



January 29, 2014

## LABORATORY REPORT FOR

# Giant Mine Backfill Testing - South and Central Pond

**Submitted to:**

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(PWGSC)  
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REPORT



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### Study Limitations

This report was prepared for the exclusive use of Public Works and Government Services Canada (PWGSC) on the Giant Mine Project. The report, which specifically includes all tables, figures and appendices, is based on measurements and observations made and data and information collected during the laboratory studies conducted by Golder Associates Ltd. (Golder) for PWGSC. The test results are based solely on the ambient conditions of the laboratory at the time the measurements and tests were conducted.

The services performed, as described in this report, were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

The sample(s) provided for the tests are assumed to be representative of material found at the site. The test data given herein pertains to the sample(s) provided, and may not be applicable to material from other production periods or zones. Assessment of the sample environmental conditions and possible hazards associated with the material composition is based on the results of chemical analysis of samples which are possibly from a limited number of locations. However, it is never possible, even with exhaustive sampling and testing, to dismiss the possibility that part of a site or a production line may remain undetected. The results found from the tests may not be reproducible under the field conditions.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by PWGSC, communications between Golder and PWGSC, and to any other reports prepared by Golder for PWGSC relative to the specific site described in the report, tables, drawings, figures and appendices. ***In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder cannot be responsible for use of portions of the report without reference to the entire report.***

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## 1.0 INTRODUCTION

Public Works and Government Services Canada (PWGSC) has retained Golder Associates Ltd. (Golder) to carry out laboratory testing on Giant Mine tailings to assess the rheological and strength properties of the South and Central Pond tailings for the purpose of using them as feed material for underground paste backfill.

## 2.0 SAMPLE RECEIPT AND PREPARATION

### 2.1 Sample Receipt

Samples received by Golder’s Sudbury laboratory are summarized in Table 1. All samples were received in good condition with all seals intact. The total weight of the shipment was 928 kg. The samples were shipped via Manitoulin Transport.

**Table 1: Sample Receipt Summary**

Date	Amount / Container	Label as Received	Golder Sample ID
November 26, 2013	22.2kg – 20L Pail	Central Tailings Pond, GA13 -TP09	13-1426-0010 CTP - GA13-TP09
	8.7kg – 20L Pail	Central Tailings Pond, GA13 -TP10	13-1426-0010 CTP - GA13-TP10
	16.2kg – 20L Pail	Central Tailings Pond, GA13 -TP11	13-1426-0010 CTP - GA13-TP11
	13.3kg – 20L Pail	Central Tailings Pond, GA13-TP14 (1 of 2)	13-1426-0010 CTP - GA13-TP14-1
	16.4kg – 20L Pail	Central Tailings Pond, GA13-TP14 (2 of 2)	13-1426-0010 CTP - GA13-TP14-2
	15.1kg – 20L Pail	Central Tailings Pond, GA13-TP15	13-1426-0010 CTP - GA13-TP15
	14.1kg – 20L Pail	Central Tailings Pond, GA13-TP16	13-1426-0010 CTP - GA13-TP16
	14.8kg – 20L Pail	Central Tailings Pond, GA13-TP18	13-1426-0010 CTP - GA13-TP18
	13.3kg – 20L Pail	Central Tailings Pond, GA13-TP19	13-1426-0010 CTP - GA13-TP19
	10.2kg – 20L Pail	Central Tailings Pond, GA13-TP20	13-1426-0010 CTP - GA13-TP20
	14.8kg – 20L Pail	Central Tailings Pond, GA13-TP26	13-1426-0010 CTP - GA13-TP26
	19.7kg – 20L Pail	South Tailings Pond, GA13-TP27	13-1426-0010 STP - GA13-TP27
	11.7kg – 20L Pail	South Tailings Pond, GA13-TP35	13-1426-0010 STP - GA13-TP35
	13.8kg – 20L Pail	South Tailings Pond, GA13-TP36	13-1426-0010 STP - GA13-TP36
	18.1kg – 20L Pail	South Tailings Pond, GA13-TP38	13-1426-0010 STP - GA13-TP38
	9.0kg – 20L Pail	South Tailings Pond, GA13-TP41	13-1426-0010 STP - GA13-TP41
	17.0kg – 20L Pail	South Tailings Pond, GA13-TP52	13-1426-0010 STP - GA13-TP52
	November 26, 2013	1 - 200L Drum	South and Central Tailings Ponds, Bulk Sample - Silty Sand
1 - 200L Drum		South and Central Tailings Ponds, Bulk Sample - Mixed silt, sand, and clay	13-1426-0010 SCTP - BS - Mixed (Silt- Sand -Clay)
1 - 200L Drum		South and Central Tailings Ponds, Bulk Sample - Clayey Silt	13-1426-0010 SCTP - BS - Clay - Silt
December 9, 2013	1 – 200L Drum	Crushed Rock	13-1426-0010 SCTP-BS-Clay-Silt (S2)



## GIANT MINE TAILINGS TESTING - SOUTH AND CENTRAL POND

All samples received by Golder are subjected to material property characterization tests to establish properties and allow for comparison should future testing be required.

### 2.2 Hazard Assessment

Prior to handling the Giant Mine sample each pails and drums was assessed separately for hazardous gases. The gas analysis results are presented in Table 2.

**Table 2: Sample Hazard Assessment**

Date	Label as Received	Golder Sample ID	VOC (ppm)	HCN (ppm)	H <sub>2</sub> S (ppm)
November 26, 2013	Central Tailings Pond, GA13 -TP09	13-1426-0010 CTP - GA13-TP09	0	0	0
	Central Tailings Pond, GA13 -TP10	13-1426-0010 CTP - GA13-TP10	0	0	0
	Central Tailings Pond, GA13 -TP11	13-1426-0010 CTP - GA13-TP11	0	0	0
	Central Tailings Pond, GA13-TP14 (1 of 2)	13-1426-0010 CTP - GA13-TP14-1	0	0	0
	Central Tailings Pond, GA13-TP14 (2 of 2)	13-1426-0010 CTP - GA13-TP14-2	0	0	0
	Central Tailings Pond, GA13-TP15	13-1426-0010 CTP - GA13-TP15	0	0	0
	Central Tailings Pond, GA13-TP16	13-1426-0010 CTP - GA13-TP16	0	0	0
	Central Tailings Pond, GA13-TP18	13-1426-0010 CTP - GA13-TP18	0	0	0
	Central Tailings Pond, GA13-TP19	13-1426-0010 CTP - GA13-TP19	0	0	0
	Central Tailings Pond, GA13-TP20	13-1426-0010 CTP - GA13-TP20	0	0	0
	Central Tailings Pond, GA13-TP26	13-1426-0010 CTP - GA13-TP26	0	0	0
	South Tailings Pond, GA13-TP27	13-1426-0010 STP - GA13-TP27	0	0	0
	South Tailings Pond, GA13-TP35	13-1426-0010 STP - GA13-TP35	0	0	0
	South Tailings Pond, GA13-TP36	13-1426-0010 STP - GA13-TP36	0	0	0
	South Tailings Pond, GA13-TP38	13-1426-0010 STP - GA13-TP38	0	0	0
	South Tailings Pond, GA13-TP41	13-1426-0010 STP - GA13-TP41	0	0	0
	South Tailings Pond, GA13-TP52	13-1426-0010 STP - GA13-TP52	0	0	0
	December 9, 2013	South and Central Tailings Ponds, Bulk Sample - Silty Sand	13-1426-0010 SCTP - BS - Silty Sand	0	0
South and Central Tailings Ponds, Bulk Sample - Mixed silt, sand, and clay		13-1426-0010 SCTP - BS - Mixed (Silt- Sand -Clay)	0	0	0
December 9, 2013	Crushed Rock	13-1426-0010 SCTP-BS-Clay-Silt (S2)	0	0	0

VOC: Volatile Organic Compounds  
 HCN: Hydrogen Cyanide gas  
 H<sub>2</sub>S: Hydrogen Sulphide gas



## GIANT MINE TAILINGS TESTING - SOUTH AND CENTRAL POND

Metals analysis using Inductively Coupled Plasma with a Mass Spectrometer detector (ICP-MS) was performed on a composite sample obtained via individual pipe samples from each pail. This testing helps to identify health and safety hazards such as heavy metals which may be present. The sample was sent to an external laboratory for ICP-MS analysis. Figures 1 and 2, and Appendix A present the results.

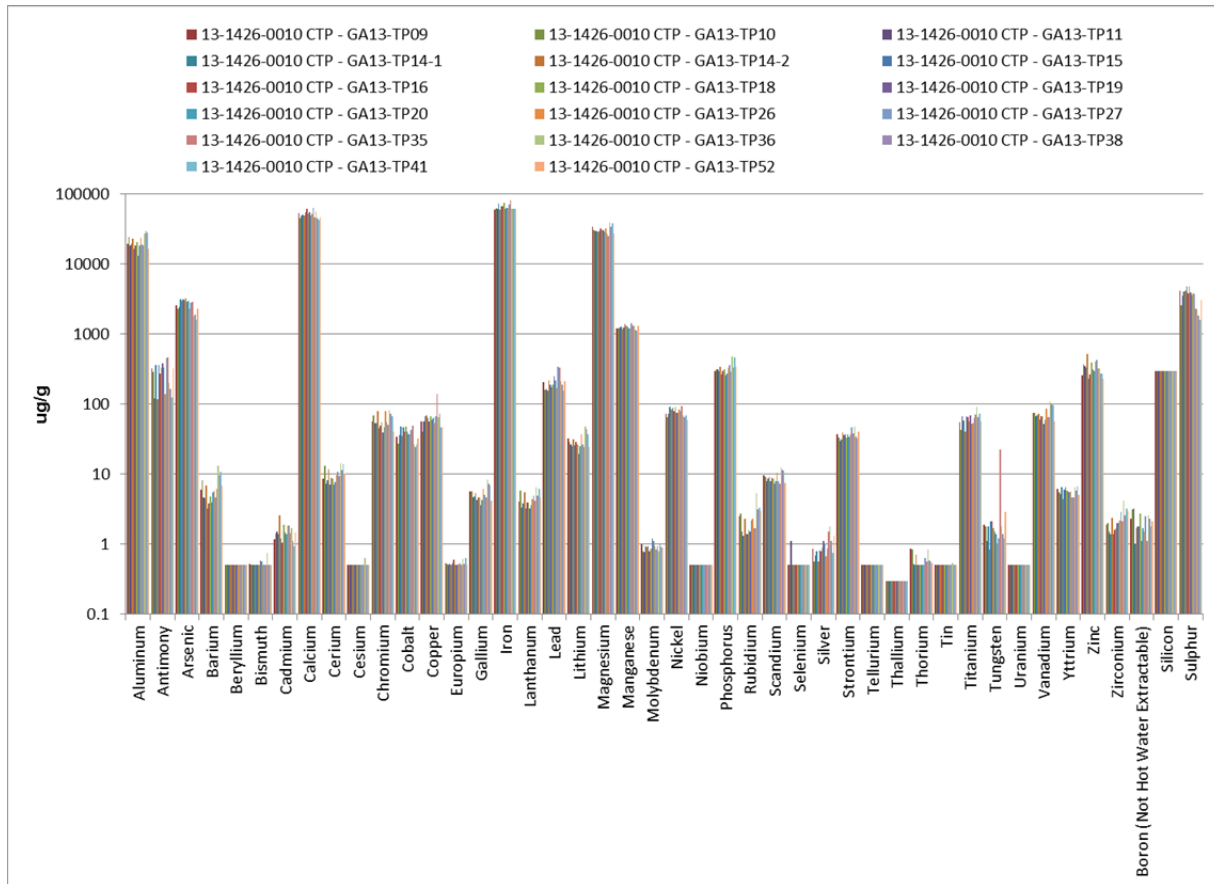


Figure 1: ICP-MS Results



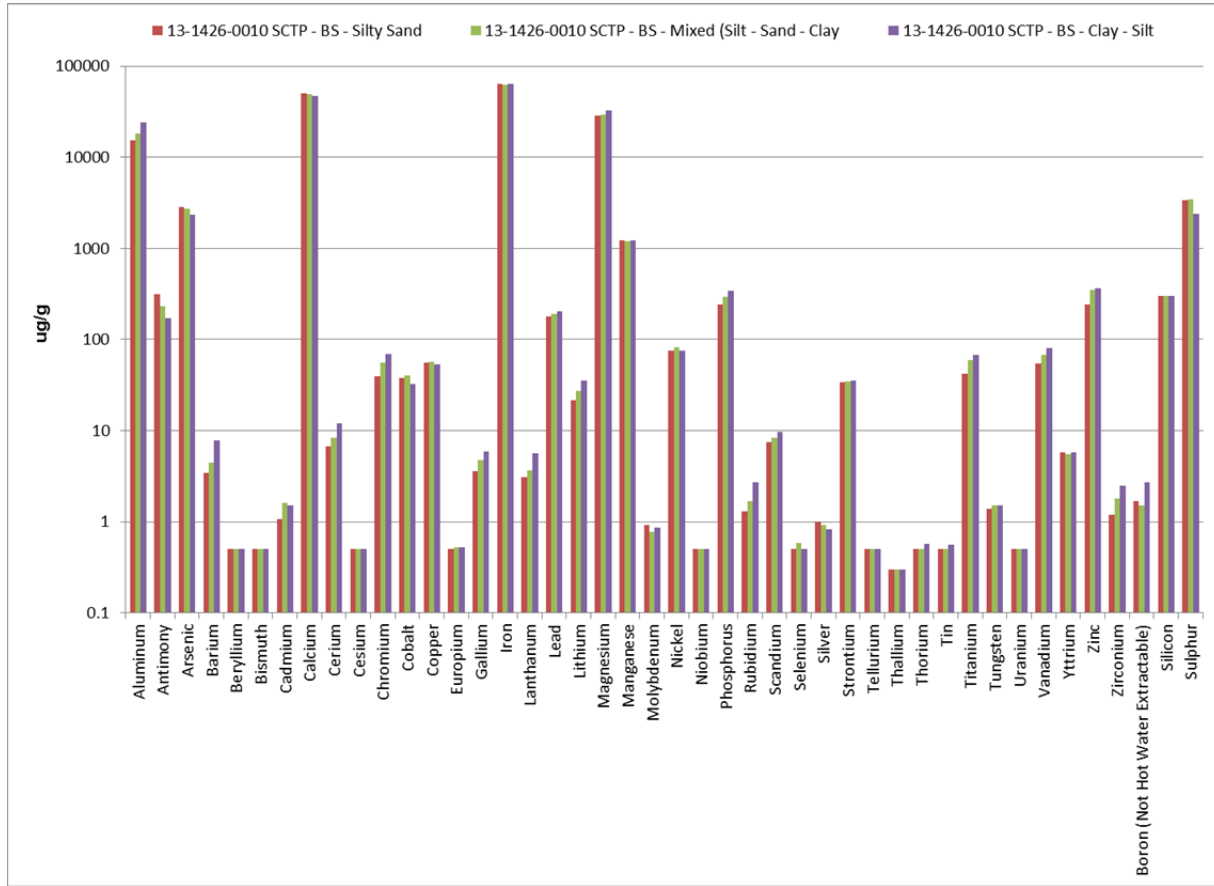


Figure 2: ICP-MS Results - Drums

No hazardous gases were detected in any of the samples. The concentrations of heavy metals and cyanide present in the samples were considered to be acceptable to handle according to Golder's established protocols.

## 2.3 Sample Preparation

Proper sample preparation technique is a critical first step to ensure proper homogenization of solids, representative sub-sampling and reproducibility of results.

The first step was to mix all of the samples individually with the available 13-1426-0010 Water in order to achieve homogenized samples. Photos are presented in Appendix B.



### 3.0 MATERIAL CHARACTERIZATION

#### 3.1 pH Analysis

Table 3 presents the pH of each sample and the temperature at which it was measured.

**Table 3: pH Analysis**

Sample	pH	Temperature (°Celsius)
13-1426-0010 CTP - GA13-TP09	8.5	18
13-1426-0010 CTP - GA13-TP10	8.7	
13-1426-0010 CTP - GA13-TP11	9.1	
13-1426-0010 CTP - GA13-TP14-1	8.7	
13-1426-0010 CTP - GA13-TP14-2	8.7	
13-1426-0010 CTP - GA13-TP15	8.6	
13-1426-0010 CTP - GA13-TP16	8.7	
13-1426-0010 CTP - GA13-TP18	8.6	
13-1426-0010 CTP - GA13-TP19	8.7	
13-1426-0010 CTP - GA13-TP20	8.4	
13-1426-0010 CTP - GA13-TP26	8.5	
13-1426-0010 STP - GA13-TP27	8.5	
13-1426-0010 STP - GA13-TP35	8.6	
13-1426-0010 STP - GA13-TP36	8.8	
13-1426-0010 STP - GA13-TP38	8.8	
13-1426-0010 STP - GA13-TP41	8.9	
13-1426-0010 STP - GA13-TP52	8.9	
13-1426-0010 SCTP - BS - Silty Sand	7.9	19
13-1426-0010 SCTP - BS - Mixed (Silt- Sand -Clay)	8.0	
13-1426-0010 SCTP - BS - Clay - Silt	8.7	
13-1426-0010 SCTP-BS-Clay-Silt (S2)	8.7	18



## 3.2 Particle Size Distribution

Particle size distribution (PSD) was determined using mechanical sieving and a Fritsch laser particle size analyzer according to ASTM D4464.

Specific values are presented in Table 4, and on Figures 3 and 4. The gradation parameter DXX, tabulated in microns, refers to the average particle diameter that XX% by weight of material is smaller than.

**Table 4: Particle Size Distribution**

Sample	D10 (µm)	D30 (µm)	D50 (µm)	D60 (µm)	D80 (µm)
13-1426-0010 CTP - GA13-TP09	3	8	18	27	104
13-1426-0010 CTP - GA13-TP10	2	5	10	14	26
13-1426-0010 CTP - GA13-TP11	3	11	26	39	115
13-1426-0010 CTP - GA13-TP14-1	5	23	55	81	127
13-1426-0010 CTP - GA13-TP14-2	2	6	11	15	28
13-1426-0010 CTP - GA13-TP15	8	54	117	128	149
13-1426-0010 CTP - GA13-TP16	5	26	71	107	135
13-1426-0010 CTP - GA13-TP18	4	14	35	52	116
13-1426-0010 CTP - GA13-TP19	4	18	41	61	120
13-1426-0010 CTP - GA13-TP20	3	8	18	26	52
13-1426-0010 CTP - GA13-TP26	2	7	14	20	43
13-1426-0010 STP - GA13-TP27	3	12	28	39	94
13-1426-0010 STP - GA13-TP35	4	16	44	70	125
13-1426-0010 STP - GA13-TP36	2	5	8	11	19
13-1426-0010 STP - GA13-TP38	2	4	7	9	16
13-1426-0010 STP - GA13-TP41	2	4	8	10	18
13-1426-0010 STP - GA13-TP52	3	7	16	22	44
13-1426-0010 SCTP - BS - Silty Sand	2	6	12	17	36
13-1426-0010 SCTP - BS - Mixed (Silt- Sand - Clay)	3	12	29	44	114
13-1426-0010 SCTP - BS - Clay - Silt	5	24	67	103	136
13-1426-0010 SCTP-BS-Clay-Silt (S2)	6	29	87	119	158



# GIANT MINE TAILINGS TESTING - SOUTH AND CENTRAL POND

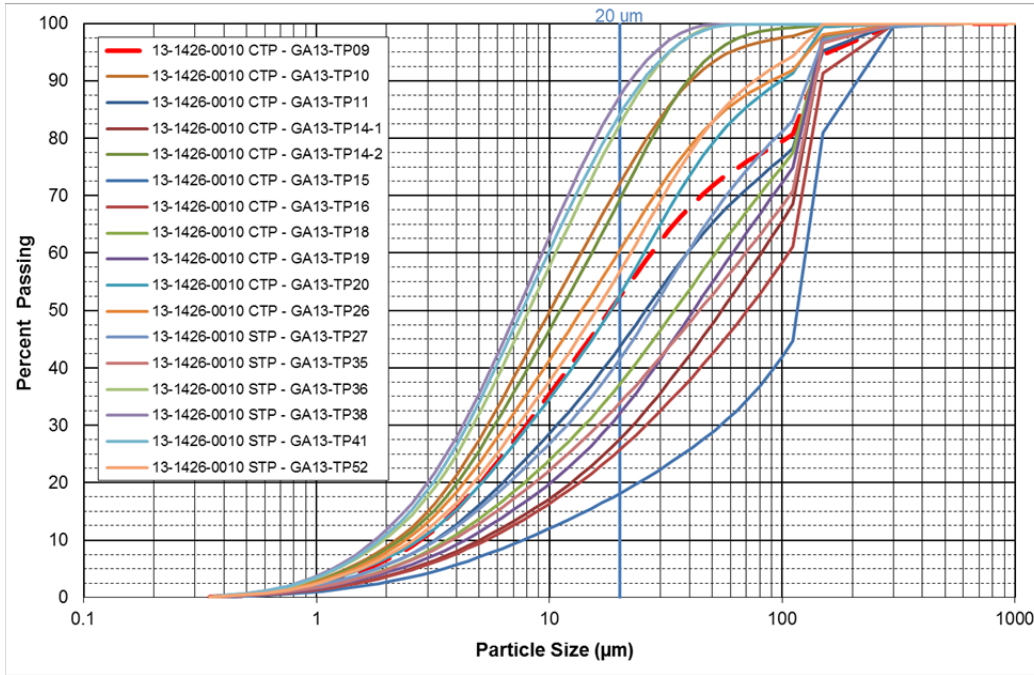


Figure 3: PSD Results

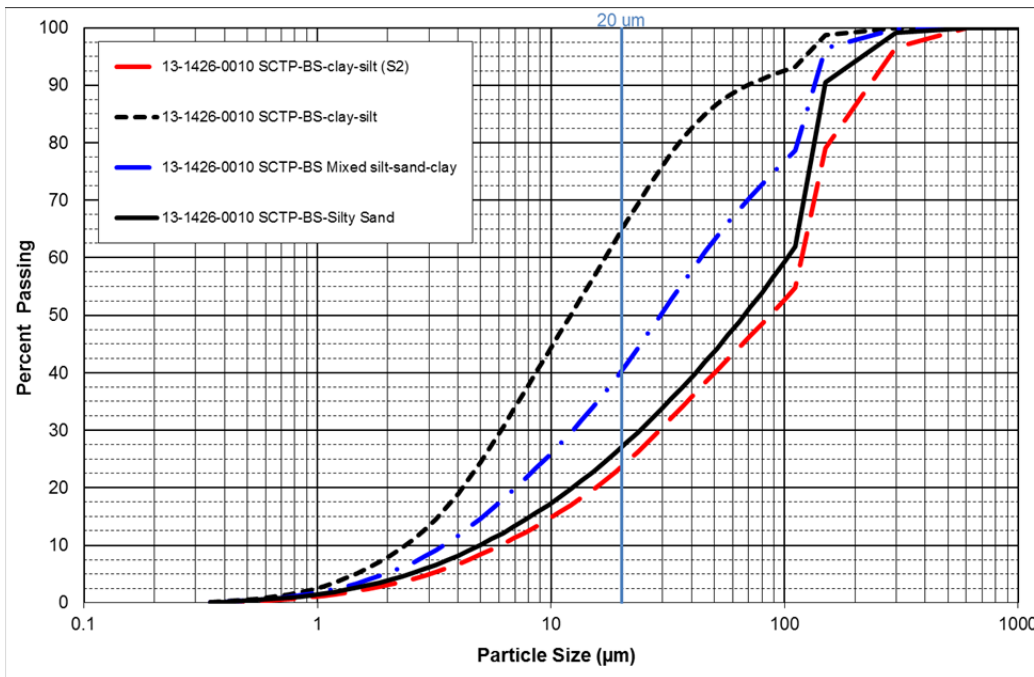


Figure 4: PSD Results



### 3.3 Specific Gravity

The specific gravity (SG) of the sample was determined using vacuum de-aired water. Each slurry sample was also vacuum de-aired prior to SG measurement. The results are presented in Table 5.

**Table 5: Specific Gravity Results**

Sample	Trial 1	Trial 2	Average
13-1426-0010 CTP - GA13-TP09	2.78	2.76	2.77
13-1426-0010 CTP - GA13-TP10	2.78	2.77	2.78
13-1426-0010 CTP - GA13-TP11	2.78	2.79	2.78
13-1426-0010 CTP - GA13-TP14-1	2.82	2.83	2.83
13-1426-0010 CTP - GA13-TP14-2	2.80	2.81	2.81
13-1426-0010 CTP - GA13-TP15	2.81	2.84	2.83
13-1426-0010 CTP - GA13-TP16	2.82	2.81	2.82
13-1426-0010 CTP - GA13-TP18	2.80	2.82	2.81
13-1426-0010 CTP - GA13-TP19	2.81	2.82	2.82
13-1426-0010 CTP - GA13-TP20	2.80	2.81	2.80
13-1426-0010 CTP - GA13-TP26	2.78	2.77	2.77
13-1426-0010 STP - GA13-TP27	2.82	2.83	2.83
13-1426-0010 STP - GA13-TP35	2.87	2.89	2.88
13-1426-0010 STP - GA13-TP36	2.75	2.75	2.75
13-1426-0010 STP - GA13-TP38	2.70	2.69	2.69
13-1426-0010 STP - GA13-TP41	2.75	2.77	2.76
13-1426-0010 STP - GA13-TP52	2.82	2.81	2.81
13-1426-0010 SCTP - BS - Silty Sand	2.80	2.83	2.81
13-1426-0010 SCTP - BS - Mixed (Silt- Sand -Clay)	2.83	2.84	2.84
13-1426-0010 SCTP - BS - Clay - Silt	2.82	2.82	2.82
13-1426-0010 SCTP - BS - Clay - Silt (S2)	2.70	2.71	2.71

The sample 13-1426-0010 SCTP- BS-Clay-Silt (S2) was collected on-site in December and had a similar PSD results to the 13-1426-0010 SCTP-BS-Silty Sand (November) sample. It was intended to collect a sample with a PSD result closer to the 13-1426-0010 SCTP-BS Clay - Silt (November) sample however due to site conditions and the snow covered/frozen tailings the sample turned out to be coarser than anticipated.



### 4.0 RHEOLOGICAL CHARACTERIZATION

Rheological testing was carried out to evaluate flow and handling properties. These tests provide an indication regarding the material’s behaviour in the course of mixing, slump adjustment, pumping, flowing and also while sitting idle. Rheological characterization provides data for the selection of process equipment such as mixers, pumps and pipelines.

The testing was carried out on the finer and coarser tailings samples from the South pond (13-1426-0010 STP-0010-GA13-TP38 and 13-1426-0010 STP-GA13-TP27) and Central pond (13-1426-0010 CTP-GA13-TP15 and 13-1426-0010 CTP-GA13-TP14-2), we also completed rheological testing on the three (3) bulk samples from various location labeled 13-1426-0010 SCTP-BS-Mixed (Silt-Sand-Clay) , 13-1426-0010 SCTP-BS-Silty Sand and 13-1426-0010 SCTP-BS-Clay-Silt.

### 4.1 Slump vs. Solids Content

To gauge sensitivity to water additions, small increments of water were added to the bulk sample. After each addition, slump and solids content was determined. This generates a relationship between slump and solids content which is typically used to determine the degree of process control required to maintain slump control of the final product. The results are presented on Figure 5.

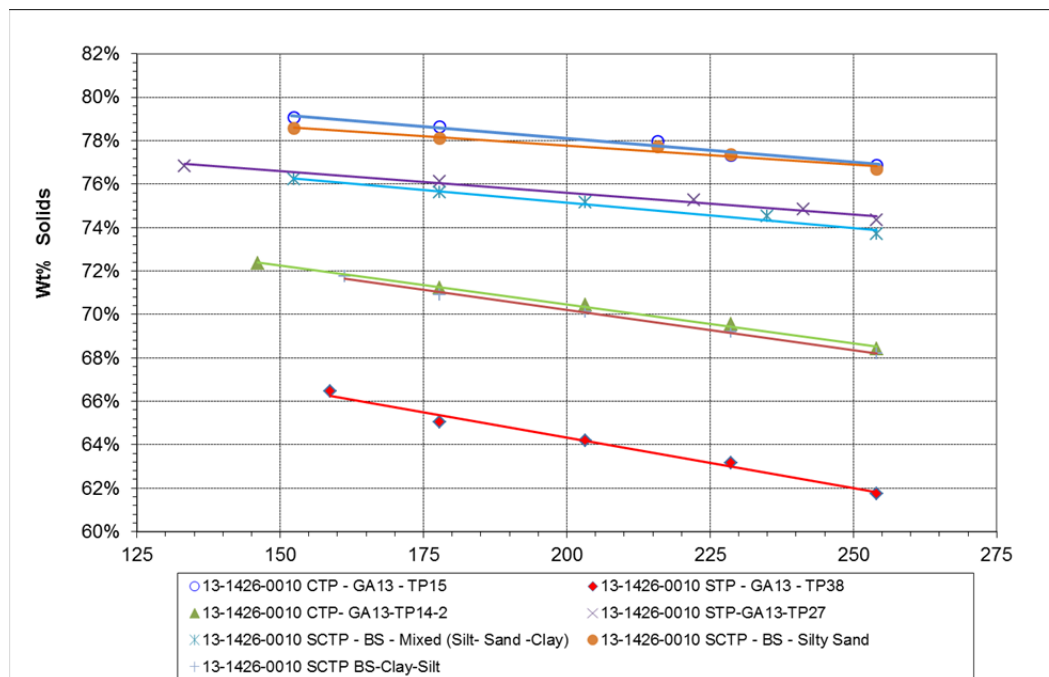


Figure 5: Solids Content vs. Slump



## 4.2 Static Yield Stress Testing

Yield stress is defined as the minimum force required to initiate flow. Static yield stress was determined by using a very slow moving (0.2 RPM) vane spindle attached to a torque spring. The spindle was immersed in the sample and measurements were taken at various solids contents. There are different test methods to determine yield stress, one termed 'static' and the other 'dynamic'. Figure 6 presents the static yield stress testing results.

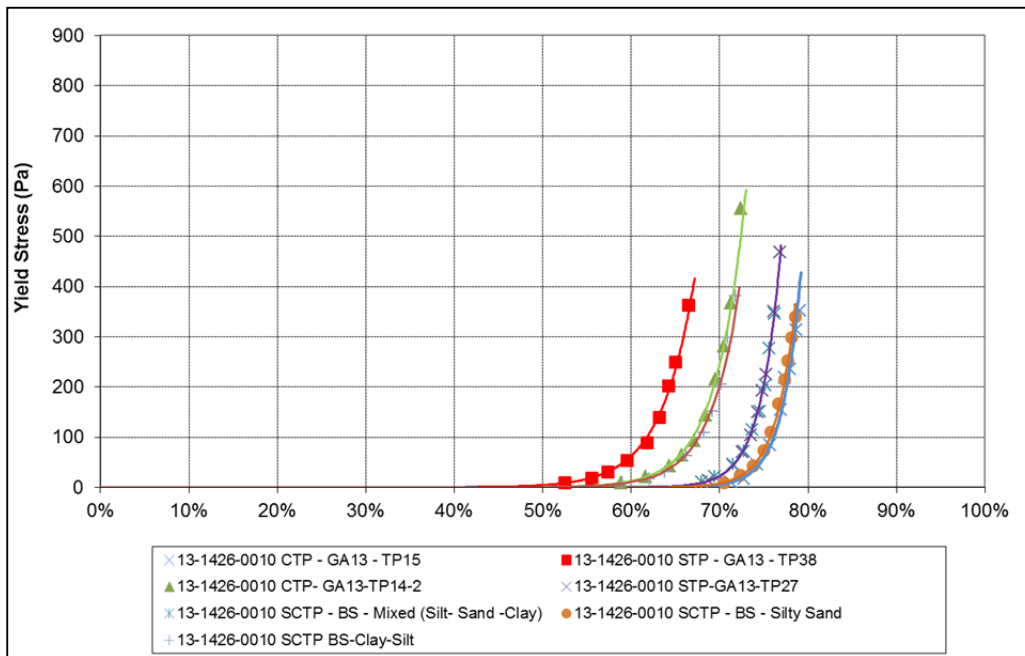


Figure 6: Static Yield Stress vs. wt% Solids

## 4.3 Water Bleed and Yield Stress vs. Time

Moisture retention testing was carried out to assess the water bleed properties of the paste while sitting idle in test beakers. Two slump consistencies were tested at four time intervals. At each time interval the water bleed and yield stress were measured. Figures 7 to 13 present the results.



# GIANT MINE TAILINGS TESTING - SOUTH AND CENTRAL POND

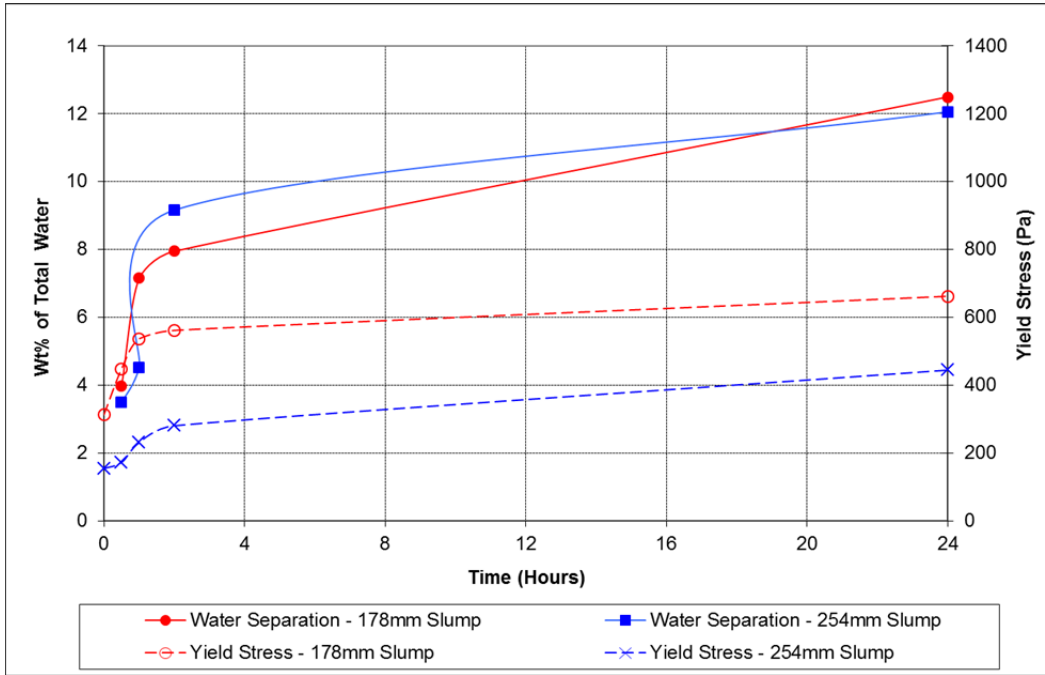


Figure 7: Water Bleed and Yield Stress vs. Time – 13-1426-0010 CTP-GA13-TP15

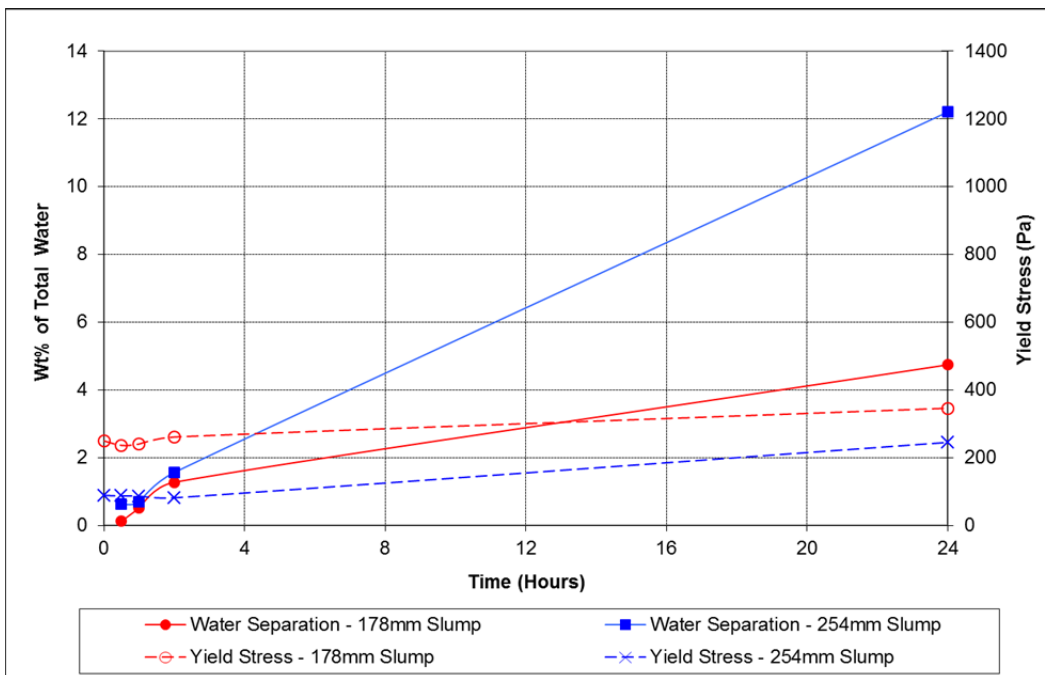


Figure 8: Water Bleed and Yield Stress vs. Time – 13-1426-0010 STP-GA13-TP38





# GIANT MINE TAILINGS TESTING - SOUTH AND CENTRAL POND

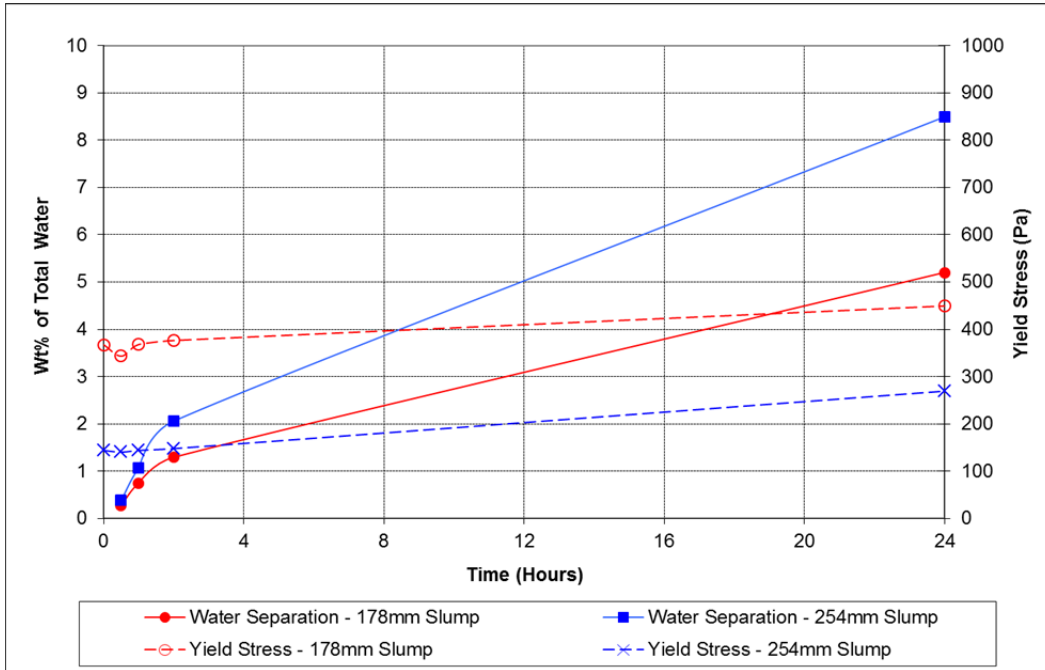


Figure 9: Water Bleed and Yield Stress vs. Time – 13-1426-0010 CTP-GA13-TP14-2

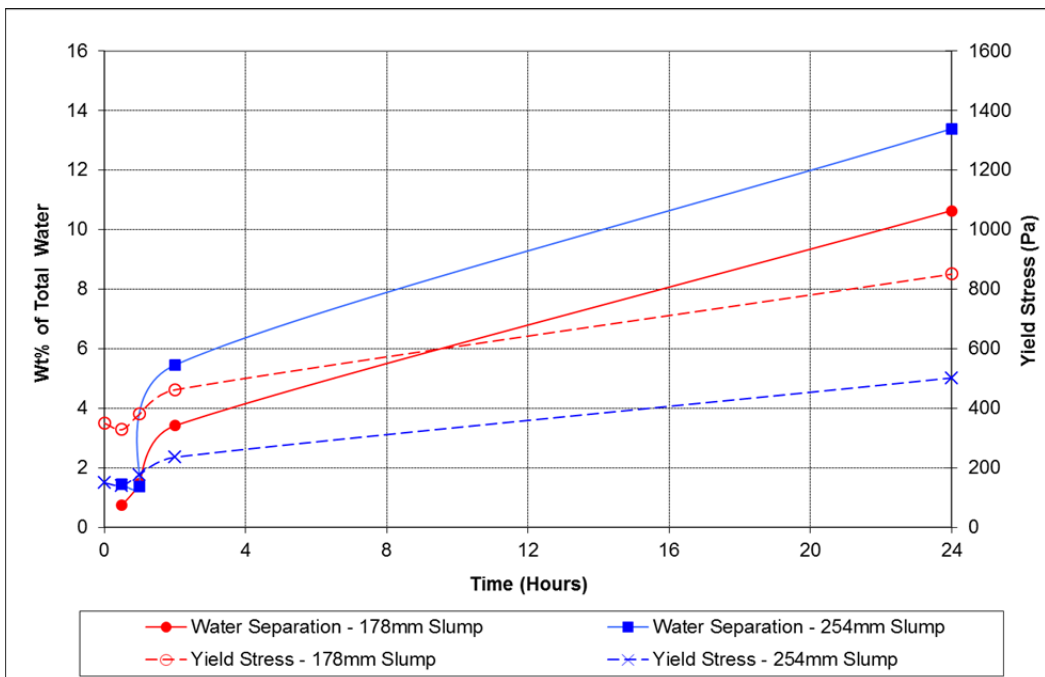


Figure 10: Water Bleed and Yield Stress vs. Time – 13-1426-0010 STP-GA13-TP27



# GIANT MINE TAILINGS TESTING - SOUTH AND CENTRAL POND

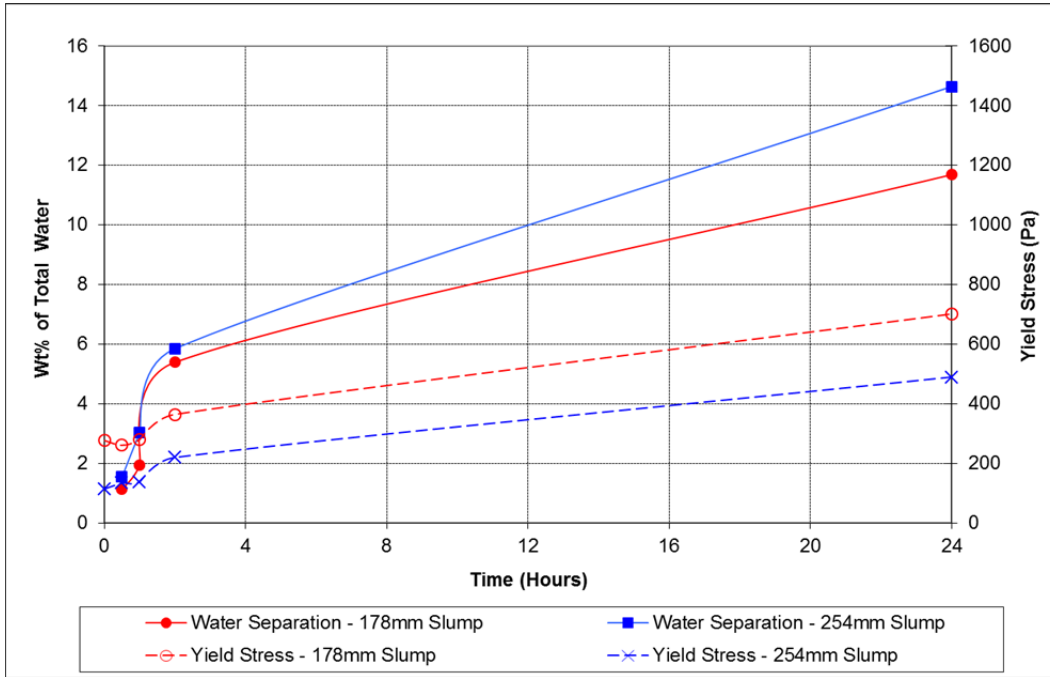


Figure 11: Water Bleed and Yield Stress vs. Time – 13-1426-0010 SCTP - BS - Mixed (Silt - Sand - Clay)

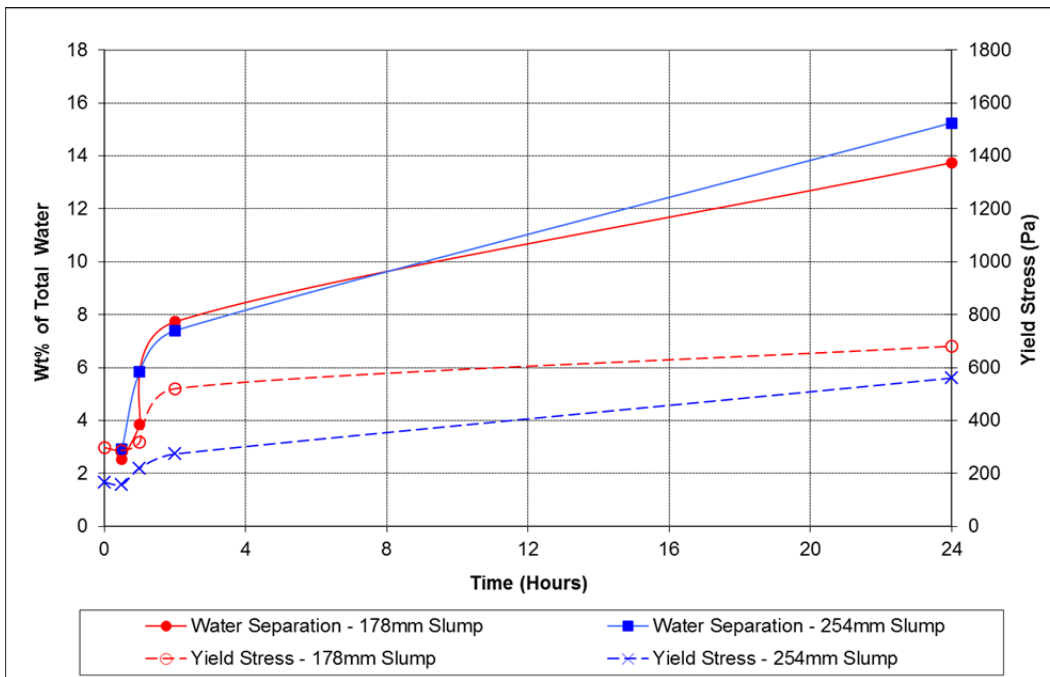


Figure 12: Water Bleed and Yield Stress vs. Time – 13-1426-0010 SCTP - BS - Silty Sand

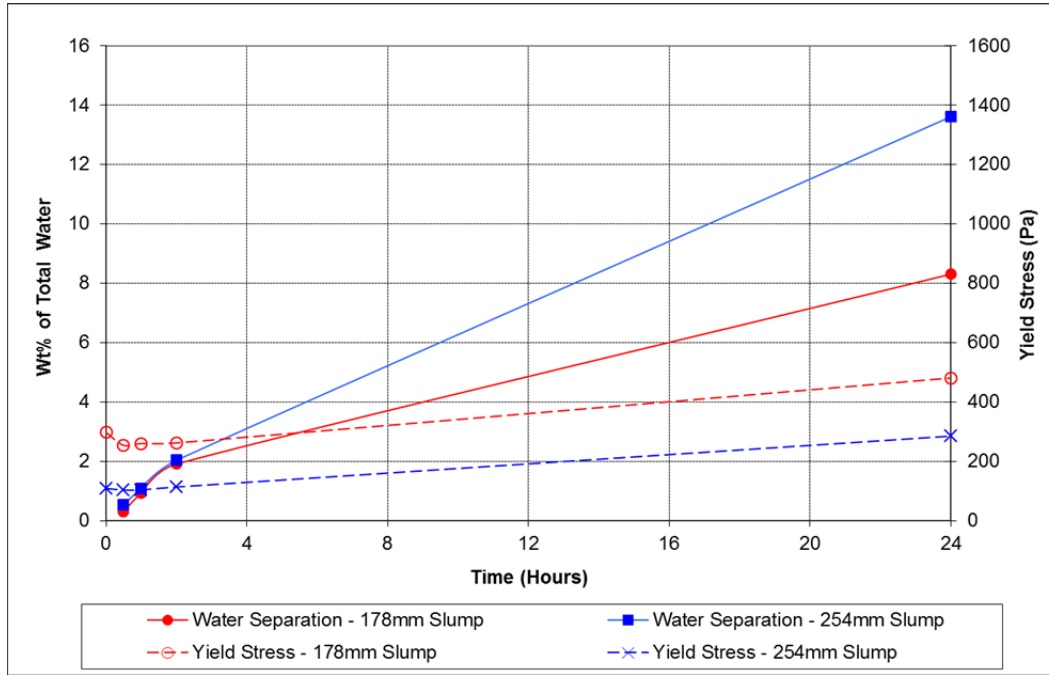


Figure 13: Water Bleed and Yield Stress vs. Time – 13-1426-0010 SCTP - BS - Clay – Silt

### 4.4 Plug Yield Stress

Plug yield stress analysis was performed to determine if consolidation has occurred throughout a cross-section of idle paste material, as may be present in a pipeline's cross-section. Two slump consistencies of material were allowed to sit idle for two hours, and a specially designed vane spindle was immersed at three depths to measure yield stress. Figures 14 to 20 present the results.

