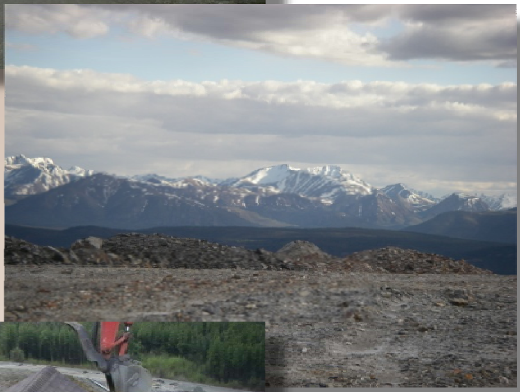
Faro Mine Closure
Fermeture de la mine Faro

Faro Mine Complex
Monitor Mine Waste Rock Trial Covers: 2008 Data Summary



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Prepared by:

SRK Consulting
Engineers and Scientists

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Faro Mining Complex

Monitor Mine Waste Rock Trial Covers: 2008 Data Summary

Yukon Territorial Government

On behalf of

Faro Mine Closure Planning Office

SRK Consulting (Canada) Inc.
Suite 2200, 1066 West Hastings Street
Vancouver, B.C. V6E 3X2

Tel: 604.681.4196 Fax: 604.687.5532
E-mail: vancouver@srk.com Web site: www.srk.com

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Executive Summary

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Objectives and Primary Findings:

This report summarizes the data collected during the 2008 monitoring season (May to October) from the waste rock cover trials at the Faro Mining Complex. The intent of this report is to document the field results and provide feedback on the quality of the data collected. Where problems with the collected data have been identified, this report provides recommendations for remedying the problem as well as mitigation strategies to prevent similar problems from reoccurring. The scope of this report is simply to confirm that the data collected is following reasonable trends, and that the instrumentation and data acquisition systems are performing as expected.

Detailed information regarding operation, calibration, suitability, and accuracy of the monitoring instrumentation used to collect the data presented in this report is provided in the as-built report (SRK 2006a), and therefore it is not repeated here.

Future Work Recommendations

The report provides a series of recommendations to improve data collection and prevent loss of data during subsequent monitoring years. These range from improved monitoring protocols to installing a second solar panel for the CR1000 datalogger. Also, this report makes recommendations regarding the extent and focus of the in-situ hydraulic conductivity and density testing of the covers.

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1 Introduction and Scope of Report

1.1 General

In 1998, the mining activities undertaken by Anvil Range Mining Corporation (ARMC) ceased due to financial problems and Deloitte & Touche Inc. (D&T) was appointed Interim Receiver of the mine site. Included in the Interim Receiver's role were:

- management of the site's care and maintenance and
- development of a site closure plan.

D&T was recently released of these obligations. In particular, a new 3-year care and maintenance contract for the Faro Mine Complex (FMC) was awarded to Denison Environmental Services (DES), with the transfer of responsibility for the site's care and maintenance on March 1, 2009. As regards the Final Closure and Reclamation Plan (the Plan), SRK Consulting (Canada) Inc. (SRK) was retained by D&T, on behalf of the Faro Mine Closure Planning Office (FMCPO), to assist in the development of a closure plan. Following several years of technical studies, public consultation and review by an independent review panel, two closure alternatives were subsequently agreed on by the Federal, Territorial and First Nations Governments as part of the overall closure plan for the Faro Mine Complex, i.e. one for the Vangorda-Grum area and one for the Faro area and the tailings impoundment. The development of the Project Description and the Environmental Impact Statement associated with the Plan is presently ongoing. Based on current expectations, this Plan will be submitted to the relevant regulating authorities by end of July 2009.

Engineering studies continue to be undertaken in the interim to provide the necessary scientific background information required to characterize and estimate costs for the closure methods to be used in the Plan. Soil covers are one of the key components of the remediation strategy. The trial covers constructed in 2004 will provide valuable information regarding the physical stability and infiltration reduction performance of soil covers constructed using locally available soils.

This report summarizes data collected between November 2007 and October 2008. The 2008 Monitoring Report follows 2007/08 Task 18a, "Monitor Mine Waste Rock Trial Covers"(SRK 2008a), 2006/07 Task 17a, "Monitor Mine Waste Rock Trial Covers"(SRK 2007), 2005/06 Task 20a, "Waste Rock Dump Cover Trials" (SRK 2006b), and 2004/05 Task 14a. No report was issued for 2004/05 Task 14a because construction of the cover trials was only completed in September 2004, and there was no data to report. An "as-built" report for the trial covers has been prepared as a separate report under 2004/05 Task 14a (SRK 2006a).

1.2 Background of the Project

The Faro Mining Complex (FMC) has about 185 million cubic meters of waste rock covering about 542 ha of surface area. Detailed geochemical characterization has confirmed that much of this waste rock is acid generating and contains leachable metals. As part of the approved Plan, one of the methods is physical covering of the waste rock piles.

The specific functions that a cover would have to perform have not been defined. However, the most likely functions would include:

- preventing direct exposure and contact with the waste rock;
- reducing, and possibly minimizing infiltration through the waste rock; and
- providing a medium that would allow re-vegetation of the piles.

Other potential functions have not been excluded, but there appears to be consensus within the Work Group responsible for the description and evaluation of the cover methods, that constructing covers to act as oxygen barriers would not be beneficial. Significant oxidation of the waste rock has already occurred, effectively negating benefits offered by oxygen exclusion.

One of the single most challenging aspects of cover design for the site entails designing an infiltration reducing cover that will continue to perform effectively in the very long term, using the locally available till and glacio-fluvial soils. It is standard practice to make use of numerical models to assess the potential performance ranges of different cover configurations. However, the only reliable method to evaluate the physical aspects that determine long-term cover performance is to monitor site specific trial covers.

Subsequently, six trial covers (CT#1, CT#2A, CT#2B, CT#3A, CT#3B and CT#4) were constructed on the Vangorda waste rock pile in September 2004, as illustrated in Figures 1, 2 and 3. These trial covers have been designed to test a range of different physical performance criteria for the available materials, specifically focused towards evaluating performance as “infiltration reducing” covers. Detailed water balance instrumentation was installed in the trial covers in June 2005 (see Figures 4 through 8).

In 2007, following the recommendation of the Independent Peer Review Panel a set of two large lysimeters (25 meters by 25 meters) were constructed on the plateau of the Vangorda waste rock dump. As shown in Figure 3, the lysimeters were built immediately west of the existing cover trial plots, adjacent to CT#2A. The lysimeters were instrumented in June 2008, using the same suite of instrumentation installed for the existing cover trials (Figure 9). Details about the location and type of instrumentation can be found in the lysimeters as-built report (SRK 2008b). The first season of collected data is presented in this report.

It is anticipated that the trial covers and lysimeters will be monitored for at least 3 more years, and that the resultant information will be used to optimize final cover designs for the FMC.

1.3 Scope of Work

This report summarizes the data collected from the trial covers during the 2008 monitoring season (November 2007 to October 2008). The intent of this report is to document the basic field results and provide feedback on the quality of data collected. Where data collection problems are identified, this report provides recommendations to remedy the problems as well as propose mitigation measures that can be implemented to prevent similar problems from occurring again. This report does not contain a technical analysis of the data. Nevertheless, a preliminary performance review was completed based on three years of data.

Instrumentation was re-commissioned by SRK in May 2008. FMC personnel retrieved data from all data loggers every two weeks until September 11, 2008. Some additional, infrequent downloads were performed after that period by FMC personnel, and the last download for the season was performed by Jozsef Miskolczi, EIT of SRK at the time of decommissioning of the instrumentation, on October 3, 2008.

Detailed information regarding the monitoring instrumentation used to collect the data presented in this report, covering their operation, calibration, suitability and accuracy is provided in the respective as-built reports (SRK 2006a, SRK 2008b), and is therefore not repeated here.

1.4 Methods

Six trial covers (Figures 2 and 3) were constructed in September 2004, in accordance with SRK design requirements. Construction was carried out by a local contractor, Tim Moon Construction, supported by FMC staff and equipment. Construction supervision was carried out by two SRK engineers, Maritz Rykaart, P.Eng. and Peter Mikes, E.I.T. The instrumentation was installed in June 2005 by Maritz Rykaart. The instrumentation was commissioned in June 2005, with complete construction and instrumentation details provided in an as-built report (SRK 2006a). Two lysimeters were built in 2007 by the same local contractor, Tim Moon Construction, with support from FMC staff. Supervision of the construction phase was provided by SRK engineer Jozsef Miskolczi, EIT. Instrumentation was installed and commissioned in June 2008 by Jozsef Miskolczi. Detailed construction and instrumentation notes can be found in the as-built report (SRK 2008b).

FMC staff, including two UBC summer students, was trained by SRK to carry out the field monitoring for the 2008 monitoring season (May to October). A written monitoring protocol was provided to FMC. Data was downloaded directly from the different data loggers onto a laptop computer. In addition, a series of readings were collected manually and converted into electronic format. All field data collected by FMC was sent to SRK via e-mail.

SRK used proprietary software linked to each of the data loggers to open and view the data to ensure that the loggers were operating satisfactorily. All data was collated into a master database at the end of the season. This master database converts raw field data into its final usable format by applying material specific calibration information. The figures illustrating the field data presented in this report (Figures 11 through 139) were created using this master database. Figures 11 through 139 do not show all the data collected to date. These figures only present the data collected during the 2008 monitoring season. As a result, figures presenting data as a graph will have lines extending from the end of the 2007 data set to the start of the 2008 data set. The range of the x-axis has been set to obscure this artefact but it can still be observed on the left hand side of the graph. Complete details of how data is prepared for input into the database and how the database was developed are included in the as-built report (SRK 2006a).

In addition to the data presented in this report, weather data is collected from two on-site weather stations, and annual snow surveys are conducted by staff from the Yukon Territorial Government (Janowicz *et al*. 2005, 2006, 2007, and 2008). This data is not presented here, but will be used to compare the validity of the trial cover data when detailed data analysis is carried out following future years of monitoring.

1.5 Post Processing

Every year the raw data collected by site personnel and conveyed to SRK by email was post-processed and integrated into a complete database containing all the data, from the beginning of monitoring in 2005, to date. Due to the required application of material-specific calibrations, a dedicated software package was created using the Fortran programming code that would perform the calibration-dependant conversions as well as check for validity of data and outliers. With the addition of the tipping buckets and the lysimeter instrumentation, the post-processing utilities had to be changed to accommodate the altered data structure collected from the CR10X data loggers, as well as the new type of output files generated by the CR1000 data logger.

In an effort to make the new post-processing protocol more simple and more versatile, it was decided to make use of the VBA and SQL programming capabilities of the Microsoft Access database and make the data check and calibration functions resident within the database. The 2008 data was compiled using this new protocol, as well as the integration of the old data (2007 and before). The new post-processing protocol does not change the data download protocols from the field instruments.

1.6 Report Structure

Section 2 contains information associated with the series of automated data loggers which collect field monitoring data for the trial covers. The remainder of the instrumentation data is collected manually, the details of which are presented in Section 4. The in-situ material characterization program carried out in 2008 is summarised in Section 5, while the final section of the report provides a summary of the action items arising from this data summary report.

2 Automated Instrumentation Data Logger Data

2.1 Davis Instruments Vantage Pro (Weather Stations and Satellite Stations)

Complete climatic data is collected at the Vangorda Waste Rock Pile trial cover location using two Davis Instruments Vantage Pro Weather stations. The first station is located on the sloped CT#1 trial cover and the second on the dividing berm between horizontal trial covers CT#2A and CT#2B. Figure 2 schematically illustrates these locations. Additional climatic data (air temperature and relative humidity), as well as shallow soil moisture and temperature data, are collected via two satellite Davis Instruments stations located approximately 25 m from these two primary weather stations, as illustrated in Figure 4. Figures 6 and 7 illustrate the locations of the soil moisture and temperature sensors installed as part of the satellite stations.

At each setup, the data from the weather station and the satellite station is collected by a Vantage Pro data logger housed in the weather-proof enclosure situated beneath the weather station. The data loggers collect and store primary climatic data, as listed in Table 1. This data is measured directly from the suite of climatic sensors. This data is also presented as time-series graphs in Figures 11 through 22, and spans from June through October 2008.

In addition to the sensor data listed in Table 1, the data logger uses this primary data to calculate a series of secondary climatic information. Since this report focuses on the integrity of the primary collected data, this reduced data was not reported. SRK did, however, review all this data to confirm that the data logger was operating satisfactorily, and that the data collected made sense. This data has also been imported into the central database for future use. Appendix A provides a brief summary of this data.

Maintenance or recalibration was not carried out on the weather or satellite stations in 2008; however, regular visual inspections by the monitoring staff concluded that there were no problems. The rechargeable batteries installed in 2007 were replaced at the beginning of the 2008 season. As a precautionary measure, a spare set of batteries were provided on site, but did not have to be used.

Review of the data records revealed a major gap in data collection for Station 2 between June 8 and July 31, during which period no data from any of the sensors external to the weather station console was collected. Figures 11 through 22 show a flat line for the period with no data. The investigation of the incident found all the sensor components in good working order, and the console was working as well. The suspicion is that the problem was caused by radio communication between the sensor suite and the console being disrupted by interference with another more powerful radio source. On July 31 the communication was restored spontaneously, and data recording was resumed in good order, although the plotted time stamps of the recorded data indicate a one-day offset between the two stations. Station 1 also has a short gap in data from September 11 to October 1. The cause of this gap is not known, and data collection resumed spontaneously around 1AM on October 1.

At time of decommissioning, on October 3, the wind cup of Station 2 was damaged by Jozsef Miskolczi of SRK, and will be replaced at time of recommissioning for the 2009 season.

Table 1: Summary of Primary Data Collected by Davis Instruments Vantage Pro Weather and Satellite Stations

Parameter	Location	Sample Frequency	Units	Figure	Comment
Rainfall	Both weather stations	Every 50-60 sec; output as hourly total	mm	Figure 11	Hourly total; Rain rate (mm/hr) is also recorded (not presented)
Ambient Outside Air Temperature	Both weather and satellite stations	Every 10-12 sec; output as mean hourly	^oC	Figure 12	Max/Min hourly also recorded at weather stations (not presented)
Relative Humidity	Both weather and satellite stations	Every 50-60 sec; output as mean hourly	%	Figure 13	Range of 0% to 100%
Solar Radiation	Both weather stations	Every 50-60 sec; output as mean hourly	W/m^2	Figure 14	"Hi solar radiation", i.e. peak hourly solar radiation also recorded (not presented)
Barometric Pressure	Both weather stations	Every 50-60 sec; output as mean hourly	KPa	Figure 15	
Wind Speed	Both weather stations	Every 2.5-3 sec; output as mean hourly	km/hr	Figure 16	Max/Min hourly also recorded at weather stations (not presented)
Wind Direction	Both weather stations	Every 2.5-3 sec; output as mean hourly	N/E/S/W	Figure 17	Max hourly also recorded at weather stations (not presented)
Ultraviolet (UV) Index	Both weather stations	Every 50-60 sec; output as mean hourly	Scale 1 – 16	Figure 18	"Hi UV Index", i.e. maximum hourly UV Index also recorded (not presented)
Soil Moisture[1]	Both satellite stations	Every 50-60 sec; output as mean hourly	KPa	Figure 19 (CT#1); Figure 21 (CT#2A)	Measured at two depths
Soil Temperature	Both satellite stations	Every 50-60 sec; output as mean hourly	^oC	Figure 20 (CT#1); Figure 22 (CT#2A)	Measured at two depths

1. Soil moisture is measured in units of centibar (Cb) according to the supplier, which is not a true unit of soil moisture. The true parameter measured by this instrument is soil matric suction.

2.2 Campbell Scientific Data Loggers

Installing the lysimeter instrumentation resulted in the addition of a Campbell Scientific CR1000 data logger to the exiting two CR10X dataloggers. The CR1000 performs the same functions as the CR10X, and is basically the next generation of the same family of data loggers. The programming of the new CR1000 is radically different from the programming of the CR10X, but the wiring and the performance of the two types of loggers are similar. Also the output files have different structure, but the post-processing protocol was adjusted to allow the full integration of the data from all data loggers.

2.2.1 General Setup

Two Campbell Scientific CR10X data loggers collect soil matric suction and temperature data from Campbell Scientific CS229 thermal conductivity sensors, as well as soil volumetric moisture content from Sentek Sensor Technologies EnviroSCAN sensors. Flow volumes from the tipping bucket flow gauges are also monitored by one of the CR10X data loggers. In addition, the data loggers monitor and record the minimum battery voltage each day, for diagnostic purposes. The CR10X are located adjacent to each other in the monitoring hut at the base of CT#3B while the CR1000 is located in the second monitoring hut between CT#4 and CT#3A, as illustrated in Figures 4 and 5.

The first data logger (CR10X #1) collects volumetric moisture content data from CT#2A and 2B, as well as the entire suite of flow data from 9 tipping buckets . The second data logger (CR10X #2) records the soil temperature and suction as well as moisture content data from CT#1, CT#3A, CT#3B, and CT#4. In addition, the CR1000 is collecting soil temperature, suction, moisture content and interflow data from Lysimeters L#1 and L#2. Details of the instrument locations are presented in Figures 4 through 9.

Data collected by the CR10X data loggers is stored in a series of “arrays” (i.e. a summary table of data). The soil matric suction, temperature and volumetric moisture content are recorded every six hours (midnight, 6AM, noon, and 6PM) by CR10X#2 and CR1000 while CR10X #1 outputs moisture content data every 15 minutes. The interflow is continuously monitored by both CR1000 and CR10X#2 and cumulative flow is output every 30 minutes. Daily summary output of all the data is provided, which also includes information about the battery voltage for diagnostic purposes.

The Campbell Scientific data loggers are not decommissioned during winter months and as a consequence data is continuously collected, as opposed to the weather stations that are decommissioned during winter. Data collected using the CR10X data loggers and presented in this report spans from the end of the 2007 monitoring season in November to October 2008.

2.2.2 Battery Voltage

The data loggers and instruments are powered by a 12V battery (one per data logger). These batteries are continuously recharged using solar energy (one solar panel per battery). The data logger has an internal protection circuit that will shut the logger down if the battery voltage drops below 10.5V, or exceeds 15V. For this reason, the data loggers have been programmed to record the battery voltage as part of the daily summary array. Figure 23 presents the graph of daily minimum battery voltages measured for each of the CR data loggers.

As can be observed in Figure 23, the battery voltage of the CR1000 datalogger was often lower than optimum, causing the datalogger to shut down several times for short time periods. Nevertheless the data loss was minimal, as the solar panel would recharge the battery. The cause of the low voltage was the underestimation of the datalogger’s power requirements. To avoid similar situation in the future, SRK recommends the installation of a second solar panel to boost the recharge capacity of the battery.

The written monitoring protocol required a physical diagnostic check on the batteries and solar panels every time that the data is downloaded, which confirmed that both systems were functioning properly. Observation sheets are included as Appendix F.

2.2.3 Soil Matric Suction

Soil matric suction is measured in each trial cover using a series of Campbell Scientific CS229 thermal conductivity sensors. There are three to six sensors in each trial cover and four sensors in each lysimeter, as illustrated in Figures 6 to 9. Soil matric suction is recorded as a voltage differential by the data logger. This voltage differential, through the application of material specific calibration curves, is converted to matric suction, expressed in kPa. This conversion is done by SRK during the process of transferring the raw data to a central database. Figures 24 through 31 illustrate the converted soil matric suction values recorded during the 2008 season.

2.2.4 Soil Temperature

The soil temperature is measured using the same CS229 thermal conductivity sensors. This occurs because the first step in recording the soil matric suction entails taking an in-situ soil temperature reading. Just as with the matric suction data, the raw data is recorded as a voltage and, through application of the material specific calibration curves in the post-processing phase, the soil temperature profiles illustrated in Figures 32 to 39 are produced.

2.2.5 Soil Volumetric Moisture Content

A profile of soil volumetric moisture content is measured in each trial cover using Sentek Senor Technologies EnviroSCAN probes. Each profile contains between seven and thirteen individual beads, as illustrated in Figures 6 to 9. The data recorded by the sensors is relative volumetric moisture content, expressed as a fraction, using a standard calibration curve. During the post-processing, these values are corrected to actual volumetric moisture contents by applying material specific calibration curves. This data is presented in Figures 40 through 47.

