
CH13-108-TP041_SOa	3
CH13-108-TP043_SOa	Lighter than No. 1
CH13-108-TP022_SOa	2
CH13-108-TP025_SOa	4
CH13-108-TP027A_SOa	Lighter than No. 1

Note:
Colour plate values range from No. 1 to 5, with No. 1 being the lightest.

TABLE 11
Metals and General Chemistry
Faro Mine Remediation Project

				Location	CH13-108-BH001		CH13-108-BH002		CH13-108-BH003			CH13-108-BH004			CH13-108-SS006	CH13-108-TP040	CH13-108-TP041	CH13-108-TP043
				Sample ID	CH13-108-BH001_SOa	CH13-108-BH001_SOb	CH13-108-BH002_SOa	CH13-108-BH002_SOb	CH13-108-BH003_SOa	CH13-108-BH003_SOb	CH13-108-BH903_SOb	CH13-108-BH004_SOa	CH13-108-BH004_SOb	CH13-108-BH904_SOb	CH13-108-SS006_SOa	CH13-108-TP040_SOa	CH13-108-TP041_SOa	CH13-108-TP043_SOa
				Sampling Depth (feet)	0–0.3	0.5–1	0–0.3	0.5–1	0–0.3	0.4–0.5	0.4–0.5	0–0.3	0.2–0.3	0.2–0.3	0–0.5	4–5	4–5	4–5
				Sampling Date	8/21/2013	8/22/2013	8/21/2013	8/22/2013	8/21/2013	8/28/2013	8/28/2013	8/21/2013	8/28/2013	8/28/2013	8/22/2013	8/13/2013	8/13/2013	8/13/2013
Analyte	**Screening Level**	**GARD**	**MEND**															
Aluminum	mg/kg	852,000	823,000		**19,500**	**16,700**	**19,000**	**10,200**	**34,000**	**21,500**	**22,600**	**18,200**	**23,300**	**20,100**	**19,100**	**12,200**	**9,000**	**9,010**
Antimony	mg/kg	60	2		**0.39**	**0.76**	**0.45**	**0.25**	**0.23**	**0.54**	**0.57**	**0.43**	**0.59**	**0.53**	**0.53**	**0.66**	**0.65**	**0.38**
Arsenic	mg/kg	72	18		**7.75**	**21.6**	**11**	**3.84**	**6.15**	**9.41**	**10.5**	**9.96**	**12.9**	**13.8**	**16.4**	**8.95**	**7.32**	**5.76**
Barium	mg/kg	6,000	4,250		**198**	**155**	**176**	**159**	**377**	**153**	**177**	**148**	**156**	**155**	**108**	**130**	**96.4**	**73.5**
Beryllium	mg/kg	72	28		**0.61**	**0.59**	**0.54**	**0.26**	**0.93**	**0.7**	**0.75**	**0.71**	**0.73**	**0.64**	**0.81**	**0.57**	**0.44**	**0.35**
Bismuth	mg/kg	-	0.09		**0.3**	**0.27**	**0.24**	< 0.2	< 0.2	**0.22**	**0.24**	**0.25**	**0.2**	**0.21**	**0.24**	**0.45**	**0.26**	**0.22**
Boron	mg/kg	-	-		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Cadmium	mg/kg	4.2	1.5		**0.144**	**0.245**	**0.156**	**0.124**	**0.083**	**0.184**	**0.223**	**0.258**	**0.229**	**0.27**	**0.274**	**0.422**	**0.237**	**0.168**
Calcium	mg/kg	180,000	415,000		**5,100**	**6,180**	**7,360**	**9,990**	**17,400**	**6,360**	**6,230**	**20,800**	**5,590**	**5,040**	**2,310**	**14,700**	**12400**	**5,500**
Chromium	mg/kg	840	1,020		**48.4**	**37.7**	**48.3**	**25.9**	**45.3**	**65.6**	**73.2**	**46.3**	**52.2**	**50.7**	**39.6**	**37.2**	**19.5**	**41.9**
Cobalt	mg/kg	96	250		**10.4**	**14.7**	**13.2**	**6.14**	**12.9**	**14**	**16.5**	**13.9**	**14.4**	**13.6**	**13.2**	**11.9**	**7.68**	**8.16**
Copper	mg/kg	360	600		**16.7**	**25.1**	**27**	**18.9**	**17.1**	**28.4**	**31.6**	**29.2**	**25.4**	**26.3**	**29.9**	**27.7**	**15.7**	**15.2**
Inorganic Carbon (as CACO3 Equivalent)	%	-	-		< 0.8	< 0.8	**2.52**	**0.97**	**2.92**	**0.87**	**0.89**	**3.28**	**1**	**0.88**	< 0.8	**1.14**	**3.7**	**4**
Iron	mg/kg	480,000	563,000		**28,000**	**49,100**	**28,500**	**13,400**	**32,000**	**31,000**	**34,000**	**32,000**	**30,500**	**29,000**	**29,200**	**24,500**	**19,400**	**18,300**
Lead	mg/kg	420	140		**16.5**	**18.7**	**16**	**8.71**	**8.6**	**12.6**	**14.7**	**18.4**	**26.2**	**30.8**	**23.7**	**11.4**	**9.57**	**7.72**
Lithium	mg/kg	300	200		**34.1**	**23.3**	**28.5**	**10.8**	**45.9**	**34.4**	**35.2**	**31.6**	**35**	**28.1**	**27.9**	**23**	**22.3**	**21.1**
Magnesium	mg/kg	60,000	200,000		**8,520**	**7,750**	**9,820**	**4,530**	**17,900**	**11,700**	**13,300**	**9,650**	**11,600**	**9,760**	**8,140**	**7,090**	**4,560**	**4,700**
Manganese	mg/kg	12,000	9,500		**394**	**340**	**474**	**212**	**402**	**410**	**490**	**420**	**442**	**452**	**328**	**369**	**252**	**200**
Mercury	mg/kg	0.72	-		**0.0191**	**0.0261**	**0.0212**	**0.0279**	**0.0065**	**0.0156**	**0.0187**	**0.0236**	**0.0146**	**0.0201**	**0.0143**	**0.035**	**0.0124**	**0.0128**
Moisture	%	-	-		**18.2**	**21.1**	**14.6**	**50.7**	**10.6**	**11.9**	**11**	**13.1**	**8.56**	**9.35**	**7.02**	**3.4**	**4.55**	**7.77**
Molybdenum	mg/kg	24	12		**2.12**	**0.86**	**0.82**	< 0.5	< 0.5	**0.75**	**0.82**	**1.74**	**0.82**	**0.68**	**0.93**	**1.5**	**0.78**	< 0.5
Nickel	mg/kg	600	840		**31.7**	**33.3**	**35.4**	**20.2**	**32.6**	**48.2**	**56.8**	**41.5**	**43.7**	**41.9**	**40.4**	**42.4**	**21.3**	**25.8**
Organic Matter	%	-	-		**0.95**	**4.37**	**0.97**	**12.2**	**1.1**	< 0.7	< 0.7	< 0.7	**0.78**	**0.9**	**0.72**	< 0.7	< 0.7	< 0.7
Potassium	mg/kg	168,000	200,000		**2,220**	**760**	**1,490**	**740**	**5,950**	**2,550**	**2,560**	**2,610**	**1,940**	**1,730**	**830**	**2,200**	**1,990**	**1,680**
Selenium	mg/kg	4.8	0.5		< 0.2	**0.28**	**0.25**	**0.24**	< 0.2	< 0.2	< 0.2	**0.29**	< 0.2	< 0.2	**0.25**	**0.35**	< 0.2	< 0.2
Silver	mg/kg	-	0.75		**0.1**	**0.12**	< 0.1	**0.1**	< 0.1	< 0.1	< 0.1	**0.1**	**0.11**	**0.1**	**0.1**	**0.13**	**0.11**	**0.1**
Sodium	mg/kg	60,000	236,000		**570**	**330**	**450**	**450**	**1480**	**540**	**490**	**570**	**580**	**490**	**210**	**220**	**170**	**150**
Strontium	mg/kg	3,000	37,00		**37**	**37.3**	**40.2**	**48.9**	**66**	**40.4**	**40.3**	**85.6**	**42.4**	**39.9**	**22.7**	**63.6**	**65.2**	**35.3**
Thallium	mg/kg	108	96		**0.205**	**0.141**	**0.15**	**0.074**	**0.338**	**0.307**	**0.304**	**0.2**	**0.219**	**0.22**	**0.182**	**0.188**	**0.152**	**0.131**
Tin	mg/kg	48	23		< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Titanium	mg/kg	-	56,500		**766**	**301**	**496**	**219**	**703**	**558**	**550**	**452**	**504**	**423**	**391**	**420**	**397**	**367**

TABLE 11

Metals and General Chemistry

Faro Mine Remediation Project

			Location	CH13-108-BH001		CH13-108-BH002		CH13-108-BH003			CH13-108-BH004			CH13-108-SS006	CH13-108-TP040	CH13-108-TP041	CH13-108-TP043
			Sample ID	CH13-108-BH001_SOa	CH13-108-BH001_SOb	CH13-108-BH002_SOa	CH13-108-BH002_SOb	CH13-108-BH003_SOa	CH13-108-BH003_SOb	CH13-108-BH903_SOb	CH13-108-BH004_SOa	CH13-108-BH004_SOb	CH13-108-BH904_SOb	CH13-108-SS006_SOa	CH13-108-TP040_SOa	CH13-108-TP041_SOa	CH13-108-TP043_SOa
			Sampling Depth (feet)	0–0.3	0.5–1	0–0.3	0.5–1	0–0.3	0.4–0.5	0.4–0.5	0–0.3	0.2–0.3	0.2–0.3	0–0.5	4–5	4–5	4–5
			Sampling Date	8/21/2013	8/22/2013	8/21/2013	8/22/2013	8/21/2013	8/28/2013	8/28/2013	8/21/2013	8/28/2013	8/28/2013	8/22/2013	8/13/2013	8/13/2013	8/13/2013
Analyte	**Screening Level**	**GARD**	**MEND**														
Total Carbon by LECO	%	-	-	NA	**1.6**	NA	**5.3**	NA	**0.5**	**0.4**	NA	**0.4**	**0.6**	**0.6**	NA	NA	NA
Total Inorganic Carbon	%	-	-	< 0.1	< 0.1	**0.3**	**0.15**	**0.35**	< 0.1	< 0.1	**0.39**	< 0.1	< 0.1	< 0.1	**0.14**	**0.44**	**0.48**
Total Nitrogen by LECO	%	-	-	NA	**0.097**	NA	**0.232**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon	%	-	-	**0.6**	**2.5**	**0.6**	**7.1**	**0.6**	**0.4**	**0.27**	**0.4**	**0.5**	**0.51 J**	**0.6**	< 0.4	< 0.4	< 0.4
Total Phosphorus	mg/kg	800	10,500	**478**	**679**	**610**	**470**	**397**	**646**	**618**	**726**	**525**	**668**	**453**	**701**	**586**	**599**
Uranium	mg/kg	24	27	**0.936**	**1.18**	**0.965**	**0.736**	**1.41**	**0.771**	**0.756**	**0.933**	**0.665**	**0.636**	**0.843**	**1.02**	**0.864**	**1.23**
Vanadium	mg/kg	1,080	1,200	**45.5**	**40.5**	**49.2**	**23.5**	**38.5**	**44.5**	**49.9**	**41.1**	**43.8**	**42.8**	**36.3**	**35.8**	**25.8**	**27.9**
Zinc	mg/kg	1,080	700	**66.9**	**75.8**	**57.7**	**35.4**	**43.5**	**67.2**	**71.2**	**70.8**	**97.2**	**106**	**77.4**	**68.3**	**51.9**	**46**

Notes:

NA = Not analyzed

< = less than

J = analyte was present but the reported value may not be accurate or precise

U = analyte was analyzed for but not detected at the specified detection limit

Bold indicates the analyte was detected

Shading indicates the result exceeded the MEND criteria

TABLE 12
Acid–Base Accounting
Faro Mine Remediation Project

	Location	CH13-108-BH001		CH13-108-BH002		CH13-108-BH003			CH13-108-BH004			CH13-108-SS006	CH13-108-TP040	CH13-108-TP041	CH13-108-TP043
	Sample ID	CH13-108-BH001_SOa	CH13-108-BH001_SOb	CH13-108-BH002_SOa	CH13-108-BH002_SOb	CH13-108-BH003_SOa	CH13-108-BH003_SOb	CH13-108-BH903_SOb	CH13-108-BH004_SOa	CH13-108-BH004_SOb	CH13-108-BH904_SOb	CH13-108-SS006_SOa	CH13-108-TP040_SOa	CH13-108-TP041_SOa	CH13-108-TP043_SOa
	Sampling Depth (feet)	0–0.3	0.5–1	0–0.3	0.5–1	0–0.3	0.4–0.5	0.4–0.5	0–0.3	0.2–0.3	0.2–0.3	0–0.5	4–5	4–5	4–5
Analyte	**Sample Date**	8/21/2013	8/22/2013	8/21/2013	8/22/2013	8/21/2013	8/28/2013	8/28/2013	8/21/2013	8/28/2013	8/28/2013	8/22/2013	8/13/2013	8/13/2013	8/13/2013
Barium	%	**0.0198**	**0.0155**	**0.0176**	**0.0159**	**0.0377**	**0.0153**	**0.0177**	**0.0148**	**0.0156**	**0.0155**	**0.0108**	**0.013**	**0.00964**	**0.00735**
Lead	%	**0.00165**	**0.00187**	**0.0016**	**0.000871**	**0.00086**	**0.00126**	**0.00147**	**0.00184**	**0.00262**	**0.00308**	**0.00237**	**0.00114**	**0.000957**	**0.000772**
Zinc	%	**0.00669**	**0.00758**	**0.00577**	**0.00354**	**0.00435**	**0.00672**	**0.00712**	**0.00708**	**0.00972**	**0.0106**	**0.00774**	**0.00683**	**0.00519**	**0.0046**
Sulphur	%	0.025	**0.06**	0.025	**0.17**	0.025	0.025	0.025	0.025	0.025	0.025	0.025	**0.1**	0.025	**0.07**
NP (as CaCO3 Eq.)	T CaCO3/1000 T	**9**	**10**	**18**	**15**	**48**	**10**	**15**	**46**	**8**	**12**	**3**	**19**	**28**	**42**
Sulphate, Acid Soluble	%	**0.01**	**0.02**	**0.01**	**0.01**	**0.01**	< 0.01	**0.01**	**0.01**	**0.01**	< 0.01	**0.02**	< 0.01	< 0.01	< 0.01
Sulphide	%	**0.01**	**0.03**	**0.01**	**0.15**	**0.00**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.00**	**0.09**	**0.01**	**0.06**
AP	-	0.20	1.00	0.23	4.82	0.10	0.39	0.21	0.23	0.18	0.32	-0.06	2.76	0.46	1.90
NP:AP	-	44.70	9.98	77.22	3.11	482.37	25.34	70.68	196.60	43.64	36.97	-50.34	6.90	60.30	22.12
NNP	-	8.80	9.00	17.77	10.18	47.90	9.61	14.79	45.77	7.82	11.68	3.06	16.24	27.54	40.10
Paste pH	pH Units	**6.5**	**6.7**	**7.39**	**6.48**	**7.62**	**7.01**	**7.53**	**7.78**	**6.32**	**6.25**	**5.88**	**7.54**	**7.75**	**7.56**
pH (1:2 soil:water)	pH Units	**7.11**	**6.93**	**7.62**	**6.33**	**8.45**	**7.84**	**7.57**	**8.39**	**6.61**	**6.3**	**6.17**	**8.44**	**8.67**	**8.74**

Notes:

<	=	less than
AP	=	acid production
$CaCO_3$ Eq	=	calcium carbonate equivalent
J	=	analyte was present but the reported value may not be accurate or precise.
NA	=	not analyzed
NNP	=	net neutralisation potential
NP	=	Neutralisation potential
T $CaCO_3$/1000 T	=	tonnes calcium carbonate per 1000 tonnes of material
U	=	Analyte was analyzed for but not detected at the specified detection limit.

Bold indicates the analyte was detected

TABLE 13
Summary of Acid–Base Accounting
Faro Mine Remediation Project

Area		Sulphide (%), calculated	AP calculated	NP:AP	NNP
Rose Creek Haul Road Borrow Area	MIN	0.00	0.10	3.11	7.82
	MAX	0.15	4.82	482.37	47.90
	AVE	0.02	0.77	99.06	18.33
	MEDIAN	0.01	0.23	44.17	10.93
	COUNT	10.00	10.00	10.00	10.00
Haul Road Borrow	MIN	0.01	0.46	6.90	16.24
	MAX	0.09	2.76	60.30	40.10
	AVE	0.05	1.71	29.77	27.96
	MEDIAN	0.06	1.90	22.12	27.54
	COUNT	3.00	3.00	3.00	3.00

TABLE 14

Leachable Constituents

Faro Mine Remediation Project

		Location	CH13-108-BH001	CH13-108-BH002	CH13-108-TP040
		Sample ID	CH13-108-BH001_SOb	CH13-108-BH002_SOb	CH13-108-TP040_SOa
		Sampling Depth (feet)	0.5–1	0.5–1	4–5
		Sampling Date	8/22/2013	8/22/2013	8/13/2013
Analyte	**Units**	**CCME**			
Acidity	mg/L	-	**8.4**	**7.7**	< 1
Alkalinity, Total	mg/L	-	**63.5**	**45.9**	**54.6**
Aluminum	mg/L	0.005 to 0.1 [a]	**3.16**	**3.71**	**0.301**
Antimony	mg/L	-	**0.00178**	**0.00029**	**0.00128**
Arsenic	mg/L	0.005	**0.0258**	**0.0043**	**0.0036**
Barium	mg/L	-	**0.114**	**0.114**	**0.0171**
Beryllium	mg/L	-	< 0.0005	< 0.0005	< 0.0005
Boron	mg/L	1.5	< 0.01	< 0.01	**0.016**
Cadmium	mg/L	Variable [b]	**0.000234**	**0.000054**	< 0.00005
Calcium	mg/L	-	**22.9**	**19.4**	**13.4**
Chromium	mg/L	0.0089	**0.00727**	**0.00327**	< 0.0005
Cobalt	mg/L	-	**0.00882**	**0.00202**	< 0.0001
Copper	mg/L	-	**0.0209**	**0.0132**	< 0.001
Iron	mg/L	0.3	**63.2**	**4.48**	**0.331**
Lead	mg/L	0.001	**0.0293**	**0.00685**	**0.00055**
Lithium	mg/L	-	< 0.005	< 0.005	**0.009**
Magnesium	mg/L	-	**4.53**	**2.44**	**1.35**
Manganese	mg/L	-	**0.547**	**0.197**	**0.00401**
Mercury	mg/L	2.60E-05	< 0.00005	< 0.00005	< 0.00005
Molybdenum	mg/L	0.073	**0.00173**	**0.00064**	**0.00346**
Nickel	mg/L	0.025	**0.01**	**0.00619**	< 0.0005
ORP Leachable	mV	-	**488**	**485**	**315**
pH	pH Units	-	**6.73**	**6.26**	**8.91**
Potassium	mg/L	-	**2.1**	**2.4**	**6.7**
Selenium	mg/L	0.001	< 0.0005	< 0.0005	< 0.0005
Silicon	mg/L	-	**13.9**	**13.3**	**3.92**
Silver	mg/L	0.0001	**0.000163**	**0.000169**	< 0.00005
Sodium	mg/L	-	< 2	< 2	**3.7**
Specific Conductance	µS/cm	-	**124**	**94.7**	**105**
Strontium	mg/L	-	**0.103**	**0.0784**	**0.0475**
Sulphate	mg/L		**8.4**	**2.61**	**2.03**
Sulphur	mg/L	-	**1.9**	**1.92**	**0.69**
Thallium	mg/L	0.0008	< 0.0001	< 0.0001	< 0.0001
Titanium	mg/L	-	**0.143**	**0.091**	< 0.01
Uranium	mg/L	0.015	**0.000769**	**0.000251**	**0.00147**
Vanadium	mg/L	-	**0.0243**	**0.0089**	**0.0035**
Zinc	mg/L	0.03	**0.023**	**0.012**	< 0.01

[a] CCME guideline is pH dependent; 0.005 mg/L if pH < 6.5, 0.1 mg/L if pH ≥ 6.5

[b] CCME guideline is hardness dependent; cadmium concentration = $10^{0.86[\log10(\text{hardness})]-3.2}$ / 1000 mg/L

Notes:

-- = no guideline

CCME = Canadian Council of the Ministers of the Environment,

J = analyte was present but the reported value may not be accurate or precise.

U = analyte was analyzed for but not detected at the specified detection limit.

pH in pH Units

Bold indicates the analyte was detected

Shading indicates the result exceeded screening criteria

TABLE 15
Soil Fertility Analysis
Faro Mine Remediation Project

Analyte	Screening Level	Expected Range	Screening	Location	CH13-108-BH001_	CH13-108-BH002	CH13-108-BH003		CH13-108-BH004	
				Sample ID	CH13-108-BH001_SOb	CH13-108-BH002_SOb	CH13-108-BH003_SOb	CH13-108-BH903_SOb	CH13-108-BH004_SOb	CH13-108-BH904_SOb
				Sampling Depth (feet)	0.5–1	0.5–1	0.4–0.5	0.4–0.5	0.2–0.3	0.2–0.3
				Sampling Date	8/22/2013	8/22/2013	8/28/2013	8/28/2013	8/28/2013	8/28/2013
				Sub Area	Rose Creek Haul Road	Rose Creek Haul Road	Rose Creek Haul Road	Rose Creek Haul Road	Rose Creek Haul Road	Rose Creek Haul Road
Nutrients										
Ammonium-N, Available (DTPA)	mg/kg	0-100	-		**1.5**	**3.1**	NA	NA	NA	NA
Nitrate-N, Available (DTPA)	mg/kg	0-3	<15		< 2	< 4	NA	NA	NA	NA
Phosphate-P, Available (Mehlich 3)	mg/kg	1-30	<10		< 2	< 2	**2.4**	**1.6**	< 2	**5**
Sulphate-S, Available (DTPA)	mg/kg	3-60	-		**3.7**	**5.8**	< 3	< 3	< 3	**3.2**
Nitrogen, Total	%	0-1	-		**0.097**	**0.232**	NA	NA	NA	NA
Phosphorus, Total	mg/kg	0-2000	-		**679**	**470**	**646**	**618**	**525**	**668**
Boron, Available (DTPA)	mg/kg	0.1-5	<0.3; >1		**0.24**	**0.65**	< 0.2	< 0.2	< 0.2	< 0.2
Copper, Available (DTPA)	mg/kg	1-5	-		**5.72**	**2.71**	**0.88**	**0.85**	**0.84**	**0.88**
Iron, Available (DTPA)	mg/kg	5-50	-		**164**	**197**	**22.6**	**19.4**	**41.4**	**51.7**
Manganese, Available (DTPA)	mg/kg	1-50	-		**4.18**	**4.07**	**4.33**	**4.38**	**3.34**	**4.09**
Zinc, Available (DTPA)	mg/kg	1-10	-		**1.11**	**5.83**	**0.25**	**0.27**	**10.2**	**13.7**
Exchangeable Cations										
Cation Exchange Capacity	meq/100g	4-30	<10		**14.1**	**24.5**	**7.59**	**7.4**	**6.15**	**5.7**
Magnesium, NH_4OAc	% CEC	-	-		**13**	**6**	**9**	**9**	**9**	**9**
Potassium, NH_4OAc	% CEC	-	-		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Sodium, NH_4OAc	% CEC	-	-		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Calcium, NH_4OAc	% CEC	-	-		**70**	**78**	**107**	**107**	**76**	**85**
Exchangeable Sodium Percentage (ESP)	%	0-50	>5		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Saturated Paste Extractables										
Salinity	µS/cm	100-2000	1000-2000; > 2000		**140**	**100**	**160**	**150**	**150**	**210**
pH	pH Units	2–8.5	< 5.5; > 7.5		**6.82**	**6.25**	**7.42**	**7.48**	**6.48**	**6.49**
Saturation	%	-	-		**43.5**	**93.6**	**24.2**	**28.3**	**26.9**	**29.4**
Sodium Adsorption Ratio	SAR	0.1-50	>3		**0.24**	**0.3**	**0.2**	< 0.2	< 0.2	**0.21**
Calcium	mg/L	-	-		**20.9**	**16.3**	**24.5**	**24.4**	**19.6**	**28.9**
Chloride	mg/L	-	-		**7.8**	**6.2**	**5.6**	**5.9**	**4.8 J**	**11.6 J**
Magnesium	mg/L	-	-		**5**	**2.6**	**7.3**	**8.2**	**5**	**5.9**
Potassium	mg/L	-	-		**2.8**	**3.7**	**8**	**9.8**	**5**	**5**
Sodium	mg/L	-	-		**4.7**	**5**	**4.3**	< 4	< 4	**4.7**
Sulphur (As SO_4)	mg/L	-	-		**28.2**	**20.3**	**16.3**	**12**	**19.4**	**28.5**
Carbon Composition										
Inorganic Carbon (as $CaCO_3$ Equivalent)	%	-	-		< 0.8	**0.97**	**0.87**	**0.89**	**1**	**0.88**
Organic Matter	%	0-5	-		**4.37**	**12.2**	< 0.7	< 0.7	**0.78**	**0.9**
Total Carbon (Leco)	%	0-2.5	-		**1.6**	**5.3**	**0.5**	**0.4**	**0.4**	**0.6**
Total Inorganic Carbon	%	-	-		< 0.1	**0.15**	< 0.1	< 0.1	< 0.1	< 0.1
Total organic carbon	%	0.1-5	-		**2.5**	**7.1**	**0.4**	**0.27**	**0.5**	**0.51 J**

TABLE 15
Soil Fertility Analysis
Faro Mine Remediation Project

			Location	CH13-108-BH001_	CH13-108-BH002	CH13-108-BH003		CH13-108-BH004	
			Sample ID	CH13-108-BH001_SOb	CH13-108-BH002_SOb	CH13-108-BH003_SOb	CH13-108-BH903_SOb	CH13-108-BH004_SOb	CH13-108-BH904_SOb
			Sampling Depth (feet)	0.5–1	0.5–1	0.4–0.5	0.4–0.5	0.2–0.3	0.2–0.3
			Sampling Date	8/22/2013	8/22/2013	8/28/2013	8/28/2013	8/28/2013	8/28/2013
			Sub Area	Rose Creek Haul Road	Rose Creek Haul Road	Rose Creek Haul Road	Rose Creek Haul Road	Rose Creek Haul Road	Rose Creek Haul Road
Analyte	**Screening Level**	**Expected Range**	**Screening**						
Other									
pH (1:2 $CaCl_2$)	pH Units	2-8.5	<5.5; >7.5	**6.37**	**5.75**	**6.8**	**6.68**	**5.85**	**5.82**
Paste pH	pH Units	2-8.5	<5.5; >7.5	**6.7**	**6.48**	**7.01**	**7.53**	**6.32**	**6.25**
pH (1:2 soil:water)	pH Units	2-8.5	<5.5; >7.5	**6.93**	**6.33**	**7.84**	**7.57**	**6.61**	**6.3**

Notes:

Dark shading indicates the results were outside of the expected range.

Light shading indicated the result exceeded the screening criteria.

TABLE 16

Summary of Soil Fertility Analysis

Faro Mine Remediation Project

Analyte	Screening Level	Expected Range	Screening	MIN	MAX	Median
Nutrients						
Ammonium-N, Available (DTPA)	mg/kg	0-100	-	1.5	3.1	2.3
Nitrate-N, Available (DTPA)	mg/kg	0-3	<15	NA	NA	NA
Phosphate-P, Available (Mehlich 3)	mg/kg	1-30	<10	1	5	1.3
Sulphate-S, Available (DTPA)	mg/kg	3-60	-	1.5	5.8	2.35
Nitrogen, Total	%	0-1	-	0.097	0.232	0.1645
Phosphorus, Total	mg/kg	0-2000	-	470	679	632
Boron, Available (DTPA)	mg/kg	0.1-5	<0.3; >1	0.1	0.65	0.1
Copper, Available (DTPA)	mg/kg	1-5	-	0.84	5.72	0.88
Iron, Available (DTPA)	mg/kg	5-50	-	19.4	197	46.55
Manganese, Available (DTPA)	mg/kg	1-50	-	3.34	4.38	4.135
Zinc, Available (DTPA)	mg/kg	1-10	-	0.25	13.7	3.47
Exchangeable Cations						
Cation Exchange Capacity	meq/100g	4-30	<10	5.7	24.5	7.495
Magnesium, NH4OAc	% CEC	-	-	0.59	2.66	0.66
Potassium, NH4OAc	% CEC	-	-	NA	NA	NA
Sodium, NH4OAc	% CEC	-	-	NA	NA	NA
Calcium, NH4OAc	% CEC	-	-	70	107	82
Magnesium, NH4OAc	meq/100g			0.5	1.86	0.64
Potassium, NH4OAc	meq/100g			NA	NA	NA
Sodium, NH4OAc	meq/100g			NA	NA	NA
Calcium, NH4OAc	meq/100g			4.68	19.2	8
Exchangeable Sodium Percentage (ESP)	%	0-50	>5	NA	NA	NA
Saturated Paste Extractables						
Conductivity	µS/cm	100-2000	1000-2000 ; > 2000	100	210	150
pH	pH Units	2–8.5	< 5.5; > 7.5	6.25	7.48	6.655
Saturation	%	-	-	**43.5**	93.6	24.2
Sodium Adsorption Ratio (SAR)	SAR	0.1-50	>3	0.1	0.3	0.205
Calcium	mg/L	-	-	16.3	28.9	22.65
Chloride	mg/L	-	-	4.8	11.6	6.05
Magnesium	mg/L	-	-	2.6	8.2	5.45
Potassium	mg/L	-	-	2.8	9.8	5
Sodium	mg/L	-	-	2	5	4.5
Sulphur (As SO_4)	mg/L	-	-	12	28.5	19.85

TABLE 16

Summary of Soil Fertility Analysis

Faro Mine Remediation Project

Analyte	Screening Level	Expected Range	Screening	MIN	MAX	Median
Carbon Composition						
Organic Matter	%	-	-	0.35	12.2	0.84
Total carbon (Leco)	%	0-5	-	0.4	5.3	0.55
Total Inorganic Carbon	%	0-2.5	-	0.05	0.15	0.05
Total organic carbon	%	-	-	0.27	7.1	0.505
Inorganic Carbon (as $CaCO_3$ Equivalent)	%	0.1-5	-	0.4	1	0.885
Other						
pH (1:2 $CaCl_2$)	pH Units	2-8.5	<5.5; >7.5	5.75	6.8	6.11
Paste pH	pH Units	2-8.5	<5.5; >7.5	6.25	7.53	6.59
pH (1:2 soil:water)	pH Units	2-8.5	<5.5; >7.5	6.3	7.84	6.77

Notes:

< = less than

> = greater than

% $CaCO_3$ = percent calcium carbonate equivalent

% CEC = expressed as a percent of the total Cation Exchange Capacity

dS/cm = deciSiemans per metre

DTPA = 0.005 M diethylenetriaminepentaaceticacid extracted

J = Analyte was present but the reported value may not be accurate or precise.

Leco = Leco Combustion

meq/100 g = milliequivalents per 100 gram

mg/kg = milligrams per kilogram

mg/L = milligrams per liter

mV = Millivolts

NA = Not analyzed

ND = Parameter was not detected

NH_4OAc = 1 Normal (N) ammonium acetate extractable

ppm = parts per million

SAR = Sodium Adsorption Ratio

SO_4 = sulphate

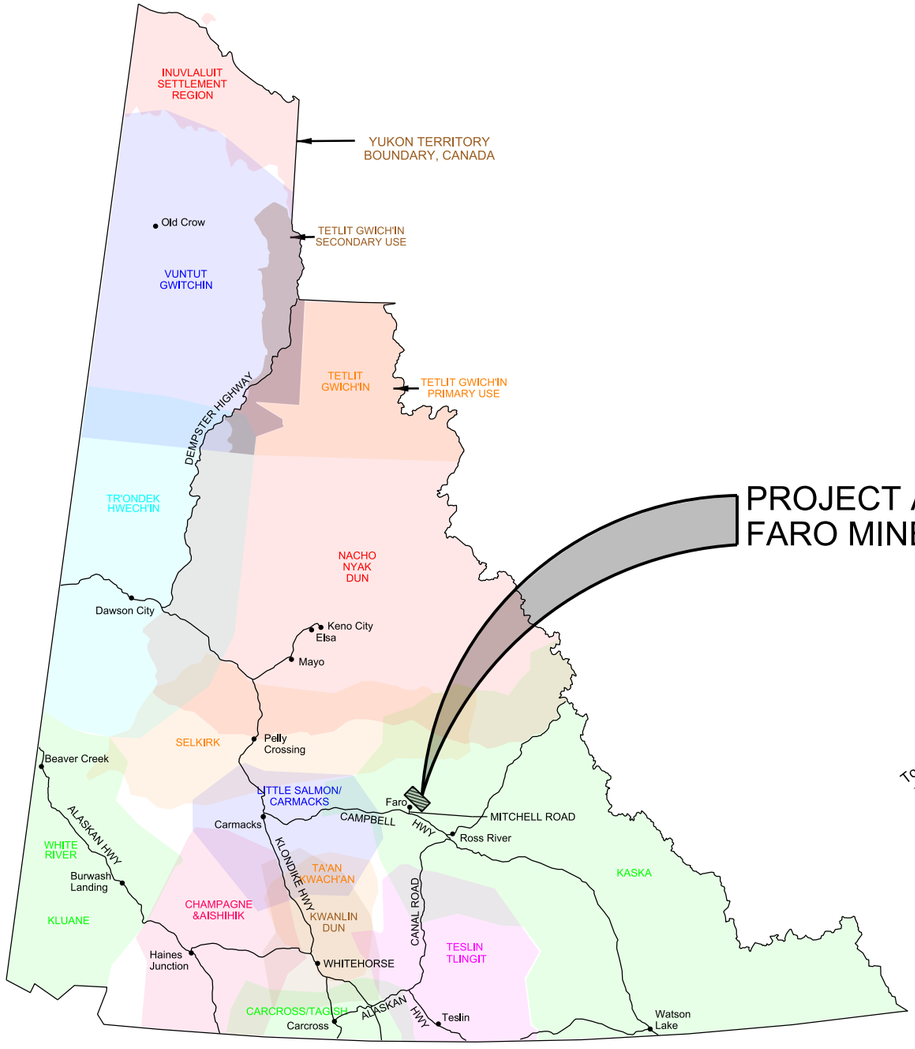
Non-detects were assigned values of half of the detection limits.

Bold indicates the analyte was detected.

Dark shading indicates the results were outside of the expected range.

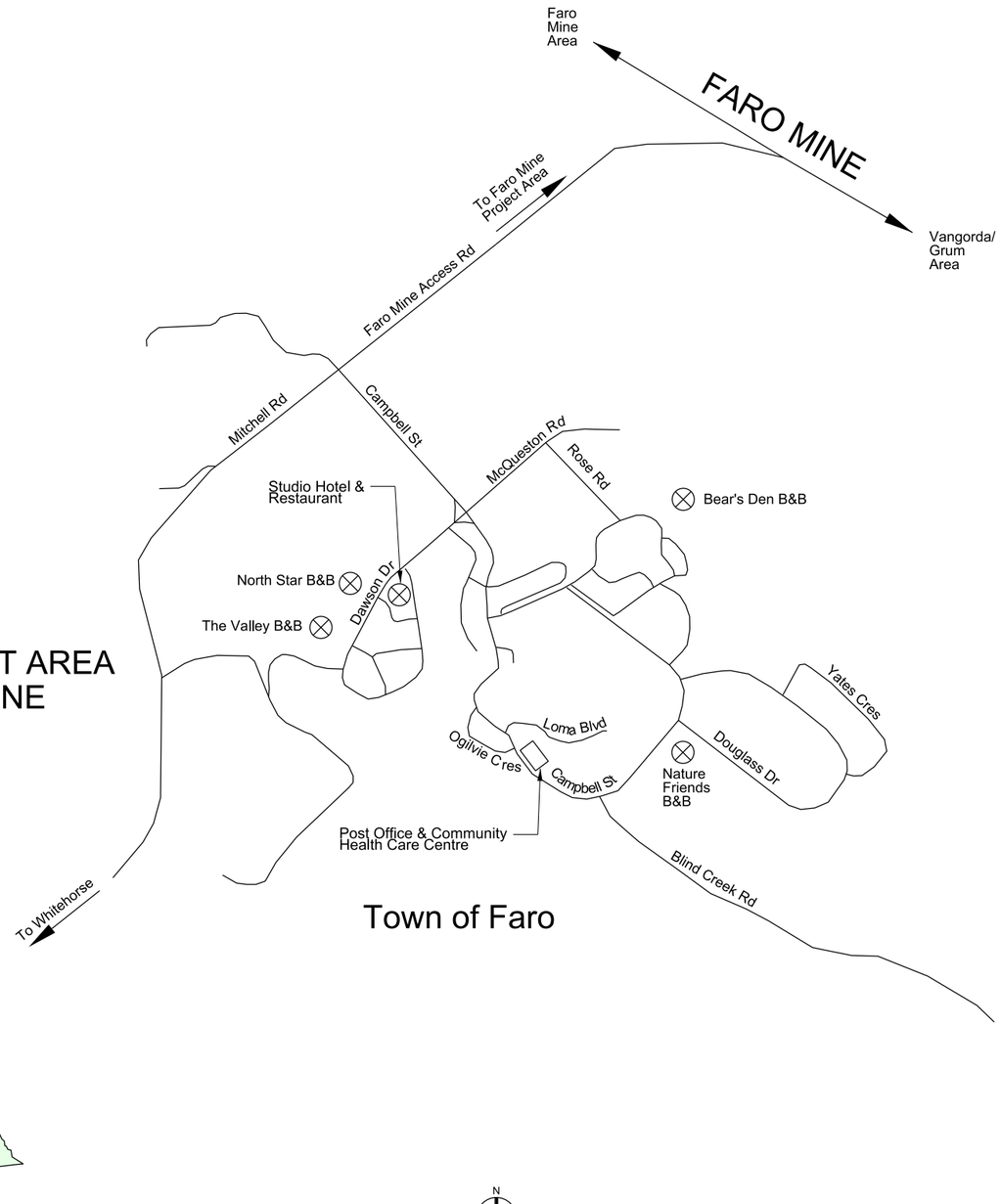
Light shading indicated the result exceeded the screening criteria.

Figures



VICINITY MAP

NOT TO SCALE

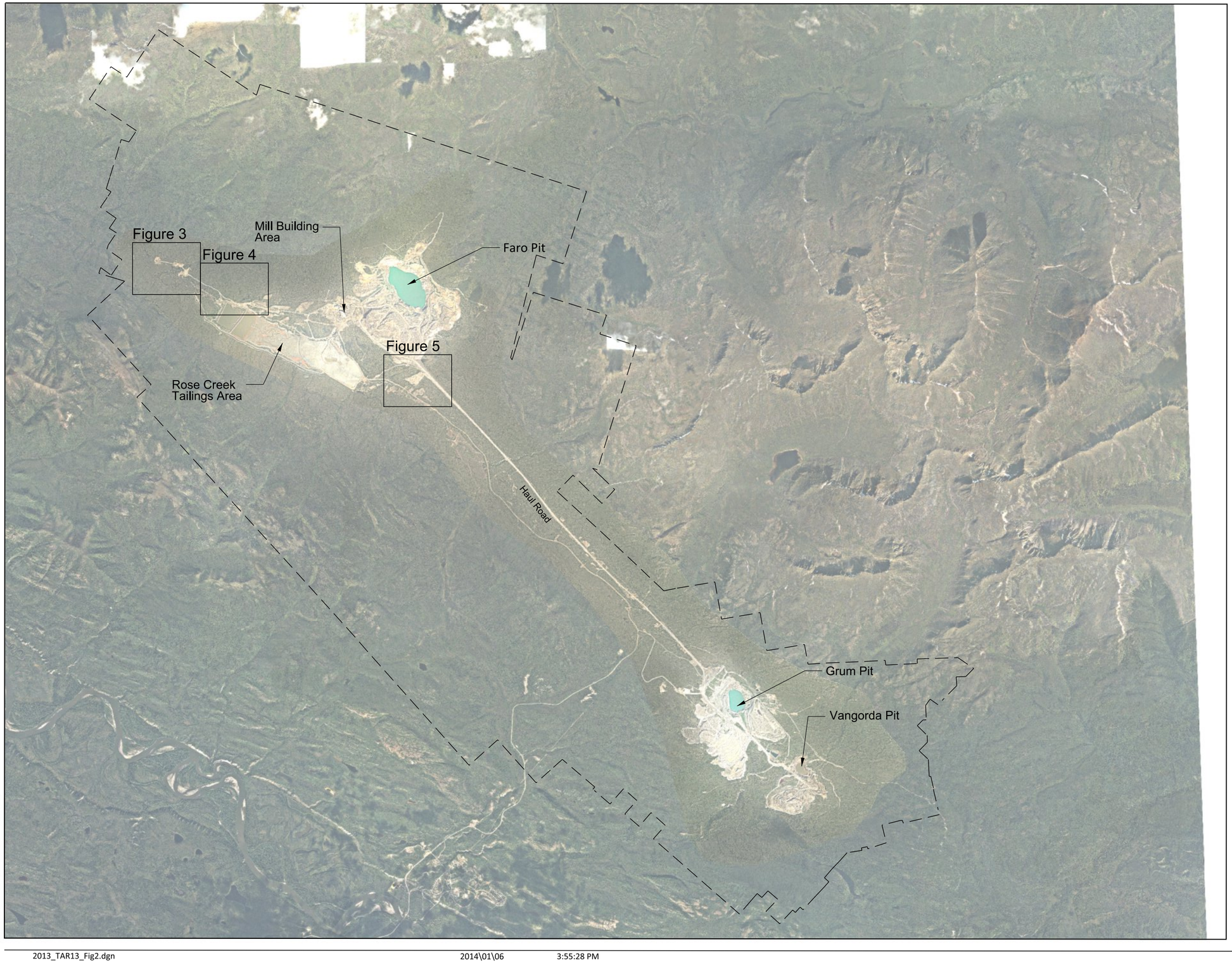


LOCATION MAP

NOT TO SCALE

FIGURE 1
Vicinity and Location Map
Faro Mine Remediation Project

CH2MHILL



N

0 1800 3600

METRES

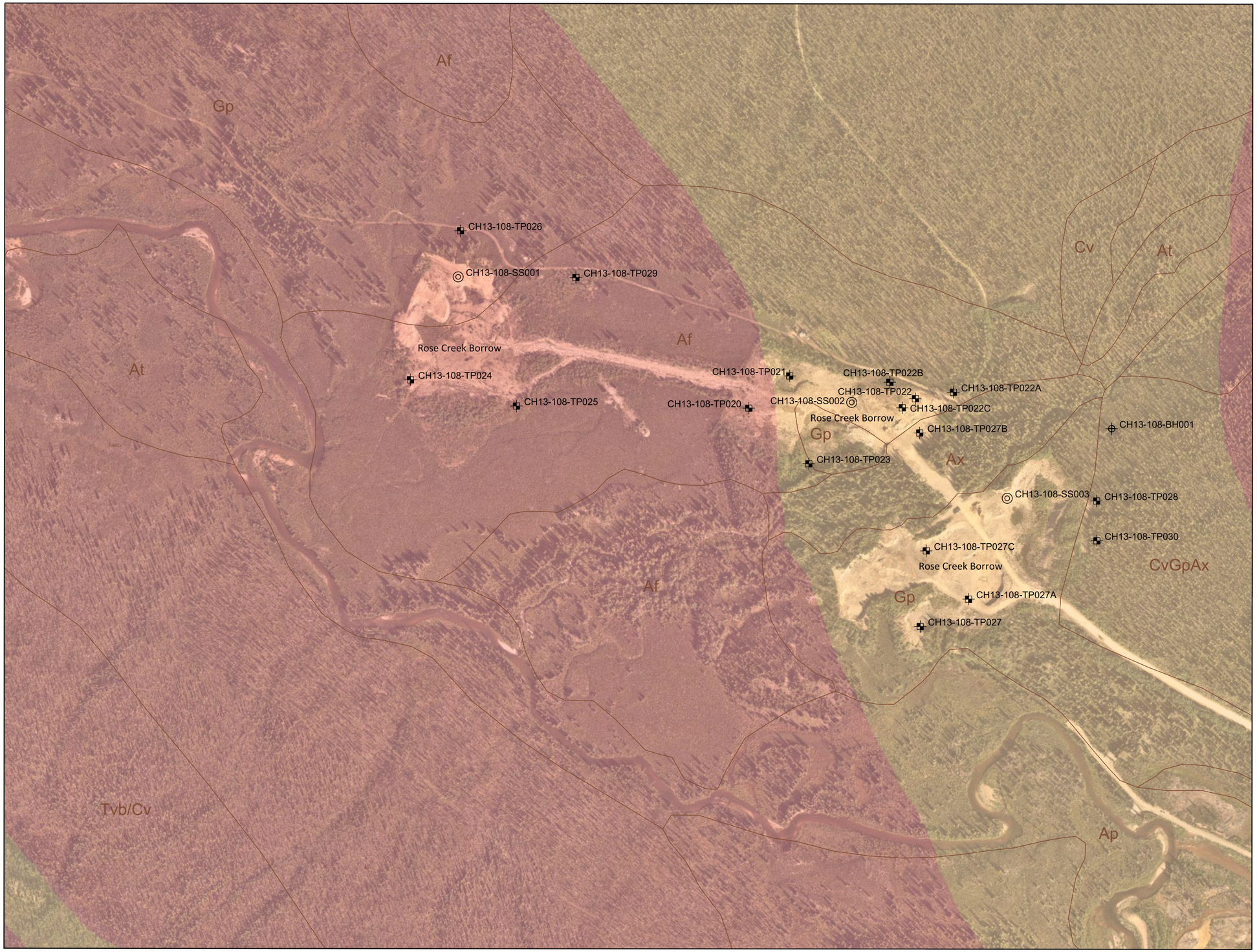
LEGEND

Area Withdrawn from Staking Mineral Claims (OIC #2008/168)

Note:
Aerial photo shown dated August 2012.

FIGURE 2
Keymap of Water Treatment Plant Borrow Sampling
Faro Mine Remediation Project

CH2MHILL



N

0 100 200

METRES

LEGEND

Surficial Geology (Note 2)

Bedrock Geology (Pigage, 2004)
- Gabbro (OSMg)
- Calc-cilicate (COVcs)

- 2013 Borehole Location (Note 3)
- 2013 Shallow Test Pit Location (Note 3)
- 2013 Test Pit Location (Note 3)

Surficial Geology (Bond, 1999)

QUATERNARY

HOLOCENE

MINE DISTURBANCE

MD- mine disturbance; consisting of an open-pit and stripped till and bedrock accumulations. Bedrock and surficial sediments exposed in open-pit.

MINE TAILINGS

MT - mine tailings; consisting of sand, silt and some clay.

ORGANIC DEPOSITS

O - organics; consisting of woody sedge peat, variable thickness. White River ash accumulations are commonly associated with poorly drained peaty areas.

ALLUVIAL DEPOSITS

Ap - alluvial plain; silt, sand and pebbles with reworked cobbles and boulders occurring as bars, overbank floodplain deposits, 0 - 10 m thick; floodplain subject to periodic floods. Small valley alluvial plains may not be mapped at this scale.

Ap (active) - alluvial plain; area of Pelly River floodplain that has been recently active.

At - alluvial terrace; silt, sand, and pebbles with reworked cobbles and boulders occurring as low terrace deposits, 0 - 10 m thick.

Af - alluvial fan; coarse sand, pebbles, cobbles and mudflow deposits, up to or >10 m thick. Appear as vegetated, often peat covered, landforms developed during post-glacial sedimentation.

Ax - complexes of Ap and Af undivided. Common when a stream is unconfined and also in narrow valleys where side-entry alluvial fans cannot be differentiated from an alluvial plain.

PLEISTOCENE AND HOLOCENE (UNDIVIDED)

COLLUVIAL DEPOSITS

Cv - colluvium veneer; conforms to bedrock topography, <1 m thick.

Ca - colluvium apron; coalescing colluvial fans at the base of a slope, >1 m thick.

Cz - mass wasting; includes slumping, debris slides and rockfalls. Slumping and rockfalls are Common on Mt. Mye.

LATE PLEISTOCENE (WISCONSINAN) - McCONNELL GLACIATION

GLACIOLACUSTRINE DEPOSITS

Lb - glaciolacustrine blanket; 1- 40 m thick.

GLACIOFLUVIAL DEPOSITS

Gp - glaciofluvial plain; 3 - 10 m thick.

Gt - glaciofluvial terrace; <10 m thick.