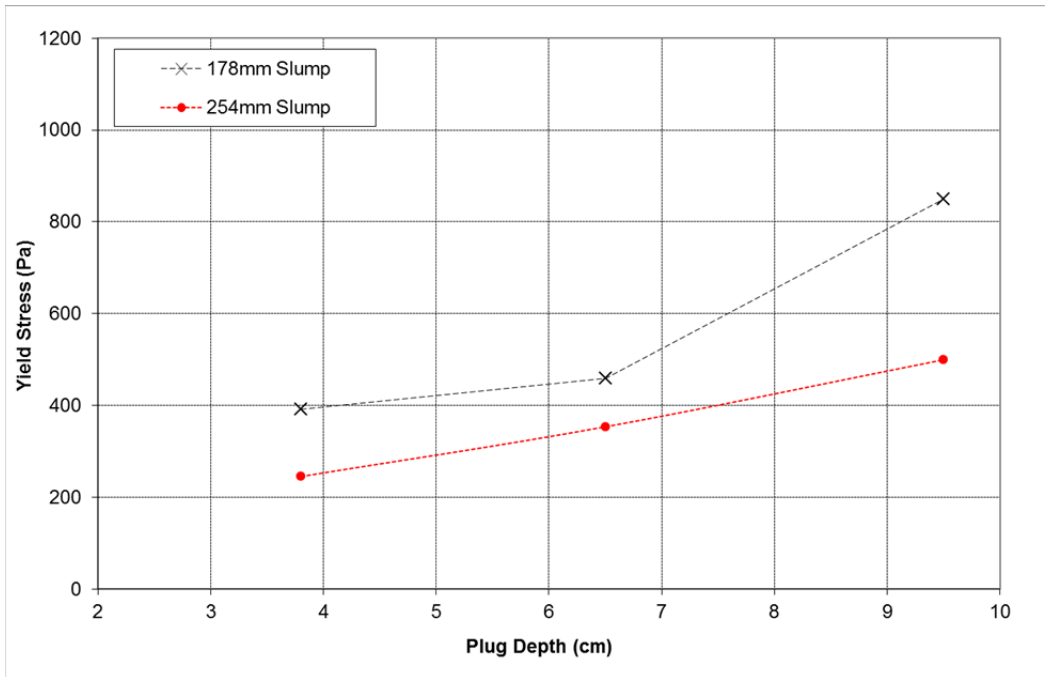


Figure 14: Plug Yield Stress Results -13-1426-0010 CTP-GA13-TP15

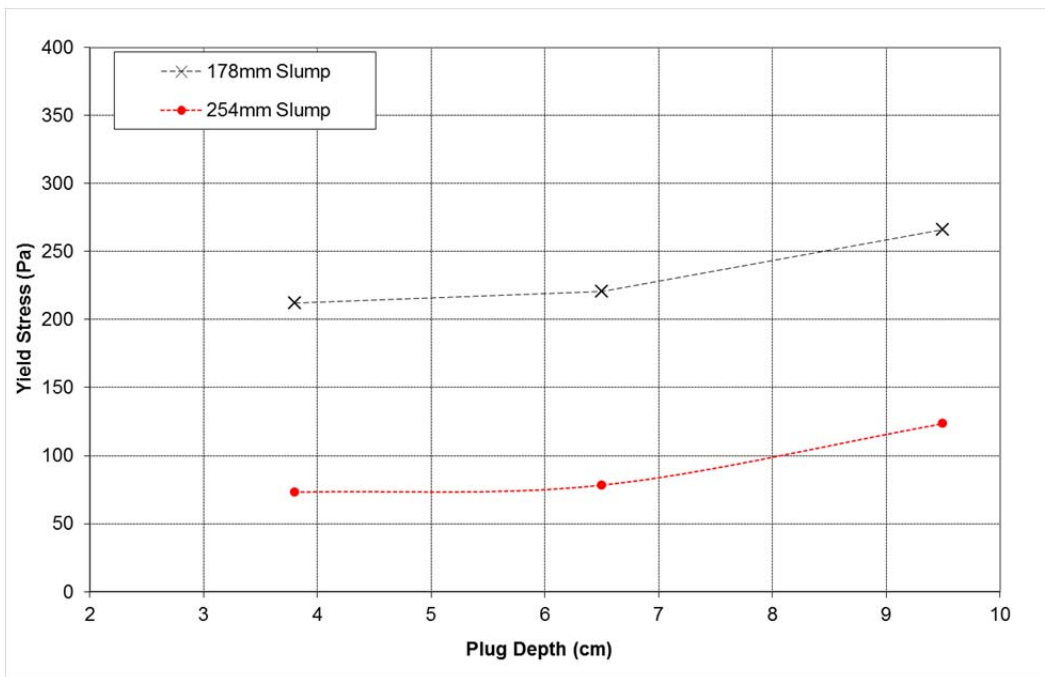


Figure 15: Plug Yield Stress Results -13-1426-0010 STP-GA13-TP38

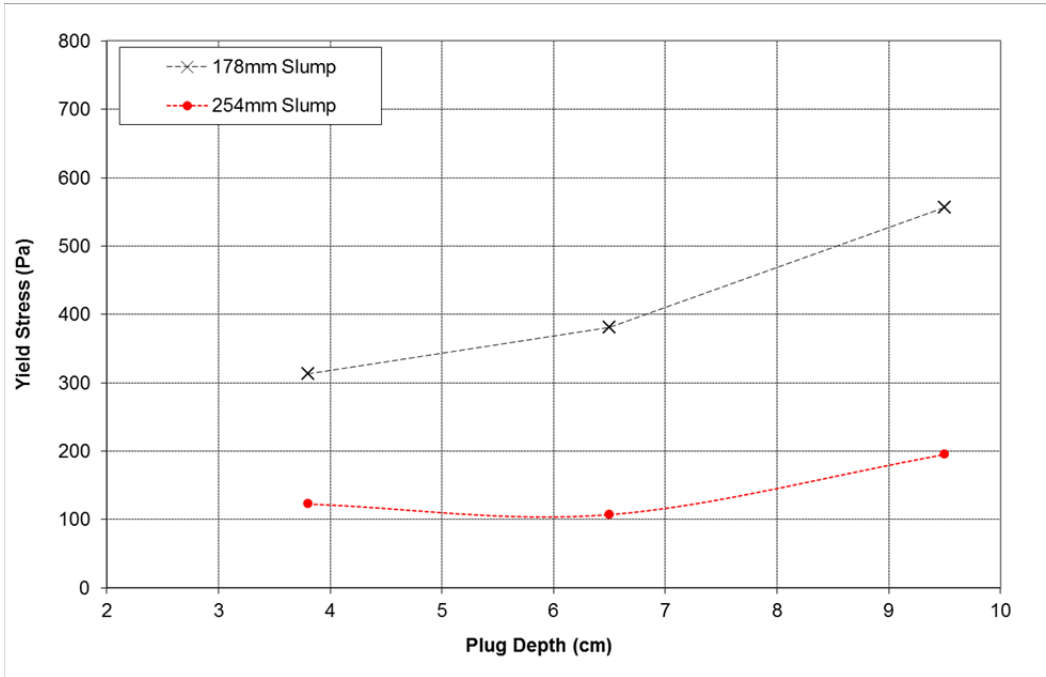


Figure 16: Plug Yield Stress Results -13-1426-0010 CTP-GA13-TP14-2

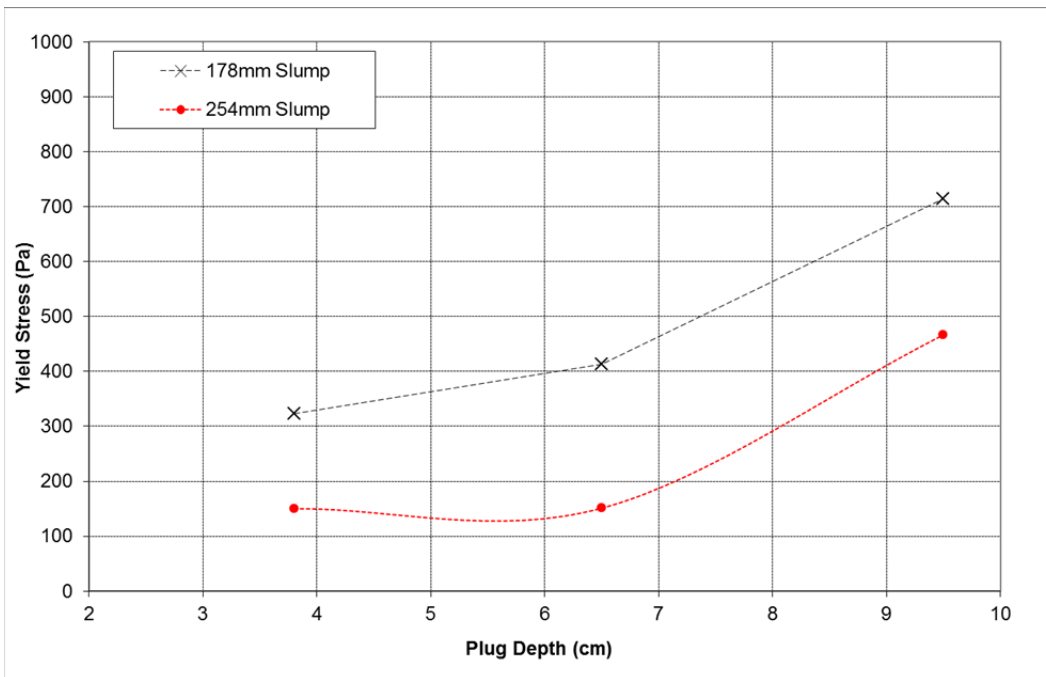


Figure 17: Plug Yield Stress Results -13-1426-0010 STP-GA13-TP27

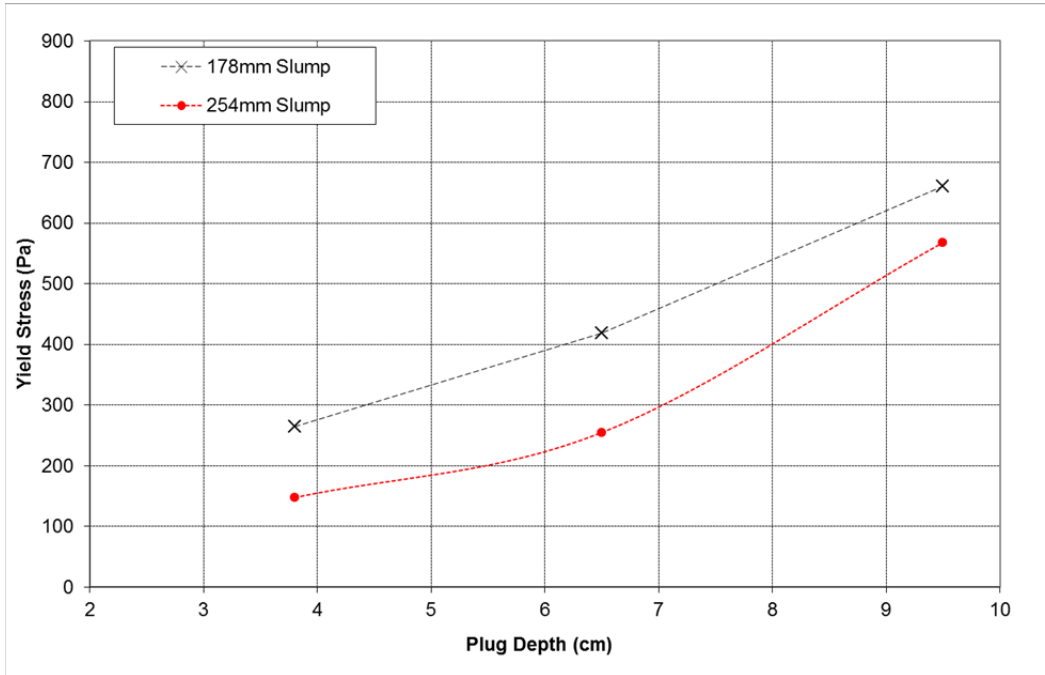


Figure 18: Plug Yield Stress Results -13-1426-0010 - BS - Mixed (Silt - Sand - Clay)

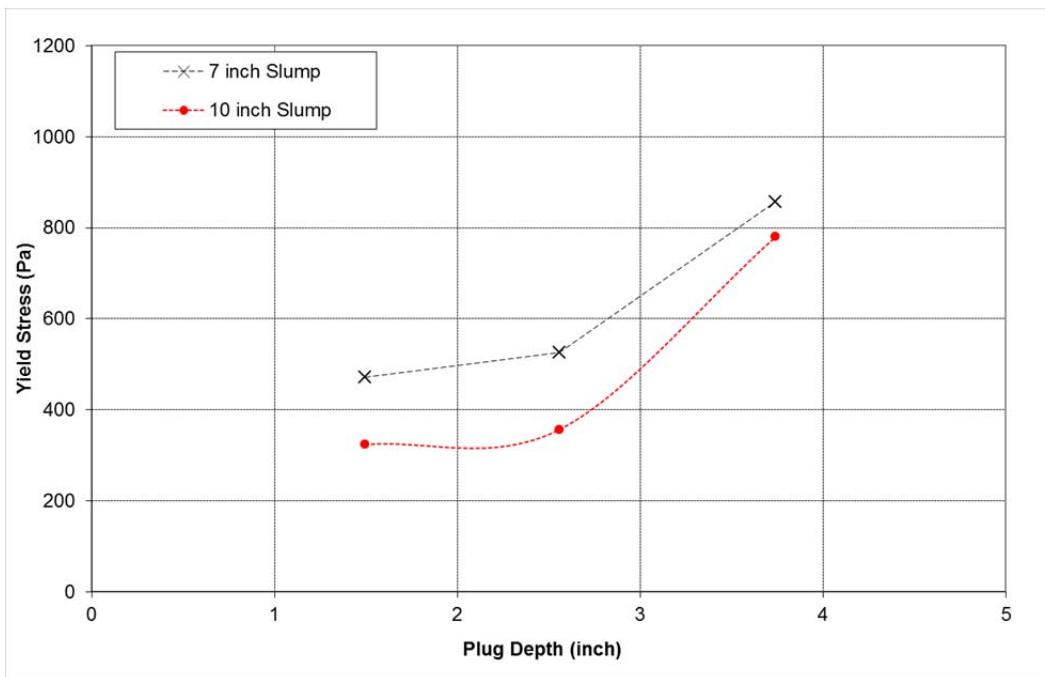


Figure 19: Plug Yield Stress Results -13-1426-0010 - BS - Silty Sand

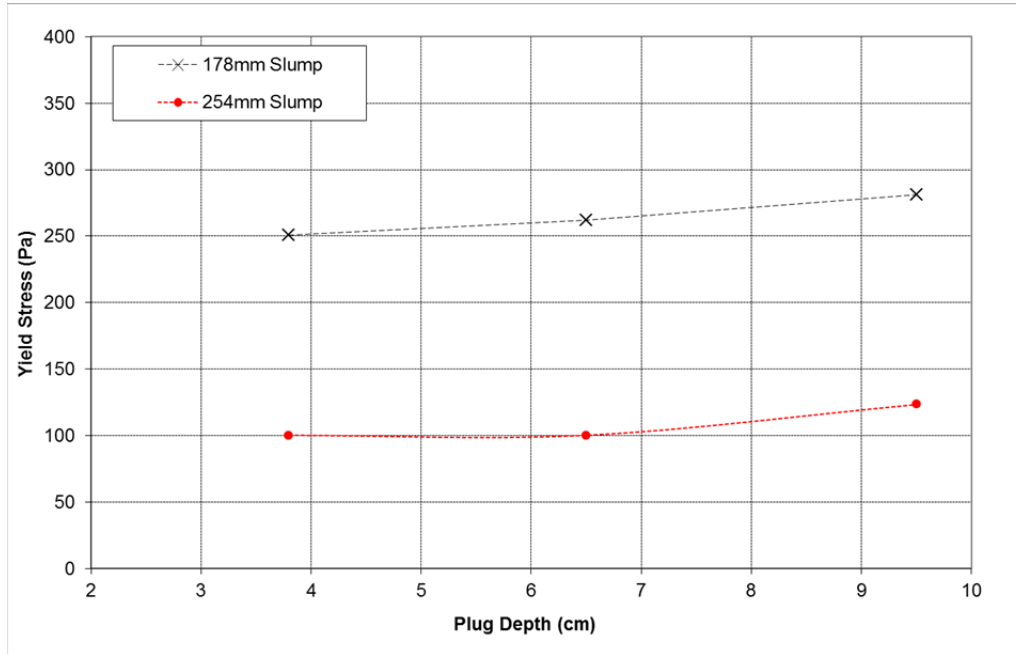


Figure 20: Plug Yield Stress Results -13-1426-0010 - BS - Clay – Silt

### 4.5 Viscosity and Dynamic Yield Stress Determination

Viscosity testing provides bench scale flow properties and fluid characterization. Dynamic viscosity and yield stress data is essential for mixer, pump and pipeline design. In order to compare or duplicate viscosity results of non-Newtonian fluids, it is important to test according to the same conditions. Test conditions and parameters such as cycle time and instrument sensor configuration are critical to producing usable data from bench scale viscometers.

The yield stress determined through this testing is referred to as dynamic yield stress since it is extrapolated from dynamic shear stress data to zero shear. The instrument sensor or bob rotated inside the cup which contained the sample and torque measurements were recorded at several incremental speeds or shear rates.

The rheograms are presented in Appendix C and summarized test results are presented in Tables 6 to 12 as well as on Figures 21 to 34.



**Table 6: Bingham Viscosity and Yield Stress Summary – 13-1426-0010 STP-GA13-TP38**

Wt% Solids	Bingham Yield Stress (Pa)		Bingham Viscosity (PaS)	
	Ramp Up	Ramp Down	Ramp Up	Ramp Down
66.4	785	673	1.644	1.816
65.2	488	453	1.00	1.066
63.9	337	307	0.528	0.610
61.6	179	167	0.233	0.280
59.1	90	85	0.094	0.113
56.5	47	47	0.050	0.053
52.7	20	20	0.024	0.023

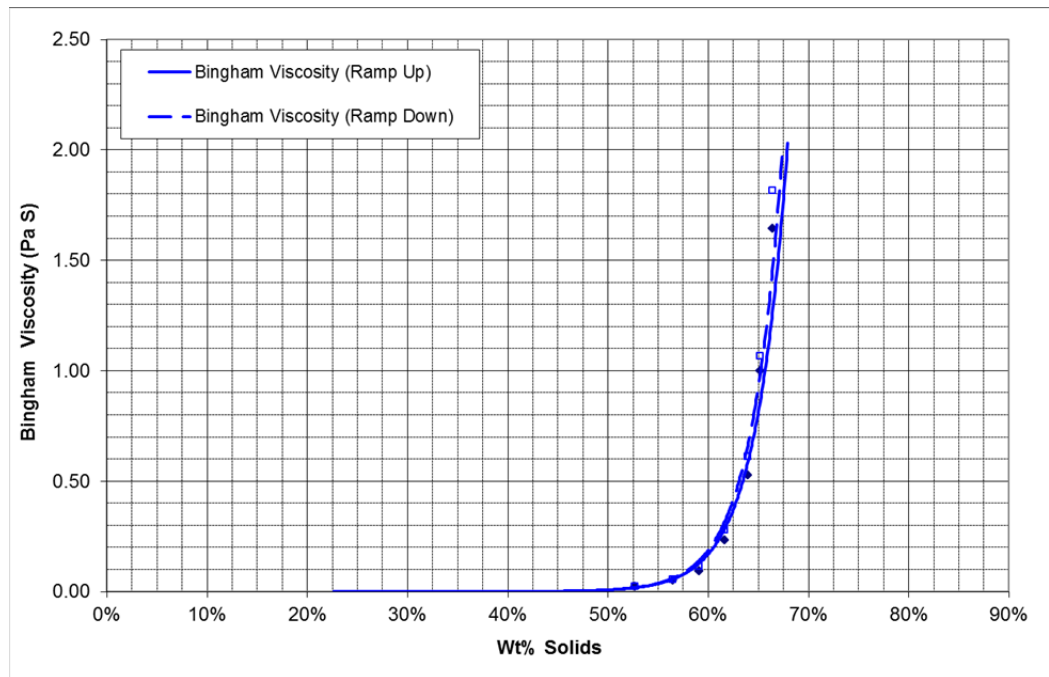


Figure 21: Bingham Viscosity Results – 13-1426-0010 STP – GA13 – TP38





## GIANT MINE TAILINGS TESTING - SOUTH AND CENTRAL POND

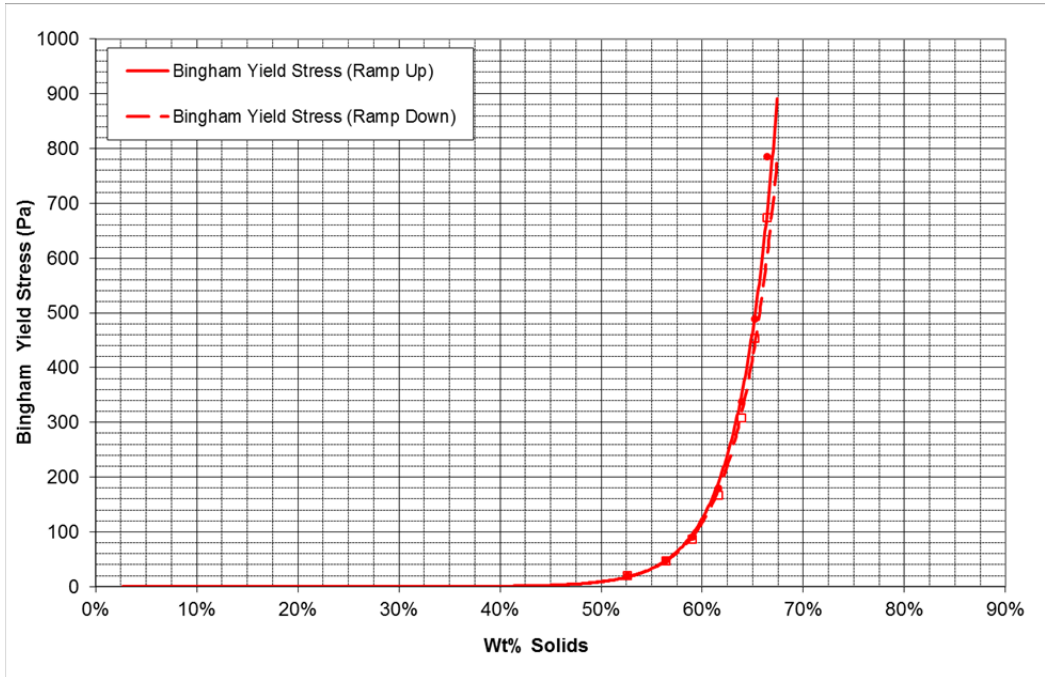


Figure 22: Bingham Yield Stress Results 13-1426-0010 - SPT-GA13-TP38

Table 7: Bingham Viscosity and Yield Stress Summary – 13-1426-0010 CTP-GA13-TP15

Wt% Solids	Bingham Yield Stress (Pa)		Bingham Viscosity (PaS)	
	Ramp Up	Ramp Down	Ramp Up	Ramp Down
77.9	58	56	0.488	0.487
76.9	49	39	0.366	0.382
74.4	43	24	0.266	0.306
72.1	19	11	0.111	0.119
68.4	6	3	0.033	0.037

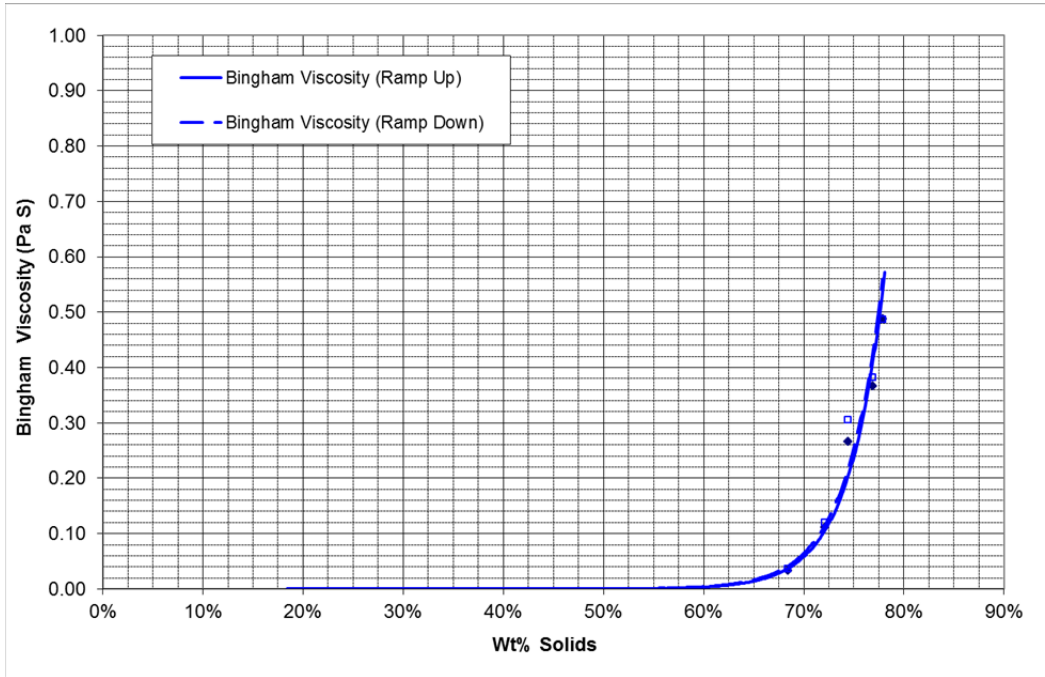


Figure 23: Bingham Viscosity Results – 13-1426-0010 CTP – GA13 – TP15

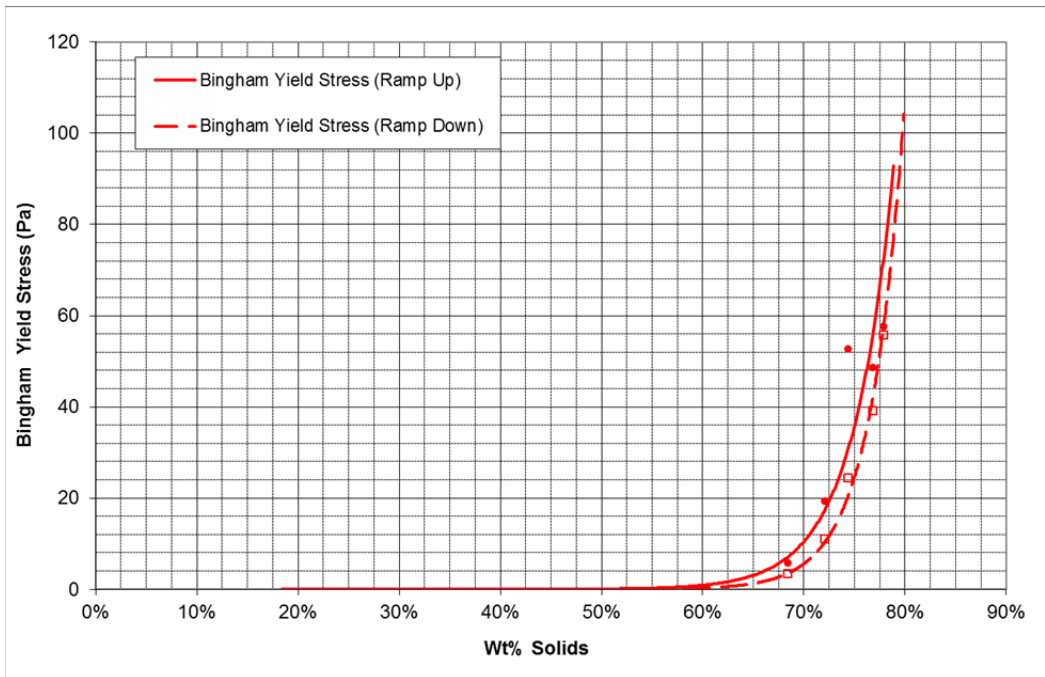


Figure 24: Bingham Yield Stress Results 13-1426-0010 - CPT-GA13-TP15



Table 8: Bingham Viscosity and Yield Stress Summary – 13-1426-0010 CTP-GA13-TP14-2

Wt% Solids	Bingham Yield Stress (Pa)		Bingham Viscosity (PaS)	
	Ramp Up	Ramp Down	Ramp Up	Ramp Down
71.5	600	529	1.448	1.617
70.4	417	396	1.041	1.090
69.2	296	288	0.666	0.698
68.1	204	204	0.415	0.433
66.3	124	124	0.198	0.205
63.1	55	54	0.066	0.069
59.9	23	23	0.030	0.031

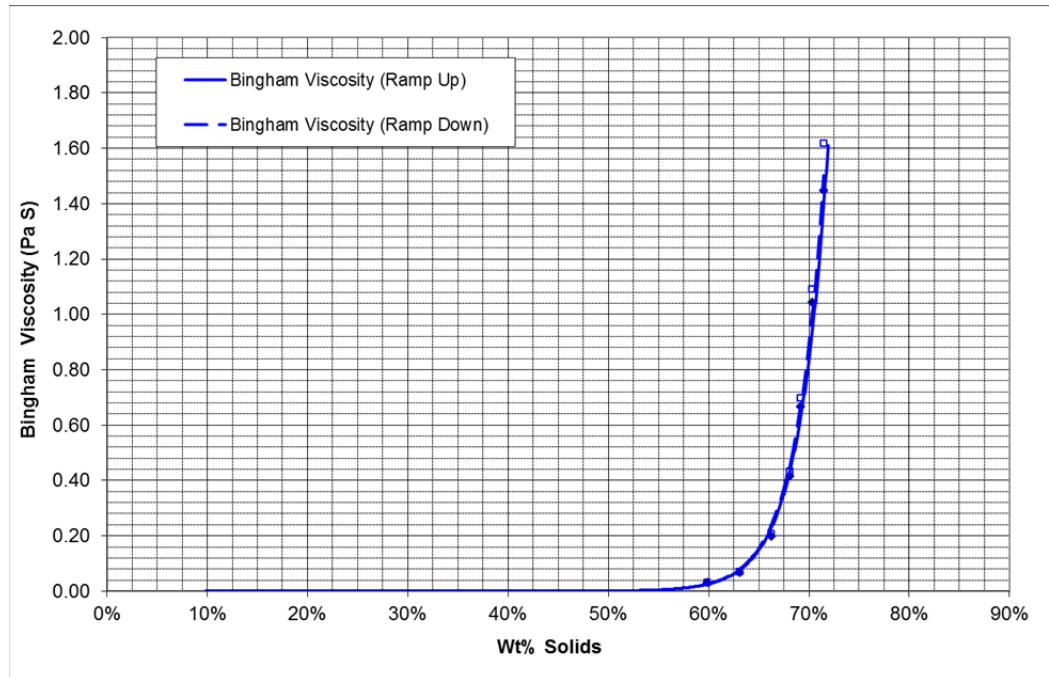


Figure 25: Bingham Viscosity Results – 13-1426-0010 CTP – GA13 – TP14-2



## GIANT MINE TAILINGS TESTING - SOUTH AND CENTRAL POND

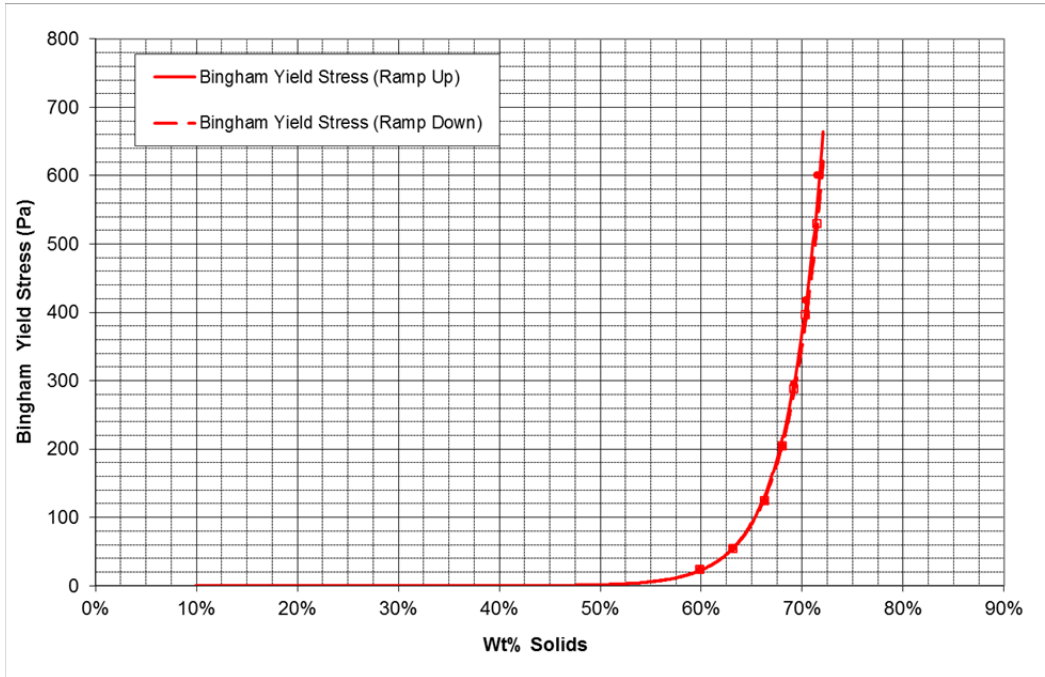


Figure 26: Bingham Yield Stress Results 13-1426-0010 - CPT-GA13-TP14-2

Table 9: Bingham Viscosity and Yield Stress Summary – 13-1426-0010 STP-GA13-TP27

Wt% Solids	Bingham Yield Stress (Pa)		Bingham Viscosity (PaS)	
	Ramp Up	Ramp Down	Ramp Up	Ramp Down
76.1	326	249	1.318	1.416
74.7	177	157	0.759	0.774
72.9	101	91	0.315	0.328
71.0	53	50	0.130	0.135
66.1	14	13	0.032	0.034

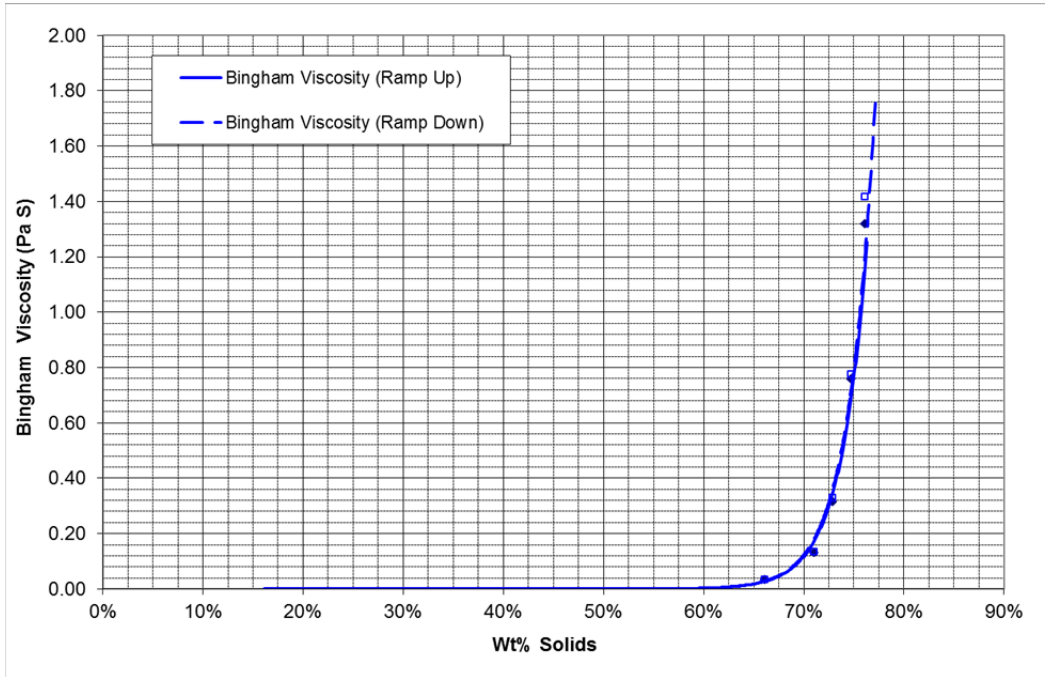


Figure 27: Bingham Viscosity Results – 13-1426-0010 STP – GA13 – TP27

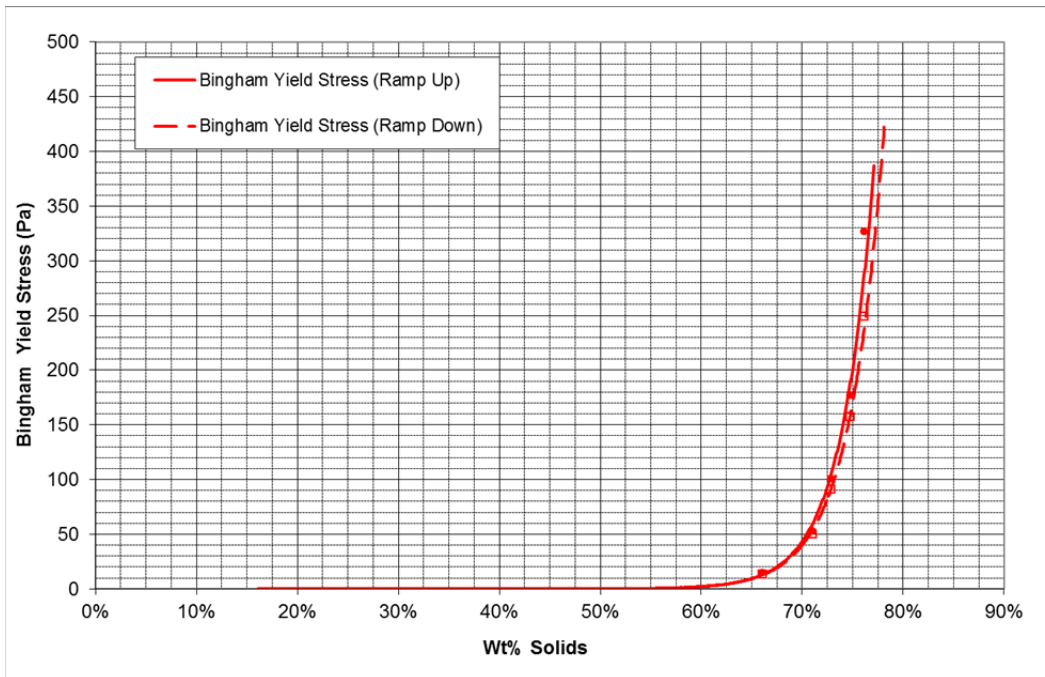


Figure 28: Bingham Yield Stress Results 13-1426-0010 - SPT-GA13-TP27



## GIANT MINE TAILINGS TESTING - SOUTH AND CENTRAL POND

Table 10: Bingham Viscosity and Yield Stress Summary – 13-1426-0010 SCTP-BS-Mixed (Silt-Sand-Clay)

Wt% Solids	Bingham Yield Stress (Pa)		Bingham Viscosity (PaS)	
	Ramp Up	Ramp Down	Ramp Up	Ramp Down
74.4	150	131	0.647	0.668
73.9	119	107	0.483	0.487
72.4	71	67	0.231	0.235
70.9	47	44	0.131	0.134
68.8	25	24	0.064	0.067
65.5	9	9	0.029	0.030