As can be seen on Figure 40 and Figures 43 through 45 the data collected from the EnviroScan probes connected to CR10X#2 between July 10 and July 29, 2008 was erratic. The cause of failure was identified in a faulty connection cable between the datalogger and the multiplexer housing box located on CT#3A/B. The buried cable was replaced with a section of armoured cable.

2.2.6 Tipping Bucket Flow Gauges (Runoff and Interflow)

As a result of the instrumentation upgrade program carried out in 2007, the flow (interflow as well as surface flow) data is collected using two methods: tipping bucket flow gauges and SeaMetrics flow gauges. The tipping buckets are continuously monitored by CR10X #1 through two 8-channel SDM-SW8A pulse counter devices connected in series; cumulated totals of tips are recorded every 30 minutes. The tipping bucket flow gauges installed at the lysimeters are monitoring the surface flow and two interflow values on each lysimeter through same type pulse counter device connected to the CR1000 data logger. The interflow of the lysimeters was separated in order to quantify the purely vertical infiltration separately from the infiltration affected by the cover-liner boundary.

The 2008 monitoring season was unusually wet, with total precipitation from May to October in excess of 322 mm compared to 214 mm, the 30 year (1971 to 2000) annual average. As a result the interflow and surface flow rates exceeded the capacity of the tipping buckets causing them to overflow on several occasions; therefore, the flow volumes recorded using the tipping bucket flow gauges are most likely underestimated. The recorded interflow data for TC#3A/B and TC#4 is presented in Figures 48 to 50, while the interflow for L#1 and L#2 is presented in Figures 56 to 61.

2.3 SeaMetrics DL75 Data Loggers (Surface Runoff and Interflow)

Surface runoff is measured from each trial cover using individual SeaMetrics flowmeters, each connected to an individual SeaMetrics DL75 data logger. Interflow from CT#3A, CT#3B and CT#4 is also measured with a similar setup (in addition to tipping buckets, as discussed in Section 2.2.6). Each of these nine flowmeters is located in a monitoring hut, with the flow directed to them through a series of buried drainage pipes, as illustrated in Figure 5. In addition, a similar setup was installed for the lysimeters, with the SeaMetrics data loggers installed on drainage pipes inside the second monitoring hut.

The flow meters monitoring the lysimeter flow proved to be affected by the organic matter and sediment transported by the water travelling down the drainage pipes to the flow meters. These impurities did, in some cases, block the turbine of the flow meter, thus preventing it from recording the real flow values. To correct this deficiency, a sedimentation or filtration system should be installed upstream of the flow meters that would capture and retain the transported sediment. The same phenomenon was not observed in the case of the nine flow meters installed in the old monitoring hut. This is probably due to the fact that the covers and the drainage pipes were installed several seasons ago, and the free sediments available for transport were already flushed during the previous seasons.

The data loggers recorded an instantaneous flow rate every 60 seconds in the case of the cover trials and every 30 seconds in the case of the lysimeters. This data is used to calculate an incremental flow volume. In addition, each data logger calculates a total volume and flow rate over a user specified timeframe. During the post-processing of the data, the null values (no flow recorded) are removed from the database to save space, thus the graphs in this report show only the non-null values in chronological sequence. This data is presented in Figures 62 through 65 and 68 through 71 and the interflow data is presented in Figures 66 and 67.

All flowmeters were performing as expected. Field staff, who visited the site almost daily throughout the 2007 field season, confirmed that they did not see any discernable runoff collect in the runoff drains at any time.

It should however be noted that the flowmeters will not record very low flows. To correct this situation, a series of six additional tipping bucket flowmeters were installed in 2007, as detailed in Appendix E. In addition, during the 2007 season the written monitoring protocol required a physical examination of the interflow pipes to monitor the presence of water to determine if an additional method of monitoring will be required. A record of these observations is included as Appendix F.

2.4 Lakewood Systems UL16 Data Logger (Soil Temperature)

Two thermistor strings, each with eight M-Squared thermistor beads, have been installed in the Grum Overburden Dump, as illustrated in Figure 10. These two thermistor strings (String A and String B) are monitored by a Lakewood UL16 data logger which records a relative voltage every twelve hours. These raw voltage profiles are presented in Figures 72 and 73, and confirm that the strings are performing as expected.

3 Manually Collected Instrumentation Data

3.1 M-Squared Thermistor Cables (Soil Temperature)

Four thermistor strings each with eight thermistor beads have been installed adjacent to the two strings connected to the Lakewood Systems data logger, in the Grum Overburden Dump. Their installation details are presented in Figure 10. These four thermistor strings are manually read at regular intervals by the site staff and the raw data is reported as resistances. These resistance values are converted to soil temperatures during the post-processing phase. The measured soil temperature profiles for the 2007 season from these four strings are shown in Figures 74 through 77. All thermistor strings performed as expected, although the first set of readings of the 2008 season proved to be erroneous and was discarded.

3.2 Sentek Sensor Technologies Diviner 2000 (Soil Volumetric Moisture Content)

Each trial cover has six to eight vertical PVC access tubes, as illustrated in Figure 5, while the lysimeters have ten access tubes each. A Sentek Senor Technologies Diviner 2000 probe is inserted manually into each of these tubes to record an instantaneous reading of the soil volumetric moisture content profile at 10 cm intervals. Data was collected throughout the 2008 monitoring season from each of the 60 access tubes on a regular schedule. However, for most of the period, daily readings were taken. Data is recorded using a portable data logger, and expresses the results in terms of relative volumetric moisture content. During the post-processing stage, material specific calibration curves are applied. Figures 78 through 135 present the final volumetric moisture content profiles for each access tube. Data collected from these tubes confirm that the instrument performed as expected.

3.3 HOBO Water Level Meters

In an effort to mitigate the difficulty of measuring flow in the beginning and end of each season due to frozen drainage pipes, a series of culverts were installed on CT#2A, CT#2B, and both lysimeters. The culverts consist of a wooden box placed in a gap in the containment berm created by breaching the berm of each of the mentioned covers. The culverts were instrumented with a HOBO water level meter that monitors and samples the pressure every 16 seconds. Changes in recorded pressure will be an indication of water level fluctuations, i.e. flow through the weir. Because of the closed pressure cell of the HOBO instrument, the recorded data has to be reduced by subtracting the atmospheric pressure recorded by the weather stations on site. Due to limited available memory of the HOBO device, the download protocol provided to the site personnel required download every 5 days. Data collected is presented in Figures 136 to 139.

4 In-Situ Geotechnical Testing

The 2008 in-situ geotechnical investigations were performed between August 8 and August 13. The investigations included saturated hydraulic conductivity measurements, performed using the single ring infiltrometer and the Guelph permeameter methods, as well as in-situ density measurements using a nuclear density gauge owned and operated by EBA Engineering Consultants Ltd.

4.1 Saturated Hydraulic Conductivity

In-situ saturated hydraulic conductivity was tested on the trial covers between August 8 and August 13, 2008 using single ring infiltrometers and a Guelph permeameter fitted with a tension infiltrometer device. Table 1 summarizes the testing carried out on each test cover.

Table 2: Summary of Performed In-situ Saturated Hydraulic Conductivity Tests

Trail Cover	Material Tested	Testing Method	Number of Tests*	Average Hydraulic Conductivity Value
CT#1	Till	Guelph Permeameter	0	N/A
		Single Ring Infiltrometer	0	N/A
CT#2A	Till	Guelph Permeameter	2	1.97×10^{-4} cm/sec
		Single Ring Infiltrometer	3	1.11×10^{-4} cm/sec
CT#2B	Till	Guelph Permeameter	3	1.20×10^{-4} cm/sec
		Single Ring Infiltrometer	4	4.42×10^{-5}cm/sec
CT#3A	Glacio-fluvial	Guelph Permeameter	0	N/A
		Single Ring Infiltrometer	0	N/A
CT#3B	Glacio-fluvial	Guelph Permeameter	0	N/A
		Single Ring Infiltrometer	0	N/A
CT#4	Till	Guelph Permeameter	8	3.83×10^{-4} cm/sec
		Single Ring Infiltrometer	7	2.36×10^{-5} cm/sec
L#1	Loose Till	Guelph Permeameter	0	N/A
		Single Ring Infiltrometer	0	N/A
L#2	Compacted Till	Guelph Permeameter	2	1.35×10^{-4} cm/sec
		Single Ring Infiltrometer	4	3.14×10^{-5} cm/sec

* Random locations were selected on each cell.

Testing concentrated on the covers that are the most likely candidates for the final remediation, thus no testing was performed on covers CT#3A and CT#3B. Furthermore, it was considered that CT#1 and CT#4 have identical surface characteristics (same construction material and same surface treatment), and the testing therefore was not repeated on CT#1. In the case of the lysimeters, due to the surface treatment of L#1, i.e. loose till in a hummocky configuration, it was considered that hydraulic conductivity testing would be inconclusive, therefore no testing was performed.

Tension infiltrometers consist of a porous disc base in contact with the tested material, and a Mariotte bubbler that keeps the head constant. The water reservoir of the Guelph permeameter is used as source for replacing the water lost during the test due to suction. The tension infiltrometer device allows the measurement of the saturated hydraulic conductivity without the need of a regular shape hole in the soil to be tested. A smooth and flat (horizontal as much as possible) surface is required instead to ensure a good hydraulic contact between the tension infiltrometer and the soil surface. To enhance the hydraulic contact, fine grained material (fine sand) was used to create a circular base just slightly larger in diameter that the tension infiltrometer disc (215 mm diameter) with thickness in the order of 2 to 3 millimetres.

In cases where the surface of the covers is horizontal (CT#2A, CT#2B, L#2), the tests were performed directly on the surface, while in the case of CT#4 an approximately horizontal pad was created on the inclined surface.

The ring infiltrometer tests were performed using 30 cm sections cut from thick wall pipe (1.3 mm thickness), with the internal diameter of 59 cm. The rings were pushed in the ground to a depth of approximately 7.5 cm using the bucket of the excavator, and then a sealing ring of moist bentonite paste was placed on the outside, at the base of the ring. In the case of the sloped trial covers, a horizontal pad was excavated, and the rings installed as previously described. The measurements were performed as falling head tests, meaning that the rings were filled with water and then left to drain, the draining rate being recorded. To avoid the accumulation of precipitation as well as excessive evaporation, sections of plywood were used to cover the rings.

Summary tables of the Guelph permeameter and ring infiltrometer test results are attached as Appendix B, while complete individual field data calculation sheets can be found in Appendix C.

4.2 In-Situ Density Testing

In-situ density testing was carried out on August 12, 2008, using a nuclear density probe owned and operated by EBA Engineering Consultants Ltd. of Whitehorse, YT. Unlike in the case of hydraulic conductivity testing, the in-situ density was measured on every single cover, as well as on both lysimeters. Table 3 summarizes the test results while field data sheets are attached in Appendix D.

It should be noted that the reference dry density of 2,130 Kg/m^3 used to calculate the percentage of standard Proctor compaction reflects the maximum density achievable in laboratory conditions of the glacial till used for the covers, thus it is not representative of the glacio-fluvial material used for the covers on CT#3A and CT#3B. The values of percentage Standard Proctor Compaction could therefore be misleading in the case of the uncompacted glacio-fluvial material and have been excluded from the results summarised in Table 3.

Table 3: Summary of In-Situ Density Tests

Trial Cover	Material Tested	Number of Tests	Average Moisture Content (%)	Average Dry Density (kg/m^3)	Average Standard Proctor Compaction (%)
CT#1	Till	18	5.6	2,033	96.4
CT#2A	Till	12	5.1	2,141	100.4
CT#2B	Till	12	5.3	2,104	98.8
CT#3A	Glacio-Fluvial	12	3.0	2,035	N/A
CT#3B	Glacio-Fluvial	12	2.7	2,015	N/A
CT#4	Till	18	7.3	2,071	96.7
L#1	Loose Till	3	5.7	2,067	80.7
L#2	Compacted Till	12	5.3	2,145	100.7

The in-situ density data will be used for relative comparison changes in the soil profile over time, and the absolute values recorded are of less importance. In-situ density testing using a Troxler nuclear density probe alone, although calibrated for the site specific soils, can be fraught with complexities. Therefore, it is recommended that during the 2009 monitoring season suitable backup tests will be carried out, such as sand-cone replacement tests.

5 Action Items

This report documents the 2008 season of data collected for the trial covers constructed on the Vangorda waste rock pile. The trial covers were constructed in September 2004, and the instrumentation installation was carried out in June 2005. For the 2008 season, instrumentation was commissioned in May 2008, and shut down on October 3rd 2008. Data collection and instrumentation performance was good, and the partial loss of data experienced for some of the instruments will not significantly affect the overall quality of information. The following is a list of recommendations that should be implemented to ensure that the 2009 monitoring is successful:

- All instrumentation should be re-commissioned in May 2009.
- An updated download protocol will be provided to site personnel at the beginning of the new monitoring season, and site staff will be retrained on the download protocol.
- Install new battery packs for both Davis Instruments weather stations.
- Install new battery pack for the Lakewood datalogger on Grum dump (automated thermistors).
- Install an additional solar panel to support the CR1000 data logger battery.
- Replace the damaged wind cups of the Davis weather station.
- The desiccant packs in each data logger weather enclosure must be replaced every two weeks. The removed desiccant packs must be dried out in the laboratory oven as per the manufacturer’s instructions.
- Install sand trap or filter on all drainage pipes connected to the lysimeters upstream of the SeaMetrics flow meters.
- Water from each Diviner and EnviroScan access tube should be bailed out prior to commencing the 2009 monitoring season.
- The weir design of the HOBO water level monitors will have to be improved to increase accuracy of collected data. The improved design should be developed and implemented ideally before the spring freshet.
- SRK will not only perform basic quality control checks on the raw data received every two weeks, but will post-process the data at that time as well, in order to ensure minimal data loss.
- SRK will evaluate insulation options for the drainage pipes in the monitoring hut during the transition season from October to November.
- Another round of in-situ density and hydraulic conductivity testing should be carried out on the trial covers in July/August 2009. The 2009 hydraulic conductivity testing program should focus on CT#1, CT#3A and CT#3B, while density testing using the sand cone replacement method should be carried out on all test covers.
- A Standard Protocol Density should be completed on the Glacio-fluvial cover material to facilitate interpretation of the in-situ density testing.

This report, **"Faro Mine Complex, Monitor Mine Waste Rock Trial Covers: 2008 Data Summary"**, has been prepared by SRK Consulting (Canada) Inc.

Prepared by:

Jozsef Miskolczi, E.I.T.
Consultant

PROFESSIONAL ENGINEER
YUKON TERRITORY
MARITZ RYKAART
31/5/09

Reviewed by:

Maritz Rykaart, Phd., P.Eng.
Principal

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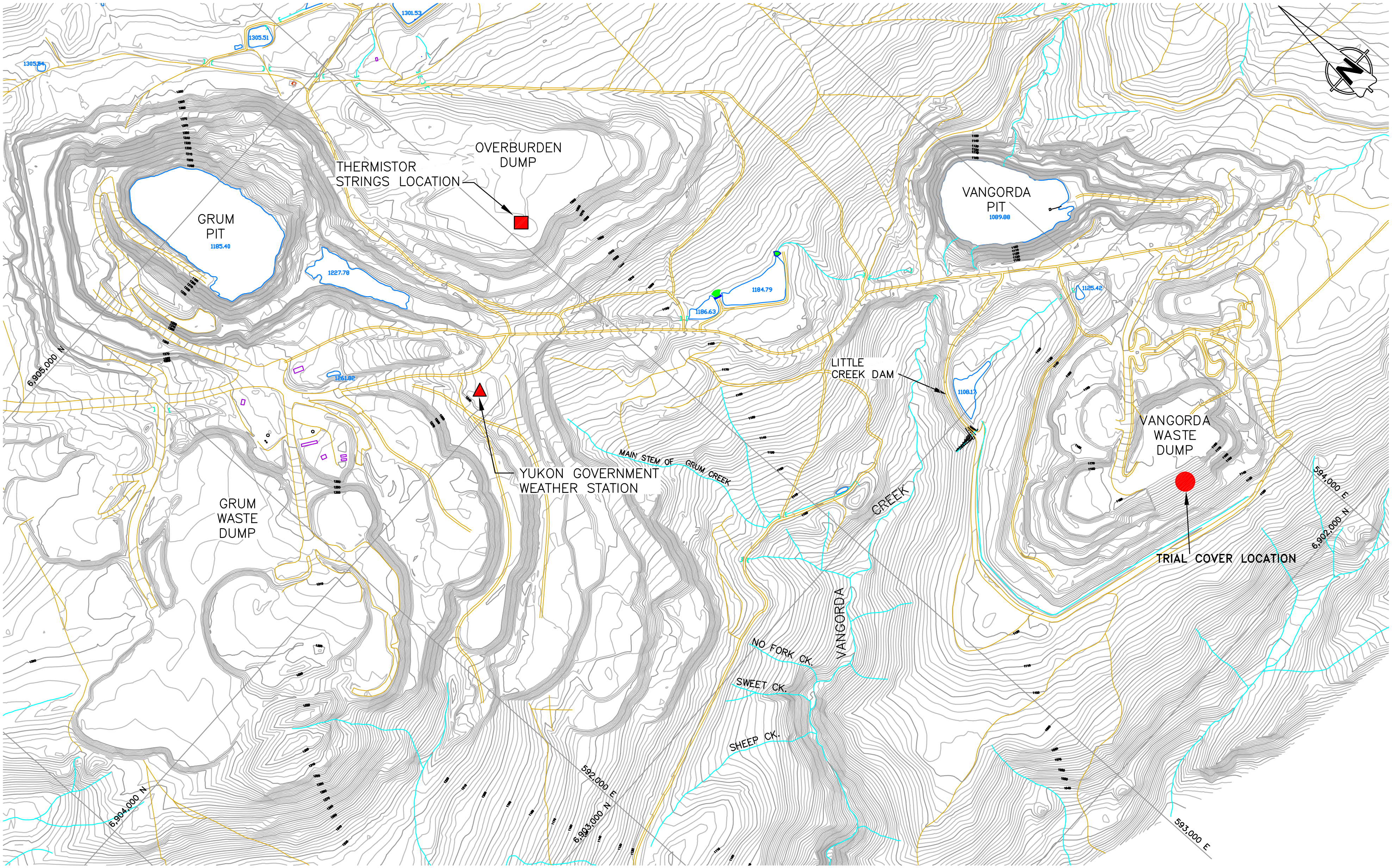
Figures