Gx - glaciofluvial complex; 1 - 30 m thick, composed of deposits of outwash, glaciolacustrine and minor till deposited in an ice contact environment. Hummocky topography is associated with this depositional setting. Crevasse fillings were mapped in the upper part of Vangorda Creek valley.

GLACIAL DEPOSITS

Tv - till veneer; conforms to underlying topography, <1 m thick.

Tb - till blanket; gently to moderately sloping plain controlled by bedrock or underlying surficial deposits, >1 m thick.

Tx - till complex; till blanket or veneer composed of meltout till and minor ice contact glaciofluvial deposits.

LOWER CAMBRIAN TO CRETACEOUS

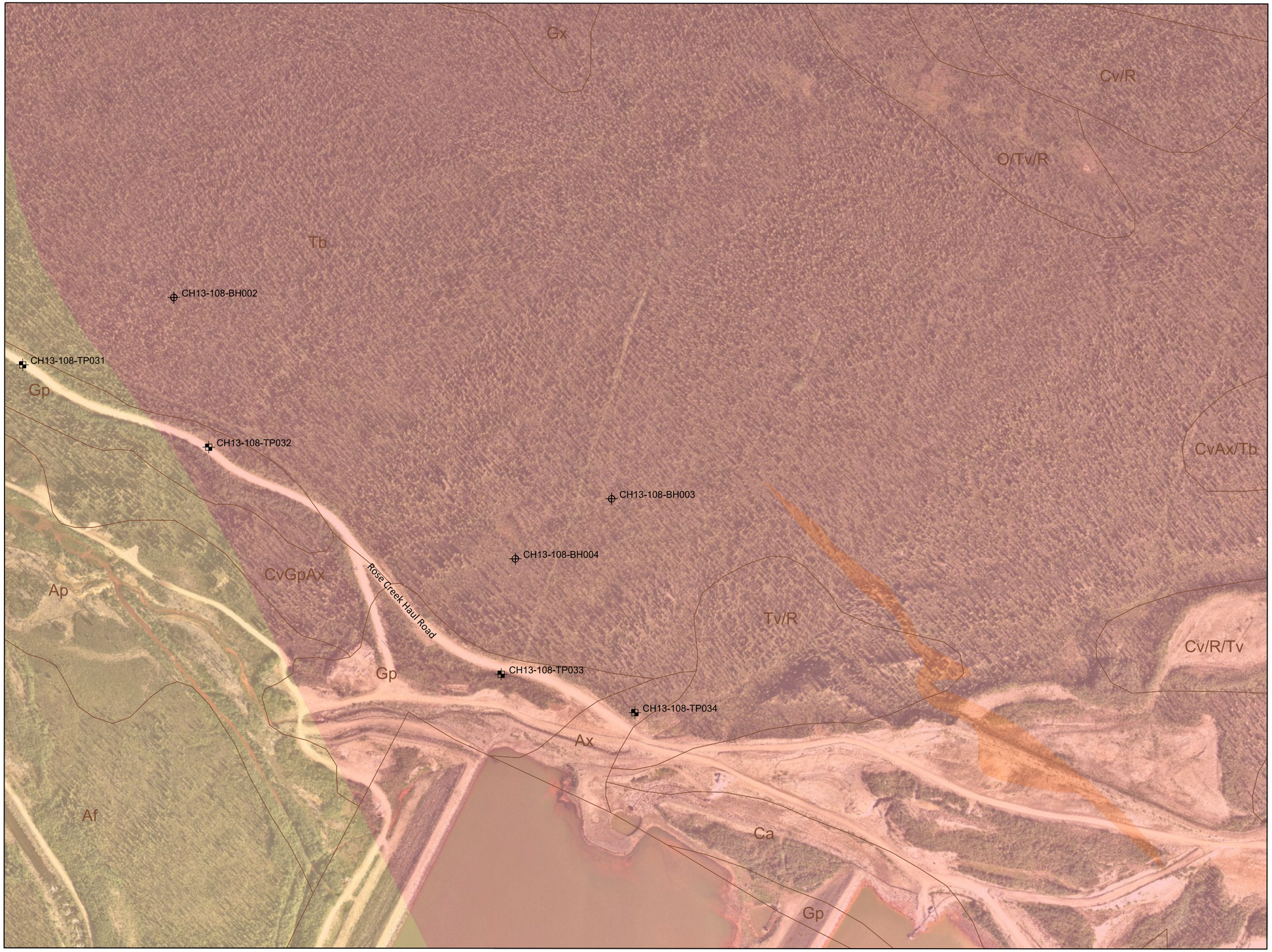
BEDROCK

R - bedrock; common on plateau summits and ridges on Mt. Mye and Sheep Mountain.

Notes:
1. Aerial photo shown dated August 2012.
2. Sources: Bond, 1999
   Bond, 2000
   Pigage, 2004
3. Locations shown based on Handheld GPS.

FIGURE 3
2013 Rose Creek Borrow Source Search
Faro Mine Remediation Project

CH2MHILL.



N

0 100 200

METRES

LEGEND

Surficial Geology (Note 2)

Bedrock Geology (Pigage, 2004)

Gabbro (OSMg)

Calc-cilicate (COVcs)

2013 Borehole Location (Note 3)

2013 Test Pit Location (Note 3)

Surficial Geology (Bond, 1999)

QUATERNARY

HOLOCENE

MINE DISTURBANCE

MD- mine disturbance; consisting of an open-pit and stripped till and bedrock accumulations. Bedrock and surficial sediments exposed in open-pit.

MINE TAILINGS

MT - mine tailings; consisting of sand, silt and some clay.

ORGANIC DEPOSITS

O - organics; consisting of woody sedge peat, variable thickness. White River ash accumulations are commonly associated with poorly drained peaty areas.

ALLUVIAL DEPOSITS

Ap - alluvial plain; silt, sand and pebbles with reworked cobbles and boulders occurring as bars, overbank floodplain deposits, 0 - 10 m thick; floodplain subject to periodic floods. Small valley alluvial plains may not be mapped at this scale.

Ap (active) - alluvial plain; area of Pelly River floodplain that has been recently active.

At - alluvial terrace; silt, sand, and pebbles with reworked cobbles and boulders occurring as low terrace deposits, 0 - 10 m thick.

Af - alluvial fan; coarse sand, pebbles, cobbles and mudflow deposits, up to or >10 m thick. Appear as vegetated, often peat covered, landforms developed during post-glacial sedimentation.

Ax - complexes of Ap and Af undivided. Common when a stream is unconfined and also in narrow valleys where side-entry alluvial fans cannot be differentiated from an alluvial plain.

PLEISTOCENE AND HOLOCENE (UNDIVIDED)

COLLUVIAL DEPOSITS

Cv - colluvium veneer; conforms to bedrock topography, <1 m thick.

Ca - colluvium apron; coalescing colluvial fans at the base of a slope, >1 m thick.

Cz - mass wasting; includes slumping, debris slides and rockfalls. Slumping and rockfalls are Common on Mt. Mye.

LATE PLEISTOCENE (WISCONSINAN) - McCONNELL GLACIATION

GLACIOLACUSTRINE DEPOSITS

Lb - glaciolacustrine blanket; 1- 40 m thick.

GLACIOFLUVIAL DEPOSITS

Gp - glaciofluvial plain; 3 - 10 m thick.

Gt - glaciofluvial terrace; <10 m thick.

Gx - glaciofluvial complex; 1 - 30 m thick, composed of deposits of outwash, glaciolacustrine and minor till deposited in an ice contact environment. Hummocky topography is associated with this depositional setting. Crevasse fillings were mapped in the upper part of Vangorda Creek valley.

GLACIAL DEPOSITS

Tv - till veneer; conforms to underlying topography, <1 m thick.

Tb - till blanket; gently to moderately sloping plain controlled by bedrock or underlying surficial deposits, >1 m thick.

Tx - till complex; till blanket or veneer composed of meltout till and minor ice contact glaciofluvial deposits.

LOWER CAMBRIAN TO CRETACEOUS

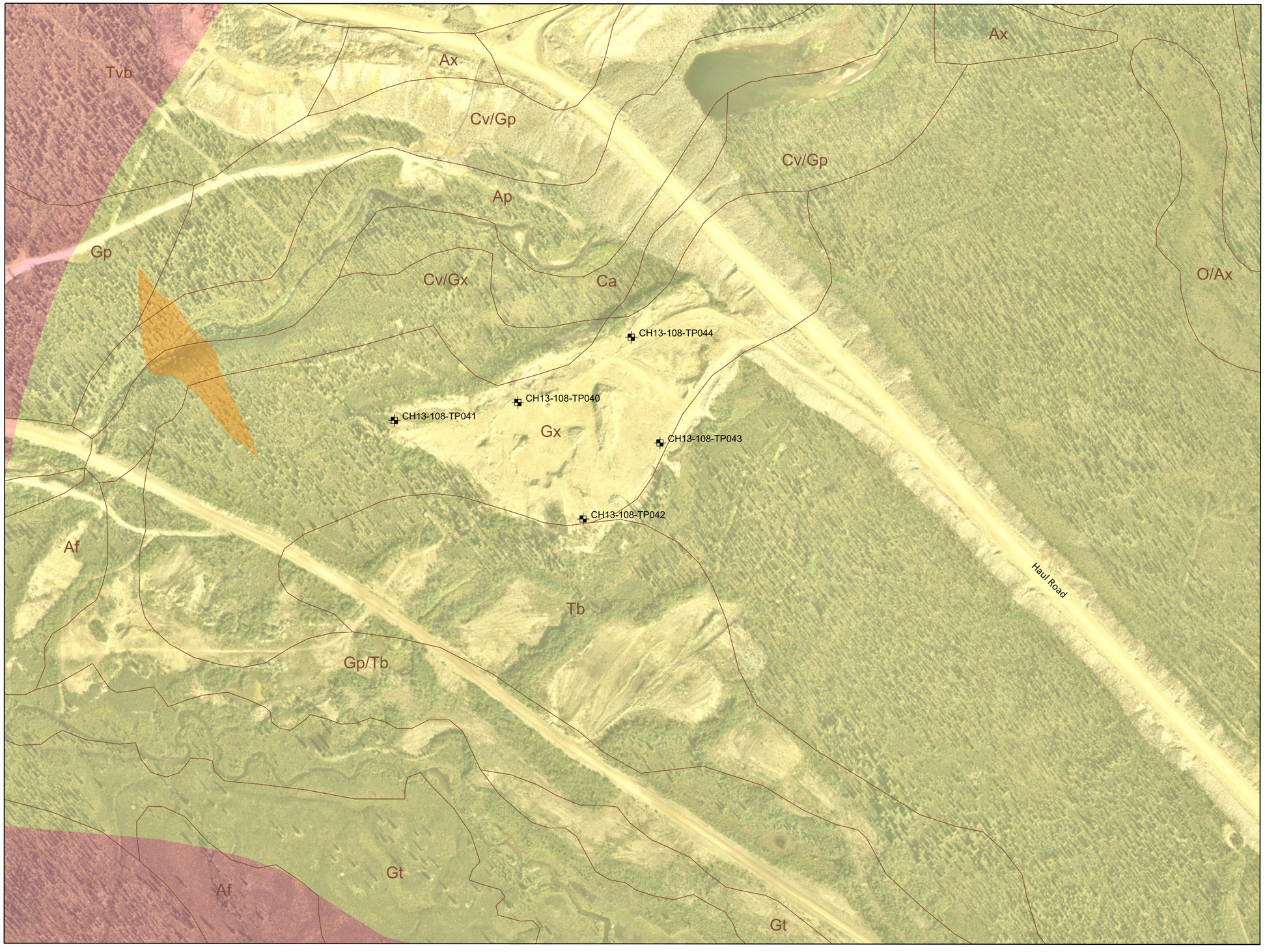
BEDROCK

R - bedrock; common on plateau summits and ridges on Mt. Mye and Sheep Mountain.

Notes:
1. Aerial photo shown dated August 2012.
2. Sources: Bond, 1999
Bond, 2000
Pigage, 2004
3. Locations shown based on Handheld GPS.

FIGURE 4
2013 Rose Creek Haul Road Borrow Source Search
Faro Mine Remediation Project

CH2MHILL.



N

0 100 200

METRES

LEGEND

Surficial Geology (Note 2)

Bedrock Geology (Pigage, 2004)

Gabbro (OSMg)

Calc-cilicate (COVcs)

Shist (UPCMMs)

2013 Test Pit Location (Note 3)

Surficial Geology (Bond, 1999)

QUATERNARY

HOLOCENE

MINE DISTURBANCE

MD- mine disturbance; consisting of an open-pit and stripped till and bedrock accumulations. Bedrock and surficial sediments exposed in open-pit.

MINE TAILINGS

MT - mine tailings; consisting of sand, silt and some clay.

ORGANIC DEPOSITS

O - organics; consisting of woody sedge peat, variable thickness. White River ash accumulations are commonly associated with poorly drained peaty areas.

ALLUVIAL DEPOSITS

Ap - alluvial plain; silt, sand and pebbles with reworked cobbles and boulders occurring as bars, overbank floodplain deposits, 0 - 10 m thick; floodplain subject to periodic floods. Small valley alluvial plains may not be mapped at this scale.

Ap (active) - alluvial plain; area of Pelly River floodplain that has been recently active.

At - alluvial terrace; silt, sand, and pebbles with reworked cobbles and boulders occurring as low terrace deposits, 0 - 10 m thick.

Af - alluvial fan; coarse sand, pebbles, cobbles and mudflow deposits, up to or >10 m thick. Appear as vegetated, often peat covered, landforms developed during post-glacial sedimentation.

Ax - complexes of Ap and Af undivided. Common when a stream is unconfined and also in narrow valleys where side-entry alluvial fans cannot be differentiated from an alluvial plain.

PLEISTOCENE AND HOLOCENE (UNDIVIDED)

COLLUVIAL DEPOSITS

Cv - colluvium veneer; conforms to bedrock topography, <1 m thick.

Ca - colluvium apron; coalescing colluvial fans at the base of a slope, >1 m thick.

Cz - mass wasting; includes slumping, debris slides and rockfalls. Slumping and rockfalls are Common on Mt. Mye.

LATE PLEISTOCENE (WISCONSINAN) - McCONNELL GLACIATION

GLACIOLACUSTRINE DEPOSITS

Lb - glaciolacustrine blanket; 1- 40 m thick.

GLACIOFLUVIAL DEPOSITS

Gp - glaciofluvial plain; 3 - 10 m thick.

Gt - glaciofluvial terrace; <10 m thick.

Gx - glaciofluvial complex; 1 - 30 m thick, composed of deposits of outwash, glaciolacustrine and minor till deposited in an ice contact environment. Hummocky topography is associated with this depositional setting. Crevasse fillings were mapped in the upper part of Vangorda Creek valley.

GLACIAL DEPOSITS

Tv - till veneer; conforms to underlying topography, <1 m thick.

Tb - till blanket; gently to moderately sloping plain controlled by bedrock or underlying surficial deposits, >1 m thick.

Tx - till complex; till blanket or veneer composed of meltout till and minor ice contact glaciofluvial deposits.

LOWER CAMBRIAN TO CRETACEOUS

BEDROCK

R - bedrock; common on plateau summits and ridges on Mt. Mye and Sheep Mountain.

Notes:
1. Aerial photo shown dated August 2012.
2. Sources: Bond, 1999
Bond, 2000
Pigage, 2004
3. Locations shown based on Handheld GPS.

FIGURE 5
2013 Rose Creek Borrow Source Search
Faro Mine Remediation Project

CH2MHILL.

Attachment 1
Borehole Logs

SHEET 1 of 1	PROJECT NUMBER: 472645	BORING NUMBER: *CH13-108-BH001*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project	**HOLE DEPTH (m):** 1.68	**DRILLING CONTRACTOR:** Kryrotech	
TOP OF CASING ELEVATION: 1051.660	**NORTHING:** 6915475.940	**EASTING:** 579397.890	**DATE STARTED:** 8/20/2013 / **DATE COMPLETED:** 8/20/2013
WATER LEVEL: --	**DATUM:** NAD83 CSRS NAD83 CSRS/Handheld GPS/2011 LiDAR		**DRILLING EQUIPMENT:** Pionjar
LOCATION: Rose Creek Haul Road			**LOGGED BY:** J. Marriott

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
	100	SS-1		0	50	50	18			**SILTY SAND (SM)**, moss, woody debris, lichen.		SOa
										POORLY GRADED GRAVEL (GP), angular, pulverized rock fragment, phyllite, schist. Occasional clay layer, moist, plastic, very cold.		-- Groundwater not encountered.
												Sample collected below organics.
	100	SS-2										SOb
1												
	100	SS-3										
				11	38	51	21	53	11	**SANDY SILT (MH)**.		
										Boring Terminated at 1.68 metres bgs		At 1.7m Pionjar refusal.

CH2MHILL

SHEET 1 of 1	PROJECT NUMBER: 472645	BORING NUMBER: *CH13-108-BH002*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project	**HOLE DEPTH (m):** 1.22	**DRILLING CONTRACTOR:** Kryrotech	
TOP OF CASING ELEVATION: 1081.740	**NORTHING:** 6915160.260	**EASTING:** 579795.270	**DATE STARTED:** 8/22/2013 / **DATE COMPLETED:** 8/22/2013
WATER LEVEL: --	**DATUM:** NAD83 CSRS GPS/2011 LiDAR	**DRILLING EQUIPMENT:** Pionjar	
LOCATION: Rose Creek Haul Road		**LOGGED BY:** J. Marriott	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
	100	SS-1		4	55	41	15			**SILTY SAND (ML)**, trace clay and silt, brown, moist.		SOa -- Groundwater not encountered. Sample collected below organics.
1	100	SS-2		0	6	94	51	110	18	**SILT (MH)**, well-graded, trace silt, brown. Pulverized angular rock fragments, gravel (60%), clay (20%), sand (10%), silt (10%).		SOb
										Boring Terminated at 1.22 metres bgs		At 1.2m Pionjar refusal.

CH2MHILL

SHEET 1 of 1

PROJECT NUMBER: 472645

BORING NUMBER: *CH13-108-BH003*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 2.00	**DRILLING CONTRACTOR:** Kryrotech
TOP OF CASING ELEVATION: 1093.280	**NORTHING:** 6914902.550	**EASTING:** 580355.770	**DATE STARTED:** 8/21/2013 / **DATE COMPLETED:** 8/21/2013
WATER LEVEL: --	**DATUM:** NAD83 CSRS GPS/2011 LiDAR		**DRILLING EQUIPMENT:** Pionjar
LOCATION: Rose Creek Haul Road			**LOGGED BY:** J. Marriott

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
	100	SS-1		13	54	33	11			**SILTY SAND (ML)**, black, moist.		SOa -- Groundwater not encountered.
				6	55	39	12			**SILTY SAND (SM)**.		Sample collected below organics. SOb
	100	SS-2								Angular schist / phyllite fragments, pulverized rock, likely cobble.		
1										**POORLY GRADED GRAVEL (GP)**, angular gravel/pebble fragments.		
	100	SS-3										
2										Boring Terminated at 2 metres bgs		

CH2MHILL

SHEET 1 of 1

PROJECT NUMBER: 472645

BORING NUMBER: *CH13-108-BH004*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 2.01	**DRILLING CONTRACTOR:** Kryrotech
TOP OF CASING ELEVATION: 1067.650	**NORTHING:** 6914825.710	**EASTING:** 580232.570	**DATE STARTED:** 8/21/2013 / **DATE COMPLETED:** 8/21/2013
WATER LEVEL: --	**DATUM:** NAD83 CSRS GPS/2011 LiDAR		**DRILLING EQUIPMENT:** Pionjar
LOCATION: Rose Creek Haul Road			**LOGGED BY:** J. Marriott

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
	100	SS-1		22	65	13	13 9			**ORGANIC SOIL (OL/OH)**, woody debris, black and brown, moist.		SOa
										SILTY CLAYEY SAND WITH GRAVEL (SC-SM), brown, moist, subangular gravel, fine grained sand, occasional organic fragments.		SOb -- Groundwater not encountered. Sample collected below organics.
	100	SS-2										
1	100	SS-3								**SANDY SILT (ML)**, brown, moist, occasional poorly graded coarse grained sand lense with sand (>60%), silt (20%), gravel (20%).		
2										Boring Terminated at 2.01 metres bgs		

CH2MHILL

SHEET 1 of 1

PROJECT NUMBER: 472645.07.FI.BW.03

BORING NUMBER: *CH13-108-SS001*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project

HOLE DEPTH (m): 0.50

DRILLING CONTRACTOR:

TOP OF CASING ELEVATION: 1018.850

NORTHING: 6915672.810

EASTING: 578550.930

DATE STARTED: 7/8/2013

DATE COMPLETED: 7/8/2013

WATER LEVEL: --

DATUM: NAD83 CSRS GPS/2011 LiDAR

DRILLING EQUIPMENT: Surface Sample/Hand Shovel

LOCATION: Rose Creek Borrow

LOGGED BY: M. Franklyne

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
				70	29	1	2			**(ALLUVIUM) WELL-GRADED GRAVEL WITH SAND (GW)**, reddish brown (5YR 4.3), moist, dense, subrounded.		SOa -- Groundwater not encountered. Taken from the quarry, 5 m of clean sand and gravel. 0% Organic, 0% Boulders, 5% Cobbles, 2% Clay
										Boring Terminated at 0.5 metres bgs		

Logged exposed 5m high slope. Sample collected from hand excavated 0.5m test pit.

CH2MHILL

SHEET 1 of 1

PROJECT NUMBER: 472645.07.FI.BW.03

BORING NUMBER: *CH13-108-SS002*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project

HOLE DEPTH (m): 0.50

DRILLING CONTRACTOR:

TOP OF CASING ELEVATION: 1027.850

NORTHING: 6915510.070

EASTING: 579060.940

DATE STARTED: 7/8/2013

DATE COMPLETED: 7/8/2013

WATER LEVEL: --

DATUM: NAD83 CSRS GPS/2011 LiDAR

DRILLING EQUIPMENT: Surface Sample/Hand Shovel

LOCATION: Rose Creek Borrow

LOGGED BY: M. Franklyne

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
				74	14	12	8			**WELL-GRADED GRAVEL (GW)**, reddish yellow (10YR 4/3), moist, dense, subangular.		SOa -- Groundwater not encountered. Edge of the usable material.
										Boring Terminated at 0.5 metres bgs		Logged 2m tall exposed slope. Collected sample from 0.5m hand-dug test pit.

CH2MHILL

SHEET 1 of 1	PROJECT NUMBER: 472645.07.FI.BW.03	BORING NUMBER: *CH13-108-TP020*

TEST PIT LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 6.00	**EXCAVATION CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1026.000	**NORTHING:** 6915502.630	**EASTING:** 578927.630	**DATE STARTED:** 7/17/2013	**DATE COMPLETED:** 7/17/2013
WATER LEVEL: --	**DATUM:** GPS/2011 LiDAR		**EXCAVATION EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Rose Creek Borrow			**LOGGED BY:** J. Rooney, J. Beckett	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0				20	65	5				**(ALLUVIUM) POORLY GRADED SAND WITH GRAVEL (SP)**, medium brown, dry, loose, subrounded.		-- Groundwater not encountered. Fine grained clean sand. 0% Organic, 0% Boulders, 10% Cobbles
1										**(ALLUVIUM) POORLY GRADED GRAVEL WITH SAND (GP)**, medium brown, subrounded, cobbles.		Sampled gravel and cobble seam for geochemistry.
2												
3										**(ALLUVIUM) POORLY GRADED SAND WITH GRAVEL (SP)**, medium brown, dry, loose, subrounded.		
4												
5												
6												

Test Pit Terminated at 6 metres bgs

CH2MHILL

SHEET 1 of 1	PROJECT NUMBER: 472645.07.FI.BW.03	BORING NUMBER: *CH13-108-TP021*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 4.50	**DRILLING CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1024.880	**NORTHING:** 6915544.350	**EASTING:** 578980.570	**DATE STARTED:** 7/17/2013	**DATE COMPLETED:** 7/17/2013
WATER LEVEL: --4.5	**DATUM:** NAD83 CSRS GPS/2011 LiDAR		**DRILLING EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Rose Creek Borrow			**LOGGED BY:** J. Rooney, J. Beckett	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0				30	55	5				**(ALLUVIUM) POORLY GRADED SAND WITH GRAVEL (SP)**, medium brown, dry, loose, fine to medium grained sand, mediumto coarse gravel, subrounded.		Organics to 0.3 m. Med to coarse gravel 30% from 0.0 to 1m - horizontal bedding. Fine to medium grained sand. Increased fines at 4 m. 0% Organic, 0% Boulders, 5% Cobbles
1				10	75	5				Decreased gravel.		
2												
3												
4										Increased fines.		
										Boring Terminated at 4.5 metres bgs		Water infiltration at 4.5 meters.

CH2MHILL

SHEET 1 of 1	PROJECT NUMBER: 472645.07.FI.BW.03	BORING NUMBER: *CH13-108-TP022*

TEST PIT LOG

PROJECT NAME: Faro Mine Remediation Project	**HOLE DEPTH (m):** 6.00	**EXCAVATION CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1035.830	**NORTHING:** 6915514.820	**EASTING:** 579143.560	**DATE STARTED:** 7/18/2013 / **DATE COMPLETED:** 7/18/2013
WATER LEVEL: --	**DATUM:** GPS/2011 LiDAR	**EXCAVATION EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Rose Creek Borrow		**LOGGED BY:** J. Rooney, J. Beckett	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0				30	35	5				**(ALLUVIUM) WELL-GRADED SAND WITH GRAVEL (SW)**, medium brown, dry, loose, subrounded, competent grains, occasional phyllite, schist, sulfides observed.		--Groundwater not encountered. Geochem. Homogeneous deposit. Sand to 0.75m. horizontal bedding. Sand, gravel, cobble, to bottom of hole. 0% Organic, 5% Boulders, 25% Cobbles
1												
2												
3				16	80	4	5			**WELL-GRADED SAND WITH GRAVEL (SW)**.		SOa
4												
5												
6												

Test Pit Terminated at 6 metres bgs

CH2MHILL

SHEET 1 of 1	PROJECT NUMBER: 472645.07.SW.FI.BW.03	BORING NUMBER: *CH13-108-TP022A*

TEST PIT LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 6.00	**EXCAVATION CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1039.190	**NORTHING:** 6915523.230	**EASTING:** 579192.760	**DATE STARTED:** 7/25/2013	**DATE COMPLETED:** 7/25/2013
WATER LEVEL: --	**DATUM:** GPS/2011 LiDAR		**EXCAVATION EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Rose Creek Borrow			**LOGGED BY:** M. Kacmarcik	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0				77	6	17				**(ALLUVIUM) SILTY GRAVEL (GM)**, brown, moist, medium dense, rounded to subangular, igneous. Large particles are generally rounded to subrounded, with smaller coarse particles subrounded to subangular. Max boulder size observed is approx 0.6m.		SOa --Groundwater not encountered. Location is approx 40m east of TP022. Excavated into existing quarry slope from top of perimeter road, depths noted are relative to backwall height. Test pit walls stand near vertical with minimal sloughing. groundwater not encountered. backfill to ground surface with compacted spoils. Minimal topsoil observed, little vegetation or root penetration. 0% Organic, 10% Boulders, 15% Cobbles
1												
2												
3												
4												
5												
6												

Test Pit Terminated at 6 metres bgs

CH2MHILL

SHEET 1 of 1	PROJECT NUMBER: 472645.07.SW.FI.BW.03	BORING NUMBER: *CH13-108-TP022B*

TEST PIT LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 6.00	**EXCAVATION CONTRACTOR:** TEES
TOP OF CASING ELEVATION: 1034.400	**NORTHING:** 6915536.100	**EASTING:** 579110.420	**DATE STARTED:** 7/25/2013 / **DATE COMPLETED:** 7/25/2013
WATER LEVEL: --	**DATUM:** GPS/2011 LiDAR		**EXCAVATION EQUIPMENT:** Cat 345CL Excavator with 4' Bucket
LOCATION: Rose Creek Borrow			**LOGGED BY:** M. Kacmarcik

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0				63	29	8				**(ALLUVIUM) WELL-GRADED GRAVEL WITH SAND (GW)**, brown, moist, medium, rounded to subangular, igneous.		SOa --Groundwater not encountered. Location is approx 40m west of TP022. Test pit walls stand vertical, no caving or sloughing. Groundwater not encountered. Backfill to original ground surface with compacted excavation spoils. Minimal topsoil observed, little vegetation or root penetration. Deposit is fairly uniform over depth explored, thin 5cm ash layer approx 50cm bgs. Appears more cobbly than TP022A. 0% Organic, 10% Boulders, 15% Cobbles
1												
2												
3												
4												
5												
6												

Test Pit Terminated at 6 metres bgs

CH2MHILL

SHEET 1 of 1	PROJECT NUMBER: 472645.07.SW.FI.BW.03	BORING NUMBER: *CH13-108-TP022C*

TEST PIT LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 6.00	**EXCAVATION CONTRACTOR:** TEES
TOP OF CASING ELEVATION: 1034.320	**NORTHING:** 6915503.010	**EASTING:** 579126.500	**DATE STARTED:** 7/25/2013 / **DATE COMPLETED:** 7/25/2013
WATER LEVEL: --	**DATUM:** GPS/2011 LiDAR		**EXCAVATION EQUIPMENT:** Cat 345CL Excavator with 4' Bucket
LOCATION: Rose Creek Borrow			**LOGGED BY:** M. Kacmarcik

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0				70	22	8				**(ALLUVIUM) WELL-GRADED GRAVEL WITH SAND (GW)**, well-graded, brown, moist, medium, rounded to subangular, igneous. Larger coarse particles are round to subround, finer gravels are subrounded to subangular. Max size observed is approx 60cm dia.		SOa --Groundwater not encountered. Location is approx 30m south of TP022. Test pit walls stand vertical, no significant caving or sloughing observed. Groundwater not encountered. Backfill to ground surface with compacted excavation spoils. Minimal topsoil observed, little vegetation or root penetration. Relatively uniform deposit, possible alluvial terrace formation, easily dug with CAT345CL excavator. Distinct sand lense (fine to med) observed from 5.0 to 5.5m bgs. 0% Organic, 5% Boulders, 20% Cobbles
1												
2												
3												
4												
5												
6												

Test Pit Terminated at 6 metres bgs

CH2MHILL

SHEET 1 of 1	PROJECT NUMBER: 472645.07.FI.BW.03	BORING NUMBER: *CH13-108-TP023*

TEST PIT LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 6.00	**EXCAVATION CONTRACTOR:** TEES
TOP OF CASING ELEVATION: 1029.740	**NORTHING:** 6915430.570	**EASTING:** 579005.450	**DATE STARTED:** 7/17/2013 / **DATE COMPLETED:** 7/17/2013
WATER LEVEL: --	**DATUM:** GPS/2011 LiDAR		**EXCAVATION EQUIPMENT:** Cat 345CL Excavator with 4' Bucket
LOCATION: Rose Creek Borrow			**LOGGED BY:** J. Rooney, J. Beckett

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0				20	25	5				**(ALLUVIUM) WELL-GRADED SAND WITH GRAVEL (SW)**, medium to dark brown, dry, loose, subrounded.		--Groundwater not encountered. Sampled for geochem. 0m to 0.2m organics. Coarse sand and gravel seam from 1.5m to 2m. Cobbles (40%) and boulders (15%) from 2.5 to 6m. 0% Organic, 15% Boulders, 35% Cobbles
1												
2												
3												
4												
5												
6												

Test Pit Terminated at 6 metres bgs

CH2MHILL

SHEET 1 of 2	PROJECT NUMBER: 472645.07.FI.BW.03	BORING NUMBER: *CH13-108-TP024*

TEST PIT LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 6.00	**EXCAVATION CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1012.990	**NORTHING:** 6915539.400	**EASTING:** 578489.140	**DATE STARTED:** 7/18/2013	**DATE COMPLETED:** 7/18/2013
WATER LEVEL: --6	**DATUM:** GPS/2011 LiDAR		**EXCAVATION EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Rose Creek Borrow			**LOGGED BY:** J. Rooney, J. Beckett	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
				35	25	5				**(ALLUVIUM) WELL-GRADED GRAVEL WITH SAND (GW)**, light to medium brown, dry, loose, subrounded, competent grains.		Organics to 0.2m, light brown fine to medium grained sand to 0.75m. horizontal bedding. Increased gravel (40%) at 0.75m. Increased cobbles and boulders at 1.75m. Moist at 4.75m. Wet at 6m. Walls sloughing. 0% Organic, 10% Boulders, 25% Cobbles
1												
2												
3												
4												
5												
6												

CH2MHILL

SHEET 2 of 2	**PROJECT NUMBER:** 472645.07.FI.BW.03	**BORING NUMBER:** *CH13-108-TP024*

TEST PIT LOG

PROJECT NAME: Faro Mine Remediation Project	**HOLE DEPTH (m):** 6.00	**EXCAVATION CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1012.990	**NORTHING:** 6915539.400	**EASTING:** 578489.140	**DATE STARTED:** 7/18/2013 / **DATE COMPLETED:** 7/18/2013
WATER LEVEL: --6	**DATUM:** GPS/2011 LiDAR	**EXCAVATION EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Rose Creek Borrow		**LOGGED BY:** J. Rooney, J. Beckett	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
										Test Pit Terminated at 6 metres bgs		

CH2MHILL

SHEET 1 of 1	PROJECT NUMBER: 472645.07.FI.BW.03	BORING NUMBER: *CH13-108-TP025*

TEST PIT LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 6.00	**EXCAVATION CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1016.330	**NORTHING:** 6915505.360	**EASTING:** 578626.420	**DATE STARTED:** 7/18/2013	**DATE COMPLETED:** 7/18/2013
WATER LEVEL: --6	**DATUM:** GPS/2011 LiDAR		**EXCAVATION EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Rose Creek Borrow			**LOGGED BY:** J. Rooney, J. Beckett	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
				30	70	0				**(ALLUVIUM) POORLY GRADED SAND (SP)**, medium brown, dry, loose, fine-grained sand, organics.		
1				30	50	5	4			**WELL-GRADED SAND WITH GRAVEL (SW)**, medium brown, dry, loose, subrounded, competent grains, occasional phyllite, schist, sulfides observed.		Sand seam at 1.5m (colour change to light brown and sloughing from this zone).
2												
3				55	36	9				**WELL-GRADED GRAVEL WITH SAND (GW)**		SOa
4												
5				10	70	5				**WELL-GRADED SAND (SW)**.		Decreased Gravel (10%) and cobble (10%) at 5m. Increase in sand. Clean/sOft. Trace brown clay.
6												

Test Pit Terminated at 6 metres bgs

CH2MHILL

SHEET 1 of 1	PROJECT NUMBER: 472645.07.FI.BW.03	BORING NUMBER: *CH13-108-TP026*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project	**HOLE DEPTH (m):** 6.00	**DRILLING CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1020.550	**NORTHING:** 6915732.530	**EASTING:** 578554.000	**DATE STARTED:** 7/18/2013 / **DATE COMPLETED:** 7/18/2013
WATER LEVEL: --	**DATUM:** NAD83 CSRS GPS/2011 LiDAR	**DRILLING EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Rose Creek Borrow		**LOGGED BY:** J. Rooney, J. Beckett	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0										**(ALLUVIUM) SILTY GRAVEL (GM)**, medium brown, dry, loose, subrounded.		--Groundwater not encountered. Entire northern portion of new corral is a potential source for aggregate. 25% cobbles.
1												
2				81	5	14	4			**SILTY GRAVEL (GM)**		SOa
3												
4												
5												
6										Boring Terminated at 6 metres bgs		

CH2MHILL

SHEET 1 of 1	PROJECT NUMBER: 472645.07.FI.BW.03	BORING NUMBER: *CH13-108-TP027*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project	**HOLE DEPTH (m):** 5.00	**DRILLING CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1024.500	**NORTHING:** 6915219.590	**EASTING:** 579149.790	**DATE STARTED:** 7/17/2013 / **DATE COMPLETED:** 7/17/2013
WATER LEVEL: --	**DATUM:** NAD83 CSRS GPS/2011 LiDAR	**DRILLING EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Rose Creek Borrow		**LOGGED BY:** J. Rooney, J. Beckett	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0				30	45	5				**(GLACIOFLUVIAL) WELL-GRADED SAND WITH GRAVEL (SW)**, medium to dark brown, moist, loose, medium to coarse grained sand with fine to medium grained, subrounded to subangular gravel.		--Groundwater not encountered. Organics in top 0.1m. horizontal bedding from 1 to 4 meters. Material is homogeneous throughout, very loose. 0% Organic, 5% Boulders, 15% Cobbles
1				57	41	2	3			**WELL-GRADED GRAVEL WITH SAND (GW)**.		SOa
2												
3												
4												
5										Boring Terminated at 5 metres bgs		

CH2MHILL

SHEET 1 of 1	PROJECT NUMBER: 472645.07.FI.BW.03	BORING NUMBER: *CH13-108-TP027A*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project	**HOLE DEPTH (m):** 5.00	**DRILLING CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1029.050	**NORTHING:** 6915255.040	**EASTING:** 579212.360	**DATE STARTED:** 7/18/2013 / **DATE COMPLETED:** 7/18/2013
WATER LEVEL: --	**DATUM:** NAD83 CSRS GPS/2011 LiDAR	**DRILLING EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Rose Creek Borrow		**LOGGED BY:** J. Rooney, J. Beckett	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0				35	55	5				**(ALLUVIUM) WELL-GRADED SAND WITH GRAVEL (SW)**, light to medium brown, dry, loose, medium to coarse grained sand, subrounded, competent grains, occasional phyllite, schist, sulfides observed.		--Groundwater not encountered. Approximately 40m from CH13-108-TP027.
1												
2				40	52	8	3			**WELL-GRADED SAND WITH GRAVEL (SW)**.		SOa
3												
4										**(ALLUVIUM) WELL-GRADED SAND (SW)**, light to medium brown, moist, soft, loose, fine to medium grained.		
5										Boring Terminated at 5 metres bgs		

CH2MHILL

SHEET 1 of 1	PROJECT NUMBER: 472645.07.FI.BW.03	BORING NUMBER: *CH13-108-TP027B*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project	**HOLE DEPTH (m):** 4.00	**DRILLING CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1030.580	**NORTHING:** 6915470.400	**EASTING:** 579149.060	**DATE STARTED:** 7/22/2013 / **DATE COMPLETED:** 7/22/2013
WATER LEVEL: --	**DATUM:** NAD83 CSRS GPS/2011 LiDAR	**DRILLING EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Rose Creek Borrow		**LOGGED BY:** J. Rooney, J. Beckett	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0				25	55	5				**(ALLUVIUM) WELL-GRADED SAND WITH GRAVEL (SW)**, medium brown, dry, dense, medium-grained sand, subangular gravel and cobbles, occasional phyllite observed.		--Groundwater not encountered. 10% cobbles, 5% boulders.
1										**(ALLUVIUM) WELL-GRADED GRAVEL WITH SAND (GW)**, medium brown, dry, dense, subangular gravel and cobbles, occasional phyllite observed.		Increased gravel and cobble.
2				56	40	4				**WELL-GRADED GRAVEL WITH SAND (GW)**.		SOa
3												
4										Boring Terminated at 4 metres bgs		

CH2MHILL

SHEET 1 of 1	PROJECT NUMBER: 472645.07.FI.BW.03	BORING NUMBER: *CH13-108-TP027C*

TEST PIT LOG

PROJECT NAME: Faro Mine Remediation Project	**HOLE DEPTH (m):** 5.00	**EXCAVATION CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1028.590	**NORTHING:** 6915317.560	**EASTING:** 579157.560	**DATE STARTED:** 7/22/2013 / **DATE COMPLETED:** 7/22/2013
WATER LEVEL: --	**DATUM:** GPS/2011 LiDAR	**EXCAVATION EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Rose Creek Borrow		**LOGGED BY:** J. Rooney, J. Beckett	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0				35	60	0				**(ALLUVIUM) WELL-GRADED SAND WITH GRAVEL (SW)**, medium brown, dry, loose, medium-grained, competent grains, subrounded cobble and gravel, max boulder size is 25cm.		--Groundwater not encountered. 5% cobbles.
1												
2				51	28	21				**SILTY GRAVEL WITH SAND (GM)**.		SOa
3										**SILTY SAND (SM)**, light brown, fine-grained sand.		Seam of fine grained sand and silt from 3.25 to 4.25m
4										**SILTY GRAVEL WITH SAND (GM)**.		Increasing gravel at 4.25m.
5										Test Pit Terminated at 5 metres bgs		

CH2MHILL

SHEET 1 of 1	PROJECT NUMBER: 472645.07.FI.BW.03	BORING NUMBER: *CH13-108-TP028*

TEST PIT LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 5.50	**EXCAVATION CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1048.390	**NORTHING:** 6915382.240	**EASTING:** 579378.250	**DATE STARTED:** 7/17/2013	**DATE COMPLETED:** 7/17/2013
WATER LEVEL: --	**DATUM:** GPS/2011 LiDAR		**EXCAVATION EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Rose Creek Borrow			**LOGGED BY:** J. Rooney, J. Beckett	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0				15	35	10				**(GLACIOFLUVIAL) WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM)**, medium brown, dry, loose, subrounded.		--Groundwater not encountered. Sampled for geochem. Organics to 0.3m. Fine to medium grained sand, band of increased silt/clay (15%) from 0.5 to 0.8. Horizontal bedding. Walls sloughing. 0% Organic, 15% Boulders, 20% Cobbles, 5% Clay
1												
2				78	5	17	7			**SILTY GRAVEL (GM)**.		SOa Gravel/cobble seam from 2.0 to 3.0m. 20% cobbles, 15% boulders.
3										**(GLACIOFLUVIAL) WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM)**, medium brown, dry, loose, subrounded.		
4												
5										Test Pit Terminated at 5.5 metres bgs		

CH2MHILL

SHEET 1 of 1	PROJECT NUMBER: 472645.07.FI.BW.03	BORING NUMBER: *CH13-108-TP029*

TEST PIT LOG

PROJECT NAME: Faro Mine Remediation Project	**HOLE DEPTH (m):** 6.00	**EXCAVATION CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1020.010	**NORTHING:** 6915671.940	**EASTING:** 578703.530	**DATE STARTED:** 7/18/2013 / **DATE COMPLETED:** 7/18/2013
WATER LEVEL: --	**DATUM:** GPS/2011 LiDAR	**EXCAVATION EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Rose Creek Borrow		**LOGGED BY:** J. Rooney, J. Beckett	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0				20	50	10				**(ALLUVIUM) WELL-GRADED SAND WITH GRAVEL (SW)**, medium brown, dry, loose, subrounded, competent grains, occasional phyllite, schist, sulfides observed.		--Groundwater not encountered. Geochem. Fine to medium grained sand and organics to 0.3m. Medium to coarse grained sand, horizontal bedding and increased gravel at 0.75m. trace brown clay at 4.5m. 0% Organic, 5% Boulders, 15% Cobbles
1												
2												
3												
4												
5												
6												

Test Pit Terminated at 6 metres bgs

CH2MHILL

SHEET 1 of 1	PROJECT NUMBER: 472645.07.FI.BW.03	BORING NUMBER: *CH13-108-TP030*

TEST PIT LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 6.00	**EXCAVATION CONTRACTOR:** TEES
TOP OF CASING ELEVATION: 1047.620	**NORTHING:** 6915330.670	**EASTING:** 579378.680	**DATE STARTED:** 7/17/2013 / **DATE COMPLETED:** 7/17/2013
WATER LEVEL: --	**DATUM:** GPS/2011 LiDAR		**EXCAVATION EQUIPMENT:** Cat 345CL Excavator with 4' Bucket
LOCATION: Rose Creek Borrow			**LOGGED BY:** J. Rooney, J. Beckett

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0				15	35	5				**(GLACIOFLUVIAL) WELL-GRADED SAND WITH GRAVEL (SW)**, medium brown, moist, loose, subrounded, with sulfides, phyllite, competent cobbles and boulders.		--Groundwater not encountered. Sampled for geochem. Placed test pit as far as excavator could access along ridge. Refusal at 6m. Organics to 0.5m. Fine to medium grained sand with some cobbles. Increased silt content (10-15%) at 3.5m (colour change to dark brown), increased moisture. Competent cobbles and boulders. 0% Organic, 20% Boulders, 25% Cobbles
1												
2												
3												
4												
5												
6												

Test Pit Terminated at 6 metres bgs

CH2MHILL

SHEET 1 of 1	**PROJECT NUMBER:** 472645.07.FI.BW.03	**BORING NUMBER:** *CH13-108-TP031*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 6.00	**DRILLING CONTRACTOR:** TEES
TOP OF CASING ELEVATION: 1040.300	**NORTHING:** 6915074.040	**EASTING:** 579601.610	**DATE STARTED:** 7/18/2013 / **DATE COMPLETED:** 7/18/2013
WATER LEVEL: --	**DATUM:** NAD83 CSRS GPS/2011 LiDAR		**DRILLING EQUIPMENT:** Cat 345CL Excavator with 4' Bucket
LOCATION: Rose Creek Haul Road			**LOGGED BY:** J. Rooney, J. Beckett

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0										**POORLY GRADED SAND WITH SILTY CLAY (SP-SC)**, poorly graded, medium brown, dry, loose, subangular.		--Groundwater not encountered. Organics to 0.3m. Fine to medium grained sand with some silt and gravel. at 3.0m, increasing clay content. at 4.0m 30%sand and 25% brown clay, increased gravel. Dry to moist, low plasticity. 0% Organic, 5% Boulders, 5% Cobbles, 5% Clay
1												
2				4	85	11	12	24	5	**POORLY GRADED SAND (SW)**.		SOa
3												
4										**SILTY CLAYEY SAND WITH GRAVEL (SC-SP)**, brown, moist, poorly graded.		5% cobbles, 5% boulders.
5												
6										Boring Terminated at 6 metres bgs		

CH2MHILL

SHEET 1 of 1	PROJECT NUMBER: 472645.07.FI.BW.03	BORING NUMBER: *CH13-108-TP032*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project	**HOLE DEPTH (m):** 6.00	**DRILLING CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1043.090	**NORTHING:** 6914968.650	**EASTING:** 579839.920	**DATE STARTED:** 7/22/2013 / **DATE COMPLETED:** 7/22/2013
WATER LEVEL: --	**DATUM:** NAD83 CSRS GPS/2011 LiDAR	**DRILLING EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Rose Creek Haul Road		**LOGGED BY:** J. Rooney, J. Beckett	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0				15	45	30				**(TILL) SILTY SAND WITH GRAVEL (SM)**, light to medium brown, moist, medium dense, well-graded fine to medium grained sand, rounded gravel and cobbles, little phyllite and schist.		--Groundwater not encountered. %5 cobbles, 5% boulders. Organics in top 2m horizontel bedding.
1												
2												
3				12	64	24	13			**SILTY SAND (SM)**.		SOa
4												Increase in silt at 4.0m (~60%).
5												
6										Boring Terminated at 6 metres bgs		

CH2MHILL

SHEET 1 of 1	PROJECT NUMBER: 472645.07.SW.FI.BW.03	BORING NUMBER: *CH13-108-TP033*

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project	**HOLE DEPTH (m):** 6.00	**DRILLING CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1044.510	**NORTHING:** 6914677.830	**EASTING:** 580214.430	**DATE STARTED:** 7/25/2013 / **DATE COMPLETED:** 7/25/2013
WATER LEVEL: --	**DATUM:** NAD83 CSRS GPS/2011 LiDAR	**DRILLING EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Rose Creek Haul Road		**LOGGED BY:** M. Kacmarcik	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0				0	100	0				**ORGANIC SANDY SILT (ML)**, trace organics, black, moist, soft, subrounded, organic.		--Groundwater not encountered. 0% Organic, 5% Boulders, 10% Cobbles
1				15	60	10				**(GLACIOFLUVIAL) WELL-GRADED SAND WITH GRAVEL AND SILT (SW-SM)**, yellowish brown, moist, medium, subrounded, igneous.		
										SILTY CLAYEY SAND (SC-SM), brown, moist, medium, subrounded, igneous.		
2				9	74	17	6	21	5	**SILTY SAND (SM)**.		SOa
3												
4												
5												Adjusted test pit location approx 25m east of planned location to avoid spruce trees. Ground surface is existing cut slope with poplar and other shrubby vegetation. Test pit excavated into roadside cutbank, all depths are relative to back wall of test pit. Largest boulder observed is approx 0.8m diameter rounded boulder. Test pit walls stand vertical with only minor sloughing. Groundwater table not encountered. Backfill to original grade with compacted excavation spoils. Test pit excavated with CAT 345CL trackhoe operated by Mike from TEES. Thin (approx 5-10cm) organic layer observed in back wall of test pit. Many roots observed (previous ground surface overlain by fill?).
6										Boring Terminated at 6 metres bgs		

CH2MHILL

SHEET 1 of 2	PROJECT NUMBER: 472645.07.SW.FI.BW.03	BORING NUMBER: *CH13-108-TP034*

TEST PIT LOG

PROJECT NAME: Faro Mine Remediation Project	**HOLE DEPTH (m):** 6.10	**EXCAVATION CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1047.440	**NORTHING:** 6914628.740	**EASTING:** 580385.640	**DATE STARTED:** 7/25/2013 / **DATE COMPLETED:** 7/25/2013
WATER LEVEL: --	**DATUM:** GPS/2011 LiDAR	**EXCAVATION EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Rose Creek Haul Road		**LOGGED BY:** M. Kacmarcik	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0				15	35	30				**(ALLUVIUM) SILTY SAND WITH GRAVEL (SM)**, glaciofluvial, well-graded, gray-brown, moist, medium dense, subangular.		--Groundwater not encountered. 0% Organic, 5% Boulders, 10% Cobbles, 5% Clay Coarse particles are rounded to subangular. Roots extend to approx 1m. Negligible topsoil thickness
1										**SILTY CLAYEY SAND WITH GRAVEL (SC-SM)**, glaciofluvial, poorly graded, olive-gray, moist, loose, rounded.		10% cobbles, 5% boulders. Variable soils possibly due to proximity to adjacent creek. Soils change both horizontally and vertically. Soil type is predom gravelly silty sand with boulders and silt lenses. Coarse particles are rounded to angular. Silt lenses observed to be moderate plasticity. Siltier zone at 4.5m underlain by gravelly cobbly zone.
2				19	41	40	12	24	6	**SILTY SAND (SM)**.		SOa Test pit location is approximately 15m from existing active stream crossing. No significant caving or sloughing observed, test pit walls stand vertical. Groundwater table not encountered despite close proximity to stream and similar elevation to stream invert. Max boulder size observed is approx 0.7 m dia rounded boulder. Backfill to original grade with compacted excavation spoils.
3												
4												
5												
6												

SHEET 2 of 2	**PROJECT NUMBER:** 472645.07.SW.FI.BW.03	**BORING NUMBER:** *CH13-108-TP034*

TEST PIT LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 6.10	**EXCAVATION CONTRACTOR:** TEES
TOP OF CASING ELEVATION: 1047.440	**NORTHING:** 6914628.740	**EASTING:** 580385.640	**DATE STARTED:** 7/25/2013 / **DATE COMPLETED:** 7/25/2013
WATER LEVEL: --	**DATUM:** GPS/2011 LiDAR		**EXCAVATION EQUIPMENT:** Cat 345CL Excavator with 4' Bucket
LOCATION: Rose Creek Haul Road			**LOGGED BY:** M. Kacmarcik

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
										Test Pit Terminated at 6.1 metres bgs		

SHEET 1 of 1	PROJECT NUMBER:	BORING NUMBER: *CH13-108-TP040*

TEST PIT LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 4.88	**EXCAVATION CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1097.060	**NORTHING:** 6912811.000	**EASTING:** 584606.000	**DATE STARTED:** 8/13/2013	**DATE COMPLETED:** 8/13/2013
WATER LEVEL: --	**DATUM:** GPS/2011 LiDAR		**EXCAVATION EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Haul Road			**LOGGED BY:** M. Kacmarcik	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
										(ALLUVIUM) WELL-GRADED GRAVEL WITH SAND (GW), brown (7.5YR 5/3), moist, medium dense, estimated 50% rounded gravel, 25% cobbles, 20% well-graded sand, 5% rounded boulders, 2' diameter.		--Groundwater not encountered. Begin excavation at 08:56. Sample 1-B at 09:06 (2 gallon bags).
												Soil profile changes abruptly to sand.
1		1-B								**(ALLUVIUM), WELL-GRADED SAND (SW)**, brown (7.5YR 5/3), moist, medium dense, estimated 70% well-graded sand, 10% rounded gravels, 10% cobbles, 5% boulders, <5% fines, max boulder size is 18 inches.		
2												
3												Test pit walls sloughing and caving.
		2-B										Sample 2-B at 09:25 (2 gallon bags). Much caving and sloughing observed.
4							3					SOa
										Test Pit Terminated at 4.88 metres bgs		Bottom of test pit at 4.9 m bgs. GWT not encountered. Walls sloughing and unstable backfill with compacted soils. Finish test pit at 09:50.