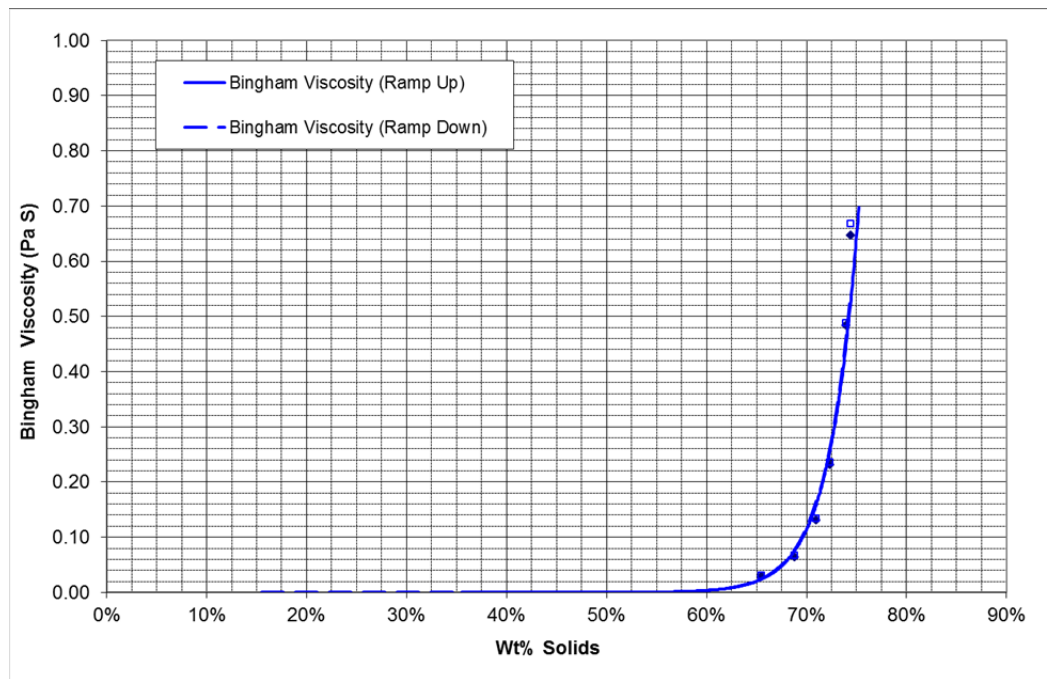


Figure 29: Bingham Viscosity Results –13-1426-0010 SCTP-BS-Mixed (Silt-Sand-Clay)



## GIANT MINE TAILINGS TESTING - SOUTH AND CENTRAL POND

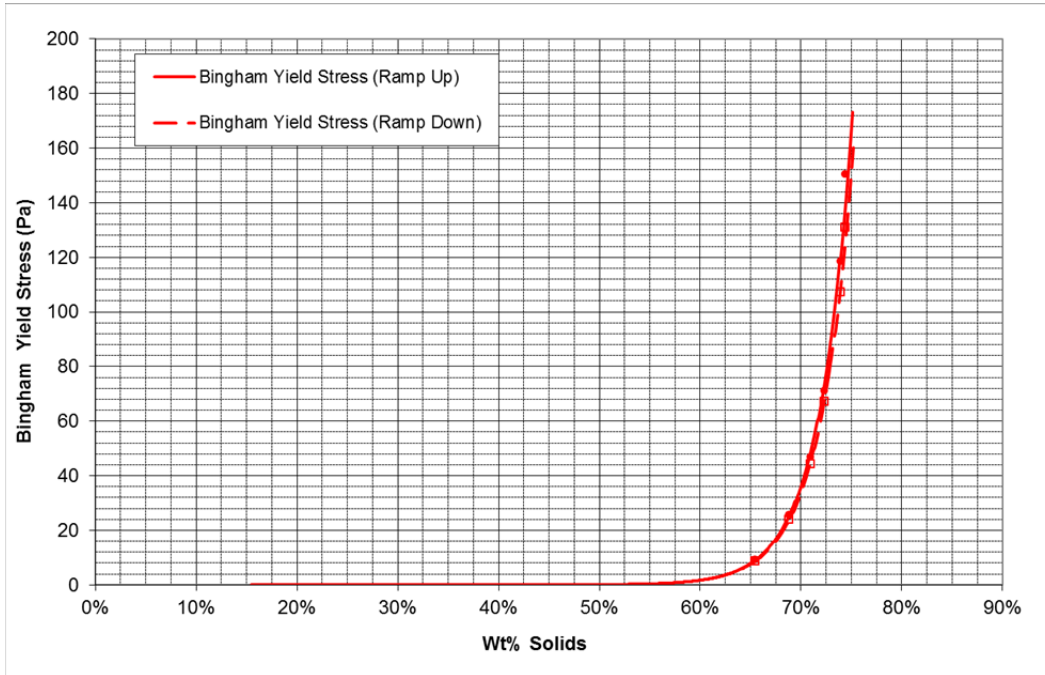


Figure 30: Bingham Yield Stress Results –13-1426-0010 SCTP-BS-Mixed (Silt-Sand-Clay)

Table 11: Bingham Viscosity and Yield Stress Summary – 13-1426-0010 SCTP – BS – Silty Sand

Wt% Solids	Bingham Yield Stress (Pa)		Bingham Viscosity (PaS)	
	Ramp Up	Ramp Down	Ramp Up	Ramp Down
76.8	156	86	0.740	0.859
76.4	112	68	0.561	0.628
74.6	55	38	0.272	0.293
73.0	33	22	0.135	0.149
71.3	18	13	0.072	0.080
69.5	10	8	0.045	0.049

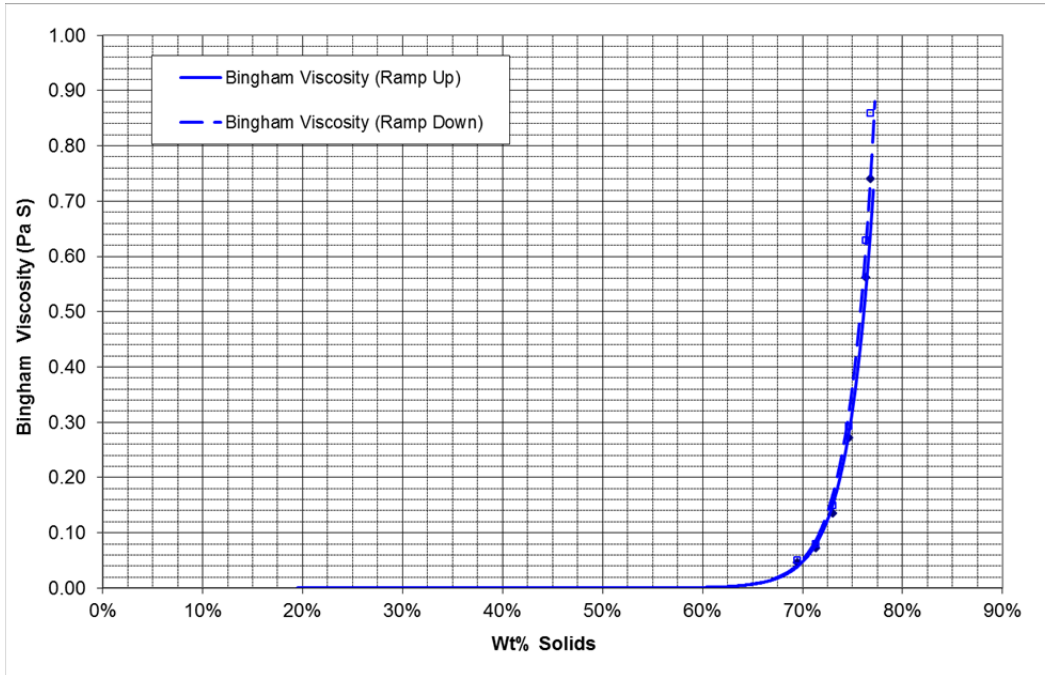


Figure 31: Bingham Viscosity Results –13-1426-0010 SCTP – BS - Silty Sand

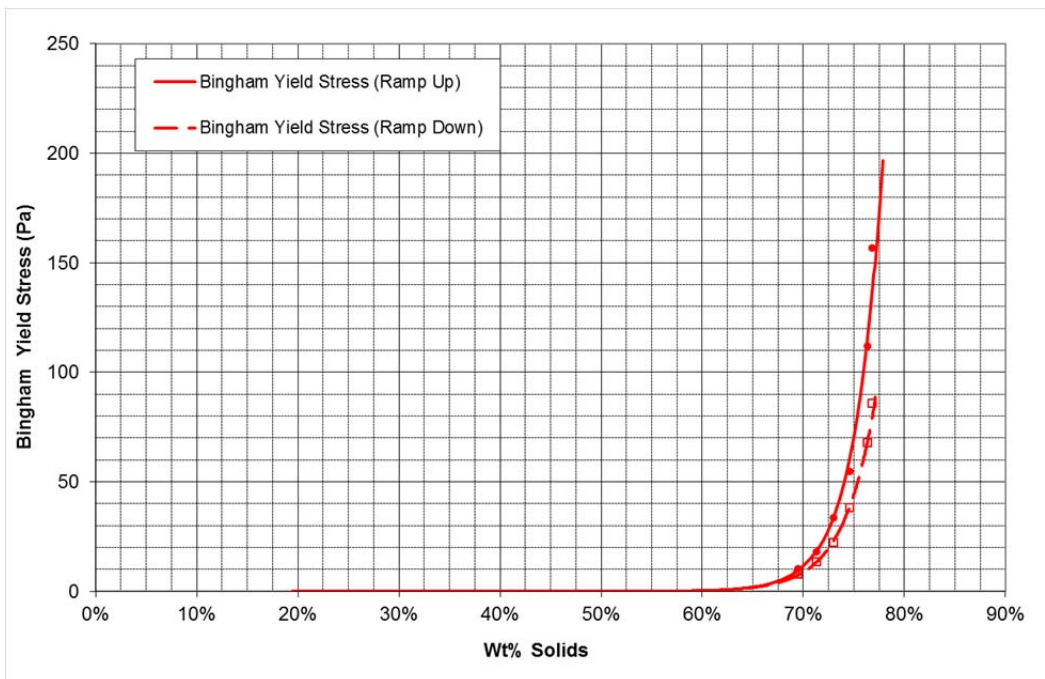


Figure 32: Bingham Yield Stress Results –13-1426-0010 SCTP-BS - Silty Sand

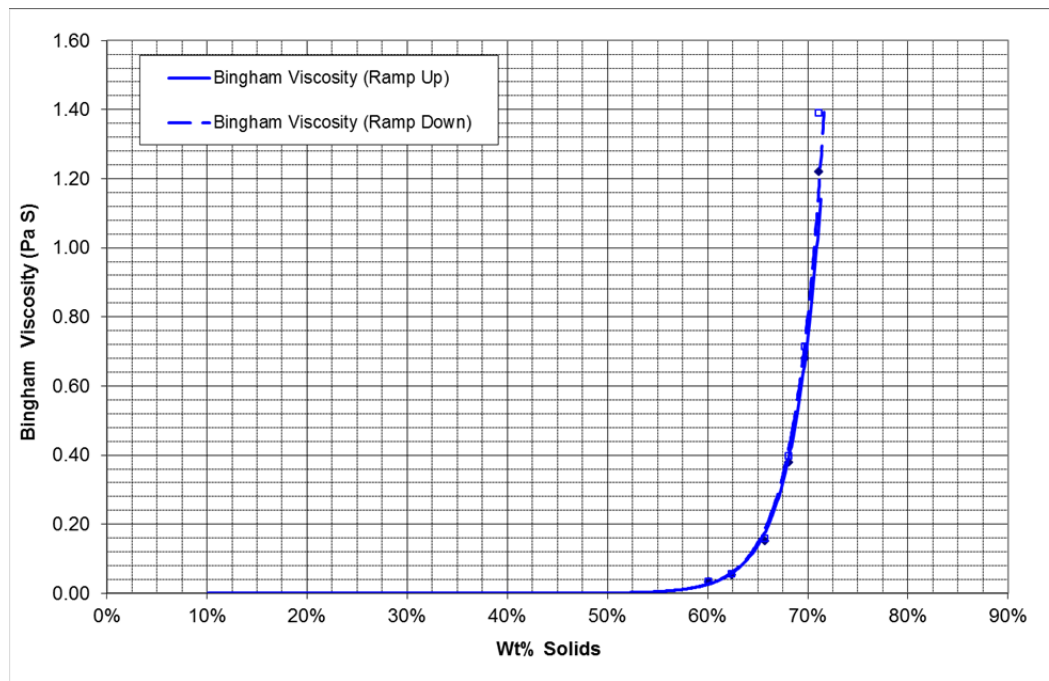




## GIANT MINE TAILINGS TESTING - SOUTH AND CENTRAL POND

**Table 12: Bingham Viscosity and Yield Stress Summary – 13-1426-0010 SCTP – BS – Clay - Silt**

Wt% Solids	Bingham Yield Stress (Pa)		Bingham Viscosity (PaS)	
	Ramp Up	Ramp Down	Ramp Up	Ramp Down
71.1	449	388	1.221	1.389
69.8	273	264	0.681	0.714
68.1	179	180	0.380	0.396
65.8	97	94	0.151	0.158
62.5	43	42	0.053	0.055
60.1	25	24	0.033	0.033



*Figure 33: Bingham Viscosity Results –13-1426-0010 SCTP – BS – Clay - Silt*

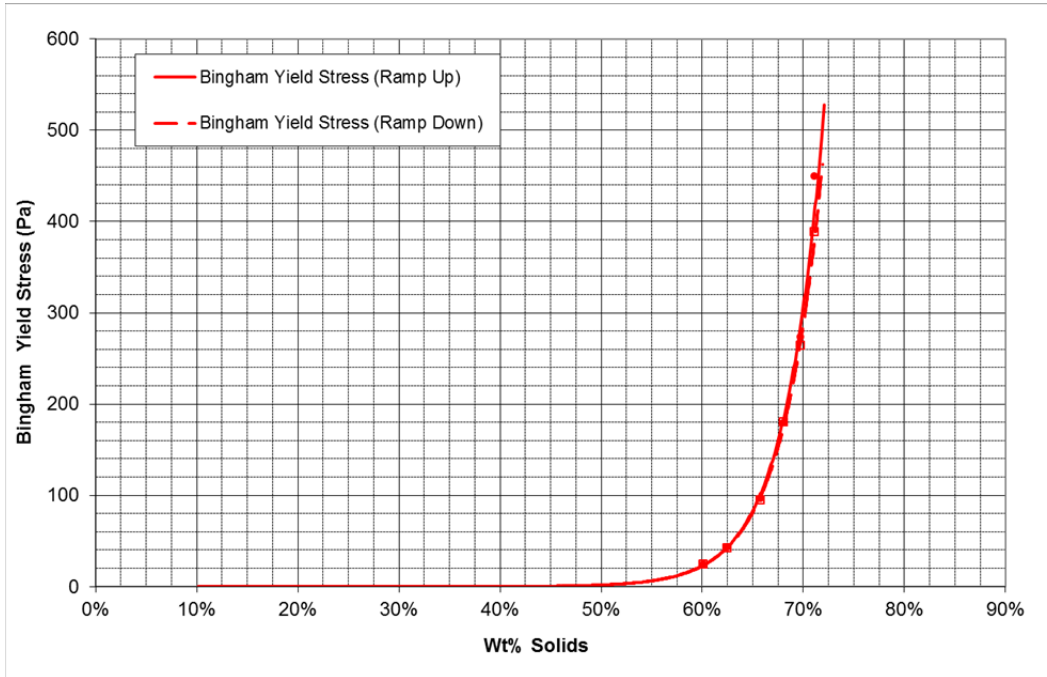


Figure 34: Bingham Yield Stress Results –13-1426-0010 SCTP-BS – Clay - Silt



## **5.0 CLOSURE**

If there are any questions regarding this report, please do not hesitate to contact the undersigned.

**GOLDER ASSOCIATES LTD.**

### **ORIGINAL SIGNED**

Mark Labelle  
Process Laboratory Manager

ML/SL/ds/md

### **ORIGINAL SIGNED**

Sue Longo, P.Eng.  
Associate / Mechanical Engineer



# **APPENDIX A**

## **ICP-MS Results**



# TESTMARK Laboratories Ltd.

Committed to Quality and Service

## Analytical Report

<b>Client:</b>	Mark Labelle	<b>Work Order Number:</b>	<b>199268</b>
<b>Company:</b>	Golder Associates Ltd - Paste Engineering Lab	<b>Date Order Received:</b>	12/2/2013
<b>Address:</b>	1010 Lorne St. Sudbury, ON, P3A 4S4	<b>Regulation:</b>	Information not provided
<b>Phone:</b>	(705) 524-6861	<b>PO #:</b>	
<b>Fax:</b>	(705) 524-9636	<b>Project #:</b>	13-1426-0010
<b>Email:</b>	mlabelle@golder.com		

Analyses were performed on the following samples submitted with your order.

The results relate only to the items tested.

Sample Name	Lab #	Matrix	Type	Comments	Date Collected	Time Collected
13-1426-0010 CTP - GA13-TP09	528822	Soil	Grab		11/27/2013	13:00
13-1426-0010 CTP - GA13-TP10	528823	Soil	Grab		11/28/2013	13:00
13-1426-0010 CTP - GA13-TP11	528824	Soil	Grab		11/29/2013	13:00
13-1426-0010 CTP - GA13-TP14-1	528825	Soil	Grab		11/30/2013	13:00
13-1426-0010 CTP - GA13-TP14-2	528826	Soil	Grab		12/1/2013	13:00
13-1426-0010 CTP - GA13-TP15	528827	Soil	Grab		11/27/2013	13:00
13-1426-0010 CTP - GA13-TP16	528828	Soil	Grab		11/27/2013	13:00
13-1426-0010 CTP - GA13-TP18	528829	Soil	Grab		11/27/2013	13:00
13-1426-0010 CTP - GA13-TP19	528830	Soil	Grab		11/27/2013	13:00
13-1426-0010 CTP - GA13-TP20	528831	Soil	Grab		11/27/2013	13:00
13-1426-0010 CTP - GA13-TP26	528832	Soil	Grab		11/27/2013	13:00
13-1426-0010 CTP - GA13-TP27	528833	Soil	Grab		11/27/2013	13:00
13-1426-0010 CTP - GA13-TP35	528834	Soil	Grab		11/27/2013	13:00
13-1426-0010 CTP - GA13-TP36	528835	Soil	Grab		11/27/2013	13:00
13-1426-0010 CTP - GA13-TP38	528836	Soil	Grab		11/27/2013	13:00
13-1426-0010 CTP - GA13-TP41	528837	Soil	Grab		11/27/2013	13:00
13-1426-0010 CTP - GA13-TP52	528838	Soil	Grab		11/27/2013	13:00

The following instrumentation and reference methods were used for your sample(s)

Method Name	Description	Reference
ICPMS Soil	Determination of Metals in Soil by ICP/MS and BCSALM Method Instrument group: Perkin Elmer ICPMS	Based on SW846-6020A

This report has been approved by:

Brad Woodward, H.B.Sc.  
Inorganic Section Head



# TESTMARK Laboratories Ltd.

Committed to Quality and Service

Golder Associates Ltd - Paste Engineering Lab

Work Order: 199268

## Sample Data:

Sample Name: 13-1426-0010 CTP - GA13-TP09 Date: 11/27/2013

Matrix: Soil

Lab #: 528822

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	19500	µg/g	20131204.R13na5
Antimony	5	321	µg/g	20131204.R13na5
Arsenic	5	2560	µg/g	20131204.R13na5
Barium	0.5	5.98	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	0.52	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	2.3	µg/g	20131204.R13na5
Cadmium	0.05	1.17	µg/g	20131204.R13na5
Calcium	30	53500	µg/g	20131204.R13na5
Cerium	0.5	8.62	µg/g	20131204.R13na5
Cesium	0.5	<0.5	µg/g	20131204.R13na5
Chromium	0.5	57	µg/g	20131204.R13na5
Cobalt	0.05	34.4	µg/g	20131204.R13na5
Copper	0.5	57.4	µg/g	20131204.R13na5
Europium	0.5	0.54	µg/g	20131204.R13na5
Gallium	0.5	5.7	µg/g	20131204.R13na5
Iron	100	59800	µg/g	20131204.R13na5
Lanthanum	0.5	4	µg/g	20131204.R13na5
Lead	0.5	209	µg/g	20131204.R13na5
Lithium	3	31.9	µg/g	20131204.R13na5
Magnesium	2	34200	µg/g	20131204.R13na5
Manganese	5	1210	µg/g	20131204.R13na5
Mercury	0.05	0.11	µg/g	20131204.R13na5
Molybdenum	0.5	0.98	µg/g	20131204.R13na5
Nickel	0.5	72.8	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5
Phosphorus	30	301	µg/g	20131204.R13na5
Potassium	10	539	µg/g	20131204.R13na5
Rubidium	0.5	2.5	µg/g	20131204.R13na5
Scandium	0.5	9.61	µg/g	20131204.R13na5
Selenium	0.5	<0.5	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5
Silver	0.5	0.85	µg/g	20131204.R13na5
Sodium	10	89	µg/g	20131204.R13na5
Strontium	0.5	37	µg/g	20131204.R13na5
Sulphur	400	4150	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5
Thorium	0.5	0.87	µg/g	20131204.R13na5
Tin	0.5	<0.5	µg/g	20131204.R13na5
Titanium	0.5	55.4	µg/g	20131204.R13na5
Tungsten	0.5	1.9	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	75.5	µg/g	20131204.R13na5

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12/9/2013

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# TESTMARK Laboratories Ltd.

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Golder Associates Ltd - Paste Engineering Lab

Work Order: 199268

**Sample Name:** 13-1426-0010 CTP - GA13-TP09 **Date:** 11/27/2013 **Matrix:** Soil **Lab #:** 528822

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Yttrium	0.5	6.22	µg/g	20131204.R13na5
Zinc	5	259	µg/g	20131204.R13na5
Zirconium	0.5	1.9	µg/g	20131204.R13na5

**Sample Name:** 13-1426-0010 CTP - GA13-TP10 **Date:** 11/28/2013 **Matrix:** Soil **Lab #:** 528823

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	24800	µg/g	20131204.R13na5
Antimony	5	288	µg/g	20131204.R13na5
Arsenic	5	2320	µg/g	20131204.R13na5
Barium	0.5	8.17	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	<0.5	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	3.1	µg/g	20131204.R13na5
Cadmium	0.05	1.42	µg/g	20131204.R13na5
Calcium	30	46000	µg/g	20131204.R13na5
Cerium	0.5	13.1	µg/g	20131204.R13na5
Cesium	0.5	<0.5	µg/g	20131204.R13na5
Chromium	0.5	68.2	µg/g	20131204.R13na5
Cobalt	0.05	27.6	µg/g	20131204.R13na5
Copper	0.5	40	µg/g	20131204.R13na5
Europium	0.5	0.52	µg/g	20131204.R13na5
Gallium	0.5	5.68	µg/g	20131204.R13na5
Iron	100	62800	µg/g	20131204.R13na5
Lanthanum	0.5	5.87	µg/g	20131204.R13na5
Lead	0.5	161	µg/g	20131204.R13na5
Lithium	3	29.2	µg/g	20131204.R13na5
Magnesium	2	30600	µg/g	20131204.R13na5
Manganese	5	1210	µg/g	20131204.R13na5
Mercury	0.05	0.15	µg/g	20131204.R13na5
Molybdenum	0.5	0.8	µg/g	20131204.R13na5
Nickel	0.5	65.1	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5
Phosphorus	30	318	µg/g	20131204.R13na5
Potassium	10	619	µg/g	20131204.R13na5
Rubidium	0.5	2.7	µg/g	20131204.R13na5
Scandium	0.5	9.05	µg/g	20131204.R13na5
Selenium	0.5	<0.5	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5
Silver	0.5	0.57	µg/g	20131204.R13na5
Sodium	10	86	µg/g	20131204.R13na5
Strontium	0.5	33.4	µg/g	20131204.R13na5
Sulphur	400	2550	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5

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# TESTMARK Laboratories Ltd.

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Golder Associates Ltd - Paste Engineering Lab

Work Order: 199268

Sample Name: 13-1426-0010 CTP - GA13-TP10 Date: 11/28/2013

Matrix: Soil

Lab #: 528823

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Thorium	0.5	0.84	µg/g	20131204.R13na5
Tin	0.5	<0.5	µg/g	20131204.R13na5
Titanium	0.5	42.4	µg/g	20131204.R13na5
Tungsten	0.5	1.8	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	75.1	µg/g	20131204.R13na5
Yttrium	0.5	5.57	µg/g	20131204.R13na5
Zinc	5	372	µg/g	20131204.R13na5
Zirconium	0.5	2	µg/g	20131204.R13na5

Sample Name: 13-1426-0010 CTP - GA13-TP11 Date: 11/29/2013

Matrix: Soil

Lab #: 528824

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	18700	µg/g	20131204.R13na5
Antimony	0.5	122	µg/g	20131204.R13na5
Arsenic	5	2450	µg/g	20131204.R13na5
Barium	0.5	4.7	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	<0.5	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	3.2	µg/g	20131204.R13na5
Cadmium	0.05	1.53	µg/g	20131204.R13na5
Calcium	30	49800	µg/g	20131204.R13na5
Cerium	0.5	7.19	µg/g	20131204.R13na5
Cesium	0.5	<0.5	µg/g	20131204.R13na5
Chromium	0.5	54.1	µg/g	20131204.R13na5
Cobalt	0.05	36	µg/g	20131204.R13na5
Copper	0.5	55.9	µg/g	20131204.R13na5
Europium	0.5	<0.5	µg/g	20131204.R13na5
Gallium	0.5	4.7	µg/g	20131204.R13na5
Iron	100	61100	µg/g	20131204.R13na5
Lanthanum	0.5	3.3	µg/g	20131204.R13na5
Lead	0.5	164	µg/g	20131204.R13na5
Lithium	3	26.4	µg/g	20131204.R13na5
Magnesium	2	29900	µg/g	20131204.R13na5
Manganese	5	1250	µg/g	20131204.R13na5
Mercury	0.05	0.15	µg/g	20131204.R13na5
Molybdenum	0.5	0.76	µg/g	20131204.R13na5
Nickel	0.5	72.8	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5
Phosphorus	30	313	µg/g	20131204.R13na5
Potassium	10	314	µg/g	20131204.R13na5
Rubidium	0.5	1.5	µg/g	20131204.R13na5
Scandium	0.5	7.99	µg/g	20131204.R13na5
Selenium	0.5	1.1	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5

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Work Order: 199268

Sample Name: 13-1426-0010 CTP - GA13-TP11 Date: 11/29/2013

Matrix: Soil

Lab #: 528824

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Silver	0.5	0.68	µg/g	20131204.R13na5
Sodium	10	49	µg/g	20131204.R13na5
Strontium	0.5	29.5	µg/g	20131204.R13na5
Sulphur	400	3550	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5
Thorium	0.5	0.52	µg/g	20131204.R13na5
Tin	0.5	<0.5	µg/g	20131204.R13na5
Titanium	0.5	67.2	µg/g	20131204.R13na5
Tungsten	0.5	1.1	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	66.9	µg/g	20131204.R13na5
Yttrium	0.5	5.14	µg/g	20131204.R13na5
Zinc	5	349	µg/g	20131204.R13na5
Zirconium	0.5	1.5	µg/g	20131204.R13na5

Sample Name: 13-1426-0010 CTP - GA13-TP14- Date: 11/30/2013

Matrix: Soil

Lab #: 528825

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	19700	µg/g	20131204.R13na5
Antimony	5	361	µg/g	20131204.R13na5
Arsenic	5	3160	µg/g	20131204.R13na5
Barium	0.5	4.5	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	<0.5	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	<1	µg/g	20131204.R13na5
Cadmium	0.05	1.4	µg/g	20131204.R13na5
Calcium	30	50300	µg/g	20131204.R13na5
Cerium	0.5	8.17	µg/g	20131204.R13na5
Cesium	0.5	<0.5	µg/g	20131204.R13na5
Chromium	0.5	53.2	µg/g	20131204.R13na5
Cobalt	0.05	48.2	µg/g	20131204.R13na5
Copper	0.5	67.1	µg/g	20131204.R13na5
Europium	0.5	0.52	µg/g	20131204.R13na5
Gallium	0.5	4.8	µg/g	20131204.R13na5
Iron	100	73000	µg/g	20131204.R13na5
Lanthanum	0.5	3.8	µg/g	20131204.R13na5
Lead	0.5	155	µg/g	20131204.R13na5
Lithium	3	25.3	µg/g	20131204.R13na5
Magnesium	2	29600	µg/g	20131204.R13na5
Manganese	5	1270	µg/g	20131204.R13na5
Mercury	0.05	0.18	µg/g	20131204.R13na5
Molybdenum	0.5	0.93	µg/g	20131204.R13na5
Nickel	0.5	92.1	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5

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Work Order: 199268

Sample Name: 13-1426-0010 CTP - GA13-TP14- Date: 11/30/2013

Matrix: Soil

Lab #: 528825

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Phosphorus	30	294	µg/g	20131204.R13na5
Potassium	10	249	µg/g	20131204.R13na5
Rubidium	0.5	1.3	µg/g	20131204.R13na5
Scandium	0.5	8.71	µg/g	20131204.R13na5
Selenium	0.5	<0.5	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5
Silver	0.5	0.8	µg/g	20131204.R13na5
Sodium	10	52	µg/g	20131204.R13na5
Strontium	0.5	31.8	µg/g	20131204.R13na5
Sulphur	400	4090	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5
Thorium	0.5	0.5	µg/g	20131204.R13na5
Tin	0.5	<0.5	µg/g	20131204.R13na5
Titanium	0.5	58.8	µg/g	20131204.R13na5
Tungsten	0.5	1.8	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	68.3	µg/g	20131204.R13na5
Yttrium	0.5	6.43	µg/g	20131204.R13na5
Zinc	5	331	µg/g	20131204.R13na5
Zirconium	0.5	1.4	µg/g	20131204.R13na5

Sample Name: 13-1426-0010 CTP - GA13-TP14- Date: 12/1/2013

Matrix: Soil

Lab #: 528826

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	22800	µg/g	20131204.R13na5
Antimony	0.5	116	µg/g	20131204.R13na5
Arsenic	5	2970	µg/g	20131204.R13na5
Barium	0.5	6.94	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	<0.5	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	1.7	µg/g	20131204.R13na5
Cadmium	0.05	2.59	µg/g	20131204.R13na5
Calcium	30	49500	µg/g	20131204.R13na5
Cerium	0.5	11.7	µg/g	20131204.R13na5
Cesium	0.5	<0.5	µg/g	20131204.R13na5
Chromium	0.5	79.8	µg/g	20131204.R13na5
Cobalt	0.05	34.8	µg/g	20131204.R13na5
Copper	0.5	69.6	µg/g	20131204.R13na5
Europium	0.5	<0.5	µg/g	20131204.R13na5
Gallium	0.5	5.41	µg/g	20131204.R13na5
Iron	100	60900	µg/g	20131204.R13na5
Lanthanum	0.5	5.46	µg/g	20131204.R13na5
Lead	0.5	219	µg/g	20131204.R13na5
Lithium	3	31.2	µg/g	20131204.R13na5

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Work Order: 199268

Sample Name: 13-1426-0010 CTP - GA13-TP14- Date: 12/1/2013

Matrix: Soil

Lab #: 528826

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Magnesium	2	29200	µg/g	20131204.R13na5
Manganese	5	1190	µg/g	20131204.R13na5
Mercury	0.05	0.32	µg/g	20131204.R13na5
Molybdenum	0.5	0.91	µg/g	20131204.R13na5
Nickel	0.5	83.8	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5
Phosphorus	30	342	µg/g	20131204.R13na5
Potassium	10	533	µg/g	20131204.R13na5
Rubidium	0.5	2.3	µg/g	20131204.R13na5
Scandium	0.5	9.09	µg/g	20131204.R13na5
Selenium	0.5	<0.5	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5
Silver	0.5	0.56	µg/g	20131204.R13na5
Sodium	10	81	µg/g	20131204.R13na5
Strontium	0.5	39	µg/g	20131204.R13na5
Sulphur	400	4140	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5
Thorium	0.5	0.71	µg/g	20131204.R13na5
Tin	0.5	<0.5	µg/g	20131204.R13na5
Titanium	0.5	40.6	µg/g	20131204.R13na5
Tungsten	0.5	0.83	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	72.6	µg/g	20131204.R13na5
Yttrium	0.5	4.4	µg/g	20131204.R13na5
Zinc	5	524	µg/g	20131204.R13na5
Zirconium	0.5	2.4	µg/g	20131204.R13na5

Sample Name: 13-1426-0010 CTP - GA13-TP15 Date: 11/27/2013

Matrix: Soil

Lab #: 528827

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	16600	µg/g	20131204.R13na5
Antimony	5	363	µg/g	20131204.R13na5
Arsenic	5	3180	µg/g	20131204.R13na5
Barium	0.5	3.2	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	<0.5	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	1.8	µg/g	20131204.R13na5
Cadmium	0.05	1.21	µg/g	20131204.R13na5
Calcium	30	54500	µg/g	20131204.R13na5
Cerium	0.5	7.14	µg/g	20131204.R13na5
Cesium	0.5	<0.5	µg/g	20131204.R13na5
Chromium	0.5	45.7	µg/g	20131204.R13na5
Cobalt	0.05	45.9	µg/g	20131204.R13na5
Copper	0.5	63	µg/g	20131204.R13na5

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Work Order: 199268

Sample Name: 13-1426-0010 CTP - GA13-TP15 Date: 11/27/2013

Matrix: Soil

Lab #: 528827

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Europium	0.5	0.54	µg/g	20131204.R13na5
Gallium	0.5	4.3	µg/g	20131204.R13na5
Iron	100	67400	µg/g	20131204.R13na5
Lanthanum	0.5	3.2	µg/g	20131204.R13na5
Lead	0.5	189	µg/g	20131204.R13na5
Lithium	3	25.9	µg/g	20131204.R13na5
Magnesium	2	30100	µg/g	20131204.R13na5
Manganese	5	1230	µg/g	20131204.R13na5
Mercury	0.05	0.14	µg/g	20131204.R13na5
Molybdenum	0.5	0.94	µg/g	20131204.R13na5
Nickel	0.5	88.8	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5
Phosphorus	30	269	µg/g	20131204.R13na5
Potassium	10	259	µg/g	20131204.R13na5
Rubidium	0.5	1.4	µg/g	20131204.R13na5
Scandium	0.5	7.94	µg/g	20131204.R13na5
Selenium	0.5	<0.5	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5
Silver	0.5	0.82	µg/g	20131204.R13na5
Sodium	10	65	µg/g	20131204.R13na5
Strontium	0.5	35.9	µg/g	20131204.R13na5
Sulphur	400	4820	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5
Thorium	0.5	<0.5	µg/g	20131204.R13na5
Tin	0.5	<0.5	µg/g	20131204.R13na5
Titanium	0.5	66.3	µg/g	20131204.R13na5
Tungsten	0.5	2.1	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	60.4	µg/g	20131204.R13na5
Yttrium	0.5	6.02	µg/g	20131204.R13na5
Zinc	5	228	µg/g	20131204.R13na5
Zirconium	0.5	1.4	µg/g	20131204.R13na5

Sample Name: 13-1426-0010 CTP - GA13-TP16 Date: 11/27/2013

Matrix: Soil

Lab #: 528828

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	18400	µg/g	20131204.R13na5
Antimony	5	271	µg/g	20131204.R13na5
Arsenic	5	3050	µg/g	20131204.R13na5
Barium	0.5	3.8	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	<0.5	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	1.8	µg/g	20131204.R13na5
Cadmium	0.05	1.04	µg/g	20131204.R13na5

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Work Order: 199268

Sample Name: 13-1426-0010 CTP - GA13-TP16 Date: 11/27/2013

Matrix: Soil

Lab #: 528828

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Calcium	30	62200	µg/g	20131204.R13na5
Cerium	0.5	8.76	µg/g	20131204.R13na5
Cesium	0.5	<0.5	µg/g	20131204.R13na5
Chromium	0.5	49.7	µg/g	20131204.R13na5
Cobalt	0.05	41	µg/g	20131204.R13na5
Copper	0.5	57	µg/g	20131204.R13na5
Europium	0.5	0.6	µg/g	20131204.R13na5
Gallium	0.5	4.6	µg/g	20131204.R13na5
Iron	100	67800	µg/g	20131204.R13na5
Lanthanum	0.5	3.9	µg/g	20131204.R13na5
Lead	0.5	175	µg/g	20131204.R13na5
Lithium	3	28.7	µg/g	20131204.R13na5
Magnesium	2	32700	µg/g	20131204.R13na5
Manganese	5	1410	µg/g	20131204.R13na5
Mercury	0.05	0.11	µg/g	20131204.R13na5
Molybdenum	0.5	0.8	µg/g	20131204.R13na5
Nickel	0.5	79.8	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5
Phosphorus	30	300	µg/g	20131204.R13na5
Potassium	10	294	µg/g	20131204.R13na5
Rubidium	0.5	1.4	µg/g	20131204.R13na5
Scandium	0.5	8.96	µg/g	20131204.R13na5
Selenium	0.5	<0.5	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5
Silver	0.5	0.8	µg/g	20131204.R13na5
Sodium	10	80	µg/g	20131204.R13na5
Strontium	0.5	37.3	µg/g	20131204.R13na5
Sulphur	400	3860	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5
Thorium	0.5	<0.5	µg/g	20131204.R13na5
Tin	0.5	<0.5	µg/g	20131204.R13na5
Titanium	0.5	65	µg/g	20131204.R13na5
Tungsten	0.5	2.1	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	67.9	µg/g	20131204.R13na5
Yttrium	0.5	6.59	µg/g	20131204.R13na5
Zinc	5	266	µg/g	20131204.R13na5
Zirconium	0.5	1.6	µg/g	20131204.R13na5

Sample Name: 13-1426-0010 CTP - GA13-TP18 Date: 11/27/2013

Matrix: Soil

Lab #: 528829

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	20600	µg/g	20131204.R13na5
Antimony	5	335	µg/g	20131204.R13na5

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Work Order: 199268

Sample Name: 13-1426-0010 CTP - GA13-TP18 Date: 11/27/2013

Matrix: Soil

Lab #: 528829

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Arsenic	5	3220	µg/g	20131204.R13na5
Barium	0.5	4.8	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	<0.5	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	2.7	µg/g	20131204.R13na5
Cadmium	0.05	1.87	µg/g	20131204.R13na5
Calcium	30	52200	µg/g	20131204.R13na5
Cerium	0.5	8.63	µg/g	20131204.R13na5
Cesium	0.5	<0.5	µg/g	20131204.R13na5
Chromium	0.5	55.1	µg/g	20131204.R13na5
Cobalt	0.05	48	µg/g	20131204.R13na5
Copper	0.5	66.7	µg/g	20131204.R13na5
Europium	0.5	<0.5	µg/g	20131204.R13na5
Gallium	0.5	4.7	µg/g	20131204.R13na5
Iron	100	75500	µg/g	20131204.R13na5
Lanthanum	0.5	3.9	µg/g	20131204.R13na5
Lead	0.5	188	µg/g	20131204.R13na5
Lithium	3	26.7	µg/g	20131204.R13na5
Magnesium	2	30700	µg/g	20131204.R13na5
Manganese	5	1320	µg/g	20131204.R13na5
Mercury	0.05	0.23	µg/g	20131204.R13na5
Molybdenum	0.5	0.86	µg/g	20131204.R13na5
Nickel	0.5	91.7	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5
Phosphorus	30	314	µg/g	20131204.R13na5
Potassium	10	339	µg/g	20131204.R13na5
Rubidium	0.5	1.6	µg/g	20131204.R13na5
Scandium	0.5	8.56	µg/g	20131204.R13na5
Selenium	0.5	<0.5	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5
Silver	0.5	0.89	µg/g	20131204.R13na5
Sodium	10	58	µg/g	20131204.R13na5
Strontium	0.5	33.4	µg/g	20131204.R13na5
Sulphur	400	4810	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5
Thorium	0.5	<0.5	µg/g	20131204.R13na5
Tin	0.5	<0.5	µg/g	20131204.R13na5
Titanium	0.5	56.5	µg/g	20131204.R13na5
Tungsten	0.5	1.7	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	67.2	µg/g	20131204.R13na5
Yttrium	0.5	5.88	µg/g	20131204.R13na5
Zinc	5	394	µg/g	20131204.R13na5
Zirconium	0.5	1.7	µg/g	20131204.R13na5

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Golder Associates Ltd - Paste Engineering Lab

Work Order: 199268

Sample Name: 13-1426-0010 CTP - GA13-TP19 Date: 11/27/2013

Matrix: Soil

Lab #: 528830

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	13200	µg/g	20131204.R13na5
Antimony	5	387	µg/g	20131204.R13na5
Arsenic	5	2920	µg/g	20131204.R13na5
Barium	0.5	3.9	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	0.58	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	1.1	µg/g	20131204.R13na5
Cadmium	0.05	1.48	µg/g	20131204.R13na5
Calcium	30	55800	µg/g	20131204.R13na5
Cerium	0.5	7.17	µg/g	20131204.R13na5
Cesium	0.5	<0.5	µg/g	20131204.R13na5
Chromium	0.5	38.9	µg/g	20131204.R13na5
Cobalt	0.05	40.2	µg/g	20131204.R13na5
Copper	0.5	60	µg/g	20131204.R13na5
Europium	0.5	<0.5	µg/g	20131204.R13na5
Gallium	0.5	3.6	µg/g	20131204.R13na5
Iron	100	62400	µg/g	20131204.R13na5
Lanthanum	0.5	3.2	µg/g	20131204.R13na5
Lead	0.5	248	µg/g	20131204.R13na5
Lithium	3	19.4	µg/g	20131204.R13na5
Magnesium	2	30200	µg/g	20131204.R13na5
Manganese	5	1290	µg/g	20131204.R13na5
Mercury	0.05	0.097	µg/g	20131204.R13na5
Molybdenum	0.5	1.2	µg/g	20131204.R13na5
Nickel	0.5	74.7	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5
Phosphorus	30	256	µg/g	20131204.R13na5
Potassium	10	315	µg/g	20131204.R13na5
Rubidium	0.5	1.5	µg/g	20131204.R13na5
Scandium	0.5	7.26	µg/g	20131204.R13na5
Selenium	0.5	<0.5	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5
Silver	0.5	1.1	µg/g	20131204.R13na5
Sodium	10	136	µg/g	20131204.R13na5
Strontium	0.5	37	µg/g	20131204.R13na5
Sulphur	400	3950	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5
Thorium	0.5	<0.5	µg/g	20131204.R13na5
Tin	0.5	<0.5	µg/g	20131204.R13na5
Titanium	0.5	68.3	µg/g	20131204.R13na5
Tungsten	0.5	1.5	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	52.1	µg/g	20131204.R13na5
Yttrium	0.5	5.72	µg/g	20131204.R13na5
Zinc	5	311	µg/g	20131204.R13na5

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Golder Associates Ltd - Paste Engineering Lab

Work Order: 199268

**Sample Name:** 13-1426-0010 CTP - GA13-TP19 **Date:** 11/27/2013 **Matrix:** Soil **Lab #:** 528830

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Zirconium	0.5	2	µg/g	20131204.R13na5

**Sample Name:** 13-1426-0010 CTP - GA13-TP20 **Date:** 11/27/2013 **Matrix:** Soil **Lab #:** 528831

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	18300	µg/g	20131204.R13na5
Antimony	5	333	µg/g	20131204.R13na5
Arsenic	5	2970	µg/g	20131204.R13na5
Barium	0.5	5.46	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	0.56	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	1.7	µg/g	20131204.R13na5
Cadmium	0.05	1.38	µg/g	20131204.R13na5
Calcium	30	49200	µg/g	20131204.R13na5
Cerium	0.5	7.79	µg/g	20131204.R13na5
Cesium	0.5	<0.5	µg/g	20131204.R13na5
Chromium	0.5	47.1	µg/g	20131204.R13na5
Cobalt	0.05	36.9	µg/g	20131204.R13na5
Copper	0.5	62.9	µg/g	20131204.R13na5
Europium	0.5	<0.5	µg/g	20131204.R13na5
Gallium	0.5	4.3	µg/g	20131204.R13na5
Iron	100	63800	µg/g	20131204.R13na5
Lanthanum	0.5	3.6	µg/g	20131204.R13na5
Lead	0.5	218	µg/g	20131204.R13na5
Lithium	3	25.2	µg/g	20131204.R13na5
Magnesium	2	29000	µg/g	20131204.R13na5
Manganese	5	1210	µg/g	20131204.R13na5
Mercury	0.05	0.093	µg/g	20131204.R13na5
Molybdenum	0.5	1.1	µg/g	20131204.R13na5
Nickel	0.5	74.4	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5
Phosphorus	30	271	µg/g	20131204.R13na5
Potassium	10	449	µg/g	20131204.R13na5
Rubidium	0.5	2.2	µg/g	20131204.R13na5
Scandium	0.5	8.02	µg/g	20131204.R13na5
Selenium	0.5	<0.5	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5
Silver	0.5	1	µg/g	20131204.R13na5
Sodium	10	94	µg/g	20131204.R13na5
Strontium	0.5	34.1	µg/g	20131204.R13na5
Sulphur	400	3650	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5
Thorium	0.5	<0.5	µg/g	20131204.R13na5
Tin	0.5	<0.5	µg/g	20131204.R13na5