0 100 200 300 400 500 metres

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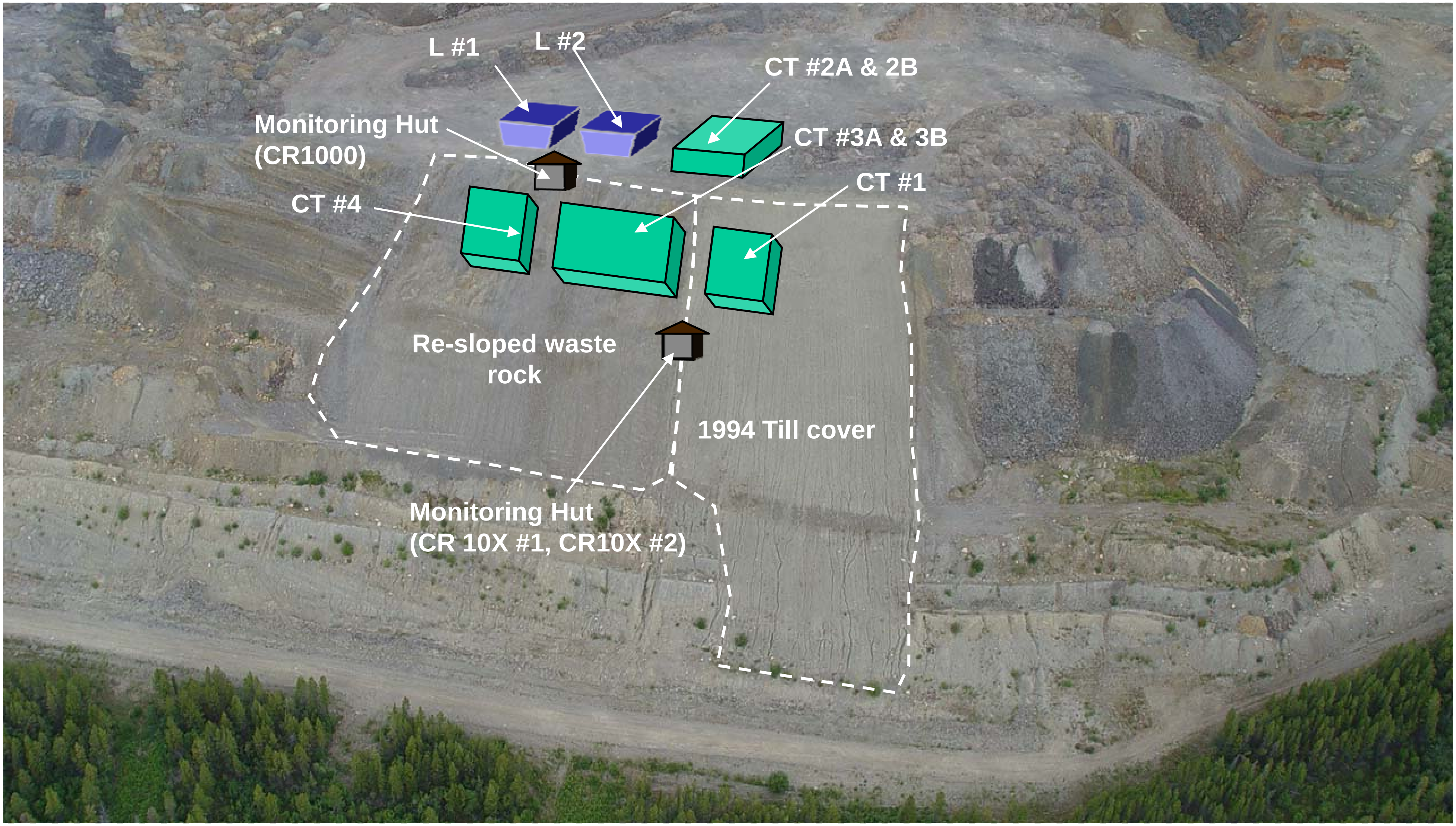
Waste Rock Trial Covers
Preliminary Performance Report

Location Plan for Trial Covers and Thermistor Strings

Anvil Range Mining Complex

SRK JOB NO.: 1CY001.020.001.06	DATE: Nov. 2008	APPROVED: JM	FIGURE: 1
FILE NAME: site_plan_Thermistor.dwg			



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		Aerial view of trial cover layout
Job No: 1CY001.020.001 Filename: Fig2_4-9_Trial covers_20090227.ppt	**Faro Mine Complex**	Date: Feb. 2009 / Approved: JM / Figure: 2

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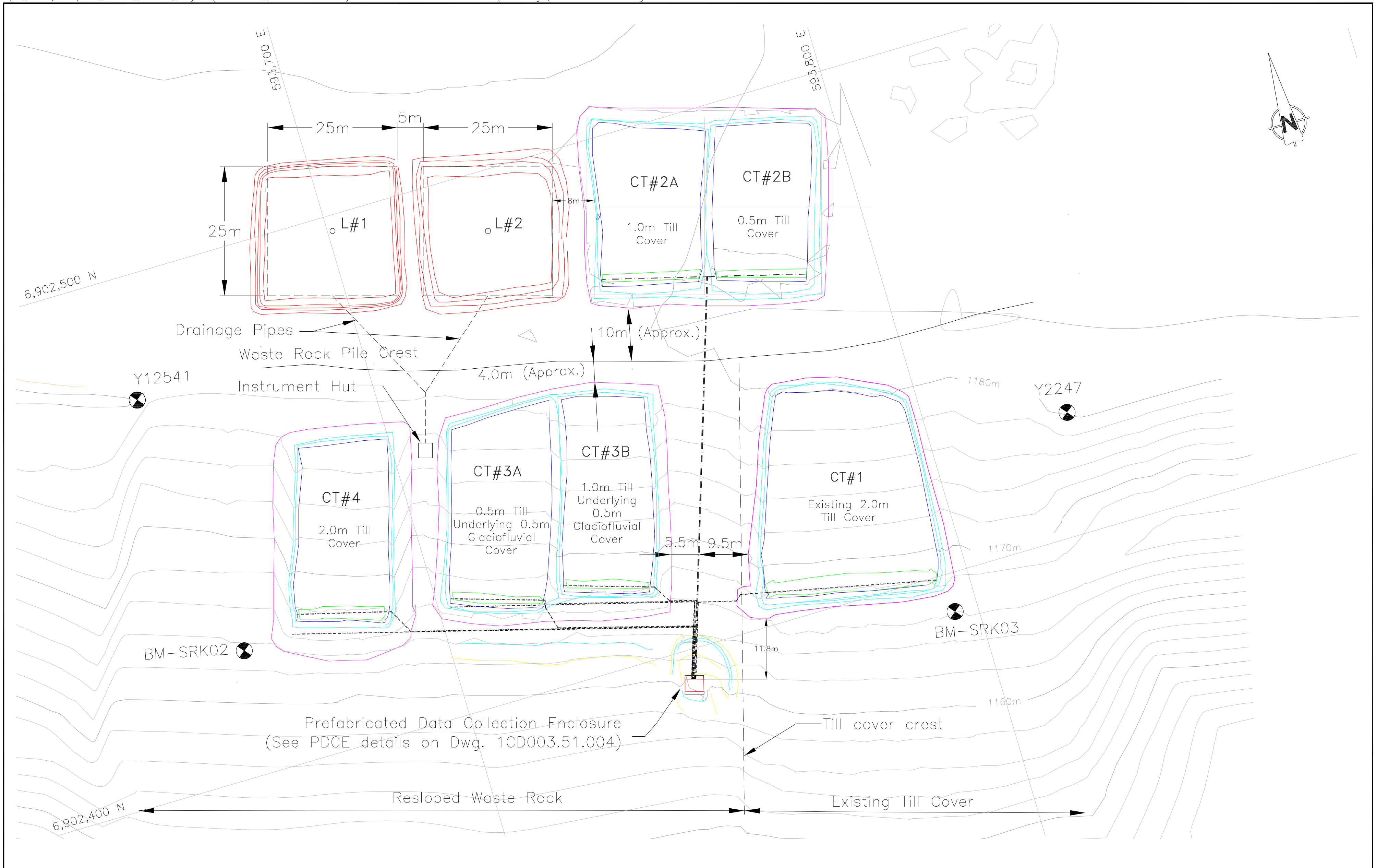

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Monitor Mine Area Waste Rock Trial Covers
2008 Data Summary

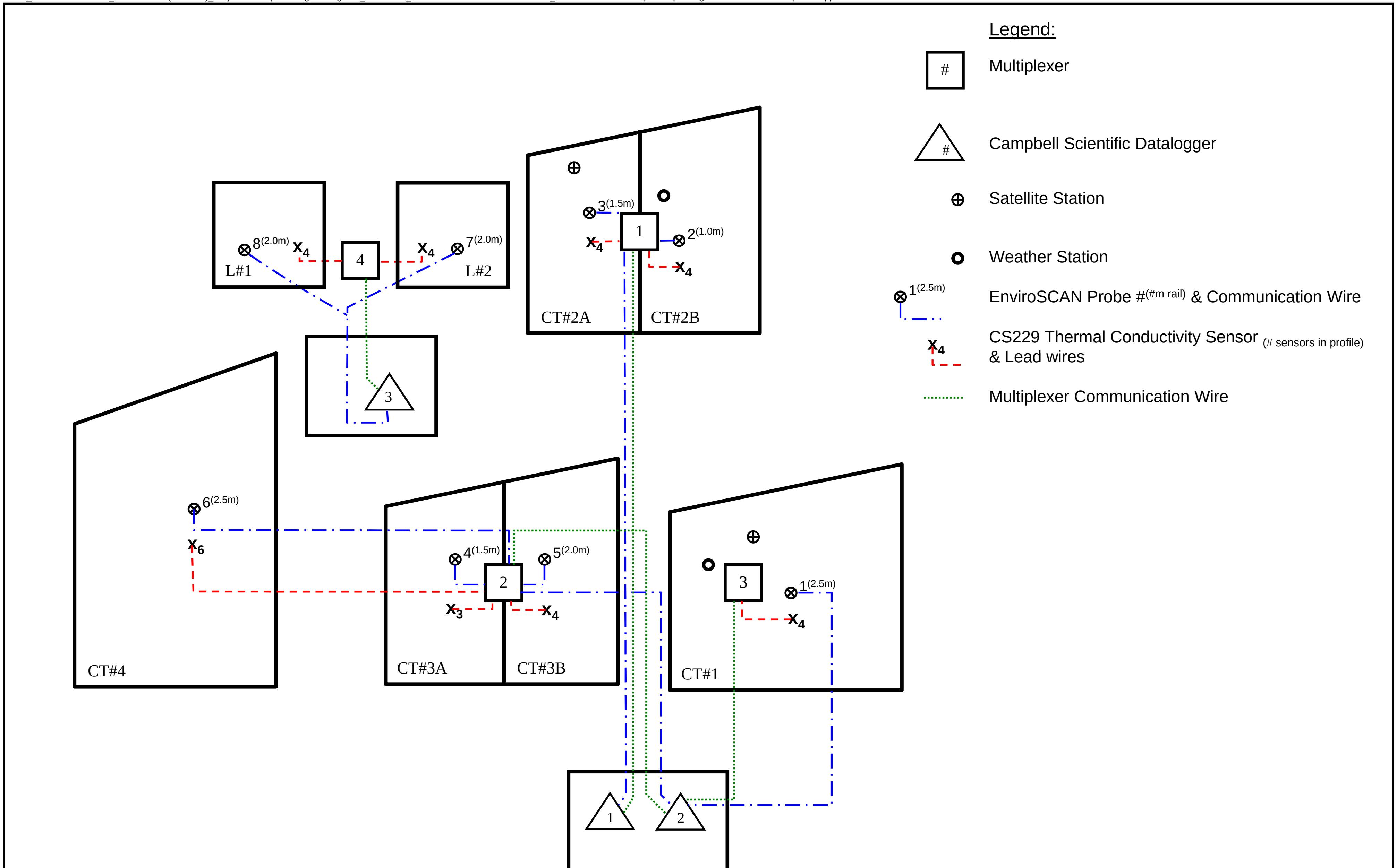
Trial Covers and Lysimeter Layout Plan

SRK JOB NO.: 1CY001.020.0001

FILE NAME: Test Covers Asbuilt.dwg

Faro Mining Complex

DATE:	APPROVED:	FIGURE:
Feb. 2009	JM	3



SRK Consulting Engineers and Scientists VANCOUVER	Yukon Government	Monitor Mine Waste Rock Covers 2008 Data Summary
		Schematic trial cover and lysimeter layout showing automated soil suction, moisture instrumentation, datalogger as well as weather and satellite station locations
Job No: 1CY001.020.001 Filename: Fig2_4-9_Trial covers_20090227.ppt	**Faro Mine Complex**	Date: Feb. 2009 Approved: JM Figure: 4

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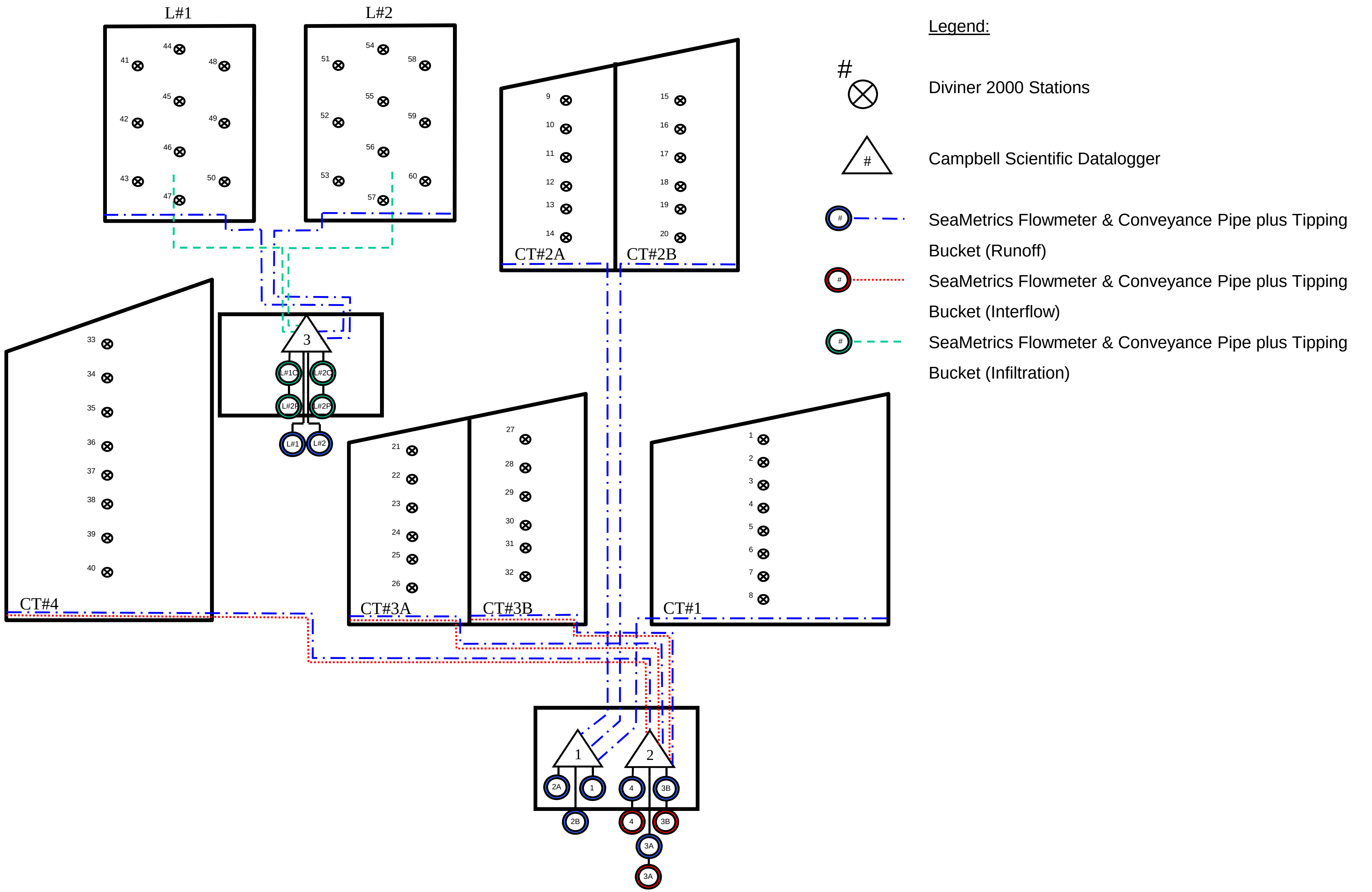

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Monitor Mine Waste Rock Covers
2008 Data Summary

Schematic trial cover and lysimeter layout showing Diviner 2000 stations, surface runoff, and interflow measurement locations

Job No:	1CY001.020.001		
Filename:	Fig2_4-9_Trial covers_20090227.ppt		

Faro Mine Complex

Date:	Approved:	Figure:
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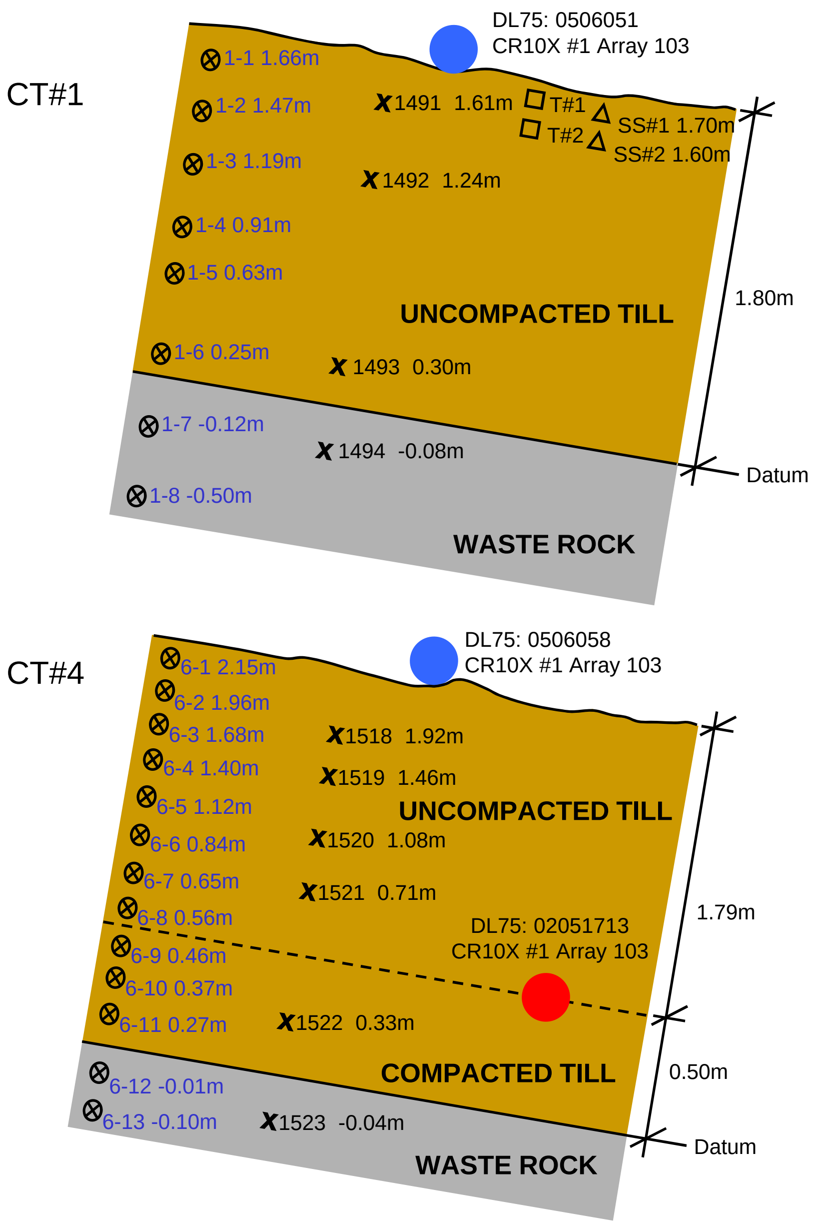


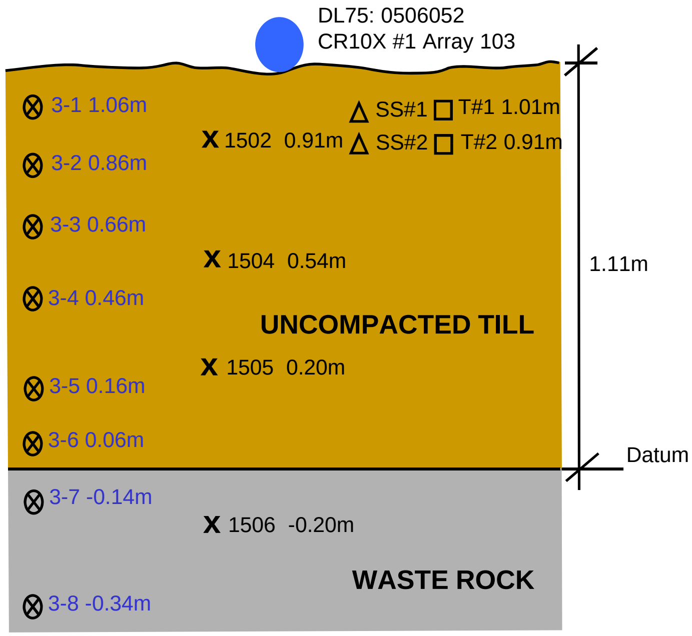
Legend:

⊗	#-# #.##m	EnviroSCAN Probe, s/n and depth
X	# #.##m	CS229 Thermal Conductivity Sensor, s/n and depth
□	T## #.##m	Satellite Station Soil Temperature probe and depth
△	SS## #.##m	Satellite Station Soil Moisture probe and depth
Red circle	DL75: # CR10X #2 Array #	Seametrics Datalogger with Flowmeter and Tipping Bucket (Interflow)
Blue circle	DL75: #	Seametrics Datalogger with Flowmeter (Runoff)