CH2MHILL

SHEET 1 of 1

PROJECT NUMBER:

BORING NUMBER: ***CH13-108-TP041***

SOIL BORING LOG

PROJECT NAME: Faro Mine Remediation Project

HOLE DEPTH (m): 4.60

DRILLING CONTRACTOR: TEES

TOP OF CASING ELEVATION: 1100.250

NORTHING: 6912788.000

EASTING: 584447.000

DATE STARTED: 8/13/2013

DATE COMPLETED: 8/13/2013

WATER LEVEL: --

DATUM: NAD83 CSRS GPS/2011 LiDAR

DRILLING EQUIPMENT: Cat 345CL Excavator with 4' Bucket

LOCATION: Haul Road

LOGGED BY: M. Kacmarcik

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
										TOPSOIL: SILTY SAND (SM), orange brown, moist, loose, tree roots and ash present.		--Groundwater not encountered. Begin excavation at 09:58. Ground surface is disturbed native ground. 0.76m diameter rounded granite boulders near surface.
1		1-B								**(ALLUVIUM) WELL-GRADED SAND WITH GRAVEL (SW)**, brown, moist, loose, estimated 80% fine to coarse sand, 20% fine to coarse gravel, gradation varies horizontally and vertically. South side of test pit has 0.6m band of GRAVEL WITH SAND below topsoil layer, <5% fines.		Sample 1-B at 10:10 (2 gallon bags).
2												
3												Significant caving and sloughing observed. Material is cohesionless.
4		2-B		53	46	1	5			Slight color change to olive brown. **WELL-GRADED GRAVEL WITH SAND (GW)**.		Sample 2-B at 10:25 (2 gallon bags). SOa
										Boring Terminated at 4.6 metres bgs		Bottom of test pit at 4.6 m bgs. Depth is approximate due to unstable sidewalls and constant sloughing. Backfill to ground surface with excavation spoils. Finish test pit at 11:10.

CH2MHILL

SHEET 1 of 1	**PROJECT NUMBER:**	**BORING NUMBER:** *CH13-108-TP042*

TEST PIT LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 5.49	**EXCAVATION CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1101.470	**NORTHING:** 6912661.000	**EASTING:** 584690.000	**DATE STARTED:** 8/13/2013	**DATE COMPLETED:** 8/13/2013
WATER LEVEL: --	**DATUM:** GPS/2011 LiDAR		**EXCAVATION EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Haul Road			**LOGGED BY:** M. Kacmarcik	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
0										**POORLY GRADED SAND (SP)**, brown, moist, loose, estimated 85% fine to medium sand, 10% fine subrounded to rounded gravel, <5% cobbles, lenses of well-graded sand and sandy gravel observed in pit wall, <5% fines.		--Groundwater not encountered. Begin excavation at 11:40. No topsoil, few sparse shrubs.
		1-B										Sample 1-B at 11:50 (2 gallon bags).
1												
2												Material very uniform in test pit over depth excavated. Operator notes density increasing with depth. No sloughing below 1.8m.
3												
4		2-B										Sample 2-B at 12:10 (2 gallon bags).
5				88	8	4				**WELL-GRADED GRAVEL (GW)**.		SOa
										Test Pit Terminated at 5.49 metres bgs		Bottom of test pit at 5.5 m bgs. Minor sloughing observed, walls stand mostly vertical. Backfill to surface with compacted spoils. Finish backfill at 12:30.

CH2MHILL

SHEET 1 of 1	**PROJECT NUMBER:**	**BORING NUMBER:** *CH13-108-TP043*

TEST PIT LOG

PROJECT NAME: Faro Mine Remediation Project		**HOLE DEPTH (m):** 4.88	**EXCAVATION CONTRACTOR:** TEES	
TOP OF CASING ELEVATION: 1101.770	**NORTHING:** 6912759.000	**EASTING:** 584789.000	**DATE STARTED:** 8/13/2013	**DATE COMPLETED:** 8/13/2013
WATER LEVEL: --	**DATUM:** GPS/2011 LiDAR		**EXCAVATION EQUIPMENT:** Cat 345CL Excavator with 4' Bucket	
LOCATION: Haul Road			**LOGGED BY:** M. Kacmarcik	

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
										SILTY SAND WITH GRAVEL (SM), brown, moist, medium dense, estimated 20% silt, 50% well-graded fine to coarse sand, 20% fine to coarse subrounded to subangular gravel, 10% cobbles and trace boulders (round to subrounded).		--Groundwater not encountered. Begin excavated at 12:35. No topsoil or vegetation.
1		1-B										Sample 1-B at 12:40 (2 gallon bags).
2												Material very uniform in test pit across depth explored.
3												
		2-B										Sample 2-B at 13:05 (2 gallon bags). Operator notes harder material below 4.6 m bgs. Difficult to curl bucket.
4				48	31	21	8			**SILTY GRAVEL WITH SAND (GM)**.		SOa
										Test Pit Terminated at 4.88 metres bgs		Bottom of test pit at 4.9 m bgs. Test pit wells stand vertical, minimal caving /sloughing observed. No water. Backfill to ground surface with compacted excavation spoils. Finish backfill at 13:15.

CH2MHILL

SHEET 1 of 1

PROJECT NUMBER:

BORING NUMBER: ***CH13-108-TP044***

TEST PIT LOG

PROJECT NAME: Faro Mine Remediation Project

HOLE DEPTH (m): 5.79

EXCAVATION CONTRACTOR: TEES

TOP OF CASING ELEVATION: 1100.530

NORTHING: 6912895.000

EASTING: 584752.000

DATE STARTED: 8/13/2013

DATE COMPLETED: 8/13/2013

WATER LEVEL: --

DATUM: GPS/2011 LiDAR

EXCAVATION EQUIPMENT: Cat 345CL Excavator with 4' Bucket

LOCATION: Haul Road

LOGGED BY: M. Kacmarcik

DEPTH (m bgs)	RECOVERY (%)	SAMPLE TYPE	SPT RESULTS 6"-6"-6"-6" (N)	SIZE DISTRIBUTION %G	%S	%F	Moisture Content	Liquid Limit	Plasticity Index	SOIL DESCRIPTION	Graphic Log	COMMENTS (e.g.: DRILLING FLUID LOSS, TESTS, OR DRILLER COMMENTS, ETC.)
										(FILL) WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM), brown, moist, medium dense.		--Groundwater not encountered. Begin excavation at 13:20. No topsoil or vegetation.
										(TILL) SANDY GRAVELLY LEAN CLAY (CL). olive gray, moist, stiff, estimated 50% silt/lean clay, 20% fine to coarse sand, 20% fine to coarse subrounded to subangular gravel, 10% rounded to subangular cobbles.		Color change to olive gray. Becomes clayier.
		1-B										Sample 1-B at 13:30 (2 gallon bags).
1												
												Profile becomes increasingly coarse and well-graded with depth. Transition occurs over range 1.5 to 3 m bgs.
2												
										SILTY GRAVEL WITH SAND (GM), olive gray, moist, hard, estimated 15% fine, 30% well-graded sand, 40% well-graded gravel, 15% rounded cobbles, <5% rounded boulders.		
3												
												Operator notes very hard digging below 3.6 m bgs.
4												
												Max boulder observed is 0.4m rounded granite boulder.
5				50	41	9				**WELL-GRADED GRAVEL WITH SAND (GW)**.		SOa
		2-B										Sample 2-B at 13:05 (2 gallon bags).
										Test Pit Terminated at 5.79 metres bgs		Bottom of test pit at 5.8 m bgs. Minimal caving and sloughing observed. Walls stand vertical. Backfill with spoils to ground surface. Finish Backfill at 14:30.

CH2MHILL

Attachment 2
Certified Laboratory Analytical Results

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

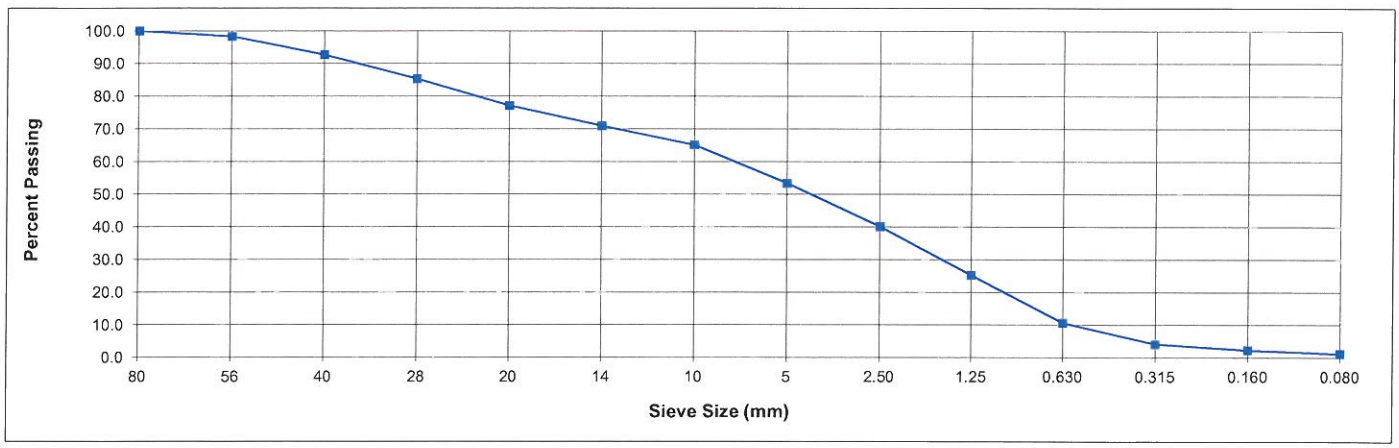
PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP041_SOa**
Source:	**BSI Haul Road, Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: August 13, 2013
DATE TESTED: September 24, 2013

SAMPLED BY: Client
TESTED BY: VN

SIEVE ANALYSIS					MATERIAL SPECIFICATION:	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 5	- 5		
80	0.0	100.0	0.0			
56	1.7	98.3	3.6			
40	5.6	92.7	12.0			
28	7.4	85.4	15.8			
20	8.2	77.2	17.6			
14	6.2	71.0	13.2			
10	5.9	65.1	12.6			
5	11.8	53.4	25.2			
2.50	13.2	40.1		24.8		
1.25	14.9	25.2		28.0		
0.630	14.6	10.6		27.4		
0.315	6.5	4.2		12.1		
0.160	1.8	2.3		3.4		
0.080	1.1	1.2		2.0		
PAN	1.2	0		2.3		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other zones/depths. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

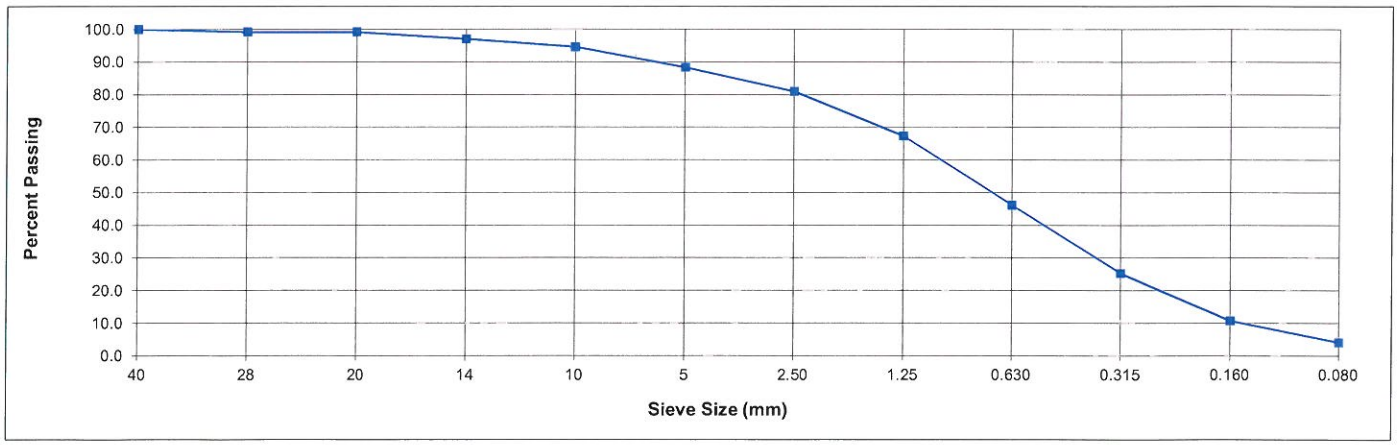
PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP042_SOa**
Source:	**BSI Haul Road, Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: August 13, 2013
DATE TESTED: September 25, 2013

SAMPLED BY: Client
TESTED BY: DC

SIEVE ANALYSIS					MATERIAL SPECIFICATION:	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 5	- 5		
40	0.0	100.0	0.0			
28	0.8	99.2	7.1			
20	0.0	99.2	0.0			
14	2.2	97.0	18.4			
10	2.5	94.6	21.0			
5	6.3	88.3	53.5			
2.50	7.3	81.0		8.3		
1.25	13.7	67.3		15.5		
0.630	21.2	46.1		24.0		
0.315	20.9	25.2		23.7		
0.160	14.5	10.7		16.5		
0.080	6.6	4.1		7.5		
PAN	4.1	0		4.6		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

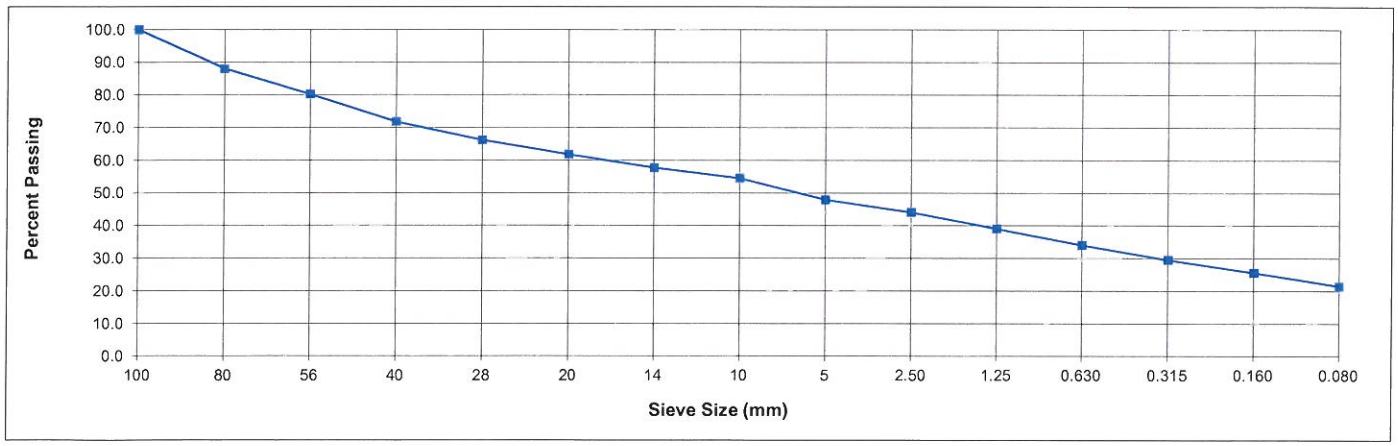
PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP043_SOa**
Source:	**BSI Haul Road,Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: August 13, 2013
DATE TESTED: September 26, 2013

SAMPLED BY: Client
TESTED BY: OA

SIEVE ANALYSIS					MATERIAL SPECIFICATION:	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 5	- 5		
100	0.0	100.0	0.0			
80	11.9	88.1	22.9			
56	7.8	80.3	14.9			
40	8.5	71.8	16.2			
28	5.6	66.2	10.7			
20	4.5	61.7	8.6			
14	4.0	57.7	7.7			
10	3.2	54.5	6.2			
5	6.6	47.9	12.7			
2.50	3.8	44.1		8.0		
1.25	5.0	39.1		10.3		
0.630	5.1	34.0		10.6		
0.315	4.5	29.5		9.4		
0.160	3.9	25.6		8.2		
0.080	4.2	21.4		8.7		
PAN	21.4	0		44.8		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

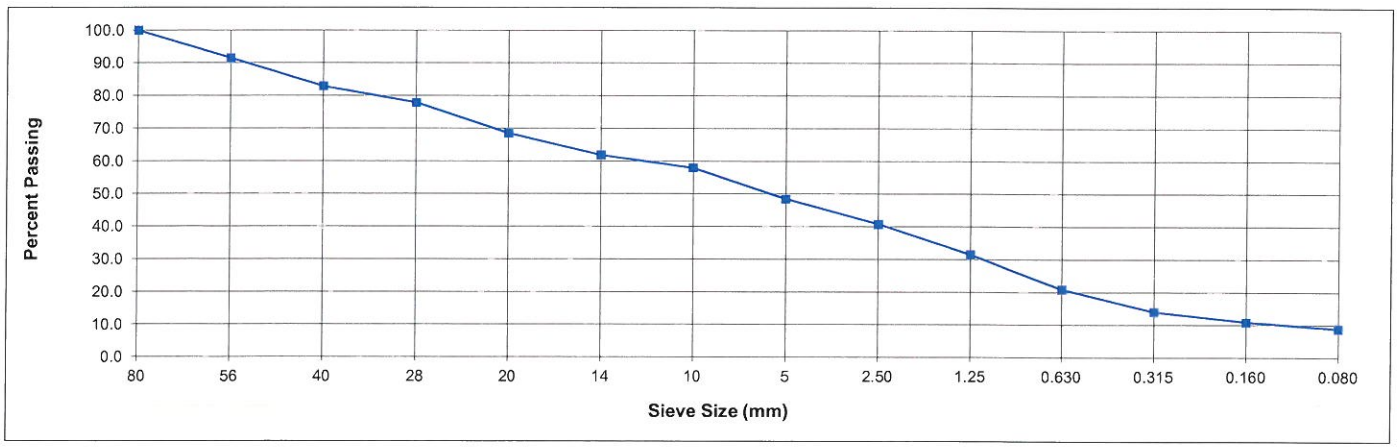
PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP044_SOa**
Source:	**BSI Haul Road, Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: August 13, 2013
DATE TESTED: September 25, 2013

SAMPLED BY: Client
TESTED BY: DC

SIEVE ANALYSIS					MATERIAL SPECIFICATION:	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 5	- 5		
80	0.0	100.0	0.0			
56	8.5	91.5	16.5			
40	8.6	82.9	16.7			
28	5.0	77.8	9.8			
20	9.3	68.5	18.1			
14	6.7	61.8	12.9			
10	3.9	57.9	7.5			
5	9.5	48.4	18.4			
2.50	7.7	40.8		15.8		
1.25	9.3	31.5		19.2		
0.630	10.6	20.9		21.9		
0.315	6.8	14.0		14.1		
0.160	3.1	10.9		6.5		
0.080	2.0	8.9		4.1		
PAN	8.9	0		18.3		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other zones/depths. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

ORGANIC IMPURITIES IN FINE AGGREGATES FOR CONCRETE

CSA A23.2-7A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP041_SOa**
Source:	**BSI Haul Road, Tar #13, Faro Mine Complex, Yukon**

Date sampled: August 13, 2013
Date tested: September 30, 2013

Sampled by: Client
Tested by: SJ

COLOUR PLATE VALUE	**3**

Note: Colour plate values range from No.1 to 5, with No. 1 being the lightest.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

ORGANIC IMPURITIES IN FINE AGGREGATES FOR CONCRETE

CSA A23.2-7A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP043_SOa**
Source:	**BSI Haul Road, Tar #13, Faro Mine Complex, Yukon**

Date sampled: August 13, 2013
Date tested: September 30, 2013

Sampled by: Client
Tested by: SJ

COLOUR PLATE VALUE	**Lighter Than No. 1**

Note: Colour plate values range from No.1 to 5, with No. 1 being the lightest.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

FLAT AND ELONGATED PARTICLES IN COARSE AGGREGATE

CSA A23.2-13A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta, T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP041_SOa**
Source:	**BSI Haul Road, Tar #13, Faro Mine Complex, Yukon**

Date sampled: August 13, 2013
Date tested: September 25, 2013
Procedure used: A

Sampled by: Client
Tested by: VN
Calliper ratio: 4:1

Particle Size (mm)	Mass of Test Sample (g)	Original Grading (% Retained)	Flat (%)	Elongated (%)	Flat & Elongated (%)
80 x 56	---	3.6(1)	0.0	0.0	0.0
56 x 40	1158.9(2)	12.0	0.0	0.0	0.0
40 x 28	2209.0	15.8	0.0	0.0	6.3
28 x 20	2844.9	17.6	1.2	0.0	5.4
20 × 14	1122.0	13.2	1.1	0.0	5.7
14 × 10	327.2	12.6	0.3	0.0	8.8
10 × 5	153.0	25.2	1.0	0.0	5.9
Weighted Average			**0.6**	**0.0**	**5.3**

Notes: *(1) The size fractions less than 10 % do not need to be tested. The percentages were taken from the next samller size for weighted average calculation*
(2) Available sample on this size fraction was insufficient to meet the minimum testing mass requirement.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

FLAT AND ELONGATED PARTICLES IN COARSE AGGREGATE

CSA A23.2-13A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta, T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP043_SOa**
Source:	**BSI Haul Road, Tar #13, Faro Mine Complex, Yukon**

Date sampled: August 13, 2013
Date tested: September 26, 2013
Procedure used: A

Sampled by: Client
Tested by: VN
Calliper ratio: 4:1

Particle Size (mm)	Mass of Test Sample (g)	Original Grading (% Retained)	Flat (%)	Elongated (%)	Flat & Elongated (%)
> 80	1500.0(2)	22.9	0.0	0.0	0.0
80 x 56	1518.3(2)	14.9	0.0	0.0	0.0
56 x 40	1513.0(2)	16.2	0.0	0.0	0.0
40 x 28	4455.5	10.7	0.6	0.0	2.2
28 x 20	---	8.6(1)	0.0	0.0	2.2
20 × 14	---	7.7(1)	0.3	0.0	2.5
14 × 10	---	6.2(1)	0.3	0.0	2.5
10 × 5	153.5	12.7	0.3	0.0	2.5
Weighted Average			**0.2**	**0.0**	**1.1**

Notes: *(1) The size fractions less than 10 % do not need to be tested. The percentages were taken from the next larger/smaller size for weighted average calculation.*
(2) Available sample on these size fractions were insufficient to meet the minimum testing mass requirement.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

RESISTANCE OF COARSE AGGREGATE TO DEGRADATION BY ABRASION IN THE MICRO-DEVAL APPARATUS

CSA A23.2-29A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP041_SOa**
Source:	**BSI Haul Road, Tar #13, Faro Mine Complex, Yukon**

Date sampled: August 13, 2013
Date tested: October 2, 2013

Sampled by: Client
Tested by: OA

Grading	Section 6.2 - 20 x 14, 14 x 10 mm sieve fractions
Loss at Conclusion of Test (%)	**14.5**

Validation test: Drain Brothers control aggregate loss was 14.0 %; tested on October 1, 2013. Valid range is 11.4 - 14.8 %.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

RESISTANCE OF COARSE AGGREGATE TO DEGRADATION BY ABRASION IN THE MICRO-DEVAL APPARATUS

CSA A23.2-29A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP043_SOa**
Source:	**BSI Haul Road, Tar #13, Faro Mine Complex, Yukon**

Date sampled: August 13, 2013
Date tested: October 2, 2013

Sampled by: Client
Tested by: OA

Grading	Section 6.2 - 20 x 14, 14 x 10 mm sieve fractions
Loss at Conclusion of Test (%)	**14.0**

Validation test: Drain Brothers control aggregate loss was 14.0 %; tested on October 1, 2013. Valid range is 11.4 - 14.8 %.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

RESISTANCE OF FINE AGGREGATE TO DEGRADATION BY ABRASION IN THE MICRO-DEVAL APPARATUS

CSA A23.2-23A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP041_SOa**
Source:	**BSI Haul Road, Tar #13, Faro Mine Complex, Yukon**

Date sampled: August 13, 2013
Date tested: October 2, 2013

Sampled by: Client
Tested by: DC

Grading	Fines, 5 x 0.08mm sieve fractions
Loss at Conclusion of Test (%)	**12.7**

Validation test: Sutherland Sand control aggregate loss was 17.1 %; tested on October 1, 2013. Valid range is 15.2 - 18.4 %.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

RESISTANCE OF FINE AGGREGATE TO DEGRADATION BY ABRASION IN THE MICRO-DEVAL APPARATUS

CSA A23.2-23A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP043_SOa**
Source:	**BSI Haul Road, Tar #13, Faro Mine Complex, Yukon**

Date sampled: August 13, 2013
Date tested: October 2, 2013

Sampled by: Client
Tested by: DC

Grading	Fines, 5 x 0.08mm sieve fractions
Loss at Conclusion of Test (%)	**16.8**

Validation test: Sutherland Sand control aggregate loss was 17.1 %; tested on October 1, 2013. Valid range is 15.2 - 18.4 %.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

RELATIVE DENSITY AND ABSORPTION OF COARSE AGGREGATE

CSA A23.2-12A

October 8, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP041_SOa**
Source:	**BSI Haul Road, Tar #13, Faro Mine Complex, Yukon**

Date sampled: August 13, 2013
Date tested: September 26, 2013

Sampled by: Client
Tested by: SJ

Trial No.	Mass (g)	Relative Density (Dry Basis)	Relative Density (SSD Basis)	Apparent Relative Density	Absorption (%)
1	4516.2	2.635	2.665	2.717	1.14
2	4189.6	2.630	2.664	2.722	1.29
AVERAGE		**2.633**	**2.665**	**2.720**	**1.22**

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

SOUNDNESS OF FINE AND COARSE AGGREGATE BY USE OF MAGNESIUM SULPHATE

CSA A23.2-9A

October 11, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP043_SOa, Coarse Portion**
Source:	**BSI Haul Road, Tar #13, Faro Mine Complex, Yukon**

Date sampled: August 13, 2013
Date tested: October 1 - 9, 2013

Sampled by: Client
Tested by: DC

Sieve Fraction (mm)	Original Grading (%)	Mass/Fraction Before Test (g)	Loss (%)	Weighted Loss (%)
> 80(1)	22.9	--	0.3	0.1
80 × 56 56 × 40	31.2	3031.3	0.3	0.1
40 × 28 28 × 20	19.3	1506.5	2.3	0.4
20 × 14 14 × 10	13.9	1002.1	3.5	0.5
10 × 5	12.7	300.5	5.5	0.7
	100.0		**TOTAL**	**1.8**

Note: *(1) The size fraction larger than 80 mm is not required for testing. The loss was taken from the next smaller size for weighted average calculation.*

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

RELATIVE DENSITY AND ABSORPTION OF FINE AGGREGATE

CSA A23.2-6A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP041_SOa**
Source:	**BSI Haul Road, Tar #13, Faro Mine Complex, Yukon**

Date sampled: August 13, 2013
Date tested: September 26, 2013

Sampled by: Client
Tested by: SJ

Sample Test Condition: as received (unwashed)

Trial No.	Mass (g)	Relative Density (Dry Basis)	Relative Density (SSD Basis)	Apparent Relative Density	Absorption (%)
1	500.5	2.573	2.615	2.686	1.65
2	500.6	2.577	2.622	2.700	1.77
AVERAGE		**2.575**	**2.619**	**2.693**	**1.71**

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

RELATIVE DENSITY AND ABSORPTION OF FINE AGGREGATE

CSA A23.2-6A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP043_SOa**
Source:	**BSI Haul Road, Tar #13, Faro Mine Complex, Yukon**

Date sampled: August 13, 2013
Date tested: October 1, 2013

Sampled by: Client
Tested by: SJ

1. Sample Test Condition: as received (unwashed)

Trial No.	Mass (g)	Relative Density (Dry Basis)	Relative Density (SSD Basis)	Apparent Relative Density	Absorption (%)
1	500.0	2.434	2.493	2.585	2.40
2	500.1	2.448	2.503	2.591	2.25
AVERAGE		**2.441**	**2.498**	**2.588**	**2.33**

2. Sample Test Condition: washed

Trial No.	Mass (g)	Relative Density (Dry Basis)	Relative Density (SSD Basis)	Apparent Relative Density	Absorption (%)
1	500.4	2.548	2.585	2.646	1.46
2	500.4	2.545	2.582	2.643	1.46
AVERAGE		**2.547**	**2.584**	**2.695**	**1.46**

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

SOUNDNESS OF FINE AND COARSE AGGREGATE BY USE OF MAGNESIUM SULPHATE

CSA A23.2-9A

October 11, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP041_SOa, Coarse Portion**
Source:	**BSI Haul Road, Tar #13, Faro Mine Complex, Yukon**

Date sampled: August 13, 2013
Date tested: October 1 - 9, 2013

Sampled by: Client
Tested by: DC

Sieve Fraction (mm)	Original Grading (%)	Mass/Fraction Before Test (g)	Loss (%)	Weighted Loss (%)
80 × 56 56 × 40	15.6	1960.8(1)	0.1	0.0
40 × 28 28 × 20	33.4	1504.3	2.9	1.0
20 × 14 14 × 10	25.8	1000.7	9.0	2.3
10 × 5	25.2	302.6	5.2	1.3
	100.0		**TOTAL**	**4.6**

Note: *(1) Available sample on this size fraction was insufficient to meet the minimum testing mass requirement.*

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

SOUNDNESS OF FINE AND COARSE AGGREGATE BY USE OF MAGNESIUM SULPHATE

CSA A23.2-9A

October 11, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP043_SOa, Coarse Portion**
Source:	**BSI Haul Road, Tar #13, Faro Mine Complex, Yukon**

Date sampled: August 13, 2013
Date tested: October 1 - 9, 2013

Sampled by: Client
Tested by: DC

Sieve Fraction (mm)	Original Grading (%)	Mass/Fraction Before Test (g)	Loss (%)	Weighted Loss (%)
> 80(1)	22.9	--	0.3	0.1
80 × 56 56 × 40	31.2	3031.3	0.3	0.1
40 × 28 28 × 20	19.3	1506.5	2.3	0.4
20 × 14 14 × 10	13.9	1002.1	3.5	0.5
10 × 5	12.7	300.5	5.5	0.7
	100.0		**TOTAL**	**1.8**

Note: *(1) The size fraction larger than 80 mm is not required for testing. The loss was taken from the next smaller size for weighted average calculation.*

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

SOUNDNESS OF FINE AND COARSE AGGREGATE BY USE OF MAGNESIUM SULPHATE

CSA A23.2-9A

October 11, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP041_SOa, Coarse Portion**
Source:	**BSI Haul Road, Tar #13, Faro Mine Complex, Yukon**

Date sampled: August 13, 2013
Date tested: October 1 - 9, 2013

Sampled by: Client
Tested by: DC

Sieve Fraction (mm)	Original Grading (%)	Mass/Fraction Before Test (g)	Loss (%)	Weighted Loss (%)
80 × 56 56 × 40	15.6	1960.8(1)	0.1	0.0
40 × 28 28 × 20	33.4	1504.3	2.9	1.0
20 × 14 14 × 10	25.8	1000.7	9.0	2.3
10 × 5	25.2	302.6	5.2	1.3
	100.0		**TOTAL**	**4.6**

Note: *(1) Available sample on this size fraction was insufficient to meet the minimum testing mass requirement.*

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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SOUNDNESS OF FINE AND COARSE AGGREGATE BY USE OF MAGNESIUM SULPHATE

CSA A23.2-9A

October 11, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP043_SOa, Fine Portion**
Source:	**BSI Haul Road, Tar #13, Faro Mine Complex, Yukon**

Date sampled: August 13, 2013
Date tested: September 30 - October 8, 2013

Sampled by: Client
Tested by: DC

Sieve Fraction (mm)	Original Grading % Retained	Mass Before Test (g)	Loss (%)	Weighted Loss (%)
5.0 - 2.5	8.0	100.0	12.1	1.0
2.5 - 1.25	10.3	100.0	9.3	1.0
1.25 - 0.630	10.6	100.0	9.9	1.0
0.630 - 0.315	9.4	100.0	8.1	0.8
< 0.315	61.7	---	0.0(1)	0.0
Weighted Average Loss				**3.8**

Note: 1. Size fractions < 0.315 mm are assumed to have a loss of 0.0 % as per standard.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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FLAT AND ELONGATED PARTICLES IN COARSE AGGREGATE

CSA A23.2-13A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta, T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP022_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: September 25, 2013
Procedure used: A

Sampled by: Client
Tested by: VN
Calliper ratio: 4:1

Particle Size (mm)	Mass of Test Sample (g)	Original Grading (% Retained)	Flat (%)	Elongated (%)	Flat & Elongated (%)
80 x 56	---	8.2(1)	0.0	0.0	0.0
56 x 40	3925.3	21.4	0.0	0.0	0.0
40 x 28	4764.7	28.1	0.0	0.0	0.8
28 x 20	3503.0	19.1	0.2	0.0	2.6
20 × 14	1105.1	10.0	1.1	0.0	5.6
14 × 10	---	6.2(1)	1.1	0.0	5.6
10 × 5	---	7.0(1)	1.1	0.0	5.6
Weighted Average			**0.3**	**0.0**	**2.0**

Notes: *(1) The size fractions less than 10 % do not need to be tested. The percentages were taken from the next larger/smaller size for weighted average calculation*

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

FLAT AND ELONGATED PARTICLES IN COARSE AGGREGATE

CSA A23.2-13A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta, T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP025_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: September 25, 2013
Procedure used: A

Sampled by: Client
Tested by: VN
Calliper ratio: 4:1

Particle Size (mm)	Mass of Test Sample (g)	Original Grading (% Retained)	Flat (%)	Elongated (%)	Flat & Elongated (%)
56 x 40	---	6.7(1)	0.0	0.0	3.0
40 x 28	2406.3	11.1	0.0	0.0	3.0
28 x 20	2680.1	18.8	0.0	0.0	6.4
20 × 14	1042.6	17.0	2.6	0.0	8.8
14 × 10	788.8	18.1	2.2	0.0	14.1
10 × 5	227.5	28.3	0.9	0.0	9.0
Weighted Average			**1.1**	**0.0**	**8.3**

Notes: *(1) The size fractions less than 10 % do not need to be tested. The percentage was taken from the next smaller size for weighted average calculation*

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

FLAT AND ELONGATED PARTICLES IN COARSE AGGREGATE

CSA A23.2-13A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta, T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP027A_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: September 27, 2013
Procedure used: A

Sampled by: Client
Tested by: VN
Calliper ratio: 4:1

Particle Size (mm)	Mass of Test Sample (g)	Original Grading (% Retained)	Flat (%)	Elongated (%)	Flat & Elongated (%)
80 x 56	1543.5(1)	13.3	0.0	0.0	0.0
56 x 40	1506.1(1)	16.1	0.0	0.0	0.0
40 x 28	5628.0	18.3	0.0	0.0	1.5
28 x 20	3935.8	14.9	0.7	0.0	2.4
20 × 14	874.4	11.4	0.0	0.0	2.0
14 × 10	426.7	10.1	1.3	0.0	5.4
10 × 5	159.6	16.0	1.4	0.0	7.7
Weighted Average			**0.5**	**0.0**	**2.6**

Note: *(1) Available sample on these size fractions were insufficient to meet the minimum testing mass requirement.*

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

RESISTANCE OF COARSE AGGREGATE TO DEGRADATION BY ABRASION IN THE MICRO-DEVAL APPARATUS

CSA A23.2-29A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP022_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: October 1, 2013

Sampled by: Client
Tested by: OA

Grading	Section 6.2 - 20 x 14, 14 x 10 mm sieve fractions
Loss at Conclusion of Test (%)	**16.8**

Validation test: Drain Brothers control aggregate loss was 14.0 %; tested on October 1, 2013. Valid range is 11.4 - 14.8 %.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

RESISTANCE OF COARSE AGGREGATE TO DEGRADATION BY ABRASION IN THE MICRO-DEVAL APPARATUS

CSA A23.2-29A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP025_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: October 1, 2013

Sampled by: Client
Tested by: OA

Grading	Section 6.2 - 20 x 14, 14 x 10 mm sieve fractions
Loss at Conclusion of Test (%)	**15.0**

Validation test: Drain Brothers control aggregate loss was 14.0 %; tested on October 1, 2013. Valid range is 11.4 - 14.8 %.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

RESISTANCE OF COARSE AGGREGATE TO DEGRADATION BY ABRASION IN THE MICRO-DEVAL APPARATUS

CSA A23.2-29A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP027A_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: October 2, 2013

Sampled by: Client
Tested by: OA

Grading	Section 6.2 - 20 x 14, 14 x 10 mm sieve fractions
Loss at Conclusion of Test (%)	**14.6**

Validation test: Drain Brothers control aggregate loss was 14.0 %; tested on October 1, 2013. Valid range is 11.4 - 14.8 %.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

RESISTANCE OF FINE AGGREGATE TO DEGRADATION BY ABRASION IN THE MICRO-DEVAL APPARATUS

CSA A23.2-23A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP022_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: October 1, 2013

Sampled by: Client
Tested by: DC

Grading	Fines, 5 x 0.08mm sieve fractions
Loss at Conclusion of Test (%)	**17.5**

Validation test: Sutherland Sand control aggregate loss was 17.1 %; tested on October 1, 2013. Valid range is 15.2 - 18.4 %.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

RESISTANCE OF FINE AGGREGATE TO DEGRADATION BY ABRASION IN THE MICRO-DEVAL APPARATUS

CSA A23.2-23A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP025_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: October 1, 2013

Sampled by: Client
Tested by: OA

Grading	Fines, 5 x 0.08mm sieve fractions
Loss at Conclusion of Test (%)	**16.8**

Validation test: Sutherland Sand control aggregate loss was 17.1 %; tested on October 1, 2013. Valid range is 15.2 - 18.4 %.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

RESISTANCE OF FINE AGGREGATE TO DEGRADATION BY ABRASION IN THE MICRO-DEVAL APPARATUS

CSA A23.2-23A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP027A_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: October 2, 2013

Sampled by: Client
Tested by: DC

Grading	Fines, 5 x 0.08mm sieve fractions
Loss at Conclusion of Test (%)	**13.9**

Validation test: Sutherland Sand control aggregate loss was 17.1 %; tested on October 1, 2013. Valid range is 15.2 - 18.4 %.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

ORGANIC IMPURITIES IN FINE AGGREGATES FOR CONCRETE

CSA A23.2-7A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP022_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: September 30, 2013

Sampled by: Client
Tested by: SJ

COLOUR PLATE VALUE	**2**

Note: Colour plate values range from No.1 to 5, with No. 1 being the lightest.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

ORGANIC IMPURITIES IN FINE AGGREGATES FOR CONCRETE

CSA A23.2-7A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP025_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: September 30, 2013

Sampled by: Client
Tested by: SJ

COLOUR PLATE VALUE	**4**

Note: Colour plate values range from No.1 to 5, with No. 1 being the lightest.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

ORGANIC IMPURITIES IN FINE AGGREGATES FOR CONCRETE

CSA A23.2-7A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP027A_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: September 30, 2013

Sampled by: Client
Tested by: SJ

COLOUR PLATE VALUE	**Lighter Than No. 1**

Note: Colour plate values range from No.1 to 5, with No. 1 being the lightest.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

RELATIVE DENSITY AND ABSORPTION OF COARSE AGGREGATE

CSA A23.2-12A

October 8, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP022_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: September 24, 2013

Sampled by: Client
Tested by: SJ

Size Fraction	Trial No.	Mass (g)	Relative Density (Dry Basis)	Relative Density (SSD Basis)	Apparent Relative Density	Absorption (%)
< 20 mm	1	2731.5	2.673	2.705	2.754	1.13
	2	2932.1	2.671	2.702	2.757	1.16
	AVERAGE		2.672	2.704	2.756	1.15
> 20 mm	1	6964.9	2.713	2.732	2.767	0.73
	AVERAGE		2.713	2.732	2.767	0.73

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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RELATIVE DENSITY AND ABSORPTION OF COARSE AGGREGATE

CSA A23.2-12A

October 8, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP025_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: September 25, 2013

Sampled by: Client
Tested by: SJ

Trial No.	Mass (g)	Relative Density (Dry Basis)	Relative Density (SSD Basis)	Apparent Relative Density	Absorption (%)
1	3873.2	2.656	2.701	2.782	1.71
2	3587.5	2.647	2.694	2.779	1.79
AVERAGE		**2.651**	**2.698**	**2.780**	**1.75**

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

RELATIVE DENSITY AND ABSORPTION OF COARSE AGGREGATE

CSA A23.2-12A

October 8, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP027A_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: September 30, 2013

Sampled by: Client
Tested by: VN

Size Fraction	Trial No.	Mass (g)	Relative Density (Dry Basis)	Relative Density (SSD Basis)	Apparent Relative Density	Absorption (%)
< 20 mm	1	2572.8	2.639	2.677	2.744	1.46
	2	2754.2	2.642	2.678	2.742	1.39
	AVERAGE		2.641	2.678	2.743	1.43
> 20 mm	1	3546.0	2.682	2.704	2.743	0.82
	2	3866.4	2.688	2.711	2.750	0.83
	AVERAGE		2.685	2.708	2.747	0.83

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

RELATIVE DENSITY AND ABSORPTION OF FINE AGGREGATE

CSA A23.2-6A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP022_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: September 24, 2013

Sampled by: Client
Tested by: SJ

Sample Test Condition: as received (unwashed)

Trial No.	Mass (g)	Relative Density (Dry Basis)	Relative Density (SSD Basis)	Apparent Relative Density	Absorption (%)
1	500.9	2.570	2.614	2.688	1.71
2	500.1	2.574	2.620	2.698	1.79
AVERAGE		**2.572**	**2.617**	**2.693**	**1.75**

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

RELATIVE DENSITY AND ABSORPTION OF FINE AGGREGATE

CSA A23.2-6A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP025_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: September 25, 2013

Sampled by: Client
Tested by: SJ

Sample Test Condition: as received (unwashed)

Trial No.	Mass (g)	Relative Density (Dry Basis)	Relative Density (SSD Basis)	Apparent Relative Density	Absorption (%)
1	500.8	2.550	2.593	2.666	1.71
2	500.1	2.557	2.601	2.674	1.71
AVERAGE		**2.553**	**2.597**	**2.670**	**1.71**

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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RELATIVE DENSITY AND ABSORPTION OF FINE AGGREGATE

CSA A23.2-6A

October 9, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP027A_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: September 25, 2013

Sampled by: Client
Tested by: SJ

Sample Test Condition: as received (unwashed)

Trial No.	Mass (g)	Relative Density (Dry Basis)	Relative Density (SSD Basis)	Apparent Relative Density	Absorption (%)
1	500.7	2.600	2.632	2.688	1.25
2	500.3	2.596	2.629	2.685	1.28
AVERAGE		**2.598**	**2.631**	**2.686**	**1.27**

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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SOUNDNESS OF FINE AND COARSE AGGREGATE BY USE OF MAGNESIUM SULPHATE

CSA A23.2-9A

October 11, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP022_SOa, Coarse Portion**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: October 1 - 9, 2013

Sampled by: Client
Tested by: DC

Sieve Fraction (mm)	Original Grading (%)	Mass/Fraction Before Test (g)	Loss (%)	Weighted Loss (%)
80 × 56 56 × 40	29.6	3005.9	0.8	0.2
40 × 28 28 × 20	47.2	1506.3	3.2	1.5
20 × 14 14 × 10	16.2	1005.9	4.8	0.8
10 × 5	7.0	304.0	6.1	0.4
	100.0		**TOTAL**	**2.9**

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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SOUNDNESS OF FINE AND COARSE AGGREGATE BY USE OF MAGNESIUM SULPHATE

CSA A23.2-9A

October 11, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP025_SOa, Coarse Portion**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: October 1 - 9, 2013

Sampled by: Client
Tested by: DC

Sieve Fraction (mm)	Original Grading (%)	Mass/Fraction Before Test (g)	Loss (%)	Weighted Loss (%)
80 × 56 56 × 40	6.7	1131.9(1)	2.5	0.2
40 × 28 28 × 20	29.9	1501.2	1.2	0.4
20 × 14 14 × 10	35.1	1000.7	4.9	1.7
10 × 5	28.3	301.2	7.6	2.2
	100.0		**TOTAL**	**4.4**

Note: *(1) Available sample on this size fraction was insufficient to meet the minimum testing mass requirement.*

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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SOUNDNESS OF FINE AND COARSE AGGREGATE BY USE OF MAGNESIUM SULPHATE

CSA A23.2-9A

October 11, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP027A_SOa, Coarse Portion**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: October 1 - 9, 2013

Sampled by: Client
Tested by: DC

Sieve Fraction (mm)	Original Grading (%)	Mass/Fraction Before Test (g)	Loss (%)	Weighted Loss (%)
80 × 56 56 × 40	29.4	3049.6	0.3	0.1
40 × 28 28 × 20	33.1	1509.8	2.0	0.7
20 × 14 14 × 10	21.5	1001.4	6.0	1.3
10 × 5	16.0	302.0	6.1	1.0
	100.0		**TOTAL**	**3.1**

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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SOUNDNESS OF FINE AND COARSE AGGREGATE BY USE OF MAGNESIUM SULPHATE

CSA A23.2-9A

October 11, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP022_SOa, Fine Portion**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013 **Sampled by:** Client
Date tested: September 30 - October 8, 2013 **Tested by:** DC

Sieve Fraction (mm)	Original Grading % Retained	Mass Before Test (g)	Loss (%)	Weighted Loss (%)
5.0 - 2.5	19.4	100.0	16.8	3.3
2.5 - 1.25	17.2	100.0	13.3	2.3
1.25 - 0.630	15.5	100.0	9.3	1.4
0.630 - 0.315	12.3	100.0	7.9	1.0
< 0.315	35.6	---	0.0(1)	0.0
Weighted Average Loss				**8.0**

Note: 1. Size fractions < 0.315 mm are assumed to have a loss of 0.0 % as per standard.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

SOUNDNESS OF FINE AND COARSE AGGREGATE BY USE OF MAGNESIUM SULPHATE

CSA A23.2-9A

October 11, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP025_SOa, Fine Portion**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: September 30 - October 8, 2013
Sampled by: Client
Tested by: DC

Sieve Fraction (mm)	Original Grading % Retained	Mass Before Test (g)	Loss (%)	Weighted Loss (%)
5.0 - 2.5	17.6	100.0	17.3	3.0
2.5 - 1.25	16.0	100.0	11.5	1.8
1.25 - 0.630	18.0	100.0	9.2	1.7
0.630 - 0.315	15.4	100.0	8.3	1.3
< 0.315	33.0	---	0.0(1)	0.0
Weighted Average Loss				**7.8**

Note: 1. Size fractions < 0.315 mm are assumed to have a loss of 0.0 % as per standard.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

SOUNDNESS OF FINE AND COARSE AGGREGATE BY USE OF MAGNESIUM SULPHATE

CSA A23.2-9A

October 11, 2013
Project Number: 13-1417-0047-1000

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta
T2G 1B1

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP027A_SOa, Fine Portion**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

Date sampled: July 8, 2013
Date tested: September 30 - October 8, 2013

Sampled by: Client
Tested by: DC

Sieve Fraction (mm)	Original Grading % Retained	Mass Before Test (g)	Loss (%)	Weighted Loss (%)
5.0 - 2.5	15.4	100.0	14.1	2.2
2.5 - 1.25	19.0	100.0	8.7	1.7
1.25 - 0.630	16.1	100.0	5.3	0.9
0.630 - 0.315	13.8	100.0	3.1	0.4
< 0.315	35.7	---	0.0(1)	0.0
Weighted Average Loss				**5.2**

Note: 1. Size fractions < 0.315 mm are assumed to have a loss of 0.0 % as per standard.