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Work Order: 199268

**Sample Name:** 13-1426-0010 CTP - GA13-TP20 **Date:** 11/27/2013 **Matrix:** Soil **Lab #:** 528831

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Titanium	0.5	52.3	µg/g	20131204.R13na5
Tungsten	0.5	1.4	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	60.7	µg/g	20131204.R13na5
Yttrium	0.5	5.53	µg/g	20131204.R13na5
Zinc	5	296	µg/g	20131204.R13na5
Zirconium	0.5	2	µg/g	20131204.R13na5

**Sample Name:** 13-1426-0010 CTP - GA13-TP26 **Date:** 11/27/2013 **Matrix:** Soil **Lab #:** 528832

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	24100	µg/g	20131204.R13na5
Antimony	0.5	139	µg/g	20131204.R13na5
Arsenic	5	2340	µg/g	20131204.R13na5
Barium	0.5	5.85	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	<0.5	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	1.5	µg/g	20131204.R13na5
Cadmium	0.05	1.83	µg/g	20131204.R13na5
Calcium	30	52700	µg/g	20131204.R13na5
Cerium	0.5	9.78	µg/g	20131204.R13na5
Cesium	0.5	<0.5	µg/g	20131204.R13na5
Chromium	0.5	79.2	µg/g	20131204.R13na5
Cobalt	0.05	37.1	µg/g	20131204.R13na5
Copper	0.5	53.3	µg/g	20131204.R13na5
Europium	0.5	0.52	µg/g	20131204.R13na5
Gallium	0.5	6.24	µg/g	20131204.R13na5
Iron	100	62700	µg/g	20131204.R13na5
Lanthanum	0.5	4.4	µg/g	20131204.R13na5
Lead	0.5	169	µg/g	20131204.R13na5
Lithium	3	37.3	µg/g	20131204.R13na5
Magnesium	2	32400	µg/g	20131204.R13na5
Manganese	5	1220	µg/g	20131204.R13na5
Mercury	0.05	0.16	µg/g	20131204.R13na5
Molybdenum	0.5	0.94	µg/g	20131204.R13na5
Nickel	0.5	84.4	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5
Phosphorus	30	331	µg/g	20131204.R13na5
Potassium	10	523	µg/g	20131204.R13na5
Rubidium	0.5	2.3	µg/g	20131204.R13na5
Scandium	0.5	10.5	µg/g	20131204.R13na5
Selenium	0.5	<0.5	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5
Silver	0.5	0.67	µg/g	20131204.R13na5
Sodium	10	94	µg/g	20131204.R13na5

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Work Order: 199268

**Sample Name:** 13-1426-0010 CTP - GA13-TP26 **Date:** 11/27/2013 **Matrix:** Soil **Lab #:** 528832

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Strontium	0.5	37.6	µg/g	20131204.R13na5
Sulphur	400	3880	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5
Thorium	0.5	<0.5	µg/g	20131204.R13na5
Tin	0.5	<0.5	µg/g	20131204.R13na5
Titanium	0.5	54.3	µg/g	20131204.R13na5
Tungsten	0.5	1	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	86.1	µg/g	20131204.R13na5
Yttrium	0.5	5.6	µg/g	20131204.R13na5
Zinc	5	403	µg/g	20131204.R13na5
Zirconium	0.5	2.2	µg/g	20131204.R13na5

**Sample Name:** 13-1426-0010 CTP - GA13-TP27 **Date:** 11/27/2013 **Matrix:** Soil **Lab #:** 528833

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	18800	µg/g	20131204.R13na5
Antimony	5	451	µg/g	20131204.R13na5
Arsenic	5	2810	µg/g	20131204.R13na5
Barium	0.5	4.7	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	<0.5	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	2.5	µg/g	20131204.R13na5
Cadmium	0.05	1.82	µg/g	20131204.R13na5
Calcium	30	64000	µg/g	20131204.R13na5
Cerium	0.5	10.8	µg/g	20131204.R13na5
Cesium	0.5	<0.5	µg/g	20131204.R13na5
Chromium	0.5	55.2	µg/g	20131204.R13na5
Cobalt	0.05	42.8	µg/g	20131204.R13na5
Copper	0.5	67.6	µg/g	20131204.R13na5
Europium	0.5	0.53	µg/g	20131204.R13na5
Gallium	0.5	5.02	µg/g	20131204.R13na5
Iron	100	71600	µg/g	20131204.R13na5
Lanthanum	0.5	4.9	µg/g	20131204.R13na5
Lead	0.5	340	µg/g	20131204.R13na5
Lithium	3	26.4	µg/g	20131204.R13na5
Magnesium	2	27500	µg/g	20131204.R13na5
Manganese	5	1420	µg/g	20131204.R13na5
Mercury	0.05	0.23	µg/g	20131204.R13na5
Molybdenum	0.5	0.83	µg/g	20131204.R13na5
Nickel	0.5	79.5	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5
Phosphorus	30	357	µg/g	20131204.R13na5
Potassium	10	365	µg/g	20131204.R13na5

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Work Order: 199268

Sample Name: 13-1426-0010 CTP - GA13-TP27 Date: 11/27/2013

Matrix: Soil

Lab #: 528833

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Rubidium	0.5	1.7	µg/g	20131204.R13na5
Scandium	0.5	7.95	µg/g	20131204.R13na5
Selenium	0.5	<0.5	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5
Silver	0.5	0.85	µg/g	20131204.R13na5
Sodium	10	54	µg/g	20131204.R13na5
Strontium	0.5	46.6	µg/g	20131204.R13na5
Sulphur	400	3710	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5
Thorium	0.5	0.63	µg/g	20131204.R13na5
Tin	0.5	<0.5	µg/g	20131204.R13na5
Titanium	0.5	63.7	µg/g	20131204.R13na5
Tungsten	0.5	1.2	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	65.9	µg/g	20131204.R13na5
Yttrium	0.5	4.6	µg/g	20131204.R13na5
Zinc	5	434	µg/g	20131204.R13na5
Zirconium	0.5	2.9	µg/g	20131204.R13na5

Sample Name: 13-1426-0010 CTP - GA13-TP35 Date: 11/27/2013

Matrix: Soil

Lab #: 528834

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	18400	µg/g	20131204.R13na5
Aluminum (Dup)	5	19600	µg/g	20131204.R13na5
Antimony	5	462	µg/g	20131204.R13na5
Antimony (Dup)	5	496	µg/g	20131204.R13na5
Arsenic	5	2910	µg/g	20131204.R13na5
Arsenic (Dup)	5	3100	µg/g	20131204.R13na5
Barium	0.5	6.12	µg/g	20131204.R13na5
Barium (Dup)	0.5	6.1	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Beryllium (Dup)	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	<0.5	µg/g	20131204.R13na5
Bismuth (Dup)	0.5	<0.5	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	1.1	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable) (Dup)	1	1.4	µg/g	20131204.R13na5
Cadmium	0.05	1.42	µg/g	20131204.R13na5
Cadmium (Dup)	0.05	1.41	µg/g	20131204.R13na5
Calcium	30	46800	µg/g	20131204.R13na5
Calcium (Dup)	30	54800	µg/g	20131204.R13na5
Cerium	0.5	9.5	µg/g	20131204.R13na5
Cerium (Dup)	0.5	9.59	µg/g	20131204.R13na5
Cesium	0.5	<0.5	µg/g	20131204.R13na5
Cesium (Dup)	0.5	<0.5	µg/g	20131204.R13na5

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Work Order: 199268

Sample Name: 13-1426-0010 CTP - GA13-TP35 Date: 11/27/2013

Matrix: Soil

Lab #: 528834

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Chromium	0.5	51.1	µg/g	20131204.R13na5
Chromium (Dup)	0.5	59.8	µg/g	20131204.R13na5
Cobalt	0.05	49.7	µg/g	20131204.R13na5
Cobalt (Dup)	0.05	57.4	µg/g	20131204.R13na5
Copper	5	139	µg/g	20131204.R13na5
Copper (Dup)	5	154	µg/g	20131204.R13na5
Europium	0.5	<0.5	µg/g	20131204.R13na5
Europium (Dup)	0.5	<0.5	µg/g	20131204.R13na5
Gallium	0.5	4.6	µg/g	20131204.R13na5
Gallium (Dup)	0.5	5.34	µg/g	20131204.R13na5
Iron	100	81000	µg/g	20131204.R13na5
Iron (Dup)	100	86800	µg/g	20131204.R13na5
Lanthanum	0.5	4.2	µg/g	20131204.R13na5
Lanthanum (Dup)	0.5	4.4	µg/g	20131204.R13na5
Lead	0.5	328	µg/g	20131204.R13na5
Lead (Dup)	0.5	358	µg/g	20131204.R13na5
Lithium	3	24.1	µg/g	20131204.R13na5
Lithium (Dup)	3	28.4	µg/g	20131204.R13na5
Magnesium	2	25000	µg/g	20131204.R13na5
Magnesium (Dup)	2	28600	µg/g	20131204.R13na5
Manganese	5	1320	µg/g	20131204.R13na5
Manganese (Dup)	5	1410	µg/g	20131204.R13na5
Mercury	0.05	0.24	µg/g	20131204.R13na5
Mercury (Dup)	0.05	0.21	µg/g	20131204.R13na5
Molybdenum	0.5	0.95	µg/g	20131204.R13na5
Molybdenum (Dup)	0.5	1.1	µg/g	20131204.R13na5
Nickel	0.5	94.5	µg/g	20131204.R13na5
Nickel (Dup)	5	105	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5
Niobium (Dup)	0.5	<0.5	µg/g	20131204.R13na5
Phosphorus	30	287	µg/g	20131204.R13na5
Phosphorus (Dup)	30	332	µg/g	20131204.R13na5
Potassium	10	316	µg/g	20131204.R13na5
Potassium (Dup)	10	367	µg/g	20131204.R13na5
Rubidium	0.5	1.7	µg/g	20131204.R13na5
Rubidium (Dup)	0.5	2	µg/g	20131204.R13na5
Scandium	0.5	7.33	µg/g	20131204.R13na5
Scandium (Dup)	0.5	8.67	µg/g	20131204.R13na5
Selenium	0.5	<0.5	µg/g	20131204.R13na5
Selenium (Dup)	0.5	<0.5	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5
Silicon (Dup)	300	<300	µg/g	20131204.R13na5
Silver	0.5	1.5	µg/g	20131204.R13na5
Silver (Dup)	0.5	1.7	µg/g	20131204.R13na5
Sodium	10	33	µg/g	20131204.R13na5
Sodium (Dup)	10	48	µg/g	20131204.R13na5

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# TESTMARK Laboratories Ltd.

Committed to Quality and Service

Golder Associates Ltd - Paste Engineering Lab

Work Order: 199268

Sample Name: 13-1426-0010 CTP - GA13-TP35 Date: 11/27/2013

Matrix: Soil

Lab #: 528834

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Strontium	0.5	38.4	µg/g	20131204.R13na5
Strontium (Dup)	0.5	45.3	µg/g	20131204.R13na5
Sulphur	400	2280	µg/g	20131204.R13na5
Sulphur (Dup)	400	3610	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Tellurium (Dup)	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5
Thallium (Dup)	0.3	<0.3	µg/g	20131204.R13na5
Thorium	0.5	0.57	µg/g	20131204.R13na5
Thorium (Dup)	0.5	0.6	µg/g	20131204.R13na5
Tin	0.5	<0.5	µg/g	20131204.R13na5
Tin (Dup)	0.5	<0.5	µg/g	20131204.R13na5
Titanium	0.5	70.6	µg/g	20131204.R13na5
Titanium (Dup)	0.5	81.9	µg/g	20131204.R13na5
Tungsten	0.5	22.7	µg/g	20131204.R13na5
Tungsten (Dup)	0.5	25.4	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Uranium (Dup)	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	64.4	µg/g	20131204.R13na5
Vanadium (Dup)	0.5	74.8	µg/g	20131204.R13na5
Yttrium	0.5	4.7	µg/g	20131204.R13na5
Yttrium (Dup)	0.5	5.23	µg/g	20131204.R13na5
Zinc	5	325	µg/g	20131204.R13na5
Zinc (Dup)	5	363	µg/g	20131204.R13na5
Zirconium	0.5	2.1	µg/g	20131204.R13na5
Zirconium (Dup)	0.5	2.2	µg/g	20131204.R13na5

Sample Name: 13-1426-0010 CTP - GA13-TP36 Date: 11/27/2013

Matrix: Soil

Lab #: 528835

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	27200	µg/g	20131204.R13na5
Antimony	0.5	198	µg/g	20131204.R13na5
Arsenic	5	1790	µg/g	20131204.R13na5
Barium	0.5	13.3	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	0.74	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	2.6	µg/g	20131204.R13na5
Cadmium	0.05	1.67	µg/g	20131204.R13na5
Calcium	30	57300	µg/g	20131204.R13na5
Cerium	0.5	14.5	µg/g	20131204.R13na5
Cesium	0.5	0.64	µg/g	20131204.R13na5
Chromium	0.5	81.6	µg/g	20131204.R13na5
Cobalt	0.05	26.2	µg/g	20131204.R13na5
Copper	0.5	65.5	µg/g	20131204.R13na5
Europium	0.5	0.61	µg/g	20131204.R13na5

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Work Order: 199268

**Sample Name:** 13-1426-0010 CTP - GA13-TP36 **Date:** 11/27/2013 **Matrix:** Soil **Lab #:** 528835

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Gallium	0.5	8.28	µg/g	20131204.R13na5
Iron	100	62000	µg/g	20131204.R13na5
Lanthanum	0.5	6.54	µg/g	20131204.R13na5
Lead	0.5	211	µg/g	20131204.R13na5
Lithium	3	47.4	µg/g	20131204.R13na5
Magnesium	2	39400	µg/g	20131204.R13na5
Manganese	5	1310	µg/g	20131204.R13na5
Mercury	0.05	0.093	µg/g	20131204.R13na5
Molybdenum	0.5	0.79	µg/g	20131204.R13na5
Nickel	0.5	68.4	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5
Phosphorus	30	476	µg/g	20131204.R13na5
Potassium	10	987	µg/g	20131204.R13na5
Rubidium	0.5	5.37	µg/g	20131204.R13na5
Scandium	0.5	12.4	µg/g	20131204.R13na5
Selenium	0.5	<0.5	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5
Silver	0.5	1.8	µg/g	20131204.R13na5
Sodium	10	134	µg/g	20131204.R13na5
Strontium	0.5	48.2	µg/g	20131204.R13na5
Sulphur	400	2270	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5
Thorium	0.5	0.83	µg/g	20131204.R13na5
Tin	0.5	0.53	µg/g	20131204.R13na5
Titanium	0.5	90.8	µg/g	20131204.R13na5
Tungsten	0.5	1.8	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	108	µg/g	20131204.R13na5
Yttrium	0.5	6.52	µg/g	20131204.R13na5
Zinc	5	327	µg/g	20131204.R13na5
Zirconium	0.5	4.2	µg/g	20131204.R13na5

**Sample Name:** 13-1426-0010 CTP - GA13-TP38 **Date:** 11/27/2013 **Matrix:** Soil **Lab #:** 528836

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	29900	µg/g	20131204.R13na5
Antimony	0.5	166	µg/g	20131204.R13na5
Arsenic	5	1880	µg/g	20131204.R13na5
Barium	0.5	9.65	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	<0.5	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	2.3	µg/g	20131204.R13na5
Cadmium	0.05	1.1	µg/g	20131204.R13na5
Calcium	30	46000	µg/g	20131204.R13na5

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Work Order: 199268

Sample Name: 13-1426-0010 CTP - GA13-TP38 Date: 11/27/2013

Matrix: Soil

Lab #: 528836

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Cerium	0.5	11.3	µg/g	20131204.R13na5
Cesium	0.5	<0.5	µg/g	20131204.R13na5
Chromium	0.5	73.4	µg/g	20131204.R13na5
Cobalt	0.05	24.2	µg/g	20131204.R13na5
Copper	0.5	73.5	µg/g	20131204.R13na5
Europium	0.5	0.52	µg/g	20131204.R13na5
Gallium	0.5	7.32	µg/g	20131204.R13na5
Iron	100	62000	µg/g	20131204.R13na5
Lanthanum	0.5	4.9	µg/g	20131204.R13na5
Lead	0.5	190	µg/g	20131204.R13na5
Lithium	3	43.5	µg/g	20131204.R13na5
Magnesium	2	34200	µg/g	20131204.R13na5
Manganese	5	1150	µg/g	20131204.R13na5
Mercury	0.05	0.081	µg/g	20131204.R13na5
Molybdenum	0.5	1	µg/g	20131204.R13na5
Nickel	0.5	65.9	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5
Phosphorus	30	335	µg/g	20131204.R13na5
Potassium	10	661	µg/g	20131204.R13na5
Rubidium	0.5	3.1	µg/g	20131204.R13na5
Scandium	0.5	11.4	µg/g	20131204.R13na5
Selenium	0.5	<0.5	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5
Silver	0.5	1.1	µg/g	20131204.R13na5
Sodium	10	137	µg/g	20131204.R13na5
Strontium	0.5	34.2	µg/g	20131204.R13na5
Sulphur	400	1830	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5
Thorium	0.5	0.58	µg/g	20131204.R13na5
Tin	0.5	<0.5	µg/g	20131204.R13na5
Titanium	0.5	64.5	µg/g	20131204.R13na5
Tungsten	0.5	1.4	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	102	µg/g	20131204.R13na5
Yttrium	0.5	5.78	µg/g	20131204.R13na5
Zinc	5	275	µg/g	20131204.R13na5
Zirconium	0.5	2.6	µg/g	20131204.R13na5

Sample Name: 13-1426-0010 CTP - GA13-TP41 Date: 11/27/2013

Matrix: Soil

Lab #: 528837

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	28300	µg/g	20131204.R13na5
Antimony	0.5	124	µg/g	20131204.R13na5
Arsenic	5	1600	µg/g	20131204.R13na5

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Work Order: 199268

Sample Name: 13-1426-0010 CTP - GA13-TP41 Date: 11/27/2013

Matrix: Soil

Lab #: 528837

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Barium	0.5	10.9	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	<0.5	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	1.8	µg/g	20131204.R13na5
Cadmium	0.05	0.94	µg/g	20131204.R13na5
Calcium	30	42400	µg/g	20131204.R13na5
Cerium	0.5	14.1	µg/g	20131204.R13na5
Cesium	0.5	<0.5	µg/g	20131204.R13na5
Chromium	0.5	67.8	µg/g	20131204.R13na5
Cobalt	0.05	26.3	µg/g	20131204.R13na5
Copper	0.5	47.2	µg/g	20131204.R13na5
Europium	0.5	0.63	µg/g	20131204.R13na5
Gallium	0.5	6.84	µg/g	20131204.R13na5
Iron	100	61100	µg/g	20131204.R13na5
Lanthanum	0.5	6.08	µg/g	20131204.R13na5
Lead	0.5	155	µg/g	20131204.R13na5
Lithium	3	36.8	µg/g	20131204.R13na5
Magnesium	2	38200	µg/g	20131204.R13na5
Manganese	5	1120	µg/g	20131204.R13na5
Mercury	0.05	0.079	µg/g	20131204.R13na5
Molybdenum	0.5	0.92	µg/g	20131204.R13na5
Nickel	0.5	69.3	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5
Phosphorus	30	472	µg/g	20131204.R13na5
Potassium	10	741	µg/g	20131204.R13na5
Rubidium	0.5	3.3	µg/g	20131204.R13na5
Scandium	0.5	11.2	µg/g	20131204.R13na5
Selenium	0.5	<0.5	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5
Silver	0.5	0.74	µg/g	20131204.R13na5
Sodium	10	126	µg/g	20131204.R13na5
Strontium	0.5	31.9	µg/g	20131204.R13na5
Sulphur	400	1610	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5
Thorium	0.5	0.56	µg/g	20131204.R13na5
Tin	0.5	<0.5	µg/g	20131204.R13na5
Titanium	0.5	73.1	µg/g	20131204.R13na5
Tungsten	0.5	1.2	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	95.6	µg/g	20131204.R13na5
Yttrium	0.5	6.62	µg/g	20131204.R13na5
Zinc	5	276	µg/g	20131204.R13na5
Zirconium	0.5	3.2	µg/g	20131204.R13na5





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Work Order: 199268

Sample Name: 13-1426-0010 CTP - GA13-TP52 Date: 11/27/2013

Matrix: Soil

Lab #: 528838

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	16700	µg/g	20131204.R13na5
Antimony	5	322	µg/g	20131204.R13na5
Arsenic	5	2300	µg/g	20131204.R13na5
Barium	0.5	6.88	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	<0.5	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	2.1	µg/g	20131204.R13na5
Cadmium	0.05	1.48	µg/g	20131204.R13na5
Calcium	30	46400	µg/g	20131204.R13na5
Cerium	0.5	10.2	µg/g	20131204.R13na5
Cesium	0.5	<0.5	µg/g	20131204.R13na5
Chromium	0.5	40.7	µg/g	20131204.R13na5
Cobalt	0.05	32	µg/g	20131204.R13na5
Copper	0.5	46.6	µg/g	20131204.R13na5
Europium	0.5	0.51	µg/g	20131204.R13na5
Gallium	0.5	4.1	µg/g	20131204.R13na5
Iron	100	62100	µg/g	20131204.R13na5
Lanthanum	0.5	4.7	µg/g	20131204.R13na5
Lead	0.5	211	µg/g	20131204.R13na5
Lithium	3	24.6	µg/g	20131204.R13na5
Magnesium	2	27400	µg/g	20131204.R13na5
Manganese	5	1310	µg/g	20131204.R13na5
Mercury	0.05	0.14	µg/g	20131204.R13na5
Molybdenum	0.5	0.89	µg/g	20131204.R13na5
Nickel	0.5	59.1	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5
Phosphorus	30	339	µg/g	20131204.R13na5
Potassium	10	572	µg/g	20131204.R13na5
Rubidium	0.5	3	µg/g	20131204.R13na5
Scandium	0.5	7.48	µg/g	20131204.R13na5
Selenium	0.5	<0.5	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5
Silver	0.5	1.3	µg/g	20131204.R13na5
Sodium	10	82	µg/g	20131204.R13na5
Strontium	0.5	39.9	µg/g	20131204.R13na5
Sulphur	400	3070	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5
Thorium	0.5	0.54	µg/g	20131204.R13na5
Tin	0.5	<0.5	µg/g	20131204.R13na5
Titanium	0.5	57.1	µg/g	20131204.R13na5
Tungsten	0.5	2.9	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	55.9	µg/g	20131204.R13na5
Yttrium	0.5	5	µg/g	20131204.R13na5
Zinc	5	228	µg/g	20131204.R13na5

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Work Order: 199268

Sample Name: 13-1426-0010 CTP - GA13-TP52 Date: 11/27/2013 Matrix: Soil Lab #: 528838

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Zirconium	0.5	3	µg/g	20131204.R13na5

MDL Method detection limit or minimum reporting limit.

% Rec Surrogate compounds are added to the sample in some cases and the recovery is reported as a percent recovered.

QAQCID This is a unique reference to the quality control data set used to generate the reported value.

Data reported for organic analysis in soil samples are corrected for moisture content

Matrix If the matrix is a leachate, the sample was extracted according to regulation 558.

INT Interferences

TNTC Too numerous to count

ND Not detected



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Work Order: 199268

## Quality Control Data:

### ICPMS Soil

Method Blank						
Parameter	MDL	Units	LCL	Result	UCL	QAQCID
Aluminum	0.5	µg/g	<0.5	<0.5	2	20131204.R13na5
Antimony	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Arsenic	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Barium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Beryllium	0.5	µg/g	<0.5	<0.5	2.5	20131204.R13na5
Bismuth	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Cadmium	0.05	µg/g	<0.05	<0.05	0.5	20131204.R13na5
Calcium	30	µg/g	<30	<30	50	20131204.R13na5
Cerium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Cesium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Chromium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Cobalt	0.05	µg/g	<0.05	<0.05	0.5	20131204.R13na5
Copper	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Europium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Gallium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Iron	10	µg/g	<10	<10	10	20131204.R13na5
Lanthanum	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Lead	0.05	µg/g	<0.05	<0.05	0.5	20131204.R13na5
Magnesium	2	µg/g	<2	<2	3	20131204.R13na5
Manganese	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Mercury	0.05	µg/g	<0.05	<0.05	0.5	20131204.R13na5
Molybdenum	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Nickel	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Niobium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Phosphorus	30	µg/g	<30	<30	30	20131204.R13na5
Potassium	10	µg/g	<10	<10	50	20131204.R13na5
Rubidium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Scandium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Selenium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Silver	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Sodium	10	µg/g	<10	<10	50	20131204.R13na5
Strontium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Thallium	0.3	µg/g	<0.3	<0.3	0.5	20131204.R13na5
Thorium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Tin	0.5	µg/g	<0.5	<0.5	2.5	20131204.R13na5
Titanium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Tungsten	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Uranium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Vanadium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Yttrium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Zinc	0.5	µg/g	<0.5	<0.5	1	20131204.R13na5
Zirconium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5



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Golder Associates Ltd - Paste Engineering Lab

Work Order: 199268

## ICPMS Soil

SS2 CRM						
Parameter	MDL	Units	LCL	Result	UCL	QAQCID
Aluminum	5	µg/g	6743	14900	19787	20131204.R13na5
Antimony	0.5	µg/g	3	4.8	5.3	20131204.R13na5
Arsenic	0.5	µg/g	25	81.8	125	20131204.R13na5
Barium	0.5	µg/g	149	235	281	20131204.R13na5
Cadmium	0.05	µg/g	1.2	2.07	3.2	20131204.R13na5
Calcium	30	µg/g	87443	105000	138279	20131204.R13na5
Chromium	0.5	µg/g	14	39.7	54	20131204.R13na5
Cobalt	0.05	µg/g	9	12.7	15	20131204.R13na5
Copper	5	µg/g	139	186	243	20131204.R13na5
Iron	100	µg/g	12831	23600	29261	20131204.R13na5
Lead	0.5	µg/g	68	129	184	20131204.R13na5
Lithium	3	µg/g	5	15.3	23	20131204.R13na5
Magnesium	2	µg/g	7628	11700	14502	20131204.R13na5
Manganese	5	µg/g	324	529	590	20131204.R13na5
Mercury	0.05	µg/g	0.23	0.32	0.43	20131204.R13na5
Molybdenum	0.5	µg/g	1.94	2.9	3.94	20131204.R13na5
Nickel	0.5	µg/g	33	60.3	75	20131204.R13na5
Silver	0.5	µg/g	0.5	0.69	2	20131204.R13na5
Strontium	0.5	µg/g	156	223	272	20131204.R13na5
Titanium	5	µg/g	298	1150	1402	20131204.R13na5
Uranium	0.5	µg/g	1	1.3	1.9	20131204.R13na5
Vanadium	0.5	µg/g	17	45.6	51	20131204.R13na5
Zinc	5	µg/g	337	479	597	20131204.R13na5

UCL Upper Control Limit

LCL Lower Control Limit



# TESTMARK Laboratories Ltd.

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## Analytical Report

<b>Client:</b>	Mark Labelle	<b>Work Order Number:</b>	<b>199274</b>
<b>Company:</b>	Golder Associates Ltd - Paste Engineering Lab	<b>Date Order Received:</b>	12/2/2013
<b>Address:</b>	1010 Lorne St. Sudbury, ON, P3A 4S4	<b>Regulation:</b>	Information not provided
<b>Phone:</b>	(705) 524-6861	<b>PO #:</b>	
<b>Fax:</b>	(705) 524-9636	<b>Project #:</b>	13-1426-0010
<b>Email:</b>	mlabelle@golder.com		

Analyses were performed on the following samples submitted with your order.

The results relate only to the items tested.

Sample Name	Lab #	Matrix	Type	Comments	Date Collected	Time Collected
13-1426-0010 SCTP - BS - Silty Sand	528850	Soil	Comp		11/30/2013	9:00
13-1426-0010 SCTP - BS - Mixed (Silt -	528851	Soil	Comp		11/30/2013	9:00
13-1426-0010 SCTP - BS - Clay - Silt	528852	Soil	Comp		11/30/2013	9:00

The following instrumentation and reference methods were used for your sample(s)

Method Name	Description	Reference
ICPMS Soil	Determination of Metals in Soil by ICP/MS and BCSALM Method Instrument group: Perkin Elmer ICPMS	Based on SW846-6020A

This report has been approved by:

Brad Woodward, H.B.Sc.  
Inorganic Section Head



# TESTMARK Laboratories Ltd.

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Golder Associates Ltd - Paste Engineering Lab

Work Order: 199274

## Sample Data:

Sample Name: 13-1426-0010 SCTP - BS - Silty Date: 11/30/2013

Matrix: Soil

Lab #: 528850

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	15300	µg/g	20131204.R13na5
Antimony	5	312	µg/g	20131204.R13na5
Arsenic	5	2860	µg/g	20131204.R13na5
Barium	0.5	3.4	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	<0.5	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	1.7	µg/g	20131204.R13na5
Cadmium	0.05	1.06	µg/g	20131204.R13na5
Calcium	30	50700	µg/g	20131204.R13na5
Cerium	0.5	6.78	µg/g	20131204.R13na5
Cesium	0.5	<0.5	µg/g	20131204.R13na5
Chromium	0.5	39.9	µg/g	20131204.R13na5
Cobalt	0.05	37.9	µg/g	20131204.R13na5
Copper	0.5	55.6	µg/g	20131204.R13na5
Europium	0.5	<0.5	µg/g	20131204.R13na5
Gallium	0.5	3.6	µg/g	20131204.R13na5
Iron	100	63900	µg/g	20131204.R13na5
Lanthanum	0.5	3.1	µg/g	20131204.R13na5
Lead	0.5	180	µg/g	20131204.R13na5
Lithium	3	21.7	µg/g	20131204.R13na5
Magnesium	2	28800	µg/g	20131204.R13na5
Manganese	5	1230	µg/g	20131204.R13na5
Mercury	0.05	0.064	µg/g	20131204.R13na5
Molybdenum	0.5	0.91	µg/g	20131204.R13na5
Nickel	0.5	74.8	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5
Phosphorus	30	242	µg/g	20131204.R13na5
Potassium	10	231	µg/g	20131204.R13na5
Rubidium	0.5	1.3	µg/g	20131204.R13na5
Scandium	0.5	7.41	µg/g	20131204.R13na5
Selenium	0.5	<0.5	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5
Silver	0.5	1	µg/g	20131204.R13na5
Sodium	10	44	µg/g	20131204.R13na5
Strontium	0.5	33.8	µg/g	20131204.R13na5
Sulphur	400	3360	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5
Thorium	0.5	<0.5	µg/g	20131204.R13na5
Tin	0.5	<0.5	µg/g	20131204.R13na5
Titanium	0.5	42.1	µg/g	20131204.R13na5
Tungsten	0.5	1.4	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	54.4	µg/g	20131204.R13na5

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Golder Associates Ltd - Paste Engineering Lab

Work Order: 199274

**Sample Name: 13-1426-0010 SCTP - BS - Silty**    **Date: 11/30/2013**    **Matrix: Soil**    **Lab #: 528850**

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Yttrium	0.5	5.79	µg/g	20131204.R13na5
Zinc	5	241	µg/g	20131204.R13na5
Zirconium	0.5	1.2	µg/g	20131204.R13na5

**Sample Name: 13-1426-0010 SCTP - BS - Mixed**    **Date: 11/30/2013**    **Matrix: Soil**    **Lab #: 528851**

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	18400	µg/g	20131204.R13na5
Antimony	0.5	230	µg/g	20131204.R13na5
Arsenic	5	2700	µg/g	20131204.R13na5
Barium	0.5	4.5	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	<0.5	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	1.5	µg/g	20131204.R13na5
Cadmium	0.05	1.61	µg/g	20131204.R13na5
Calcium	30	49800	µg/g	20131204.R13na5
Cerium	0.5	8.35	µg/g	20131204.R13na5
Cesium	0.5	<0.5	µg/g	20131204.R13na5
Chromium	0.5	56	µg/g	20131204.R13na5
Cobalt	0.05	40.5	µg/g	20131204.R13na5
Copper	0.5	57.2	µg/g	20131204.R13na5
Europium	0.5	0.53	µg/g	20131204.R13na5
Gallium	0.5	4.7	µg/g	20131204.R13na5
Iron	100	62600	µg/g	20131204.R13na5
Lanthanum	0.5	3.7	µg/g	20131204.R13na5
Lead	0.5	193	µg/g	20131204.R13na5
Lithium	3	27.4	µg/g	20131204.R13na5
Magnesium	2	29400	µg/g	20131204.R13na5
Manganese	5	1190	µg/g	20131204.R13na5
Mercury	0.05	0.16	µg/g	20131204.R13na5
Molybdenum	0.5	0.78	µg/g	20131204.R13na5
Nickel	0.5	81.7	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5
Phosphorus	30	295	µg/g	20131204.R13na5
Potassium	10	316	µg/g	20131204.R13na5
Rubidium	0.5	1.7	µg/g	20131204.R13na5
Scandium	0.5	8.39	µg/g	20131204.R13na5
Selenium	0.5	0.59	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5
Silver	0.5	0.92	µg/g	20131204.R13na5
Sodium	10	54	µg/g	20131204.R13na5
Strontium	0.5	34.7	µg/g	20131204.R13na5
Sulphur	400	3490	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5

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Golder Associates Ltd - Paste Engineering Lab

Work Order: 199274

Sample Name: 13-1426-0010 SCTP - BS - Mixed Date: 11/30/2013

Matrix: Soil

Lab #: 528851

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Thorium	0.5	<0.5	µg/g	20131204.R13na5
Tin	0.5	<0.5	µg/g	20131204.R13na5
Titanium	0.5	58.9	µg/g	20131204.R13na5
Tungsten	0.5	1.5	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	67.2	µg/g	20131204.R13na5
Yttrium	0.5	5.56	µg/g	20131204.R13na5
Zinc	5	351	µg/g	20131204.R13na5
Zirconium	0.5	1.8	µg/g	20131204.R13na5

Sample Name: 13-1426-0010 SCTP - BS - Clay - Date: 11/30/2013

Matrix: Soil

Lab #: 528852

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Aluminum	5	24300	µg/g	20131204.R13na5
Antimony	0.5	170	µg/g	20131204.R13na5
Arsenic	5	2320	µg/g	20131204.R13na5
Barium	0.5	7.75	µg/g	20131204.R13na5
Beryllium	0.5	<0.5	µg/g	20131204.R13na5
Bismuth	0.5	<0.5	µg/g	20131204.R13na5
Boron (Not Hot Water Extractable)	1	2.7	µg/g	20131204.R13na5
Cadmium	0.05	1.52	µg/g	20131204.R13na5
Calcium	30	46800	µg/g	20131204.R13na5
Cerium	0.5	12	µg/g	20131204.R13na5
Cesium	0.5	<0.5	µg/g	20131204.R13na5
Chromium	0.5	68.7	µg/g	20131204.R13na5
Cobalt	0.05	32.4	µg/g	20131204.R13na5
Copper	0.5	53.8	µg/g	20131204.R13na5
Europium	0.5	0.52	µg/g	20131204.R13na5
Gallium	0.5	5.88	µg/g	20131204.R13na5
Iron	100	64100	µg/g	20131204.R13na5
Lanthanum	0.5	5.59	µg/g	20131204.R13na5
Lead	0.5	204	µg/g	20131204.R13na5
Lithium	3	35.3	µg/g	20131204.R13na5
Magnesium	2	32500	µg/g	20131204.R13na5
Manganese	5	1230	µg/g	20131204.R13na5
Mercury	0.05	0.16	µg/g	20131204.R13na5
Molybdenum	0.5	0.86	µg/g	20131204.R13na5
Nickel	0.5	75.9	µg/g	20131204.R13na5
Niobium	0.5	<0.5	µg/g	20131204.R13na5
Phosphorus	30	346	µg/g	20131204.R13na5
Potassium	10	555	µg/g	20131204.R13na5
Rubidium	0.5	2.7	µg/g	20131204.R13na5
Scandium	0.5	9.62	µg/g	20131204.R13na5
Selenium	0.5	<0.5	µg/g	20131204.R13na5
Silicon	300	<300	µg/g	20131204.R13na5

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Golder Associates Ltd - Paste Engineering Lab

Work Order: 199274

Sample Name: 13-1426-0010 SCTP - BS - Clay - Date: 11/30/2013

Matrix: Soil

Lab #: 528852

ICPMS Soil				
Parameter	MDL	Result	Units	QAQCID
Silver	0.5	0.82	µg/g	20131204.R13na5
Sodium	10	80	µg/g	20131204.R13na5
Strontium	0.5	35.4	µg/g	20131204.R13na5
Sulphur	400	2420	µg/g	20131204.R13na5
Tellurium	0.5	<0.5	µg/g	20131204.R13na5
Thallium	0.3	<0.3	µg/g	20131204.R13na5
Thorium	0.5	0.57	µg/g	20131204.R13na5
Tin	0.5	0.56	µg/g	20131204.R13na5
Titanium	0.5	67.1	µg/g	20131204.R13na5
Tungsten	0.5	1.5	µg/g	20131204.R13na5
Uranium	0.5	<0.5	µg/g	20131204.R13na5
Vanadium	0.5	81.4	µg/g	20131204.R13na5
Yttrium	0.5	5.71	µg/g	20131204.R13na5
Zinc	5	369	µg/g	20131204.R13na5
Zirconium	0.5	2.5	µg/g	20131204.R13na5

MDL Method detection limit or minimum reporting limit.

% Rec Surrogate compounds are added to the sample in some cases and the recovery is reported as a percent recovered.

QAQCID This is a unique reference to the quality control data set used to generate the reported value.

Data reported for organic analysis in soil samples are corrected for moisture content

Matrix If the matrix is a leachate, the sample was extracted according to regulation 558.

INT Interferences

TNTC Too numerous to count

ND Not detected



# TESTMARK Laboratories Ltd.

Committed to Quality and Service

Golder Associates Ltd - Paste Engineering Lab

Work Order: 199274

## Quality Control Data:



### ICPMS Soil



Method Blank						
Parameter	MDL	Units	LCL	Result	UCL	QAQCID
Aluminum	0.5	µg/g	<0.5	<0.5	2	20131204.R13na5
Antimony	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Arsenic	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Barium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Beryllium	0.5	µg/g	<0.5	<0.5	2.5	20131204.R13na5
Bismuth	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Cadmium	0.05	µg/g	<0.05	<0.05	0.5	20131204.R13na5
Calcium	30	µg/g	<30	<30	50	20131204.R13na5
Cerium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Cesium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Chromium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Cobalt	0.05	µg/g	<0.05	<0.05	0.5	20131204.R13na5
Copper	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Europium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Gallium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Iron	10	µg/g	<10	<10	10	20131204.R13na5
Lanthanum	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Lead	0.05	µg/g	<0.05	<0.05	0.5	20131204.R13na5
Magnesium	2	µg/g	<2	<2	3	20131204.R13na5
Manganese	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Mercury	0.05	µg/g	<0.05	<0.05	0.5	20131204.R13na5
Molybdenum	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Nickel	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Niobium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Phosphorus	30	µg/g	<30	<30	30	20131204.R13na5
Potassium	10	µg/g	<10	<10	50	20131204.R13na5
Rubidium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Scandium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Selenium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Silver	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Sodium	10	µg/g	<10	<10	50	20131204.R13na5
Strontium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Thallium	0.3	µg/g	<0.3	<0.3	0.5	20131204.R13na5
Thorium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Tin	0.5	µg/g	<0.5	<0.5	2.5	20131204.R13na5
Titanium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Tungsten	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Uranium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Vanadium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Yttrium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5
Zinc	0.5	µg/g	<0.5	<0.5	1	20131204.R13na5
Zirconium	0.5	µg/g	<0.5	<0.5	0.5	20131204.R13na5







# **APPENDIX B**



## **Photos**

Client : PWGSC Giant Mine	Project Number : 13-1426-0010
Site Name : Sudbury Laboratory	
<p>Photograph 1</p> <p>13-1426-0010 CTP GA13-TP09 as received</p> <p>Observations:</p> <ul style="list-style-type: none"><li>-Received weight = 20.97Kg</li><li>-Till and lots of clay</li><li>-mixed well, no clay balls after mixing</li><li>-no water bleed</li><li>-sticky material</li><li>-As received moisture = 81.27wt% solids</li><li>-Water added = 1580mL</li><li>-Final moisture = 74.61 wt% solids</li></ul>	
<p>Photograph 2</p> <p>13-1426-0010 CTP GA13-TP09 as received - cross section</p>	



Client : PWGSC Giant Mine	Project Number : 13-1426-0010
Site Name : Sudbury Laboratory	
Photograph 3 13-1426-0010 CTP GA13-TP09 homogenized	
Photograph 4 13-1426-0010 CTP GA13-TP10 as received	
Observations: <ul style="list-style-type: none"><li>- received weight = 7.41 Kg</li><li>- sample came in wet</li><li>- pail had hole in bottom, lost some sample and water</li><li>- till + lots of clay present</li><li>- mixed well, no clay balls after mixing</li><li>- small amount of water bleed</li><li>-sticky material</li><li>- as received moisture= 74.96 wt% solids</li><li>- water added = 320 mL</li><li>- Final moisture = 71.74 wt% solids</li></ul>	



Client : PWGSC Giant Mine	Project Number : 13-1426-0010
Site Name : Sudbury Laboratory	
Photograph 5 13-1426-0010 CTP GA13-TP10 as received - cross section	
Photograph 6 13-1426-0010 CTP GA13-TP10 homogenized	



Client : PWGSC Giant Mine	Project Number : 13-1426-0010
Site Name : Sudbury Laboratory	
Photograph 7 13-1426-0010 CTP – GA13-TP11 as received  Observations: - received weight = 14.98 Kg - Till + clay - sticky material - No water bleed - mixed well, no clay balls present after mixing - as received moisture = 80.5 wt% solids - water added = 470 mL - final moisture = 75.48 wt% solids	
Photograph 8 13-1426-0010 CTP – GA13-TP11 as received - cross section	



Client : PWGSC Giant Mine	Project Number : 13-1426-0010
Site Name : Sudbury Laboratory	
Photograph 9 13-1426-0010 CTP – GA13-TP11 homogenized	
Photograph 10 13-1426-0010 CTP - GA13-TP14-1 as received  Observations: - received weight = 12 Kg - sand, silt and small amount of clay present - mixed well, no clay balls present after mixing - bleeds water as soon as mixing stops - as received moisture = 88.4 wt% solids - water added = 1600 mL - final moisture = 76.73 wt% solids	







Client : PWGSC Giant Mine	Project Number : 13-1426-0010
Site Name : Sudbury Laboratory	
Photograph 11 13-1426-0010 CTP - GA13-TP14-1 as received - cross section	
Photograph 12 13-1426-0010 CTP - GA13-TP14-1 homogenized	



Client : PWGSC Giant Mine	Project Number : 13-1426-0010
Site Name : Sudbury Laboratory	
Photograph 13	
13-1426-0010 CTP - GA13-TP14-2 as received	
Observations: <ul style="list-style-type: none"><li>- received weight – 15.18 Kg</li><li>- silt and clay present</li><li>- mixed well, no clay balls present after mixing</li><li>- slow water bleed after mixing stops</li><li>- sticky material</li><li>- as received moisture = 76.27 wt% solids</li><li>- water added = 1000 mL</li></ul> Final moisture = 71.24 wt% solids	
Photograph 14	
13-1426-0010 CTP - GA13-TP14-2 as received – cross section	
	



Client : PWGSC Giant Mine	Project Number : 13-1426-0010
Site Name : Sudbury Laboratory	
Photograph 15 13-1426-0010 CTP - GA13-TP14-2 homogenized	
Photograph 16 13-1426-0010 CTP - GA13-TP15 as received	
Observations: <ul style="list-style-type: none"><li>- received weight = 13.82 Kg</li><li>- silt and sand with very little clay visible</li><li>- bleeds water</li><li>- Mixed well, no clay balls present after mixing</li><li>- as received moisture = 92.83 wt% solids</li><li>- water added = 2770 mL</li><li>- final moisture = 77.14 wt% solids</li></ul>	

Client : PWGSC Giant Mine	Project Number : 13-1426-0010
Site Name : Sudbury Laboratory	
Photograph 17 13-1426-0010 CTP - GA13-TP15 as received – cross section	
Photograph 18 13-1426-0010 CTP - GA13-TP15 homogenized	



<b>Client : PWGSC Giant Mine</b>		<b>Project Number : 13-1426-0010</b>
<b>Site Name : Sudbury Laboratory</b>		
<b>Photograph 19</b> 13-1426-0010 CTP - GA13-TP16 as received  Observations: <ul style="list-style-type: none"><li>- received weight = 12.76 Kg</li><li>- silt, sand, and some clay present</li><li>- Bleeds water</li><li>- mixes well, no clay balls present after mixing</li><li>- as received moisture = 89.22 wt% solids</li><li>- water added = 2270 mL</li><li>- final moisture = 77.35 wt% solids</li></ul>		
<b>Photograph 20</b> 13-1426-0010 CTP - GA13-TP16 as received – cross section		