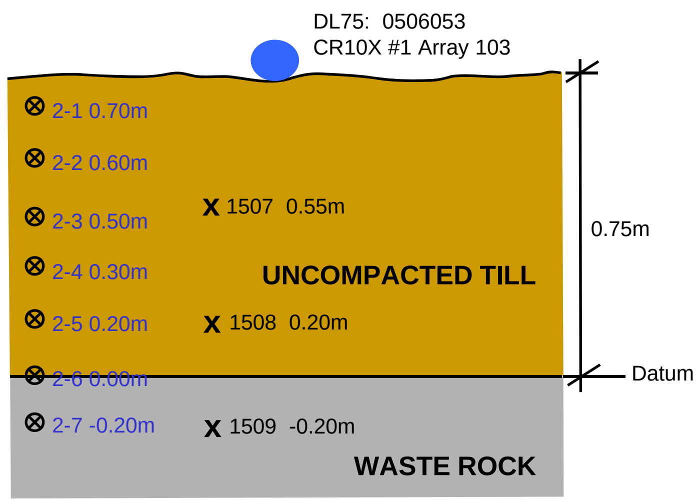
Note:

Depths measured from Datum
- Positive = up
- Negative = down

SRK Consulting Engineers and Scientists VANCOUVER	Yukon Government	Monitor Mine Waste Rock Covers 2008 Data Summary
		Schematic Instrument Profiles for CT#1 and CT#4
Job No: 1CY001.020.001	**Faro Mine Complex**	Date: Feb. 2009
Filename: Fig2_4-9_Trial covers_20090227.ppt		Approved: JM
		Figure: 6



CT#2A



CT#2B

Legend:

⊗	#-# #.##m	EnviroSCAN Probe with bead s/n and depth
X	# #.##m	CS229 Thermal Conductivity Sensor bead s/n and depth
□	T## #.##m	Satellite Station Temperature probe and depth
△	SS## #.##m	Satellite Station Soil Moisture probe and depth
Red circle	DL75: # CR10X #2 Array #	Seametrics Datalogger with Flowmeter and Tipping Bucket (Interflow)
Blue circle	DL75: #	Seametrics Datalogger with Flowmeter (Runoff)

Note:
Depths measured from Datum
- Positive = up
- Negative = down

SRK Consulting Engineers and Scientists VANCOUVER	Yukon Government	Monitor Mine Waste Rock Covers 2008 Data Summary
		Schematic Instrument Profiles for CT#2A and CT#2B
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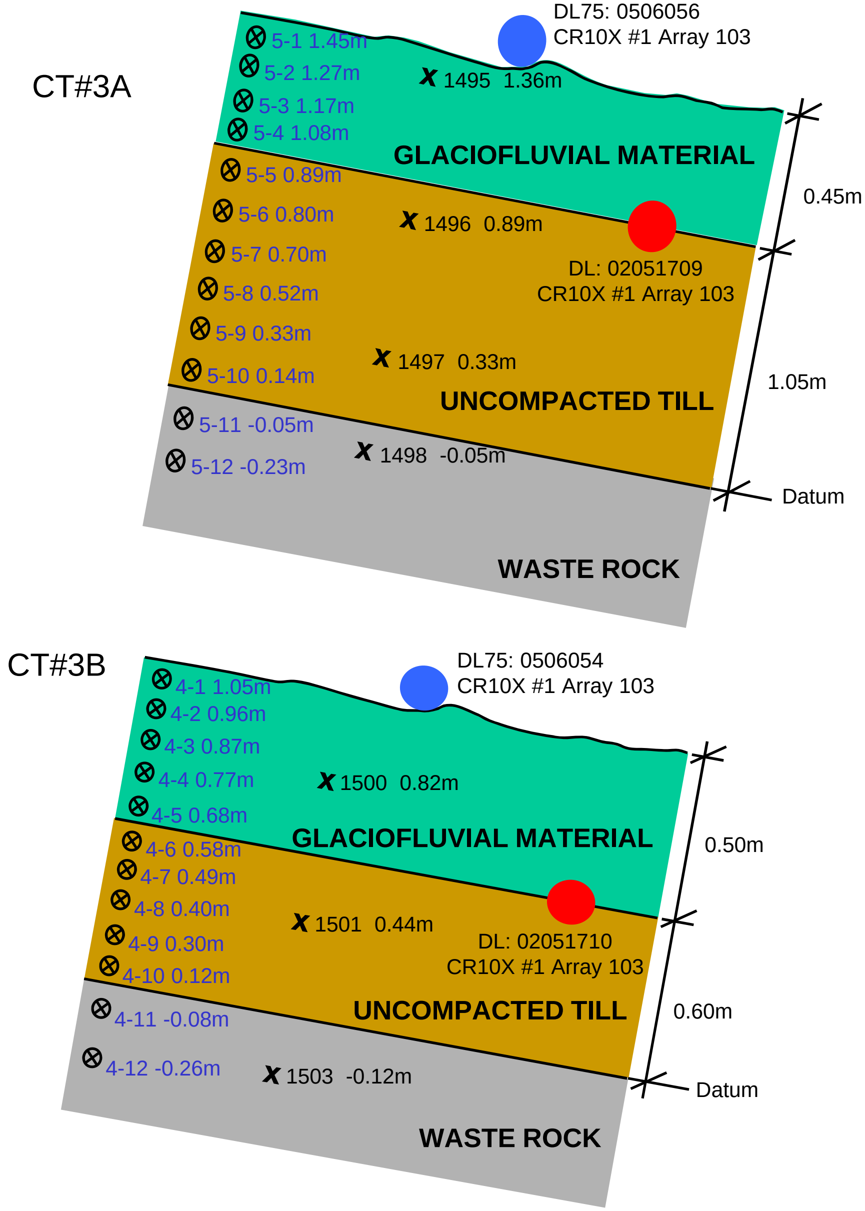
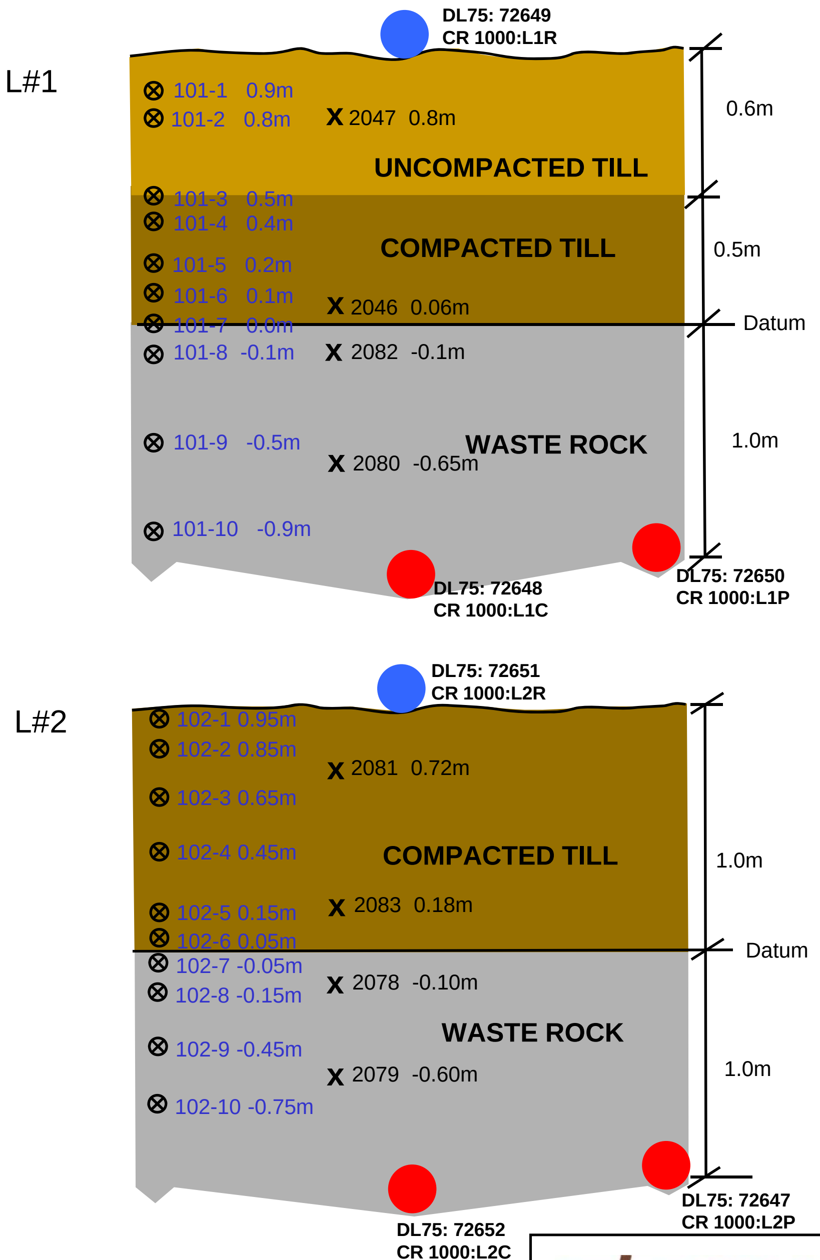


Legend:

⊗	#-# #.##m	EnviroSCAN Probe with bead s/n and depth
X	# #.##m	CS229 Thermal Conductivity Sensor bead s/n and depth
□	T## #.##m	Satellite Station Temperature probe and depth
△	SS## #.##m	Satellite Station Soil Moisture probe and depth
Red circle	DL75: # CR10X #2 Array #	Seametrics Datalogger with Flowmeter and Tipping Bucket (Interflow)
Blue circle	DL75: #	Seametrics Datalogger with Flowmeter (Runoff)

Note:
Depths measured from Datum
- Positive = up
- Negative = down

SRK Consulting Engineers and Scientists VANCOUVER	Yukon Government	Monitor Mine Waste Rock Covers 2008 Data Summary
		Schematic Instrument Profiles for CT#3A and CT#3B
Job No: 1CY001.020.001 Filename: Fig2_4-9_Trial covers_20090227.ppt	**Faro Mine Complex**	Date: Feb. 2009 / Approved: JM / Figure: 8



Legend:

⊗	#-# #.##m	EnviroSCAN Probe with bead s/n and depth
X	# #.##m	CS229 Thermal Conductivity Sensor bead s/n and depth
□	T## #.##m	Satellite Station Temperature probe and depth
△	SS## #.##m	Satellite Station Soil Moisture probe and depth
● (red)	DL75: 72650 CR 1000:L1P	Seametrics Datalogger with Flowmeter and Tipping Bucket (Interflow)
● (blue)	DL75: #	Seametrics Datalogger with Flowmeter (Runoff)

Note:
Depths measured from Datum
- Positive = up
- Negative = down

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Monitor Mine Waste Rock Covers
2008 Data Summary

Schematic Instrument Profiles for L#1 and L#2

Faro Mine Complex

Job No: 1CY001.020.001
Filename: Fig2_4-9_Trial covers_20090227.ppt

Date: Feb. 2009 | Approved: JM | Figure: 9

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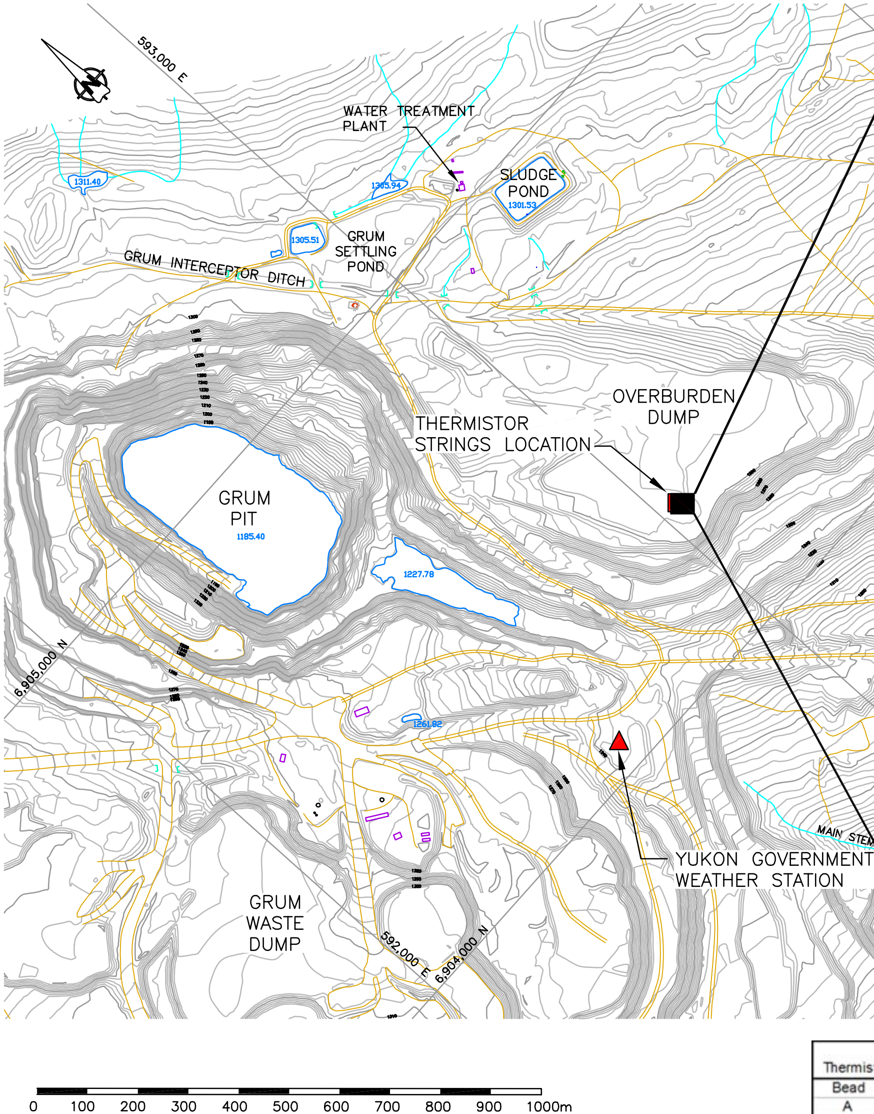
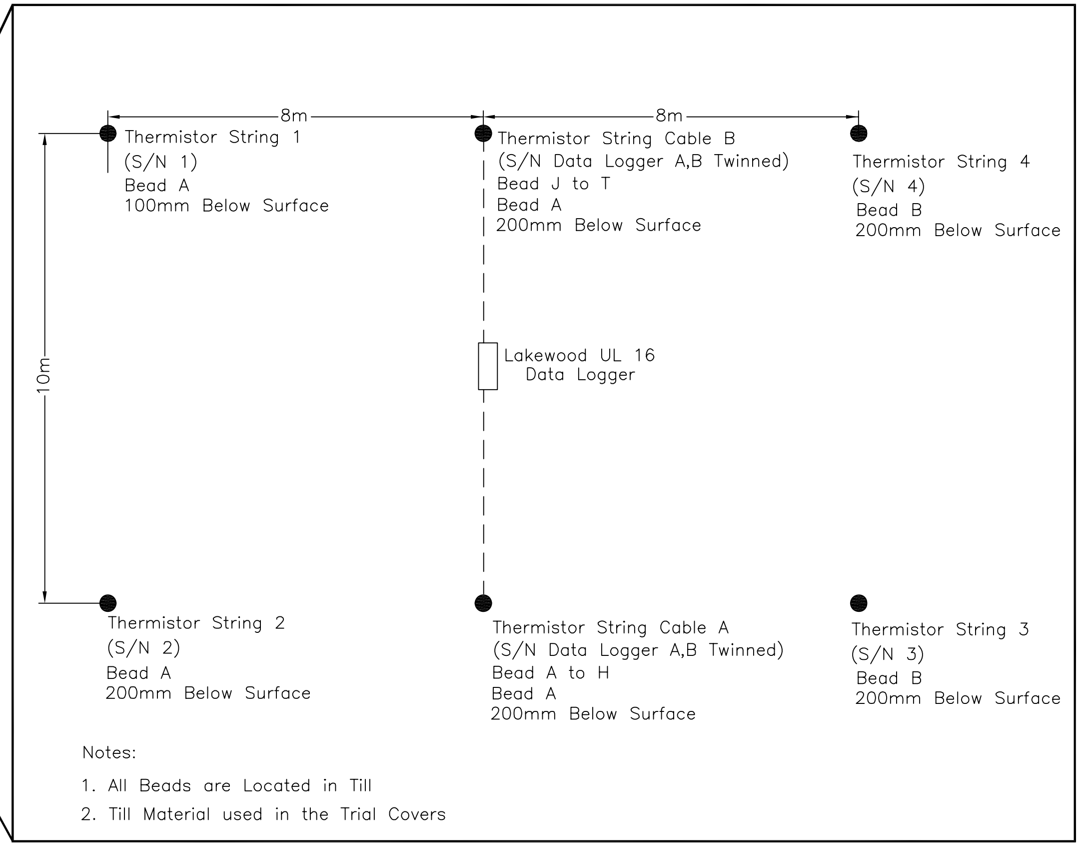


THERMISTOR STRING LAYOUT



THERMISTOR STRING PROFILES

Thermistor String 1 (S/N 1)		Thermistor String 2 (S/N 2)		Thermistor String 3 (S/N 3)		Thermistor String 4 (S/N 4)		Thermistor String Cable A (S/N Datalogger A,B Twinned)		Thermistor String Cable B (S/N Datalogger A,B Twinned)	
Bead	Depth (m)	Bead	Depth (m)	Bead	Depth (m)	Bead	Depth (m)	Bead	Depth (m)	Bead	Depth (m)
A	0.1	A	0.2	A	-0.65	A	0.2	A	0.2	J	0.2
B	0.6	B	0.7	B	-0.15	B	0.7	B	0.7	K	0.7
C	1.1	C	1.2	C	0.35	C	1.2	C	1.2	L	1.2
D	2.1	D	2.2	D	1.35	D	2.2	D	2.2	N	2.2
E	3.1	E	3.2	E	2.35	E	3.2	E	3.2	P	3.2
F	4.1	F	4.2	F	3.35	F	4.2	F	4.2	R	4.2
G	5.1	G	5.2	G	4.35	G	5.2	G	5.2	S	5.2
H	6.1	H	6.2	H	5.35	H	6.2	H	6.2	T	6.2

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Monitor Mine Area Waste Rock Trial Covers
2008 Data Summary

Location Plan and Schematic
Thermistor Layout on
Grum Overburden Dump

SRK JOB NO.: 1CY001.020.001

FILE NAME: site_plan_Thermistor.dwg

Faro Mining Complex

DATE: Feb. 2009 | APPROVED: JM | FIGURE: 10

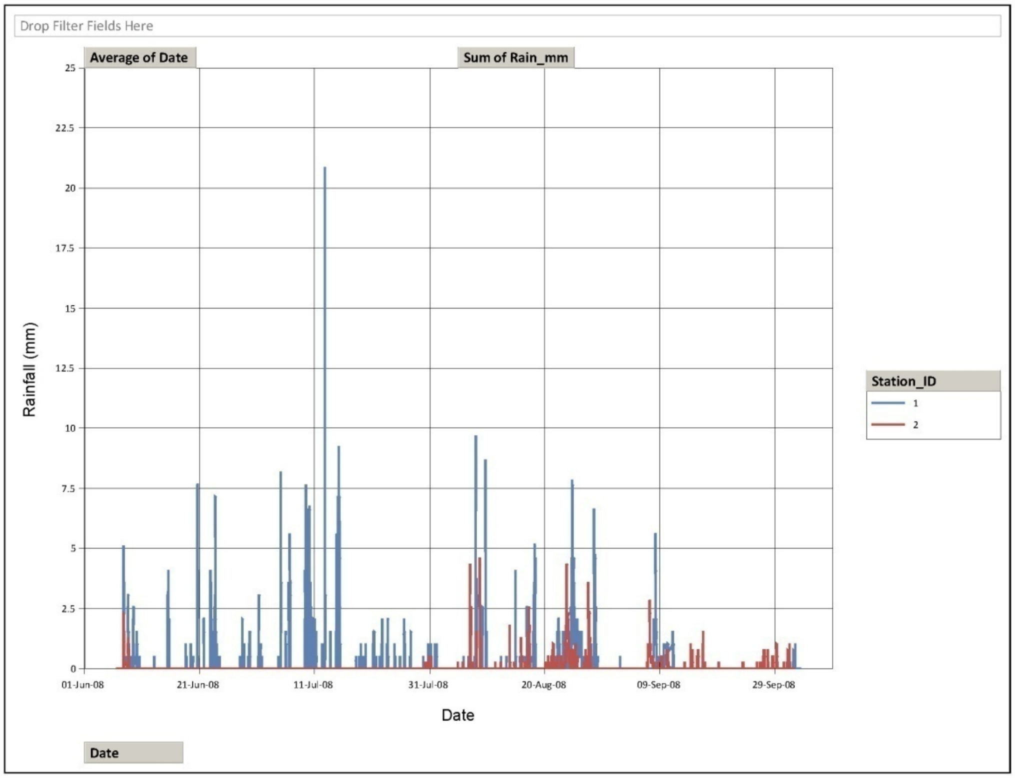

Figure 11: Total hourly rainfall on CT#1 & CT#2A, 2B recorded by the Davis Instruments Vantage Pro Weather Stations.