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

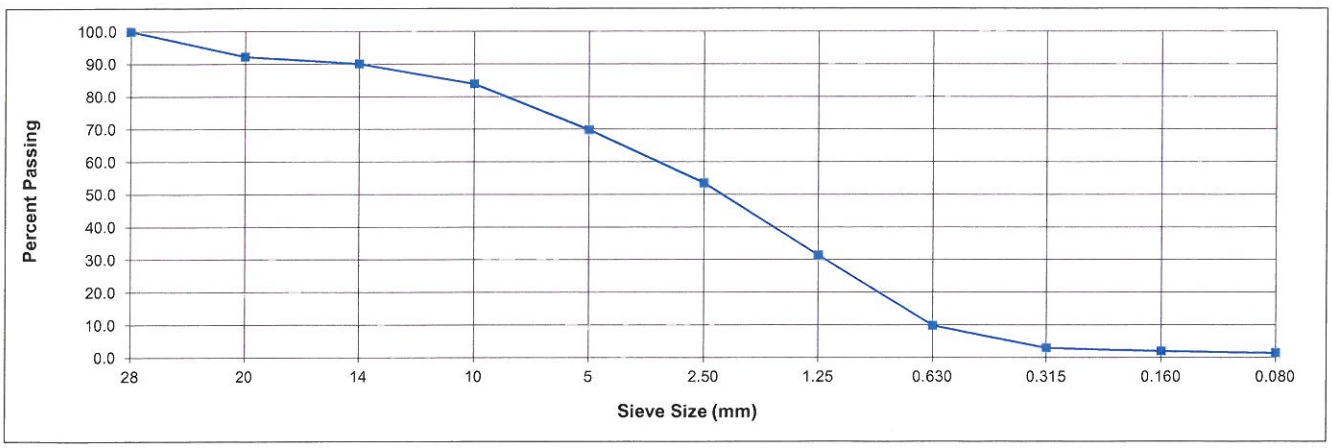
PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-SS001_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: July 8, 2013
DATE TESTED: September 24, 2013

SAMPLED BY: Client
TESTED BY: DC

SIEVE ANALYSIS					MATERIAL SPECIFICATION:	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 5	- 5		
28	0.0	100.0	0.0			
20	7.7	92.3	25.7			
14	2.2	90.0	7.3			
10	6.1	83.9	20.4			
5	14.0	69.9	46.6			
2.50	16.4	53.5		23.4		
1.25	22.1	31.4		31.6		
0.630	21.6	9.8		30.9		
0.315	6.9	2.9		9.8		
0.160	1.1	1.9		1.5		
0.080	0.5	1.4		0.7		
PAN	1.4	0		2.0		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other zones/depths. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

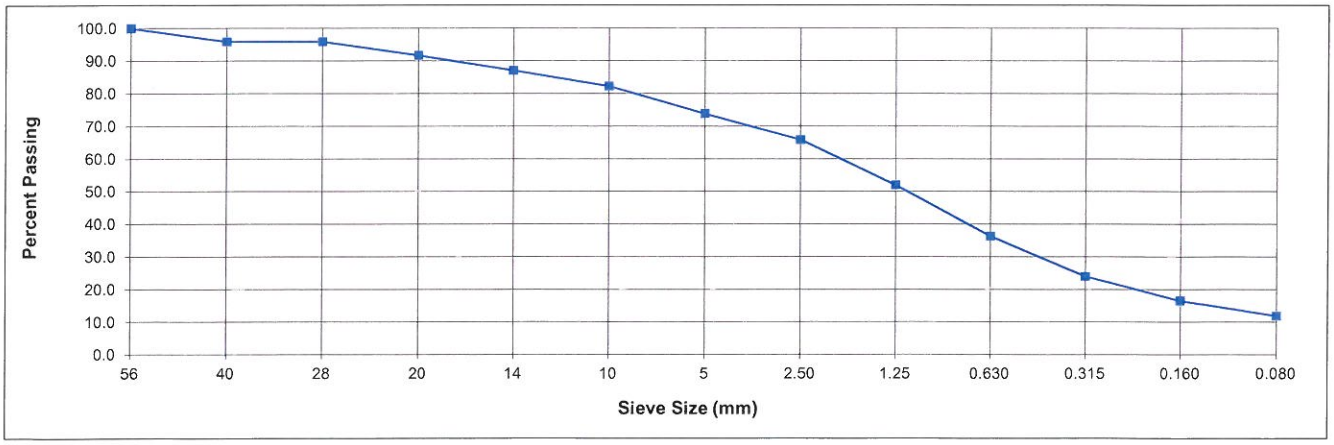
PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-SS002_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: July 8, 2013
DATE TESTED: September 24, 2013

SAMPLED BY: Client
TESTED BY: DC

SIEVE ANALYSIS					MATERIAL SPECIFICATION:	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 5	- 5		
56	0.0	100.0	0.0			
40	4.1	95.9	15.6			
28	0.0	95.9	0.0			
20	4.2	91.7	16.1			
14	4.6	87.1	17.8			
10	4.8	82.2	18.4			
5	8.4	73.8	32.1			
2.50	8.0	65.9		10.8		
1.25	13.9	51.9		18.8		
0.630	15.7	36.2		21.3		
0.315	12.3	23.9		16.6		
0.160	7.4	16.6		10.0		
0.080	4.7	11.9		6.3		
PAN	11.9	0		16.1		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

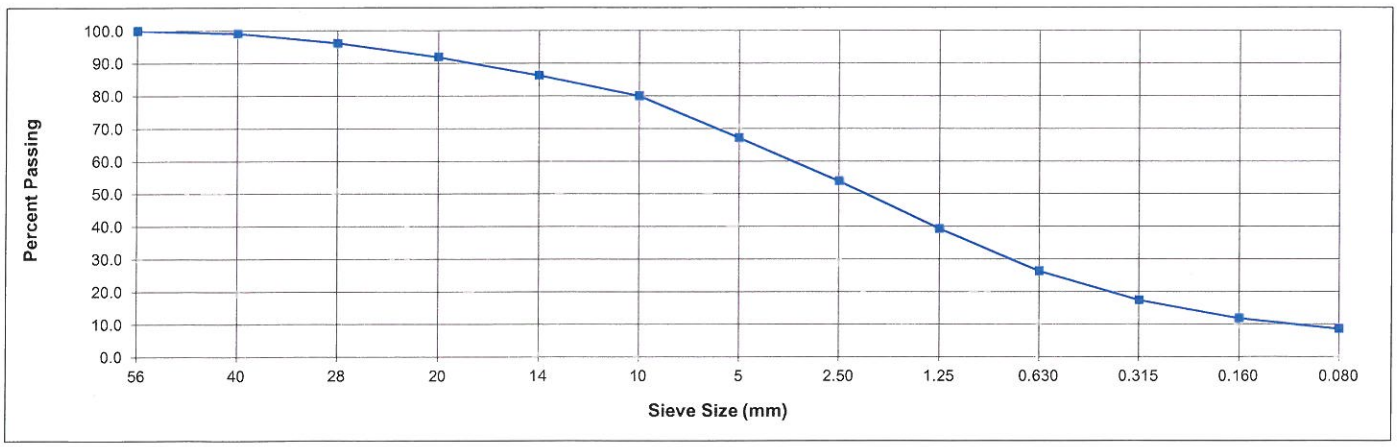
PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-SS003_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: July 8, 2013
DATE TESTED: September 24, 2013

SAMPLED BY: Client
TESTED BY: DC

SIEVE ANALYSIS					MATERIAL SPECIFICATION:	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 5	- 5		
56	0.0	100.0	0.0			
40	0.8	99.2	2.6			
28	3.0	96.2	9.0			
20	4.3	91.9	13.0			
14	5.6	86.3	17.0			
10	6.3	80.0	19.1			
5	12.9	67.1	39.3			
2.50	13.3	53.9		19.8		
1.25	14.6	39.3		21.7		
0.630	13.1	26.2		19.5		
0.315	8.8	17.4		13.1		
0.160	5.6	11.8		8.3		
0.080	3.3	8.6		4.9		
PAN	8.6	0		12.8		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

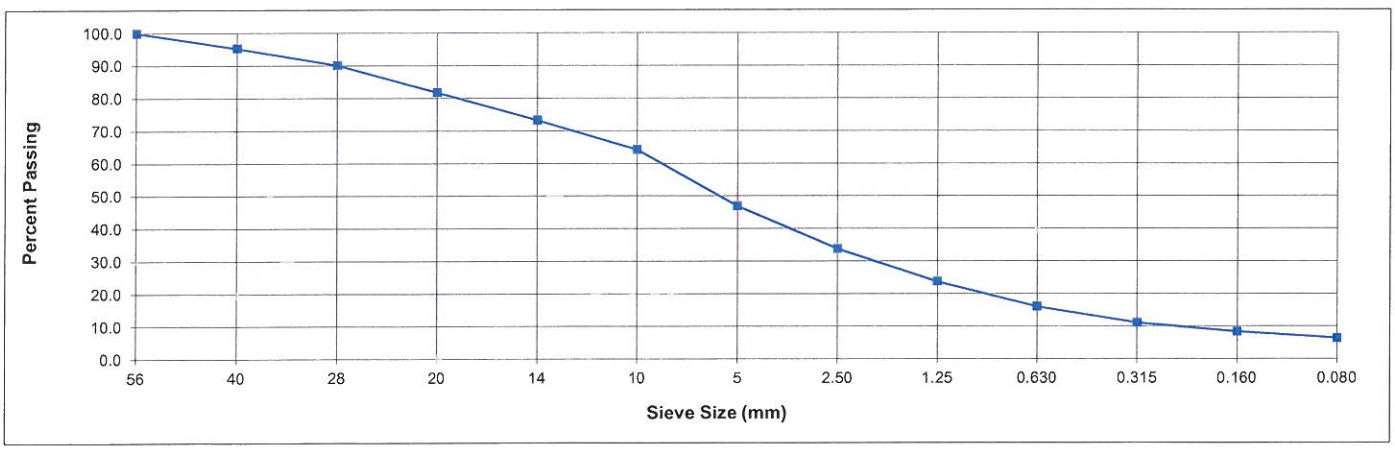
PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-SS004_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: July 8, 2013
DATE TESTED: September 24, 2013

SAMPLED BY: Client
TESTED BY: DC

SIEVE ANALYSIS					MATERIAL SPECIFICATION:	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 5	- 5		
56	0.0	100.0	0.0			
40	4.6	95.4	8.7			
28	5.2	90.1	9.9			
20	8.3	81.8	15.7			
14	8.6	73.3	16.1			
10	9.0	64.2	17.0			
5	17.4	46.9	32.7			
2.50	13.1	33.8		28.0		
1.25	10.1	23.7		21.5		
0.630	7.7	16.0		16.4		
0.315	4.9	11.1		10.5		
0.160	2.8	8.3		5.9		
0.080	2.0	6.3		4.2		
PAN	6.3	0		13.5		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

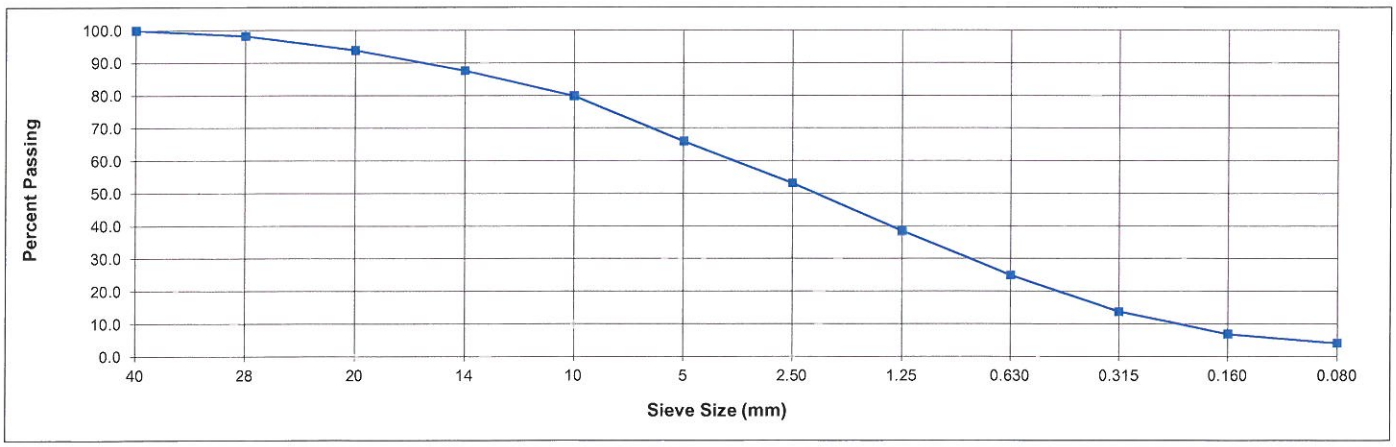
PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-SS005_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: July 8, 2013
DATE TESTED: September 24, 2013

SAMPLED BY: Client
TESTED BY: DC

SIEVE ANALYSIS					MATERIAL SPECIFICATION:	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 5	- 5		
40	0.0	100.0	0.0			
28	1.8	98.2	5.2			
20	4.3	93.9	12.8			
14	6.3	87.6	18.5			
10	7.7	79.9	22.7			
5	13.9	66.0	40.8			
2.50	12.9	53.1		19.5		
1.25	14.7	38.4		22.3		
0.630	13.5	25.0		20.4		
0.315	11.2	13.8		16.9		
0.160	6.9	6.9		10.4		
0.080	2.8	4.1		4.2		
PAN	4.1	0		6.2		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

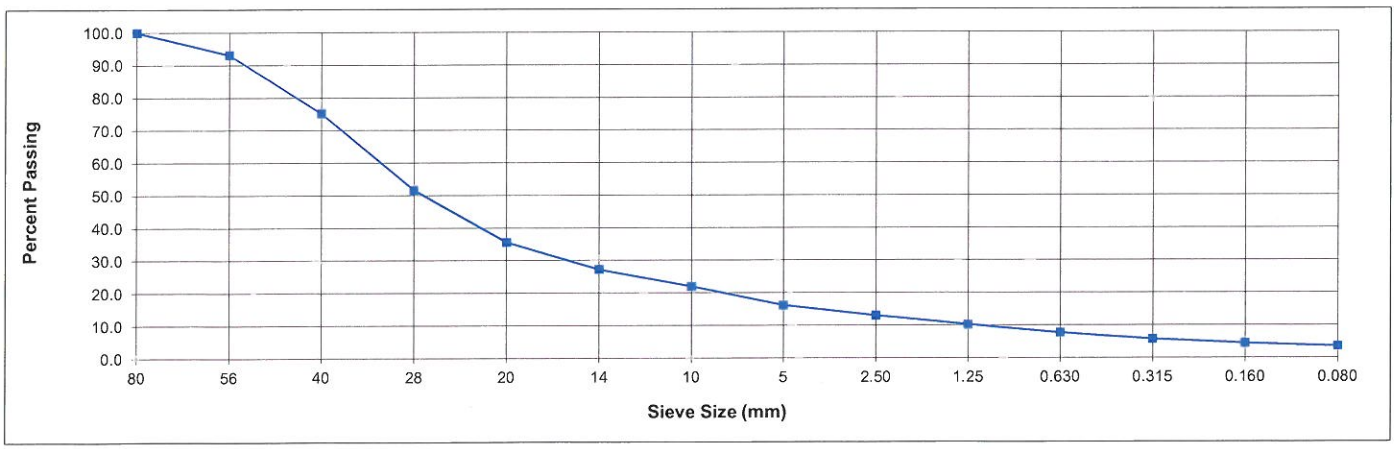
Sample:	**CH13-108-TP022_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: July 8, 2013
DATE TESTED: September 23, 2013

SAMPLED BY: Client
TESTED BY: OA

SIEVE ANALYSIS

Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)		MATERIAL SPECIFICATION:	
			+ 5	- 5		
80	0.0	100.0	0.0			
56	6.9	93.1	8.2			
40	17.9	75.2	21.4			
28	23.5	51.6	28.1			
20	16.0	35.6	19.1			
14	8.4	27.2	10.0			
10	5.2	22.0	6.2			
5	5.8	16.2	7.0			
2.50	3.1	13.0		19.4		
1.25	2.8	10.2		17.2		
0.630	2.5	7.7		15.5		
0.315	2.0	5.8		12.3		
0.160	1.3	4.5		8.0		
0.080	0.9	3.5		5.9		
PAN	3.5	0		21.7		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

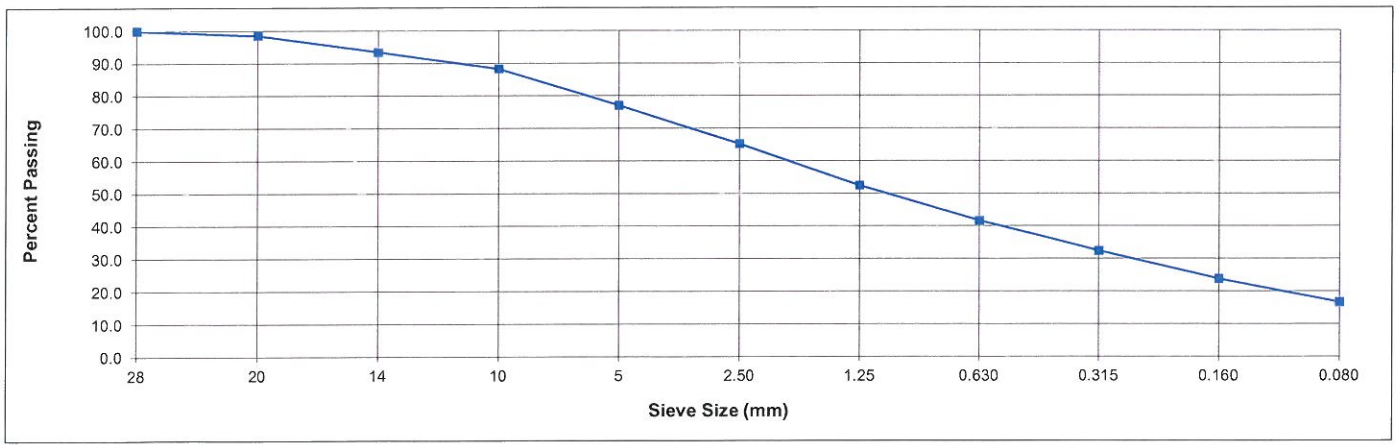
PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP022A_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: July 8, 2013
DATE TESTED: September 25, 2013

SAMPLED BY: Client
TESTED BY: DC

SIEVE ANALYSIS					MATERIAL SPECIFICATION:	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 5	- 5		
28	0.0	100.0	0.0			
20	1.5	98.5	6.5			
14	5.0	93.5	22.0			
10	5.2	88.3	22.6			
5	11.2	77.1	49.0			
2.50	11.9	65.2		15.4		
1.25	12.8	52.5		16.6		
0.630	10.8	41.7		14.0		
0.315	9.2	32.5		11.9		
0.160	8.7	23.8		11.2		
0.080	7.2	16.6		9.3		
PAN	16.6	0		21.6		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: L. Hu, M. Sc. E., P.Eng.

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

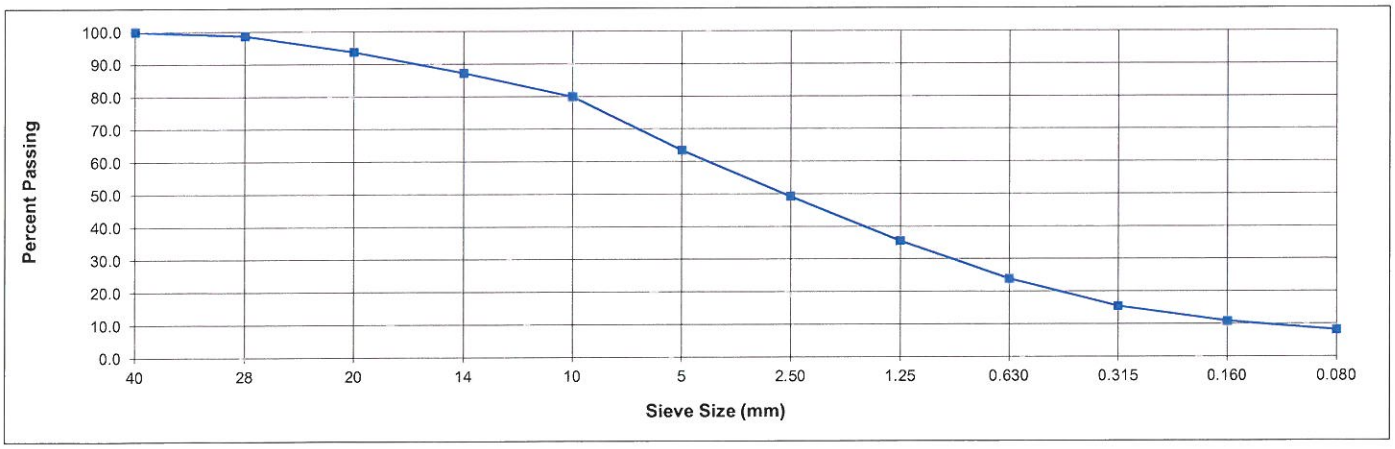
PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP022B_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: July 8, 2013
DATE TESTED: September 25, 2013

SAMPLED BY: Client
TESTED BY: DC

SIEVE ANALYSIS					MATERIAL SPECIFICATION:	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 5	- 5		
40	0.0	100.0	0.0			
28	1.3	98.7	3.5			
20	5.0	93.7	13.8			
14	6.5	87.2	17.7			
10	7.3	79.9	20.1			
5	16.5	63.4	45.0			
2.50	14.2	49.2		22.4		
1.25	13.6	35.6		21.5		
0.630	11.7	23.9		18.4		
0.315	8.4	15.5		13.3		
0.160	4.7	10.8		7.3		
0.080	2.7	8.1		4.3		
PAN	8.1	0		12.8		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

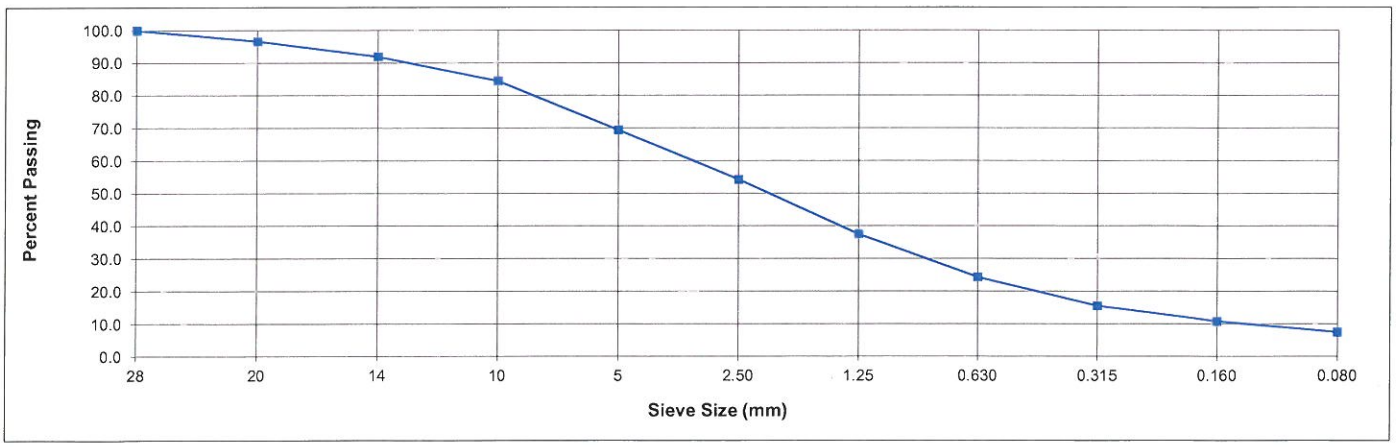
PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP022C_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: July 8, 2013
DATE TESTED: September 25, 2013

SAMPLED BY: Client
TESTED BY: DC

SIEVE ANALYSIS					MATERIAL SPECIFICATION:	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 5	- 5		
28	0.0	100.0	0.0			
20	3.4	96.6	11.1			
14	4.6	92.0	15.2			
10	7.5	84.5	24.6			
5	15.0	69.5	49.1			
2.50	15.2	54.3		21.9		
1.25	16.8	37.5		24.1		
0.630	13.2	24.3		19.0		
0.315	8.7	15.6		12.6		
0.160	4.7	10.8		6.8		
0.080	3.3	7.5		4.8		
PAN	7.5	0		10.8		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: L. Hu, M. Sc. E., P.Eng.

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

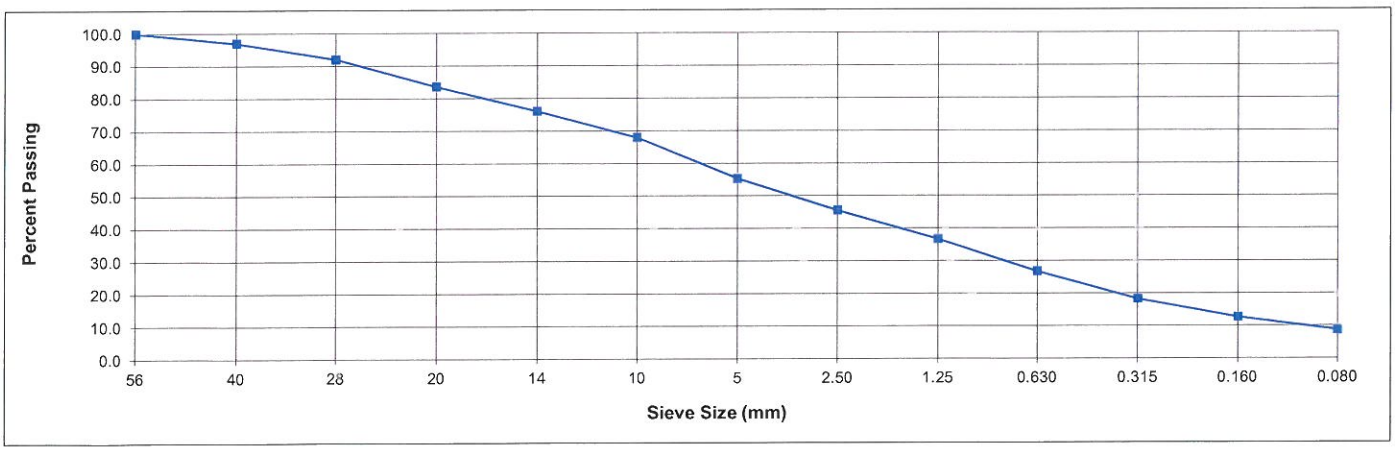
PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP025_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: July 8, 2013
DATE TESTED: September 23, 2013

SAMPLED BY: Client
TESTED BY: OA

SIEVE ANALYSIS					MATERIAL SPECIFICATION:	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 5	- 5		
56	0.0	100.0	0.0			
40	3.0	97.0	6.7			
28	4.9	92.0	11.1			
20	8.4	83.6	18.8			
14	7.6	76.0	17.0			
10	8.1	67.9	18.1			
5	12.7	55.3	28.3			
2.50	9.8	45.5		17.6		
1.25	8.8	36.7		16.0		
0.630	9.9	26.8		18.0		
0.315	8.5	18.2		15.4		
0.160	5.6	12.6		10.1		
0.080	3.9	8.7		7.1		
PAN	8.7	0		15.8		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

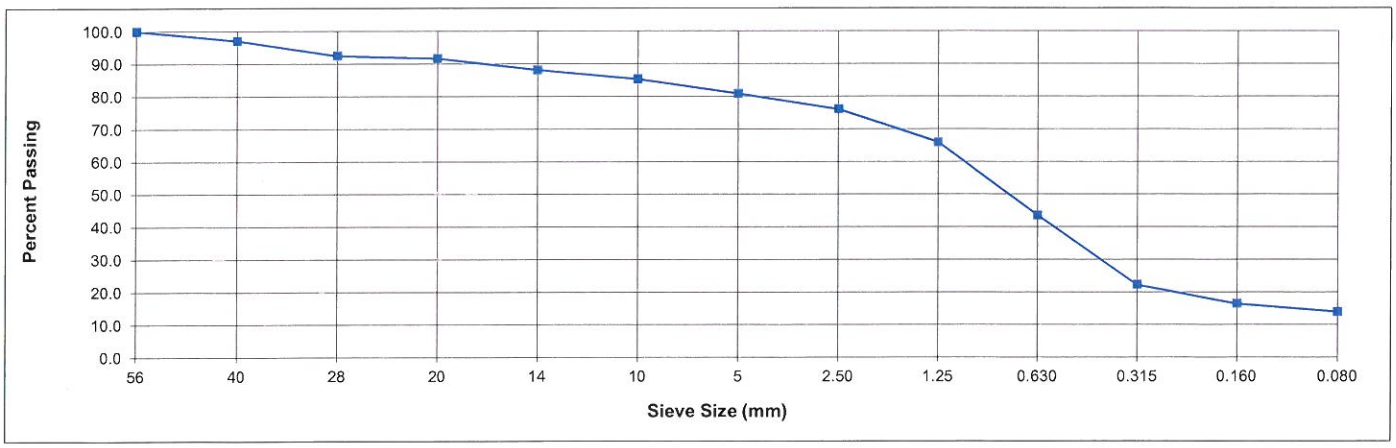
PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP026_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: July 8, 2013
DATE TESTED: September 25, 2013

SAMPLED BY: Client
TESTED BY: DC

SIEVE ANALYSIS					MATERIAL SPECIFICATION:	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 5	- 5		
56	0.0	100.0	0.0			
40	2.9	97.1	15.1			
28	4.6	92.5	24.1			
20	0.8	91.7	4.2			
14	3.6	88.2	18.6			
10	2.8	85.4	14.7			
5	4.5	80.9	23.4			
2.50	4.8	76.1		5.9		
1.25	10.2	65.9		12.6		
0.630	22.4	43.5		27.7		
0.315	21.2	22.2		26.3		
0.160	5.8	16.4		7.2		
0.080	2.5	13.9		3.1		
PAN	13.9	0		17.2		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: L. Hu, M. Sc. E., P.Eng.

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

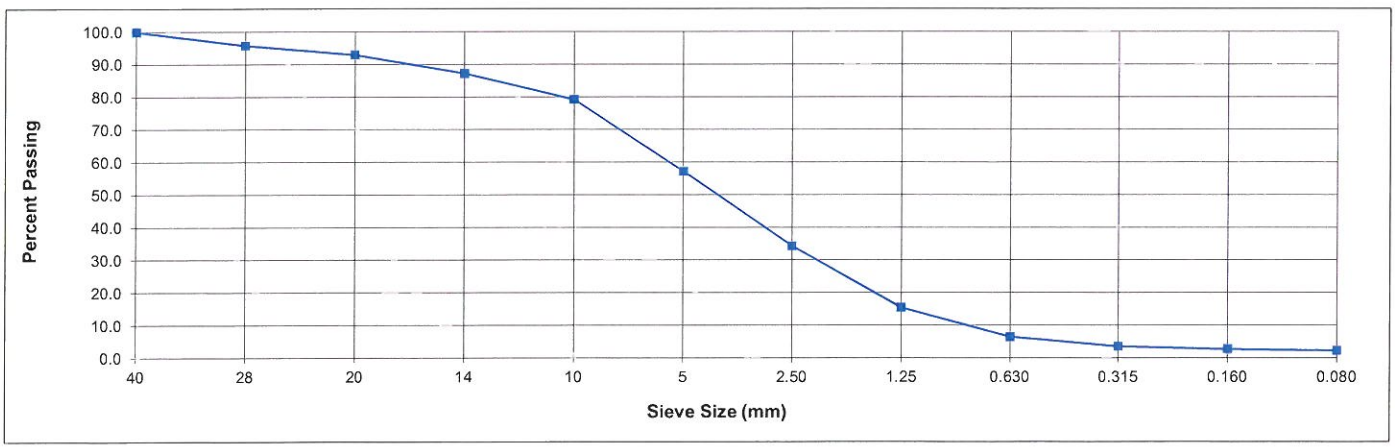
PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP027_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: July 8, 2013
DATE TESTED: September 24, 2013

SAMPLED BY: Client
TESTED BY: DC

SIEVE ANALYSIS					MATERIAL SPECIFICATION:	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 5	- 5		
40	0.0	100.0	0.0			
28	4.2	95.8	9.8			
20	2.9	92.9	6.7			
14	5.7	87.2	13.3			
10	8.0	79.2	18.8			
5	22.0	57.2	51.3			
2.50	22.9	34.3		40.0		
1.25	18.9	15.4		33.0		
0.630	9.0	6.4		15.7		
0.315	2.9	3.5		5.0		
0.160	0.9	2.7		1.5		
0.080	0.4	2.2		0.8		
PAN	2.2	0		3.9		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

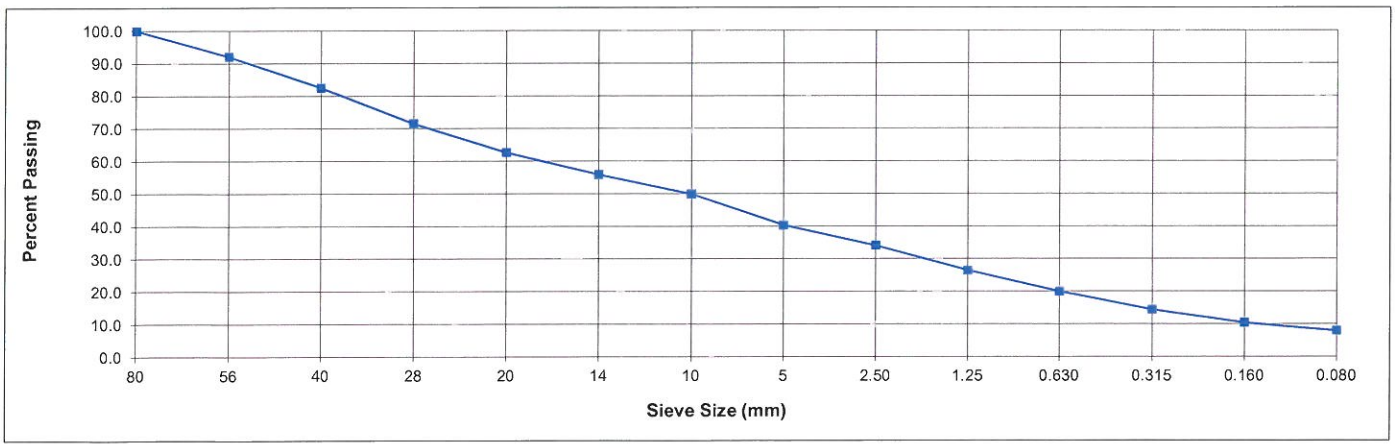
PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP027A_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: July 8, 2013
DATE TESTED: September 24, 2013

SAMPLED BY: Client
TESTED BY: OA

SIEVE ANALYSIS					MATERIAL SPECIFICATION:	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 5	- 5		
80	0.0	100.0	0.0			
56	7.9	92.1	13.3			
40	9.6	82.5	16.1			
28	10.9	71.6	18.3			
20	8.9	62.7	14.9			
14	6.8	55.9	11.4			
10	6.0	49.9	10.1			
5	9.5	40.3	16.0			
2.50	6.2	34.1		15.4		
1.25	7.7	26.4		19.0		
0.630	6.5	20.0		16.1		
0.315	5.6	14.4		13.8		
0.160	4.0	10.4		9.9		
0.080	2.5	7.9		6.3		
PAN	7.9	0		19.6		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

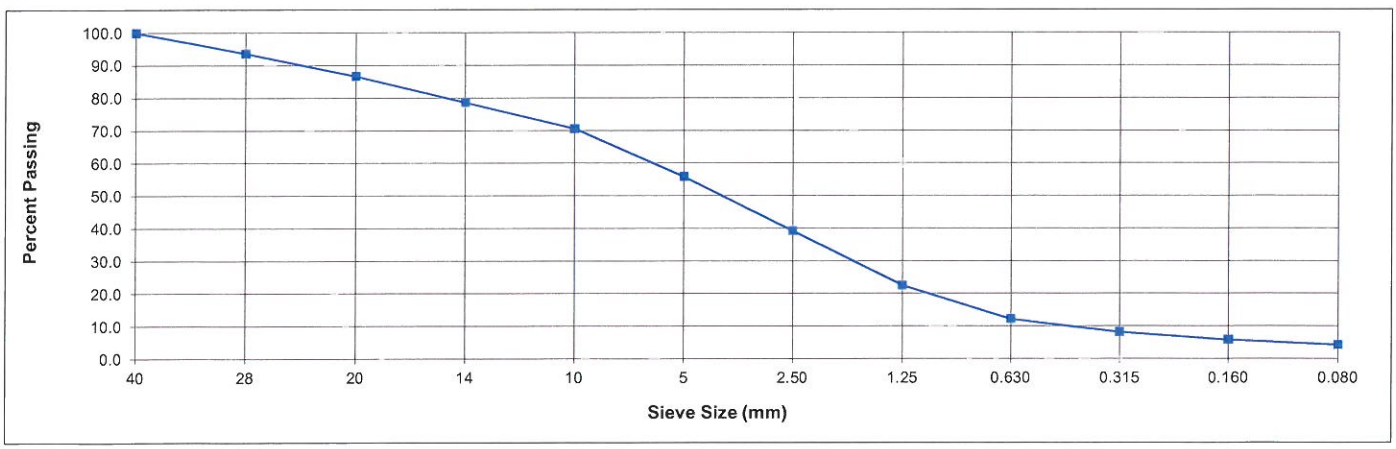
PROJECT: BSI_Rose Creek Borrow 2013

Sample:	**CH13-108-TP027B_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: July 8, 2013
DATE TESTED: September 25, 2013

SAMPLED BY: Client
TESTED BY: DC

SIEVE ANALYSIS					MATERIAL SPECIFICATION:	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 5	- 5		
40	0.0	100.0	0.0			
28	6.4	93.6	14.4			
20	6.9	86.7	15.7			
14	8.1	78.6	18.2			
10	8.1	70.6	18.2			
5	14.8	55.8	33.4			
2.50	16.6	39.2		29.8		
1.25	16.7	22.5		30.0		
0.630	10.2	12.2		18.3		
0.315	4.1	8.1		7.3		
0.160	2.3	5.8		4.2		
0.080	1.6	4.2		2.9		
PAN	4.2	0		7.5		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other zones/depths. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

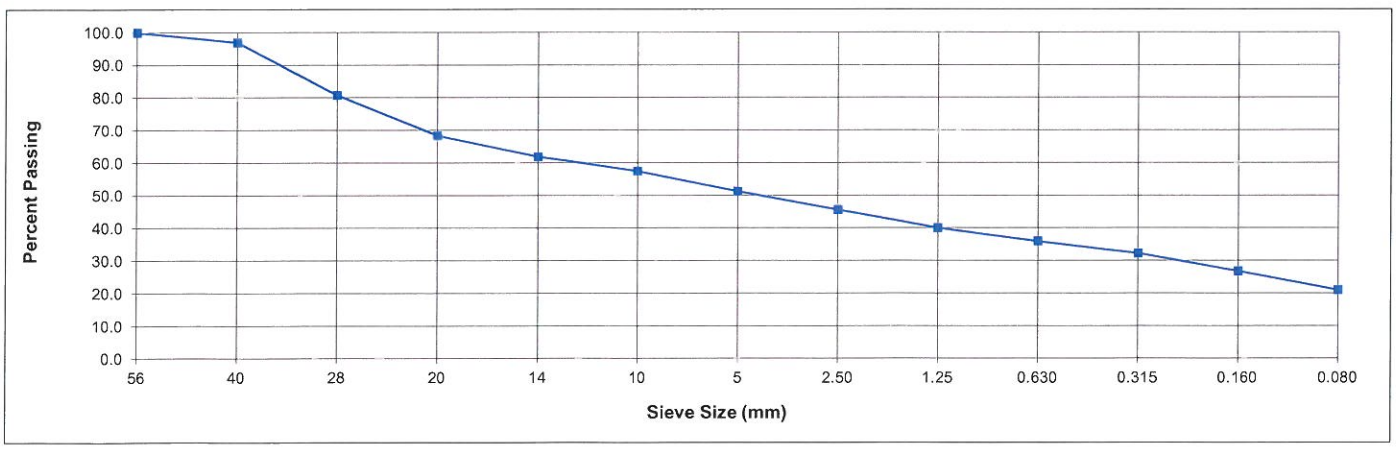
PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP027C_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: July 8, 2013
DATE TESTED: September 25, 2013

SAMPLED BY: Client
TESTED BY: DC

SIEVE ANALYSIS					MATERIAL SPECIFICATION:	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 5	- 5		
56	0.0	100.0	0.0			
40	3.1	96.9	6.3			
28	16.2	80.8	33.2			
20	12.4	68.3	25.5			
14	6.5	61.8	13.3			
10	4.4	57.5	9.0			
5	6.2	51.3	12.6			
2.50	5.7	45.6		11.1		
1.25	5.6	40.0		10.9		
0.630	4.0	36.0		7.9		
0.315	3.7	32.3		7.1		
0.160	5.5	26.8		10.8		
0.080	5.8	21.0		11.2		
PAN	21.0	0		40.9		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: L. Hu, M. Sc. E., P.Eng.

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

CSA A23.2-2A

CH2M Hill
1100 - 1st Street SE
Calgary, AB, T2G 1B1

October 8, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

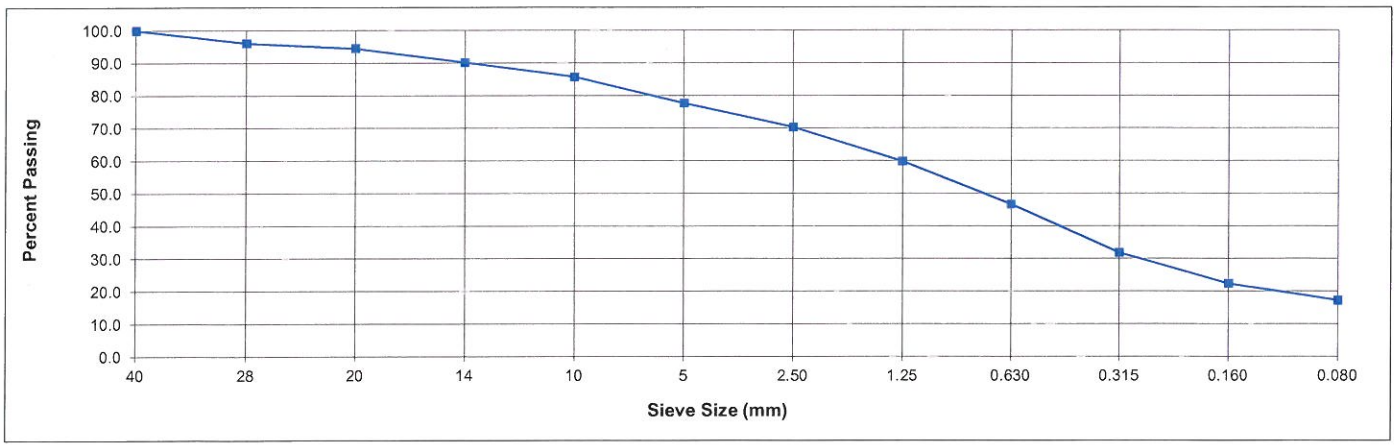
PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP028_SOa**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

DATE SAMPLED: July 8, 2013
DATE TESTED: September 24, 2013

SAMPLED BY: Client
TESTED BY: DC

SIEVE ANALYSIS					MATERIAL SPECIFICATION:	
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 5	- 5		
40	0.0	100.0	0.0			
28	3.9	96.1	17.6			
20	1.6	94.4	7.3			
14	4.3	90.2	19.2			
10	4.4	85.7	19.9			
5	8.0	77.7	36.0			
2.50	7.4	70.3		9.5		
1.25	10.4	59.8		13.4		
0.630	13.2	46.7		17.0		
0.315	14.8	31.8		19.1		
0.160	9.4	22.4		12.2		
0.080	5.2	17.2		6.7		
PAN	17.2	0		22.2		
Total	100.0		100.0	100.0		



Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other zones/depths. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

DETECTION OF ALKALI-SILICA REACTIVE AGGREGATE BY ACCELERATED EXPANSION OF MORTAR BARS

CSA A23.2-25A

CH2M Hill
1100 - 1st Street SE
Calgary, AB
T2G 1B1

November 1, 2013
Project Number: 13-1417-0047/1000

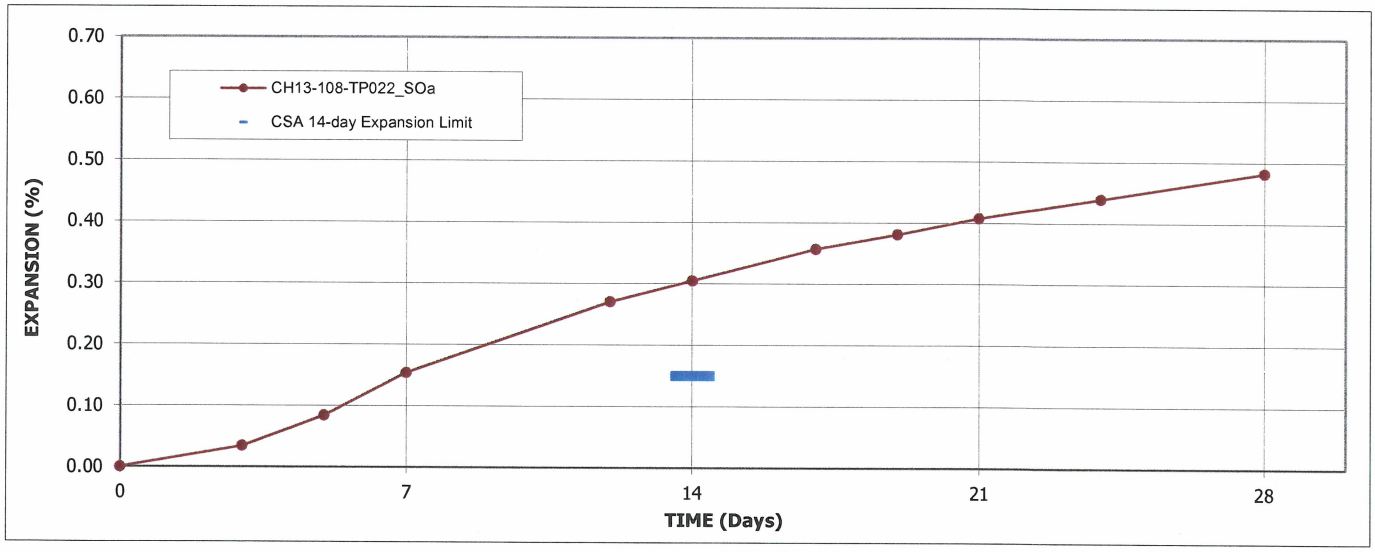
ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013, Tar #13

Sample:	CH13-108-TP022_SOa
Source:	Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon

TEST NO: **AMBT-13-034**
SAMPLED BY: **Client**
DATE SAMPLED: **July 18, 2013**
TOTAL CEMENT ALKALI: **K_2O: 1.15% ; Na_2O: 0.18%**

CEMENT TYPE: **GU**
CEMENT SOURCE: **ESSROC (Picton, ON)**
WATER BINDER RATIO: **0.50**
CEMENT ALKALI (Na_2O eq.): **0.94%**



Expansion (%)											
TIME,Days	0	3	5	7	12	**14**	17	19	21	24	28
AVERAGE	0.000	0.034	0.084	0.154	0.270	**0.305**	0.357	0.381	0.408	0.439	0.482
CSA 14-day Expansion Limit						**0.15**					

Notes: 1. Spratt Aggregate validation result: 0.42% expansion at 14 days, cast June 5, 2013

Reported by: I. Chung

Reviewed by: _____
F. Shrimer, P.Geo.