Client : PWGSC Giant Mine	Project Number : 13-1426-0010
Site Name : Sudbury Laboratory	
Photograph 21 13-1426-0010 CTP - GA13-TP16 Homogenized	
Photograph 22 13-1426-0010 CTP - GA13-TP18 as received Observations: <ul style="list-style-type: none"><li>- received weight – 13.49 Kg</li><li>- sand, silt, and very little clay present</li><li>- bleeds water</li><li>- mixes well, no clay balls present after mixing</li><li>- as received moisture = 89.12 wt% solids</li><li>- water added = 1700 mL</li><li>- final moisture = 76.17 wt% solids</li></ul>	



<b>Client : PWGSC Giant Mine</b>	<b>Project Number : 13-1426-0010</b>
<b>Site Name : Sudbury Laboratory</b>	
<b>Photograph 23</b> 13-1426-0010 CTP - GA13-TP18 as received – cross section	
<b>Photograph 24</b> 13-1426-0010 CTP - GA13-TP18 Homogenized	



<b>Client : PWGSC Giant Mine</b>	<b>Project Number : 13-1426-0010</b>
<b>Site Name : Sudbury Laboratory</b>	
<p>Photograph 25 13-1426-0010 CTP - GA13-TP19 as received</p> <p>Observations:</p> <ul style="list-style-type: none"><li>- received weight = 12.04 Kg</li><li>- sand, silt, and small amount of clay present</li><li>- bleeds water</li><li>- mixes well, no clay balls present after mixing</li><li>- as received moisture = 90.06 wt% solids</li><li>- water added = 2000 mL</li><li>- final moisture = 76.11 wt% solids</li></ul>	
<p>Photograph 26 13-1426-0010 CTP - GA13-TP19 as received – cross section</p>	







Client : PWGSC Giant Mine		Project Number : 13-1426-0010	
Site Name : Sudbury Laboratory			
Photograph 27 13-1426-0010 CTP - GA13-TP19 Homogenized			
Photograph 28 13-1426-0010 CTP - GA13-TP20 as received Observations: <ul style="list-style-type: none"><li>- received weight = 8.96 Kg</li><li>- sand, silt, and some clay present</li><li>- mixes well, no clay balls present after mixing</li><li>- bleeds water</li><li>- as received moisture = 82.17 wt% solids</li><li>- water added = 1300 mL</li><li>- final moisture = 72.64 wt% solids</li></ul>			



Client : PWGSC Giant Mine	Project Number : 13-1426-0010
Site Name : Sudbury Laboratory	
Photograph 29 13-1426-0010 CTP - GA13-TP20 as received – cross section	
Photograph 30 13-1426-0010 CTP - GA13-TP20 Homogenized	



<b>Client : PWGSC Giant Mine</b>		<b>Project Number : 13-1426-0010</b>
<b>Site Name : Sudbury Laboratory</b>		
<b>Photograph 31</b> 13-1426-0010 CTP - GA13-TP26 as received Observations: <ul style="list-style-type: none"><li>- received weight – 13.61 Kg</li><li>- silt and clay mix</li><li>- mixed well, no clay balls present after mixing</li><li>- no water bleed</li><li>- as received moisture = 81.12 wt% solids</li><li>- water added = 1500 mL</li><li>- final moisture = 72.60 wt% solids</li></ul>		
<b>Photograph 32</b> 13-1426-0010 CTP - GA13-TP26 as received – cross section		

Client : PWGSC Giant Mine	Project Number : 13-1426-0010
Site Name : Sudbury Laboratory	
Photograph 33 13-1426-0010 CTP - GA13-TP26 Homogenized	
Photograph 34 13-1426-0010 STP - GA13-TP27 as received  Observations: <ul style="list-style-type: none"><li>- received weight = 18.44 Kg</li><li>- silt, sand, and clay</li><li>- various colours present in sample (orange, gold, brown)</li><li>- mixes well, no clay balls present after mixing</li><li>- bleeds water slightly</li><li>- slightly sticky</li><li>- as received moisture = 81.99 wt% solids</li><li>- water added = 1400 mL</li><li>- final moisture = 74.73 wt% solids</li></ul>	



Client : PWGSC Giant Mine	Project Number : 13-1426-0010
Site Name : Sudbury Laboratory	
Photograph 35 13-1426-0010 STP - GA13-TP27 as received – cross section	
Photograph 36 13-1426-0010 STP - GA13-TP27 Homogenized	



<b>Client : PWGSC Giant Mine</b>	<b>Project Number : 13-1426-0010</b>
<b>Site Name : Sudbury Laboratory</b>	
<b>Photograph 37</b> 13-1426-0010 STP - GA13-TP35 as received  Observations: <ul style="list-style-type: none"><li>- received weight = 10.5 Kg</li><li>- till and clay present</li><li>- mizes well, no clay balls present after mixing</li><li>- bleeds water slightly</li><li>- as received moisture = 86.28 wt% solids</li><li>- water added = 1000 mL</li><li>- final moisture = 76.70 wt% solids</li></ul>	
<b>Photograph 38</b> 13-1426-0010 STP - GA13-TP35 as received – cross section	



Client : PWGSC Giant Mine		Project Number : 13-1426-0010	
Site Name : Sudbury Laboratory			
Photograph 39 13-1426-0010 STP - GA13-TP35 homogenized			
Photograph 40 13-1426-0010 STP - GA13-TP36 as received  Observations: <ul style="list-style-type: none"><li>- received weight = 12.61 Kg</li><li>- mostly clay with some silt present</li><li>- no water bleed</li><li>- mixed well, no clay balls present after mixing</li><li>- very sticky material</li><li>- as received moisture = 71.61 wt% solids</li><li>- water added = 770m mL</li><li>- final moisture = 68.3 wt% solids</li></ul>			



Client : PWGSC Giant Mine	Project Number : 13-1426-0010
Site Name : Sudbury Laboratory	
Photograph 41 13-1426-0010 STP - GA13-TP36 as received – cross section	
Photograph 42 13-1426-0010 STP - GA13-TP36 homogenized	







<b>Client : PWGSC Giant Mine</b>	<b>Project Number : 13-1426-0010</b>
<b>Site Name : Sudbury Laboratory</b>	
<b>Photograph 43</b> 13-1426-0010 STP - GA13-TP38 as received  Observations: <ul style="list-style-type: none"><li>- received weight = 16.93 Kg</li><li>- Till and clay (very moist)</li><li>- mixes well, no clay balls present after mixing</li><li>- bleeds water slightly</li><li>- sticy material</li><li>- as received moisture = 70.54 wt% solids</li><li>- water added = 1160 mL</li><li>- final moisture = 66.9 wt% solids</li></ul>	
<b>Photograph 44</b> 13-1426-0010 STP - GA13-TP38 as received – cross section	



Client : PWGSC Giant Mine	Project Number : 13-1426-0010
Site Name : Sudbury Laboratory	
Photograph 45 13-1426-0010 STP - GA13-TP38 homogenized	
Photograph 46 13-1426-0010 STP - GA13-TP41 as received  Observations: - received weight = 7.77 Kg - till and clay - received sample wet - no water bleed - mixes well, no clay balls present and mixing - sticky material - as received moisture = 68.12 wt% solids - no water added to sample to homogenize	



Client : PWGSC Giant Mine		Project Number : 13-1426-0010	
Site Name : Sudbury Laboratory			
Photograph 47 13-1426-0010 STP - GA13-TP41 as received – cross section			
Photograph 48 13-1426-0010 STP - GA13-TP41 homogenized			

<b>Client : PWGSC Giant Mine</b>		<b>Project Number : 13-1426-0010</b>
<b>Site Name : Sudbury Laboratory</b>		
<b>Photograph 49</b> 13-1426-0010 STP - GA13-TP52 as received  Observations: <ul style="list-style-type: none"><li>- received weight = 15.78 Kg</li><li>- till and clay</li><li>- no water bleed</li><li>- slightly sticky material</li><li>- mixes well, no clay balls present after mixing</li><li>- as received moisture = 76.75 wt% solids</li><li>- water added = 500 mL</li><li>- final moisture = 72.92 wt% solids</li></ul>		
<b>Photograph 50</b> 13-1426-0010 STP - GA13-TP52 as received – cross section		



Client : PWGSC Giant Mine		Project Number : 13-1426-0010	
Site Name : Sudbury Laboratory			
Photograph 51 13-1426-0010 STP - GA13-TP52 homogenized			
Photograph 52 13-1426-0010 SCTP - BS - Silty Sand as received			
Observations: <ul style="list-style-type: none"><li>- received weight – 244.8 Kg</li><li>- sand/silt with some clay balls present</li><li>- bleeds water as soon as mixing stops</li><li>- no clay balls present after mixing</li><li>- as received moisture = 90.4 wt% solids</li><li>- water added = 38.6L</li><li>- final moisture = 75.71 wt% solids</li></ul>			

Client : PWGSC Giant Mine	Project Number : 13-1426-0010
Site Name : Sudbury Laboratory	
Photograph 53 13-1426-0010 SCTP - BS - Silty Sand as received – cross section	
Photograph 54 13-1426-0010 SCTP - BS - Mixed (Silt- Sand -Clay) as received  Observations: - received weight = 271.56 Kg - sand, silt, and clay chunks - bleeds water as soon as mixing stops - took a while to break clay balls with mixer - as received moisture = 86.94 wt% solids - water added = 35.15L - final moisture = 72.92 wt% solids	

Client : PWGSC Giant Mine		Project Number : 13-1426-0010	
Site Name : Sudbury Laboratory			
Photograph 55 13-1426-0010 SCTP - BS - Mixed (Silt- Sand -Clay) as received – cross section			
Photograph 56 13-1426-0010 SCTP - BS - Clay – Silt as received  Observations: <ul style="list-style-type: none"><li>- received weight = 127.27 Kg</li><li>- chunks of clay with silt</li><li>- sample came in wet</li><li>- very sticky material</li><li>- no water bleed</li><li>- mixed well with no clay balls present after mixing</li><li>- as received moisture = 74.07 wt% solids</li><li>- water added = 7.26L</li><li>- final moisture = 69.84 wt% solids</li></ul>			

Client : PWGSC Giant Mine	Project Number : 13-1426-0010
Site Name : Sudbury Laboratory	
<p>Photograph 57</p> <p>13-1426-0010 SCTP - BS - Clay – Silt as received – cross section</p>	
<p>Photograph 58</p> <p>13-1426-0010 SCTP - BS - Clay - Silt (S2) as received</p> <p>Observations:</p> <ul style="list-style-type: none"> <li>- received weight – 191.96 Kg</li> <li>- mostly sand with some balls/chunks of clay</li> <li>- bleeds water as soon as mixing stops</li> <li>- bottom of drum had more clay than the top portion</li> <li>- mixes well with no clay chunks after mixing</li> <li>- as received moisture = 92.49 wt% solids</li> <li>- water added = 11.83 Kg</li> <li>- final moisture = 76.98 wt% solids</li> </ul>	



<b>Client : PWGSC Giant Mine</b>		<b>Project Number : 13-1426-0010</b>
<b>Site Name : Sudbury Laboratory</b>		
<b>Photograph 59</b> 13-1426-0010 SCTP - BS - Clay - Silt (S2) as received – cross section		
<b>Photograph 60</b> 13-1426-0010 SCTP - BS - Clay - Silt (S2) homogenized		

Client : PWGSC Giant Mine

Project Number : 13-1426-0010

Site Name : Sudbury Laboratory

Photograph 61



13-1426-0010 CTP - GA13-TP15  
178mm Slump



Photograph 62

13-1426-0010 CTP - GA13-TP15  
254mm Slump



Client : PWGSC Giant Mine	Project Number : 13-1426-0010
Site Name : Sudbury Laboratory	
Photograph 63 13-1426-0010 STP - GA13-TP38 178mm Slump	
Photograph 64 13-1426-0010 STP - GA13-TP38 254mm Slump	

Client : PWGSC Giant Mine

Project Number : 13-1426-0010

Site Name : Sudbury Laboratory

Photograph 65

13-1426-0010 SCTP - BS - Silty Sand  
178mm Slump



Photograph 66

13-1426-0010 SCTP - BS - Silty Sand  
254mm Slump



Client : PWGSC Giant Mine

Project Number : 13-1426-0010

Site Name : Sudbury Laboratory

Photograph 67

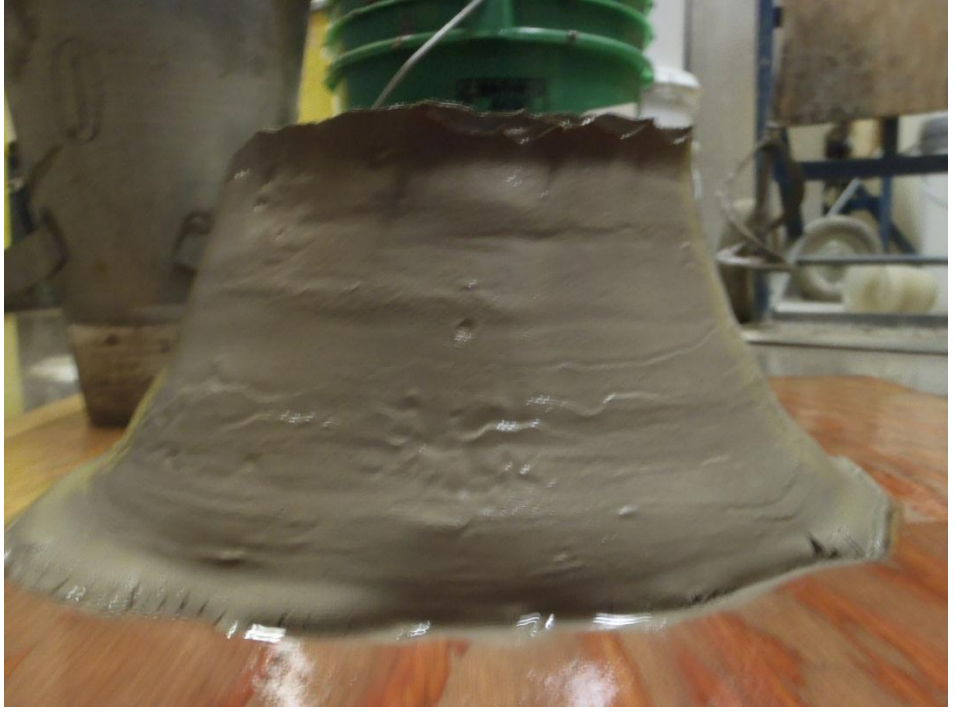

13-1426-0010 CTP – GA13 –TP14-2  
178mm Slump



Photograph 68

13-1426-0010 CTP – GA13 –TP14-2  
254mm Slump



Client : PWGSC Giant Mine	Project Number : 13-1426-0010
Site Name : Sudbury Laboratory	
Photograph 69 13-1426-0010 SCTP - BS – Clay-Silt 178mm Slump	
Photograph 70 13-1426-0010 SCTP - BS – Clay-Silt 254mm Slump	

Client : PWGSC Giant Mine

Project Number : 13-1426-0010

Site Name : Sudbury Laboratory

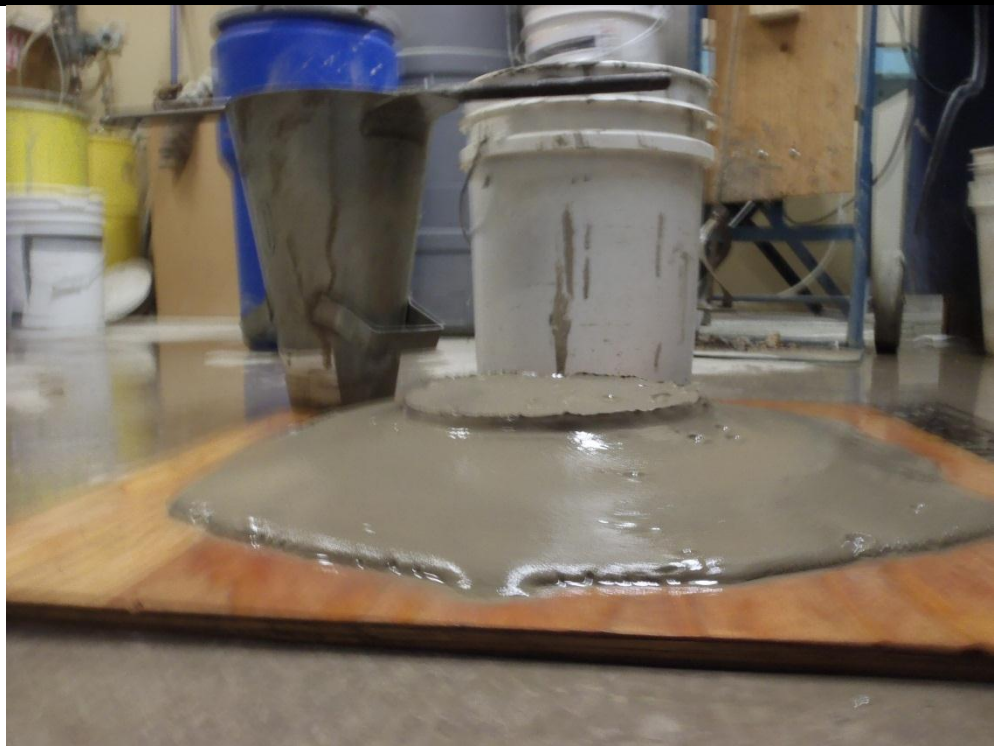
Photograph 71

13-1426-0010 SCTP – BS – Mixed  
(Silt - Sand - Clay)  
178mm Slump



Photograph 72

13-1426-0010 SCTP – BS – Mixed  
(Silt - Sand - Clay)  
254mm Slump



Client : PWGSC Giant Mine

Project Number : 13-1426-0010

Site Name : Sudbury Laboratory

Photograph 73

13-1426-0010 STP – GA13 – TP27  
178mm Slump



Photograph 74

13-1426-0010 STP – GA13 – TP27  
254mm Slump



END OF DOCUMENT





# **APPENDIX C**

## **Rheograms**



Golder Associates Ltd.  
Viscosity / Flow Curve Testing R/S Plus Rheometer

Client:	Giant Mining Support Services
Project Number:	13-1426-0010
Date:	12/3/2013
Technologist	CA

	Status	Reviewer	Date Complete
Data Entry	Complete	CA	12/5/2013
Data Review	1st Review Complete	CA	12/5/2013
	2nd Review Complete	ML	12/5/2013

Sample ID:	13-1426-0010 CTP - GA13-TP15
Sample Description:	coarse, dark brown material
Water:	13-1426-0010 Water
pH Adjustment:	none
Bob:	CC25 Profiled Bob
Additional Info:	
Specific Gravity	2.83

## VISCOSITY DATA

## Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
1	0.5338	0.4903	0.4413	0.488
2	0.3610	0.3796	0.3576	0.366
3	0.2649	0.2693	0.2652	0.266
4	0.1108	0.1132	0.1089	0.111
5	0.0335	0.0329	0.0330	0.033
6				
7				

## Ramp Down

Trial 1	Trial 2	Trial 3	AVG
0.5011	0.4852	0.4746	0.487
0.3885	0.3919	0.3646	0.382
0.3050	0.3041	0.3080	0.306
0.1197	0.1209	0.1175	0.119
0.0368	0.0371	0.0364	0.037

## YIELD STRESS DATA

## Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
1	48.2150	53.1899	71.2924	58
2	52.3876	49.2982	43.9033	49
3	52.6106	49.9730	55.4771	53
4	19.5248	18.7665	19.3227	19
5	5.7117	5.9028	5.3996	6
6				
7				

## Ramp Down

Trial 1	Trial 2	Trial 3	AVG
58.6723	56.3238	51.8377	56
38.2012	40.0758	39.0847	39
23.9359	24.1377	24.9465	24
10.8839	10.8103	10.9874	11
3.3477	3.2378	3.2942	3

## WEIGHT PERCENT SOLIDS

REF	Pan #	Pan Wt. (g)	Wet (g)	Dry (g)	Wt% Solids	SVF (Φ)
1	12	29.80	54.84	49.30	77.9%	0.55
2	58	30.36	62.63	55.16	76.9%	0.54
3	14	30.12	61.46	53.44	74.4%	0.51
4	35	30.26	53.16	46.78	72.1%	0.48
5	3	30.33	59.97	50.61	68.4%	0.43
6						
7						

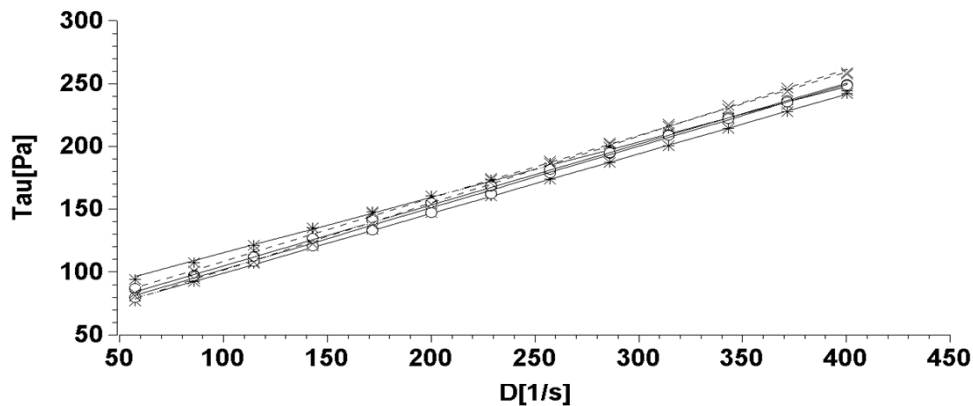
## Additional Notes:

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Manual Report Analysis/Regression



\* \* 13-1426-0010 CTP - GA13-TP15 REF1-1.dat Block:1  
 — regr.trace:13-1426-0010 CTP - GA13-TP15 REF1-1.dat Block:1  
 ○ ○ 13-1426-0010 CTP - GA13-TP15 REF1-2.dat Block:1  
 — regr.trace:13-1426-0010 CTP - GA13-TP15 REF1-2.dat Block:1  
 × × 13-1426-0010 CTP - GA13-TP15 REF1-6.dat Block:1  
 - - - regr.trace:13-1426-0010 CTP - GA13-TP15 REF1-6.dat Block:1  
 □ □ ...  
 - - - ...

## Analysis-results

Analysis data source: 13-1426-0010 CTP - GA13-TP15 REF1-1.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 71.292 + 0.44129 \cdot X$ ;  $B = 0.99849$ ;  $S = 1.99$ 

step1: Bingham yieldstress[Pa]=71.2924

step1: Bingham viscosity[Pas]=0.4413

step2: Bingham:  $Y = 51.838 + 0.47464 \cdot X$ ;  $B = 0.99975$ ;  $S = 0.878$ 

step2: Bingham yieldstress[Pa]=51.8377

step2: Bingham viscosity[Pas]=0.4746

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 53.19 + 0.49028 \cdot X$ ;  $B = 0.99745$ ;  $S = 2.88$ 

step1: Bingham yieldstress[Pa]=53.1899

step1: Bingham viscosity[Pas]=0.4903

step2: Bingham:  $Y = 56.324 + 0.48518 \cdot X$ ;  $B = 0.99909$ ;  $S = 1.7$ 

step2: Bingham yieldstress[Pa]=56.3238

step2: Bingham viscosity[Pas]=0.4852

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 48.215 + 0.53379 \cdot X$ ;  $B = 0.99921$ ;  $S = 1.74$ 

step1: Bingham yieldstress[Pa]=48.215

step1: Bingham viscosity[Pas]=0.5338

step2: Bingham:  $Y = 58.672 + 0.50112 \cdot X$ ;  $B = 0.99899$ ;  $S = 1.85$ 

step2: Bingham yieldstress[Pa]=58.6723

step2: Bingham viscosity[Pas]=0.5011

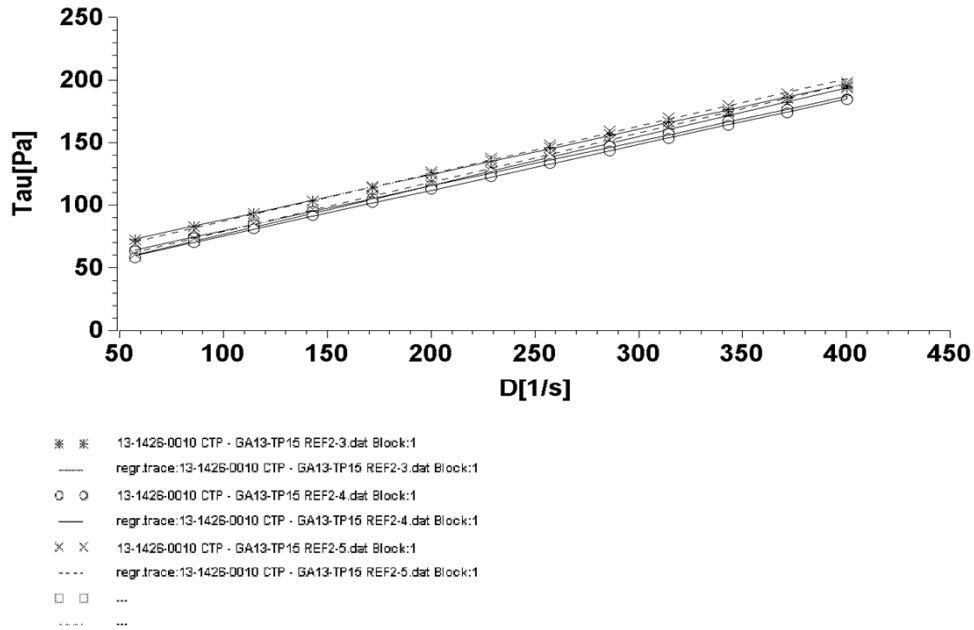
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multiple data sources

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Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 CTP - GA13-TP15 REF2-3.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 52.388 + 0.36099 \cdot X$ ;  $B = 0.99944$ ;  $S = 0.99$ 

step1: Bingham yieldstress[Pa]=52.3876

step1: Bingham viscosity[Pa·s]=0.361

step2: Bingham:  $Y = 38.201 + 0.38854 \cdot X$ ;  $B = 0.99983$ ;  $S = 0.585$ 

step2: Bingham yieldstress[Pa]=38.2012

step2: Bingham viscosity[Pa·s]=0.3885

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 43.903 + 0.35761 \cdot X$ ;  $B = 0.99961$ ;  $S = 0.823$ 

step1: Bingham yieldstress[Pa]=43.9033

step1: Bingham viscosity[Pa·s]=0.3576

step2: Bingham:  $Y = 39.085 + 0.3646 \cdot X$ ;  $B = 0.99963$ ;  $S = 0.817$ 

step2: Bingham yieldstress[Pa]=39.0847

step2: Bingham viscosity[Pa·s]=0.3646

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 49.298 + 0.37957 \cdot X$ ;  $B = 0.99868$ ;  $S = 1.6$ 

step1: Bingham yieldstress[Pa]=49.2982

step1: Bingham viscosity[Pa·s]=0.3796

step2: Bingham:  $Y = 40.076 + 0.39195 \cdot X$ ;  $B = 0.99975$ ;  $S = 0.717$ 

step2: Bingham yieldstress[Pa]=40.0758

step2: Bingham viscosity[Pa·s]=0.3919

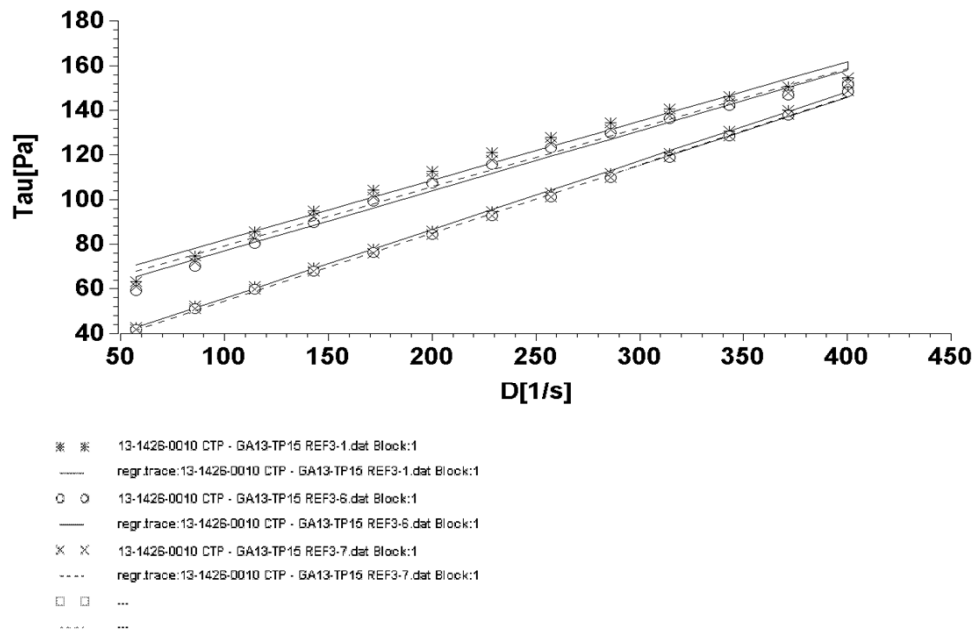
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Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 CTP - GA13-TP15 REF3-1.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 55.477 + 0.26522 * X$ ;  $B = 0.98039$ ;  $S = 4.36$ 

step1: Bingham yieldstress[Pa]=55.4771

step1: Bingham viscosity[Pas]=0.2652

step2: Bingham:  $Y = 24.946 + 0.308 * X$ ;  $B = 0.99895$ ;  $S = 1.16$ 

step2: Bingham yieldstress[Pa]=24.9465

step2: Bingham viscosity[Pas]=0.308

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 49.973 + 0.26928 * X$ ;  $B = 0.9851$ ;  $S = 3.85$ 

step1: Bingham yieldstress[Pa]=49.973

step1: Bingham viscosity[Pas]=0.2693

step2: Bingham:  $Y = 24.138 + 0.30406 * X$ ;  $B = 0.99906$ ;  $S = 1.08$ 

step2: Bingham yieldstress[Pa]=24.1377

step2: Bingham viscosity[Pas]=0.3041

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 52.611 + 0.26494 * X$ ;  $B = 0.98283$ ;  $S = 4.07$ 

step1: Bingham yieldstress[Pa]=52.6106

step1: Bingham viscosity[Pas]=0.2649

step2: Bingham:  $Y = 23.936 + 0.30504 * X$ ;  $B = 0.99891$ ;  $S = 1.17$ 

step2: Bingham yieldstress[Pa]=23.9359

step2: Bingham viscosity[Pas]=0.305

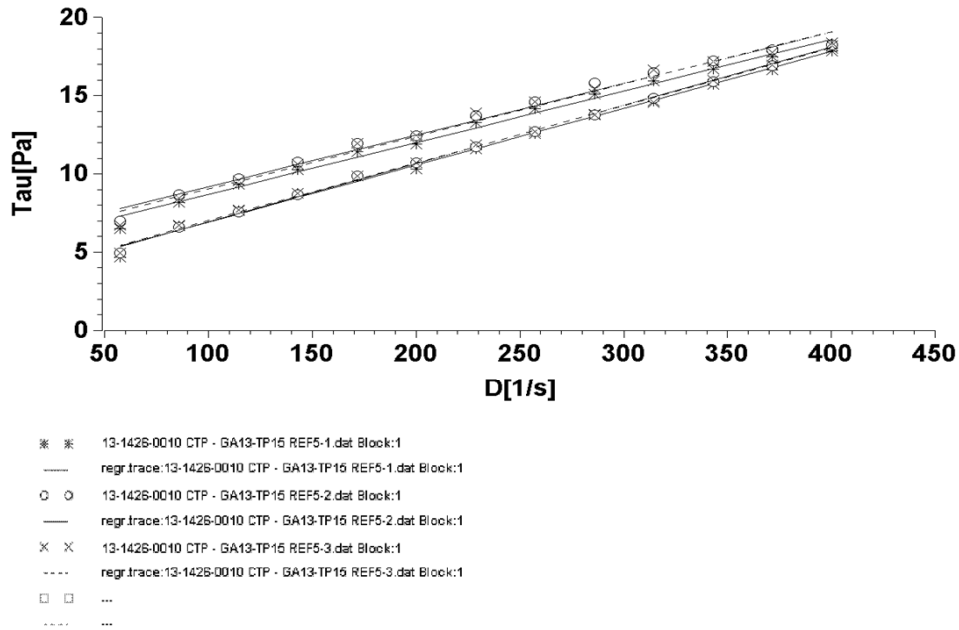
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Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 CTP - GA13-TP15 REF5-1.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 5.3996 + 0.033023 * X$ ;  $B = 0.99131$ ;  $S = 0.359$ 

step1: Bingham yieldstress[Pa]=5.3996

step1: Bingham viscosity[Pa]=0.033

step2: Bingham:  $Y = 3.2942 + 0.036369 * X$ ;  $B = 0.99562$ ;  $S = 0.28$ 

step2: Bingham yieldstress[Pa]=3.2942

step2: Bingham viscosity[Pa]=0.0364

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 5.9028 + 0.032919 * X$ ;  $B = 0.98757$ ;  $S = 0.429$ 

step1: Bingham yieldstress[Pa]=5.9028

step1: Bingham viscosity[Pa]=0.0329

step2: Bingham:  $Y = 3.2378 + 0.037144 * X$ ;  $B = 0.99826$ ;  $S = 0.18$ 

step2: Bingham yieldstress[Pa]=3.2378

step2: Bingham viscosity[Pa]=0.0371

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 5.7117 + 0.033501 * X$ ;  $B = 0.98613$ ;  $S = 0.462$ 

step1: Bingham yieldstress[Pa]=5.7117

step1: Bingham viscosity[Pa]=0.0335

step2: Bingham:  $Y = 3.3477 + 0.036764 * X$ ;  $B = 0.99719$ ;  $S = 0.227$ 

step2: Bingham yieldstress[Pa]=3.3477

step2: Bingham viscosity[Pa]=0.0368

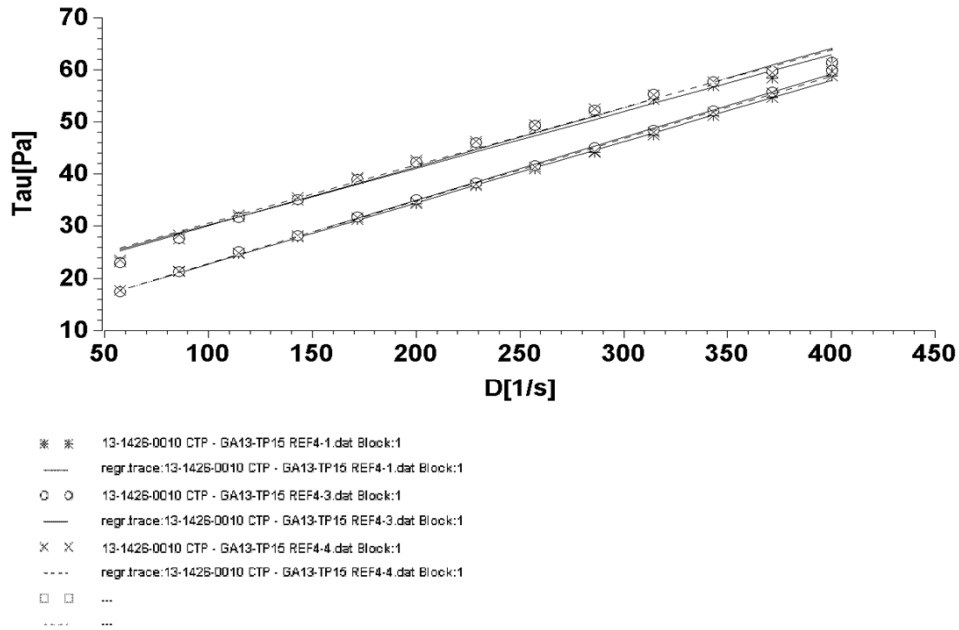
End of report

multiple data sources

page 1

09:14 04/12/13

Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 CTP - GA13-TP15 REF4-1.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 19.323 + 0.1089 \cdot X$ ;  $B = 0.98468$ ;  $S = 1.58$ 

step1: Bingham yieldstress[Pa]=19.3227

step1: Bingham viscosity[Pas]=0.1089

step2: Bingham:  $Y = 10.987 + 0.11748 \cdot X$ ;  $B = 0.99938$ ;  $S = 0.339$ 

step2: Bingham yieldstress[Pa]=10.9874

step2: Bingham viscosity[Pas]=0.1175

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 18.767 + 0.11322 \cdot X$ ;  $B = 0.98892$ ;  $S = 1.39$ 

step1: Bingham yieldstress[Pa]=18.7665

step1: Bingham viscosity[Pas]=0.1132

step2: Bingham:  $Y = 10.81 + 0.12089 \cdot X$ ;  $B = 0.99945$ ;  $S = 0.33$ 

step2: Bingham yieldstress[Pa]=10.8103

step2: Bingham viscosity[Pas]=0.1209

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 19.525 + 0.11078 \cdot X$ ;  $B = 0.98785$ ;  $S = 1.43$ 

step1: Bingham yieldstress[Pa]=19.5248

step1: Bingham viscosity[Pas]=0.1108

step2: Bingham:  $Y = 10.884 + 0.11971 \cdot X$ ;  $B = 0.9989$ ;  $S = 0.462$ 

step2: Bingham yieldstress[Pa]=10.8839

step2: Bingham viscosity[Pas]=0.1197

End of report



Golder Associates Ltd.

Viscosity / Flow Curve Testing R/S Plus Rheometer

Client:	Giant Mine
Project Number:	13-1426-0010
Date:	12/3/2013
Technologist	CJC

	Status	Reviewer	Date Complete
Data Entry	Complete	CA	12/4/2013
Data Review	1st Review Complete	CA	12/4/2013
	2nd Review Complete	ML	12/4/2013

Sample ID: 13-1426-0010 STP - GA13 - TP38  
 Sample Description: Fine greyish brown material  
 Water: 13-1426-0010 Water  
 pH Adjustment: none  
 Bob: CC25 Profiled Bob  
 Additional Info:  
 Specific Gravity: 2.69

## VISCOSITY DATA

## Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
1	1.5975	1.6049	1.7287	1.644
2	0.9609	1.0312	1.0082	1.000
3	0.4560	0.5517	0.5776	0.528
4	0.2304	0.2297	0.2399	0.233
5	0.0919	0.0937	0.0956	0.094
6	0.0494	0.0493	0.0521	0.050
7	0.0238	0.0239	0.0235	0.024

## Ramp Down

Trial 1	Trial 2	Trial 3	AVG
1.8213	1.8516	1.7764	1.816
1.0401	1.0720	1.0855	1.066
0.5892	0.6197	0.6216	0.610
0.2838	0.2668	0.2891	0.280
0.1141	0.1119	0.1142	0.113
0.0531	0.0532	0.0538	0.053
0.0233	0.0230	0.0240	0.023

## YIELD STRESS DATA

## Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
1	805.8629	768.3056	781.5014	785
2	494.6412	477.5789	491.0321	488
3	354.2079	335.6710	321.6282	337
4	183.0677	172.3010	182.7526	179
5	91.5078	88.9613	90.9444	90
6	47.0538	47.5368	47.4477	47
7	19.7419	18.9251	19.9241	20

## Ramp Down

Trial 1	Trial 2	Trial 3	AVG
687.2435	638.8650	693.7880	673
450.9390	449.2406	458.1900	453
304.5041	309.9102	306.1957	307
168.0362	162.3977	169.1041	167
85.2695	84.3810	86.3901	85
46.1139	46.7091	47.0746	47
20.0277	19.3358	19.8079	20

## WEIGHT PERCENT SOLIDS

REF	Pan #	Pan Wt. (g)	Wet (g)	Dry (g)	Wt% Solids	SVF (Φ)
1	55	6.84	19.26	15.09	66.4%	0.42
2	65	6.68	21.91	16.61	65.2%	0.41
3	11x	6.10	18.69	14.15	63.9%	0.40
4	57	6.75	17.10	13.13	61.6%	0.37
5	x10	6.08	22.33	15.68	59.1%	0.35
6	x24	6.24	23.77	16.14	56.5%	0.33
7	x15	6.03	21.03	13.93	52.7%	0.29

Additional Notes:

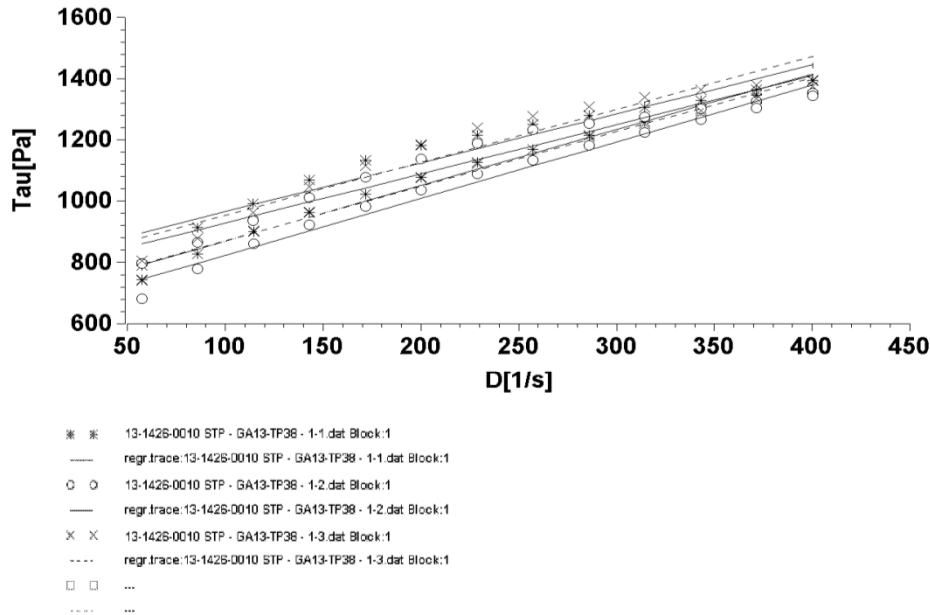


multiple data sources

page 1

14:29 03/12/13

Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 STP - GA13-TP38 - 1-1.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 805.86 + 1.5975 \cdot X$ ;  $B = 0.93182$ ;  $S = 50.2$ 

step1: Bingham yieldstress[Pa]=805.8629

step1: Bingham viscosity[Pas]=1.5975

step2: Bingham:  $Y = 687.24 + 1.8213 \cdot X$ ;  $B = 0.98851$ ;  $S = 22.8$ 

step2: Bingham yieldstress[Pa]=687.2435

step2: Bingham viscosity[Pas]=1.8213

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 768.31 + 1.6049 \cdot X$ ;  $B = 0.94738$ ;  $S = 44$ 

step1: Bingham yieldstress[Pa]=768.3056

step1: Bingham viscosity[Pas]=1.6049

step2: Bingham:  $Y = 638.87 + 1.8516 \cdot X$ ;  $B = 0.98217$ ;  $S = 29$ 

step2: Bingham yieldstress[Pa]=638.865

step2: Bingham viscosity[Pas]=1.8516

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 781.5 + 1.7287 \cdot X$ ;  $B = 0.93725$ ;  $S = 52$ 

step1: Bingham yieldstress[Pa]=781.5014

step1: Bingham viscosity[Pas]=1.7287

step2: Bingham:  $Y = 693.79 + 1.7764 \cdot X$ ;  $B = 0.98479$ ;  $S = 25.7$ 

step2: Bingham yieldstress[Pa]=693.788

step2: Bingham viscosity[Pas]=1.7764

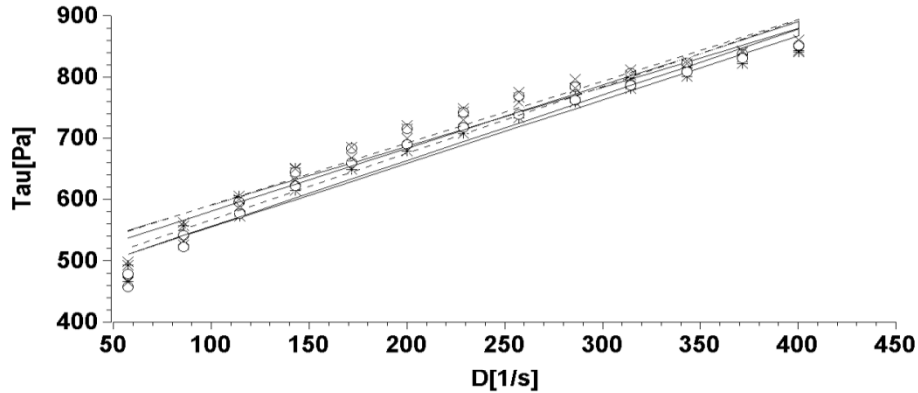
End of report

multiple data sources

page 1

14:33 03/12/13

Manual Report Analysis/Regression



\* 13-1426-0010 STP - GA13-TP38 - 2-4.dat Block:1  
 — regr.trace:13-1426-0010 STP - GA13-TP38 - 2-4.dat Block:1  
 ○ 13-1426-0010 STP - GA13-TP38 - 2-2.dat Block:1  
 — regr.trace:13-1426-0010 STP - GA13-TP38 - 2-2.dat Block:1  
 × 13-1426-0010 STP - GA13-TP38 - 2-3.dat Block:1  
 - - - regr.trace:13-1426-0010 STP - GA13-TP38 - 2-3.dat Block:1  
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 - - - ...