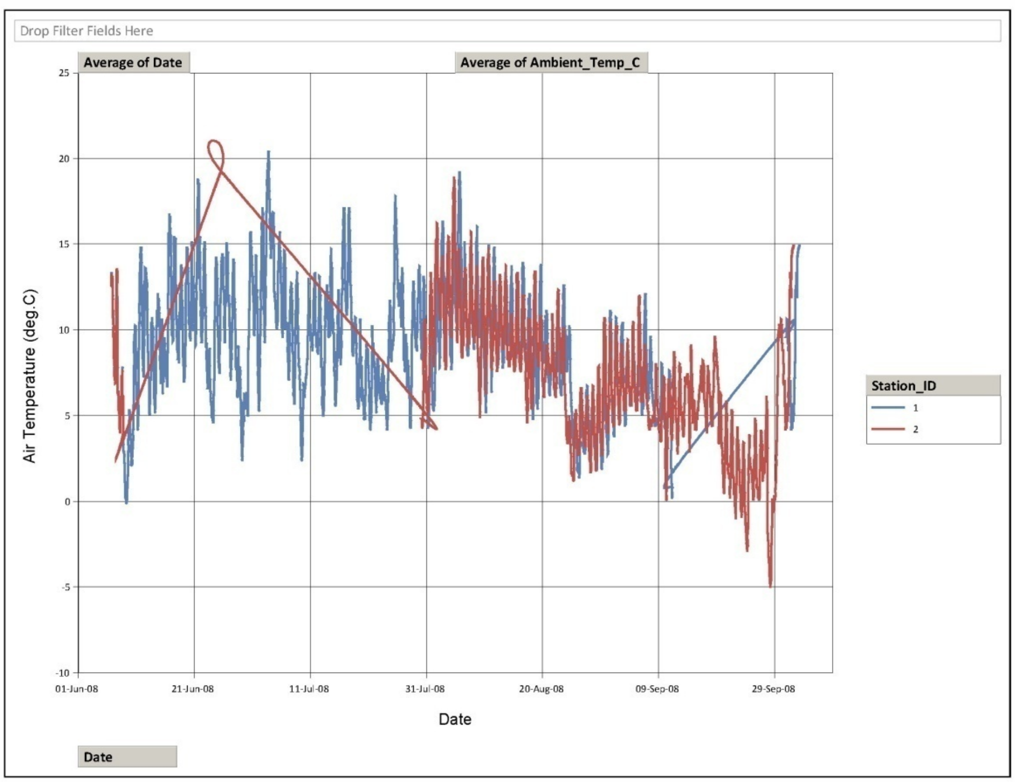

Figure 12: Mean hourly air temperature on CT#1 & CT#2A, 2B recorded by the Davis Instruments Vantage Pro Weather Stations and Satellite Stations.

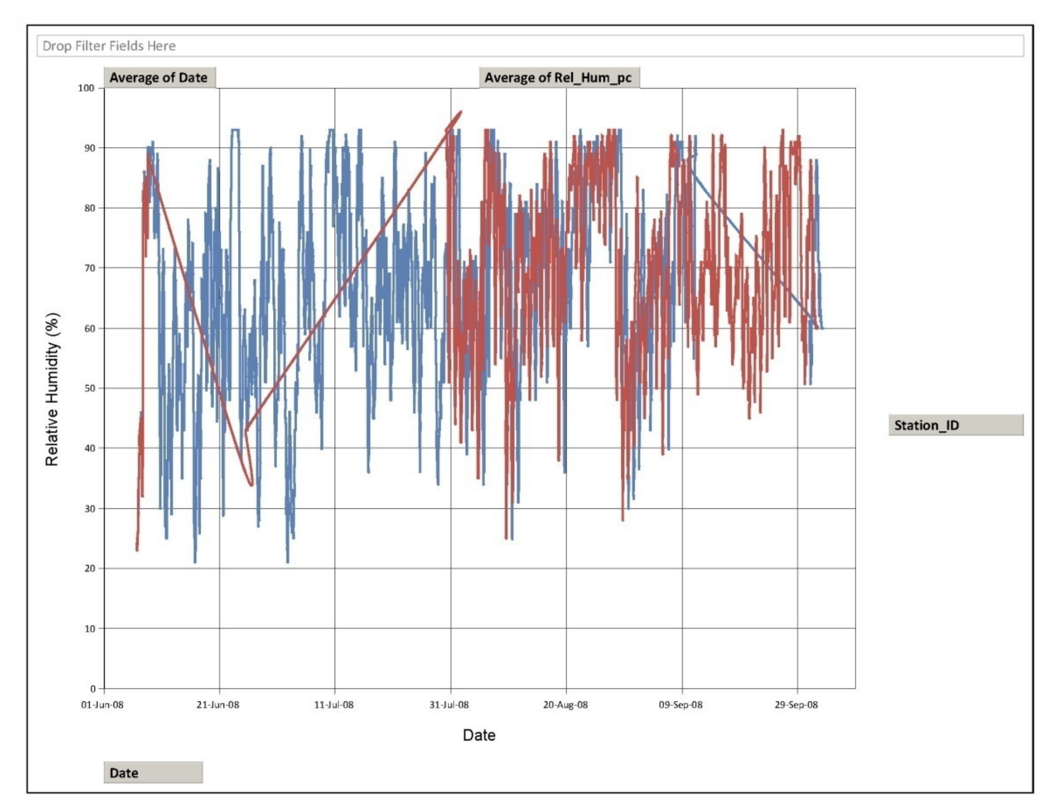

Figure 13: Mean hourly relative humidity on CT#1 & CT#2A, 2B recorded by the Davis Instruments Vantage Pro Weather Stations and Satellite Stations.

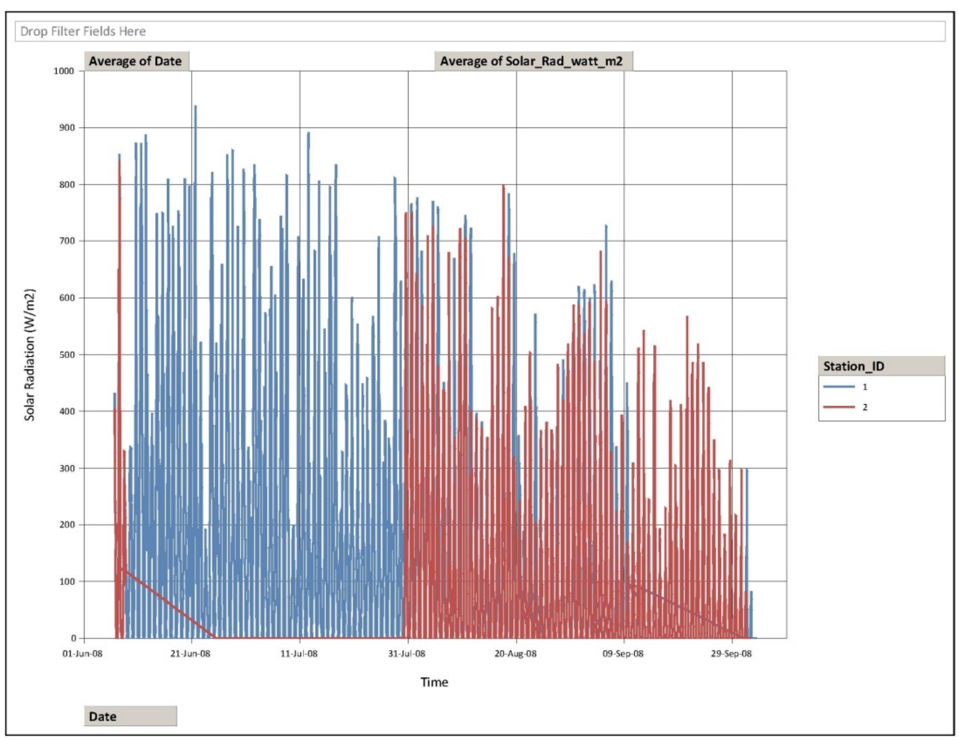

Figure 14: Mean hourly solar radiation on CT#1 & CT2A, 2B recorded by the Davis Instruments Vantage Pro Weather Stations.

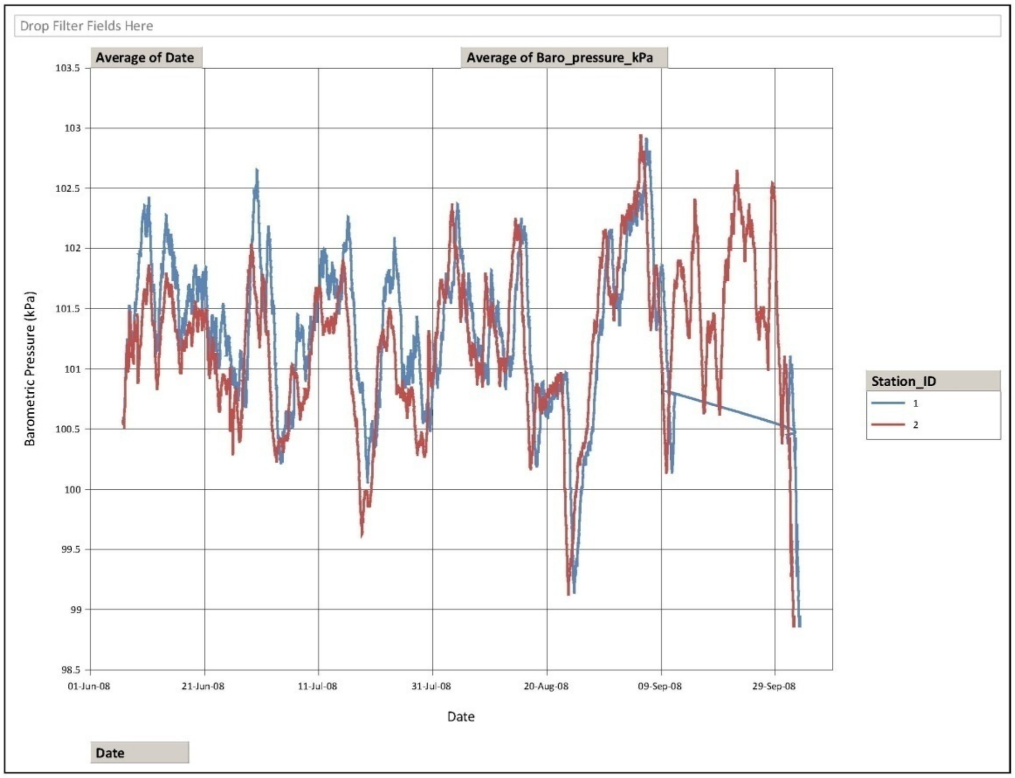

Figure 15: Mean hourly barometric pressure on CT#1 & CT#2A, 2B recorded by the Davis Instruments Vantage Pro Weather Stations.

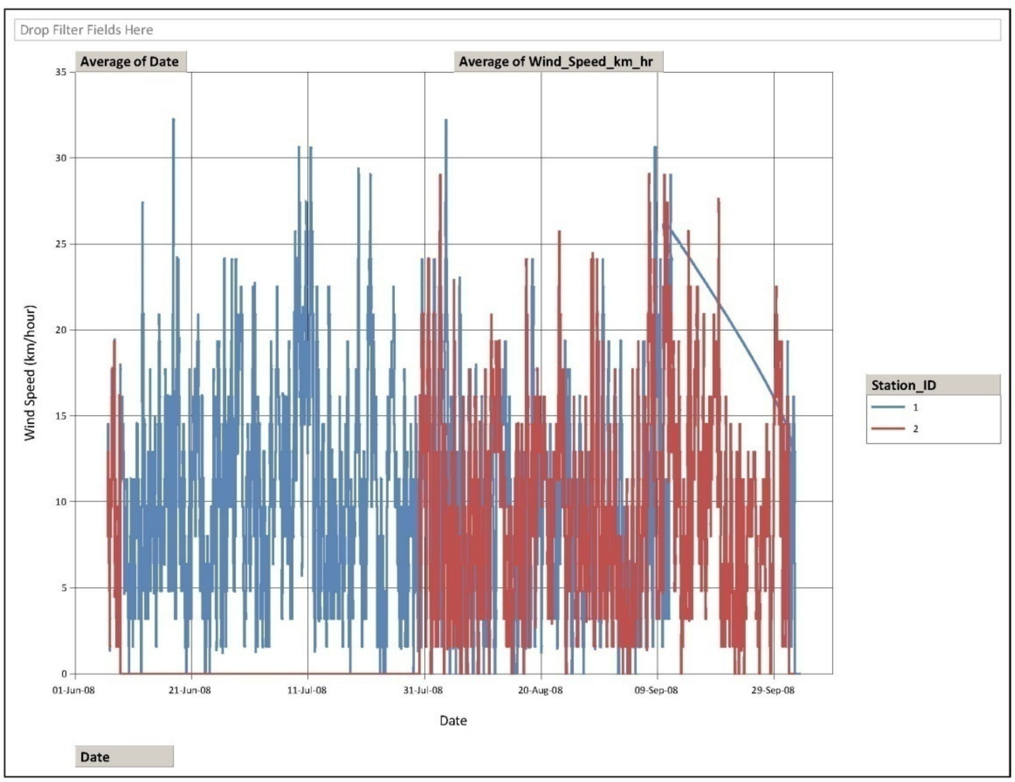

Figure 16: Mean hourly wind speed on CT#1 & CT#2A, 2B recorded by the Davis Instruments Vantage Pro Weather Stations.

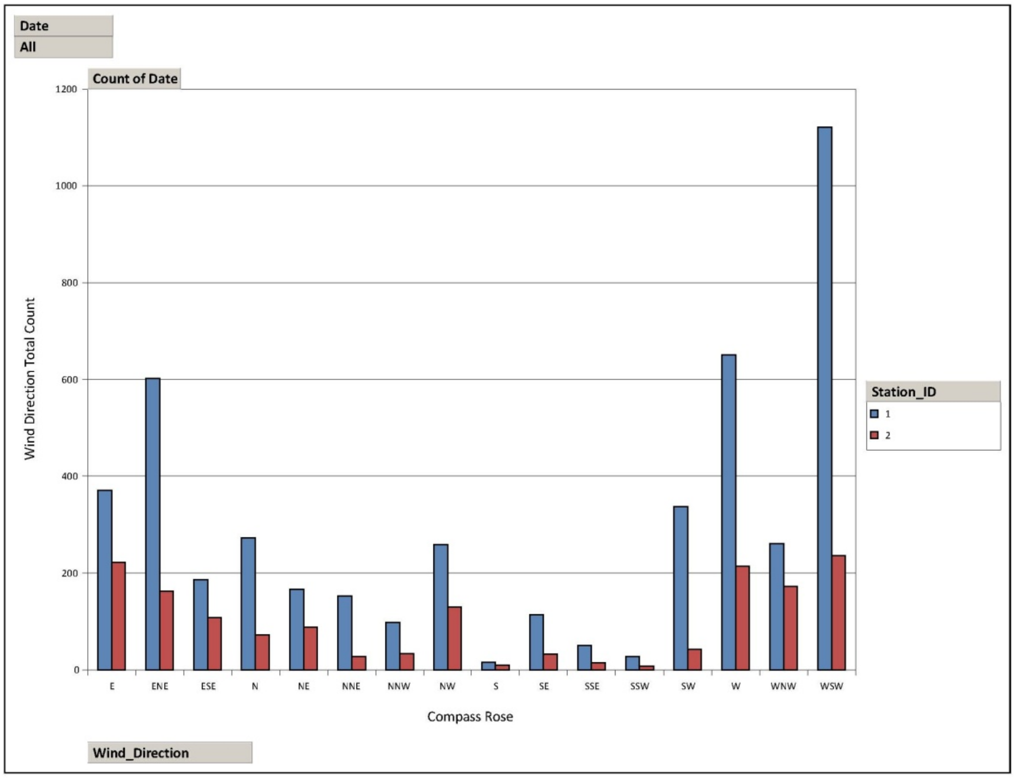

Figure 17: Wind direction totals (measured hourly) on CT#1 & CT#2A, 2B recorded by the Davis Instruments Vantage Pro Weather Stations.

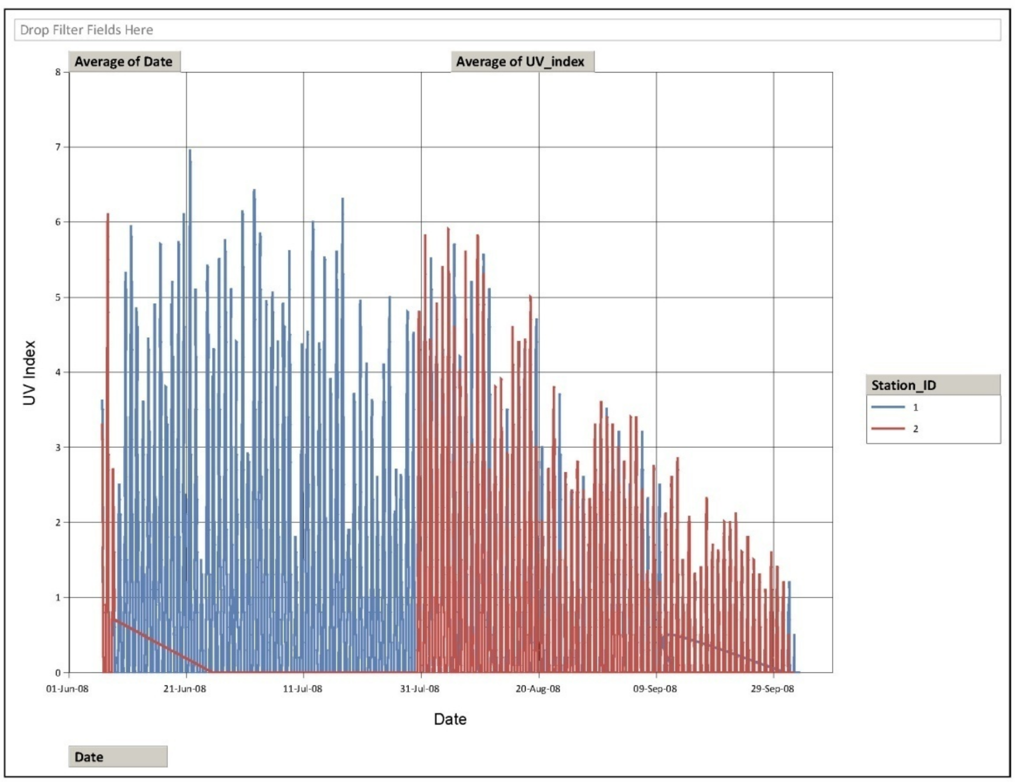

Figure 18: Mean hourly UV Index on CT#1 & CT#2A, 2B recorded by the Davis Instruments Vantage Pro Weather Stations.