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA F. H. SHRIMER GEOSCIENTIST

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

DETECTION OF ALKALI-SILICA REACTIVE AGGREGATE BY ACCELERATED EXPANSION OF MORTAR BARS

CSA A23.2-25A

CH2M Hill
1100 - 1st Street SE
Calgary, AB
T2G 1B1

November 1, 2013
Project Number: 13-1417-0047/1000

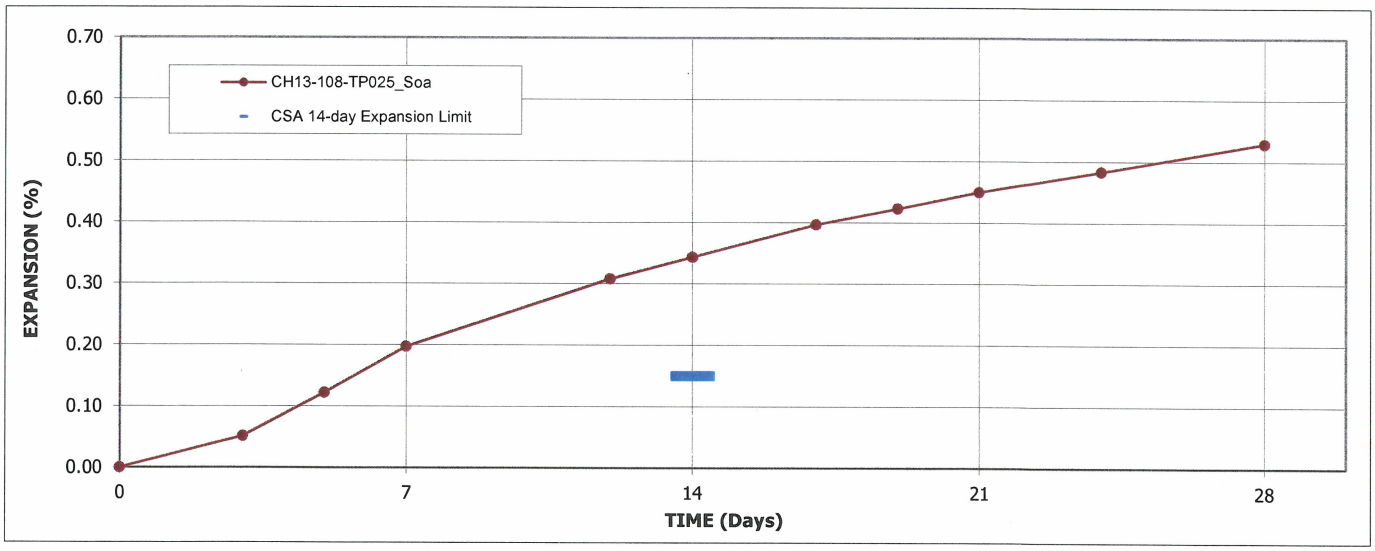
ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013, Tar #13

Sample:	CH13-108-TP025_Soa
Source:	Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon

TEST NO: **AMBT-13-035**
SAMPLED BY: **Client**
DATE SAMPLED: **July 18, 2013**
TOTAL CEMENT ALKALI: **K_2O: 1.15% ; Na_2O: 0.18%**

CEMENT TYPE: **GU**
CEMENT SOURCE: **ESSROC (Picton, ON)**
WATER BINDER RATIO: **0.48**
CEMENT ALKALI (Na_2O eq.): **0.94%**



Expansion (%)											
TIME,Days	0	3	5	7	12	**14**	17	19	21	24	28
AVERAGE	0.000	0.051	0.122	0.198	0.308	**0.343**	0.396	0.423	0.450	0.483	0.529
CSA 14-day Expansion Limit						**0.15**					

Notes: 1. Spratt Aggregate validation result: 0.42% expansion at 14 days, cast June 5, 2013

Reported by: I. Chung

Reviewed by: F. Shrimer, P.Geo.

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA F. H. SHRIMER GEOSCIENTIST

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

DETECTION OF ALKALI-SILICA REACTIVE AGGREGATE BY ACCELERATED EXPANSION OF MORTAR BARS

CSA A23.2-25A

CH2M Hill
1100 - 1st Street SE
Calgary, AB
T2G 1B1

November 1, 2013
Project Number: 13-1417-0047/1000

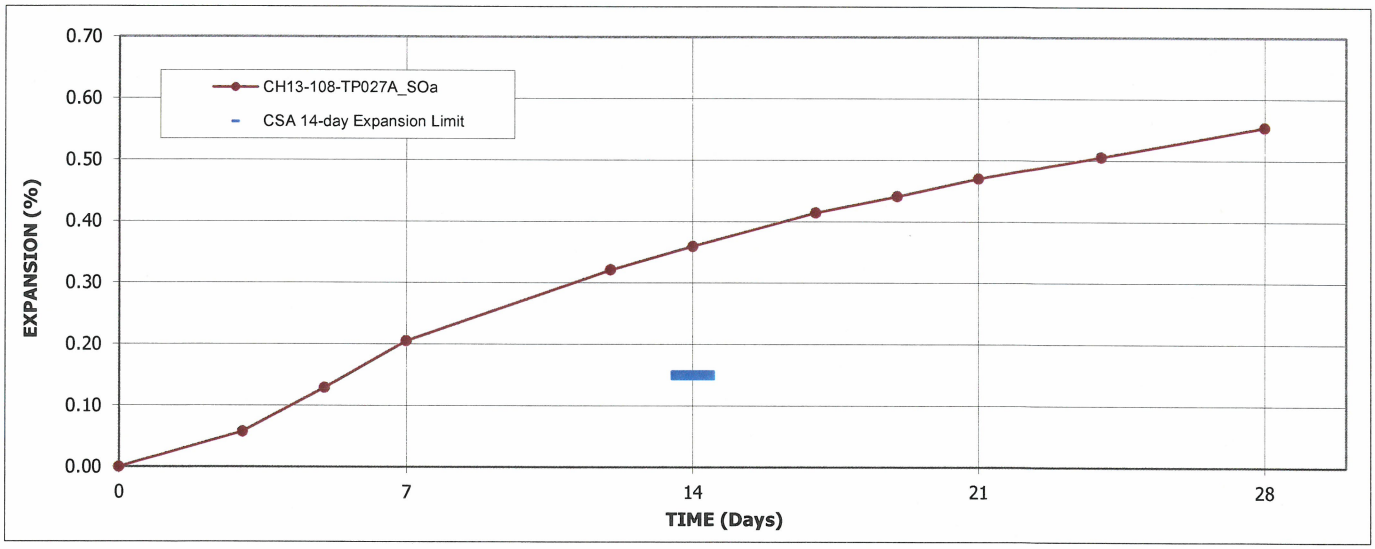
ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013, Tar #13

Sample:	CH13-108-TP027A_SOa
Source:	Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon

TEST NO: **AMBT-13-036**
SAMPLED BY: **Client**
DATE SAMPLED: **July 18, 2013**
TOTAL CEMENT ALKALI: **K_2O: 1.15% ; Na_2O: 0.18%**

CEMENT TYPE: **GU**
CEMENT SOURCE: **ESSROC (Picton, ON)**
WATER BINDER RATIO: **0.48**
CEMENT ALKALI (Na_2O eq.): **0.94%**



Expansion (%)											
TIME,Days	0	3	5	7	12	**14**	17	19	21	24	28
AVERAGE	0.000	0.057	0.129	0.205	0.321	**0.359**	0.414	0.441	0.470	0.505	0.554
CSA 14-day Expansion Limit						**0.15**					

Notes: 1. Spratt Aggregate validation result: 0.42% expansion at 14 days, cast June 5, 2013

Reported by: I. Chung

Reviewed by: F. Shrimer, P.Geo.

PROFESSIONAL GEOSCIENTIST PROVINCE OF BRITISH COLUMBIA F. H. SHRIMER

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DETECTION OF ALKALI-SILICA REACTIVE AGGREGATE BY ACCELERATED EXPANSION OF MORTAR BARS

CSA A23.2-25A

CH2M Hill
1100 - 1st Street SE
Calgary, AB
T2G 1B1

November 1, 2013
Project Number: 13-1417-0047/1000

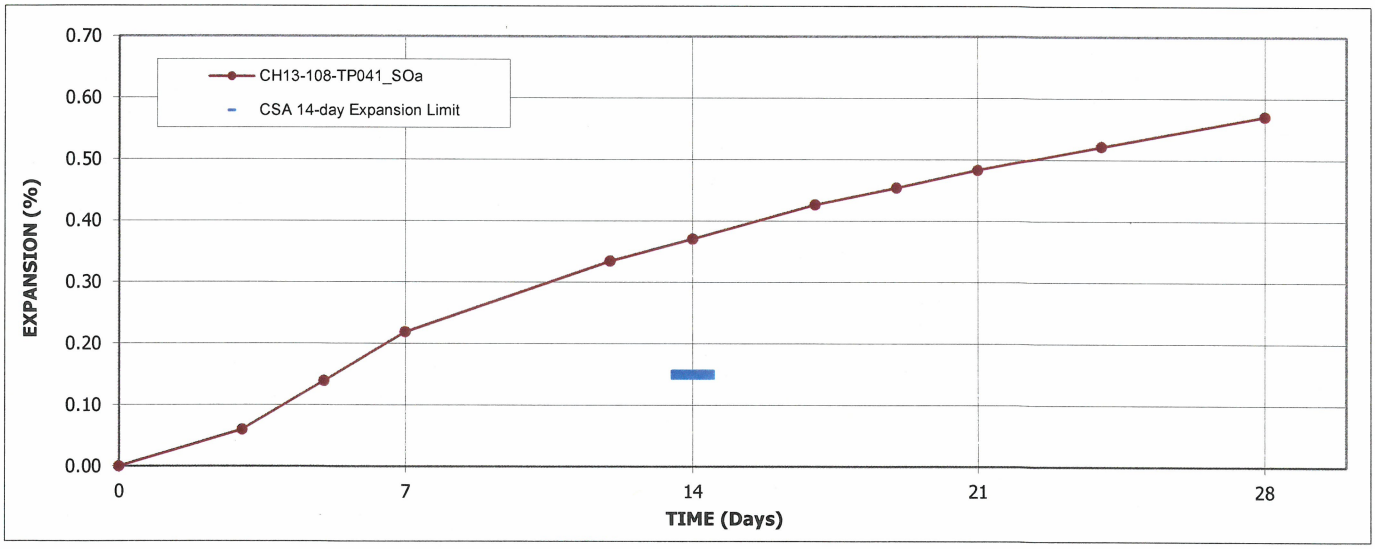
ATTENTION: Mr. Mark Cichy

PROJECT: BSI Haul Road 2013, Tar #13

Sample:	CH13-108-TP041_SOa
Source:	BSI Haul Road, Tar #13, Faro Mine Complex, Yukon

TEST NO: **AMBT-13-037**
SAMPLED BY: **Client**
DATE SAMPLED: **August 13, 2013**
TOTAL CEMENT ALKALI: **K_2O: 1.15% ; Na_2O: 0.18%**

CEMENT TYPE: **GU**
CEMENT SOURCE: **ESSROC (Picton, ON)**
WATER BINDER RATIO: **0.48**
CEMENT ALKALI (Na_2O eq.): **0.94%**



Expansion (%)											
TIME,Days	0	3	5	7	12	**14**	17	19	21	24	28
AVERAGE	0.000	0.060	0.139	0.219	0.335	**0.370**	0.426	0.454	0.483	0.521	0.571
CSA 14-day Expansion Limit						**0.15**					

Notes: 1. Spratt Aggregate validation result: 0.42% expansion at 14 days, cast June 5, 2013

Reported by: I. Chung

Reviewed by: F. Shrimer, P.Geo.

PROFESSIONAL GEOSCIENTIST PROVINCE OF BRITISH COLUMBIA F. H. SHRIMER

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

DETECTION OF ALKALI-SILICA REACTIVE AGGREGATE BY ACCELERATED EXPANSION OF MORTAR BARS

CSA A23.2-25A

CH2M Hill
1100 - 1st Street SE
Calgary, AB
T2G 1B1

November 1, 2013
Project Number: 13-1417-0047/1000

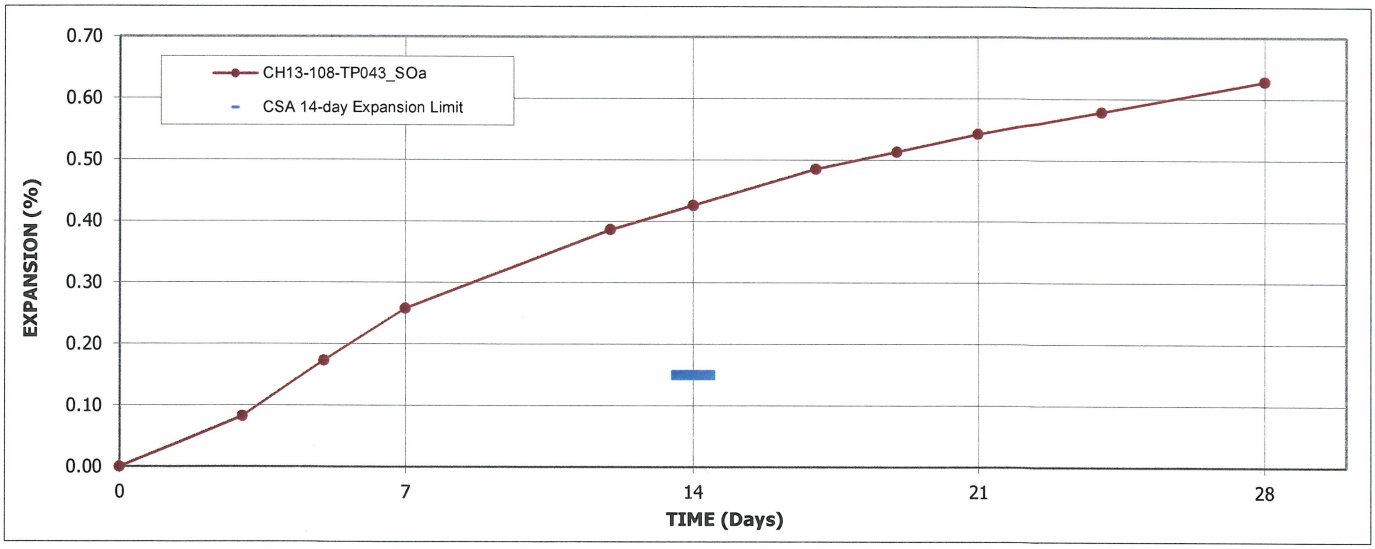
ATTENTION: Mr. Mark Cichy

PROJECT: BSI Haul Road 2013, Tar #13

Sample:	CH13-108-TP043_SOa
Source:	BSI Haul Road, Tar #13, Faro Mine Complex, Yukon

TEST NO: **AMBT-13-038**
SAMPLED BY: **Client**
DATE SAMPLED: **August 13, 2013**
TOTAL CEMENT ALKALI: **K_2O: 1.15% ; Na_2O: 0.18%**

CEMENT TYPE: **GU**
CEMENT SOURCE: **ESSROC (Picton, ON)**
WATER BINDER RATIO: **0.48**
CEMENT ALKALI (Na_2O eq.): **0.94%**



Expansion (%)											
TIME,Days	0	3	5	7	12	**14**	17	19	21	24	28
AVERAGE	0.000	0.082	0.173	0.258	0.386	**0.426**	0.485	0.513	0.542	0.579	0.628
CSA 14-day Expansion Limit						**0.15**					

Notes: 1. Spratt Aggregate validation result: 0.42% expansion at 14 days, cast June 5, 2013

Reported by: I. Chung

Reviewed by: _____
F. Shrimer, P.Geo.

PROFESSIONAL GEOSCIENTIST PROVINCE OF BRITISH COLUMBIA E. H. SHRIMER

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

PETROGRAPHIC EXAMINATION OF COARSE AGGREGATE

CSA A23.2-15A / ASTM C 295

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta, T2G 1B1

October 28, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP041_SOa, 4 to 7 ft, 13-Aug-2013 - Coarse Fraction (>5 mm)**
Source:	**Haul Road, Tar #13, Faro Mine Complex, Yukon**

	PETROGRAPHIC DESCRIPTION/ PHYSICAL QUALITY	PERCENT BY MASS	MULTI -PLIER	PN CONTRI-BUTION
GOOD	**Volcanic rock** - black, green, brown, porphyritic, dense, hard, strong	11.0	1	**11.0**
	Granite-granodiorite (medium grained) - dense, hard, strong	23.9	1	**23.9**
	Granite-granodiorite (pegmatitic) - hard, strong	7.5	1	**7.5**
	Gneiss - fine to coarse grained, banded, strong	9.7	1	**9.7**
	Schist - medium to coarse grained, foliated, strong	24.2	1	**24.2**
	Greywacke, lithic arenite - grey, brown, fine grained, hard strong	1.5	1	**1.5**
	Quartzite - white-yellow, fine to med. grained, dense, hard, strong	0.7	1	**0.7**
	Chert - black, grey, brown, veined, very dense, very hard, strong	2.4	1	**2.4**
	Subtotal	**80.9**		**80.9**
GOOD -FAIR	**Schist** - flat/elongated, strong, unweathered	0.8	2	**1.6**
	Subtotal	**0.8**		**1.6**
FAIR	**Volcanic rock** - weathered, oxidized, moderate strength	0.4	3	**1.2**
	Granite, medium grained - weathered, oxidized, moderate strength, brittle	2.3	3	**6.9**
	Granite-granodiorite (pegmatitic) - brittle	0.5	3	**1.5**
	Gneiss - weathered, oxidized, moderate strength	1.6	3	**4.8**
	Schist - weathered, oxidized, pitted, mod. strength, flat/thin particles	10.1	3	**30.3**
	Limestone - moderate strength, medium hard	0.2	3	**0.6**
	Oxidized, undifferentiated metamorphic rock - severely oxidized, stained orange, moderate strength, medium hard surfaces	0.5	3	**1.5**
	Subtotal	**15.6**		**46.8**
POOR	**Schist** - flat/thin, fissile, weak, severely weathered	2.2	6	**13.2**
	Oxidized, undifferentiated metamorphic rock - friable, soft, weak	0.4	6	**2.4**
	Siltstone - soft, porous, weak	0.1	6	**0.6**
	Subtotal	**2.7**		**16.2**
TOTALS		**100.0**	**PN**	**145.5**

Note: 1. The PN is not related to potential for Alkali-Aggregate Reaction. AAR must be assessed separately.

PETROGRAPHER: _____
B. Hudson, B. Sc., GIT

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other locations/depths. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

BSI Haul Road 2013, Faro Mine Complex, CH13-108-TP041-SOa, 4 to 7 ft, Coarse Fraction

General

The as-received sample consisted of natural silty cobble, sand and gravel with some clay; the material was understood to have been collected from test pits. It consisted of one portion finer than about 75 mm, labelled as "sand and gravel" and another portion coarser than about 75 mm, labelled as "cobbles". The cobble portion was not examined. The portion with a maximum nominal particle size of 75 mm was oven-dried, and the coarse portion of the sample, which consisted of particles coarser than 5 mm, was separated.

A representative portion of the coarse fraction was split and quartered and reduced to a suitable size in preparation for the examination. The gravel sized particles were coated with silt and some clay; this material required moderate washing effort to be removed in preparation for the examination. The particle shapes ranged widely from cubic to flat and surface textures ranged from smooth to rough. Identification of particles as being flat and/or elongated was done by visual estimate; calipers were not utilized.

Lithologic Composition

Identification of rock types and minerals was done using a stereomicroscope with magnifications from 8x to about 50x, supplemented by basic geologic diagnostic methods. In some cases, identification of rock types and minerals was difficult due to particles surfaces being highly weathered or rock types being highly metamorphosed and very fine grained. Thin-section and chemical analyses to assist in rock type and mineralogical identifications were not undertaken; however, they are recommended if detailed mineralogical or texture analysis of the rock types is desired.

The sample was composed of a mixture of igneous and metamorphic rock types, with lesser amounts of sedimentary rock.

Volcanic rock was identified in about 11% of the sample and ranged in composition from basalt to andesite with smaller amounts of dacite and rhyolite. Porphyritic varieties and volcanic rock types with massive texture were equally common. Most volcanic rock was hard, strong and free of vugs; however, a portion was weathered, pitted, oxidized and of moderate strength.

Plutonic rocks made up a large portion of the sample (about 34%) and consisted of varieties of granite with some granodiorite. These rocks ranged in texture from medium- to coarse-grained; very coarse-grained "pegmatitic" varieties were separately classified. Mineral constituents consisted of quartz, plagioclase, alkali feldspar, muscovite and a mafic component of biotite. Most plutonics were dense and strong; however, some were weathered and of moderate strength only. Oxidation of ferromagnesian minerals such as biotite was evident in some of the moderate strength particles.

Particles of plutonic rock with very coarse mineral grain size were separately classified as pegmatitic varieties. The mineral grain size ranged from 10 to 30 mm with the coarsest mineral grains consisting of quartz and feldspar. Most pegmatitic plutonic rocks were very hard and strong. Some particles of coarsely crystalline quartz and feldspar may have been associated with gneiss or veins/bands in schist rather than granite or granodiorite. However, they were grouped into this category because they had similar composition and physical-mechanical characteristic as the pegmatitic plutonic rock particles. Particles of pegmatitic plutonic rocks and coarsely crystalline quartz and feldspar made up 8% of the sample, most of which was strong with only a few particles that were brittle and of moderate strength.

About 11% of the sample consisted of rocks of granitic composition that were metamorphosed and exhibited gneissic textures. The mafic component of most gneissic rock was biotite; muscovite and chlorite were observed in some particles. Most gneiss particles were hard and strong; however, a portion was weathered such that these particles were of moderate strength.

The metamorphic rock schist was abundant in the sample, making up about 37% of the total. The schist identified in this sample was highly variable in texture, composition, particle shape, degree of weathering and physical-mechanical quality. Mineral grain size ranged from fine to coarse and some schist particles contained bands of very coarsely crystalline quartz, feldspar and some calcite. The schist was composed of quartz and feldspar with highly variable proportions of phyllosilicates consisting of biotite, muscovite, pyrophyllite, chlorite and talc. Most schist particles trended towards being flat-shaped with some also being elongated. Strong, unweathered particles that were flat and plate-like were separately classified as being of intermediate quality between "Fair" and "Good". A large portion of the schist particles were not excessively flat and/or elongated, and were dense, unweathered, hard and strong. However, about 1/4 of all schist particles were of moderate or lower strength, typically due to moderate to severe weathering.

Some of the schist particles of moderate or lower strength that were weathered exhibited surface pitting, which was sometimes concentrated in calcareous bands. Oxidation was prevalent and particles contained orange iron oxide and dark brown, weak, soft, friable and absorptive oxidation product. Some mica-rich particles exhibited thin oxidation bands between mineral sheets and the particles were consequently soft and weak. Some moderate to low strength schist particles were unweathered, but, were thin, plate-shaped, fissile and weak. Many schist particles were resistant to fracturing when struck with a geologic hammer in a direction perpendicular to the foliation; however, they were susceptible to splitting when struck parallel to the foliation.

A few particles in the sample could not be classified due to severe oxidation; they were tentatively identified as 'undifferentiated metamorphic rock'. These severely oxidized particles made up almost 1% of the sample and were of moderate strength or were weak, porous, soft and friable.

Very hard and dense chert was identified in about 2% of the sample and was cryptocrystalline, generally dark grey, black and brown, and veined.

Fine grained lithic arenite and greywacke made up almost 2% of the sample. These particles were of grey and brown, sub-rounded to sub-angular, dense and strong. An additional 0.1% of the sample consisted of grey-brown siltstone that was soft, weak and highly absorptive.

Particles of quartzite made up nearly 1% of the sample and were very hard and strong, fine to medium grained and ranged from brown to yellow.

A few fragments of calcite vein and fine grained limestone were identified in 0.2% the sample; these were moderately strong.

Engineering Characteristics

In addition to the geologic classification of the particles, the sample was also examined for characteristics relevant to engineering uses. Aspects such as porosity, strength, tenacity, particle shape, presence or absence of vugs, voids, fissures, cracks, coatings and impurities in the particles were considered in the assignment of individual particles into various quality classifications.

On the basis of this sorting of the sample, the relative amounts of "Good", "Fair" and "Poor" quality material were determined. This enabled the determination of a Petrographic Number (or "PN"), in accordance with the method given in CSA A23.2-15A. The PN is an index of a coarse aggregate's overall physical-mechanical quality. The PN for this sample was "146".

Schist particles which possessed good strength, but were flat and/or elongated were assigned a Petrographic Multiplier of "2", to recognize their projected performance in concrete mixes, whereby water demand may increase, and workability characteristics may be reduced.

For reference, the PN scale referenced in CSA A23.2-15A, Attachment A2, is as follows:

PN LIMITS	PRODUCT TYPE
125	Concrete Class C1, C2, F1
140 max	Other concrete classes
125	Shotcrete
125	Railroad ballast
150	Granular base
160	Select Granular sub-base

The PN of 146 indicates that the CH13-108-TP041-SOa coarse fraction is not of optimal quality and does not meet many of the PN limits given above. This is attributable to the significant content of schist in the sample, of which a significant proportion possesses less than desirable physical-mechanical properties.

However, we note that the sample may represent the 'typical' gravel material available within the region, having resulted from local/regional geological conditions.

As such, provided that adjustments are made to account for such effects as increased absorption, water demand, cement content for concrete (or asphalt binder for asphalt mixes), and provided that other physical parameters are met to the satisfaction of users/owners, the gravel could be utilized in a variety of applications, including concrete and asphalt. The expectation would be that this material, if used in its as-is condition, would potentially exhibit durability, resistance to wear and strength that is lower than what may be desired.

A significant portion of schist particles were assigned to the "Fair" and "Poor" category on the basis of them having split, fractured or crumbled when struck with a geological hammer. If utilized in high-strength concrete, it is possible that these particles may not provide adequate strength, and therefore split, crumble and fracture under extreme compressive and/or tensional forces. Prior to utilizing this material in high-strength concrete it is recommended that appropriate concrete trial mixes and strength evaluations be undertaken with guidance from a concrete engineer.

If the sample represents a surface "grab sample", the possibility exists that better quality material is present at depth. Additionally, improvement of the material's engineering properties could potentially be achieved through processing, including crushing and blending of oversize material, screening and washing.

Alkali-Aggregate Reaction Potential

Many of the rocks comprising this sample have been identified as "potentially alkali-reactive", meaning that they may contribute under certain circumstances to a deleterious expansive reaction in concrete termed *"Alkali-Aggregate Reaction"* (AAR).

In order to evaluate this potential, periodic assessment of the material's AAR characteristics should be carried out utilizing the procedures given in the current issue of CSA A23.1/.2, if use of the material as concrete aggregate is considered. The potential for AAR is being evaluated by means of the Accelerated Mortar Bar test (CSA A23.2-25A). The test is in progress and results will be issued under separate cover; results to date indicate that the material is to be classified as "reactive" with respect to AAR.

Summary

The CH13-108-TP041-SOa coarse fraction consisted of natural gravel composed of a mixture of igneous and metamorphic rocks with a small portion of sedimentary rock types. The sample had a PN of 146.

It was considered to be of unsuitable quality for use in most concrete applications, including high-strength concrete in its as-received condition. Additional testing and strength evaluations by concrete trial mix are recommended prior to utilizing this material in concrete applications. Processing may improve the engineering quality of the material. Evaluation of AAR potential is in progress, the results for which will be provided under separate cover.

B. Hudson, B.Sc., GIT

Reviewed by:

A. Briggs, P. Geo.

PETROGRAPHIC EXAMINATION OF COARSE AGGREGATE

CSA A23.2-15A / ASTM C 295

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta, T2G 1B1
ATTENTION: Mr. Mark Cichy

October 28, 2013
Project Number: 13-1417-0047-1000

PROJECT: BSI Haul Road 2013

Sample:	**CH13-108-TP043_SOa, 10 ft, 13-Aug-2013 - Coarse Fraction (>5 mm)**
Source:	**Haul Road, Tar #13, Faro Mine Complex, Yukon**

	PETROGRAPHIC DESCRIPTION/ PHYSICAL QUALITY	PERCENT BY MASS	MULTI -PLIER	PN CONTRI-BUTION
GOOD	**Volcanic rock** - black, green, brown, porphyritic, dense, hard, strong	15.8	1	**15.8**
	Granite-granodiorite (medium grained) - dense, hard, strong	8.0	1	**8.0**
	Granite-granodiorite (pegmatitic) - hard, strong	4.6	1	**4.6**
	Gneiss - fine to coarse grained, banded, strong	6.0	1	**6.0**
	Schist - medium to coarse grained, foliated, strong	35.9	1	**35.9**
	Limestone - grey, brown, fine grained, dense, strong	0.7	1	**0.7**
	Greywacke, lithic arenite - grey, brown, fine grained, dense, hard strong	1.8	1	**1.8**
	Quartzite - white-yellow, fine to medium grained, dense, hard, strong	1.5	1	**1.5**
	Chert - black, grey, brown, veined, very dense, very hard, strong	2.9	1	**2.9**
	Subtotal	**77.2**		**77.2**
GOOD -FAIR	**Schist** - flat/elongated, strong, unweathered	1.1	2	**2.2**
	Subtotal	**1.1**		**2.2**
FAIR	**Volcanic rock** - weathered, oxidized, moderate strength	0.6	3	**1.8**
	Granite, medium grained - weathered, oxidized, moderate strength, brittle	1.2	3	**3.6**
	Granite-granodiorite (pegmatitic) - brittle	0.3	3	**0.9**
	Gneiss - weathered, oxidized, moderate strength	0.4	3	**1.2**
	Schist - weathered, oxidized, pitted, moderate strength, flat/thin particles	12.6	3	**37.8**
	Limestone - moderate strength, medium hard	0.1	3	**0.3**
	Oxidized, undifferentiated metamorphic rock - severely oxidized, stained orange, moderate strength, medium hard surfaces	0.3	3	**0.9**
	Encrusted particles - particles with calcareous, sandy encrustation covering >33% particle surface area	3.7	3	**11.1**
	Subtotal	**19.2**		**57.6**
POOR	**Schist** - flat/thin, fissile, weak, severely weathered	0.8	6	**4.8**
	Oxidized, undifferentiated metamorphic rock - friable, soft, weak	0.2	6	**1.2**
	Encrusted particles - particles with weak, calcareous, sandy encrustation making up 75% of the particle	1.1	6	**6.6**
	Subtotal	**2.1**		**12.6**
DEL.	**Encrustation fragment /clay lump** - soft, weak, highly absorptive silty, sandy, clay lump	0.4	10	**4.0**
	Subtotal	**0.4**		**4.0**
TOTALS		**100.0**	**PN**	**153.6**

Note: 1. The PN is not related to potential for Alkali-Aggregate Reaction. AAR must be assessed separately.

PETROGRAPHER: _____
B. Hudson, B. Sc., GIT

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other locations/depths. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

BSI Haul Road 2013, Faro Mine Complex, CH13-108-TP043-SOa, 10 ft, Coarse Fraction

General

The as-received sample consisted of natural silty cobble, sand and gravel with some clay; the material was understood to have been collected from test pits. It consisted of one portion finer than about 75 mm, labelled as "sand and gravel" and another portion coarser than about 75 mm labelled as "cobbles". The cobble portion was not examined. The portion with a maximum nominal particle size of 75 mm was oven-dried, and the coarse portion of the sample, which consisted of particles coarser than 5 mm, was separated.

A representative portion of the coarse fraction was split and quartered and reduced to a suitable in size in preparation for the examination. The gravel sized particles were coated with sand, silt and some clay; this material required vigorous washing effort to be removed, in preparation for the examination. Even after washing, some particles, particularly those with rough surfaces, had some silt and/or clay coating the particle surface. The particle shapes ranged widely from cubic to flat and surface textures ranged from smooth to rough. Identification of particles as being flat and/or elongated was done by visual estimate; calipers were not utilized.

Lithologic Composition

Identification of rock types and minerals was done using a stereomicroscope with magnifications from 8x to about 50x, supplemented by basic geologic diagnostic methods. In some cases, identification of rock types and minerals was difficult due to particles surfaces being highly weathered or rock types being highly metamorphosed and very fine grained. Thin-section and chemical analyses to assist in rock type and mineralogical identifications were not undertaken; however, they are recommended if detailed mineralogical or texture analysis of the rock types is desired.

The sample was composed of a mixture of igneous and metamorphic rock types, with lesser amounts of sedimentary rock.

Volcanic rock was identified in about 16% of the sample and ranged in composition from basalt to andesite with smaller amounts of dacite and rhyolite. Porphyritic varieties and volcanic rock types with massive texture were equally common. Most volcanic rock was hard, strong and free of vugs; however, a portion was weathered, pitted, oxidized and of moderate strength.

Plutonic rocks made up about 14% of the sample, and consisted of varieties of granite with some granodiorite. These rocks ranged in texture from medium- to coarse-grained in texture; very coarse-grained "pegmatitic" varieties were separately classified. Mineral constituents consisted of quartz, plagioclase, alkali feldspar, muscovite and a mafic component of biotite. Most plutonics were dense and strong; however, some were weathered and of moderate strength only. Oxidation of ferromagnesian minerals such as biotite was evident in some of the moderate strength particles.

Particles of plutonic rock with very coarse mineral grain size were separately classified as pegmatitic varieties. The mineral grain size ranged from 10 to 30 mm with the coarsest mineral grains consisting of quartz and feldspar. Most pegmatitic plutonic rocks were very hard and strong. Some particles of coarsely crystalline quartz and feldspar may have been associated with gneiss or veins/bands in schist rather than granite or granodiorite. However, they were grouped into this category because they had similar composition and physical-mechanical characteristic as the pegmatitic plutonic rock particles. Particles of pegmatitic plutonic rock and coarsely crystalline quartz and feldspar made up almost 5% of the sample, most of which was strong with only a few particles that were brittle and

moderate strength.

About 6% of the sample consisted of rocks of granitic composition that were metamorphosed and exhibited gneissic textures. The mafic component of most gneissic rock was biotite; muscovite and chlorite were observed in some particles. Most gneiss particles were hard and strong; however, a portion was weathered such that these particles were of moderate strength.

The most abundant rock type in the sample was the metamorphic rock schist; it made up about 1/2 of the total sample. The schist identified in this sample was highly variable in texture, composition, particle shape, degree of weathering and physical-mechanical quality. Mineral grain size ranged from fine to coarse and some schist particles contained bands of very coarsely crystalline quartz, feldspar and some calcite. The schist was composed of quartz and feldspar with highly variable proportions of phyllosilicates consisting of biotite, muscovite, pyrophyllite, chlorite and talc. Most schist particles trended towards being flat-shaped with some also being elongated. Strong, unweathered particles that were flat and plate-like were separately classified as being of intermediate quality between "Fair" and "Good". A large portion of the schist particles were not excessively flat and/or elongated, and were dense, unweathered, hard and strong. However, almost 1/3 of all schist particles were of moderate or lower strength, typically due to moderate to severe weathering.

The particles of moderate or lower strength schist that were weathered exhibited pitting, which was sometimes concentrated in calcareous bands. Oxidation was prevalent and particles contained orange iron oxide and dark brown, weak, soft, friable and absorptive oxidation product. Some mica-rich particles exhibited thin oxidation bands between mineral sheets and the particles were consequently soft and weak. Some moderate to low strength schist particles were unweathered, but, were thin, plate-shaped, fissile and weak. Many schist particles were resistant to fracturing when struck with a geologic hammer in a direction perpendicular to the foliation; however, they were susceptible to splitting when struck parallel to the foliation.

A few particles in the sample could not be classified due to severe oxidation; they were tentatively identified as 'undifferentiated metamorphic rock'. These severely oxidized particles made up 0.5% of the sample and were of moderate strength or were weak, porous, soft and friable.

Very hard and dense chert was identified in about 3% of the sample and was cryptocrystalline, generally dark grey, black and brown, and veined.

Fine grained lithic arenite and greywacke made up almost 2% of the sample. These particles were grey and brown, sub-rounded to sub-angular, dense and strong.

Particles of quartzite made up nearly 2% of the sample and were very hard and strong, fine to medium grained and ranged from brown to yellow.

Rounded particles of grey and brown, fine grained limestone were identified in almost 1% the sample and ranged from strong to weathered, porous and moderately strong. A few fragments composed of calcite vein were included in the limestone category.

Some particles in about 4% of the sample had calcareous, silty, clayey, and sandy encrustations on more than 33% of the particle surfaces area. Some of the encrustations may have been clay lumps attached to the particle surface that were not adequately removed during washing of the sample prior to examination. A few of the particles appeared to have well adhering encrustations with some amount of calcareous cement. The encrustations ranged from being thin, hard and brittle to thick, friable and weak. Fragments of encrustation material that did not adhere to particles were typically

very weak, soft, highly absorptive, and contained silt and clay.

Engineering Characteristics

In addition to the geologic classification of the particles, the sample was also examined for characteristics relevant to engineering uses. Aspects such as porosity, strength, tenacity, particle shape, presence or absence of vugs, voids, fissures, cracks, coatings and impurities in the particles were considered in the assignment of individual particles into various quality classifications.

On the basis of this sorting of the sample, the relative amounts of "Good", "Fair", "Poor" and "Deleterious" quality material were determined. This enabled the determination of a Petrographic Number (or "PN"), in accordance with the method given in CSA A23.2-15A. The PN is an index of a coarse aggregate's overall physical-mechanical quality. The PN for this sample was "154".

Schist particles which possessed good strength, but were flat and/or elongated were assigned a Petrographic Multiplier of "2", to recognize their projected performance in concrete mixes, whereby water demand may increase, and workability characteristics may be reduced.

Many particles were observed to have silty coatings that required vigorous effort by washing with water to be removed. If the material was used as-is without adequate washing, particles could have unsatisfactory performance in bound mixtures (concrete, asphalt, etc.) due to poor particle-paste/binder bond strength.

For reference, the PN scale referenced in CSA A23.2-15A, Attachment A2, is as follows:

PN LIMITS	PRODUCT TYPE
125	Concrete Class C1, C2, F1
140 max	Other concrete classes
125	Shotcrete
125	Railroad ballast
150	Granular base
160	Select Granular sub-base

The PN of 154 indicates that the CH13-108-TP043-SOa coarse fraction is not of optimal quality and does not meet many of the PN limits given above. This is attributable to the significant content of schist in the sample, of which a significant proportion possesses less than desirable physical-mechanical properties.

However, we note that the sample may represent the 'typical' gravel material available within the region, having resulted from local/regional geological conditions.

As such, provided that adjustments are made to account for such effects as increased absorption, water demand, cement content for concrete (or asphalt binder for asphalt mixes), and provided that other physical parameters are met to the satisfaction of users/owners, the gravel could be utilized in a variety of applications, including concrete and asphalt. The expectation would be that this material, if

used in its as-is condition, would potentially exhibit durability, resistance to wear and strength that is lower than what may be desired.

A significant portion of schist particles were assigned to the "Fair" and "Poor" category on the basis of them having split, fractured or crumbled when struck with a geological hammer. If utilized in high-strength concrete, it is possible that these particles may not provide adequate strength, and therefore split, crumble and fracture under extreme compressive and/or tensional forces. Prior to utilizing this material in high-strength concrete it is recommended that appropriate concrete trial mixes and strength evaluations be undertaken with guidance from a concrete engineer.

If the sample represents a surface "grab sample", the possibility exists that better quality material is present at depth. Additionally, improvement of the material's engineering properties could potentially be achieved through processing, including crushing and blending of oversize material, screening and washing.

Alkali-Aggregate Reaction Potential

Many of the rocks comprising this sample have been identified as "potentially alkali-reactive", meaning that they may contribute under certain circumstances to a deleterious expansive reaction in concrete termed *"Alkali-Aggregate Reaction"* (AAR).

In order to evaluate this potential, periodic assessment of the material's AAR characteristics should be carried out utilizing the procedures given in the current issue of CSA A23.1/.2, if use of the material as concrete aggregate is considered. The potential for AAR is being evaluated by means of the Accelerated Mortar Bar test (CSA A23.2-25A). The test is in progress and results will be issued under separate cover; results to date indicate that the material is to be classified as "reactive" with respect to AAR.

Summary

The CH13-108-TP043-SOa coarse fraction consisted of natural gravel composed of a mixture of igneous and metamorphic rocks with a small portion of sedimentary rocks. The sample had a PN of 154.

It was considered to be of unsuitable quality for use in most concrete applications, including high-strength concrete in its as-received condition. Additional testing and strength evaluations by concrete trial mix are recommended prior to utilizing this material in concrete applications. Processing may improve the engineering quality of the material. Evaluation of AAR potential is in progress, the results for which will be provided under separate cover.

B. Hudson, B.Sc., GIT

Reviewed by:

A. Briggs, P. Geo.

PETROGRAPHIC EXAMINATION OF COARSE AGGREGATE

CSA A23.2-15A / ASTM C 295

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta, T2G 1B1

October 28, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP022_SOa, 18-Jul-2013 - Coarse Fraction (>5 mm)**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

	PETROGRAPHIC DESCRIPTION/ PHYSICAL QUALITY	PERCENT BY MASS	MULTI -PLIER	PN CONTRI-BUTION
GOOD	**Volcanic rock** - black, green, brown, porphyritic, dense, hard, strong	11.6	1	**11.6**
	Granite-granodiorite (medium grained) - dense, hard, strong	14.7	1	**14.7**
	Granite-granodiorite (pegmatitic) - hard, strong	9.4	1	**9.4**
	Gneiss - fine to coarse grained, banded, strong	2.3	1	**2.3**
	Schist - medium to coarse grained, foliated, strong	32.7	1	**32.7**
	Chert - black, grey, brown, veined, very dense, very hard, strong	1.6	1	**1.6**
	Subtotal	**72.3**		**72.3**
GOOD -FAIR	**Schist** - flat/elongated, strong, unweathered	3.4	2	**6.8**
	Subtotal	**3.4**		**6.8**
FAIR	**Volcanic rock** - weathered, oxidized, moderate strength	0.3	3	**0.9**
	Granite-granodiorite (medium grained) - weathered, oxidized, moderate strength, brittle	3.6	3	**10.8**
	Gneiss - weathered, oxidized, moderate strength	1.2	3	**3.6**
	Schist - weathered, oxidized, pitted, moderate strength, flat/elongated/thin	14.8	3	**44.4**
	Oxidized, undifferentiated metamorphic rock - severely oxidized, stained orange, moderate strength, medium hard surfaces	0.4	3	**1.2**
	Encrusted particles – particles with calcareous, oxidized, sandy encrustation covering >33% particle surface area	0.2	3	**0.6**
	Subtotal	**20.5**		**61.5**
POOR	**Schist** - flat/thin, fissile, weak, severely weathered	3.7	6	**22.2**
	Oxidized, undifferentiated metamorphic rock - friable, soft, weak	0.1	6	**0.6**
	Subtotal	**3.8**		**22.8**
TOTALS		**100.0**	**PN**	**163.4**

Note: 1. The PN is not related to potential for Alkali-Aggregate Reaction. AAR must be assessed separately.

PETROGRAPHER: _____
B. Hudson, B. Sc., GIT

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other locations/depths. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

BSI Rose Creek Borrow, Faro Mine Complex, CH13-108-TP022-SOa, Coarse Fraction

General

The as-received sample consisted of natural fine to coarse gravel and sand with some clay and silt; the maximum nominal particle size was about 75 mm. The material was understood to have been collected from test pits; however, depth information was not provided. It is unknown whether particles greater than 75 mm were separated from the material at the time of sampling. The as-received sample was oven-dried, and the coarse portion, which consisted of particles coarser than 5 mm, was separated.

A representative portion of the coarse fraction was split and quartered and reduced in size in preparation for the examination. The gravel sized particles were coated with silt and some clay; this material required moderate washing effort to be removed, in preparation for the examination. The particle shapes ranged widely from cubic to flat and surface textures ranged from smooth to rough. The designation of particles as being flat and/or elongated was done by visual estimate; calipers were not utilized.

Lithologic Composition

Identification of rock types and minerals was done using a stereomicroscope with magnifications from 8x to about 50x, supplemented by basic geologic diagnostic methods. In some cases, identification of rock types and minerals was difficult due to particles surfaces being highly weathered or rock types being highly metamorphosed and very fine grained. Thin-section and chemical analyses to assist in rock type and mineralogical identifications were not undertaken; however, they are recommended if detailed mineralogical or texture analysis of the rock types is desired.

The sample was composed of a mixture of igneous and metamorphic rock types, with lesser amounts of sedimentary rock.

Volcanic rock was identified in 12% of the sample and ranged in composition from basalt to andesite with smaller amounts of dacite and rhyolite. Porphyritic varieties and volcanic rock types with massive texture were equally common. Most volcanic rock was hard, strong and free of vugs; however, a portion was weathered, pitted, oxidized and of moderate strength.

Plutonic rocks made up around 28% of the sample, and consisted of varieties of granite with some granodiorite. These rocks ranged in texture from medium- to coarse-grained in texture; very coarse-grained "pegmatitic" varieties were separately classified. Mineral constituents consisted of quartz, plagioclase, alkali feldspar, muscovite and a mafic component of biotite. Most plutonics were dense and strong; however, some were weathered and of moderate strength only. Oxidation of ferromagnesian minerals such as biotite was evident in some of the moderate strength particles.

Particles of plutonic rock with very coarse mineral grain size were separately classified as pegmatitic varieties. The mineral grain size ranged from 10 to 30 mm with the coarsest mineral grains consisting of quartz and feldspar. Most pegmatitic plutonic rocks were very hard and strong. Some particles of coarsely crystalline quartz and feldspar may have been associated with gneiss or veins/bands in schist rather than granite or granodiorite. However, they were grouped into this category because they had similar composition and physical-mechanical characteristic to the pegmatitic plutonic rock particles. Particles of pegmatitic plutonic rocks and coarsely crystalline quartz and feldspar made up around 9% of the sample.

Almost 5% of the sample consisted of rocks of granitic composition that were metamorphosed and exhibited gneissic textures. The mafic component of most gneissic rock was biotite; muscovite and chlorite were observed in some particles. Most gneiss particles were hard and strong; however, a portion was weathered such that these particles were of moderate strength.

The most abundant rock type in the sample was the metamorphic rock schist; it made up nearly 55% of the total sample. The schist identified in this sample was highly variable in texture, composition, particle shape, degree of weathering and physical-mechanical quality. Mineral grain size ranged from fine to coarse and some schist particles contained bands of very coarsely crystalline quartz, feldspar and some calcite. The schist was composed of quartz and feldspar with highly variable proportions of phyllosilicates consisting of biotite, muscovite, pyrophyllite, chlorite and talc. Most schist particles tended towards being flat-shaped with some also being elongated. Strong, unweathered particles that were flat and plate-like were separately classified as being of intermediate quality between "Fair" and "Good". A large portion of the schist particles were not excessively flat and/or elongated, and were dense, unweathered, hard and strong. However, about 1/3 of all schist particles were of moderate or lower strength, typically due to moderate to severe weathering.

Some of the schist particles of moderate or lower strength that were weathered exhibited deep pitting which was often concentrated in calcareous bands. Oxidation was prevalent and particles contained orange iron oxide and dark brown, weak, soft, friable and absorptive oxidation product. Some mica-rich particles exhibited thin oxidation bands between mineral sheets and the particles were consequently soft and weak. Some moderate to low strength schist particles were unweathered, but, were thin, plate-shaped, fissile and weak. Many schist particles were resistant to fracturing when struck with a geologic hammer in a direction perpendicular to the foliation; however, they were susceptible to splitting when struck parallel to the foliation.