## Analysis-results

Analysis data source: 13-1426-0010 STP - GA13-TP38 - 2-4.dat Block:1

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=494.64+0.96089*X$ ;  $B=0.93927$ ;  $S=28.4$ 

step1: Bingham yieldstress[Pa]=494.6412

step1: Bingham viscosity[Pas]=0.9609

step2: Bingham:  $Y=450.94+1.0401*X$ ;  $B=0.96998$ ;  $S=21.3$ 

step2: Bingham yieldstress[Pa]=450.939

step2: Bingham viscosity[Pas]=1.0401

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=477.58+1.0312*X$ ;  $B=0.94067$ ;  $S=30.1$ 

step1: Bingham yieldstress[Pa]=477.5789

step1: Bingham viscosity[Pas]=1.0312

step2: Bingham:  $Y=449.24+1.072*X$ ;  $B=0.9615$ ;  $S=24.9$ 

step2: Bingham yieldstress[Pa]=449.2406

step2: Bingham viscosity[Pas]=1.072

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=491.03+1.0082*X$ ;  $B=0.95124$ ;  $S=26.5$ 

step1: Bingham yieldstress[Pa]=491.0321

step1: Bingham viscosity[Pas]=1.0082

step2: Bingham:  $Y=458.19+1.0855*X$ ;  $B=0.95856$ ;  $S=26.2$ 

step2: Bingham yieldstress[Pa]=458.19

step2: Bingham viscosity[Pas]=1.0855

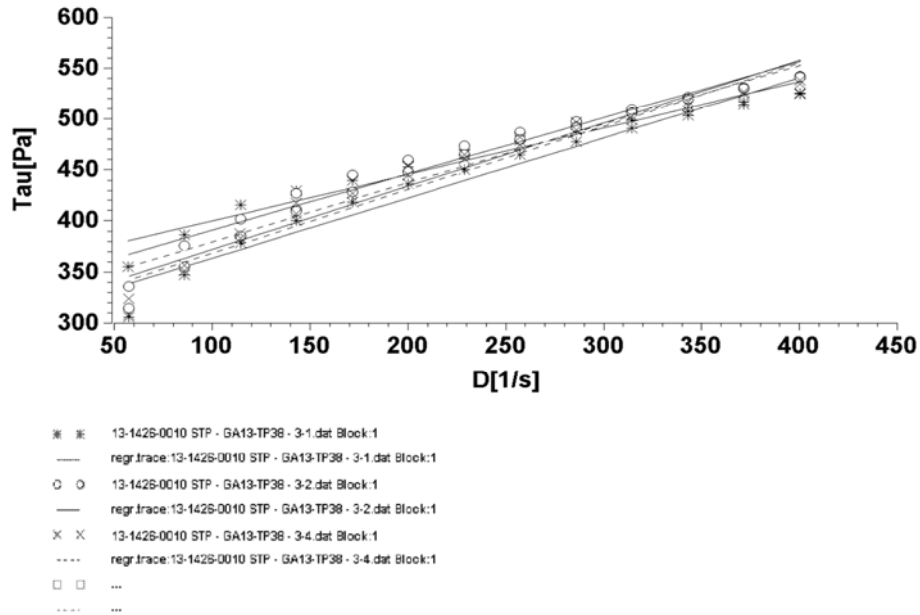
End of report

multiple data sources

page 1

14:37 03/12/13

Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 STP - GA13-TP38 - 3-1.dat Block:1

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=354.21+0.45604*X$  ;B=0.95997; S=10.8

step1: Bingham yieldstress[Pa]=354.2079

step1: Bingham viscosity[Pas]=0.456

step2: Bingham:  $Y=304.5+0.5892*X$  ;B=0.95892; S=14.2

step2: Bingham yieldstress[Pa]=304.5041

step2: Bingham viscosity[Pas]=0.5892

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=335.67+0.5517*X$  ;B=0.95528; S=13.9

step1: Bingham yieldstress[Pa]=335.671

step1: Bingham viscosity[Pas]=0.5517

step2: Bingham:  $Y=309.91+0.61971*X$  ;B=0.96288; S=14.1

step2: Bingham yieldstress[Pa]=309.9102

step2: Bingham viscosity[Pas]=0.6197

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=321.63+0.57758*X$  ;B=0.94632; S=16

step1: Bingham yieldstress[Pa]=321.6282

step1: Bingham viscosity[Pas]=0.5776

step2: Bingham:  $Y=306.2+0.62163*X$  ;B=0.95884; S=15

step2: Bingham yieldstress[Pa]=306.1957

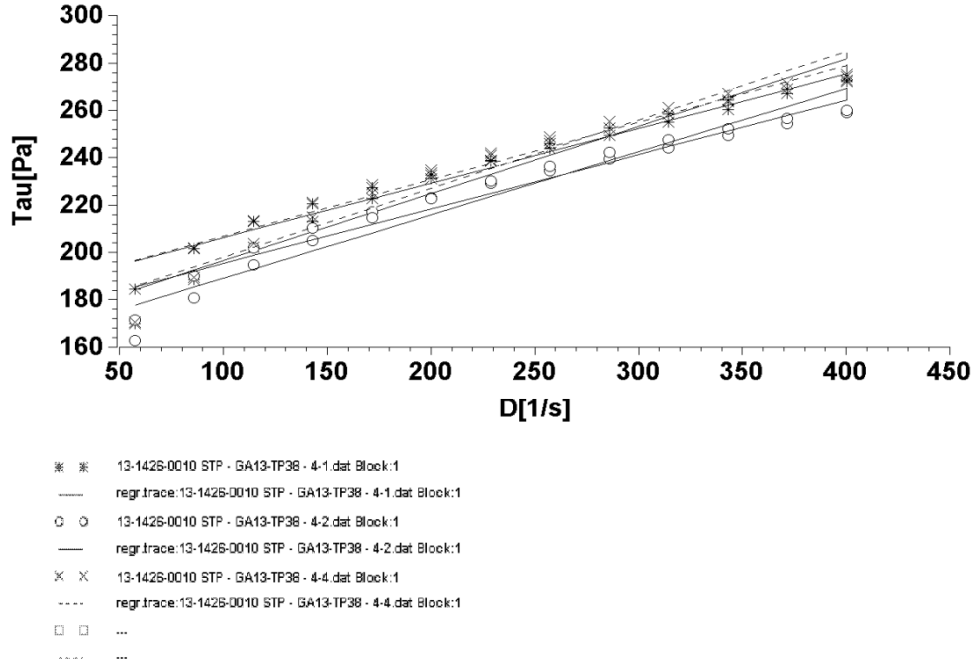
step2: Bingham viscosity[Pas]=0.6216

End of report

multiple data sources

page 1

14:38 03/12/13  
Manual Report Analysis/Regression



Analysis-results

Analysis data source: 13-1426-0010 STP - GA13-TP38 - 4-1.dat Block:1

filter activated: D[1/s]>40

step1: Bingham:  $Y=183.07+0.23043 \cdot X$ ;  $B=0.97134$ ;  $S=4.6$

step1: Bingham yieldstress[Pa]=183.0677

step1: Bingham viscosity[Pas]=0.2304

step2: Bingham:  $Y=168.04+0.28377 \cdot X$ ;  $B=0.96112$ ;  $S=6.63$

step2: Bingham yieldstress[Pa]=168.0362

step2: Bingham viscosity[Pas]=0.2838

filter activated: D[1/s]>40

step1: Bingham:  $Y=172.3+0.22967 \cdot X$ ;  $B=0.95718$ ;  $S=5.65$

step1: Bingham yieldstress[Pa]=172.301

step1: Bingham viscosity[Pas]=0.2297

step2: Bingham:  $Y=162.4+0.26676 \cdot X$ ;  $B=0.95051$ ;  $S=7.07$

step2: Bingham yieldstress[Pa]=162.3977

step2: Bingham viscosity[Pas]=0.2668

filter activated: D[1/s]>40

step1: Bingham:  $Y=182.75+0.23987 \cdot X$ ;  $B=0.97004$ ;  $S=4.9$

step1: Bingham yieldstress[Pa]=182.7526

step1: Bingham viscosity[Pas]=0.2399

step2: Bingham:  $Y=169.1+0.28909 \cdot X$ ;  $B=0.95684$ ;  $S=7.14$

step2: Bingham yieldstress[Pa]=169.1041

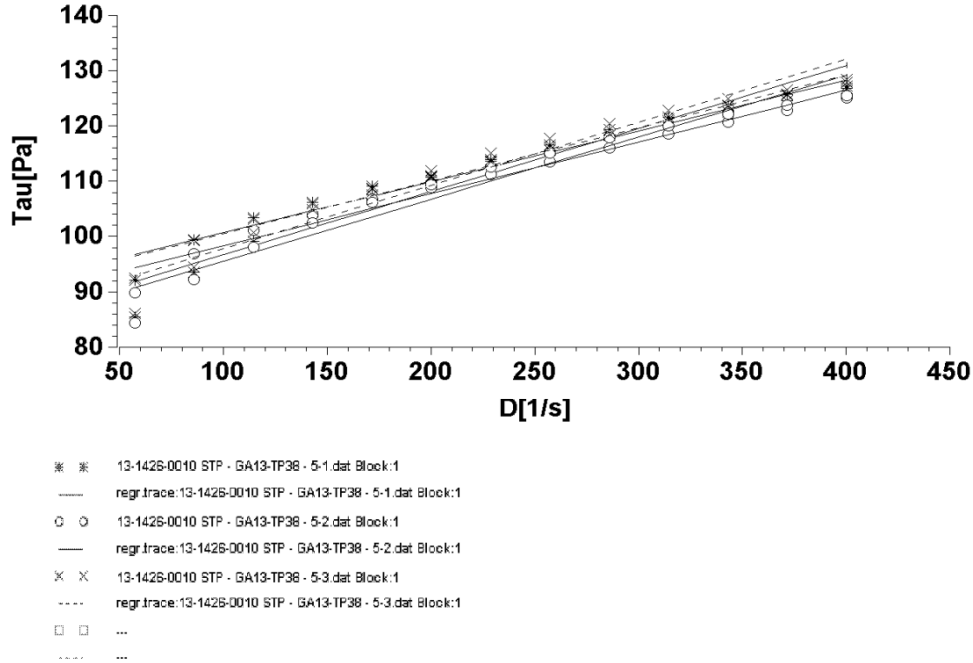
step2: Bingham viscosity[Pas]=0.2891

End of report

multiple data sources

page 1

14:40 03/12/13  
Manual Report Analysis/Regression



Analysis-results

Analysis data source: 13-1426-0010 STP - GA13-TP38 - 5-1.dat Block:1

filter activated: D[1/s]>40

step1: Bingham:  $Y=91.508+0.091927*X$  ;B=0.97264; S=1.79

step1: Bingham yieldstress[Pa]=91.5078

step1: Bingham viscosity[Pas]=0.0919

step2: Bingham:  $Y=85.27+0.11413*X$  ;B=0.95524; S=2.87

step2: Bingham yieldstress[Pa]=85.2695

step2: Bingham viscosity[Pas]=0.1141

filter activated: D[1/s]>40

step1: Bingham:  $Y=88.961+0.093694*X$  ;B=0.9754; S=1.73

step1: Bingham yieldstress[Pa]=88.9613

step1: Bingham viscosity[Pas]=0.0937

step2: Bingham:  $Y=84.381+0.11185*X$  ;B=0.95143; S=2.94

step2: Bingham yieldstress[Pa]=84.381

step2: Bingham viscosity[Pas]=0.1119

filter activated: D[1/s]>40

step1: Bingham:  $Y=90.944+0.095622*X$  ;B=0.98246; S=1.48

step1: Bingham yieldstress[Pa]=90.9444

step1: Bingham viscosity[Pas]=0.0956

step2: Bingham:  $Y=86.39+0.11423*X$  ;B=0.95007; S=3.04

step2: Bingham yieldstress[Pa]=86.3901

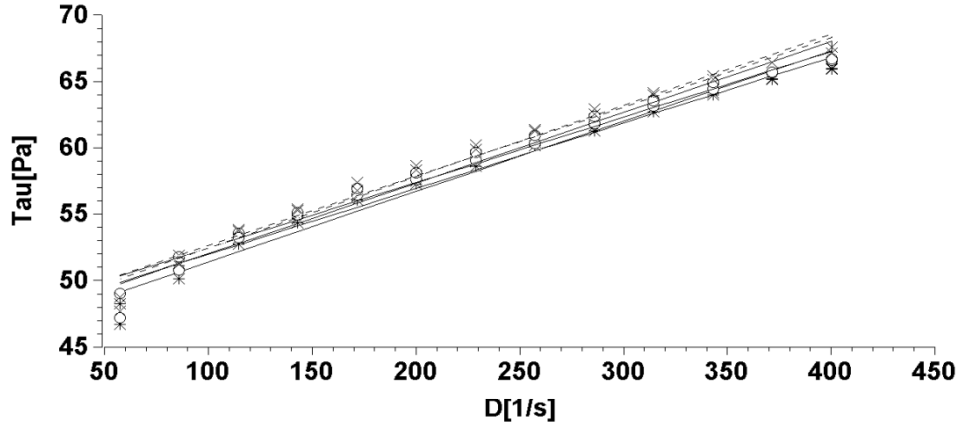
step2: Bingham viscosity[Pas]=0.1142

End of report

multiple data sources

page 1

14:43 03/12/13  
Manual Report Analysis/Regression



\* \* 13-1426-0010 STP - GA13-TP38 - 6-1.dat Block:1  
 — regr.trace:13-1426-0010 STP - GA13-TP38 - 6-1.dat Block:1  
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 — regr.trace:13-1426-0010 STP - GA13-TP38 - 6-2.dat Block:1  
 × × 13-1426-0010 STP - GA13-TP38 - 6-3.dat Block:1  
 - - - regr.trace:13-1426-0010 STP - GA13-TP38 - 6-3.dat Block:1  
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 - - - ...

Analysis-results

Analysis data source: 13-1426-0010 STP - GA13-TP38 - 6-1.dat Block:1

filter activated: D[1/s]>40

step1: Bingham:  $Y=47.054+0.049404*X$  ;B=0.98765; S=0.642

step1: Bingham yieldstress[Pa]=47.0538

step1: Bingham viscosity[Pas]=0.0494

step2: Bingham:  $Y=46.114+0.053052*X$  ;B=0.97093; S=1.07

step2: Bingham yieldstress[Pa]=46.1139

step2: Bingham viscosity[Pas]=0.0531

filter activated: D[1/s]>40

step1: Bingham:  $Y=47.537+0.049299*X$  ;B=0.99222; S=0.507

step1: Bingham yieldstress[Pa]=47.5368

step1: Bingham viscosity[Pas]=0.0493

step2: Bingham:  $Y=46.709+0.053244*X$  ;B=0.97035; S=1.08

step2: Bingham yieldstress[Pa]=46.7091

step2: Bingham viscosity[Pas]=0.0532

filter activated: D[1/s]>40

step1: Bingham:  $Y=47.448+0.052131*X$  ;B=0.98855; S=0.652

step1: Bingham yieldstress[Pa]=47.4477

step1: Bingham viscosity[Pas]=0.0521

step2: Bingham:  $Y=47.075+0.053803*X$  ;B=0.97126; S=1.08

step2: Bingham yieldstress[Pa]=47.0746

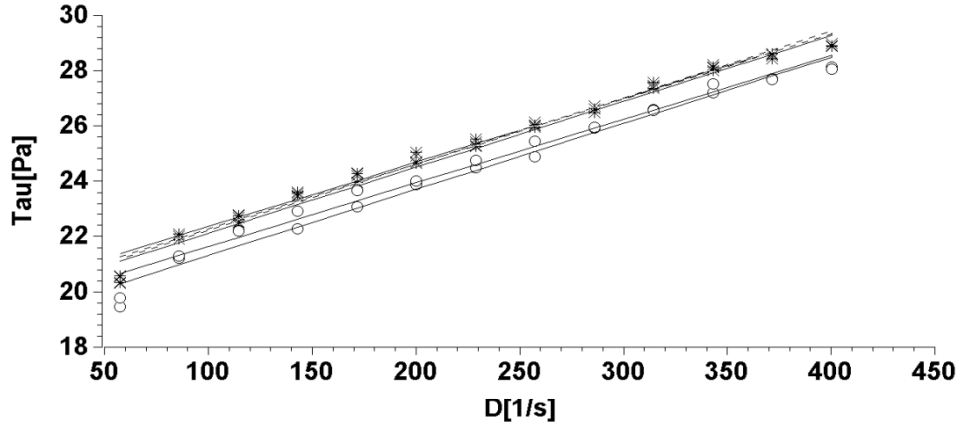
step2: Bingham viscosity[Pas]=0.0538

End of report

multiple data sources

page 1

14:48 03/12/13  
Manual Report Analysis/Regression



\* \* 13-1426-0010 STP - GA13-TP38 - 7-6.dat Block:1  
 — regr.trace:13-1426-0010 STP - GA13-TP38 - 7-5.dat Block:1  
 ○ ○ 13-1426-0010 STP - GA13-TP38 - 7-5.dat Block:1  
 — regr.trace:13-1426-0010 STP - GA13-TP38 - 7-5.dat Block:1  
 × × 13-1426-0010 STP - GA13-TP38 - 7-2.dat Block:1  
 - - - regr.trace:13-1426-0010 STP - GA13-TP38 - 7-2.dat Block:1  
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 - - - ...

Analysis-results

Analysis data source: 13-1426-0010 STP - GA13-TP38 - 7-6.dat Block:1

filter activated: D[1/s]>40

step1: Bingham:  $Y=19.742+0.023801*X$  ;B=0.98678; S=0.32

step1: Bingham yieldstress[Pa]=19.7419

step1: Bingham viscosity[Pas]=0.0238

step2: Bingham:  $Y=20.028+0.023263*X$  ;B=0.98614; S=0.32

step2: Bingham yieldstress[Pa]=20.0277

step2: Bingham viscosity[Pas]=0.0233

step1: Bingham:  $Y=19.742+0.023801*X$  ;B=0.98678; S=0.32

step1: Bingham yieldstress[Pa]=19.7419

step1: Bingham viscosity[Pas]=0.0238

step2: Bingham:  $Y=20.028+0.023263*X$  ;B=0.98614; S=0.32

step2: Bingham yieldstress[Pa]=20.0277

step2: Bingham viscosity[Pas]=0.0233

filter activated: D[1/s]>40

step1: Bingham:  $Y=18.925+0.023877*X$  ;B=0.98438; S=0.35

step1: Bingham yieldstress[Pa]=18.9251

step1: Bingham viscosity[Pas]=0.0239

step2: Bingham:  $Y=19.336+0.023007*X$  ;B=0.98172; S=0.365

step2: Bingham yieldstress[Pa]=19.3358

step2: Bingham viscosity[Pas]=0.023

filter activated: D[1/s]>40

step1: Bingham:  $Y=19.924+0.023479*X$  ;B=0.98926; S=0.284

step1: Bingham yieldstress[Pa]=19.9241

step1: Bingham viscosity[Pas]=0.0235

step2: Bingham:  $Y=19.808+0.024034*X$  ;B=0.98539; S=0.34

step2: Bingham yieldstress[Pa]=19.8079

step2: Bingham viscosity[Pas]=0.024



Golder Associates Ltd.  
Viscosity / Flow Curve Testing R/S Plus Rheometer

Client:	Giant Mining Support Services
Project Number:	13-1426-0010
Date:	1/7/2014
Technologist	CA

	Status	Reviewer	Date Complete
Data Entry	Complete	CA	1/9/2014
Data Review	1st Review Complete	CA	1/9/2014
	2nd Review Complete	ML	1/27/2014

Sample ID:	13-1426-0010 CTP - GA13-TP14-2
Sample Description:	fine, sticky, grey material
Water:	13-1426-0010 Water
pH Adjustment:	none
Bob:	CC25 Profiled Bob
Additional Info:	
Specific Gravity	2.81

## VISCOSITY DATA

## Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
1	1.4802	1.5314	1.3318	1.448
2	1.0516	1.0585	1.0136	1.041
3	0.6656	0.6636	0.6686	0.666
4	0.4243	0.4098	0.4110	0.415
5	0.2059	0.1929	0.1944	0.198
6	0.0677	0.0673	0.0641	0.066
7	0.0296	0.0307	0.0301	0.030

## Ramp Down

Trial 1	Trial 2	Trial 3	AVG
1.5794	1.6016	1.6689	1.617
1.0715	1.1022	1.0948	1.090
0.7033	0.7013	0.6898	0.698
0.4383	0.4259	0.4345	0.433
0.2088	0.2039	0.2024	0.205
0.0704	0.0697	0.0674	0.069
0.0312	0.0306	0.0316	0.031

## YIELD STRESS DATA

## Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
1	597.5729	592.6002	610.9867	600
2	417.2371	424.9920	410.0059	417
3	291.0699	305.0972	292.0489	296
4	201.9752	204.2052	205.1375	204
5	124.0283	124.2351	122.3630	124
6	55.4439	55.1196	54.8252	55
7	23.3275	22.9330	23.2173	23

## Ramp Down

Trial 1	Trial 2	Trial 3	AVG
547.0058	563.2819	476.8242	529
403.4689	401.8788	383.6234	396
281.0569	293.0721	289.2823	288
204.5816	203.8495	204.3042	204
125.8655	122.7039	122.0837	124
54.3127	54.1838	53.4292	54
22.9169	22.8936	22.8351	23

## WEIGHT PERCENT SOLIDS

REF	Pan #	Pan Wt. (g)	Wet (g)	Dry (g)	Wt% Solids	SVF (Φ)
1	X6	6.00	27.40	21.30	71.50%	0.47
2	X13	6.02	33.15	25.11	70.36%	0.46
3	57	6.74	32.65	24.67	69.20%	0.44
4	24Z	30.31	60.55	50.90	68.09%	0.43
5	22B	30.23	63.64	52.37	66.27%	0.41
6	24	31.47	66.82	53.79	63.14%	0.38
7	24F	30.26	63.16	49.96	59.88%	0.35

Additional Notes:

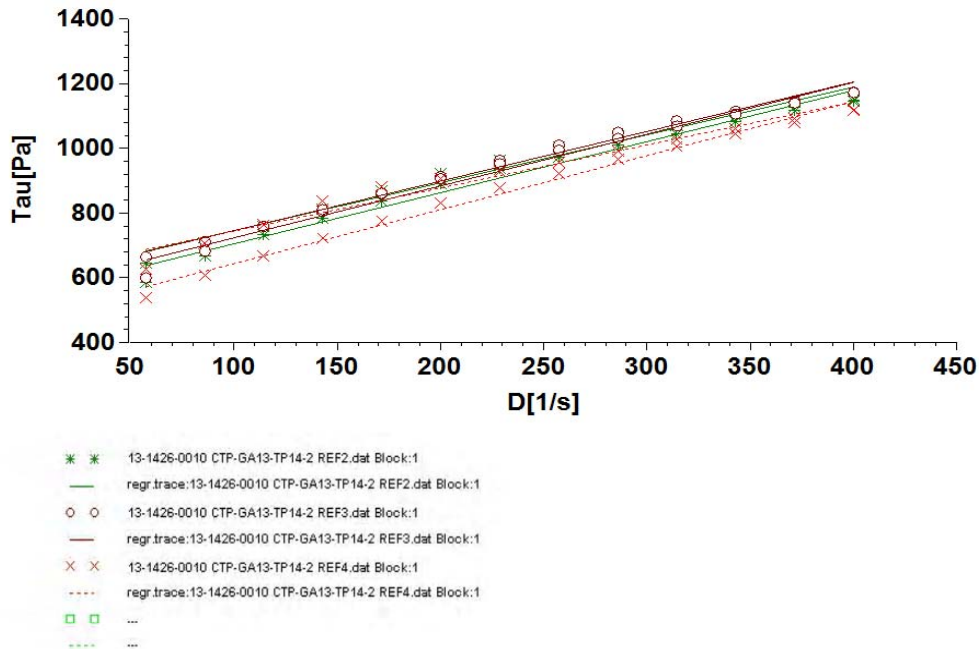


multiple data sources

page 1

10:44 08/01/14

Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 CTP-GA13-TP14-2 REF2.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 597.57 + 1.4802 \cdot X$ ;  $B = 0.98016$ ;  $S = 24.5$ 

step1: Bingham yieldstress[Pa]=597.5729

step1: Bingham viscosity[Pas]=1.4802

step2: Bingham:  $Y = 547.01 + 1.5794 \cdot X$ ;  $B = 0.98126$ ;  $S = 25.4$ 

step2: Bingham yieldstress[Pa]=547.0058

step2: Bingham viscosity[Pas]=1.5794

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 592.6 + 1.5314 \cdot X$ ;  $B = 0.99029$ ;  $S = 17.6$ 

step1: Bingham yieldstress[Pa]=592.6002

step1: Bingham viscosity[Pas]=1.5314

step2: Bingham:  $Y = 563.28 + 1.6016 \cdot X$ ;  $B = 0.98115$ ;  $S = 25.8$ 

step2: Bingham yieldstress[Pa]=563.2819

step2: Bingham viscosity[Pas]=1.6016

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 610.99 + 1.3318 \cdot X$ ;  $B = 0.96757$ ;  $S = 28.3$ 

step1: Bingham yieldstress[Pa]=610.9867

step1: Bingham viscosity[Pas]=1.3318

step2: Bingham:  $Y = 476.82 + 1.6689 \cdot X$ ;  $B = 0.99121$ ;  $S = 18.3$ 

step2: Bingham yieldstress[Pa]=476.8242

step2: Bingham viscosity[Pas]=1.6689

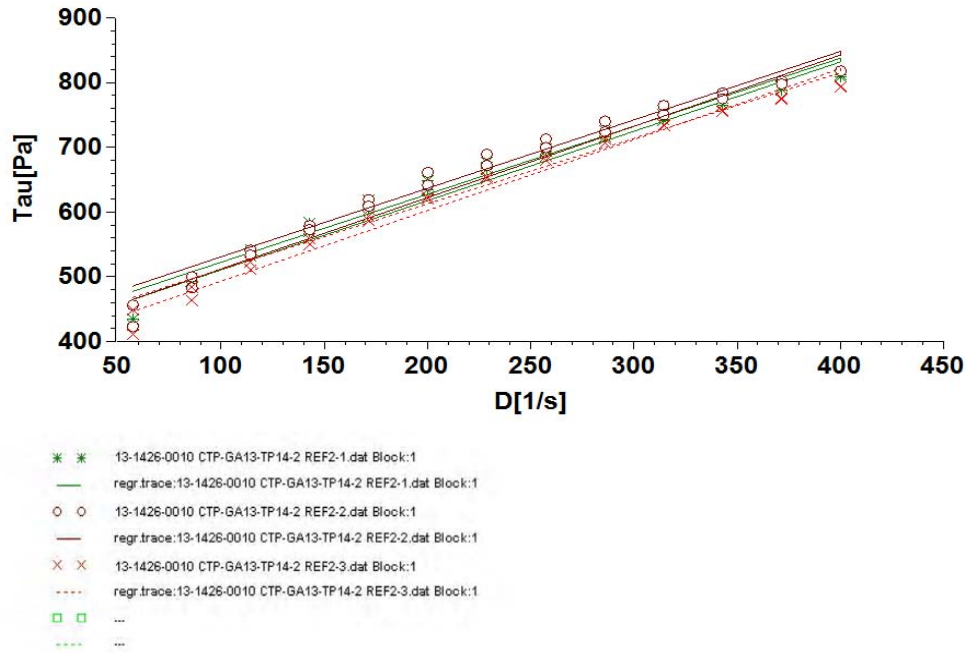
End of report

multiple data sources

page 1

11:15 08/01/14

Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 CTP-GA13-TP14-2 REF2-1.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y=417.24+1.0516 \cdot X$ ;  $B=0.97259$ ;  $S=20.5$ 

step1: Bingham yieldstress[Pa]=417.2371

step1: Bingham viscosity[Pas]=1.0516

step2: Bingham:  $Y=403.47+1.0715 \cdot X$ ;  $B=0.97783$ ;  $S=18.8$ 

step2: Bingham yieldstress[Pa]=403.4689

step2: Bingham viscosity[Pas]=1.0715

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y=424.99+1.0585 \cdot X$ ;  $B=0.97598$ ;  $S=19.3$ 

step1: Bingham yieldstress[Pa]=424.992

step1: Bingham viscosity[Pas]=1.0585

step2: Bingham:  $Y=401.88+1.1022 \cdot X$ ;  $B=0.97674$ ;  $S=19.8$ 

step2: Bingham yieldstress[Pa]=401.8788

step2: Bingham viscosity[Pas]=1.1022

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y=410.01+1.0136 \cdot X$ ;  $B=0.98705$ ;  $S=13.5$ 

step1: Bingham yieldstress[Pa]=410.0059

step1: Bingham viscosity[Pas]=1.0136

step2: Bingham:  $Y=383.62+1.0948 \cdot X$ ;  $B=0.97992$ ;  $S=18.2$ 

step2: Bingham yieldstress[Pa]=383.6234

step2: Bingham viscosity[Pas]=1.0948

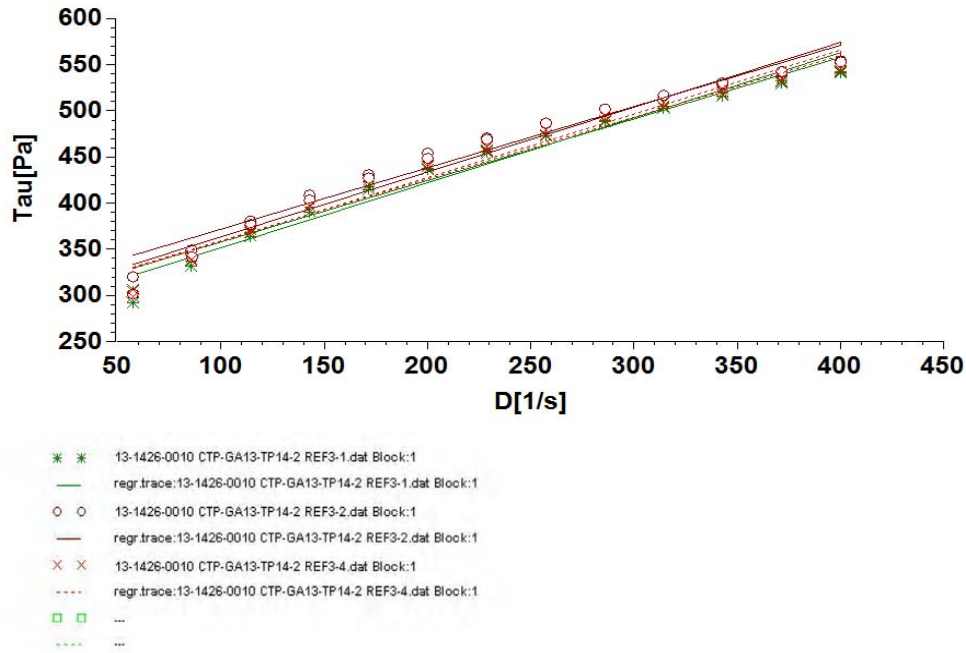
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page 1

11:43 08/01/14

Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 CTP-GA13-TP14-2 REF3-1.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 291.07 + 0.66564 \cdot X$ ;  $B = 0.97386$ ;  $S = 12.7$ 

step1: Bingham yieldstress[Pa]=291.0699

step1: Bingham viscosity[Pas]=0.6656

step2: Bingham:  $Y = 281.06 + 0.70328 \cdot X$ ;  $B = 0.9691$ ;  $S = 14.6$ 

step2: Bingham yieldstress[Pa]=281.0569

step2: Bingham viscosity[Pas]=0.7033

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 305.1 + 0.6636 \cdot X$ ;  $B = 0.97142$ ;  $S = 13.2$ 

step1: Bingham yieldstress[Pa]=305.0972

step1: Bingham viscosity[Pas]=0.6636

step2: Bingham:  $Y = 293.07 + 0.70131 \cdot X$ ;  $B = 0.96448$ ;  $S = 15.6$ 

step2: Bingham yieldstress[Pa]=293.0721

step2: Bingham viscosity[Pas]=0.7013

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 292.05 + 0.66856 \cdot X$ ;  $B = 0.97342$ ;  $S = 12.8$ 

step1: Bingham yieldstress[Pa]=292.0489

step1: Bingham viscosity[Pas]=0.6686

step2: Bingham:  $Y = 289.28 + 0.68976 \cdot X$ ;  $B = 0.96822$ ;  $S = 14.5$ 

step2: Bingham yieldstress[Pa]=289.2823

step2: Bingham viscosity[Pas]=0.6898

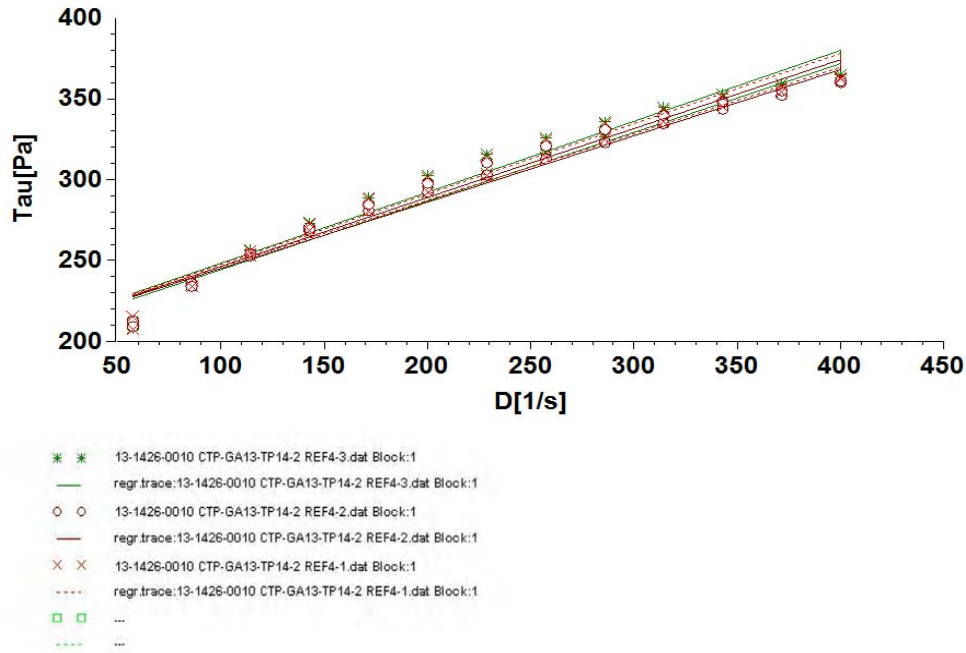
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page 1

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Manual Report Analysis/Regression

**Analysis-results**

Analysis data source: 13-1426-0010 CTP-GA13-TP14-2 REF4-3.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 201.98 + 0.4243 \cdot X$ ;  $B = 0.98177$ ;  $S = 6.72$ 

step1: Bingham yieldstress[Pa]=201.9752

step1: Bingham viscosity[Pas]=0.4243

step2: Bingham:  $Y = 204.58 + 0.43834 \cdot X$ ;  $B = 0.95705$ ;  $S = 10.8$ 

step2: Bingham yieldstress[Pa]=204.5816

step2: Bingham viscosity[Pas]=0.4383

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 204.21 + 0.40978 \cdot X$ ;  $B = 0.9816$ ;  $S = 6.52$ 

step1: Bingham yieldstress[Pa]=204.2052

step1: Bingham viscosity[Pas]=0.4098

step2: Bingham:  $Y = 203.85 + 0.42592 \cdot X$ ;  $B = 0.96528$ ;  $S = 9.39$ 

step2: Bingham yieldstress[Pa]=203.8495

step2: Bingham viscosity[Pas]=0.4259

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 205.14 + 0.41097 \cdot X$ ;  $B = 0.98566$ ;  $S = 5.76$ 

step1: Bingham yieldstress[Pa]=205.1375

step1: Bingham viscosity[Pas]=0.411

step2: Bingham:  $Y = 204.3 + 0.43446 \cdot X$ ;  $B = 0.95676$ ;  $S = 10.7$ 

step2: Bingham yieldstress[Pa]=204.3042

step2: Bingham viscosity[Pas]=0.4345

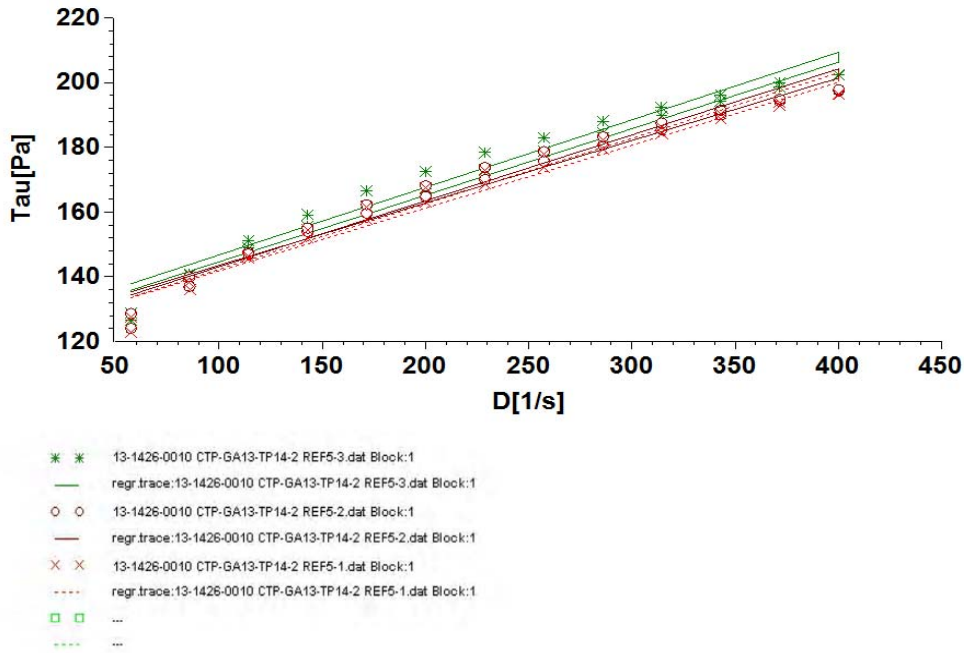
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Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 CTP-GA13-TP14-2 REF5-3.dat Block:1

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=124.03+0.20586 \cdot X$ ;  $B=0.98484$ ;  $S=2.97$ 

step1: Bingham yieldstress[Pa]=124.0283

step1: Bingham viscosity[Pas]=0.2059

step2: Bingham:  $Y=125.87+0.20884 \cdot X$ ;  $B=0.95582$ ;  $S=5.22$ 

step2: Bingham yieldstress[Pa]=125.8655

step2: Bingham viscosity[Pas]=0.2088

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=124.24+0.19294 \cdot X$ ;  $B=0.98448$ ;  $S=2.82$ 

step1: Bingham yieldstress[Pa]=124.2351

step1: Bingham viscosity[Pas]=0.1929

step2: Bingham:  $Y=122.7+0.20386 \cdot X$ ;  $B=0.95874$ ;  $S=4.91$ 

step2: Bingham yieldstress[Pa]=122.7039

step2: Bingham viscosity[Pas]=0.2039

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=122.36+0.19436 \cdot X$ ;  $B=0.98651$ ;  $S=2.64$ 

step1: Bingham yieldstress[Pa]=122.363

step1: Bingham viscosity[Pas]=0.1944

step2: Bingham:  $Y=122.08+0.20241 \cdot X$ ;  $B=0.95592$ ;  $S=5.05$ 

step2: Bingham yieldstress[Pa]=122.0837

step2: Bingham viscosity[Pas]=0.2024

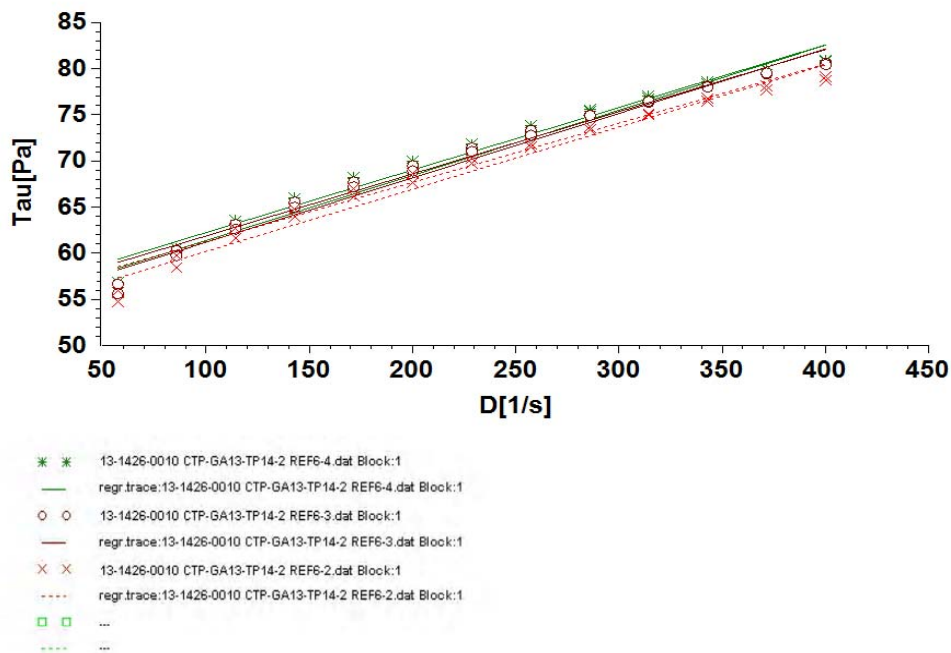
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Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 CTP-GA13-TP14-2 REF6-4.dat Block:1

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=55.444+0.067694*X$ ;  $B=0.97827$ ;  $S=1.17$ 

step1: Bingham yieldstress[Pa]=55.4439

step1: Bingham viscosity[Pas]=0.0677

step2: Bingham:  $Y=54.313+0.070432*X$ ;  $B=0.97964$ ;  $S=1.18$ 

step2: Bingham yieldstress[Pa]=54.3127

step2: Bingham viscosity[Pas]=0.0704

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=55.12+0.06726*X$ ;  $B=0.98114$ ;  $S=1.08$ 

step1: Bingham yieldstress[Pa]=55.1196

step1: Bingham viscosity[Pas]=0.0673

step2: Bingham:  $Y=54.184+0.069746*X$ ;  $B=0.98064$ ;  $S=1.14$ 

step2: Bingham yieldstress[Pa]=54.1838

step2: Bingham viscosity[Pas]=0.0697

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=54.825+0.06408*X$ ;  $B=0.97886$ ;  $S=1.09$ 

step1: Bingham yieldstress[Pa]=54.8252

step1: Bingham viscosity[Pas]=0.0641

step2: Bingham:  $Y=53.429+0.067362*X$ ;  $B=0.97791$ ;  $S=1.18$ 

step2: Bingham yieldstress[Pa]=53.4292

step2: Bingham viscosity[Pas]=0.0674

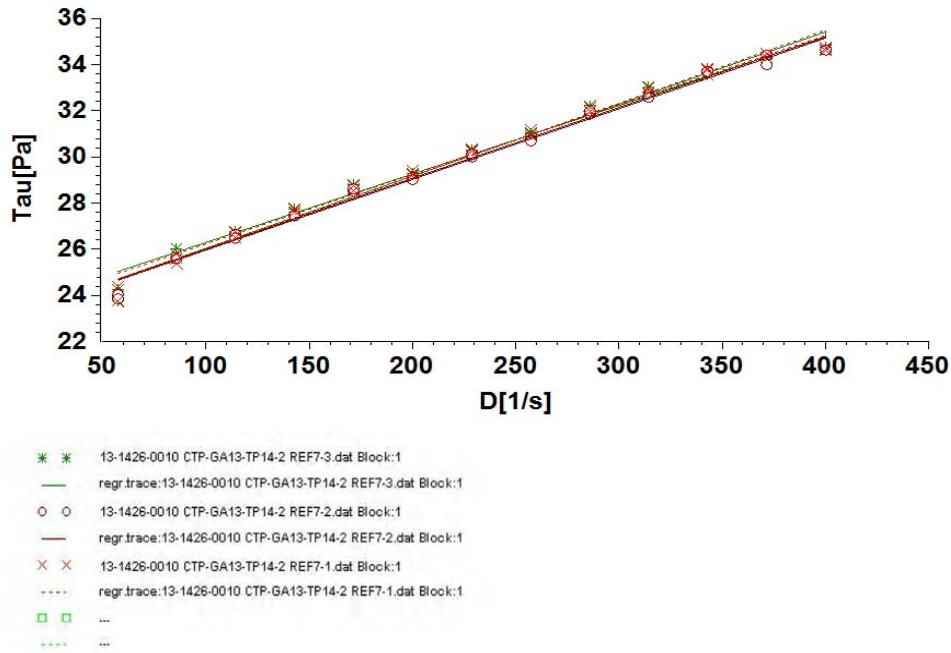
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page 1