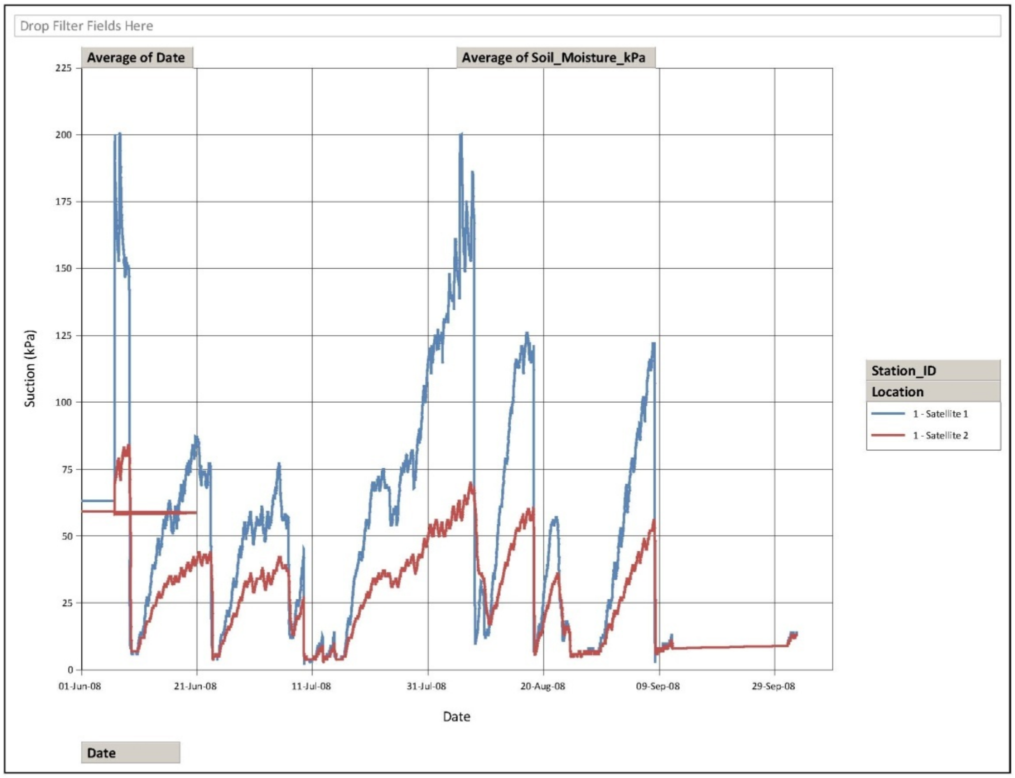

Figure 19: Mean hourly Matric Suction in CT#1 recorded by the Davis Instruments Vantage Pro Satellite Station.

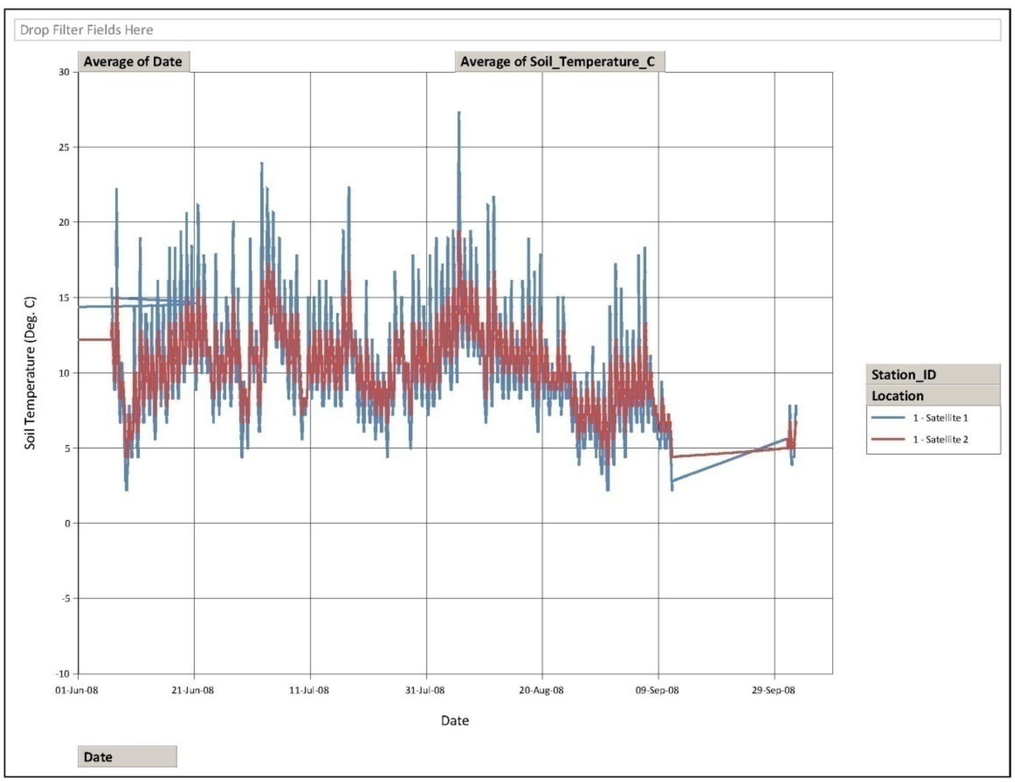

Figure 20: Mean hourly soil temperature in CT#1 recorded by the Davis Instruments Vantage Pro Satellite Station.

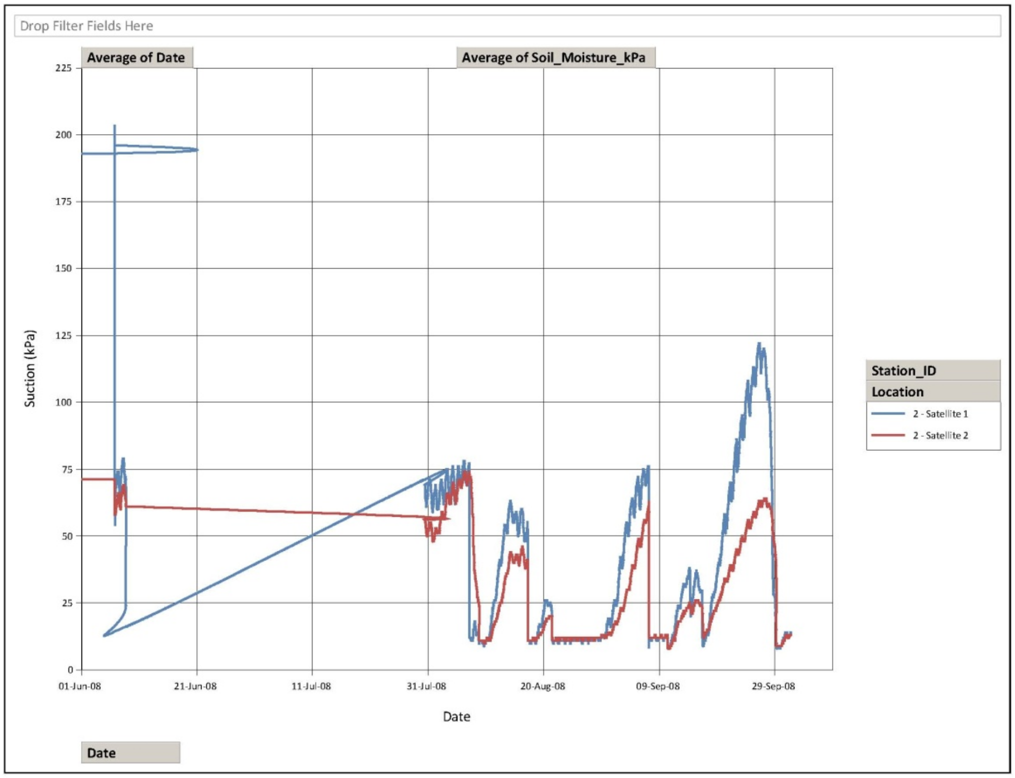

Figure 21: Mean hourly Matric Suction in CT#2A recorded by the Davis Instruments Vantage Pro Satellite Station.

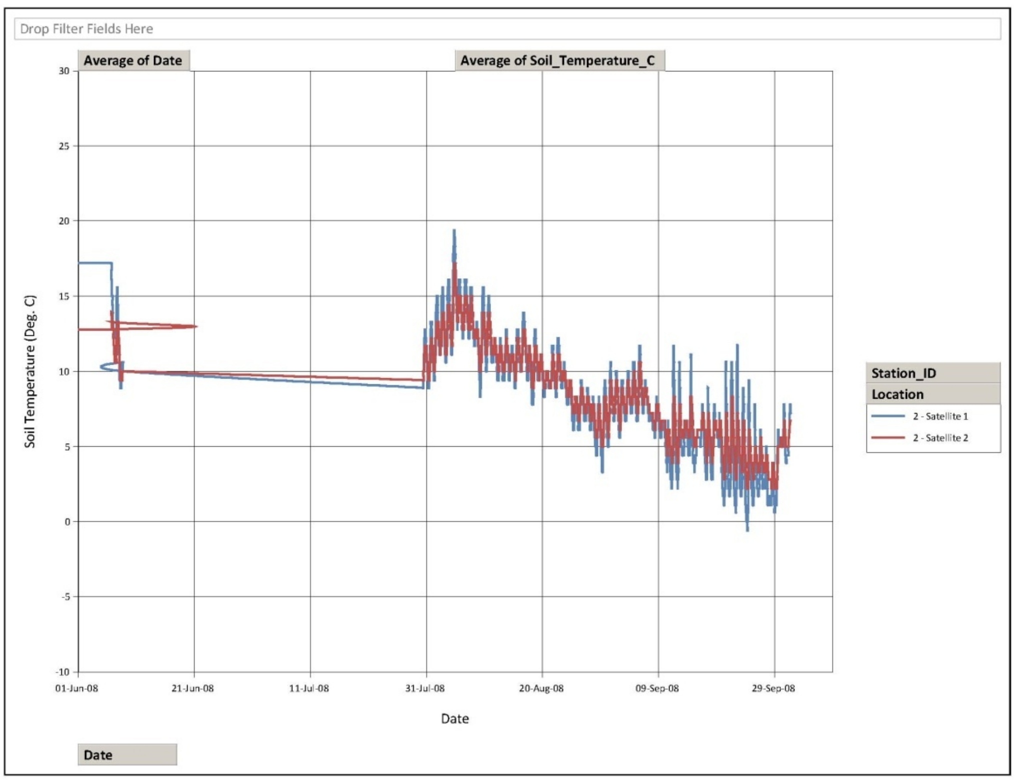

Figure 22: Mean hourly soil temperature in CT#2A recorded by the Davis Instruments Vantage Pro Satellite Station.

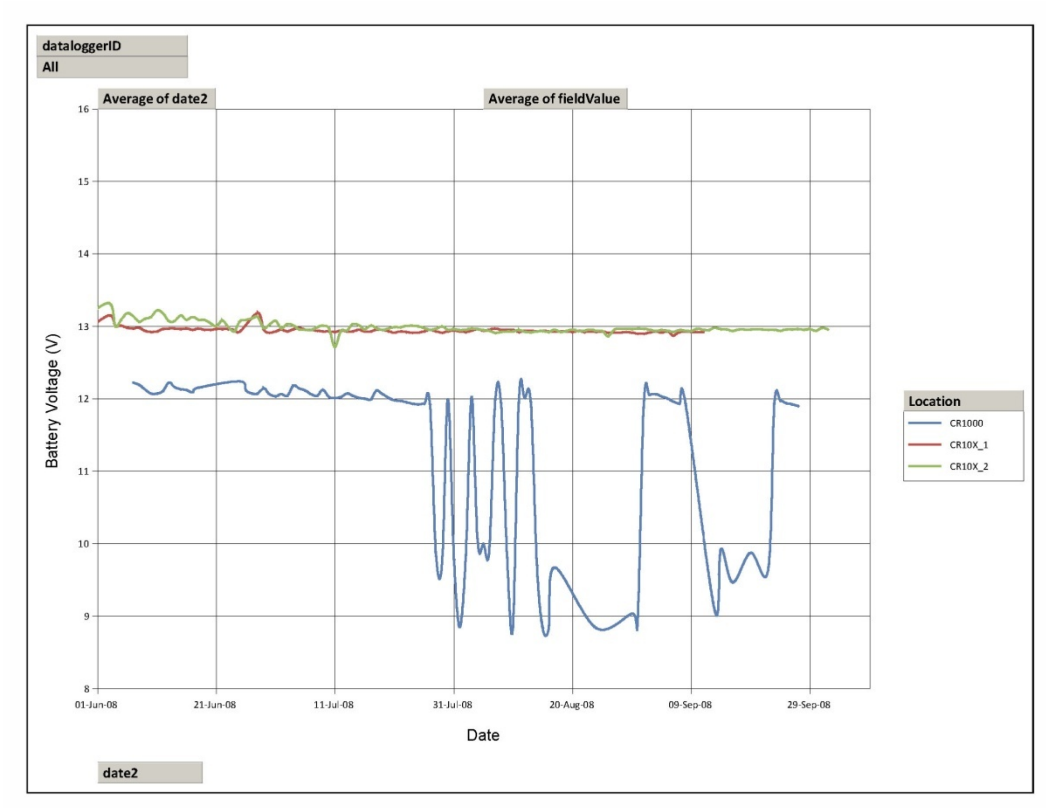

Figure 23: Daily battery voltage of the Campbell Scientific CR10X #1 Data Logger (Array 102).

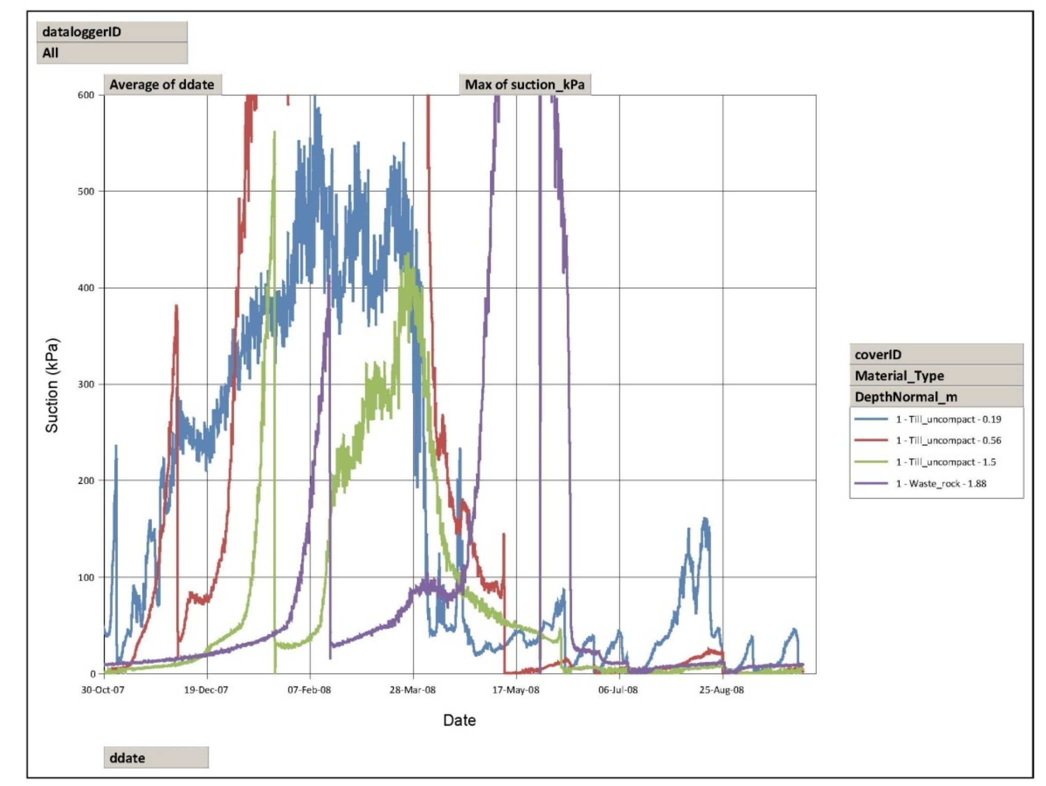

Figure 24: Soil matric suction measurements (taken every six hours) in CT#1 recorded by CS229 sensors connected to Campbell Scientific Data logger CR10X #2 (Array 168).

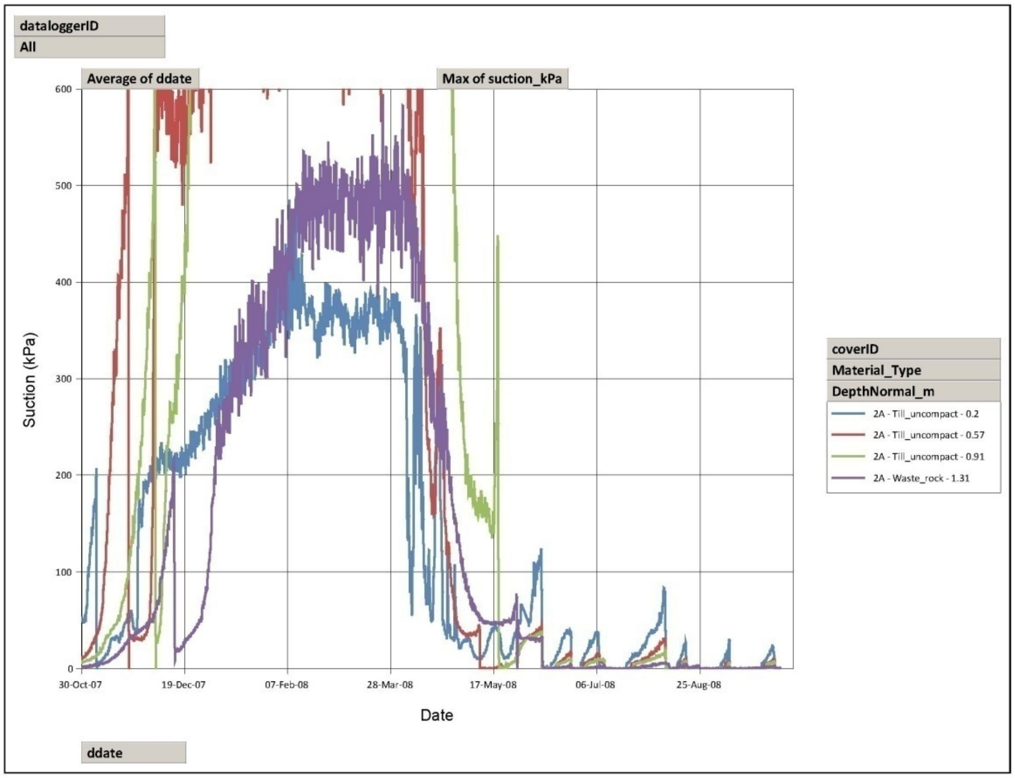

Figure 25: Soil matric suction measurements (taken every six hours) in CT#2A recorded by CS229 sensors connected to Campbell Scientific Data logger CR10X #2 (Array 130).

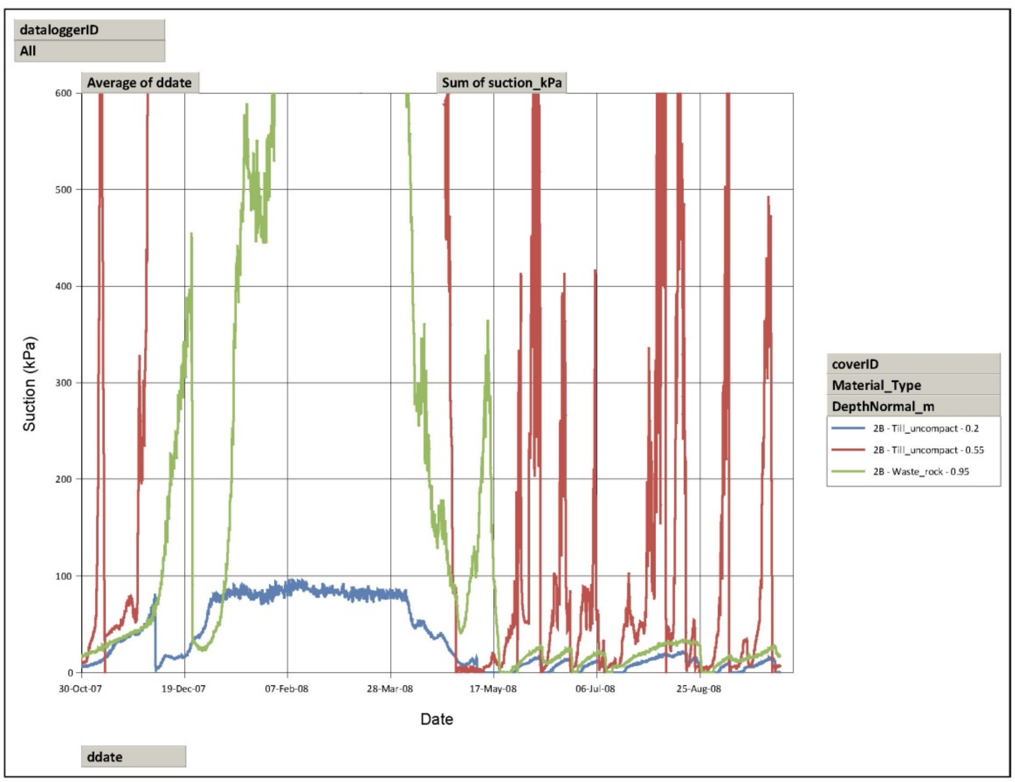

Figure 26: Soil matric suction measurements (taken daily) in CT#2B recorded by CS229 sensors connected to Campbell Scientific Data logger CR10X #2 (Array 130).