A few particles in the sample could not be classified due to severe oxidation; they were tentatively identified as 'undifferentiated metamorphic rock'. These severely oxidized particles made up about 0.5% of the sample and were of moderate strength or were weak, soft and friable.

A small portion of the particles, about 0.2% of the sample, had calcareous, oxidized and sandy encrustations on more than 33% of the particle surfaces area. The encrustations were friable and very porous.

Very hard and dense chert was identified in almost 2% of the sample and was cryptocrystalline, generally dark grey, black and brown, and veined.

Engineering Characteristics

In addition to the geologic classification of the particles, the sample was also examined for characteristics relevant to engineering uses. Aspects such as porosity, strength, tenacity, particle shape, presence or absence of vugs, voids, fissures, cracks, coatings and impurities in the particles were considered in the assignment of individual particles into various quality classifications.

On the basis of this sorting of the sample, the relative amounts of "Good", "Fair" and "Poor" quality material were determined. This enabled the determination of a Petrographic Number (or "PN"), in accordance with the method given in CSA A23.2-15A. The PN is an index of a coarse aggregate's overall physical-mechanical quality. The PN for this sample was "163".

Schist particles which possessed good strength, but were flat and/or elongated were assigned a

Petrographic Multiplier of "2", to recognize their projected performance in concrete mixes, whereby water demand may increase, and workability characteristics may be reduced.

For reference, the PN scale referenced in CSA A23.2-15A, Attachment A2, is as follows:

PN LIMITS	PRODUCT TYPE
125	Concrete Class C1, C2, F1
140 max	Other concrete classes
125	Shotcrete
125	Railroad ballast
150	Granular base
160	Select Granular sub-base

The PN of 163 indicates that the CH13-108-TP022-SOa coarse fraction is not of optimal quality and does not meet the PN limits given above. This is attributable to the significant content of schist in the sample, of which a significant proportion possesses less than desirable physical-mechanical properties.

However, we note that the sample may represent the 'typical' gravel material available within the region, having resulted from local/regional geological conditions.

As such, provided that adjustments are made to account for such effects as increased absorption, water demand, cement content for concrete (or asphalt binder for asphalt mixes), and provided that other physical parameters are met to the satisfaction of users/owners, the gravel could be utilized in a variety of applications, including concrete and asphalt. The expectation would be that this material, if used in its as-is condition, would potentially exhibit durability, resistance to wear and strength that is lower than what may be desired.

A significant portion of schist particles were assigned to the "Fair" and "Poor" category on the basis of them having split, fractured or crumbled when struck with a geological hammer. If utilized in high-strength concrete, it is possible that these particles may not provide adequate strength, and therefore split, crumble and fracture under extreme compressive and/or tensional forces. Prior to utilizing this material in high-strength concrete it is recommended that appropriate concrete trial mixes and strength evaluations be undertaken with guidance from a concrete engineer.

If the sample represents a surface "grab sample", the possibility exists that better quality material is present at depth. Additionally, improvement of the material's engineering properties could potentially be achieved through processing, including crushing and blending of oversize material, screening and washing.

Alkali-Aggregate Reaction Potential

Many of the rocks comprising this sample have been identified as "potentially alkali-reactive", meaning that they may contribute under certain circumstances to a deleterious expansive reaction in concrete termed *"Alkali-Aggregate Reaction"* (AAR).

In order to evaluate this potential, periodic assessment of the material's AAR characteristics should be carried out utilizing the procedures given in the current issue of CSA A23.1/.2, if use of the material as concrete aggregate is considered. The potential for AAR is being evaluated by means of the Accelerated Mortar Bar test (CSA A23.2-25A). The test is in progress and results will be issued under separate cover; results to date indicate that the material is to be classified as "reactive" with respect to AAR.

Summary

The CH13-108-TP022-SOa coarse fraction consisted of natural gravel composed of a mixture of igneous and metamorphic rocks. The sample had a PN of 163.

It was considered to be of unsuitable quality for use in most concrete applications, including high-strength concrete in its as-received condition. Additional testing and strength evaluations by concrete trial mix are recommended prior to utilizing this material in concrete applications. Processing may improve the engineering quality of the material. Evaluation of AAR potential is in progress, the results for which will be provided under separate cover.

B. Hudson, B.Sc., GIT

Reviewed by:

A. Briggs, P. Geo.

PETROGRAPHIC EXAMINATION OF COARSE AGGREGATE

CSA A23.2-15A / ASTM C 295

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta, T2G 1B1

October 28, 2013
Project Number: 13-1417-0047-1000

ATTENTION: Mr. Mark Cichy

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP025_SOa, 18-Jul-2013 - Coarse Fraction (>5 mm)**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

	PETROGRAPHIC DESCRIPTION/ PHYSICAL QUALITY	PERCENT BY MASS	MULTI -PLIER	PN CONTRI-BUTION
GOOD	**Volcanic rock** - black, green, brown, porphyritic, dense, hard, strong	12.5	1	**12.5**
	Granite-granodiorite (medium grained) - dense, hard, strong	7.2	1	**7.2**
	Granite-granodiorite (pegmatitic) - hard, strong	4.8	1	**4.8**
	Gneiss - fine to coarse grained, banded, strong	3.7	1	**3.7**
	Schist - medium to coarse grained, foliated, strong	34.3	1	**34.3**
	Limestone - grey, brown, fine grained, dense, strong	0.5	1	**0.5**
	Quartzite - white-yellow, fine to medium grained, dense, hard, strong	0.8	1	**0.8**
	Chert - black, grey, brown, veined, very dense, very hard, strong	6.4	1	**6.4**
	Subtotal	**70.2**		**70.2**
GOOD -FAIR	**Schist** - flat/elongated, strong, unweathered	3.5	2	**7.0**
	Subtotal	**3.5**		**7.0**
FAIR	**Volcanic rock** - weathered, oxidized, moderate strength	0.7	3	**2.1**
	Granite, medium grained - weathered, oxidized, moderate strength, brittle	2.8	3	**8.4**
	Granite-granodiorite (pegmatitic) - brittle	0.8	3	**2.4**
	Gneiss - weathered, oxidized, moderate strength	0.3	3	**0.9**
	Schist - weathered, oxidized, pitted, moderate strength, flat/ thin particles	17.0	3	**51.0**
	Limestone - moderate strength	Trace	3	**Trace**
	Oxidized, undifferentiated metamorphic rock - severely oxidized, stained orange, moderate strength, medium hard surfaces	0.9	3	**2.7**
	Subtotal	**22.5**		**67.5**
POOR	**Schist** - flat/thin, fissile, weak, severely weathered	3.6	6	**21.6**
	Oxidized, undifferentiated metamorphic rock - friable, soft, weak	0.2	6	**1.2**
	Subtotal	**3.8**		**22.8**
TOTALS		**100.0**	**PN**	**167.5**

Note: 1. The PN is not related to potential for Alkali-Aggregate Reaction. AAR must be assessed separately.

PETROGRAPHER: _____
B. Hudson, B. Sc., GIT

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other locations/depths. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

BSI Rose Creek Borrow, Faro Mine Complex, CH13-108-TP025-SOa, Coarse Fraction

General

The as-received sample consisted of natural fine to coarse gravel and sand with some clay and silt; the maximum nominal particle size was about 75 mm. The material was understood to have been collected from test pits; however, depth information was not provided. It is unknown whether particles greater than 75 mm were separated from the material at the time of sampling. The as-received sample was oven-dried, and the coarse portion, which consisted of particles coarser than 5 mm, was separated.

A representative portion of the coarse fraction was split and quartered and reduced in size in preparation for the examination. The gravel sized particles were coated with silt and some clay; this material required moderate washing effort to be removed, in preparation for the examination. The particle shapes ranged widely from cubic to flat and surface textures ranged from smooth to rough. The designation of particles as being flat and/or elongated was done by visual estimate; calipers were not utilized.

Lithologic Composition

Identification of rock types and minerals was done using a stereomicroscope with magnifications from 8x to about 50x, supplemented by basic geologic diagnostic methods. In some cases, identification of rock types and minerals was difficult due to particles surfaces being highly weathered or rock types being highly metamorphosed and very fine grained. Thin-section and chemical analyses to assist in rock type and mineralogical identifications were not undertaken; however, they are recommended if detailed mineralogical or texture analysis of the rock types is desired.

The sample was composed of a mixture of igneous and metamorphic rock types, with lesser amounts of sedimentary rock.

Volcanic rock was identified in about 13% of the sample and ranged in composition from basalt to andesite with smaller amounts of dacite and rhyolite. Porphyritic varieties and volcanic rock types with massive texture were equally common. Most volcanic rock was hard, strong and free of vugs; however, a portion was weathered, pitted, oxidized and of moderate strength.

Plutonic rocks made up almost 16% of the sample, and consisted of varieties of granite with some granodiorite. These rocks ranged in texture from medium- to coarse-grained in texture; very coarse-grained "pegmatitic" varieties were separately classified. Mineral constituents consisted of quartz, plagioclase, alkali feldspar, muscovite and a mafic component of biotite. Most plutonics were dense and strong; however, some were weathered and of moderate strength only. Oxidation of ferromagnesian minerals such as biotite was evident in some of the moderate strength particles.

Particles of plutonic rock with very coarse mineral grain size were separately classified as pegmatitic varieties. The mineral grain size ranged from 10 to 30 mm with the coarsest mineral grains consisting of quartz and feldspar. Most pegmatitic plutonic rocks were very hard and strong. Some particles of coarsely crystalline quartz and feldspar may have been associated with gneiss or veins/bands in schist rather than granite or granodiorite. However, they were grouped into this category because they had similar composition and physical-mechanical characteristic to the pegmatitic plutonic rock particles. Particles of pegmatitic plutonic rocks and coarsely crystalline quartz and feldspar made up around 9% of the sample, most of which was strong with only a few particles that were brittle and moderate strength.

Four % of the sample consisted of rocks of granitic composition that were metamorphosed and exhibited gneissic textures. The mafic component of most gneissic rock was biotite; muscovite and chlorite were observed in some particles. Most gneiss particles were hard and strong; however, a portion was weathered such that these particles were of moderate strength.

The most abundant rock type in the sample was the metamorphic rock schist; it made up about 58% of the total sample. The schist identified in this sample was highly variable in texture, composition, particle shape, degree of weathering and physical-mechanical quality. Mineral grain size ranged from fine to coarse and some schist particles contained bands of very coarsely crystalline quartz, feldspar and some calcite. The schist was composed of quartz and feldspar with highly variable proportions of phyllosilicates consisting of biotite, muscovite, pyrophyllite, chlorite and talc. Most schist particles tended towards being flat-shaped with some also being elongated. Strong, unweathered particles that were flat and plate-like were separately classified as being of intermediate quality between "Fair" and "Good". A large portion of the schist particles were not excessively flat and/or elongated, and were dense, unweathered, hard and strong. However, about 1/3 of all schist particles were of moderate or lower strength, typically due to moderate to severe weathering.

Some of the schist particles of moderate or lower strength that were weathered exhibited deep pitting, which was often concentrated in calcareous bands. Oxidation was prevalent and particles contained orange iron oxide and dark brown, weak, soft, friable and absorptive oxidation product. Some mica-rich particles exhibited thin oxidation bands between mineral sheets and the particles were consequently soft and weak. Some moderate to low strength schist particles were unweathered, but, were thin, plate-shaped, fissile and weak. Many schist particles were resistant to fracturing when struck with a geologic hammer in a direction perpendicular to the foliation; however, they were susceptible to splitting when struck parallel to the foliation.

A few particles in the sample could not be classified due to severe oxidation; they were tentatively identified as 'undifferentiated metamorphic rock'. These severely oxidized particles made up about 1% of the sample and were of moderate strength or were weak, porous, soft and friable.

Very hard and dense chert was identified in about 6% of the sample and was cryptocrystalline, generally dark grey, black and brown, and veined.

Particles of quartzite made up nearly 1% of the sample and were very hard and strong, fine to medium grained and ranged from brown to yellow.

Rounded particles of grey and brown, fine grained limestone were identified in 0.5% the sample and ranged from strong to weathered, porous and moderately strong. A few fragments composed of calcite vein were included in the limestone category.

Engineering Characteristics

In addition to the geologic classification of the particles, the sample was also examined for characteristics relevant to engineering uses. Aspects such as porosity, strength, tenacity, particle shape, presence or absence of vugs, voids, fissures, cracks, coatings and impurities in the particles were considered in the assignment of individual particles into various quality classifications.

On the basis of this sorting of the sample, the relative amounts of "Good", "Fair" and "Poor" quality material were determined. This enabled the determination of a Petrographic Number (or "PN"), in accordance with the method given in CSA A23.2-15A. The PN is an index of a coarse aggregate's

overall physical-mechanical quality. The PN for this sample was "168".

Schist particles which possessed good strength, but were flat and/or elongated were assigned a Petrographic Multiplier of "2", to recognize their projected performance in concrete mixes, whereby water demand may increase, and workability characteristics may be reduced.

For reference, the PN scale referenced in CSA A23.2-15A, Attachment A2, is as follows:

PN LIMITS	PRODUCT TYPE
125	Concrete Class C1, C2, F1
140 max	Other concrete classes
125	Shotcrete
125	Railroad ballast
150	Granular base
160	Select Granular sub-base

The PN of 168 indicates that the CH13-108-TP025-SOa coarse fraction is not of optimal quality and does not meet the PN limits given above. This is attributable to the significant content of schist in the sample, of which a significant proportion possesses less than desirable physical-mechanical properties.

However, we note that the sample may represent the 'typical' gravel material available within the region, having resulted from local/regional geological conditions.

As such, provided that adjustments are made to account for such effects as increased absorption, water demand, cement content for concrete (or asphalt binder for asphalt mixes), and provided that other physical parameters are met to the satisfaction of users/owners, the gravel could be utilized in a variety of applications, including concrete and asphalt. The expectation would be that this material, if used in its as-is condition, would potentially exhibit durability, resistance to wear and strength that is lower than what may be desired.

A significant portion of schist particles were assigned to the "Fair" and "Poor" category on the basis of them having split, fractured or crumbled when struck with a geological hammer. If utilized in high-strength concrete, it is possible that these particles may not provide adequate strength, and therefore split, crumble and fracture under extreme compressive and/or tensional forces. Prior to utilizing this material in high-strength concrete it is recommended that appropriate concrete trial mixes and strength evaluations be undertaken with guidance from a concrete engineer.

If the sample represents a surface "grab sample", the possibility exists that better quality material is present at depth. Additionally, improvement of the material's engineering properties could potentially be achieved through processing, including crushing and blending of oversize material, screening and washing.

Alkali-Aggregate Reaction Potential

Many of the rocks comprising this sample have been identified as "potentially alkali-reactive", meaning

that they may contribute under certain circumstances to a deleterious expansive reaction in concrete termed *"Alkali-Aggregate Reaction"* (AAR).

In order to evaluate this potential, periodic assessment of the material's AAR characteristics should be carried out utilizing the procedures given in the current issue of CSA A23.1/.2, if use of the material as concrete aggregate is considered. The potential for AAR is being evaluated by means of the Accelerated Mortar Bar test (CSA A23.2-25A). The test is in progress and results will be issued under separate cover; results to date indicate that the material is to be classified as "reactive" with respect to AAR.

Summary

The CH13-108-TP025-SOa coarse fraction consisted of natural gravel composed of a mixture of igneous and metamorphic rocks with a small portion of sedimentary rock types. The sample had a PN of 168.

It was considered to be of unsuitable quality for use in most concrete applications, including high-strength concrete in its as-received condition. Additional testing and strength evaluations by concrete trial mix are recommended prior to utilizing this material in concrete applications. Processing may improve the engineering quality of the material. Evaluation of AAR potential is in progress, the results for which will be provided under separate cover.

B. Hudson, B.Sc., GIT

Reviewed by:

A. Briggs, P. Geo.

PETROGRAPHIC EXAMINATION OF COARSE AGGREGATE

CSA A23.2-15A / ASTM C 295

CH2M Hill
1100 – 1st Street SE
Calgary, Alberta, T2G 1B1

ATTENTION: Mr. Mark Cichy

October 28, 2013
Project Number: 13-1417-0047-1000

PROJECT: BSI Rose Creek Borrow 2013

Sample:	**CH13-108-TP027A_SOa, 18-Jul-2013 - Coarse Fraction (>5 mm)**
Source:	**Rose Creek Borrow, Tar #13, Faro Mine Complex, Yukon**

	PETROGRAPHIC DESCRIPTION/ PHYSICAL QUALITY	PERCENT BY MASS	MULTI -PLIER	PN CONTRI-BUTION
GOOD	**Volcanic rock** - black, green, brown, porphyritic, dense, hard, strong	6.2	1	**6.2**
	Granite-granodiorite (medium grained) - dense, hard, strong	20.0	1	**20.0**
	Granite-granodiorite (pegmatitic) - hard, strong	12.3	1	**12.3**
	Gneiss - fine to coarse grained, banded, strong	1.5	1	**1.5**
	Schist - medium to coarse grained, foliated, strong	37.1	1	**37.1**
	Limestone - grey, brown, fine grained, dense, strong	0.9	1	**0.9**
	Greywacke, lithic arenite - grey, brown, fine grained, dense, hard, strong	1.9	1	**1.9**
	Quartzite - white-yellow, fine to medium grained, dense, hard, strong	0.2	1	**0.2**
	Chert - black, grey, brown, veined, very dense, very hard, strong	3.1	1	**3.1**
	Subtotal	**83.2**		**83.2**
GOOD -FAIR	**Schist** - flat/elongated, strong, unweathered	2.8	2	**5.6**
	Subtotal	**2.8**		**5.6**
FAIR	**Volcanic rock** - weathered, oxidized, moderate strength	0.2	3	**0.6**
	Granite, medium grained - weathered, oxidized, moderate strength, brittle	2.5	3	**7.5**
	Granite-granodiorite (pegmatitic) - brittle	0.6	3	**1.8**
	Gneiss - weathered, oxidized, moderate strength	0.2	3	**0.6**
	Schist - weathered, oxidized, pitted, moderate strength, flat/thin particles	9.2	3	**27.6**
	Quartzite - brittle	0.3	3	**0.9**
	Oxidized, undifferentiated metamorphic rock - severely oxidized, stained orange, moderate strength, medium hard surfaces	0.1	3	**0.3**
	Encrusted particles - particles with calcareous, sandy encrustation covering >33% particle surface area	0.2	3	**0.6**
	Subtotal	**13.3**		**39.9**
POOR	**Schist** - flat/thin, fissile, weak, severely weathered	0.4	6	**2.4**
	Oxidized, undifferentiated metamorphic rock - friable, soft, weak	0.2	6	**1.2**
	Encrusted particles - particles with weak, calcareous, sandy encrustation making up 75% of the particle	0.1	6	**0.6**
	Subtotal	**0.7**		**4.2**
TOTALS		**100.0**	**PN**	**132.9**

Note: 1. The PN is not related to potential for Alkali-Aggregate Reaction. AAR must be assessed separately.

PETROGRAPHER: _____
B. Hudson, B. Sc., GIT

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other locations/depths. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

BSI Rose Creek Borrow, Faro Mine Complex, CH13-108-TP027A-SOa, Coarse Fraction

General

The as-received sample consisted of natural fine to coarse gravel and sand with some clay and silt; the maximum nominal particle size was about 75 mm. The material was understood to have been collected from test pits; however, depth information was not provided. It is unknown whether particles greater than 75 mm were separated from the material at the time of sampling. The as-received sample was oven-dried, and the coarse portion, which consisted of particles coarser than 5 mm, was separated.

A representative portion of the coarse fraction was split and quartered and reduced in size in preparation for the examination. The gravel sized particles were coated with silt and some clay; this material required light washing effort to be removed, in preparation for the examination. The particle shapes ranged widely from cubic to flat and surface textures ranged from smooth to rough. The designation of particles as being flat and/or elongated was done by visual estimate; calipers were not utilized.

Lithologic Composition

Identification of rock types and minerals was done using a stereomicroscope with magnifications from 8x to about 50x, supplemented by basic geologic diagnostic methods. In some cases, identification of rock types and minerals was difficult due to particles surfaces being highly weathered or rock types being highly metamorphosed and very fine grained. Thin-section and chemical analyses to assist in rock type and mineralogical identifications were not undertaken; however, they are recommended if detailed mineralogical or texture analysis of the rock types is desired.

The sample was composed of a mixture of igneous and metamorphic rock types, with lesser amounts of sedimentary rock.

Volcanic rock was identified in about 6% of the sample and ranged in composition from basalt to andesite with smaller amounts of dacite and rhyolite. Porphyritic varieties and volcanic rock types with massive texture were equally common. Most volcanic rock was hard, strong and free of vugs; however, a portion was weathered, pitted, oxidized and of moderate strength.

Plutonic rocks were the second-most abundant rock type in the sample, making up about 35% of the sample. They consisted of varieties of granite with some granodiorite. These rocks ranged in texture from medium- to coarse-grained in texture; very coarse-grained "pegmatitic" varieties were separately classified. Mineral constituents consisted of quartz, plagioclase, alkali feldspar, muscovite and a mafic component of biotite. Most plutonics were dense and strong; however, some were weathered and of moderate strength only. Oxidation of ferromagnesian minerals such as biotite was evident in some of the moderate strength particles.

Particles of plutonic rock with very coarse mineral grain size were separately classified as pegmatitic varieties. The mineral grain size ranged from 10 to 30 mm with the coarsest mineral grains consisting of quartz and feldspar. Most pegmatitic plutonic rocks were very hard and strong. Some particles of coarsely crystalline quartz and feldspar may have been associated with gneiss or veins/bands in schist rather than granite or granodiorite. However, they were grouped into this category because they had similar composition and physical-mechanical characteristic to the pegmatitic plutonic rock particles. Particles of pegmatitic plutonic rocks and coarsely crystalline quartz and feldspar made up almost 13% of the sample, most of which was strong with only a few particles that were brittle and of

moderate strength.

Almost 2% of the sample consisted of rocks of granitic composition that were metamorphosed and exhibited gneissic textures. The mafic component of most gneissic rock was biotite; muscovite and chlorite were observed in some particles. Most gneiss particles were hard and strong; however, a portion was weathered such that these particles were of moderate strength.

The most abundant rock type in the sample was the metamorphic rock schist; it made up nearly 50% of the total sample. The schist identified in this sample was highly variable in texture, composition, particle shape, degree of weathering and physical-mechanical quality. Mineral grain size ranged from fine to coarse and some schist particles contained bands of very coarsely crystalline quartz, feldspar and some calcite. The schist was composed of quartz and feldspar with highly variable proportions of phyllosilicates consisting of biotite, muscovite, and chlorite. Many schist particles trended towards being flat-shaped with some also being elongated. Strong, unweathered particles that were flat and plate-like were separately classified as being of intermediate quality between "Fair" and "Good". A large portion of the schist particles were not excessively flat and/or elongated, and were dense, unweathered, hard and strong. However, about 1/5 of all schist particles were of moderate or lower strength, typically due to moderate to severe weathering.

Some of the schist particles of moderate or lower strength that were weathered exhibited pitting on the surfaces. Oxidation was prevalent and particles contained orange iron oxide and dark brown, weak, soft, friable and absorptive oxidation product. Some moderate to low strength schist particles were unweathered, but, were thin, plate-shaped, fissile and weak. Many schist particles were resistant to fracturing when struck with a geologic hammer in a direction perpendicular to the foliation; however, they were susceptible to splitting when struck parallel to the foliation.

A few particles in the sample could not be classified due to severe oxidation; they were tentatively identified as 'undifferentiated metamorphic rock'. These severely oxidized particles made up 0.3% of the sample and were of moderate strength or were weak, porous, soft and friable.

Very hard and dense chert was identified in about 3% of the sample and was cryptocrystalline, generally dark grey, black and brown, and veined.

Fine grained lithic arenite and greywacke made up almost 2% of the sample. These particles were grey and brown, sub-rounded to sub-angular, dense and strong.

Particles of quartzite made up 0.5% of the sample and were fine to medium grained and ranged from brown to yellow. Most varieties of quartzite were very hard and strong; however, a small portion was weathered, brittle and of moderate strength.

Rounded particles of grey and brown, fine grained limestone were identified in almost 1% the sample; these were moderately strong. A few fragments composed of calcite vein were included in the limestone category.

A small portion of the particles, about 0.3% of the sample, had calcareous, oxidized and sandy encrustations on more than 33% of the particle surfaces area. The encrustations were friable and very porous.

Engineering Characteristics

In addition to the geologic classification of the particles, the sample was also examined for characteristics relevant to engineering uses. Aspects such as porosity, strength, tenacity, particle shape, presence or absence of vugs, voids, fissures, cracks, coatings and impurities in the particles were considered in the assignment of individual particles into various quality classifications.

On the basis of this sorting of the sample, the relative amounts of "Good", "Fair" and "Poor" quality material were determined. This enabled the determination of a Petrographic Number (or "PN"), in accordance with the method given in CSA A23.2-15A. The PN is an index of a coarse aggregate's overall physical-mechanical quality. The PN for this sample was "133".

Schist particles which possessed good strength, but were flat and/or elongated were assigned a Petrographic Multiplier of "2", to recognize their projected performance in concrete mixes, whereby water demand may increase, and workability characteristics may be reduced.

For reference, the PN scale referenced in CSA A23.2-15A, Attachment A2, is as follows:

PN LIMITS	PRODUCT TYPE
125	Concrete Class C1, C2, F1
140 max	Other concrete classes
125	Shotcrete
125	Railroad ballast
150	Granular base
160	Select Granular sub-base

The PN of 133 indicates that the CH13-108-TP027A-SOa coarse aggregate may be unsuitable for use in some concrete applications. It may be suitable for other concrete and general construction aggregate applications, subject to demonstrated compliance with relevant specification requirements. The PN exceeds the limits for certain exposure classes; this is attributable to the significant content of schist in the sample, of which a significant proportion possesses less than desirable physical-mechanical properties.

However, we note that the sample may represent the 'typical' gravel material available within the region, having resulted from local/regional geological conditions.

As such, provided that adjustments are made to account for such effects as increased absorption, water demand, cement content for concrete (or asphalt binder for asphalt mixes), and provided that other physical parameters are met to the satisfaction of users/owners, the gravel could be utilized in a variety of applications, including concrete and asphalt. The expectation would be that this material, if used in its as-is condition, would potentially exhibit durability, resistance to wear and strength that is lower than what may be desired.

A significant portion of schist particles were assigned to the "Fair" and "Poor" category on the basis of them having split, fractured or crumbled when struck with a geological hammer. If utilized in high-strength concrete, it is possible that these particles may not provide adequate strength, and therefore

split, crumble and fracture under extreme compressive and/or tensional forces. Prior to utilizing this material in high-strength concrete it is recommended that appropriate concrete trial mixes and strength evaluations be undertaken with guidance from a concrete engineer.

If the sample represents a surface "grab sample", the possibility exists that better quality material is present at depth. Additionally, improvement of the material's engineering properties could potentially be achieved through processing, including crushing and blending of oversize material, screening and washing.

Alkali-Aggregate Reaction Potential

Many of the rocks comprising this sample have been identified as "potentially alkali-reactive", meaning that they may contribute under certain circumstances to a deleterious expansive reaction in concrete termed *"Alkali-Aggregate Reaction"* (AAR).

In order to evaluate this potential, periodic assessment of the material's AAR characteristics should be carried out utilizing the procedures given in the current issue of CSA A23.1/.2, if use of the material as concrete aggregate is considered. The potential for AAR is being evaluated by means of the Accelerated Mortar Bar test (CSA A23.2-25A). The test is in progress and results will be issued under separate cover; results to date indicate that the material is to be classified as "reactive" with respect to AAR.

Summary

The CH13-108-TP027A-SOa coarse fraction consisted of natural gravel composed of a mixture of igneous and metamorphic rocks with a small proportion of sedimentary rock types. The sample had a PN of 133.

It was considered to be of unsuitable quality for use in some concrete applications, including in high-strength concrete in its as-received condition, but may be suitable in other concrete and general construction aggregate applications. Additional testing and strength evaluations by concrete trial mix are recommended prior to utilizing this material in high-strength concrete applications. Processing may improve the engineering quality of the material. Evaluation of AAR potential is in progress, the results for which will be provided under separate cover.

B. Hudson, B.Sc., GIT

Reviewed by:

A. Briggs, P. Geo.

Attachment 3
Borrow Source Investigation Rose Creek Borrow and Haul Road 2013 Soil Sampling Data Quality Evaluation Report

ATTACHMENT 3

Borrow Source Investigation Rose Creek Borrow and Haul Road 2013 Soil Sampling Data Quality Evaluation Report

Soil samples were collected and analyzed during the 2013 Borrow Source Investigation (BSI) Rose Creek Borrow and Haul Road sampling event in support of the Faro Mine Remediation Project. All analytical data were evaluated as described in the *Quality Assurance Project Plan, Faro Mine Remediation Project* (QAPP) (CH2M HILL, 2013a). This Data Quality Evaluation report summarizes the results of the quality assurance and quality control (QA/QC) activities prescribed in the QAPP and provides a complete data usability assessment. The QAPP identifies the method-specific QC requirements for each analytical parameter and matrix and defines a plan to test that the correct sampling, analytical, and data reduction procedures are followed using audits and data validation.

This report is intended as a general data quality assessment designed to summarize data issues.

Analytical Data

A total of 28 native environmental soil samples and 3 soil field duplicates (FD) were collected from July 8 through August 28, 2013. Samples were analyzed by the ALS network of laboratories, with the majority of analyses performed by ALS Vancouver in Burnaby, British Columbia. The laboratory divided the samples into 16 sample delivery groups (SDG). Summaries of the samples collected are presented in Tables 1 and 2. A total of 39 methods were used to analyze the environmental samples. Samples were collected and couriered to the ALS Whitehorse laboratory. Samples were then shipped by overnight carrier to the ALS Vancouver laboratory for analysis. Selected samples were analyzed for one or more of the following analytes/methods:

- Moisture by Method ASTM 2216
- Moisture at liquid limit and plasticity index by Method ASTM D4318
- Oxidation reduction potential (ORP), Leachable by Method ASTM 1498_DI
- Percent saturation by Carter Saturation Percentage Method
- pH (1:2 CACL2) by Method CSSC 3.11
- Copper, iron, manganese, zinc, MN by Method CSSS 11.3/11.4
- SMP buffer pH by Method CSSS 14.2
- Chloride in saturation extract by Method CSSS 18.2.2/SM4500CL
- Conductivity and pH in saturated soil paste by Method CSSS 18.3.1
- Exchangeable cations with ammonium acetate extract by Method CSSS 19.4
- Organic matter (OM) and Total organic carbon (TOC) by Method CSSS 21.2
- Cation exchange capacity (CEC) by Method CSSS 3.321
- Available ammonium by Method CSSS 4.2
- Available nitrate by Method CSSS 4.2/4.3
- Available phosphate by Method CSSS 7.2/7.31 or SSSA P 894-895
- Specific conductance in deionized water (DI) by Method CSSS/APHA 2510B_DI
- Paste pH, pH, and paste pH in DI by Methods CSSS/APHA 4500H and CSSS/APHA 4500H_DI
- Mercury by Method E245.7
- Mercury in DI by Method E245.7_DI
- Acid soluble sulphate by Method E600/2-78-054
- Sulphur by Method ISO 15178:2000
- Neutralization potential by Method MOD-SOBEK-3.2.3
- Available sulphate by Method NCR P36/SM3120B
- Acidity in DI by Method SM2310_DI
- Alkalinity in DI by Method SM2320B_DI

- Calcium, magnesium, potassium, sodium, and sulphur, and sodium adsorption ratio (SAR) by Method SM3120B
- Sulphate in DI by Method SM4110B_DI
- Available boron by Method SSSA (1996)P 610-611
- Inorganic carbon (IC) and total inorganic carbon (TIC) by Method SSSA P 455-456
- Available phosphate by Method SSSA P 894-895
- Total carbon by LECO and total nitrogen by LECO by Method SSSA P 973-974
- Metals by Method SW6010B
- Metals in DI by Method SW6010B_DI
- Barium by fusion by Method SW6020A
- Metals in DI by Method SW6020A_DI
- Exchangable sodium percentage by Method USDA-HB60 P 101_CALC

Each SDG was evaluated by CH2M HILL chemists for data quality. Analytical performance was initially assessed on an SDG basis or an analytical batch basis. Several SDGs may be associated with the same laboratory QC samples. The association of laboratory QC samples and environmental samples from the same analytical batches is determined by the laboratory lot control number. Data were assessed using Level II validation as indicated below:

- Review of the data set narrative to identify issues that the laboratory reported in the data deliverable
- Check of sample integrity (sample collection, preservation, and holding times)
- Evaluation of basic QC measurements used to assess the accuracy, precision and representativeness of data, including QC blanks, LCS, MS, surrogate recovery when applicable, and field or laboratory duplicate results
- Review of sample results, target compound lists, and detection limits to verify that project analytical requirements are met
- Initiation of corrective actions, as necessary, based on the data review findings
- Verification that hardcopy results match electronic deliverable results
- Qualification of the data using appropriate qualifier flags, as necessary, to reflect data usability limitations

Field samples were also reviewed to ascertain field compliance and data quality issues. This included a review of FDs and an EB. Data flags were assigned according to the QC acceptance limits defined in the QAPP (CH2M HILL, 2013a). The data validation flags for each SDG are summarized in each data quality validation report. These flags, and the reason for each flag, are recorded in the electronic validation database. Multiple flags can routinely be applied to a specific sample method/matrix/analyte combination, but there will be only one final flag. As discussed below, a final flag is applied to the data on the basis of the flags entered into the database and is the most conservative of the applied validation flags. The final flag also includes matrix and blank sample impacts.

Data flags can be separated into the following two categories to be used in estimating both contractor and analytical completeness:

- Flags caused by laboratory deviation from requirements in the QAPP
- Flags applied because of the nature of the sample matrix or method limitations

The database keeps track of the type of protocol violation, and contractual and analytical completeness during data validation.

The data flags are those listed in the QAPP and are defined as follows:

J - Analyte was present but the reported value may not be accurate or precise.

UJ - Analyte was not detected above the detection limit objective. However, the reported detection limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

R - Result has been rejected for use.

U - Analyte was analyzed for but not detected at the specified detection limit.

None - A database flag with no QC implications. A flag is not applied. This is a placeholder for calculating QC criteria issues that do not require flagging.

Exclude - A database flag with no QC implications. When multiple data points have been reported, such as dilutions or re-extractions, the data that best match QAPP QC requirements (CH2M HILL, 2013a) are presented to the data users and the remainders are marked with this flag.

= - A database flag with no QC implications. A place holder for the DQE reporting purposes noting that the reported result is a detected concentration greater than the RL.

Findings

The overall summaries of the data validation findings are contained in Tables 3 through 8 and summarized in the following method sections:

- Table 3, Overall Flagging Summary. Presents the number of occurrences for each data validation reason by method.
- Table 4, Holding Time Exceedances – Qualified Data. Presents the data qualified because of holding time criteria exceedances.
- Table 5, Field Duplicate Precision – Qualified Data. Presents the results that are qualified because of FD precision exceedances.
- Table 6, Calibration Criteria – Qualified Data. Presents the data qualified because of calibration criteria exceedances.
- Table 7, Matrix Spike Precision/Accuracy – Qualified Data. Presents the results which are qualified because of MS or matrix spike duplicate (MSD) precision or accuracy exceedances.
- Table 8, Site Completeness by Analyte – Qualified Data. Presents the percent completeness by method, analyte and matrix.

Overall Flagging Summary

The frequency of field and laboratory QC samples and the associated control criteria are specified in the QAPP (CH2M HILL, 2013a). These control criteria were used to evaluate the laboratory data. In the following method-specific discussions, only the criteria exceedances that impact data qualification are discussed.

General Comments

Laboratory Qualifiers

The laboratory applied informational qualifiers to multiple results to note analytical issues such as dilutions, blank contamination, matrix effects, limited sample volume, holding time, and reanalyses. These qualifiers were reviewed and where the informational qualifiers did not result in a validation flags noting a QC exceedances, these qualifiers where replaced with the concentration flags “U” or “=”. All instances of these laboratory qualifier replacements are recorded in Table 3, and are not further discussed.

Holding Time

Holding times were also exceeded for several samples. The laboratory completed a detailed analysis and corrective action report to address these exceedances. The corrective action report is included as Attachment 1. Qualified data are discussed in detail below.

Method ASTM 2216 (Moisture)

Holding Time

Table 4 lists the specific field samples and their associated holding time criteria exceedances. The 14 day holding time for soil samples was exceeded by 1 day for 10 samples. The associated results were flagged "J."

Method CSSS 18.2.2/SM4500CL (Chloride_SP)

Field Duplicate

Table 5 lists the specific field samples and their associated FD criteria exceedances. One FD pair had criteria exceedances. The associated detected concentrations were flagged "J."

Method CSSS 21.2 (OM and TOC)

Holding Time

Table 4 lists the specific field samples and their associated holding time criteria exceedances. The 28 day holding time for soil samples was exceeded by 2 days for 10 samples. The associated detected concentration was flagged "J." The associated non-detected concentrations were flagged "UJ."

Method CSSS 3.321 (CEC)

Estimated Value

Table 6 lists the specific field sample with a result qualified because the reported concentration is the average of two or more analyses. The associated detected concentration was flagged "J."

Method SM3120B (SAR)

Estimated Value

Table 6 lists the specific field sample with a result qualified because not all of the component cations were detected. The actual SAR may be lower than the reported value. The associated detected concentration was flagged "J."

Method SSSA P 455-456 (TOC)

Field Duplicates

Table 5 lists the specific field samples and their associated FD precision criteria exceedances. One FD pair had criteria exceedances. The associated detected concentrations were flagged "J."

Method SW6010B (Metals)

Matrix/Laboratory Duplicates

Table 7 lists the specific field samples and their associated laboratory duplicate (LD) precision criteria exceedances. The LD relative percent difference limit was exceeded in four instances. The associated detected concentrations were flagged "J."

Overall Assessment

Completeness is calculated and reported for each method, matrix, and analyte combination as outlined in the QAPP (CH2M HILL, 2013a). The number of valid (not qualified with an "R" flag) results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. A summary of the completeness percentages can be found in Table 8.

The QAPP completeness goal is 90 percent and the overall data completeness is 100 percent.

Out of 1768 normal and FD data points, 21 detected results and 9 non-detected results (approximately 1.7 percent) were qualified as estimated concentrations because of QC exceedances.

Evaluation of 100 percent of the chemical data was performed by using the QAPP (CH2M HILL, 2013a) as a guide for data quality evaluation.

Data Management

Faro Mine Remediation sampling activity logs and laboratory analytical data are maintained in a project database and/or in project files, where appropriate. Data were collected and stored in a manner consistent with the requirements of the QAPP (CH2M HILL, 2013a).

All raw data will be maintained on file in the laboratory, and will be available upon request. Complete documentation of sample preparation and analysis and associated QC information will be maintained in a manner that allows easy retrieval in the event that additional information is required. The following minimum documentation should be kept for each project:

- Original work order, COC forms, and other pertinent documents received with the samples
- Records of communication between the laboratory, field personnel, and the client
- Corrective action reports
- Laboratory data reports
- Laboratory logbooks and all raw sample preparation and analytical data
- Electronic data and all pertinent SOPs

Field records to be retained as a minimum will include correspondence, COC forms, field notes, field equipment performance records, maintenance logs, field procedures, corrective action reports, field personnel files, and project-related reports.

The receipt of electronic and pdf laboratory data was logged into the sample tracking program to determine completeness and contractor turnaround time compliance.

The laboratory uploaded electronic data to the Faro Mine EQuIS site. CH2M HILL chemists downloaded this data into the validation program. All data quality evaluation was done using a semi-automated data validation program that uses laboratory pdf report and electronic data simultaneously. All validation flags and discoveries were entered into the validation database and linked directly to each individual data point.

All data quality evaluation reports were generated from the validation database. Final validation flags were uploaded to the Faro Mine EQuIS site.

The data management system was designed to maintain the usability and integrity of the data through a series of procedures and QC checks that began at the field site and carried through to the generation of data for the user. These data included both the chemical data and field operation information. Both the chemical data and the field data were handled according to the guidelines established in the QAPP (CH2M HILL, 2013a) and in the *Faro Mine Data Management Plan* (CH2M HILL, 2013b).

The laboratory pdf reports are stored in the project files and project local area network hard drive areas in the CH2M HILL office in Redding, California and the Faro Mine SharePoint site. The original field data forms are stored on the Faro Mine SharePoint site. Laboratories are required to archive the analytical data as outlined in the QAPP.

Works Cited

CH2M HILL. 2013a. *Quality Assurance Project Plan, Faro Mine Remediation Project*. July.

CH2M HILL. 2013b. *Faro Mine Data Management Plan.* August.

Tables

TABLE 1

Sample Summary by COC - Data Summary

CoC Number	Sample Date	Matrix	Sample ID / QAQC Type	SDG	Laboratory
ALS07111301					
	08-Jul-13	SOIL	CH13-108-SS001_SOa / N	L1331452	ALS
			CH13-108-SS002_SOa / N	L1331452	ALS
			CH13-108-SS002_SOAMS / MS	L1331452	ALS
			CH13-108-SS003_SOa / N	L1331452	ALS
			CH13-108-SS004_SOa / N	L1331452	ALS
			CH13-108-SS005_SOa / N	L1331452	ALS
ALS07211302					
	18-Jul-13	SOIL	CH13-108-TP022_SOa / N	L1335880	ALS
			CH13-108-TP025_SOa / N	L1335880	ALS
			CH13-108-TP026_SOa / N	L1335880	ALS
	17-Jul-13		CH13-108-TP027_SOa / N	L1335880	ALS
	18-Jul-13		CH13-108-TP027A_SOa / N	L1335880	ALS
	17-Jul-13		CH13-108-TP028_SOa / N	L1335880	ALS
ALS07211302R					
	18-Jul-13	SOIL	CH13-108-TP022_SOa / N	L1335880	ALS
			CH13-108-TP025_SOa / N	L1335880	ALS
			CH13-108-TP026_SOa / N	L1335880	ALS
	17-Jul-13		CH13-108-TP027_SOa / N	L1335880	ALS
	18-Jul-13		CH13-108-TP027A_SOa / N	L1335880	ALS
	17-Jul-13		CH13-108-TP028_SOa / N	L1335880	ALS
ALS07211303					
	18-Jul-13	SOIL	CH13-108-TP031_SOA / N	L1335953	ALS
ALS07211303R					
	18-Jul-13	SOIL	CH13-108-TP031_SOA / N	L1335953	ALS
ALS07211304					
	18-Jul-13	SOIL	CH13-108-TP031_SOA / N	L1335977	ALS
			CH13-108-TP031_SOA / N	L1377915	ALS
ALS07231302					
	22-Jul-13	SOIL	CH13-108-TP032_SOa / N	L1338657	ALS
			CH13-108-TP032_SOAMS / MS	L1338657	ALS

TABLE 1

Sample Summary by COC - Data Summary

CoC Number	Sample Date	Matrix	Sample ID / QAQC Type	SDG	Laboratory
ALS07231302R					
	22-Jul-13	SOIL	CH13-108-TP032_SOa / N	L1338657	ALS
ALS07231303					
	22-Jul-13	SOIL	CH13-108-TP032_SOa / N	L1338697	ALS
			CH13-108-TP032_SOa / N	L1377915	ALS
ALS07271303					
	25-Jul-13	SOIL	CH13-108-TP033_SOa / N	L1339353	ALS
			CH13-108-TP034_SOa / N	L1339353	ALS
			CH13-108-TP934_SOa / FD	L1339353	ALS
ALS07271303R					
	25-Jul-13	SOIL	CH13-108-TP033_SOa / N	L1339353	ALS
			CH13-108-TP034_SOa / N	L1339353	ALS
			CH13-108-TP934_SOa / FD	L1339353	ALS
ALS07271304					
	25-Jul-13	SOIL	CH13-108-TP033_SOa / N	L1339370	ALS
			CH13-108-TP033_SOa / N	L1377915	ALS
			CH13-108-TP034_SOa / N	L1339370	ALS
			CH13-108-TP034_SOa / N	L1377915	ALS
			CH13-108-TP934_SOa / FD	L1339370	ALS
			CH13-108-TP934_SOa / FD	L1377915	ALS
ALS07271305					
	25-Jul-13	SOIL	CH13-108-TP022A_Soa / N	L1339376	ALS
ALS07271305R					
	25-Jul-13	SOIL	CH13-108-TP022A_Soa / N	L1339376	ALS
ALS08151303					
	13-Aug-13	SOIL	CH13-108-TP040_SOa / N	L1349013	ALS
			CH13-108-TP041_SOa / N	L1349013	ALS
			CH13-108-TP043_SOa / N	L1349013	ALS
ALS08151303H					
	13-Aug-13	SOIL	CH13-108-TP040_SOa / N	L1349013	ALS

TABLE 1

Sample Summary by COC - Data Summary

CoC Number	Sample Date	Matrix	Sample ID / QAQC Type	SDG	Laboratory
ALS08151303H					
	13-Aug-13	SOIL	CH13-108-TP040_SOAMS / MS	L1349013	ALS
ALS08151303R					
	13-Aug-13	SOIL	CH13-108-TP040_SOa / N	L1349013	ALS
			CH13-108-TP041_SOa / N	L1349013	ALS
			CH13-108-TP043_SOa / N	L1349013	ALS
ALS08221301					
	21-Aug-13	SOIL	CH13-108-BH001_SOa / N	L1352371	ALS
	22-Aug-13		CH13-108-BH001_SOb / N	L1352371	ALS
	21-Aug-13		CH13-108-BH002_SOa / N	L1352371	ALS
	22-Aug-13		CH13-108-BH002_SOb / N	L1352371	ALS
	21-Aug-13		CH13-108-BH003_SOa / N	L1352371	ALS
			CH13-108-BH004_SOa / N	L1352371	ALS
	22-Aug-13		CH13-108-SS006_SOa / N	L1352371	ALS
ALS08221301H					
	22-Aug-13	SOIL	CH13-108-BH001_SOb / N	L1352371	ALS
			CH13-108-BH001_SOBMS / MS	L1352371	ALS
			CH13-108-BH002_SOb / N	L1352371	ALS
ALS08221301R					
	21-Aug-13	SOIL	CH13-108-BH001_SOa / N	L1352371	ALS
	22-Aug-13		CH13-108-BH001_SOb / N	L1352371	ALS
	21-Aug-13		CH13-108-BH002_SOa / N	L1352371	ALS
	22-Aug-13		CH13-108-BH002_SOb / N	L1352371	ALS
	21-Aug-13		CH13-108-BH003_SOa / N	L1352371	ALS
			CH13-108-BH004_SOa / N	L1352371	ALS
	22-Aug-13		CH13-108-SS006_SOa / N	L1352371	ALS
ALS08221302					
	22-Aug-13	SOIL	CH13-108-BH001_SOb / N	L1352419	ALS
			CH13-108-BH001_SOb / N	L1377915	ALS
			CH13-108-BH002_SOb / N	L1352419	ALS
			CH13-108-BH002_SOb / N	L1377915	ALS
			CH13-108-SS006_SOa / N	L1352419	ALS

TABLE 1

Sample Summary by COC - Data Summary

CoC Number	Sample Date	Matrix	Sample ID / QAQC Type	SDG	Laboratory
ALS08221302					
	22-Aug-13	SOIL	CH13-108-SS006_SOa / N	L1377915	ALS
ALS08251303					
	24-Aug-13	WATER	E_108_13_001 / EB	L1353127	ALS
			E_108_13_001MS / MS	L1353127	ALS
ALS08291304					
	28-Aug-13	SOIL	CH13-108-BH003_SOb / N	L1356001	ALS
			CH13-108-BH004_SOb / N	L1356001	ALS
			CH13-108-BH903_SOb / FD	L1356001	ALS
			CH13-108-BH904_SOb / FD	L1356001	ALS
ALS08291304R					
	28-Aug-13	SOIL	CH13-108-BH003_SOb / N	L1356001	ALS
			CH13-108-BH004_SOb / N	L1356001	ALS
			CH13-108-BH903_SOb / FD	L1356001	ALS
			CH13-108-BH904_SOb / FD	L1356001	ALS
ALS08291305					
	28-Aug-13	SOIL	CH13-108-BH003_SOb / N	L1356018	ALS
			CH13-108-BH003_SOb / N	L1377915	ALS
			CH13-108-BH004_SOb / N	L1356018	ALS
			CH13-108-BH004_SOb / N	L1377915	ALS
			CH13-108-BH903_SOb / FD	L1356018	ALS
			CH13-108-BH903_SOb / FD	L1377915	ALS
			CH13-108-BH904_SOb / FD	L1356018	ALS
			CH13-108-BH904_SOb / FD	L1377915	ALS

QAQC Type

N = normal environmental sample
FD = field duplicate
MS = matrix spike
SD = spike duplicate
TB = trip blank
EB = equipment blank
AB = ambient blank
FB = field blank