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Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 CTP-GA13-TP14-2 REF7-3.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 23.328 + 0.029607 \cdot X$ ;  $B = 0.99201$ ;  $S = 0.309$ 

step1: Bingham yieldstress[Pa]=23.3275

step1: Bingham viscosity[Pas]=0.0296

step2: Bingham:  $Y = 22.917 + 0.031199 \cdot X$ ;  $B = 0.98639$ ;  $S = 0.426$ 

step2: Bingham yieldstress[Pa]=22.9169

step2: Bingham viscosity[Pas]=0.0312

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 22.933 + 0.030658 \cdot X$ ;  $B = 0.99305$ ;  $S = 0.298$ 

step1: Bingham yieldstress[Pa]=22.933

step1: Bingham viscosity[Pas]=0.0307

step2: Bingham:  $Y = 22.894 + 0.030591 \cdot X$ ;  $B = 0.98943$ ;  $S = 0.368$ 

step2: Bingham yieldstress[Pa]=22.8936

step2: Bingham viscosity[Pas]=0.0306

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 23.217 + 0.030068 \cdot X$ ;  $B = 0.9936$ ;  $S = 0.281$ 

step1: Bingham yieldstress[Pa]=23.2173

step1: Bingham viscosity[Pas]=0.0301

step2: Bingham:  $Y = 22.835 + 0.031581 \cdot X$ ;  $B = 0.98554$ ;  $S = 0.445$ 

step2: Bingham yieldstress[Pa]=22.8351

step2: Bingham viscosity[Pas]=0.0316

End of report



Golder Associates Ltd.  
Viscosity / Flow Curve Testing R/S Plus Rheometer

Client:	Giant Mining Support Services
Project Number:	13-1426-0010
Date:	1/8/2014
Technologist	CA

	Status	Reviewer	Date Complete
Data Entry	Complete	CA	1/9/2014
Data Review	1st Review Complete	CA	1/9/2014
	2nd Review Complete	ML	1/27/2014

Sample ID:	13-1426-0010 STP - GA13-TP27
Sample Description:	dark grey material
Water:	13-1426-0010 Water
pH Adjustment:	none
Bob:	CC25 Profiled Bob
Additional Info:	
Specific Gravity	2.81

## VISCOSITY DATA

## Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
1	1.2549	1.3564	1.3432	1.318
2	0.7385	0.7538	0.7857	0.759
3	0.3242	0.3062	0.3153	0.315
4	0.1259	0.1322	0.1325	0.130
5	0.0324	0.0308	0.0330	0.032
6				
7				

## Ramp Down

Trial 1	Trial 2	Trial 3	AVG
1.4887	1.2684	1.4917	1.416
0.7483	0.7699	0.8026	0.774
0.3307	0.3213	0.3315	0.328
0.1320	0.1368	0.1356	0.135
0.0339	0.0340	0.0347	0.034

## YIELD STRESS DATA

## Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
1	335.8220	302.8626	340.7784	326
2	177.1931	172.3880	181.5711	177
3	99.9674	101.2115	101.3564	101
4	53.3793	53.1099	52.7261	53
5	14.1437	14.4922	14.2799	14
6				
7				

## Ramp Down

Trial 1	Trial 2	Trial 3	AVG
222.6610	279.9550	245.1108	249
153.3467	155.4334	162.2436	157
92.0638	90.1789	91.1446	91
49.9905	50.1587	50.0896	50
13.4895	13.3860	13.4326	13

## WEIGHT PERCENT SOLIDS

REF	Pan #	Pan Wt. (g)	Wet (g)	Dry (g)	Wt% Solids	SVF (Φ)
1	Z3	31.27	66.49	58.08	76.12%	0.53
2	46	30.55	59.49	52.18	74.74%	0.51
3	49	6.76	27.75	22.06	72.89%	0.49
4	15	30.30	58.26	50.16	71.03%	0.47
5	64	30.26	58.99	49.25	66.10%	0.41
6						
7						

## Additional Notes:

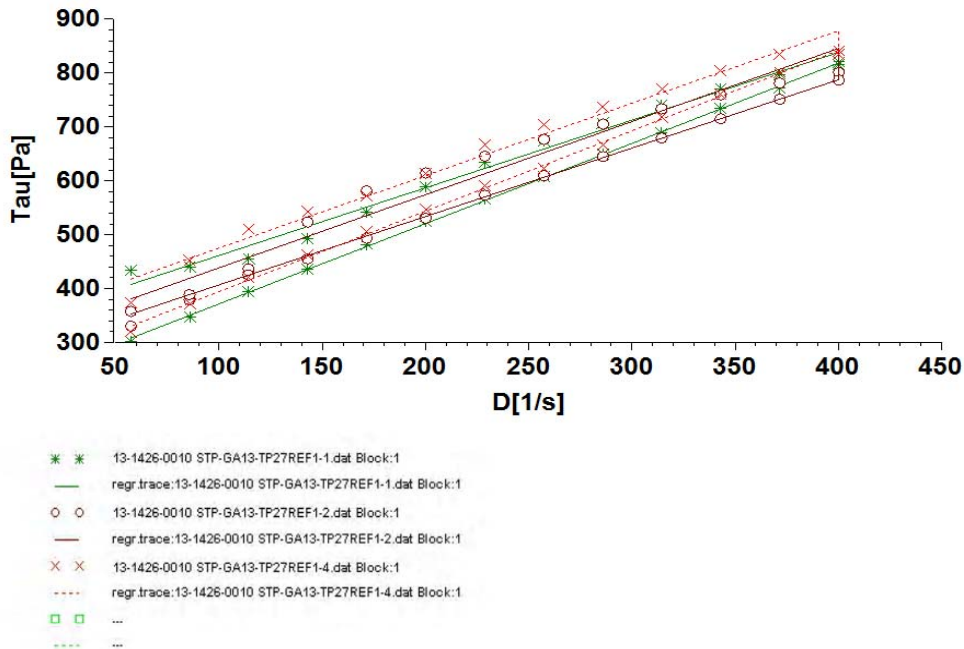


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page 1

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Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 STP-GA13-TP27REF1-1.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 335.82 + 1.2549 \cdot X$ ;  $B = 0.98808$ ;  $S = 16$ 

step1: Bingham yieldstress[Pa]=335.822

step1: Bingham viscosity[Pas]=1.2549

step2: Bingham:  $Y = 222.66 + 1.4887 \cdot X$ ;  $B = 0.99965$ ;  $S = 3.22$ 

step2: Bingham yieldstress[Pa]=222.661

step2: Bingham viscosity[Pas]=1.4887

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 302.86 + 1.3564 \cdot X$ ;  $B = 0.9524$ ;  $S = 35.2$ 

step1: Bingham yieldstress[Pa]=302.8626

step1: Bingham viscosity[Pas]=1.3564

step2: Bingham:  $Y = 279.95 + 1.2684 \cdot X$ ;  $B = 0.9995$ ;  $S = 3.29$ 

step2: Bingham yieldstress[Pa]=279.955

step2: Bingham viscosity[Pas]=1.2684

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 340.78 + 1.3432 \cdot X$ ;  $B = 0.98296$ ;  $S = 20.6$ 

step1: Bingham yieldstress[Pa]=340.7784

step1: Bingham viscosity[Pas]=1.3432

step2: Bingham:  $Y = 245.11 + 1.4917 \cdot X$ ;  $B = 0.999$ ;  $S = 5.49$ 

step2: Bingham yieldstress[Pa]=245.1108

step2: Bingham viscosity[Pas]=1.4917

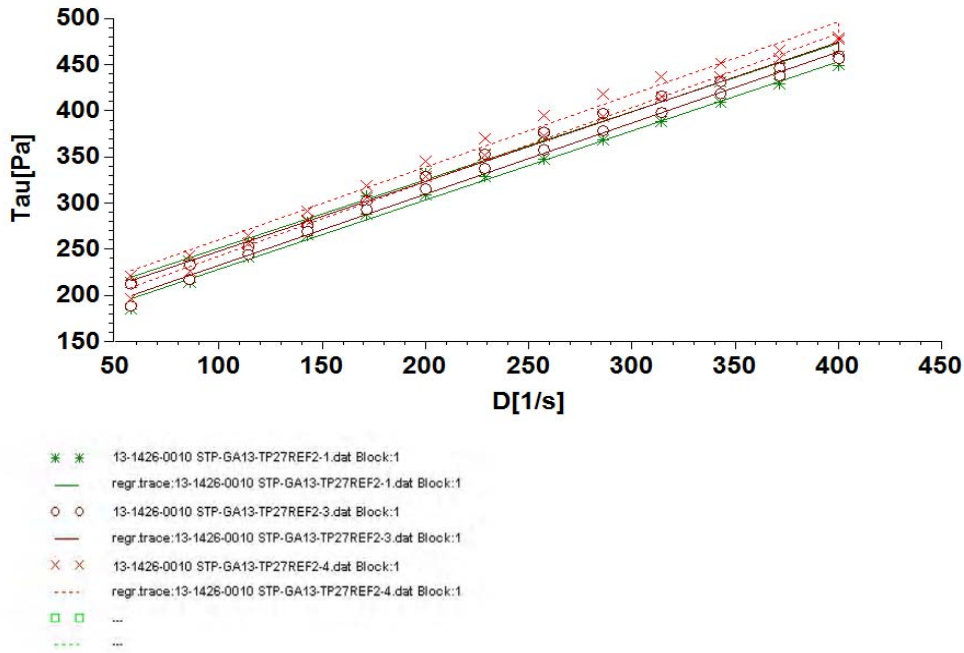
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16:04 08/01/14

Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 STP-GA13-TP27REF2-1.dat Block:1

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=177.19+0.73853 \cdot X$ ;  $B=0.99401$ ;  $S=6.66$ 

step1: Bingham yieldstress[Pa]=177.1931

step1: Bingham viscosity[Pas]=0.7385

step2: Bingham:  $Y=153.35+0.74825 \cdot X$ ;  $B=0.99689$ ;  $S=4.85$ 

step2: Bingham yieldstress[Pa]=153.3467

step2: Bingham viscosity[Pas]=0.7483

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=172.39+0.75378 \cdot X$ ;  $B=0.99212$ ;  $S=7.81$ 

step1: Bingham yieldstress[Pa]=172.388

step1: Bingham viscosity[Pas]=0.7538

step2: Bingham:  $Y=155.43+0.7699 \cdot X$ ;  $B=0.99609$ ;  $S=5.61$ 

step2: Bingham yieldstress[Pa]=155.4334

step2: Bingham viscosity[Pas]=0.7699

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=181.57+0.78566 \cdot X$ ;  $B=0.99036$ ;  $S=9.01$ 

step1: Bingham yieldstress[Pa]=181.5711

step1: Bingham viscosity[Pas]=0.7857

step2: Bingham:  $Y=162.24+0.80265 \cdot X$ ;  $B=0.99621$ ;  $S=5.75$ 

step2: Bingham yieldstress[Pa]=162.2436

step2: Bingham viscosity[Pas]=0.8026

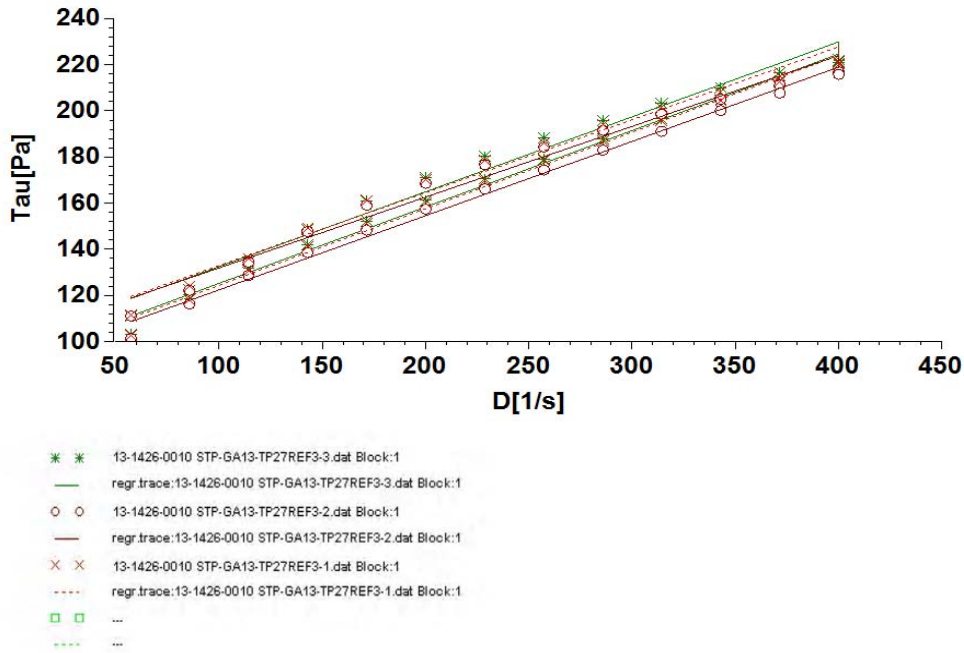
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Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 STP-GA13-TP27REF3-3.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 99.967 + 0.32416 \cdot X$ ;  $B = 0.98053$ ;  $S = 5.31$ 

step1: Bingham yieldstress[Pa]=99.9674

step1: Bingham viscosity[Pas]=0.3242

step2: Bingham:  $Y = 92.064 + 0.3307 \cdot X$ ;  $B = 0.99225$ ;  $S = 3.4$ 

step2: Bingham yieldstress[Pa]=92.0638

step2: Bingham viscosity[Pas]=0.3307

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 101.21 + 0.3062 \cdot X$ ;  $B = 0.9802$ ;  $S = 5.06$ 

step1: Bingham yieldstress[Pa]=101.2115

step1: Bingham viscosity[Pas]=0.3062

step2: Bingham:  $Y = 90.179 + 0.32133 \cdot X$ ;  $B = 0.99343$ ;  $S = 3.04$ 

step2: Bingham yieldstress[Pa]=90.1789

step2: Bingham viscosity[Pas]=0.3213

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 101.36 + 0.31528 \cdot X$ ;  $B = 0.98284$ ;  $S = 4.84$ 

step1: Bingham yieldstress[Pa]=101.3564

step1: Bingham viscosity[Pas]=0.3153

step2: Bingham:  $Y = 91.145 + 0.3315 \cdot X$ ;  $B = 0.99312$ ;  $S = 3.21$ 

step2: Bingham yieldstress[Pa]=91.1446

step2: Bingham viscosity[Pas]=0.3315

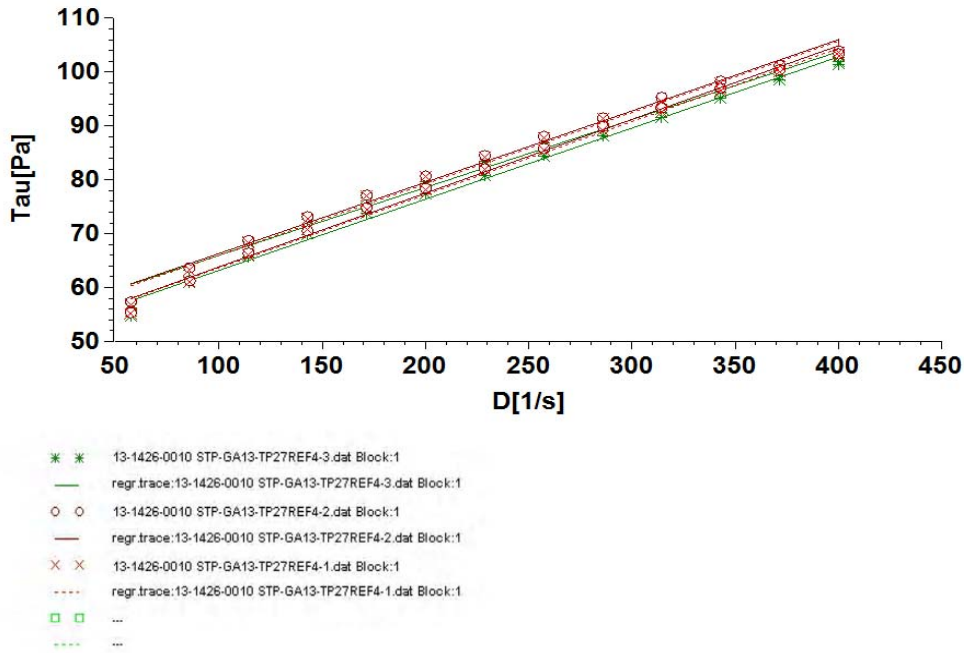
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Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 STP-GA13-TP27REF4-3.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 53.379 + 0.12593 \cdot X$ ;  $B = 0.98863$ ;  $S = 1.57$ 

step1: Bingham yieldstress[Pa]=53.3793

step1: Bingham viscosity[Pas]=0.1259

step2: Bingham:  $Y = 49.991 + 0.13199 \cdot X$ ;  $B = 0.9943$ ;  $S = 1.16$ 

step2: Bingham yieldstress[Pa]=49.9905

step2: Bingham viscosity[Pas]=0.132

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 53.11 + 0.13219 \cdot X$ ;  $B = 0.99067$ ;  $S = 1.49$ 

step1: Bingham yieldstress[Pa]=53.1099

step1: Bingham viscosity[Pas]=0.1322

step2: Bingham:  $Y = 50.159 + 0.13679 \cdot X$ ;  $B = 0.9949$ ;  $S = 1.14$ 

step2: Bingham yieldstress[Pa]=50.1587

step2: Bingham viscosity[Pas]=0.1368

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 52.726 + 0.13245 \cdot X$ ;  $B = 0.98978$ ;  $S = 1.56$ 

step1: Bingham yieldstress[Pa]=52.7261

step1: Bingham viscosity[Pas]=0.1325

step2: Bingham:  $Y = 50.09 + 0.13564 \cdot X$ ;  $B = 0.99469$ ;  $S = 1.15$ 

step2: Bingham yieldstress[Pa]=50.0896

step2: Bingham viscosity[Pas]=0.1356

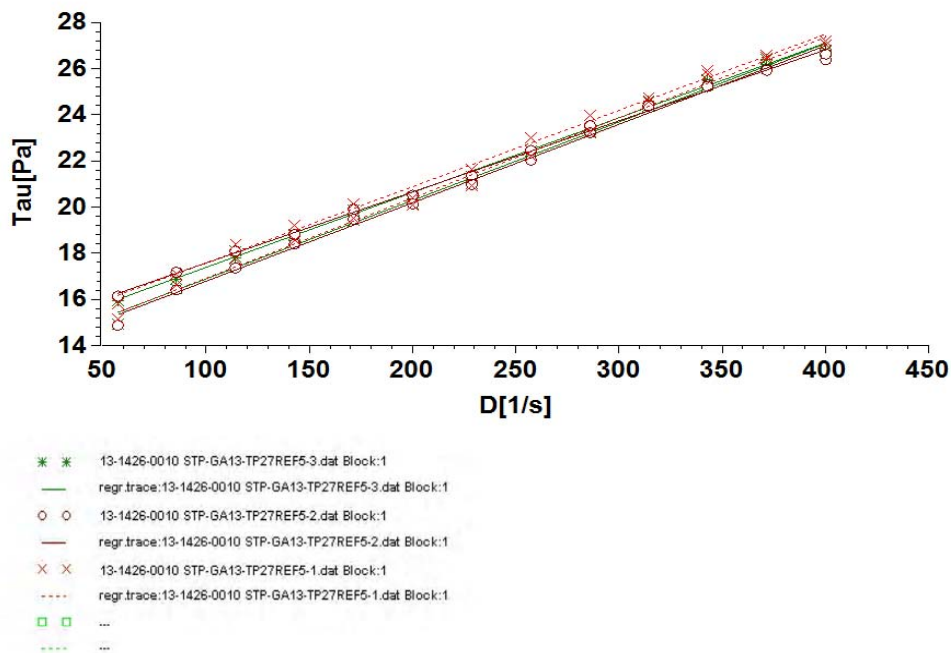
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page 1

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Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 STP-GA13-TP27REF5-3.dat Block:1

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=14.144+0.032367*X$  ;B=0.99658; S=0.22

step1: Bingham yieldstress[Pa]=14.1437

step1: Bingham viscosity[Pas]=0.0324

step2: Bingham:  $Y=13.49+0.033943*X$  ;B=0.99571; S=0.259

step2: Bingham yieldstress[Pa]=13.4895

step2: Bingham viscosity[Pas]=0.0339

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=14.492+0.030759*X$  ;B=0.99689; S=0.2

step1: Bingham yieldstress[Pa]=14.4922

step1: Bingham viscosity[Pas]=0.0308

step2: Bingham:  $Y=13.386+0.033956*X$  ;B=0.99632; S=0.24

step2: Bingham yieldstress[Pa]=13.386

step2: Bingham viscosity[Pas]=0.034

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=14.28+0.032974*X$  ;B=0.99377; S=0.303

step1: Bingham yieldstress[Pa]=14.2799

step1: Bingham viscosity[Pas]=0.033

step2: Bingham:  $Y=13.433+0.034748*X$  ;B=0.99529; S=0.278

step2: Bingham yieldstress[Pa]=13.4326

step2: Bingham viscosity[Pas]=0.0347

End of report



Golder Associates Ltd.  
Viscosity / Flow Curve Testing R/S Plus Rheometer

Client:	Giant Mining Support Services
Project Number:	13-1426-0010
Date:	12/6/2013
Technologist	CJC

	Status	Reviewer	Date Complete
Data Entry	Complete	CJC	12/6/2013
Data Review	1st Review Complete	CA	12/9/2013
	2nd Review Complete	ML	1/27/2014

Sample ID:	13-1426-0010 SCTP - BS - Mixed (Silt- Sand -Clay)
Sample Description:	coarse grey material
Water:	13-1426-0010 Water
pH Adjustment:	None
Bob:	CC25 Profiled Bob
Additional Info:	
Specific Gravity	2.84

## VISCOSITY DATA

## Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
1	0.6557	0.6430	0.6408	0.647
2	0.4873	0.4757	0.4874	0.483
3	0.2340	0.2391	0.2208	0.231
4	0.1303	0.1316	0.1309	0.131
5	0.0647	0.0633	0.0646	0.064
6	0.0290	0.0294	0.0292	0.029
7				

## Ramp Down

Trial 1	Trial 2	Trial 3	AVG
0.6673	0.6614	0.6742	0.668
0.4795	0.4863	0.4962	0.487
0.2352	0.2416	0.2278	0.235
0.1322	0.1360	0.1349	0.134
0.0673	0.0666	0.0679	0.067
0.0300	0.0312	0.0294	0.030

## YIELD STRESS DATA

## Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
1	148.9690	147.2086	155.2590	150
2	117.6858	118.2698	119.9104	119
3	71.1029	71.1412	71.3580	71
4	46.5032	47.3369	46.5106	47
5	25.3269	25.3096	25.8217	25
6	9.2349	9.8064	8.7810	9
7				

## Ramp Down

Trial 1	Trial 2	Trial 3	AVG
129.6029	128.4371	134.4695	131
109.4912	105.3553	106.7777	107
67.6556	67.6590	66.0430	67
44.4739	44.2490	44.2473	44
23.9223	23.7257	24.0186	24
8.7451	8.8625	8.5863	9

## WEIGHT PERCENT SOLIDS

REF	Pan #	Pan Wt. (g)	Wet (g)	Dry (g)	Wt% Solids	SVF (Φ)
1	x3	6.24	25.36	20.47	74.42%	0.51
2	45	6.79	18.70	15.60	73.97%	0.50
3	CA	6.16	24.71	19.58	72.35%	0.48
4	65	6.68	23.79	18.82	70.95%	0.46
5	x10	6.07	21.43	16.64	68.82%	0.44
6	x24	6.24	21.13	15.99	65.48%	0.40
7						

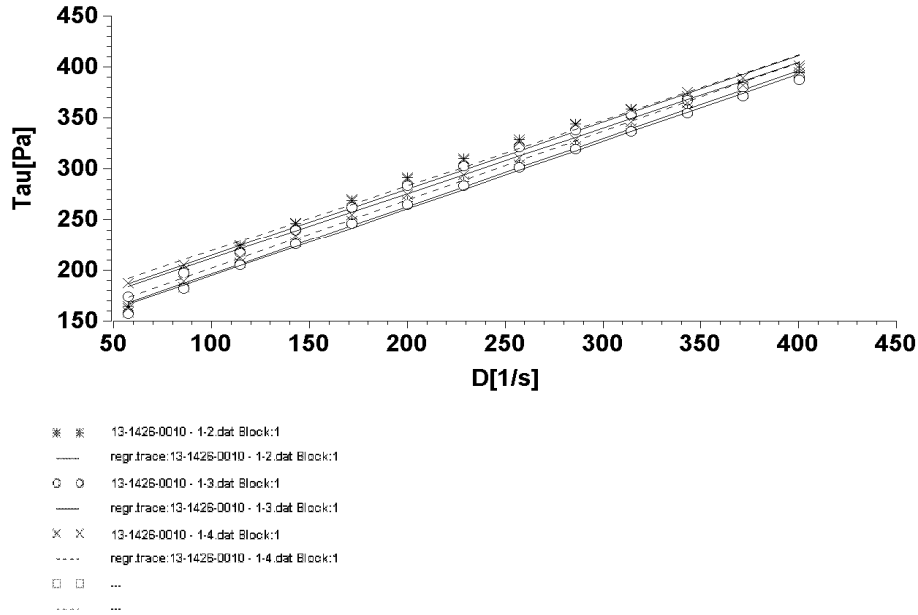
## Additional Notes:

multiple data sources

page 1

14:24 05/12/13

Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 - 1-2.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 148.97 + 0.65572 * X$ ;  $B = 0.97846$ ;  $S = 11.3$ 

step1: Bingham yieldstress[Pa]=148.969

step1: Bingham viscosity[Pas]=0.6557

step2: Bingham:  $Y = 129.6 + 0.66726 * X$ ;  $B = 0.99633$ ;  $S = 4.71$ 

step2: Bingham yieldstress[Pa]=129.6029

step2: Bingham viscosity[Pas]=0.6673

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 147.21 + 0.64299 * X$ ;  $B = 0.98895$ ;  $S = 7.9$ 

step1: Bingham yieldstress[Pa]=147.2086

step1: Bingham viscosity[Pas]=0.643

step2: Bingham:  $Y = 128.44 + 0.66142 * X$ ;  $B = 0.99692$ ;  $S = 4.27$ 

step2: Bingham yieldstress[Pa]=128.4371

step2: Bingham viscosity[Pas]=0.6614

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 155.26 + 0.64077 * X$ ;  $B = 0.99353$ ;  $S = 6.01$ 

step1: Bingham yieldstress[Pa]=155.259

step1: Bingham viscosity[Pas]=0.6408

step2: Bingham:  $Y = 134.47 + 0.67421 * X$ ;  $B = 0.99596$ ;  $S = 4.99$ 

step2: Bingham yieldstress[Pa]=134.4695

step2: Bingham viscosity[Pas]=0.6742

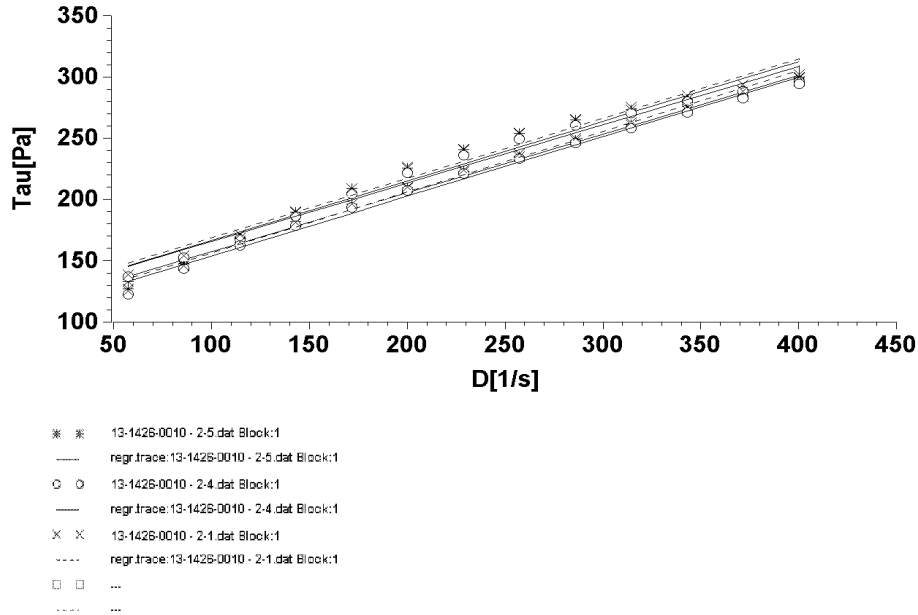
End of report

multiple data sources

page 1

15:07 05/12/13

Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 - 2-5.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 117.69 + 0.48725 * X$ ;  $B = 0.97135$ ;  $S = 9.73$ 

step1: Bingham yieldstress[Pa]=117.6858

step1: Bingham viscosity[Pas]=0.4873

step2: Bingham:  $Y = 109.49 + 0.4795 * X$ ;  $B = 0.99362$ ;  $S = 4.46$ 

step2: Bingham yieldstress[Pa]=109.4912

step2: Bingham viscosity[Pas]=0.4795

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 118.27 + 0.47565 * X$ ;  $B = 0.98091$ ;  $S = 7.71$ 

step1: Bingham yieldstress[Pa]=118.2698

step1: Bingham viscosity[Pas]=0.4757

step2: Bingham:  $Y = 105.36 + 0.48634 * X$ ;  $B = 0.99273$ ;  $S = 4.84$ 

step2: Bingham yieldstress[Pa]=105.3553

step2: Bingham viscosity[Pas]=0.4863

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 119.91 + 0.4874 * X$ ;  $B = 0.98036$ ;  $S = 8.02$ 

step1: Bingham yieldstress[Pa]=119.9104

step1: Bingham viscosity[Pas]=0.4874

step2: Bingham:  $Y = 106.78 + 0.4962 * X$ ;  $B = 0.99383$ ;  $S = 4.54$ 

step2: Bingham yieldstress[Pa]=106.7777

step2: Bingham viscosity[Pas]=0.4962

End of report

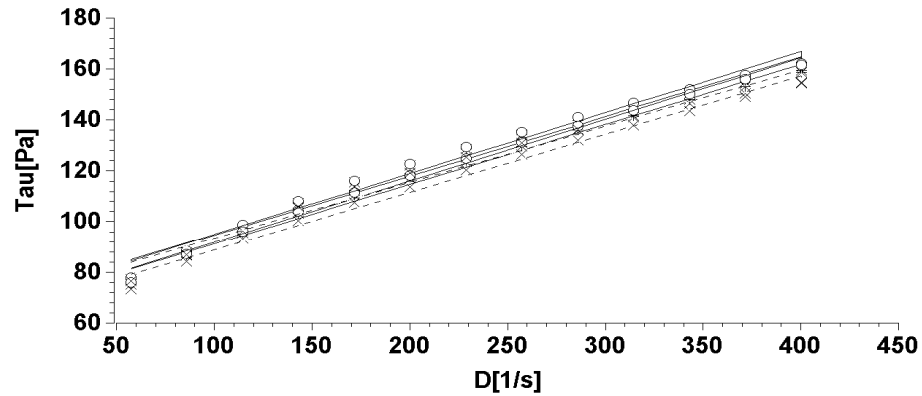


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page 1

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Manual Report Analysis/Regression



\* \* 13-1426-0010 - 3-4.dat Block:1  
 --- regr.trace:13-1426-0010 - 3-4.dat Block:1  
 O O 13-1426-0010 - 3-3.dat Block:1  
 --- regr.trace:13-1426-0010 - 3-3.dat Block:1  
 X X 13-1426-0010 - 3-2.dat Block:1  
 --- regr.trace:13-1426-0010 - 3-2.dat Block:1  
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## Analysis-results

Analysis data source: 13-1426-0010 - 3-4.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 71.103 + 0.23396 * X$  ;  $B = 0.97865$ ;  $S = 4.02$ 

step1: Bingham yieldstress[Pa]=71.1029

step1: Bingham viscosity[Pas]=0.234

step2: Bingham:  $Y = 67.656 + 0.23515 * X$  ;  $B = 0.99104$ ;  $S = 2.6$ 

step2: Bingham yieldstress[Pa]=67.6556

step2: Bingham viscosity[Pas]=0.2352

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 71.141 + 0.23906 * X$  ;  $B = 0.98244$ ;  $S = 3.71$ 

step1: Bingham yieldstress[Pa]=71.1412

step1: Bingham viscosity[Pas]=0.2391

step2: Bingham:  $Y = 67.659 + 0.24159 * X$  ;  $B = 0.99271$ ;  $S = 2.41$ 

step2: Bingham yieldstress[Pa]=67.659

step2: Bingham viscosity[Pas]=0.2416

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 71.358 + 0.22081 * X$  ;  $B = 0.97718$ ;  $S = 3.92$ 

step1: Bingham yieldstress[Pa]=71.358

step1: Bingham viscosity[Pas]=0.2208

step2: Bingham:  $Y = 66.043 + 0.22779 * X$  ;  $B = 0.99079$ ;  $S = 2.55$ 

step2: Bingham yieldstress[Pa]=66.043

step2: Bingham viscosity[Pas]=0.2278

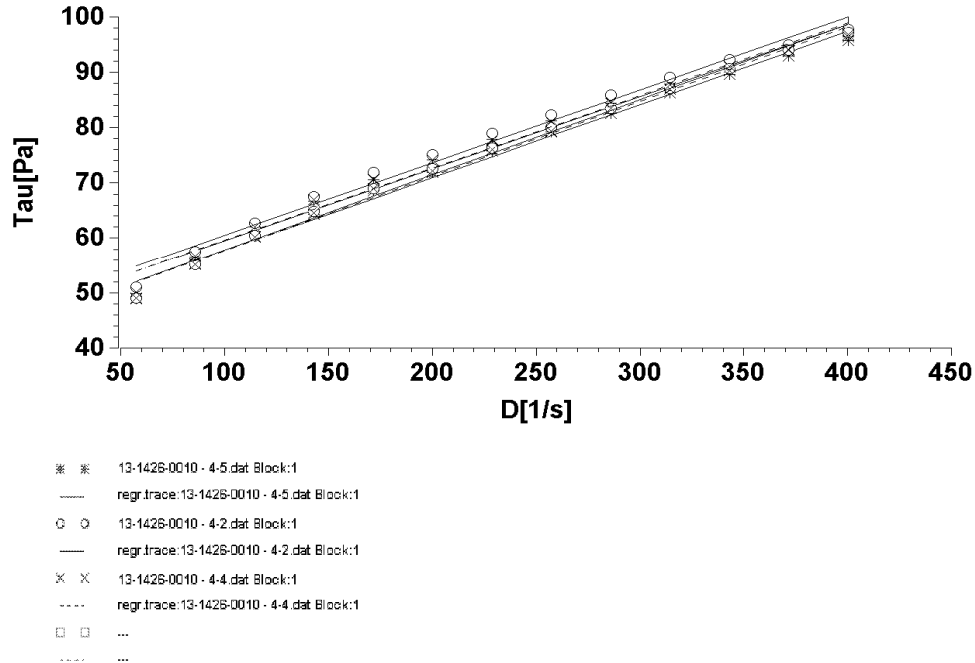
End of report

multiple data sources

page 1

09:54 06/12/13

Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 - 4-5.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 46.503 + 0.13033 \cdot X$ ;  $B = 0.98497$ ;  $S = 1.87$ 

step1: Bingham yieldstress[Pa]=46.5032

step1: Bingham viscosity[Pa·s]=0.1303

step2: Bingham:  $Y = 44.474 + 0.1322 \cdot X$ ;  $B = 0.99241$ ;  $S = 1.34$ 

step2: Bingham yieldstress[Pa]=44.4739

step2: Bingham viscosity[Pa·s]=0.1322

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 47.337 + 0.13161 \cdot X$ ;  $B = 0.98635$ ;  $S = 1.8$ 

step1: Bingham yieldstress[Pa]=47.3369

step1: Bingham viscosity[Pa·s]=0.1316

step2: Bingham:  $Y = 44.249 + 0.136 \cdot X$ ;  $B = 0.99328$ ;  $S = 1.3$ 

step2: Bingham yieldstress[Pa]=44.249

step2: Bingham viscosity[Pa·s]=0.136

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 46.511 + 0.13086 \cdot X$ ;  $B = 0.98663$ ;  $S = 1.77$ 

step1: Bingham yieldstress[Pa]=46.5106

step1: Bingham viscosity[Pa·s]=0.1309

step2: Bingham:  $Y = 44.247 + 0.13486 \cdot X$ ;  $B = 0.99301$ ;  $S = 1.32$ 

step2: Bingham yieldstress[Pa]=44.2473

step2: Bingham viscosity[Pa·s]=0.1349

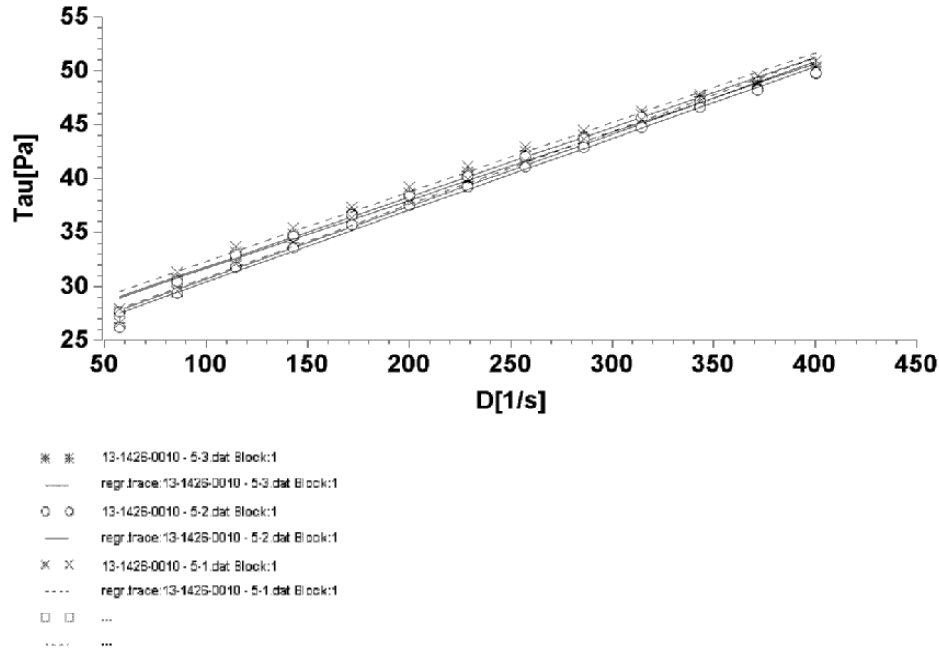
End of report

multiple data sources

page 1

11:01 06/12/13

Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 - 5-3.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 25.327 + 0.064741 * X$ ;  $B = 0.99317$ ;  $S = 0.624$ 

step1: Bingham yieldstress[Pa]=25.3269

step1: Bingham viscosity[Pas]=0.0647

step2: Bingham:  $Y = 23.922 + 0.067338 * X$ ;  $B = 0.99575$ ;  $S = 0.511$ 

step2: Bingham yieldstress[Pa]=23.9223

step2: Bingham viscosity[Pas]=0.0673

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 25.31 + 0.063297 * X$ ;  $B = 0.99298$ ;  $S = 0.619$ 

step1: Bingham yieldstress[Pa]=25.3096

step1: Bingham viscosity[Pas]=0.0633

step2: Bingham:  $Y = 23.726 + 0.066628 * X$ ;  $B = 0.99509$ ;  $S = 0.544$ 

step2: Bingham yieldstress[Pa]=23.7257

step2: Bingham viscosity[Pas]=0.0666

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 25.822 + 0.064632 * X$ ;  $B = 0.99242$ ;  $S = 0.657$ 

step1: Bingham yieldstress[Pa]=25.8217

step1: Bingham viscosity[Pas]=0.0646

step2: Bingham:  $Y = 24.019 + 0.067873 * X$ ;  $B = 0.99461$ ;  $S = 0.581$ 

step2: Bingham yieldstress[Pa]=24.0186

step2: Bingham viscosity[Pas]=0.0679

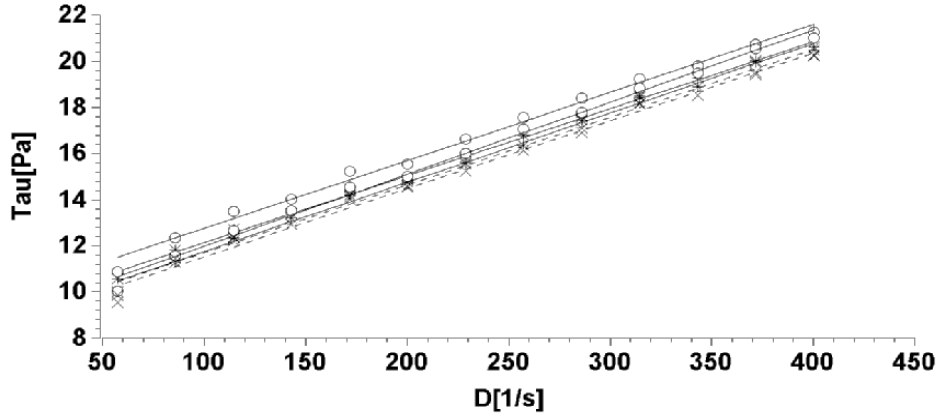
End of report

multiple data sources

page 1

11:30 06/12/13

Manual Report Analysis/Regression



\* \* 13-1426-0010 - 6-3.dat Block:1  
 — regr.trace:13-1426-0010 - 6-3.dat Block:1  
 o o 13-1426-0010 - 6-2.dat Block:1  
 — regr.trace:13-1426-0010 - 6-2.dat Block:1  
 x x 13-1426-0010 - 6-1.dat Block:1  
 - - - regr.trace:13-1426-0010 - 6-1.dat Block:1  
 □ □ ...  
 - - - ...