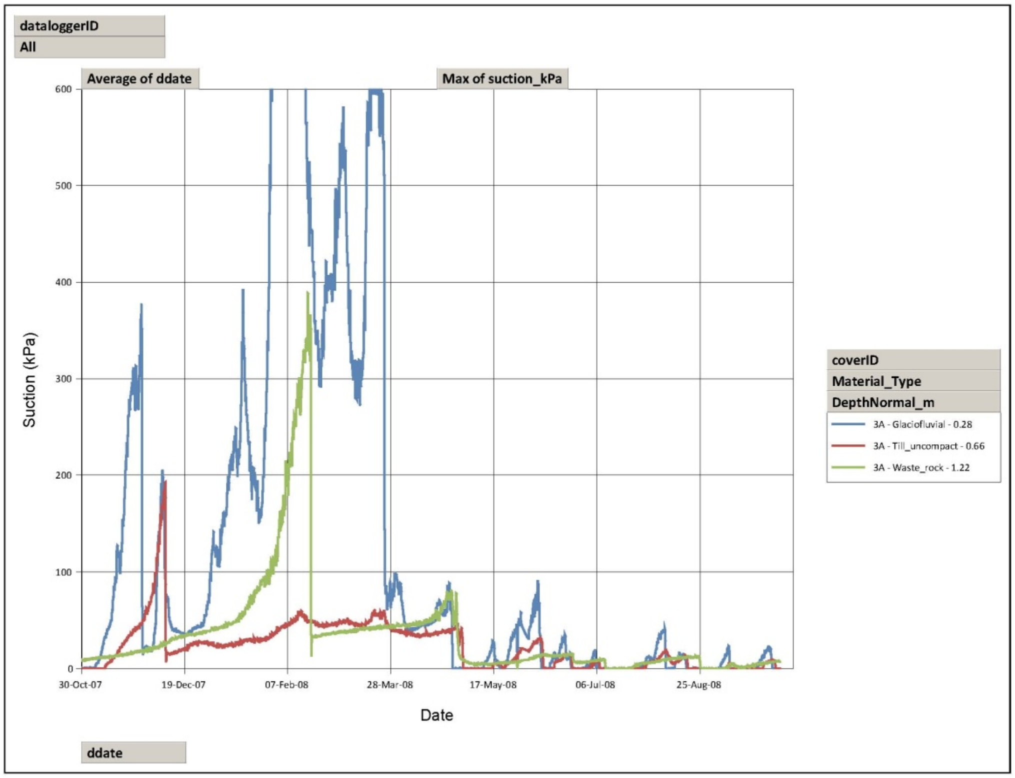

Figure 27: Soil matric suction measurements (taken every six hours) in CT#3A recorded by CS229 sensors connected to Campbell Scientific Data logger CR10X #2 (Array 168).

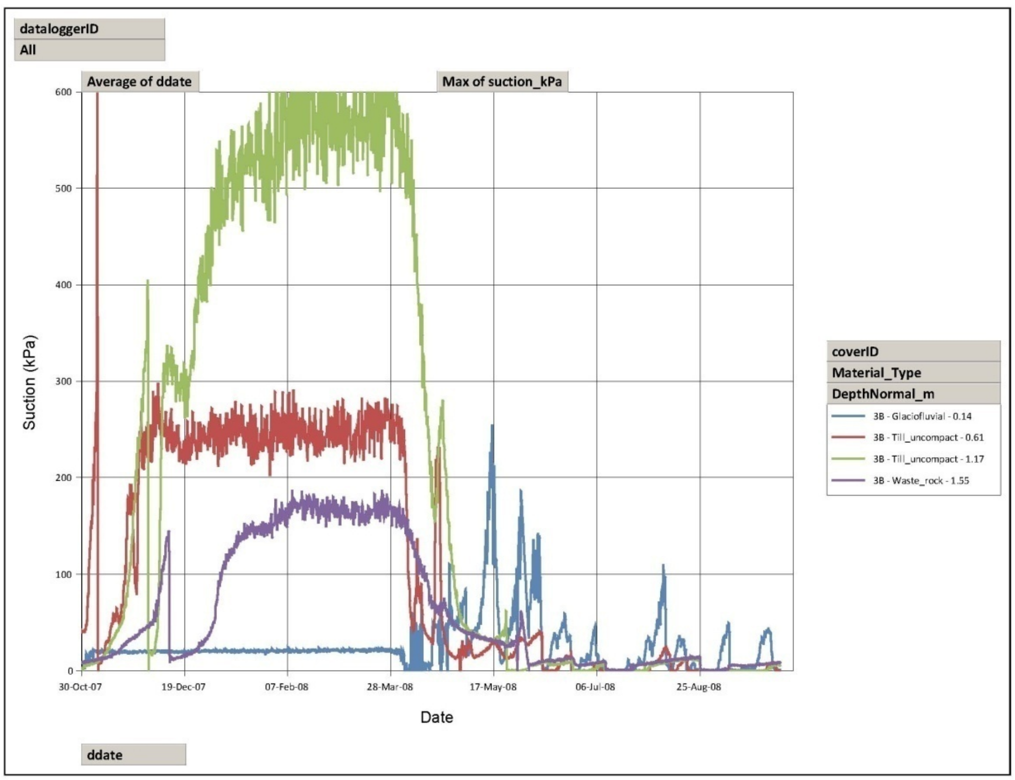

Figure 28: Soil matric suction measurements (taken every six hours) in CT#3B recorded by CS229 sensors connected to Campbell Scientific Data logger CR10X #2 (Array 168).

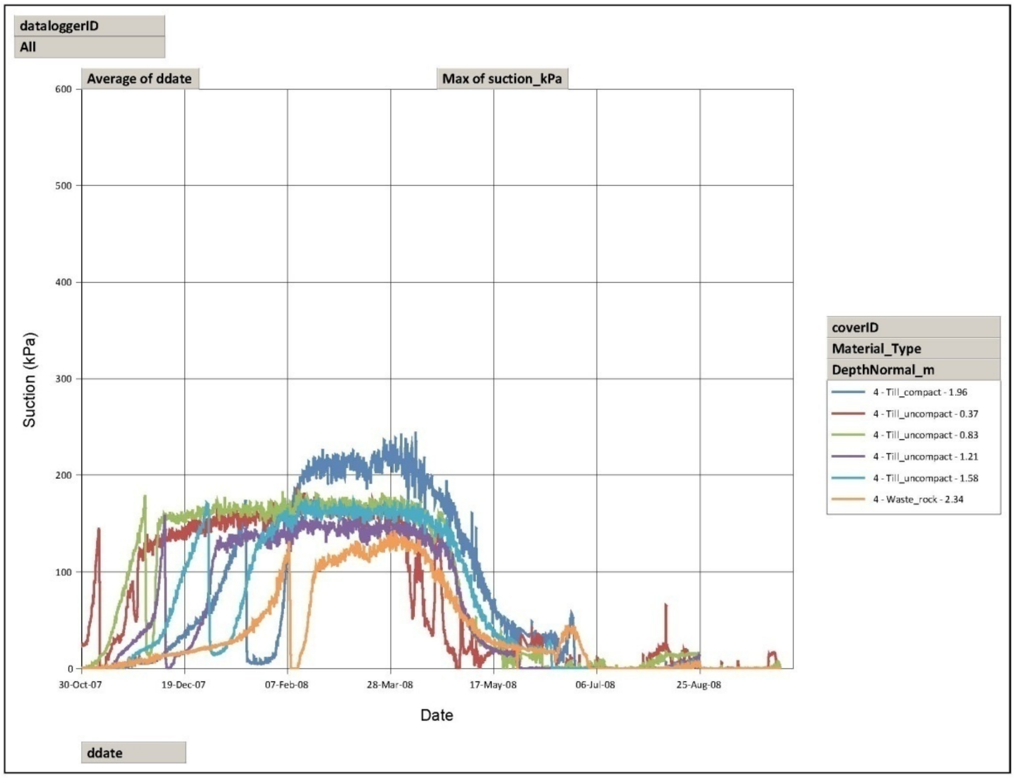

Figure 29: Soil matric suction measurements (taken every six hours) in CT#4 recorded by CS229 sensors connected to Campbell Scientific Data logger CR10X #2 (Array 168).

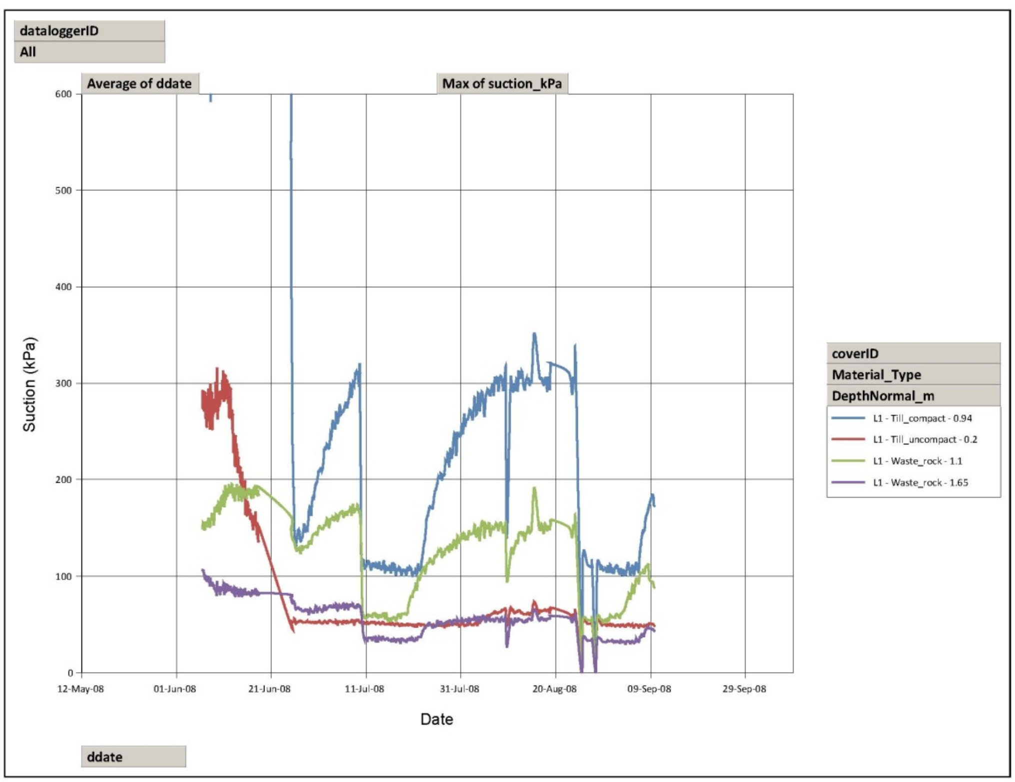

Figure 30: Soil matric suction measurements (taken every six hours) in L#1 recorded by CS229 sensors connected to Campbell Scientific Data logger CR1000.

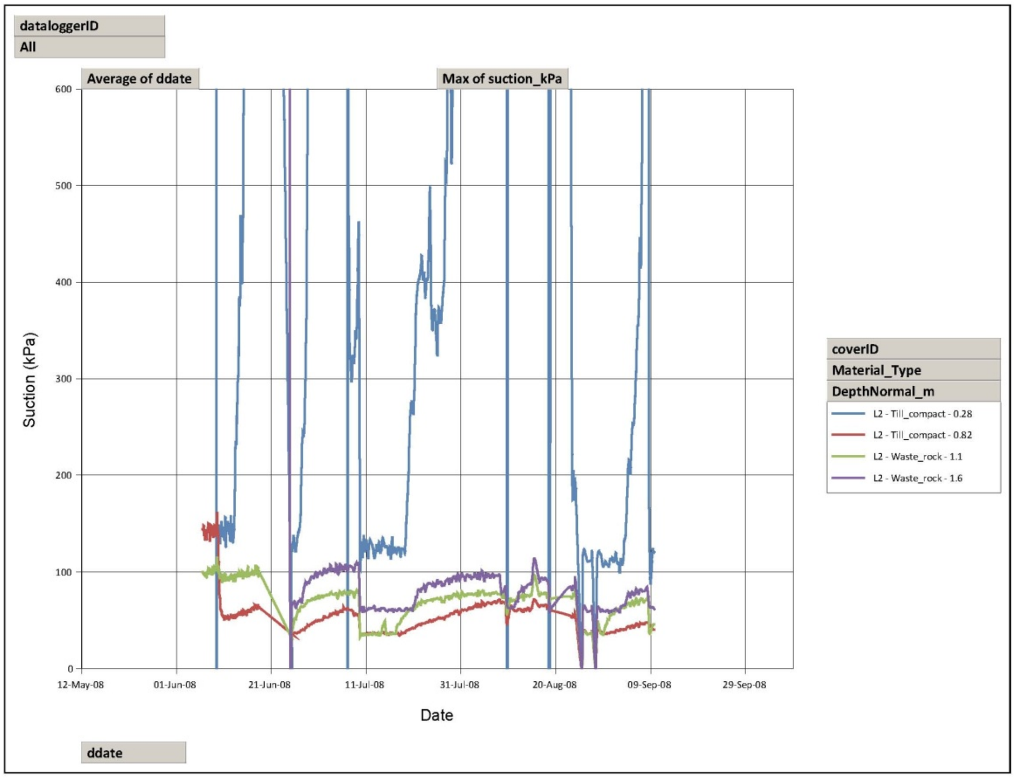

Figure 31: Soil matric suction measurements (taken every six hours) in L#2 recorded by CS229 sensors connected to Campbell Scientific Data logger CR1000.

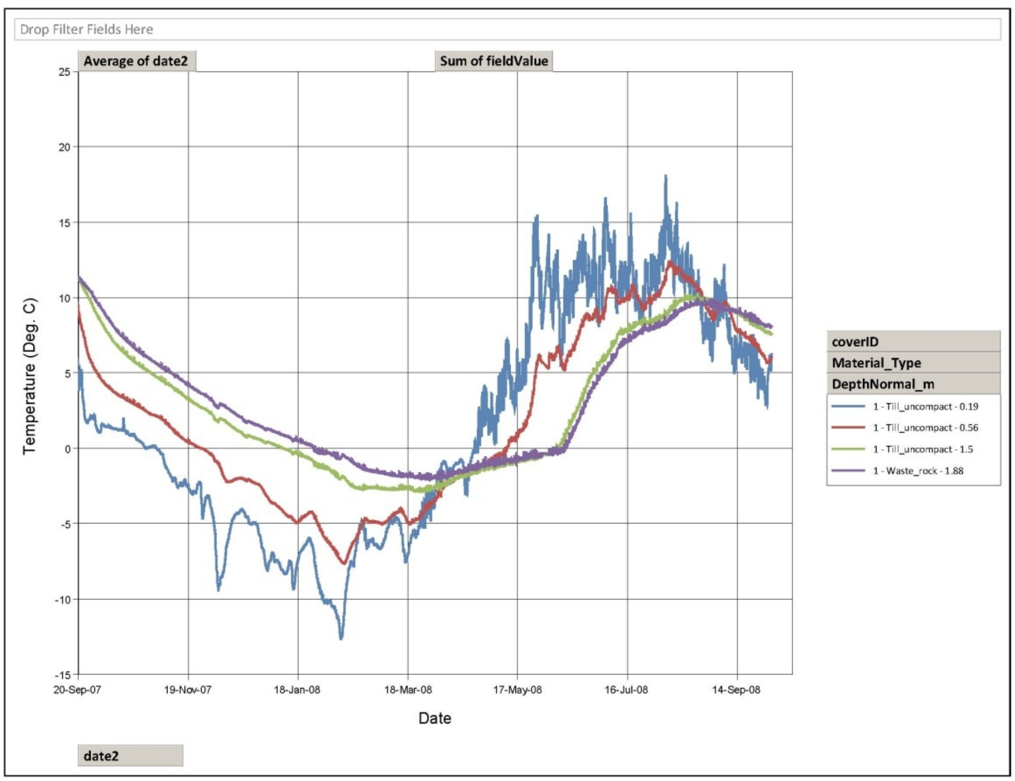

Figure 32: Soil temperature measurements (taken every six hours) in CT#1 recorded by CS229 sensors connected to Campbell Scientific Data logger CR10X #2 (Array 168).

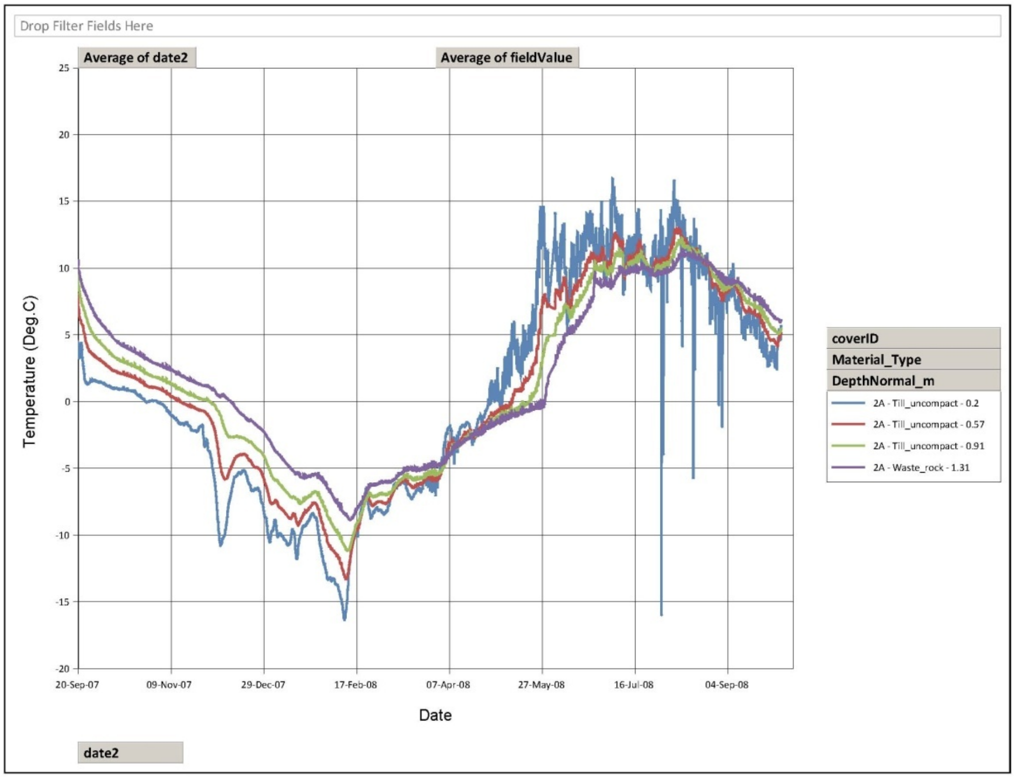

Figure 33: Soil temperature measurements (taken every six hours) in CT#2A recorded by CS229 sensors connected to Campbell Scientific Data logger CR10X #1 (Array 130).