TABLE 2

Sample Chronology - Data Summary

Laboratory	SDG	Sample ID	Method	Sample Date	Receive Date	Extract Date	Analysis Date
ALS	L1331452	CH13-108-SS001_SOa	ASTM 2216	7/8/2013	7/12/2013		7/23/2013
		CH13-108-SS001_SOa	CSSS 21.2	7/8/2013	7/12/2013	8/7/2013	8/7/2013
		CH13-108-SS001_SOa	CSSS/APHA 4500H	7/8/2013	7/12/2013		7/25/2013
		CH13-108-SS001_SOa	E245.7	7/8/2013	7/12/2013	7/22/2013	7/25/2013
		CH13-108-SS001_SOa	ISO 15178:2000	7/8/2013	7/12/2013	7/18/2013	7/18/2013
		CH13-108-SS001_SOa	MOD-SOBEK-3.2.3	7/8/2013	7/12/2013		8/27/2013
		CH13-108-SS001_SOa	SSSA P 455-456	7/8/2013	7/12/2013		7/24/2013
		CH13-108-SS001_SOa	SSSA P 455-456	7/8/2013	7/12/2013	7/20/2013	7/20/2013
		CH13-108-SS001_SOa	SW6010B	7/8/2013	7/12/2013	7/22/2013	7/24/2013
		CH13-108-SS002_SOa	ASTM 2216	7/8/2013	7/12/2013		7/23/2013
		CH13-108-SS002_SOa	CSSS 21.2	7/8/2013	7/12/2013	8/7/2013	8/7/2013
		CH13-108-SS002_SOa	CSSS/APHA 4500H	7/8/2013	7/12/2013		7/25/2013
		CH13-108-SS002_SOa	E245.7	7/8/2013	7/12/2013	7/22/2013	7/25/2013
		CH13-108-SS002_SOa	ISO 15178:2000	7/8/2013	7/12/2013	7/18/2013	7/18/2013
		CH13-108-SS002_SOa	MOD-SOBEK-3.2.3	7/8/2013	7/12/2013		8/27/2013
		CH13-108-SS002_SOa	SSSA P 455-456	7/8/2013	7/12/2013		7/24/2013
		CH13-108-SS002_SOa	SSSA P 455-456	7/8/2013	7/12/2013	7/20/2013	7/20/2013
		CH13-108-SS002_SOa	SW6010B	7/8/2013	7/12/2013	7/22/2013	7/24/2013
		CH13-108-SS002_SOAMS	E245.7	7/8/2013		7/25/2013	7/24/2013
		CH13-108-SS002_SOAMS	SW6010B	7/8/2013		7/24/2013	7/24/2013
		CH13-108-SS003_SOa	ASTM 2216	7/8/2013	7/12/2013		7/22/2013
		CH13-108-SS003_SOa	CSSS 21.2	7/8/2013	7/12/2013	8/7/2013	8/7/2013
		CH13-108-SS003_SOa	CSSS/APHA 4500H	7/8/2013	7/12/2013		7/25/2013
		CH13-108-SS003_SOa	E245.7	7/8/2013	7/12/2013	7/22/2013	7/25/2013
		CH13-108-SS003_SOa	ISO 15178:2000	7/8/2013	7/12/2013	7/18/2013	7/18/2013
		CH13-108-SS003_SOa	MOD-SOBEK-3.2.3	7/8/2013	7/12/2013		8/27/2013
		CH13-108-SS003_SOa	SSSA P 455-456	7/8/2013	7/12/2013		7/24/2013
		CH13-108-SS003_SOa	SSSA P 455-456	7/8/2013	7/12/2013	7/20/2013	7/20/2013
		CH13-108-SS003_SOa	SW6010B	7/8/2013	7/12/2013	7/22/2013	7/24/2013
		CH13-108-SS004_SOa	ASTM 2216	7/8/2013	7/12/2013		7/23/2013
		CH13-108-SS004_SOa	CSSS 21.2	7/8/2013	7/12/2013	8/7/2013	8/7/2013
		CH13-108-SS004_SOa	CSSS/APHA 4500H	7/8/2013	7/12/2013		7/25/2013
		CH13-108-SS004_SOa	E245.7	7/8/2013	7/12/2013	7/22/2013	7/25/2013
		CH13-108-SS004_SOa	ISO 15178:2000	7/8/2013	7/12/2013	7/18/2013	7/18/2013
		CH13-108-SS004_SOa	MOD-SOBEK-3.2.3	7/8/2013	7/12/2013		8/27/2013

TABLE 2

Sample Chronology - Data Summary

Laboratory	SDG	Sample ID	Method	Sample Date	Receive Date	Extract Date	Analysis Date
ALS	L1331452	CH13-108-SS004_SOa	SSSA P 455-456	7/8/2013	7/12/2013		7/24/2013
		CH13-108-SS004_SOa	SSSA P 455-456	7/8/2013	7/12/2013	7/20/2013	7/20/2013
		CH13-108-SS004_SOa	SW6010B	7/8/2013	7/12/2013	7/22/2013	7/24/2013
		CH13-108-SS005_SOa	ASTM 2216	7/8/2013	7/12/2013		7/23/2013
		CH13-108-SS005_SOa	CSSS 21.2	7/8/2013	7/12/2013	8/7/2013	8/7/2013
		CH13-108-SS005_SOa	CSSS/APHA 4500H	7/8/2013	7/12/2013		7/25/2013
		CH13-108-SS005_SOa	E245.7	7/8/2013	7/12/2013	7/22/2013	7/25/2013
		CH13-108-SS005_SOa	ISO 15178:2000	7/8/2013	7/12/2013	7/18/2013	7/18/2013
		CH13-108-SS005_SOa	MOD-SOBEK-3.2.3	7/8/2013	7/12/2013		8/27/2013
		CH13-108-SS005_SOa	SSSA P 455-456	7/8/2013	7/12/2013		7/24/2013
		CH13-108-SS005_SOa	SSSA P 455-456	7/8/2013	7/12/2013	7/20/2013	7/20/2013
		CH13-108-SS005_SOa	SW6010B	7/8/2013	7/12/2013	7/22/2013	7/24/2013
	L1335880	CH13-108-TP022_SOa	ASTM 2216	7/18/2013	7/22/2013		7/31/2013
		CH13-108-TP022_SOa	CarterSatPercent	7/18/2013	7/22/2013	7/28/2013	8/6/2013
		CH13-108-TP022_SOa	CSSS 21.2	7/18/2013	7/22/2013	8/7/2013	8/7/2013
		CH13-108-TP022_SOa	CSSS/APHA 4500H	7/18/2013	7/22/2013		8/6/2013
		CH13-108-TP022_SOa	CSSS/APHA 4500H	7/18/2013	7/22/2013		8/7/2013
		CH13-108-TP022_SOa	E245.7	7/18/2013	7/22/2013	8/6/2013	8/7/2013
		CH13-108-TP022_SOa	ISO 15178:2000	7/18/2013	7/22/2013	7/26/2013	7/26/2013
		CH13-108-TP022_SOa	MOD-SOBEK-3.2.3	7/18/2013	7/22/2013		9/3/2013
		CH13-108-TP022_SOa	SSSA P 455-456	7/18/2013	7/22/2013		7/26/2013
		CH13-108-TP022_SOa	SSSA P 455-456	7/18/2013	7/22/2013	7/26/2013	7/26/2013
		CH13-108-TP022_SOa	SW6010B	7/18/2013	7/22/2013	8/6/2013	8/7/2013
		CH13-108-TP025_SOa	ASTM 2216	7/18/2013	7/22/2013		8/2/2013
		CH13-108-TP025_SOa	CarterSatPercent	7/18/2013	7/22/2013	7/28/2013	8/6/2013
		CH13-108-TP025_SOa	CSSS 21.2	7/18/2013	7/22/2013	8/7/2013	8/7/2013
		CH13-108-TP025_SOa	CSSS/APHA 4500H	7/18/2013	7/22/2013		8/6/2013
		CH13-108-TP025_SOa	CSSS/APHA 4500H	7/18/2013	7/22/2013		8/7/2013
		CH13-108-TP025_SOa	E245.7	7/18/2013	7/22/2013	8/6/2013	8/7/2013
		CH13-108-TP025_SOa	ISO 15178:2000	7/18/2013	7/22/2013	7/26/2013	7/26/2013
		CH13-108-TP025_SOa	MOD-SOBEK-3.2.3	7/18/2013	7/22/2013		9/3/2013
		CH13-108-TP025_SOa	SSSA P 455-456	7/18/2013	7/22/2013		7/26/2013
		CH13-108-TP025_SOa	SSSA P 455-456	7/18/2013	7/22/2013	7/26/2013	7/26/2013
		CH13-108-TP025_SOa	SW6010B	7/18/2013	7/22/2013	8/6/2013	8/7/2013
		CH13-108-TP026_SOa	ASTM 2216	7/18/2013	7/22/2013		8/2/2013

TABLE 2

Sample Chronology - Data Summary

Laboratory	SDG	Sample ID	Method	Sample Date	Receive Date	Extract Date	Analysis Date
ALS	L1335880	CH13-108-TP026_SOa	CarterSatPercent	7/18/2013	7/22/2013	7/28/2013	8/6/2013
		CH13-108-TP026_SOa	CSSS 21.2	7/18/2013	7/22/2013	8/7/2013	8/7/2013
		CH13-108-TP026_SOa	CSSS/APHA 4500H	7/18/2013	7/22/2013		8/6/2013
		CH13-108-TP026_SOa	CSSS/APHA 4500H	7/18/2013	7/22/2013		8/7/2013
		CH13-108-TP026_SOa	E245.7	7/18/2013	7/22/2013	8/6/2013	8/7/2013
		CH13-108-TP026_SOa	ISO 15178:2000	7/18/2013	7/22/2013	7/26/2013	7/26/2013
		CH13-108-TP026_SOa	MOD-SOBEK-3.2.3	7/18/2013	7/22/2013		9/3/2013
		CH13-108-TP026_SOa	SSSA P 455-456	7/18/2013	7/22/2013		7/26/2013
		CH13-108-TP026_SOa	SSSA P 455-456	7/18/2013	7/22/2013	7/26/2013	7/26/2013
		CH13-108-TP026_SOa	SW6010B	7/18/2013	7/22/2013	8/6/2013	8/7/2013
		CH13-108-TP027_SOa	ASTM 2216	7/17/2013	7/22/2013		8/2/2013
		CH13-108-TP027_SOa	CarterSatPercent	7/17/2013	7/22/2013	7/28/2013	8/6/2013
		CH13-108-TP027_SOa	CSSS 21.2	7/17/2013	7/22/2013	8/7/2013	8/7/2013
		CH13-108-TP027_SOa	CSSS/APHA 4500H	7/17/2013	7/22/2013		8/6/2013
		CH13-108-TP027_SOa	CSSS/APHA 4500H	7/17/2013	7/22/2013		8/7/2013
		CH13-108-TP027_SOa	E245.7	7/17/2013	7/22/2013	8/6/2013	8/7/2013
		CH13-108-TP027_SOa	ISO 15178:2000	7/17/2013	7/22/2013	7/26/2013	7/26/2013
		CH13-108-TP027_SOa	MOD-SOBEK-3.2.3	7/17/2013	7/22/2013		9/3/2013
		CH13-108-TP027_SOa	SSSA P 455-456	7/17/2013	7/22/2013		7/26/2013
		CH13-108-TP027_SOa	SSSA P 455-456	7/17/2013	7/22/2013	7/26/2013	7/26/2013
		CH13-108-TP027_SOa	SW6010B	7/17/2013	7/22/2013	8/6/2013	8/7/2013
		CH13-108-TP027A_SOa	ASTM 2216	7/18/2013	7/22/2013		8/6/2013
		CH13-108-TP027A_SOa	CarterSatPercent	7/18/2013	7/22/2013	7/28/2013	8/6/2013
		CH13-108-TP027A_SOa	CSSS 21.2	7/18/2013	7/22/2013	8/7/2013	8/7/2013
		CH13-108-TP027A_SOa	CSSS/APHA 4500H	7/18/2013	7/22/2013		8/6/2013
		CH13-108-TP027A_SOa	CSSS/APHA 4500H	7/18/2013	7/22/2013		8/7/2013
		CH13-108-TP027A_SOa	E245.7	7/18/2013	7/22/2013	8/6/2013	8/7/2013
		CH13-108-TP027A_SOa	ISO 15178:2000	7/18/2013	7/22/2013	7/26/2013	7/26/2013
		CH13-108-TP027A_SOa	MOD-SOBEK-3.2.3	7/18/2013	7/22/2013		9/3/2013
		CH13-108-TP027A_SOa	SSSA P 455-456	7/18/2013	7/22/2013		7/26/2013
		CH13-108-TP027A_SOa	SSSA P 455-456	7/18/2013	7/22/2013	7/26/2013	7/26/2013
		CH13-108-TP027A_SOa	SW6010B	7/18/2013	7/22/2013	8/6/2013	8/7/2013
		CH13-108-TP028_SOa	ASTM 2216	7/17/2013	7/22/2013		7/31/2013
		CH13-108-TP028_SOa	CarterSatPercent	7/17/2013	7/22/2013	7/28/2013	8/6/2013
		CH13-108-TP028_SOa	CSSS 21.2	7/17/2013	7/22/2013	8/7/2013	8/7/2013

TABLE 2

Sample Chronology - Data Summary

Laboratory	SDG	Sample ID	Method	Sample Date	Receive Date	Extract Date	Analysis Date
ALS	L1335880	CH13-108-TP028_SOa	CSSS/APHA 4500H	7/17/2013	7/22/2013		8/6/2013
		CH13-108-TP028_SOa	CSSS/APHA 4500H	7/17/2013	7/22/2013		8/7/2013
		CH13-108-TP028_SOa	E245.7	7/17/2013	7/22/2013	8/6/2013	8/7/2013
		CH13-108-TP028_SOa	ISO 15178:2000	7/17/2013	7/22/2013	7/26/2013	7/26/2013
		CH13-108-TP028_SOa	MOD-SOBEK-3.2.3	7/17/2013	7/22/2013		9/3/2013
		CH13-108-TP028_SOa	SSSA P 455-456	7/17/2013	7/22/2013		7/26/2013
		CH13-108-TP028_SOa	SSSA P 455-456	7/17/2013	7/22/2013	7/26/2013	7/26/2013
		CH13-108-TP028_SOa	SW6010B	7/17/2013	7/22/2013	8/6/2013	8/7/2013
	L1335953	CH13-108-TP031_SOA	ASTM 2216	7/18/2013	7/22/2013		8/2/2013
		CH13-108-TP031_SOA	ASTM D4318	7/18/2013	7/22/2013	7/30/2013	7/30/2013
		CH13-108-TP031_SOA	CSSS 21.2	7/18/2013	7/22/2013	7/27/2013	7/27/2013
		CH13-108-TP031_SOA	CSSS/APHA 4500H	7/18/2013	7/22/2013		8/6/2013
		CH13-108-TP031_SOA	CSSS/APHA 4500H	7/18/2013	7/22/2013		8/7/2013
		CH13-108-TP031_SOA	E245.7	7/18/2013	7/22/2013	8/6/2013	8/7/2013
		CH13-108-TP031_SOA	ISO 15178:2000	7/18/2013	7/22/2013	7/26/2013	7/26/2013
		CH13-108-TP031_SOA	MOD-SOBEK-3.2.3	7/18/2013	7/22/2013		9/3/2013
		CH13-108-TP031_SOA	SSSA P 455-456	7/18/2013	7/22/2013		7/26/2013
		CH13-108-TP031_SOA	SSSA P 455-456	7/18/2013	7/22/2013	7/26/2013	7/26/2013
		CH13-108-TP031_SOA	SW6010B	7/18/2013	7/22/2013	8/6/2013	8/7/2013
	L1335977	CH13-108-TP031_SOA	CSSC 3.11	7/18/2013	7/22/2013	8/1/2013	8/1/2013
		CH13-108-TP031_SOA	CSSS 11.3/11.4	7/18/2013	7/22/2013	8/1/2013	8/1/2013
		CH13-108-TP031_SOA	CSSS 14.2	7/18/2013	7/22/2013	8/1/2013	8/1/2013
		CH13-108-TP031_SOA	CSSS 18.2.2/SM4500C	7/18/2013	7/22/2013	8/1/2013	8/1/2013
		CH13-108-TP031_SOA	CSSS 18.3.1	7/18/2013	7/22/2013	7/31/2013	8/1/2013
		CH13-108-TP031_SOA	CSSS 19.4	7/18/2013	7/22/2013	8/2/2013	8/2/2013
		CH13-108-TP031_SOA	CSSS 3.321	7/18/2013	7/22/2013	8/2/2013	8/2/2013
		CH13-108-TP031_SOA	CSSS 4.2	7/18/2013	7/22/2013	7/31/2013	7/31/2013
		CH13-108-TP031_SOA	CSSS 4.2/4.3	7/18/2013	7/22/2013	7/31/2013	7/31/2013
		CH13-108-TP031_SOA	CSSS 7.2/7.31	7/18/2013	7/22/2013	7/31/2013	7/31/2013
		CH13-108-TP031_SOA	NCR P 36/SM3120B	7/18/2013	7/22/2013	7/31/2013	7/31/2013
		CH13-108-TP031_SOA	SM3120B	7/18/2013	7/22/2013	8/1/2013	8/1/2013
		CH13-108-TP031_SOA	SSSA P 455-456	7/18/2013	7/22/2013	8/2/2013	8/2/2013
		CH13-108-TP031_SOA	SSSA P 973-974	7/18/2013	7/22/2013	7/31/2013	7/31/2013
		CH13-108-TP031_SOA	SW6010B	7/18/2013	7/22/2013	8/7/2013	8/8/2013
		CH13-108-TP031_SOA	USDA-HB60 P 101_CA	7/18/2013	7/22/2013		8/2/2013

TABLE 2

Sample Chronology - Data Summary

Laboratory	SDG	Sample ID	Method	Sample Date	Receive Date	Extract Date	Analysis Date
ALS	L1338657	CH13-108-TP032_SOa	ASTM 2216	7/22/2013	7/25/2013		8/10/2013
		CH13-108-TP032_SOa	CSSS 21.2	7/22/2013	7/25/2013	7/30/2013	7/30/2013
		CH13-108-TP032_SOa	CSSS/APHA 4500H	7/22/2013	7/25/2013		8/8/2013
		CH13-108-TP032_SOa	CSSS/APHA 4500H	7/22/2013	7/25/2013		8/14/2013
		CH13-108-TP032_SOa	E245.7	7/22/2013	7/25/2013	8/9/2013	8/14/2013
		CH13-108-TP032_SOa	ISO 15178:2000	7/22/2013	7/25/2013	7/29/2013	7/29/2013
		CH13-108-TP032_SOa	MOD-SOBEK-3.2.3	7/22/2013	7/25/2013		8/28/2013
		CH13-108-TP032_SOa	SSSA P 455-456	7/22/2013	7/25/2013		7/30/2013
		CH13-108-TP032_SOa	SSSA P 455-456	7/22/2013	7/25/2013	7/30/2013	7/30/2013
		CH13-108-TP032_SOa	SW6010B	7/22/2013	7/25/2013	8/9/2013	8/13/2013
		CH13-108-TP032_SOAMS	E245.7	7/22/2013		8/14/2013	8/13/2013
		CH13-108-TP032_SOAMS	SW6010B	7/22/2013		8/13/2013	8/13/2013
	L1338697	CH13-108-TP032_SOa	CSSC 3.11	7/22/2013	7/25/2013	8/1/2013	8/1/2013
		CH13-108-TP032_SOa	CSSS 11.3/11.4	7/22/2013	7/25/2013	8/1/2013	8/1/2013
		CH13-108-TP032_SOa	CSSS 14.2	7/22/2013	7/25/2013	8/1/2013	8/1/2013
		CH13-108-TP032_SOa	CSSS 18.2.2/SM4500C	7/22/2013	7/25/2013	8/1/2013	8/1/2013
		CH13-108-TP032_SOa	CSSS 18.3.1	7/22/2013	7/25/2013	7/31/2013	8/1/2013
		CH13-108-TP032_SOa	CSSS 19.4	7/22/2013	7/25/2013	8/2/2013	8/2/2013
		CH13-108-TP032_SOa	CSSS 3.321	7/22/2013	7/25/2013	8/2/2013	8/2/2013
		CH13-108-TP032_SOa	CSSS 7.2/7.31	7/22/2013	7/25/2013	7/31/2013	7/31/2013
		CH13-108-TP032_SOa	NCR P 36/SM3120B	7/22/2013	7/25/2013	7/31/2013	7/31/2013
		CH13-108-TP032_SOa	SM3120B	7/22/2013	7/25/2013	8/1/2013	8/1/2013
		CH13-108-TP032_SOa	SSSA P 455-456	7/22/2013	7/25/2013	8/2/2013	8/2/2013
		CH13-108-TP032_SOa	SSSA P 973-974	7/22/2013	7/25/2013	7/31/2013	7/31/2013
		CH13-108-TP032_SOa	USDA-HB60 P 101_CA	7/22/2013	7/25/2013		8/2/2013
	L1339353	CH13-108-TP033_SOa	ASTM 2216	7/25/2013	7/29/2013		8/8/2013
		CH13-108-TP033_SOa	ASTM D4318	7/25/2013	7/29/2013	8/6/2013	8/6/2013
		CH13-108-TP033_SOa	CSSS 21.2	7/25/2013	7/29/2013	8/3/2013	8/3/2013
		CH13-108-TP033_SOa	CSSS/APHA 4500H	7/25/2013	7/29/2013		8/15/2013
		CH13-108-TP033_SOa	E245.7	7/25/2013	7/29/2013	8/9/2013	8/13/2013
		CH13-108-TP033_SOa	ISO 15178:2000	7/25/2013	7/29/2013	8/2/2013	8/2/2013
		CH13-108-TP033_SOa	MOD-SOBEK-3.2.3	7/25/2013	7/29/2013		8/27/2013
		CH13-108-TP033_SOa	SSSA P 455-456	7/25/2013	7/29/2013		8/3/2013
		CH13-108-TP033_SOa	SSSA P 455-456	7/25/2013	7/29/2013	8/3/2013	8/3/2013
		CH13-108-TP033_SOa	SW6010B	7/25/2013	7/29/2013	8/9/2013	8/13/2013

TABLE 2

Sample Chronology - Data Summary

Laboratory	SDG	Sample ID	Method	Sample Date	Receive Date	Extract Date	Analysis Date
ALS	L1339353	CH13-108-TP034_SOa	ASTM 2216	7/25/2013	7/29/2013		8/8/2013
		CH13-108-TP034_SOa	ASTM D4318	7/25/2013	7/29/2013	8/6/2013	8/6/2013
		CH13-108-TP034_SOa	CSSS 21.2	7/25/2013	7/29/2013	8/3/2013	8/3/2013
		CH13-108-TP034_SOa	CSSS/APHA 4500H	7/25/2013	7/29/2013		8/15/2013
		CH13-108-TP034_SOa	E245.7	7/25/2013	7/29/2013	8/9/2013	8/13/2013
		CH13-108-TP034_SOa	ISO 15178:2000	7/25/2013	7/29/2013	8/2/2013	8/2/2013
		CH13-108-TP034_SOa	MOD-SOBEK-3.2.3	7/25/2013	7/29/2013		8/27/2013
		CH13-108-TP034_SOa	SSSA P 455-456	7/25/2013	7/29/2013		8/3/2013
		CH13-108-TP034_SOa	SSSA P 455-456	7/25/2013	7/29/2013	8/3/2013	8/3/2013
		CH13-108-TP034_SOa	SW6010B	7/25/2013	7/29/2013	8/9/2013	8/13/2013
		CH13-108-TP934_SOa	ASTM 2216	7/25/2013	7/29/2013		8/8/2013
		CH13-108-TP934_SOa	CSSS 21.2	7/25/2013	7/29/2013	8/3/2013	8/3/2013
		CH13-108-TP934_SOa	CSSS/APHA 4500H	7/25/2013	7/29/2013		8/15/2013
		CH13-108-TP934_SOa	E245.7	7/25/2013	7/29/2013	8/9/2013	8/13/2013
		CH13-108-TP934_SOa	ISO 15178:2000	7/25/2013	7/29/2013	8/2/2013	8/2/2013
		CH13-108-TP934_SOa	MOD-SOBEK-3.2.3	7/25/2013	7/29/2013		8/27/2013
		CH13-108-TP934_SOa	SSSA P 455-456	7/25/2013	7/29/2013		8/3/2013
		CH13-108-TP934_SOa	SSSA P 455-456	7/25/2013	7/29/2013	8/3/2013	8/3/2013
		CH13-108-TP934_SOa	SW6010B	7/25/2013	7/29/2013	8/9/2013	8/13/2013
	L1339370	CH13-108-TP033_SOa	CSSC 3.11	7/25/2013	7/29/2013	8/2/2013	8/2/2013
		CH13-108-TP033_SOa	CSSS 11.3/11.4	7/25/2013	7/29/2013	8/7/2013	8/7/2013
		CH13-108-TP033_SOa	CSSS 14.2	7/25/2013	7/29/2013	8/2/2013	8/2/2013
		CH13-108-TP033_SOa	CSSS 18.2.2/SM4500C	7/25/2013	7/29/2013	8/7/2013	8/7/2013
		CH13-108-TP033_SOa	CSSS 18.3.1	7/25/2013	7/29/2013	8/6/2013	8/7/2013
		CH13-108-TP033_SOa	CSSS 19.4	7/25/2013	7/29/2013	8/9/2013	8/9/2013
		CH13-108-TP033_SOa	CSSS 3.321	7/25/2013	7/29/2013	8/9/2013	8/9/2013
		CH13-108-TP033_SOa	CSSS 7.2/7.31	7/25/2013	7/29/2013	8/8/2013	8/8/2013
		CH13-108-TP033_SOa	NCR P 36/SM3120B	7/25/2013	7/29/2013	8/6/2013	8/6/2013
		CH13-108-TP033_SOa	SM3120B	7/25/2013	7/29/2013	8/7/2013	8/7/2013
		CH13-108-TP033_SOa	SSSA P 455-456	7/25/2013	7/29/2013	8/3/2013	8/3/2013
		CH13-108-TP033_SOa	SSSA P 973-974	7/25/2013	7/29/2013	8/2/2013	8/2/2013
		CH13-108-TP033_SOa	USDA-HB60 P 101_CA	7/25/2013	7/29/2013		8/9/2013
		CH13-108-TP034_SOa	CSSC 3.11	7/25/2013	7/29/2013	8/2/2013	8/2/2013
		CH13-108-TP034_SOa	CSSS 11.3/11.4	7/25/2013	7/29/2013	8/7/2013	8/7/2013
		CH13-108-TP034_SOa	CSSS 14.2	7/25/2013	7/29/2013	8/2/2013	8/2/2013

TABLE 2

Sample Chronology - Data Summary

Laboratory	SDG	Sample ID	Method	Sample Date	Receive Date	Extract Date	Analysis Date
ALS	L1339370	CH13-108-TP034_SOa	CSSS 18.2.2/SM4500C	7/25/2013	7/29/2013	8/7/2013	8/7/2013
		CH13-108-TP034_SOa	CSSS 18.3.1	7/25/2013	7/29/2013	8/6/2013	8/7/2013
		CH13-108-TP034_SOa	CSSS 19.4	7/25/2013	7/29/2013	8/9/2013	8/9/2013
		CH13-108-TP034_SOa	CSSS 3.321	7/25/2013	7/29/2013	8/9/2013	8/9/2013
		CH13-108-TP034_SOa	CSSS 7.2/7.31	7/25/2013	7/29/2013	8/8/2013	8/8/2013
		CH13-108-TP034_SOa	NCR P 36/SM3120B	7/25/2013	7/29/2013	8/6/2013	8/6/2013
		CH13-108-TP034_SOa	SM3120B	7/25/2013	7/29/2013	8/7/2013	8/7/2013
		CH13-108-TP034_SOa	SSSA P 455-456	7/25/2013	7/29/2013	8/3/2013	8/3/2013
		CH13-108-TP034_SOa	SSSA P 973-974	7/25/2013	7/29/2013	8/2/2013	8/2/2013
		CH13-108-TP034_SOa	USDA-HB60 P 101_CA	7/25/2013	7/29/2013		8/9/2013
		CH13-108-TP934_SOa	CSSC 3.11	7/25/2013	7/29/2013	8/2/2013	8/2/2013
		CH13-108-TP934_SOa	CSSS 11.3/11.4	7/25/2013	7/29/2013	8/7/2013	8/7/2013
		CH13-108-TP934_SOa	CSSS 14.2	7/25/2013	7/29/2013	8/2/2013	8/2/2013
		CH13-108-TP934_SOa	CSSS 18.2.2/SM4500C	7/25/2013	7/29/2013	8/7/2013	8/7/2013
		CH13-108-TP934_SOa	CSSS 18.3.1	7/25/2013	7/29/2013	8/6/2013	8/7/2013
		CH13-108-TP934_SOa	CSSS 19.4	7/25/2013	7/29/2013	8/9/2013	8/9/2013
		CH13-108-TP934_SOa	CSSS 3.321	7/25/2013	7/29/2013	8/9/2013	8/9/2013
		CH13-108-TP934_SOa	CSSS 7.2/7.31	7/25/2013	7/29/2013	8/8/2013	8/8/2013
		CH13-108-TP934_SOa	NCR P 36/SM3120B	7/25/2013	7/29/2013	8/6/2013	8/6/2013
		CH13-108-TP934_SOa	SM3120B	7/25/2013	7/29/2013	8/7/2013	8/7/2013
		CH13-108-TP934_SOa	SSSA P 455-456	7/25/2013	7/29/2013	8/3/2013	8/3/2013
		CH13-108-TP934_SOa	SSSA P 973-974	7/25/2013	7/29/2013	8/2/2013	8/2/2013
		CH13-108-TP934_SOa	USDA-HB60 P 101_CA	7/25/2013	7/29/2013		8/9/2013
	L1339376	CH13-108-TP022A_Soa	ASTM 2216	7/25/2013	7/29/2013		8/7/2013
		CH13-108-TP022A_Soa	CSSS 21.2	7/25/2013	7/29/2013	8/3/2013	8/3/2013
		CH13-108-TP022A_Soa	CSSS/APHA 4500H	7/25/2013	7/29/2013		8/15/2013
		CH13-108-TP022A_Soa	E245.7	7/25/2013	7/29/2013	8/9/2013	8/13/2013
		CH13-108-TP022A_Soa	ISO 15178:2000	7/25/2013	7/29/2013	8/2/2013	8/2/2013
		CH13-108-TP022A_Soa	MOD-SOBEK-3.2.3	7/25/2013	7/29/2013		8/26/2013
		CH13-108-TP022A_Soa	SSSA P 455-456	7/25/2013	7/29/2013		8/3/2013
		CH13-108-TP022A_Soa	SSSA P 455-456	7/25/2013	7/29/2013	8/3/2013	8/3/2013
		CH13-108-TP022A_Soa	SW6010B	7/25/2013	7/29/2013	8/9/2013	8/13/2013
	L1349013	CH13-108-TP040_SOa	ASTM 2216	8/13/2013	8/16/2013		8/26/2013
		CH13-108-TP040_SOa	ASTMD1498_DI	8/13/2013	8/16/2013		9/16/2013
		CH13-108-TP040_SOa	CSSS 21.2	8/13/2013	8/16/2013	8/21/2013	8/21/2013

TABLE 2

Sample Chronology - Data Summary

Laboratory	SDG	Sample ID	Method	Sample Date	Receive Date	Extract Date	Analysis Date
ALS	L1349013	CH13-108-TP040_SOa	CSSS/APHA 2510B_DI	8/13/2013	8/16/2013		9/11/2013
		CH13-108-TP040_SOa	CSSS/APHA 4500H	8/13/2013	8/16/2013		8/28/2013
		CH13-108-TP040_SOa	CSSS/APHA 4500H	8/13/2013	8/16/2013		8/30/2013
		CH13-108-TP040_SOa	CSSS/APHA 4500H_DI	8/13/2013	8/16/2013		9/10/2013
		CH13-108-TP040_SOa	E245.7	8/13/2013	8/16/2013	8/23/2013	8/27/2013
		CH13-108-TP040_SOa	E245.7_DI	8/13/2013	8/16/2013		9/12/2013
		CH13-108-TP040_SOa	EPA600/2-78-054	8/13/2013	8/16/2013	9/1/2013	9/1/2013
		CH13-108-TP040_SOa	ISO 15178:2000	8/13/2013	8/16/2013	8/21/2013	8/21/2013
		CH13-108-TP040_SOa	MOD-SOBEK-3.2.3	8/13/2013	8/16/2013		9/19/2013
		CH13-108-TP040_SOa	SM2310_DI	8/13/2013	8/16/2013		9/11/2013
		CH13-108-TP040_SOa	SM2320B_DI	8/13/2013	8/16/2013		9/11/2013
		CH13-108-TP040_SOa	SM4110B_DI	8/13/2013	8/16/2013		9/11/2013
		CH13-108-TP040_SOa	SSSA P 455-456	8/13/2013	8/16/2013		8/24/2013
		CH13-108-TP040_SOa	SSSA P 455-456	8/13/2013	8/16/2013	8/22/2013	8/22/2013
		CH13-108-TP040_SOa	SW6010B	8/13/2013	8/16/2013	8/23/2013	8/27/2013
		CH13-108-TP040_SOa	SW6010B_DI	8/13/2013	8/16/2013		9/12/2013
		CH13-108-TP040_SOa	SW6020A	8/13/2013	8/16/2013	9/1/2013	9/1/2013
		CH13-108-TP040_SOa	SW6020A_DI	8/13/2013	8/16/2013		9/16/2013
		CH13-108-TP040_SOAMS	SW6010B_DI	8/13/2013			9/6/2013
		CH13-108-TP040_SOAMS	SW6020A_DI	8/13/2013			9/6/2013
		CH13-108-TP041_SOa	ASTM 2216	8/13/2013	8/16/2013		8/26/2013
		CH13-108-TP041_SOa	CSSS 21.2	8/13/2013	8/16/2013	8/23/2013	8/23/2013
		CH13-108-TP041_SOa	CSSS/APHA 4500H	8/13/2013	8/16/2013		8/28/2013
		CH13-108-TP041_SOa	CSSS/APHA 4500H	8/13/2013	8/16/2013		8/30/2013
		CH13-108-TP041_SOa	E245.7	8/13/2013	8/16/2013	8/23/2013	8/27/2013
		CH13-108-TP041_SOa	EPA600/2-78-054	8/13/2013	8/16/2013	9/1/2013	9/1/2013
		CH13-108-TP041_SOa	ISO 15178:2000	8/13/2013	8/16/2013	8/22/2013	8/22/2013
		CH13-108-TP041_SOa	MOD-SOBEK-3.2.3	8/13/2013	8/16/2013		9/19/2013
		CH13-108-TP041_SOa	SSSA P 455-456	8/13/2013	8/16/2013		8/23/2013
		CH13-108-TP041_SOa	SSSA P 455-456	8/13/2013	8/16/2013	8/22/2013	8/22/2013
		CH13-108-TP041_SOa	SW6010B	8/13/2013	8/16/2013	8/23/2013	8/27/2013
		CH13-108-TP041_SOa	SW6020A	8/13/2013	8/16/2013	9/1/2013	9/1/2013
		CH13-108-TP043_SOa	ASTM 2216	8/13/2013	8/16/2013		8/26/2013
		CH13-108-TP043_SOa	CSSS 21.2	8/13/2013	8/16/2013	8/21/2013	8/21/2013
		CH13-108-TP043_SOa	CSSS/APHA 4500H	8/13/2013	8/16/2013		8/28/2013

TABLE 2

Sample Chronology - Data Summary

Laboratory	SDG	Sample ID	Method	Sample Date	Receive Date	Extract Date	Analysis Date
ALS	L1349013	CH13-108-TP043_SOa	CSSS/APHA 4500H	8/13/2013	8/16/2013		8/30/2013
		CH13-108-TP043_SOa	E245.7	8/13/2013	8/16/2013	8/23/2013	8/27/2013
		CH13-108-TP043_SOa	EPA600/2-78-054	8/13/2013	8/16/2013	9/1/2013	9/1/2013
		CH13-108-TP043_SOa	ISO 15178:2000	8/13/2013	8/16/2013	8/21/2013	8/21/2013
		CH13-108-TP043_SOa	MOD-SOBEK-3.2.3	8/13/2013	8/16/2013		9/19/2013
		CH13-108-TP043_SOa	SSSA P 455-456	8/13/2013	8/16/2013		8/24/2013
		CH13-108-TP043_SOa	SSSA P 455-456	8/13/2013	8/16/2013	8/22/2013	8/22/2013
		CH13-108-TP043_SOa	SW6010B	8/13/2013	8/16/2013	8/23/2013	8/27/2013
		CH13-108-TP043_SOa	SW6020A	8/13/2013	8/16/2013	9/1/2013	9/1/2013
	L1352371	CH13-108-BH001_SOa	ASTM 2216	8/21/2013	8/23/2013		9/2/2013
		CH13-108-BH001_SOa	CSSS 21.2	8/21/2013	8/23/2013	8/31/2013	8/31/2013
		CH13-108-BH001_SOa	CSSS/APHA 4500H	8/21/2013	8/23/2013		9/5/2013
		CH13-108-BH001_SOa	CSSS/APHA 4500H	8/21/2013	8/23/2013		9/12/2013
		CH13-108-BH001_SOa	E245.7	8/21/2013	8/23/2013	9/11/2013	9/11/2013
		CH13-108-BH001_SOa	EPA600/2-78-054	8/21/2013	8/23/2013	9/9/2013	9/9/2013
		CH13-108-BH001_SOa	ISO 15178:2000	8/21/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH001_SOa	MOD-SOBEK-3.2.3	8/21/2013	8/23/2013		9/27/2013
		CH13-108-BH001_SOa	SSSA P 455-456	8/21/2013	8/23/2013		8/30/2013
		CH13-108-BH001_SOa	SSSA P 455-456	8/21/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH001_SOa	SW6010B	8/21/2013	8/23/2013	9/11/2013	9/11/2013
		CH13-108-BH001_SOa	SW6020A	8/21/2013	8/23/2013	9/9/2013	9/9/2013
		CH13-108-BH001_SOb	ASTM 2216	8/22/2013	8/23/2013		9/3/2013
		CH13-108-BH001_SOb	ASTM D4318	8/22/2013	8/23/2013	9/4/2013	9/4/2013
		CH13-108-BH001_SOb	ASTMD1498_DI	8/22/2013	8/23/2013		9/25/2013
		CH13-108-BH001_SOb	CSSS 21.2	8/22/2013	8/23/2013	8/31/2013	8/31/2013
		CH13-108-BH001_SOb	CSSS/APHA 2510B_DI	8/22/2013	8/23/2013		9/25/2013
		CH13-108-BH001_SOb	CSSS/APHA 4500H	8/22/2013	8/23/2013		9/5/2013
		CH13-108-BH001_SOb	CSSS/APHA 4500H	8/22/2013	8/23/2013		9/6/2013
		CH13-108-BH001_SOb	CSSS/APHA 4500H_DI	8/22/2013	8/23/2013		9/24/2013
		CH13-108-BH001_SOb	E245.7	8/22/2013	8/23/2013	9/3/2013	9/5/2013
		CH13-108-BH001_SOb	E245.7_DI	8/22/2013	8/23/2013		9/24/2013
		CH13-108-BH001_SOb	EPA600/2-78-054	8/22/2013	8/23/2013	9/9/2013	9/9/2013
		CH13-108-BH001_SOb	ISO 15178:2000	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH001_SOb	MOD-SOBEK-3.2.3	8/22/2013	8/23/2013		9/27/2013
		CH13-108-BH001_SOb	SM2310_DI	8/22/2013	8/23/2013		9/25/2013

TABLE 2

Sample Chronology - Data Summary

Laboratory	SDG	Sample ID	Method	Sample Date	Receive Date	Extract Date	Analysis Date
ALS	L1352371	CH13-108-BH001_SOb	SM2320B_DI	8/22/2013	8/23/2013		9/25/2013
		CH13-108-BH001_SOb	SM4110B_DI	8/22/2013	8/23/2013		9/25/2013
		CH13-108-BH001_SOb	SSSA P 455-456	8/22/2013	8/23/2013		8/30/2013
		CH13-108-BH001_SOb	SSSA P 455-456	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH001_SOb	SW6010B	8/22/2013	8/23/2013	9/3/2013	9/5/2013
		CH13-108-BH001_SOb	SW6010B_DI	8/22/2013	8/23/2013		9/24/2013
		CH13-108-BH001_SOb	SW6020A	8/22/2013	8/23/2013	9/9/2013	9/9/2013
		CH13-108-BH001_SOb	SW6020A_DI	8/22/2013	8/23/2013		9/25/2013
		CH13-108-BH001_SOBMS	E245.7_DI	8/22/2013			9/24/2013
		CH13-108-BH001_SOBMS	SW6010B_DI	8/22/2013			9/24/2013
		CH13-108-BH001_SOBMS	SW6020A_DI	8/22/2013			9/24/2013
		CH13-108-BH002_SOa	ASTM 2216	8/21/2013	8/23/2013		9/2/2013
		CH13-108-BH002_SOa	CSSS 21.2	8/21/2013	8/23/2013	8/31/2013	8/31/2013
		CH13-108-BH002_SOa	CSSS/APHA 4500H	8/21/2013	8/23/2013		9/5/2013
		CH13-108-BH002_SOa	CSSS/APHA 4500H	8/21/2013	8/23/2013		9/12/2013
		CH13-108-BH002_SOa	E245.7	8/21/2013	8/23/2013	9/11/2013	9/11/2013
		CH13-108-BH002_SOa	EPA600/2-78-054	8/21/2013	8/23/2013	9/9/2013	9/9/2013
		CH13-108-BH002_SOa	ISO 15178:2000	8/21/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH002_SOa	MOD-SOBEK-3.2.3	8/21/2013	8/23/2013		9/27/2013
		CH13-108-BH002_SOa	SSSA P 455-456	8/21/2013	8/23/2013		8/30/2013
		CH13-108-BH002_SOa	SSSA P 455-456	8/21/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH002_SOa	SW6010B	8/21/2013	8/23/2013	9/11/2013	9/11/2013
		CH13-108-BH002_SOa	SW6020A	8/21/2013	8/23/2013	9/9/2013	9/9/2013
		CH13-108-BH002_SOb	ASTM 2216	8/22/2013	8/23/2013		9/3/2013
		CH13-108-BH002_SOb	ASTM D4318	8/22/2013	8/23/2013	9/4/2013	9/4/2013
		CH13-108-BH002_SOb	ASTMD1498_DI	8/22/2013	8/23/2013		9/25/2013
		CH13-108-BH002_SOb	CSSS 21.2	8/22/2013	8/23/2013	8/31/2013	8/31/2013
		CH13-108-BH002_SOb	CSSS/APHA 2510B_DI	8/22/2013	8/23/2013		9/25/2013
		CH13-108-BH002_SOb	CSSS/APHA 4500H	8/22/2013	8/23/2013		9/5/2013
		CH13-108-BH002_SOb	CSSS/APHA 4500H	8/22/2013	8/23/2013		9/6/2013
		CH13-108-BH002_SOb	CSSS/APHA 4500H_DI	8/22/2013	8/23/2013		9/24/2013
		CH13-108-BH002_SOb	E245.7	8/22/2013	8/23/2013	9/3/2013	9/5/2013
		CH13-108-BH002_SOb	E245.7_DI	8/22/2013	8/23/2013		9/24/2013
		CH13-108-BH002_SOb	EPA600/2-78-054	8/22/2013	8/23/2013	9/9/2013	9/9/2013
		CH13-108-BH002_SOb	ISO 15178:2000	8/22/2013	8/23/2013	8/30/2013	8/30/2013

TABLE 2

Sample Chronology - Data Summary

Laboratory	SDG	Sample ID	Method	Sample Date	Receive Date	Extract Date	Analysis Date
ALS	L1352371	CH13-108-BH002_SOb	MOD-SOBEK-3.2.3	8/22/2013	8/23/2013		9/27/2013
		CH13-108-BH002_SOb	SM2310_DI	8/22/2013	8/23/2013		9/25/2013
		CH13-108-BH002_SOb	SM2320B_DI	8/22/2013	8/23/2013		9/25/2013
		CH13-108-BH002_SOb	SM4110B_DI	8/22/2013	8/23/2013		9/25/2013
		CH13-108-BH002_SOb	SSSA P 455-456	8/22/2013	8/23/2013		8/30/2013
		CH13-108-BH002_SOb	SSSA P 455-456	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH002_SOb	SW6010B	8/22/2013	8/23/2013	9/3/2013	9/5/2013
		CH13-108-BH002_SOb	SW6010B_DI	8/22/2013	8/23/2013		9/24/2013
		CH13-108-BH002_SOb	SW6020A	8/22/2013	8/23/2013	9/9/2013	9/9/2013
		CH13-108-BH002_SOb	SW6020A_DI	8/22/2013	8/23/2013		9/25/2013
		CH13-108-BH003_SOa	ASTM 2216	8/21/2013	8/23/2013		9/2/2013
		CH13-108-BH003_SOa	CSSS 21.2	8/21/2013	8/23/2013	8/31/2013	8/31/2013
		CH13-108-BH003_SOa	CSSS/APHA 4500H	8/21/2013	8/23/2013		9/6/2013
		CH13-108-BH003_SOa	CSSS/APHA 4500H	8/21/2013	8/23/2013		9/12/2013
		CH13-108-BH003_SOa	E245.7	8/21/2013	8/23/2013	9/11/2013	9/11/2013
		CH13-108-BH003_SOa	EPA600/2-78-054	8/21/2013	8/23/2013	9/9/2013	9/9/2013
		CH13-108-BH003_SOa	ISO 15178:2000	8/21/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH003_SOa	MOD-SOBEK-3.2.3	8/21/2013	8/23/2013		9/27/2013
		CH13-108-BH003_SOa	SSSA P 455-456	8/21/2013	8/23/2013		8/30/2013
		CH13-108-BH003_SOa	SSSA P 455-456	8/21/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH003_SOa	SW6010B	8/21/2013	8/23/2013	9/11/2013	9/11/2013
		CH13-108-BH003_SOa	SW6020A	8/21/2013	8/23/2013	9/9/2013	9/9/2013
		CH13-108-BH004_SOa	ASTM 2216	8/21/2013	8/23/2013		9/2/2013
		CH13-108-BH004_SOa	CSSS 21.2	8/21/2013	8/23/2013	8/31/2013	8/31/2013
		CH13-108-BH004_SOa	CSSS/APHA 4500H	8/21/2013	8/23/2013		9/6/2013
		CH13-108-BH004_SOa	CSSS/APHA 4500H	8/21/2013	8/23/2013		9/12/2013
		CH13-108-BH004_SOa	E245.7	8/21/2013	8/23/2013	9/11/2013	9/11/2013
		CH13-108-BH004_SOa	EPA600/2-78-054	8/21/2013	8/23/2013	9/9/2013	9/9/2013
		CH13-108-BH004_SOa	ISO 15178:2000	8/21/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH004_SOa	MOD-SOBEK-3.2.3	8/21/2013	8/23/2013		9/27/2013
		CH13-108-BH004_SOa	SSSA P 455-456	8/21/2013	8/23/2013		8/30/2013
		CH13-108-BH004_SOa	SSSA P 455-456	8/21/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH004_SOa	SW6010B	8/21/2013	8/23/2013	9/11/2013	9/11/2013
		CH13-108-BH004_SOa	SW6020A	8/21/2013	8/23/2013	9/9/2013	9/9/2013
		CH13-108-SS006_SOa	ASTM 2216	8/22/2013	8/23/2013		9/3/2013