Analysis-results

Analysis data source: 13-1426-0010 - 6-3.dat Block:1

filter activated: D[1/s]>40

step1: Bingham:  $Y=9.2349+0.028976*X$  ;B=0.99788; S=0.155

step1: Bingham yieldstress[Pa]=9.2349

step1: Bingham viscosity[Pas]=0.029

step2: Bingham:  $Y=8.7451+0.030005*X$  ;B=0.99568; S=0.23

step2: Bingham yieldstress[Pa]=8.7451

step2: Bingham viscosity[Pas]=0.03

filter activated: D[1/s]>40

step1: Bingham:  $Y=9.8064+0.02943*X$  ;B=0.99355; S=0.276

step1: Bingham yieldstress[Pa]=9.8064

step1: Bingham viscosity[Pas]=0.0294

step2: Bingham:  $Y=8.8625+0.031194*X$  ;B=0.99474; S=0.264

step2: Bingham yieldstress[Pa]=8.8625

step2: Bingham viscosity[Pas]=0.0312

filter activated: D[1/s]>40

step1: Bingham:  $Y=8.781+0.029247*X$  ;B=0.99467; S=0.249

step1: Bingham yieldstress[Pa]=8.781

step1: Bingham viscosity[Pas]=0.0292

step2: Bingham:  $Y=8.5863+0.029398*X$  ;B=0.99254; S=0.296

step2: Bingham yieldstress[Pa]=8.5863

step2: Bingham viscosity[Pas]=0.0294

End of report



Golder Associates Ltd.  
Viscosity / Flow Curve Testing R/S Plus Rheometer

Client:	Giant Mining Support Services
Project Number:	13-1426-0010
Date:	12/4/2013
Technologist	CA

	Status	Reviewer	Date Complete
Data Entry	Complete	CA	12/11/2013
Data Review	1st Review Complete	CA	12/11/2013
	2nd Review Complete	ML	1/27/2014

Sample ID:	13-1426-0010 SCTP - BS - Silty Sand
Sample Description:	dark brown material
Water:	13-1426-0010 Water
pH Adjustment:	none
Bob:	CC25 Profiled Bob
Additional Info:	
Specific Gravity	2.81

VISCOSITY DATA

Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
1	0.7352	0.7094	0.7765	0.740
2	0.5787	0.5399	0.5652	0.561
3	0.2691	0.2705	0.2769	0.272
4	0.1378	0.1334	0.1332	0.135
5	0.0715	0.0729	0.0729	0.072
6	0.0461	0.0439	0.0464	0.045
7				

Ramp Down

Trial 1	Trial 2	Trial 3	AVG
0.8545	0.8453	0.8776	0.859
0.6306	0.6165	0.6382	0.628
0.2910	0.2903	0.2984	0.293
0.1527	0.1486	0.1461	0.149
0.0775	0.0806	0.0812	0.080
0.0497	0.0484	0.0499	0.049

YIELD STRESS DATA

Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
1	161.3561	157.7334	150.4089	156
2	109.7308	111.9380	114.0450	112
3	54.9029	53.6947	55.2612	55
4	34.0351	34.3865	32.0434	33
5	17.5617	18.4719	18.1813	18
6	10.4675	10.0376	10.3051	10
7				

Ramp Down

Trial 1	Trial 2	Trial 3	AVG
80.9777	85.3608	91.0097	86
70.2783	66.4065	66.5790	68
38.1892	37.4850	38.7782	38
22.5851	22.1467	21.8092	22
13.2631	13.3811	13.1021	13
7.7950	7.6210	8.0191	8

WEIGHT PERCENT SOLIDS

REF	Pan #	Pan Wt. (g)	Wet (g)	Dry (g)	Wt% Solids	SVF (Φ)
1	14	30.09	62.13	54.71	76.84%	0.54
2	68	30.41	69.02	59.90	76.38%	0.54
3	46	30.53	64.42	55.82	74.62%	0.51
4	54	30.46	62.72	54.01	73.00%	0.49
5	56	30.46	64.97	55.07	71.31%	0.47
6	12	29.77	68.77	56.87	69.49%	0.45
7						

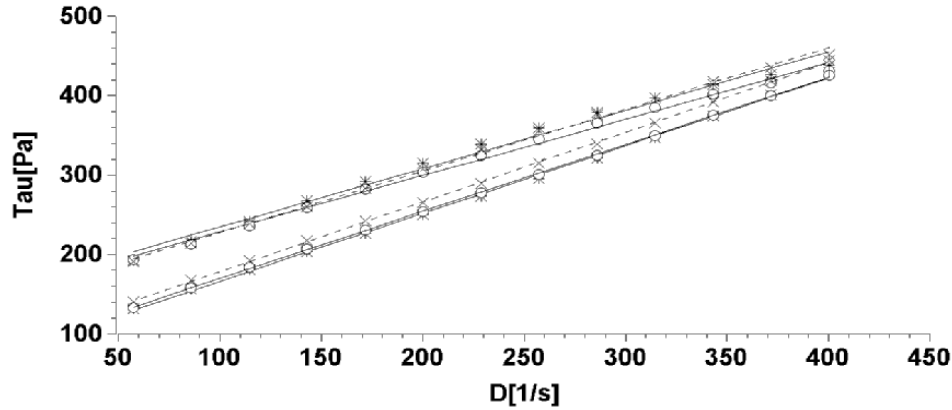
Additional Notes:

multiple data sources

page 1

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Manual Report Analysis/Regression



\* \* 13-1426-0010 SCTP-BS-Silty Sand REF1-7.dat Block:1  
 — regr.trace:13-1426-0010 SCTP-BS-Silty Sand REF1-7.dat Block:1  
 o o 13-1426-0010 SCTP-BS-Silty Sand REF1-6.dat Block:1  
 — regr.trace:13-1426-0010 SCTP-BS-Silty Sand REF1-6.dat Block:1  
 x x 13-1426-0010 SCTP-BS-Silty Sand REF1-1.dat Block:1  
 - - - regr.trace:13-1426-0010 SCTP-BS-Silty Sand REF1-1.dat Block:1  
 □ □ ...  
 - - - ...

## Analysis-results

Analysis data source: 13-1426-0010 SCTP-BS-Silty Sand REF1-7.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 161.36 + 0.73519 * X$ ;  $B = 0.98941$ ;  $S = 8.84$ 

step1: Bingham yieldstress[Pa]=161.3561

step1: Bingham viscosity[Pas]=0.7352

step2: Bingham:  $Y = 80.978 + 0.8545 * X$ ;  $B = 0.99887$ ;  $S = 3.35$ 

step2: Bingham yieldstress[Pa]=80.9777

step2: Bingham viscosity[Pas]=0.8545

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 157.73 + 0.70939 * X$ ;  $B = 0.99583$ ;  $S = 5.33$ 

step1: Bingham yieldstress[Pa]=157.7334

step1: Bingham viscosity[Pas]=0.7094

step2: Bingham:  $Y = 85.361 + 0.84528 * X$ ;  $B = 0.9998$ ;  $S = 1.39$ 

step2: Bingham yieldstress[Pa]=85.3608

step2: Bingham viscosity[Pas]=0.8453

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 150.41 + 0.77647 * X$ ;  $B = 0.99766$ ;  $S = 4.37$ 

step1: Bingham yieldstress[Pa]=150.4089

step1: Bingham viscosity[Pas]=0.7765

step2: Bingham:  $Y = 91.01 + 0.87761 * X$ ;  $B = 0.99969$ ;  $S = 1.79$ 

step2: Bingham yieldstress[Pa]=91.0097

step2: Bingham viscosity[Pas]=0.8776

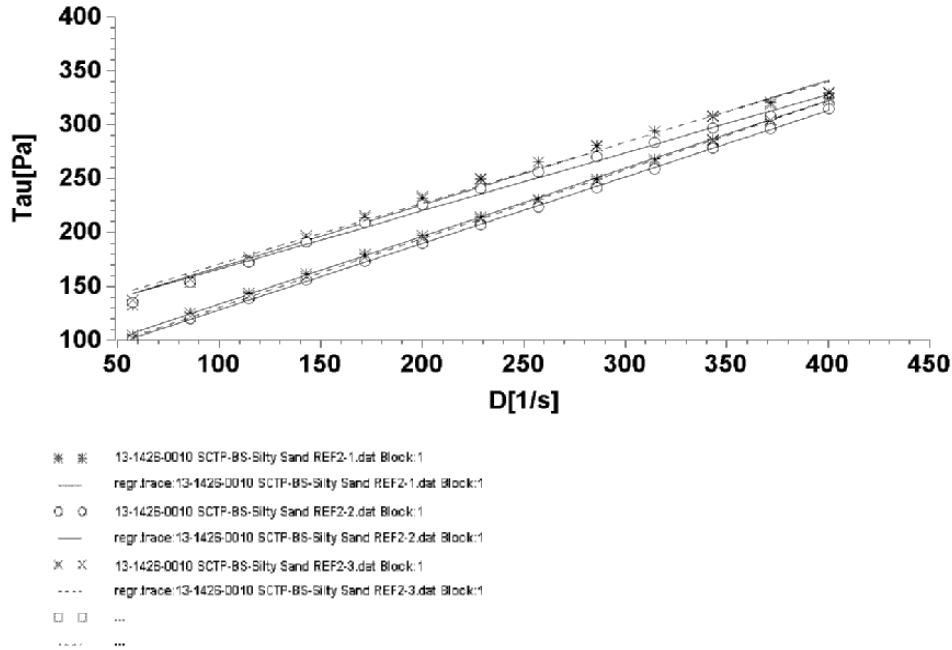
End of report

multiple data sources

page 1

14:42 09/12/13

Manual Report Analysis/Regression



Analysis-results

Analysis data source: 13-1426-0010 SCTP-BS-Silty Sand REF2-1.dat Block:1

filter activated: D[1/s]>40

step1: Bingham:  $Y=109.73+0.57874*X$  ;B=0.9902; S=6.69

step1: Bingham yieldstress[Pa]=109.7308

step1: Bingham viscosity[Pas]=0.5787

step2: Bingham:  $Y=70.278+0.63065*X$  ;B=0.99971; S=1.25

step2: Bingham yieldstress[Pa]=70.2783

step2: Bingham viscosity[Pas]=0.6306

filter activated: D[1/s]>40

step1: Bingham:  $Y=111.94+0.53989*X$  ;B=0.99294; S=5.29

step1: Bingham yieldstress[Pa]=111.938

step1: Bingham viscosity[Pas]=0.5399

step2: Bingham:  $Y=66.406+0.61652*X$  ;B=0.99974; S=1.16

step2: Bingham yieldstress[Pa]=66.4065

step2: Bingham viscosity[Pas]=0.6165

filter activated: D[1/s]>40

step1: Bingham:  $Y=114.05+0.56519*X$  ;B=0.99091; S=6.29

step1: Bingham yieldstress[Pa]=114.045

step1: Bingham viscosity[Pas]=0.5652

step2: Bingham:  $Y=66.579+0.63817*X$  ;B=0.99971; S=1.26

step2: Bingham yieldstress[Pa]=66.579

step2: Bingham viscosity[Pas]=0.6382

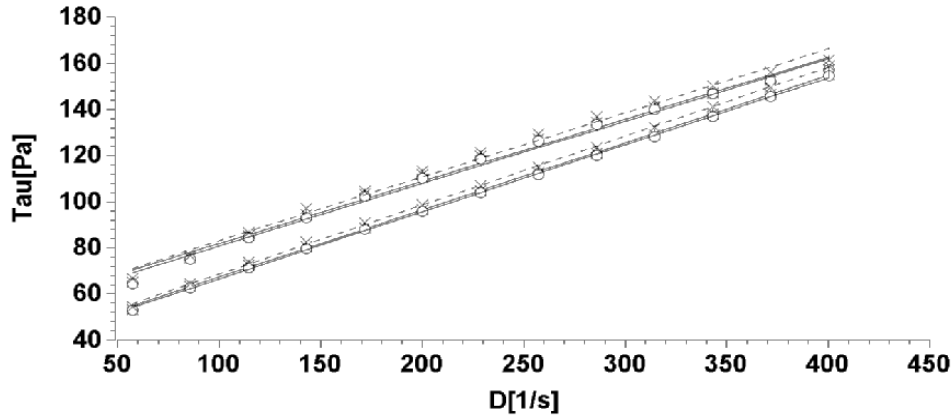
End of report

multiple data sources

page 1

15:00 09/12/13

Manual Report Analysis/Regression



\* \* 13-1426-0010 SCTP-BS-Silty Sand REF3-4.dat Block:1  
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 o o 13-1426-0010 SCTP-BS-Silty Sand REF3-2.dat Block:1  
 — regr.trace:13-1426-0010 SCTP-BS-Silty Sand REF3-2.dat Block:1  
 x x 13-1426-0010 SCTP-BS-Silty Sand REF3-1.dat Block:1  
 - - - regr.trace:13-1426-0010 SCTP-BS-Silty Sand REF3-1.dat Block:1  
 □ □ ...  
 - - - ...

## Analysis-results

Analysis data source: 13-1426-0010 SCTP-BS-Silty Sand REF3-4.dat Block:1

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 54.903 + 0.26914 * X$ ;  $B = 0.99013$ ;  $S = 3.12$ 

step1: Bingham yieldstress[Pa]=54.9029

step1: Bingham viscosity[Pa]=0.2691

step2: Bingham:  $Y = 38.189 + 0.291 * X$ ;  $B = 0.9996$ ;  $S = 0.675$ 

step2: Bingham yieldstress[Pa]=38.1892

step2: Bingham viscosity[Pa]=0.291

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 53.695 + 0.27049 * X$ ;  $B = 0.99182$ ;  $S = 2.85$ 

step1: Bingham yieldstress[Pa]=53.6947

step1: Bingham viscosity[Pa]=0.2705

step2: Bingham:  $Y = 37.485 + 0.29032 * X$ ;  $B = 0.99966$ ;  $S = 0.619$ 

step2: Bingham yieldstress[Pa]=37.485

step2: Bingham viscosity[Pa]=0.2903

filter activated:  $D[1/s] > 40$ step1: Bingham:  $Y = 55.261 + 0.27693 * X$ ;  $B = 0.99224$ ;  $S = 2.85$ 

step1: Bingham yieldstress[Pa]=55.2612

step1: Bingham viscosity[Pa]=0.2769

step2: Bingham:  $Y = 38.778 + 0.29836 * X$ ;  $B = 0.99956$ ;  $S = 0.724$ 

step2: Bingham yieldstress[Pa]=38.7782

step2: Bingham viscosity[Pa]=0.2984

End of report

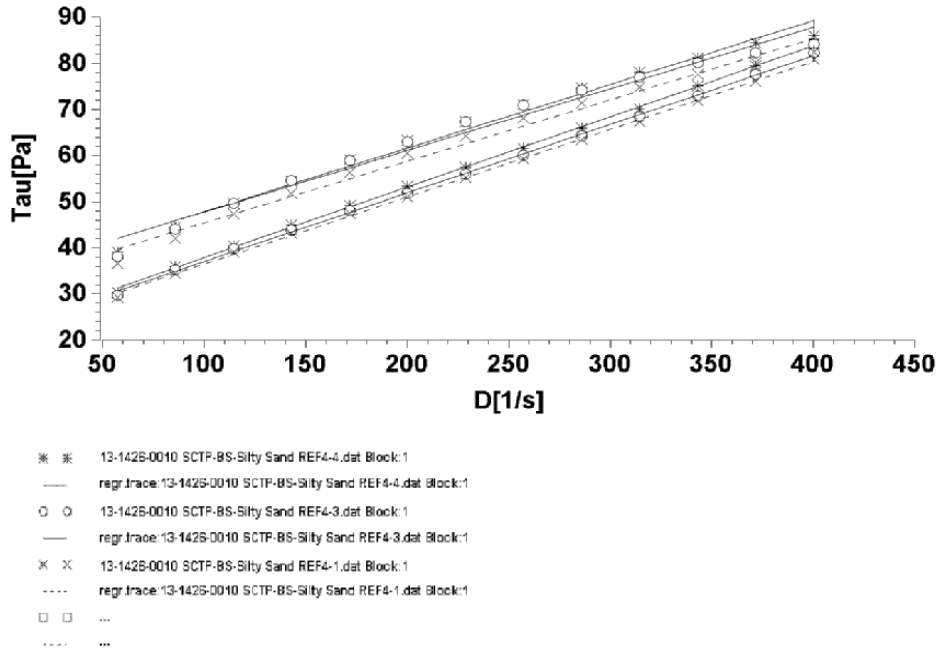


multiple data sources

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Manual Report Analysis/Regression



Analysis-results

Analysis data source: 13-1426-0010 SCTP-BS-Silty Sand REF4-4.dat Block:1

filter activated: D[1/s]>40

step1: Bingham:  $Y=34.035+0.13778*X$  ;B=0.98787; S=1.77

step1: Bingham yieldstress[Pa]=34.0351

step1: Bingham viscosity[Pas]=0.1378

step2: Bingham:  $Y=22.585+0.15273*X$  ;B=0.99926; S=0.483

step2: Bingham yieldstress[Pa]=22.5851

step2: Bingham viscosity[Pas]=0.1527

filter activated: D[1/s]>40

step1: Bingham:  $Y=34.386+0.1334*X$  ;B=0.97942; S=2.25

step1: Bingham yieldstress[Pa]=34.3865

step1: Bingham viscosity[Pas]=0.1334

step2: Bingham:  $Y=22.147+0.14858*X$  ;B=0.99911; S=0.514

step2: Bingham yieldstress[Pa]=22.1467

step2: Bingham viscosity[Pas]=0.1486

filter activated: D[1/s]>40

step1: Bingham:  $Y=32.043+0.13316*X$  ;B=0.98634; S=1.82

step1: Bingham yieldstress[Pa]=32.0434

step1: Bingham viscosity[Pas]=0.1332

step2: Bingham:  $Y=21.809+0.14609*X$  ;B=0.99933; S=0.44

step2: Bingham yieldstress[Pa]=21.8092

step2: Bingham viscosity[Pas]=0.1461

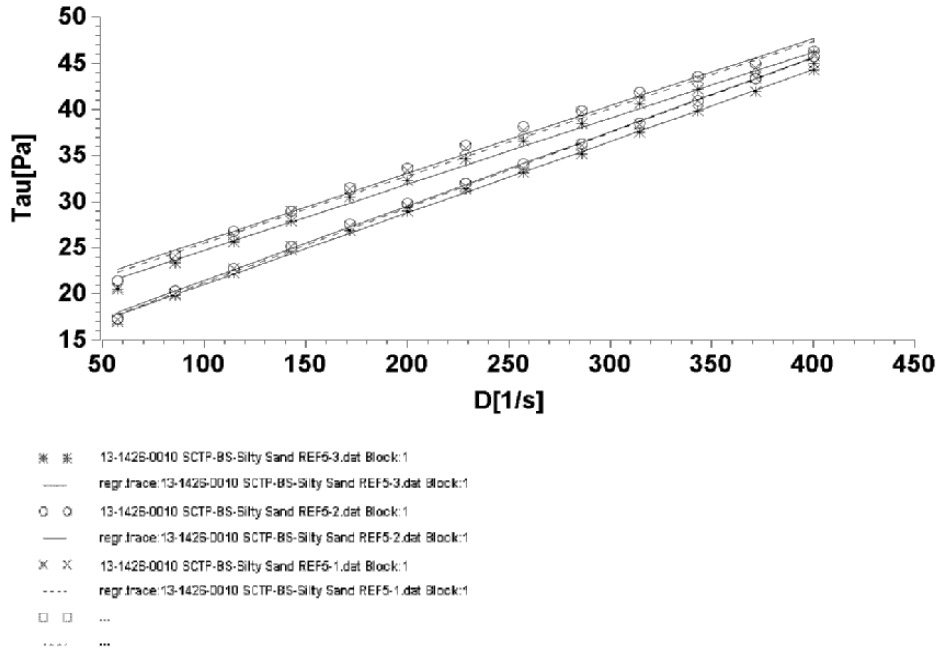
End of report

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Manual Report Analysis/Regression



Analysis-results

Analysis data source: 13-1426-0010 SCTP-BS-Silty Sand REF5-3.dat Block:1

filter activated: D[1/s]>40

step1: Bingham:  $Y=17.562+0.07155*X$  ;B=0.99325; S=0.685

step1: Bingham yieldstress[Pa]=17.5617

step1: Bingham viscosity[Pas]=0.0715

step2: Bingham:  $Y=13.263+0.077489*X$  ;B=0.99887; S=0.303

step2: Bingham yieldstress[Pa]=13.2631

step2: Bingham viscosity[Pas]=0.0775

filter activated: D[1/s]>40

step1: Bingham:  $Y=18.472+0.072948*X$  ;B=0.99138; S=0.791

step1: Bingham yieldstress[Pa]=18.4719

step1: Bingham viscosity[Pas]=0.0729

step2: Bingham:  $Y=13.381+0.080607*X$  ;B=0.99903; S=0.292

step2: Bingham yieldstress[Pa]=13.3811

step2: Bingham viscosity[Pas]=0.0806

filter activated: D[1/s]>40

step1: Bingham:  $Y=18.181+0.072944*X$  ;B=0.98985; S=0.858

step1: Bingham yieldstress[Pa]=18.1813

step1: Bingham viscosity[Pas]=0.0729

step2: Bingham:  $Y=13.102+0.081176*X$  ;B=0.99892; S=0.31

step2: Bingham yieldstress[Pa]=13.1021

step2: Bingham viscosity[Pas]=0.0812

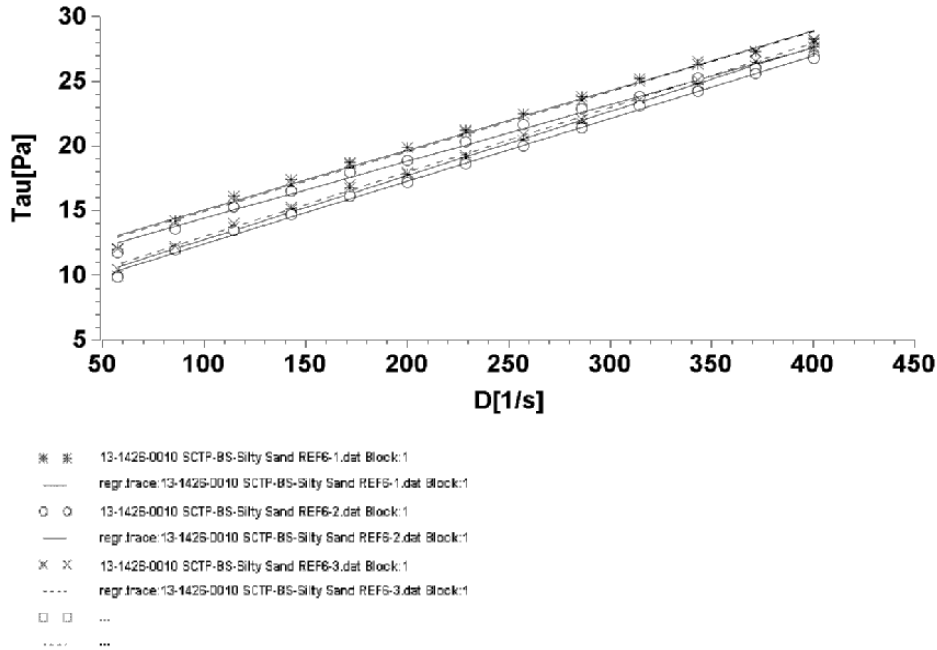
End of report

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Manual Report Analysis/Regression



Analysis-results

Analysis data source: 13-1426-0010 SCTP-BS-Silty Sand REF6-1.dat Block:1

filter activated: D[1/s]>40

step1: Bingham:  $Y=10.468+0.046081*X$  ;B=0.99287; S=0.454

step1: Bingham yieldstress[Pa]=10.4675

step1: Bingham viscosity[Pas]=0.0461

step2: Bingham:  $Y=7.795+0.049655*X$  ;B=0.99775; S=0.274

step2: Bingham yieldstress[Pa]=7.795

step2: Bingham viscosity[Pas]=0.0497

filter activated: D[1/s]>40

step1: Bingham:  $Y=10.038+0.043903*X$  ;B=0.99428; S=0.387

step1: Bingham yieldstress[Pa]=10.0376

step1: Bingham viscosity[Pas]=0.0439

step2: Bingham:  $Y=7.621+0.048375*X$  ;B=0.99821; S=0.238

step2: Bingham yieldstress[Pa]=7.621

step2: Bingham viscosity[Pas]=0.0484

filter activated: D[1/s]>40

step1: Bingham:  $Y=10.305+0.046369*X$  ;B=0.99418; S=0.412

step1: Bingham yieldstress[Pa]=10.3051

step1: Bingham viscosity[Pas]=0.0464

step2: Bingham:  $Y=8.0191+0.049857*X$  ;B=0.9986; S=0.217

step2: Bingham yieldstress[Pa]=8.0191

step2: Bingham viscosity[Pas]=0.0499

End of report



Golder Associates Ltd.  
Viscosity / Flow Curve Testing R/S Plus Rheometer

Client:	Giant Mining Support Services
Project Number:	13-1426-0010
Date:	1/10/2014
Technologist	CJC

	Status	Reviewer	Date Complete
Data Entry	Complete	CA	1/14/2014
Data Review	1st Review Complete	CA	1/14/2014
	2nd Review Complete	ML	1/27/2014

Sample ID:	13-1426-0010 SCTP - BS - Clay - Silt
Sample Description:	Fine Grey Material
Water:	13-1426-0010 Water
pH Adjustment:	none
Bob:	CC25 Profiled Bob
Additional Info:	
Specific Gravity	2.82

VISCOSITY DATA

Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
1	1.2024	1.2450	1.2147	1.221
2	0.6866	0.6832	0.6738	0.681
3	0.3842	0.3698	0.3851	0.380
4	0.1532	0.1471	0.1525	0.151
5	0.0539	0.0522	0.0520	0.053
6	0.0324	0.0322	0.0332	0.033
7				

Ramp Down

Trial 1	Trial 2	Trial 3	AVG
1.3879	1.3868	1.3933	1.389
0.7160	0.6921	0.7342	0.714
0.3994	0.3905	0.3976	0.396
0.1601	0.1560	0.1568	0.158
0.0558	0.0551	0.0555	0.055
0.0332	0.0335	0.0334	0.033

YIELD STRESS DATA

Ramp Up

REF	Trial 1	Trial 2	Trial 3	AVG
1	447.9799	444.4236	455.2807	449
2	277.5498	269.1825	272.6703	273
3	177.8271	181.9153	177.4569	179
4	97.6812	95.9827	95.9051	97
5	42.8525	42.3300	42.6274	43
6	24.8330	24.4724	24.4095	25
7				

Ramp Down

Trial 1	Trial 2	Trial 3	AVG
391.0541	384.8612	389.1268	388
270.1349	265.9030	256.5575	264
180.9864	179.8639	180.0922	180
95.9650	92.9490	94.5235	94
42.3178	41.5142	41.6537	42
24.4971	24.1457	24.4079	24

WEIGHT PERCENT SOLIDS

REF	Pan #	Pan Wt. (g)	Wet (g)	Dry (g)	Wt% Solids	SVF (Φ)
1	x33	6.10	28.72	22.18	71.09%	0.47
2	x13	6.01	27.01	20.66	69.76%	0.45
3	43	6.96	25.51	19.59	68.09%	0.43
4	x18	5.94	28.45	20.74	65.75%	0.41
5	x10	6.08	22.99	16.64	62.45%	0.37
6	x36	6.27	21.55	15.46	60.14%	0.35
7						

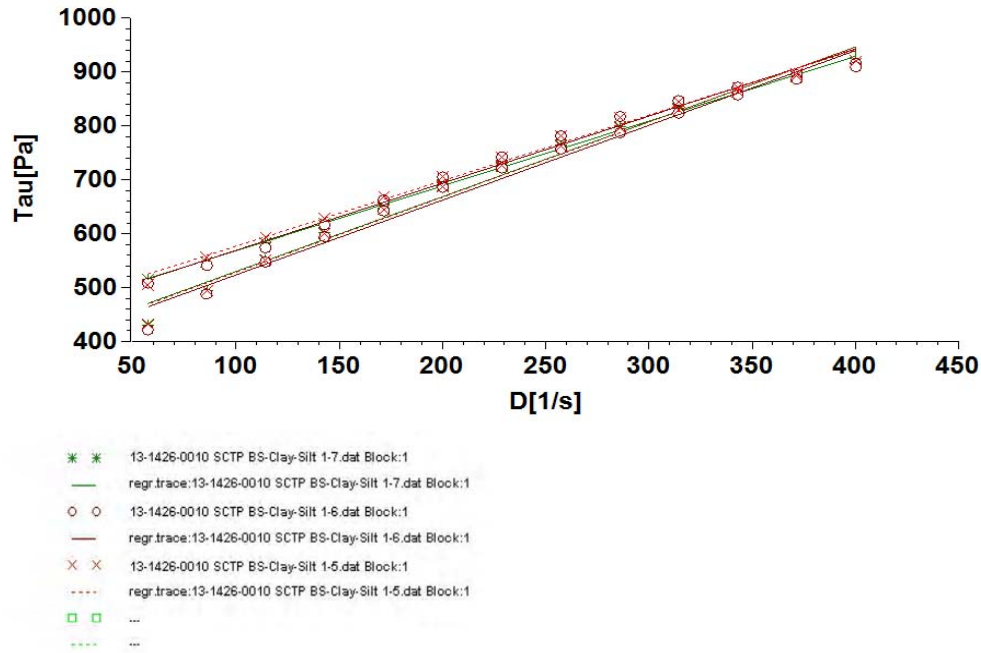
Additional Notes:

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page 1

15:39 10/01/14

Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 SCTP BS-Clay-Silt 1-7.dat Block:1

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=447.98+1.2024 \cdot X$ ;  $B=0.99846$ ;  $S=5.48$ 

step1: Bingham yieldstress[Pa]=447.9799

step1: Bingham viscosity[Pas]=1.2024

step2: Bingham:  $Y=391.05+1.3879 \cdot X$ ;  $B=0.9837$ ;  $S=20.8$ 

step2: Bingham yieldstress[Pa]=391.0541

step2: Bingham viscosity[Pas]=1.3879

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=444.42+1.245 \cdot X$ ;  $B=0.99032$ ;  $S=14.3$ 

step1: Bingham yieldstress[Pa]=444.4236

step1: Bingham viscosity[Pas]=1.245

step2: Bingham:  $Y=384.86+1.3868 \cdot X$ ;  $B=0.98312$ ;  $S=21.1$ 

step2: Bingham yieldstress[Pa]=384.8612

step2: Bingham viscosity[Pas]=1.3868

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=455.28+1.2147 \cdot X$ ;  $B=0.99303$ ;  $S=11.8$ 

step1: Bingham yieldstress[Pa]=455.2807

step1: Bingham viscosity[Pas]=1.2147

step2: Bingham:  $Y=389.13+1.3933 \cdot X$ ;  $B=0.98651$ ;  $S=18.9$ 

step2: Bingham yieldstress[Pa]=389.1268

step2: Bingham viscosity[Pas]=1.3933

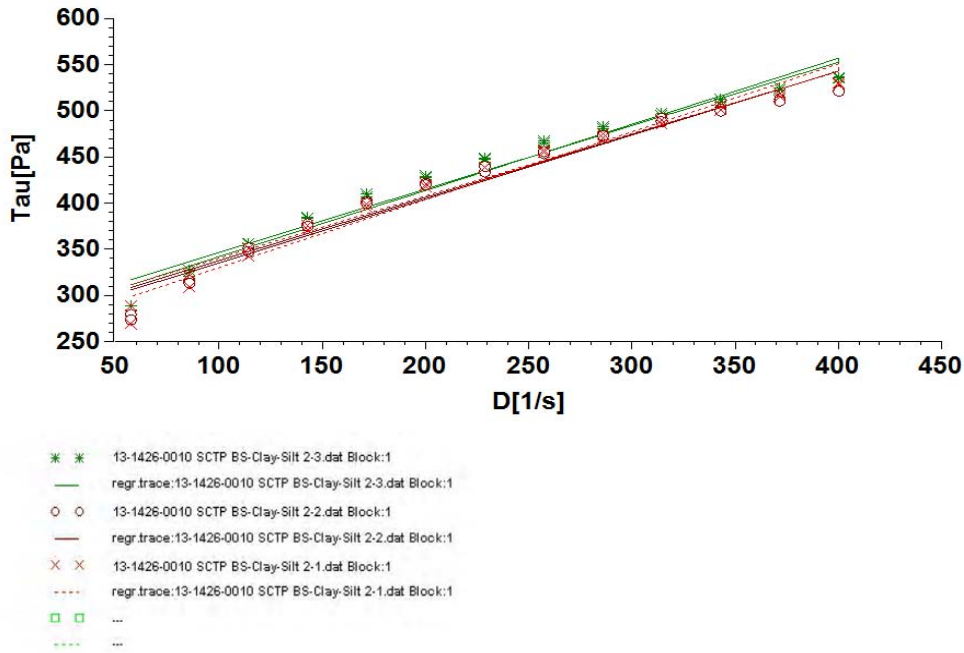
End of report

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09:05 13/01/14

Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 SCTP BS-Clay-Silt 2-3.dat Block:1

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=277.55+0.6866 \cdot X$ ; B=0.971; S=13.8

step1: Bingham yieldstress[Pa]=277.5498

step1: Bingham viscosity[Pas]=0.6866

step2: Bingham:  $Y=270.13+0.71599 \cdot X$ ; B=0.96586; S=15.6

step2: Bingham yieldstress[Pa]=270.1349

step2: Bingham viscosity[Pas]=0.716

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=269.18+0.68321 \cdot X$ ; B=0.96659; S=14.8

step1: Bingham yieldstress[Pa]=269.1825

step1: Bingham viscosity[Pas]=0.6832

step2: Bingham:  $Y=265.9+0.69208 \cdot X$ ; B=0.96138; S=16.1

step2: Bingham yieldstress[Pa]=265.903

step2: Bingham viscosity[Pas]=0.6921

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=272.67+0.67378 \cdot X$ ; B=0.97942; S=11.4

step1: Bingham yieldstress[Pa]=272.6703

step1: Bingham viscosity[Pas]=0.6738

step2: Bingham:  $Y=256.56+0.73424 \cdot X$ ; B=0.97115; S=14.7

step2: Bingham yieldstress[Pa]=256.5575

step2: Bingham viscosity[Pas]=0.7342

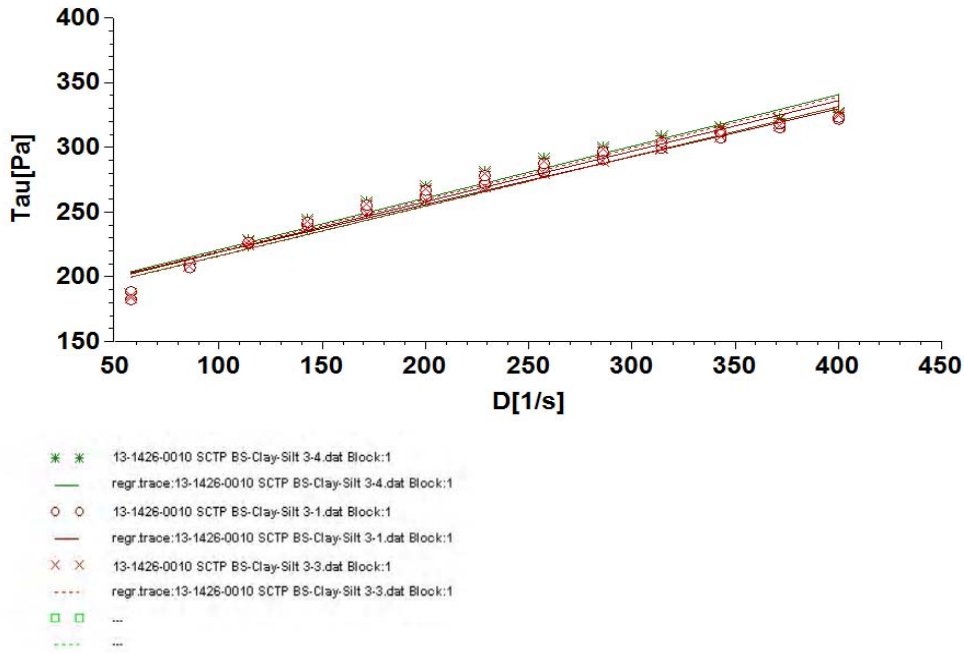
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Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 SCTP BS-Clay-Silt 3-4.dat Block:1

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=177.83+0.38424 \cdot X$ ;  $B=0.9846$ ;  $S=5.58$ 

step1: Bingham yieldstress[Pa]=177.8271

step1: Bingham viscosity[Pas]=0.3842

step2: Bingham:  $Y=180.99+0.39936 \cdot X$ ;  $B=0.95612$ ;  $S=9.94$ 

step2: Bingham yieldstress[Pa]=180.9864

step2: Bingham viscosity[Pas]=0.3994

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=181.92+0.36982 \cdot X$ ;  $B=0.97845$ ;  $S=6.38$ 

step1: Bingham yieldstress[Pa]=181.9153

step1: Bingham viscosity[Pas]=0.3698

step2: Bingham:  $Y=179.86+0.39051 \cdot X$ ;  $B=0.9574$ ;  $S=9.57$ 

step2: Bingham yieldstress[Pa]=179.8639

step2: Bingham viscosity[Pas]=0.3905

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=177.46+0.38509 \cdot X$ ;  $B=0.98282$ ;  $S=5.92$ 

step1: Bingham yieldstress[Pa]=177.4569

step1: Bingham viscosity[Pas]=0.3851

step2: Bingham:  $Y=180.09+0.39765 \cdot X$ ;  $B=0.96239$ ;  $S=9.14$ 

step2: Bingham yieldstress[Pa]=180.0922

step2: Bingham viscosity[Pas]=0.3976

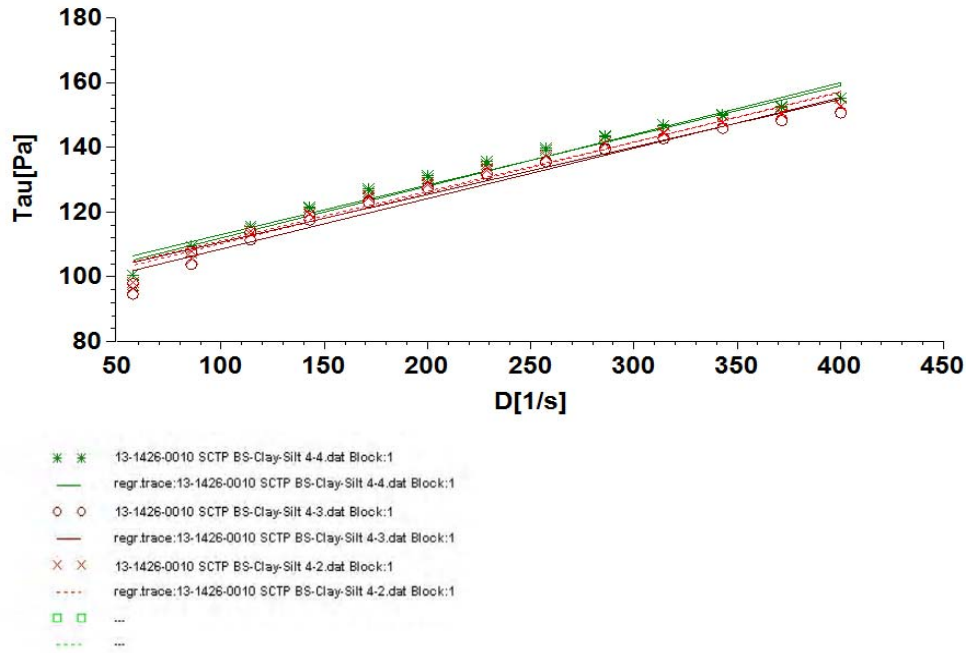
End of report

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page 1

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Manual Report Analysis/Regression

**Analysis-results**

Analysis data source: 13-1426-0010 SCTP BS-Clay-Silt 4-4.dat Block:1

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=97.681+0.15325*X$ ; B=0.9766; S=2.76

step1: Bingham yieldstress[Pa]=97.6812

step1: Bingham viscosity[Pas]=0.1532

step2: Bingham:  $Y=95.965+0.16009*X$ ; B=0.96341; S=3.63

step2: Bingham yieldstress[Pa]=95.965

step2: Bingham viscosity[Pas]=0.1601

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=95.983+0.14713*X$ ; B=0.97291; S=2.85

step1: Bingham yieldstress[Pa]=95.9827

step1: Bingham viscosity[Pas]=0.1471

step2: Bingham:  $Y=92.949+0.15599*X$ ; B=0.9636; S=3.52

step2: Bingham yieldstress[Pa]=92.949

step2: Bingham viscosity[Pas]=0.156

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=95.905+0.15247*X$ ; B=0.97567; S=2.8

step1: Bingham yieldstress[Pa]=95.9051

step1: Bingham viscosity[Pas]=0.1525

step2: Bingham:  $Y=94.523+0.15681*X$ ; B=0.96417; S=3.51

step2: Bingham yieldstress[Pa]=94.5235

step2: Bingham viscosity[Pas]=0.1568

End of report

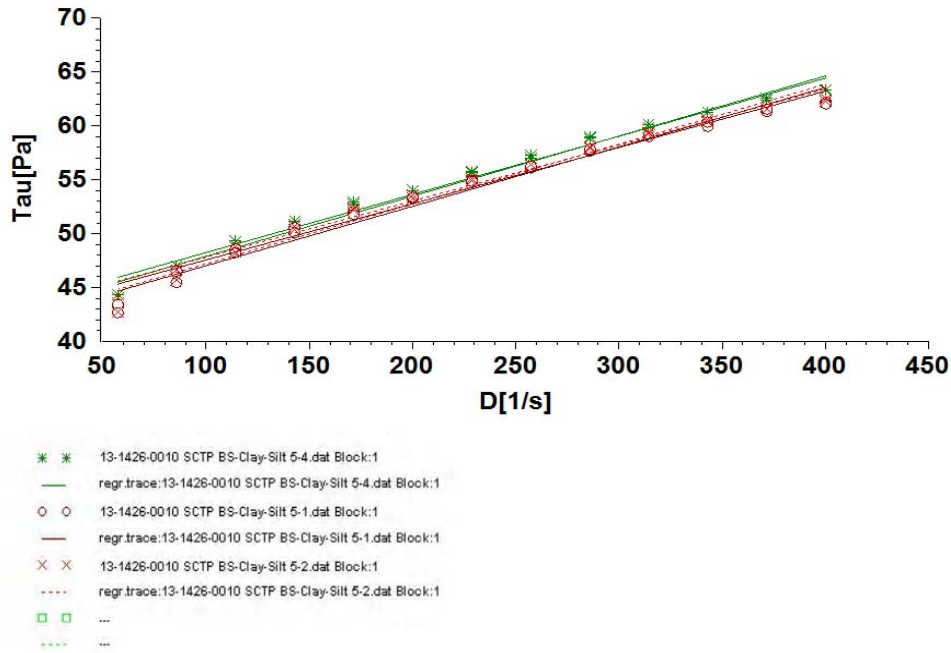


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page 1

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Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 SCTP BS-Clay-Silt 5-4.dat Block:1

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=42.852+0.053923*X$  ;B=0.98637; S=0.737

step1: Bingham yieldstress[Pa]=42.8525

step1: Bingham viscosity[Pas]=0.0539

step2: Bingham:  $Y=42.318+0.055774*X$  ;B=0.98116; S=0.898

step2: Bingham yieldstress[Pa]=42.3178

step2: Bingham viscosity[Pas]=0.0558

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=42.33+0.052215*X$  ;B=0.98228; S=0.815

step1: Bingham yieldstress[Pa]=42.33

step1: Bingham viscosity[Pas]=0.0522

step2: Bingham:  $Y=41.514+0.055095*X$  ;B=0.97758; S=0.97

step2: Bingham yieldstress[Pa]=41.5142

step2: Bingham viscosity[Pas]=0.0551

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=42.627+0.05197*X$  ;B=0.98627; S=0.713

step1: Bingham yieldstress[Pa]=42.6274

step1: Bingham viscosity[Pas]=0.052

step2: Bingham:  $Y=41.654+0.055479*X$  ;B=0.97763; S=0.975

step2: Bingham yieldstress[Pa]=41.6537

step2: Bingham viscosity[Pas]=0.0555

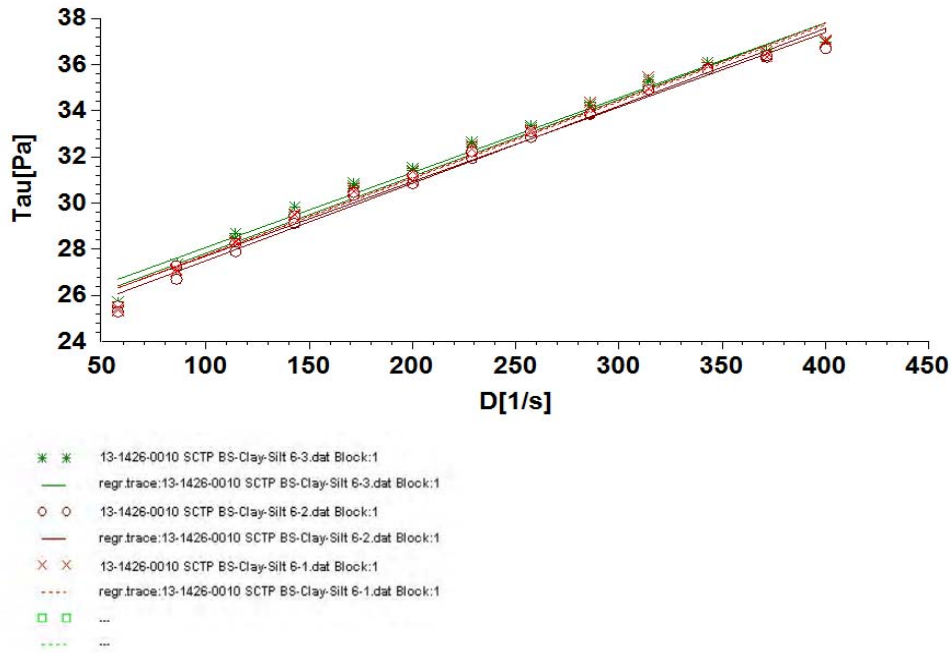
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page 1

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Manual Report Analysis/Regression



## Analysis-results

Analysis data source: 13-1426-0010 SCTP BS-Clay-Silt 6-3.dat Block:1

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=24.833+0.032386 \cdot X$  ;B=0.98347; S=0.488

step1: Bingham yieldstress[Pa]=24.833

step1: Bingham viscosity[Pas]=0.0324

step2: Bingham:  $Y=24.497+0.033231 \cdot X$  ;B=0.98244; S=0.516

step2: Bingham yieldstress[Pa]=24.4971

step2: Bingham viscosity[Pas]=0.0332

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=24.472+0.032241 \cdot X$  ;B=0.99019; S=0.373

step1: Bingham yieldstress[Pa]=24.4724

step1: Bingham viscosity[Pas]=0.0322

step2: Bingham:  $Y=24.146+0.033502 \cdot X$  ;B=0.98625; S=0.46

step2: Bingham yieldstress[Pa]=24.1457

step2: Bingham viscosity[Pas]=0.0335

filter activated: D[1/s]&gt;40

step1: Bingham:  $Y=24.409+0.03322 \cdot X$  ;B=0.98627; S=0.456

step1: Bingham yieldstress[Pa]=24.4095

step1: Bingham viscosity[Pas]=0.0332

step2: Bingham:  $Y=24.408+0.033407 \cdot X$  ;B=0.98587; S=0.465

step2: Bingham yieldstress[Pa]=24.4079

step2: Bingham viscosity[Pas]=0.0334

End of report

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

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