TABLE 2

Sample Chronology - Data Summary

Laboratory	SDG	Sample ID	Method	Sample Date	Receive Date	Extract Date	Analysis Date
ALS	L1352371	CH13-108-SS006_SOa	ASTM D4318	8/22/2013	8/23/2013	9/4/2013	9/4/2013
		CH13-108-SS006_SOa	CSSS 21.2	8/22/2013	8/23/2013	8/31/2013	8/31/2013
		CH13-108-SS006_SOa	CSSS/APHA 4500H	8/22/2013	8/23/2013		9/5/2013
		CH13-108-SS006_SOa	CSSS/APHA 4500H	8/22/2013	8/23/2013		9/6/2013
		CH13-108-SS006_SOa	E245.7	8/22/2013	8/23/2013	9/3/2013	9/5/2013
		CH13-108-SS006_SOa	EPA600/2-78-054	8/22/2013	8/23/2013	9/9/2013	9/9/2013
		CH13-108-SS006_SOa	ISO 15178:2000	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-SS006_SOa	MOD-SOBEK-3.2.3	8/22/2013	8/23/2013		9/27/2013
		CH13-108-SS006_SOa	SSSA P 455-456	8/22/2013	8/23/2013		8/30/2013
		CH13-108-SS006_SOa	SSSA P 455-456	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-SS006_SOa	SW6010B	8/22/2013	8/23/2013	9/3/2013	9/5/2013
		CH13-108-SS006_SOa	SW6020A	8/22/2013	8/23/2013	9/9/2013	9/9/2013
	L1352419	CH13-108-BH001_SOb	CSSC 3.11	8/22/2013	8/23/2013	9/3/2013	9/3/2013
		CH13-108-BH001_SOb	CSSS 11.3/11.4	8/22/2013	8/23/2013	9/4/2013	9/4/2013
		CH13-108-BH001_SOb	CSSS 14.2	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH001_SOb	CSSS 18.2.2/SM4500C	8/22/2013	8/23/2013	9/4/2013	9/4/2013
		CH13-108-BH001_SOb	CSSS 18.3.1	8/22/2013	8/23/2013	9/3/2013	9/4/2013
		CH13-108-BH001_SOb	CSSS 18.3.1	8/22/2013	8/23/2013	9/9/2013	9/9/2013
		CH13-108-BH001_SOb	CSSS 19.4	8/22/2013	8/23/2013	9/4/2013	9/4/2013
		CH13-108-BH001_SOb	CSSS 3.321	8/22/2013	8/23/2013	9/3/2013	9/3/2013
		CH13-108-BH001_SOb	CSSS 4.2	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH001_SOb	CSSS 4.2/4.3	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH001_SOb	NCR P 36/SM3120B	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH001_SOb	SM3120B	8/22/2013	8/23/2013	9/4/2013	9/4/2013
		CH13-108-BH001_SOb	SSSA P 455-456	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH001_SOb	SSSA P 894-895	8/22/2013	8/23/2013	9/4/2013	9/4/2013
		CH13-108-BH001_SOb	SSSA P 973-974	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH001_SOb	SW6010B	8/22/2013	8/23/2013	9/3/2013	9/4/2013
		CH13-108-BH001_SOb	USDA-HB60 P 101_CA	8/22/2013	8/23/2013		9/4/2013
		CH13-108-BH002_SOb	CSSC 3.11	8/22/2013	8/23/2013	9/3/2013	9/3/2013
		CH13-108-BH002_SOb	CSSS 11.3/11.4	8/22/2013	8/23/2013	9/4/2013	9/4/2013
		CH13-108-BH002_SOb	CSSS 14.2	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH002_SOb	CSSS 18.2.2/SM4500C	8/22/2013	8/23/2013	9/4/2013	9/4/2013
		CH13-108-BH002_SOb	CSSS 18.3.1	8/22/2013	8/23/2013	9/3/2013	9/4/2013
		CH13-108-BH002_SOb	CSSS 18.3.1	8/22/2013	8/23/2013	9/9/2013	9/9/2013

TABLE 2

Sample Chronology - Data Summary

Laboratory	SDG	Sample ID	Method	Sample Date	Receive Date	Extract Date	Analysis Date
ALS	L1352419	CH13-108-BH002_SOb	CSSS 19.4	8/22/2013	8/23/2013	9/4/2013	9/4/2013
		CH13-108-BH002_SOb	CSSS 3.321	8/22/2013	8/23/2013	9/3/2013	9/3/2013
		CH13-108-BH002_SOb	CSSS 4.2	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH002_SOb	CSSS 4.2/4.3	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH002_SOb	NCR P 36/SM3120B	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH002_SOb	SM3120B	8/22/2013	8/23/2013	9/4/2013	9/4/2013
		CH13-108-BH002_SOb	SSSA P 455-456	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH002_SOb	SSSA P 894-895	8/22/2013	8/23/2013	9/4/2013	9/4/2013
		CH13-108-BH002_SOb	SSSA P 973-974	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-BH002_SOb	SW6010B	8/22/2013	8/23/2013	9/3/2013	9/4/2013
		CH13-108-BH002_SOb	USDA-HB60 P 101_CA	8/22/2013	8/23/2013		9/4/2013
		CH13-108-SS006_SOa	CSSC 3.11	8/22/2013	8/23/2013	9/3/2013	9/3/2013
		CH13-108-SS006_SOa	CSSS 11.3/11.4	8/22/2013	8/23/2013	9/4/2013	9/4/2013
		CH13-108-SS006_SOa	CSSS 14.2	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-SS006_SOa	CSSS 18.2.2/SM4500C	8/22/2013	8/23/2013	9/4/2013	9/4/2013
		CH13-108-SS006_SOa	CSSS 18.3.1	8/22/2013	8/23/2013	9/3/2013	9/4/2013
		CH13-108-SS006_SOa	CSSS 18.3.1	8/22/2013	8/23/2013	9/9/2013	9/9/2013
		CH13-108-SS006_SOa	CSSS 19.4	8/22/2013	8/23/2013	9/4/2013	9/4/2013
		CH13-108-SS006_SOa	CSSS 3.321	8/22/2013	8/23/2013	9/3/2013	9/3/2013
		CH13-108-SS006_SOa	NCR P 36/SM3120B	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-SS006_SOa	SM3120B	8/22/2013	8/23/2013	9/4/2013	9/4/2013
		CH13-108-SS006_SOa	SSSA P 455-456	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-SS006_SOa	SSSA P 894-895	8/22/2013	8/23/2013	9/4/2013	9/4/2013
		CH13-108-SS006_SOa	SSSA P 973-974	8/22/2013	8/23/2013	8/30/2013	8/30/2013
		CH13-108-SS006_SOa	USDA-HB60 P 101_CA	8/22/2013	8/23/2013		9/4/2013
	L1353127	E_108_13_001	E245.7	8/24/2013	8/26/2013		9/4/2013
		E_108_13_001	E245.7	8/24/2013	8/26/2013	8/28/2013	8/29/2013
		E_108_13_001	SM2340B_CALC	8/24/2013	8/26/2013		9/10/2013
		E_108_13_001	SM4110B	8/24/2013	8/26/2013		8/28/2013
		E_108_13_001	SSSA P 455-456	8/24/2013	8/26/2013		8/28/2013
		E_108_13_001	SW6010B	8/24/2013	8/26/2013		9/5/2013
		E_108_13_001	SW6010B	8/24/2013	8/26/2013		9/6/2013
		E_108_13_001	SW6010B	8/24/2013	8/26/2013		9/9/2013
		E_108_13_001	SW6010B	8/24/2013	8/26/2013	8/28/2013	9/6/2013
		E_108_13_001	SW6010B	8/24/2013	8/26/2013	8/28/2013	9/9/2013

TABLE 2

Sample Chronology - Data Summary

Laboratory	SDG	Sample ID	Method	Sample Date	Receive Date	Extract Date	Analysis Date
ALS	L1353127	E_108_13_001	SW6010B_DI	8/24/2013	8/26/2013	8/28/2013	9/6/2013
		E_108_13_001	SW6020A_DI	8/24/2013	8/26/2013	8/28/2013	9/6/2013
		E_108_13_001	SW6020A_DI	8/24/2013	8/26/2013	8/28/2013	9/9/2013
		E_108_13_001MS	E245.7	8/24/2013			9/4/2013
		E_108_13_001MS	SM4110B	8/24/2013			8/29/2013
	L1356001	CH13-108-BH003_SOb	ASTM 2216	8/28/2013	8/30/2013		9/10/2013
		CH13-108-BH003_SOb	CSSS 21.2	8/28/2013	8/30/2013	9/7/2013	9/7/2013
		CH13-108-BH003_SOb	CSSS/APHA 4500H	8/28/2013	8/30/2013		9/11/2013
		CH13-108-BH003_SOb	CSSS/APHA 4500H	8/28/2013	8/30/2013		9/12/2013
		CH13-108-BH003_SOb	E245.7	8/28/2013	8/30/2013	9/10/2013	9/12/2013
		CH13-108-BH003_SOb	EPA600/2-78-054	8/28/2013	8/30/2013	9/14/2013	9/14/2013
		CH13-108-BH003_SOb	ISO 15178:2000	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH003_SOb	MOD-SOBEK-3.2.3	8/28/2013	8/30/2013		9/27/2013
		CH13-108-BH003_SOb	SSSA P 455-456	8/28/2013	8/30/2013		9/6/2013
		CH13-108-BH003_SOb	SSSA P 455-456	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH003_SOb	SW6010B	8/28/2013	8/30/2013	9/10/2013	9/11/2013
		CH13-108-BH003_SOb	SW6020A	8/28/2013	8/30/2013	9/14/2013	9/14/2013
		CH13-108-BH004_SOb	ASTM 2216	8/28/2013	8/30/2013		9/10/2013
		CH13-108-BH004_SOb	CSSS 21.2	8/28/2013	8/30/2013	9/7/2013	9/7/2013
		CH13-108-BH004_SOb	CSSS/APHA 4500H	8/28/2013	8/30/2013		9/11/2013
		CH13-108-BH004_SOb	CSSS/APHA 4500H	8/28/2013	8/30/2013		9/12/2013
		CH13-108-BH004_SOb	E245.7	8/28/2013	8/30/2013	9/10/2013	9/12/2013
		CH13-108-BH004_SOb	EPA600/2-78-054	8/28/2013	8/30/2013	9/14/2013	9/14/2013
		CH13-108-BH004_SOb	ISO 15178:2000	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH004_SOb	MOD-SOBEK-3.2.3	8/28/2013	8/30/2013		9/27/2013
		CH13-108-BH004_SOb	SSSA P 455-456	8/28/2013	8/30/2013		9/6/2013
		CH13-108-BH004_SOb	SSSA P 455-456	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH004_SOb	SW6010B	8/28/2013	8/30/2013	9/10/2013	9/11/2013
		CH13-108-BH004_SOb	SW6020A	8/28/2013	8/30/2013	9/14/2013	9/14/2013
		CH13-108-BH903_SOb	ASTM 2216	8/28/2013	8/30/2013		9/10/2013
		CH13-108-BH903_SOb	CSSS 21.2	8/28/2013	8/30/2013	9/7/2013	9/7/2013
		CH13-108-BH903_SOb	CSSS/APHA 4500H	8/28/2013	8/30/2013		9/11/2013
		CH13-108-BH903_SOb	CSSS/APHA 4500H	8/28/2013	8/30/2013		9/12/2013
		CH13-108-BH903_SOb	E245.7	8/28/2013	8/30/2013	9/10/2013	9/12/2013
		CH13-108-BH903_SOb	EPA600/2-78-054	8/28/2013	8/30/2013	9/14/2013	9/14/2013

TABLE 2

Sample Chronology - Data Summary

Laboratory	SDG	Sample ID	Method	Sample Date	Receive Date	Extract Date	Analysis Date
ALS	L1356001	CH13-108-BH903_SOb	ISO 15178:2000	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH903_SOb	MOD-SOBEK-3.2.3	8/28/2013	8/30/2013		9/27/2013
		CH13-108-BH903_SOb	SSSA P 455-456	8/28/2013	8/30/2013		9/6/2013
		CH13-108-BH903_SOb	SSSA P 455-456	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH903_SOb	SW6010B	8/28/2013	8/30/2013	9/10/2013	9/11/2013
		CH13-108-BH903_SOb	SW6020A	8/28/2013	8/30/2013	9/14/2013	9/14/2013
		CH13-108-BH904_SOb	ASTM 2216	8/28/2013	8/30/2013		9/10/2013
		CH13-108-BH904_SOb	CSSS 21.2	8/28/2013	8/30/2013	9/7/2013	9/7/2013
		CH13-108-BH904_SOb	CSSS/APHA 4500H	8/28/2013	8/30/2013		9/11/2013
		CH13-108-BH904_SOb	CSSS/APHA 4500H	8/28/2013	8/30/2013		9/12/2013
		CH13-108-BH904_SOb	E245.7	8/28/2013	8/30/2013	9/10/2013	9/12/2013
		CH13-108-BH904_SOb	EPA600/2-78-054	8/28/2013	8/30/2013	9/14/2013	9/14/2013
		CH13-108-BH904_SOb	ISO 15178:2000	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH904_SOb	MOD-SOBEK-3.2.3	8/28/2013	8/30/2013		9/27/2013
		CH13-108-BH904_SOb	SSSA P 455-456	8/28/2013	8/30/2013		9/6/2013
		CH13-108-BH904_SOb	SSSA P 455-456	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH904_SOb	SW6010B	8/28/2013	8/30/2013	9/10/2013	9/11/2013
		CH13-108-BH904_SOb	SW6020A	8/28/2013	8/30/2013	9/14/2013	9/14/2013
	L1356018	CH13-108-BH003_SOb	CSSC 3.11	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH003_SOb	CSSS 11.3/11.4	8/28/2013	8/30/2013	9/9/2013	9/9/2013
		CH13-108-BH003_SOb	CSSS 14.2	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH003_SOb	CSSS 18.2.2/SM4500C	8/28/2013	8/30/2013	9/10/2013	9/10/2013
		CH13-108-BH003_SOb	CSSS 18.3.1	8/28/2013	8/30/2013	9/9/2013	9/9/2013
		CH13-108-BH003_SOb	CSSS 18.3.1	8/28/2013	8/30/2013	9/9/2013	9/10/2013
		CH13-108-BH003_SOb	CSSS 19.4	8/28/2013	8/30/2013	9/9/2013	9/9/2013
		CH13-108-BH003_SOb	CSSS 3.321	8/28/2013	8/30/2013	9/9/2013	9/9/2013
		CH13-108-BH003_SOb	CSSS 7.2/7.31	8/28/2013	8/30/2013	9/10/2013	9/10/2013
		CH13-108-BH003_SOb	NCR P 36/SM3120B	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH003_SOb	SM3120B	8/28/2013	8/30/2013	9/10/2013	9/10/2013
		CH13-108-BH003_SOb	SSSA P 455-456	8/28/2013	8/30/2013	9/10/2013	9/10/2013
		CH13-108-BH003_SOb	SSSA P 973-974	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH003_SOb	USDA-HB60 P 101_CA	8/28/2013	8/30/2013		9/9/2013
		CH13-108-BH004_SOb	CSSC 3.11	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH004_SOb	CSSS 11.3/11.4	8/28/2013	8/30/2013	9/9/2013	9/9/2013
		CH13-108-BH004_SOb	CSSS 14.2	8/28/2013	8/30/2013	9/6/2013	9/6/2013

TABLE 2

Sample Chronology - Data Summary

Laboratory	SDG	Sample ID	Method	Sample Date	Receive Date	Extract Date	Analysis Date
ALS	L1356018	CH13-108-BH004_SOb	CSSS 18.2.2/SM4500C	8/28/2013	8/30/2013	9/10/2013	9/10/2013
		CH13-108-BH004_SOb	CSSS 18.3.1	8/28/2013	8/30/2013	9/9/2013	9/9/2013
		CH13-108-BH004_SOb	CSSS 18.3.1	8/28/2013	8/30/2013	9/9/2013	9/10/2013
		CH13-108-BH004_SOb	CSSS 19.4	8/28/2013	8/30/2013	9/9/2013	9/9/2013
		CH13-108-BH004_SOb	CSSS 3.321	8/28/2013	8/30/2013	9/9/2013	9/9/2013
		CH13-108-BH004_SOb	NCR P 36/SM3120B	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH004_SOb	SM3120B	8/28/2013	8/30/2013	9/10/2013	9/10/2013
		CH13-108-BH004_SOb	SSSA P 455-456	8/28/2013	8/30/2013	9/10/2013	9/10/2013
		CH13-108-BH004_SOb	SSSA P 894-895	8/28/2013	8/30/2013	9/10/2013	9/10/2013
		CH13-108-BH004_SOb	SSSA P 973-974	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH004_SOb	USDA-HB60 P 101_CA	8/28/2013	8/30/2013		9/9/2013
		CH13-108-BH903_SOb	CSSC 3.11	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH903_SOb	CSSS 11.3/11.4	8/28/2013	8/30/2013	9/9/2013	9/9/2013
		CH13-108-BH903_SOb	CSSS 14.2	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH903_SOb	CSSS 18.2.2/SM4500C	8/28/2013	8/30/2013	9/10/2013	9/10/2013
		CH13-108-BH903_SOb	CSSS 18.3.1	8/28/2013	8/30/2013	9/9/2013	9/9/2013
		CH13-108-BH903_SOb	CSSS 18.3.1	8/28/2013	8/30/2013	9/9/2013	9/10/2013
		CH13-108-BH903_SOb	CSSS 19.4	8/28/2013	8/30/2013	9/9/2013	9/9/2013
		CH13-108-BH903_SOb	CSSS 3.321	8/28/2013	8/30/2013	9/9/2013	9/9/2013
		CH13-108-BH903_SOb	CSSS 7.2/7.31	8/28/2013	8/30/2013	9/10/2013	9/10/2013
		CH13-108-BH903_SOb	NCR P 36/SM3120B	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH903_SOb	SM3120B	8/28/2013	8/30/2013	9/10/2013	9/10/2013
		CH13-108-BH903_SOb	SSSA P 455-456	8/28/2013	8/30/2013	9/10/2013	9/10/2013
		CH13-108-BH903_SOb	SSSA P 973-974	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH903_SOb	USDA-HB60 P 101_CA	8/28/2013	8/30/2013		9/9/2013
		CH13-108-BH904_SOb	CSSC 3.11	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH904_SOb	CSSS 11.3/11.4	8/28/2013	8/30/2013	9/9/2013	9/9/2013
		CH13-108-BH904_SOb	CSSS 14.2	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH904_SOb	CSSS 18.2.2/SM4500C	8/28/2013	8/30/2013	9/10/2013	9/10/2013
		CH13-108-BH904_SOb	CSSS 18.3.1	8/28/2013	8/30/2013	9/9/2013	9/9/2013
		CH13-108-BH904_SOb	CSSS 18.3.1	8/28/2013	8/30/2013	9/9/2013	9/10/2013
		CH13-108-BH904_SOb	CSSS 19.4	8/28/2013	8/30/2013	9/9/2013	9/9/2013
		CH13-108-BH904_SOb	CSSS 3.321	8/28/2013	8/30/2013	9/9/2013	9/9/2013
		CH13-108-BH904_SOb	CSSS 7.2/7.31	8/28/2013	8/30/2013	9/10/2013	9/10/2013
		CH13-108-BH904_SOb	NCR P 36/SM3120B	8/28/2013	8/30/2013	9/6/2013	9/6/2013

TABLE 2

Sample Chronology - Data Summary

Laboratory	SDG	Sample ID	Method	Sample Date	Receive Date	Extract Date	Analysis Date
ALS	L1356018	CH13-108-BH904_SOb	SM3120B	8/28/2013	8/30/2013	9/10/2013	9/10/2013
		CH13-108-BH904_SOb	SSSA P 455-456	8/28/2013	8/30/2013	9/10/2013	9/10/2013
		CH13-108-BH904_SOb	SSSA P 973-974	8/28/2013	8/30/2013	9/6/2013	9/6/2013
		CH13-108-BH904_SOb	USDA-HB60 P 101_CA	8/28/2013	8/30/2013		9/9/2013
	L1377915	CH13-108-BH001_SOb	SSSA (1996) P 610-61	8/22/2013		10/22/2013	10/22/2013
		CH13-108-BH002_SOb	SSSA (1996) P 610-61	8/22/2013		10/22/2013	10/22/2013
		CH13-108-BH003_SOb	SSSA (1996) P 610-61	8/28/2013	8/30/2013	10/22/2013	10/22/2013
		CH13-108-BH004_SOb	SSSA (1996) P 610-61	8/28/2013	8/30/2013	10/22/2013	10/22/2013
		CH13-108-BH903_SOb	SSSA (1996) P 610-61	8/28/2013	8/30/2013	10/22/2013	10/22/2013
		CH13-108-BH904_SOb	SSSA (1996) P 610-61	8/28/2013	8/30/2013	10/22/2013	10/22/2013
		CH13-108-SS006_SOa	SSSA (1996) P 610-61	8/22/2013		10/22/2013	10/22/2013
		CH13-108-TP031_SOA	SSSA (1996) P 610-61	7/18/2013	7/22/2013	10/22/2013	10/22/2013
		CH13-108-TP032_SOa	SSSA (1996) P 610-61	7/22/2013	7/25/2013	10/19/2013	10/19/2013
		CH13-108-TP033_SOa	SSSA (1996) P 610-61	7/25/2013	7/29/2013	10/22/2013	10/22/2013
		CH13-108-TP034_SOa	SSSA (1996) P 610-61	7/25/2013	7/29/2013	10/22/2013	10/22/2013
		CH13-108-TP934_SOa	SSSA (1996) P 610-61	7/25/2013	7/29/2013	10/22/2013	10/22/2013

TABLE 3

Overall Flagging Summary

Method	Matrix	Validation Reason	Qualifier*	Qualifier Type	Number of Affected Analytes
ASTM 2216	SOIL				
Category = HoldingTime		Holding time exceeded			
			J	Protocol	10
CSSS 18.2.2/SM4500CL	SOIL				
Category = FieldDuplicate		Field duplicate exceeds RPD criteria			
			J	Other	2
CSSS 21.2	SOIL				
Category = HoldingTime		Holding time exceeded			
			UJ	Protocol	9
			J	Protocol	1
CSSS 3.321	SOIL				
Category = Calibration		The reported result is an estimated value			
			J	Other	1
CSSS 4.2	SOIL				
Category = Miscellaneous		Invalid Final Flag replaced with Concqual			
			=	Other	1
CSSS 4.2/4.3	SOIL				
Category = Miscellaneous		Invalid Final Flag replaced with Concqual			
			U	Other	1
SM3120B	SOIL				
Category = Calibration		The reported result is an estimated value			
			J	Other	1
Category = Miscellaneous		Invalid Final Flag replaced with Concqual			
			U	Other	3
SSSA P 455-456	SOIL				
Category = FieldDuplicate		Field duplicate exceeds RPD criteria			

TABLE 3

Overall Flagging Summary

Method	Matrix	Validation Reason	Qualifier*	Qualifier Type	Number of Affected Analytes
			J	Other	2
SW6010B	SOIL				
Category = Matrix		Lab duplicate RPD criteria exceeded			
			J	Other	4

* The most severe flag for each analyte becomes the final validation flag.

Qualifier Description:

= = Analyte was detected at a concentration greater than the RL.

J = Analyte was present but the reported value may not be accurate or precise.

U = This analyte was analyzed for but not detected at the specified detection limit.

UJ = The analyte was not detected above the detection limit objective. However, the reported detection limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Qualifier Type:

Protocol = Flagging due to contractor/laboratory protocol violations.
Other = Flagging due to sample, matrix, or field issues not related to Quality Assurance Project Plan (QAPP) or Sampling and Analysis Plan (SAP) protocol.

TABLE 4

Holding Times - Qualified Data

Method	Matrix	Sample ID	Analyte	Holding Time	Result	Holding Time Qualifier	Final Flag*
ASTM 2216	SOIL	CH13-108-SS001_SOa					
			Moisture	15 Days	2.39 percent	J	J
ASTM 2216	SOIL	CH13-108-SS002_SOa					
			Moisture	15 Days	8.04 percent	J	J
ASTM 2216	SOIL	CH13-108-SS004_SOa					
			Moisture	15 Days	2.15 percent	J	J
ASTM 2216	SOIL	CH13-108-SS005_SOa					
			Moisture	15 Days	3.78 percent	J	J
ASTM 2216	SOIL	CH13-108-TP025_SOa					
			Moisture	15 Days	3.9 percent	J	J
ASTM 2216	SOIL	CH13-108-TP026_SOa					
			Moisture	15 Days	3.97 percent	J	J
ASTM 2216	SOIL	CH13-108-TP027_SOa					
			Moisture	16 Days	2.93 percent	J	J
ASTM 2216	SOIL	CH13-108-TP027A_SOa					
			Moisture	19 Days	3.02 percent	J	J
ASTM 2216	SOIL	CH13-108-TP031_SOA					
			Moisture	15 Days	11.6 percent	J	J
ASTM 2216	SOIL	CH13-108-TP032_SOa					
			Moisture	19 Days	12.6 percent	J	J
CSSS 21.2	SOIL	CH13-108-SS001_SOa					
			Organic Matter	30 Days	0.7 percent	UJ	UJ
			Total Organic Carbon	30 Days	0.4 percent	UJ	UJ
CSSS 21.2	SOIL	CH13-108-SS002_SOa					
			Organic Matter	30 Days	0.7 percent	UJ	UJ
			Total Organic Carbon	30 Days	0.4 percent	J	J

TABLE 4

Holding Times - Qualified Data

Method	Matrix	Sample ID	Analyte	Holding Time	Result	Holding Time Qualifier	Final Flag*
CSSS 21.2	SOIL	CH13-108-SS003_SOa					
			Organic Matter	30 Days	0.7 percent	UJ	UJ
			Total Organic Carbon	30 Days	0.4 percent	UJ	UJ
CSSS 21.2	SOIL	CH13-108-SS004_SOa					
			Organic Matter	30 Days	0.7 percent	UJ	UJ
			Total Organic Carbon	30 Days	0.4 percent	UJ	UJ
CSSS 21.2	SOIL	CH13-108-SS005_SOa					
			Organic Matter	30 Days	0.7 percent	UJ	UJ
			Total Organic Carbon	30 Days	0.4 percent	UJ	UJ

* The most severe flag for each analyte becomes the final validation flag.

Qualifier Description:

J = Analyte was present but the reported value may not be accurate or precise.

UJ = The analyte was not detected above the detection limit objective. However, the reported detection limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Criteria:

HTa>UCL **=** Holding time exceeded

TABLE 5

Field Duplicate Precision - Qualified Data

Method	Matrix	Sample ID	Analyte	Result	Field Duplicate Qualifier*	Criteria
CSSS 18.2.2/SM4500CL	SOIL		**Chloride_SP**			
		CH13-108-BH004_SOb		4.8 mg/l	J	FD>RPD
		CH13-108-BH904_SOb		11.6 mg/l	J	FD>RPD
SSSA P 455-456	SOIL		**Total Organic Carbon**			
		CH13-108-BH004_SOb		0.28 percent	J	FD>RPD
		CH13-108-BH904_SOb		0.51 percent	J	FD>RPD

* The most severe flag for each analyte becomes the final validation flag.

Qualifier Description:

J = Analyte was present but the reported value may not be accurate or precise.

Criteria:

FD>RPD = Field duplicate exceeds RPD criteria

TABLE 6

Calibration Criteria - Qualified Data

Method	Matrix	Analyte	Sample ID	Result	Calibration Qualifier*	Criteria
CSSS 3.321	SOIL	**CATION EXCHANGE CAPACITY**				
			CH13-108-SS006_SOa	6.31 meq/100g	J	EstimatedValue
SM3120B	SOIL	**Sodium Adsorption Ratio**				
			CH13-108-SS006_SOa	0.57 SAR	J	EstimatedValue

* The most severe flag for each analyte becomes the final validation flag.

Qualifier Description:

J = Analyte was present but the reported value may not be accurate or precise.

Criteria:

EstimatedVa **=** The reported result is an estimated value

TABLE 7

Matrix Spike Precision/Accuracy - Qualified Data

Method	Matrix	Sample ID	Analyte	Result	MS/MSD Qualifier*	MS Recovery	Criteria
SW6010B	SOIL		**Bismuth**				
		CH13-108-TP033_SOa		0.28 mg/kg	J	%RPD = 0.55 vs 0.4	LabDupRPD
		CH13-108-TP034_SOa		0.43 mg/kg	J	%RPD = 0.55 vs 0.4	LabDupRPD
		CH13-108-TP934_SOa		0.37 mg/kg	J	%RPD = 0.55 vs 0.4	LabDupRPD
SW6010B	SOIL		**Phosphorus**				
		CH13-108-TP027_SOa		460 mg/kg	J	%RPD = 53.5 vs 30	LabDupRPD

* The most severe flag for each analyte becomes the final validation flag.

Qualifier Description:

J = Analyte was present but the reported value may not be accurate or precise.

Criteria:

LabDupRPD = Lab duplicate RPD criteria exceeded

TABLE 8

Site Completeness by Analyte - Qualified Data

			Number of Occurrences									
Method	**Analyte**	**Units**	**Analyses**	**Detects**	**Non-detects**	**Blank Flags**	**J Flags**	**M Flags**	**Contractor R Flags**	**Total R Flags**	**Contractor Percent Completeness**	**Overall Percent Completeness**
ASTM 2216	Moisture	PERCENT	31	31			10				100	100
ASTM D4318	MOISTURE AT LIQUID LIMIT	PERCENT	6	6							100	100
ASTM D4318	PLASTICITY INDEX	PERCENT	6	6							100	100
ASTMD1498_DI	ORP Leachable, DI	MV	3	3							100	100
CarterSatPercent	% saturation	PERCENT	6	6							100	100
CSSC 3.11	PH (1:2 CACL2)	PH UNITS	12	12							100	100
CSSS 11.3/11.4	Copper, MN	MG/KG	12	12							100	100
CSSS 11.3/11.4	Iron, MN	MG/KG	12	12							100	100
CSSS 11.3/11.4	Manganese, MN	MG/KG	12	12							100	100
CSSS 11.3/11.4	Zinc, MN	MG/KG	12	12							100	100
CSSS 14.2	SMP Buffer pH	PH UNITS	12	12							100	100
CSSS 18.2.2/SM4500CL	Chloride_SP	MG/L	12	11	1		2				100	100
CSSS 18.3.1	Conductivity_SP	DS/M	5	5							100	100
CSSS 18.3.1	% saturation_SP	PERCENT	12	12							100	100
CSSS 18.3.1	pH, SP	PH UNITS	12	12							100	100
CSSS 18.3.1	Conductivity (1:2)	US/CM	7		7						100	100
CSSS 18.3.1	Conductivity_SP	US/CM	7	6	1						100	100
CSSS 19.4	Calcium, NH4OAc	MEQ/100G	12	12							100	100
CSSS 19.4	Magnesium, NH4OAc	MEQ/100G	12	11	1						100	100

TABLE 8

Site Completeness by Analyte - Qualified Data

			Number of Occurrences									
Method	Analyte	Units	Analyses	Detects	Non-detects	Blank Flags	J Flags	M Flags	Contractor R Flags	Total R Flags	Contractor Percent Completeness	Overall Percent Completeness
CSSS 19.4	Potassium, NH4OAc	MEQ/100G	12		12						100	100
CSSS 19.4	Sodium, NH4OAc	MEQ/100G	12		12						100	100
CSSS 21.2	Organic Matter	PERCENT	31	8	23		5				100	100
CSSS 21.2	Total Organic Carbon	PERCENT	31	13	18		5				100	100
CSSS 3.321	CATION EXCHANGE CAPACITY	MEQ/100G	12	12			1				100	100
CSSS 4.2	AVAILABLE AMMONIUM	MG/KG	3	3							100	100
CSSS 4.2/4.3	AVAILABLE NITRATE	MG/KG	3		3						100	100
CSSS 7.2/7.31	AVAILABLE PHOSPHATE	MG/KG	8	7	1						100	100
CSSS/APHA 2510B_DI	Specific Conductance, DI	US/CM	3	3							100	100
CSSS/APHA 4500H	Paste pH	PH UNITS	31	31							100	100
CSSS/APHA 4500H	pH (1:2 soil:water)	PH UNITS	31	31							100	100
CSSS/APHA 4500H_DI	Paste pH, DI	PH UNITS	3	3							100	100
E245.7	Mercury	MG/KG	31	31							100	100
E245.7_DI	Mercury, DI	MG/L	3		3						100	100
EPA600/2-78-054	Sulfate, Acid Soluble	PERCENT	14	9	5						100	100
ISO 15178:2000	Sulfur	MG/KG	31	5	26						100	100
MOD-SOBEK-3.2.3	Neutralization Potential (as CaCO3 Eq.)	T CACO3/1	31	31							100	100
NCR P 36/SM3120B	AVAILABLE SULFATE	MG/KG	12	8	4						100	100
SM2310_DI	Acidity, DI	MG/L	3	2	1						100	100

TABLE 8

Site Completeness by Analyte - Qualified Data

			Number of Occurrences									
Method	Analyte	Units	Analyses	Detects	Non-detects	Blank Flags	J Flags	M Flags	Contractor R Flags	Total R Flags	Contractor Percent Completeness	Overall Percent Completeness
SM2320B_DI	Alkalinity, Total, DI	MG/L	3	3							100	100
SM3120B	Calcium, Sat	MG/L	12	12							100	100
SM3120B	Magnesium, Sat	MG/L	12	11	1						100	100
SM3120B	Potassium, Sat	MG/L	12	12							100	100
SM3120B	Sodium, Sat	MG/L	12	9	3						100	100
SM3120B	SULFUR (AS SO4)_Saturated	MG/L	12	12							100	100
SM3120B	Sodium Adsorption Ratio	SAR	12	9	3		1				100	100
SM4110B_DI	Sulfate, DI	MG/L	3	3							100	100
SSSA (1996) P 610-611	Available Boron	MG/KG	12	3	9						100	100
SSSA P 455-456	Inorganic Carbon (as CACO3 Equivalent)	PERCENT	31	21	10						100	100
SSSA P 455-456	Total Inorganic Carbon	PERCENT	31	16	15						100	100
SSSA P 455-456	Total Organic Carbon	PERCENT	12	12			2				100	100
SSSA P 894-895	AVAILABLE PHOSPHATE	MG/KG	4	1	3						100	100
SSSA P 973-974	TOTAL CARBON BY LECO	PERCENT	12	12							100	100
SSSA P 973-974	TOTAL NITROGEN BY LECO	PERCENT	3	3							100	100
SW6010B	Aluminum	MG/KG	31	31							100	100
SW6010B	Antimony	MG/KG	31	31							100	100
SW6010B	Arsenic	MG/KG	31	31							100	100
SW6010B	Barium	MG/KG	31	31							100	100

TABLE 8

Site Completeness by Analyte - Qualified Data

			Number of Occurrences									
Method	Analyte	Units	Analyses	Detects	Non-detects	Blank Flags	J Flags	M Flags	Contractor R Flags	Total R Flags	Contractor Percent Completeness	Overall Percent Completeness
SW6010B	Beryllium	MG/KG	31	31							100	100
SW6010B	Bismuth	MG/KG	31	27	4		3				100	100
SW6010B	Boron	MG/KG	31		31						100	100
SW6010B	Cadmium	MG/KG	31	31							100	100
SW6010B	Calcium	MG/KG	31	31							100	100
SW6010B	Chromium	MG/KG	31	31							100	100
SW6010B	Cobalt	MG/KG	31	31							100	100
SW6010B	Copper	MG/KG	31	31							100	100
SW6010B	Iron	MG/KG	31	31							100	100
SW6010B	Lead	MG/KG	31	31							100	100
SW6010B	Lithium	MG/KG	31	31							100	100
SW6010B	Magnesium	MG/KG	31	31							100	100
SW6010B	Manganese	MG/KG	31	31							100	100
SW6010B	Molybdenum	MG/KG	31	25	6						100	100
SW6010B	Nickel	MG/KG	31	31							100	100
SW6010B	Phosphorus	MG/KG	31	31			1				100	100
SW6010B	Potassium	MG/KG	31	31							100	100
SW6010B	Selenium	MG/KG	31	11	20						100	100
SW6010B	Silver	MG/KG	31	21	10						100	100

TABLE 8

Site Completeness by Analyte - Qualified Data

			Number of Occurrences									
Method	Analyte	Units	Analyses	Detects	Non-detects	Blank Flags	J Flags	M Flags	Contractor R Flags	Total R Flags	Contractor Percent Completeness	Overall Percent Completeness
SW6010B	Sodium	MG/KG	31	31							100	100
SW6010B	Strontium	MG/KG	31	31							100	100
SW6010B	Thallium	MG/KG	31	31							100	100
SW6010B	Tin	MG/KG	31		31						100	100
SW6010B	Titanium	MG/KG	31	31							100	100
SW6010B	Uranium	MG/KG	31	31							100	100
SW6010B	Vanadium	MG/KG	31	31							100	100
SW6010B	Zinc	MG/KG	31	31							100	100
SW6010B_DI	Calcium, DI	MG/L	3	3							100	100
SW6010B_DI	Iron, DI	MG/L	3	3							100	100
SW6010B_DI	Magnesium, DI	MG/L	3	3							100	100
SW6010B_DI	Potassium, DI	MG/L	3	3							100	100
SW6010B_DI	Silicon, DI	MG/L	3	3							100	100
SW6010B_DI	Sodium, DI	MG/L	3	1	2						100	100
SW6010B_DI	Sulfur, DI	MG/L	3	3							100	100
SW6010B_DI	Titanium, DI	MG/L	3	2	1						100	100
SW6020A	Barium, LMB	PPM	14	14							100	100
SW6020A_DI	Aluminum, DI	MG/L	3	3							100	100
SW6020A_DI	Antimony, DI	MG/L	3	3							100	100

TABLE 8

Site Completeness by Analyte - Qualified Data

			Number of Occurrences									
Method	Analyte	Units	Analyses	Detects	Non-detects	Blank Flags	J Flags	M Flags	Contractor R Flags	Total R Flags	Contractor Percent Completeness	Overall Percent Completeness
SW6020A_DI	Arsenic, DI	MG/L	3	3							100	100
SW6020A_DI	Barium, DI	MG/L	3	3							100	100
SW6020A_DI	Beryllium, DI	MG/L	3		3						100	100
SW6020A_DI	Boron, DI	MG/L	3	1	2						100	100
SW6020A_DI	Cadmium, DI	MG/L	3	2	1						100	100
SW6020A_DI	Chromium, DI	MG/L	3	2	1						100	100
SW6020A_DI	Cobalt, DI	MG/L	3	2	1						100	100
SW6020A_DI	Copper, DI	MG/L	3	2	1						100	100
SW6020A_DI	Lead, DI	MG/L	3	3							100	100
SW6020A_DI	Lithium, DI	MG/L	3	1	2						100	100
SW6020A_DI	Manganese, DI	MG/L	3	3							100	100
SW6020A_DI	Molybdenum, DI	MG/L	3	3							100	100
SW6020A_DI	Nickel, DI	MG/L	3	2	1						100	100
SW6020A_DI	Selenium, DI	MG/L	3		3						100	100
SW6020A_DI	Silver, DI	MG/L	3	2	1						100	100
SW6020A_DI	Strontium, DI	MG/L	3	3							100	100
SW6020A_DI	Thallium, DI	MG/L	3		3						100	100
SW6020A_DI	Uranium, DI	MG/L	3	3							100	100
SW6020A_DI	Vanadium, DI	MG/L	3	3							100	100

TABLE 8

Site Completeness by Analyte - Qualified Data

Method	Analyte	Units	Number of Occurrences						Contractor R Flags	Total R Flags	Contractor Percent Completeness	Overall Percent Completeness
			Analyses	Detects	Non-detects	Blank Flags	J Flags	M Flags				
SW6020A_DI	Zinc, DI	MG/L	3	2	1						100	100
USDA-HB60 P 101_CAL	EXCHANGEABLE SODIUM PERCENTAGE	PERCENT	12		12						100	100

Attachment 1
Holding Time Corrective Action Report

December 11, 2013

CH2M Hill
2525 Airpark Drive
Redding, CA
96001

Attention: Travis Gouveia

Dear Mr. Gouveia,

RE: ALS Corrective Action Report (CAR) #10939 – Missed Holding Times for CH2M Hill Faro Mine Project IDs 472645.06.AD.01.04.13, 472645.18.VG.DF, 472645.15.CS.DM.01, and 472645.13.WT.AD.01

Between July 15 and September 9, ALS Whitehorse received several submissions from CH2M Hill for the above mentioned projects. Analyses for these submissions were performed by the ALS labs in Whitehorse and Vancouver, and some unexpected holding time (HT) exceedances were experienced for HTs set at three to twenty -eight days.

The affected tests and samples span a number of submissions and the root causes have been summarized below:

Insufficient Time: ALS does request a minimum of 24 hours lead time to perform any tests where holding times are about to expire. The samples/test requests listed below were received at ALS with insufficient time to meet prescribed holding time requirements. ALS recommends submitting samples/test requests to the lab with additional lead time to ensure the laboratory can meet HT requirements.

Work Order	Samples	Client ID	Analyte	Matrix	ALS HT	Root Cause
L1359691	1-3	CH13-311-TP022_SOA CH13-311-TP023_SOA CH13-311-TP021_SOA	Moisture	Soil	14 Days	Insufficient Time to Perform Testing.
L1332147	2	CH13-311-SS024_SOA	N-Tot-LECO		28 Days	

Contingent Login: For the CH2M Hill projects listed above, the selection of the appropriate Acidity method is contingent upon the iron concentrations of the samples. Thus, Iron testing must be performed before the initiation of the acidity testing and can directly affect the acidity testing timeline. The samples listed below experienced delays for iron testing which resulted in the Acidity HT failure. For future submissions, holding time requirements can be satisfied if iron analysis is performed on a rush basis or if both acidity methods are concurrently tested with iron.

Work Order	Samples	Client ID	Analyte	Matrix	ALS HT	Root Cause
L1355914	5-8, 11, 13, 17, 19, 20	P05-01-01_GW0813 P05-01-02_GW0813 P05-01-04_GW0813 P05-01-06_GW0813 CH12-204-MW001A_GW0813 CH12-204-MW901A_GW0813 P05-02_GW0813 P905-02_GW0813 P03-08-04_GW0813	Acidity	Water	14	Contingent Login: Acidity could not be run until iron concentration was known.
L1356637	2-6, 9, 10	P03-03-03_GW0813 P03-03-06_GW0813 P03-05-02_GW0813 P03-05-03_GW0813 P903-05-02_GW0813 X21A-96_GW0813 X21B-96_GW0813				
L1356684	16-19, 23-28	P03-04-06_GW0813 P03-06-03_GW0813 P03-06-04_GW0813 P03-08-05_GW0813 P03-04-08_GW0813 P03-05-05_GW0813 P03-05-06_GW0813 P03-05-07_GW0813 P03-05-08_GW0813 P03-06-05_GW0813	Acidity - H2O2			

Lab Error: For the holding time failures listed in the table below, ALS errors pertaining to logistics and sample reception were the direct causes. These errors, and their consequences, have been reviewed with all affected staff. ALS endeavors to prevent all future occurrences though improved awareness and training.

Work Order	Samples	Client ID	Analyte	Matrix	ALS HT	Root Cause
L1349069	1	CH13-204-MW011A_GW0813	PO4	Water	3	Lab Error - shipping delays.
L1346114	1-4	CH13-311-BH017_RKA CH13-311-BH017_RKB CH13-311-BH017_RKC CH13-311-BH917_RKC	Moisture	Soil	14	Lab Error - Sample Reception: Test missed at the login stage.

No Failure: Six parameters, in two separate instances, were analyzed by ALS within their prescribed HTs but were reported with HT qualification. In both instances, the analysis date was not correctly compared to the sampling date in determination of the holding time exceedance. Revised reports with holding time qualifications removed are available upon request.

Work Order	Samples	Client ID	Analyte	Matrix	ALS HT	Root Cause
L1346114	11,12	CH13-311-BH017_RKA PH5 CH13-311-BH017_RKC PH3	SPLP Hg	Soil	28	No Failure - Reporting Error: Reports can be revised upon request.
L1338656	1-4	CH13-311-BH011_SOA CH13-311-BH011_SOB CH13-311-BH011_SOC CH13-311-BH011_SOD	Moisture		14	

Non-Routine Procedure: For the samples listed in the table below, ALS received soil core tubes which required special handling before moisture testing could be initiated. Samples required Direct Shear Testing through the Golder Associates Laboratory before our testing could be initiated. As a result, holding times could not be met.

Work Order	Samples	Client ID	Analyte	Matrix	ALS HT	Root Cause
L1345512	3,5	CH13-303-BH002_SOC CH13-303-BH002_SOE	Moisture -VA, SK	Soil	14	Non-Routine Procedure Required Prior to Testing

CH2M Hill Quality Assurance Project Plan (QAPP) - Faro Mine: The holding times listed in the Faro Mine QAPP, and agreed to by ALS, were not met for certain parameters. In response, ALS will monitor due dates where QAPP HT < ALS HT, and will ensure the applied sample due date is prior to the QAPP HT expiration dates.

Work Order	Analyte	Matrix	ALS HT	QAPP HT	Root Cause
L1332147	Exchangeable Sodium	Soil	365	28	QAPP HT < ALS Recommended Holding Time: ALS testing prioritization did not account for CH2M Hill QAPP holding times.
L1338738	Paste pH pH 1:2 soil water				
L1346114	Paste pH				
L1351297	pH 1:2 soil water				
L1352327	Paste pH				
L1359691	Paste pH				

Re-testing and Quality Assurance: During the assembly of a final report, quality checks are performed as part of the ALS Quality Assurance program, which can lead to questions about non-conforming data points. The standard response is to confirm validity of the original results through re-testing. It is not uncommon for the re-test to be requested after HTs have expired and may even require the re-tested data to be entered into the report. The table below lists four affected work orders where HT failures occurred as a result of re-testing.

Work Order	Samples	Client ID	Analyte	Matrix	ALS HT	Root Cause
L1356684	28	P03-06-05_GW0813	Alkalinity	Water	14	Retested for Quality Assurance: Retested result replaced the original data point.
L1350226	1	E_204_13_003	TIC			
L1356637	3,9	P03-03-06_GW0813 X21A-96_GW0813	Alkalinity			
L1357022	7	P03-02-05_GW0813	Alkalinity			

Temporary Re-allocation of Testing: The Whitehorse laboratory offers testing for some short holding time parameters. The scope of testing performed by this lab can be affected on short notice. For the samples listed below, the short HT parameters were missed due to the inability of the Whitehorse lab to perform testing at the time of sample receipt. ALS will improve its notification system for temporary Whitehorse testing interruptions, and will inform CH2M Hill when additional lead time will be required to satisfy alternate testing arrangements.

Work Order	Samples	Client ID	Analytes	Matrix	ALS HT	Root Cause
L1347053	1, 2	CH13-204-MW009A_GW0813 CH13-204-MW909A_GW0813	NO2 NO3 PO4	Water	3	Temporary Re-allocation of Testing: Vancouver lab used as an alternate provider during brief Whitehorse outage.

Workload Management Issue: ALS Vancouver relies on a core group of staff which is expanded seasonally to match resource requirements. During the period these samples were received at ALS, workloads for some departments at ALS Vancouver were approaching unexpected record highs at a time when the resources required to accommodate these workloads had not yet been fully mobilized.

As a result, the workload management tools used to prioritize the workloads were not performing as designed due to the backlogged test volumes. Thus, work lists were manually re-sorted during peak workloads to ensure correct prioritization was occurring.

The laboratory is taking other measures to address this gap including the reorganization of our Canadian database and workload management tools, and increased resource management planning.

The table below summarizes the affected samples and tests:

Work Order	Samples	Client ID	Analyte	Matrix	ALS HT	Root Cause
L1335790	8	CH13-204-MW007_SOG	Moisture	Soil	14	Workload Management Issue
L1335880	1, 4-6	CH13-108-TP027_SOA CH13-108-TP025_SOA CH13-108-TP026_SOA CH13-108-TP027A_SOA				
L1335953	1	CH13-108-TP031_SOA				
L1336037	3,4	CH13-311-BH010_SOC CH13-311-BH010_SOD				
L1336054	1-4	CH13-311-BH013_SOA CH13-311-BH013_SOB CH13-311-BH013_SOC CH13-311-BH913_SOB				
L1338657	1	CH13-108-TP032_SOA				
L1338766	1-6	CH13-311-BH015_SOA CH13-311-BH015_SOB CH13-311-BH015_SOC CH13-311-BH015_SOD CH13-311-BH015_SOE CH13-311-BH915_SOC				
L1339332	4	CH13-311-BH012_SOD				
L1348930	1-10	CH13-311-TP006_SOA CH13-311-TP906_SOA CH13-311-TP002_SOA CH13-311-TP003_SOA CH13-311-TP004_SOA CH13-311-TP005_SOA CH13-311-TP902_SOA CH13-311-TP903_SOA CH13-311-TP904_SOA CH13-311-TP905_SOA				
L1353073	6-8	CH13-311-BH004_SOA CH13-311-BH005_SOA CH13-311-BH005_SOB				
L1355921	1,2	CH13-311-BH022_SOA CH13-311-BH022_SOB				
L1338738	1,2	CH13-311-SS001_RKA CH13-311-SS019_RKA	Hg	Soil	28	
L1351297	1-11	CH13-204-MW016E_SOA CH13-204-MW016E_SOB CH13-204-MW016E_SOC CH13-204-MW016E_SOD CH13-204-MW016E_SOE CH13-204-MW016E_SOF CH13-204-MW016E_SOG CH13-204-MW016E_SOH CH13-204-MW016E_SOI CH13-204-MW016E_SOJ CH13-204-MW016E_SOK				

We sincerely apologize for any problems and inconvenience that holding time issues may have caused CH2M Hill. We hope that this letter sufficiently explains how these issues occurred and addresses how ALS plans to ensure that they do not occur again in the future.

Please feel free to contact myself or Joyce Chow if you require any additional information.

Sincerely,





Jerry Holzbecher, B.Sc.
Client Services Manager,
Vancouver

Joyce Chow, B.Sc.
Director,
Western Canada