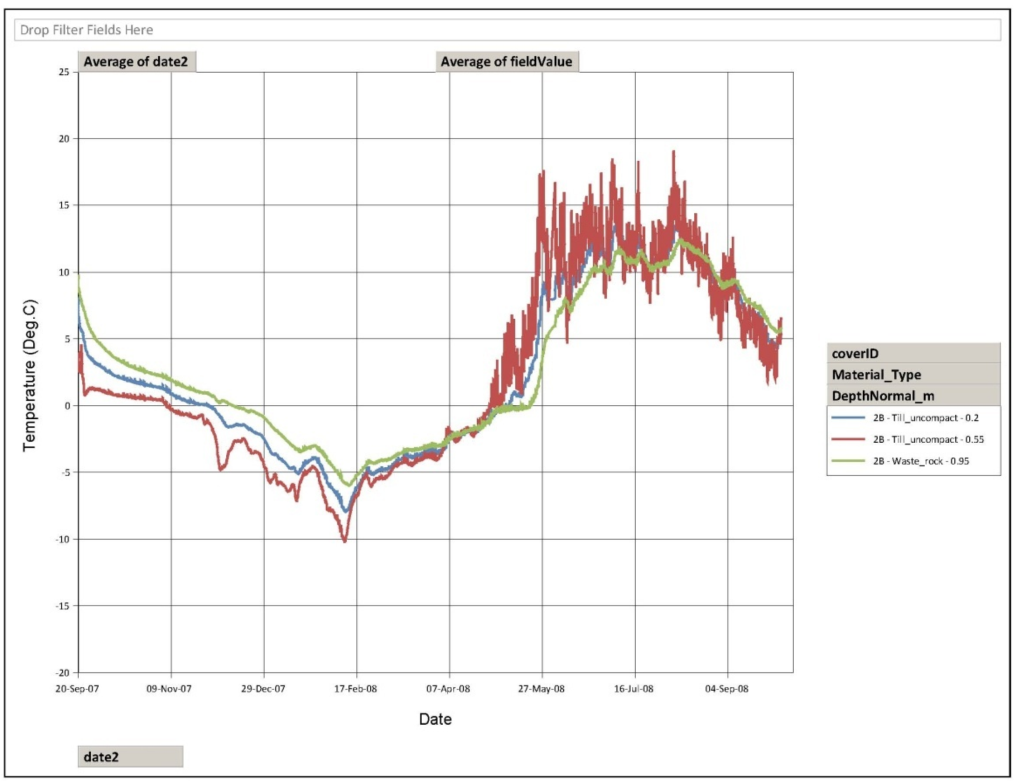

Figure 34: Soil temperature measurements (taken every six hours) in CT#2B recorded by CS229 sensors connected to Campbell Scientific Data logger CR10X #1 (Array 130).

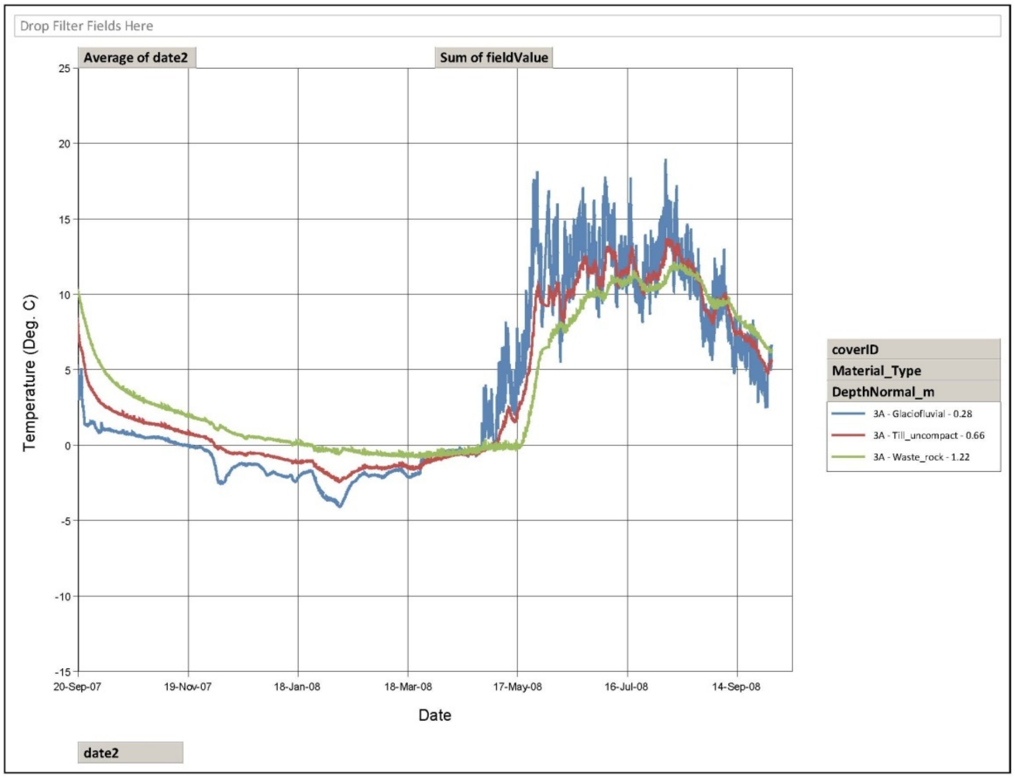

Figure 35: Soil temperature measurements (taken every six hours) in CT#3A recorded by CS229 sensors connected to Campbell Scientific Data logger CR10X #2 (Array 168).

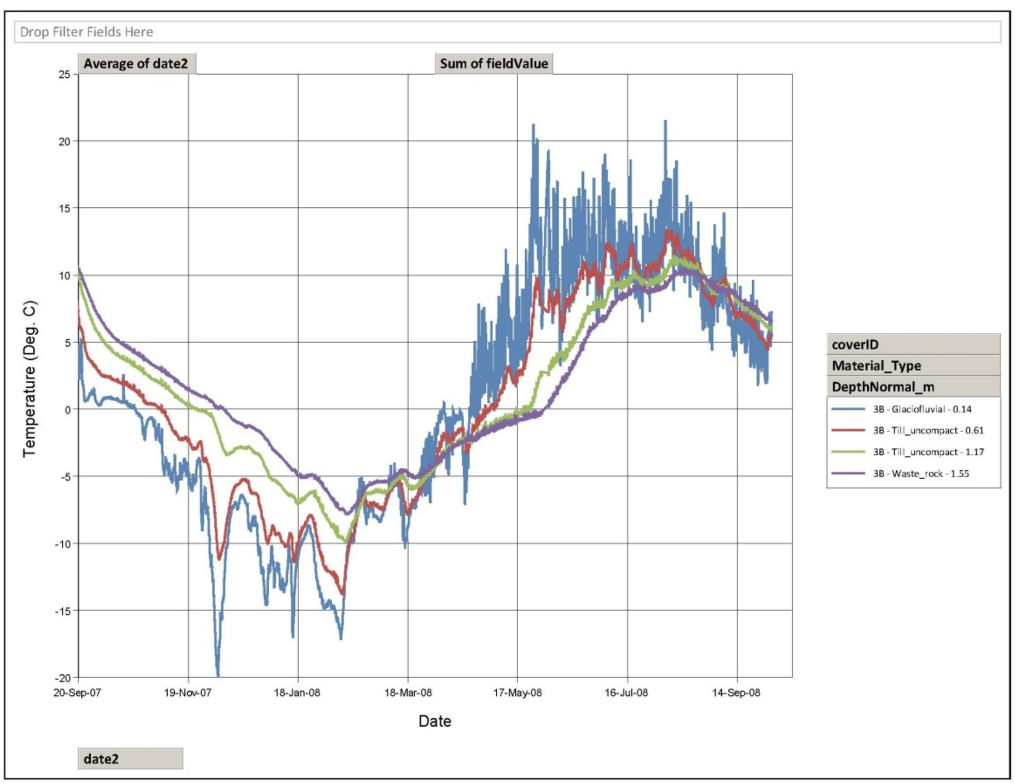

Figure 36: Soil temperature measurements (taken every six hours) in CT#3B recorded by CS229 sensors connected to Campbell Scientific Data logger CR10X #2 (Array 168).

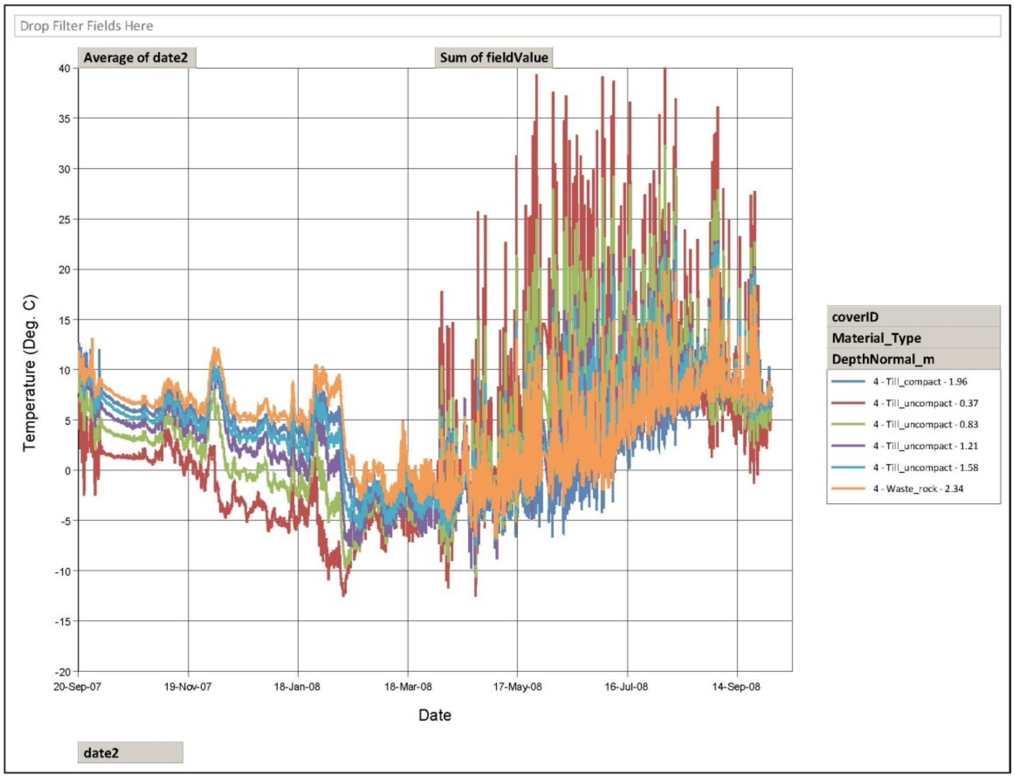

Figure 37: Soil temperature measurements (taken every six hours) in CT#4 recorded by CS229 sensors connected to Campbell Scientific Data logger CR10X #2 (Array 168).

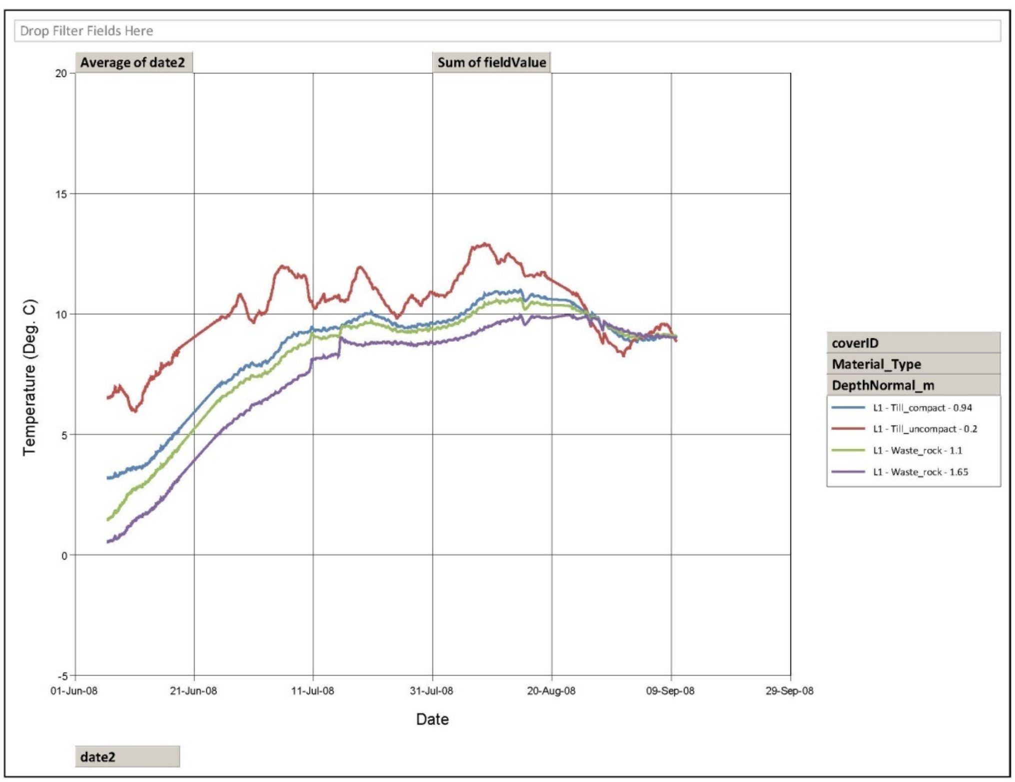

Figure 38: Soil temperature measurements (taken every six hours) in L#1 recorded by CS229 sensors connected to Campbell Scientific Data logger CR1000.

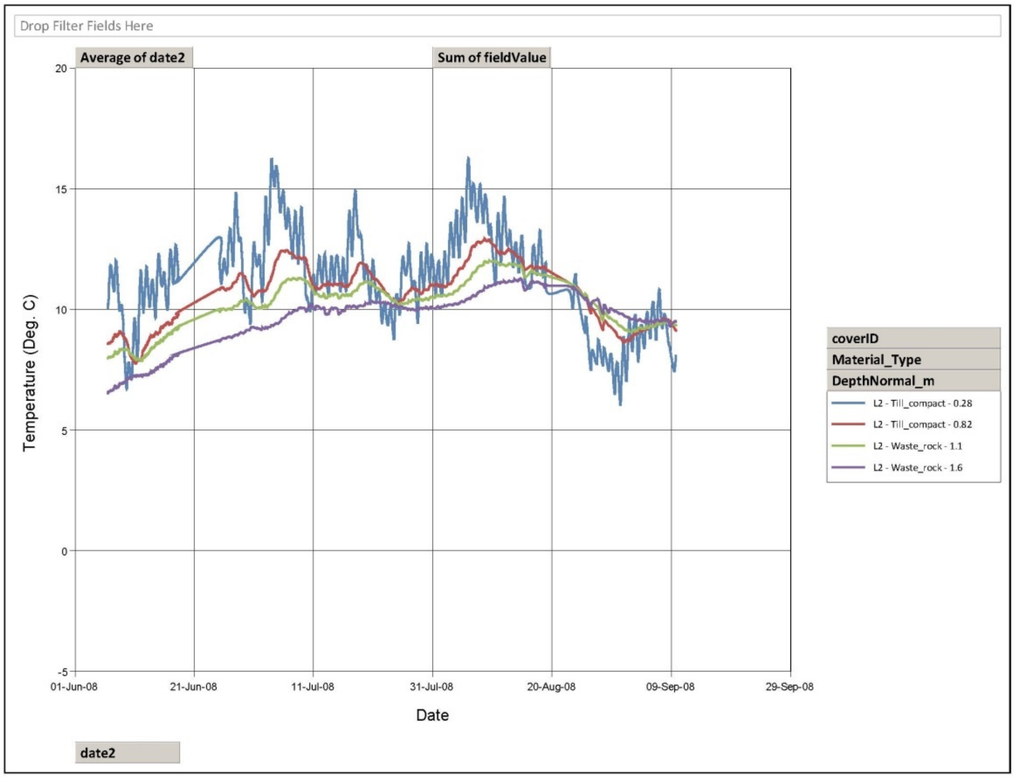

Figure 39: Soil temperature measurements (taken every six hours) in L#2 recorded by CS229 sensors connected to Campbell Scientific Data logger CR1000.

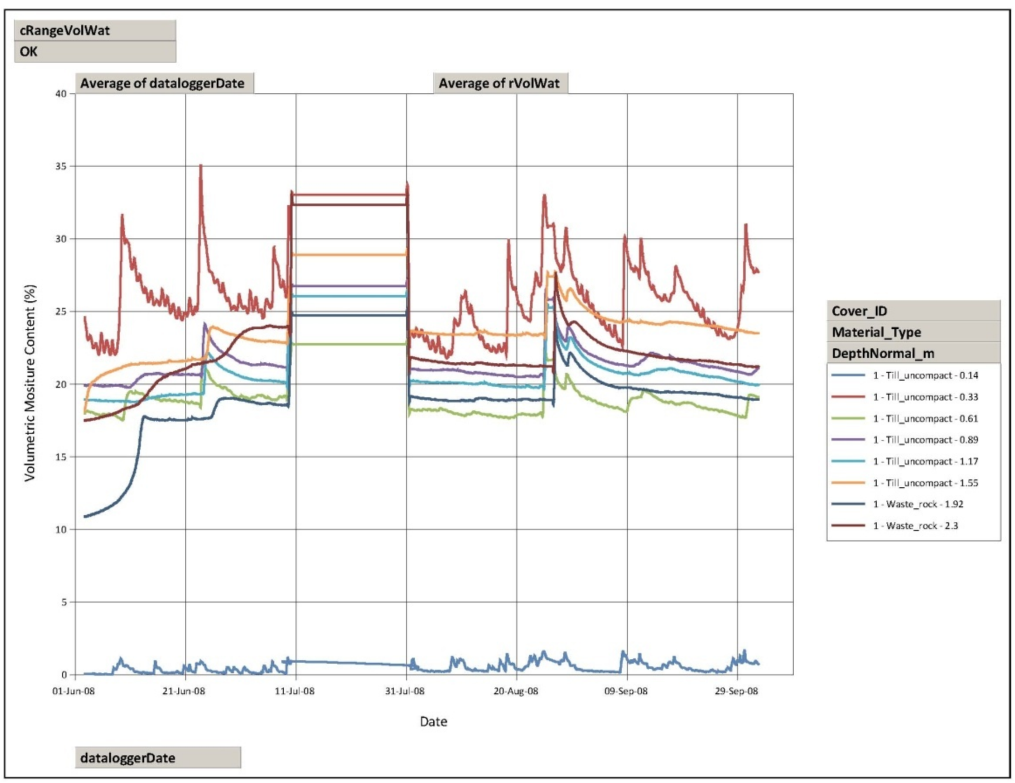

Figure 40: Volumetric moisture content measurements (taken every six hours) in CT#1 recorded by EnviroSCAN sensors connected to Campbell Scientific Data logger CR10X #2 (Array 168).

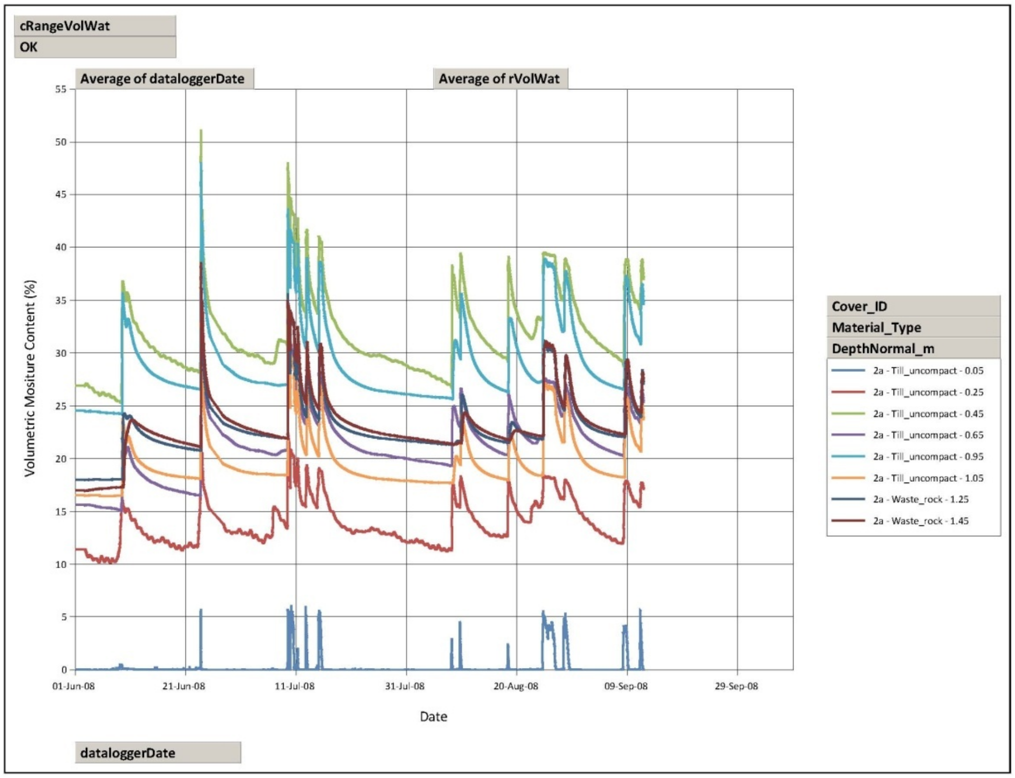

Figure 41: Volumetric moisture content measurements (taken every six hours) in CT#2A recorded by EnviroSCAN sensors connected to Campbell Scientific Data logger CR10X #1 (Array 130).

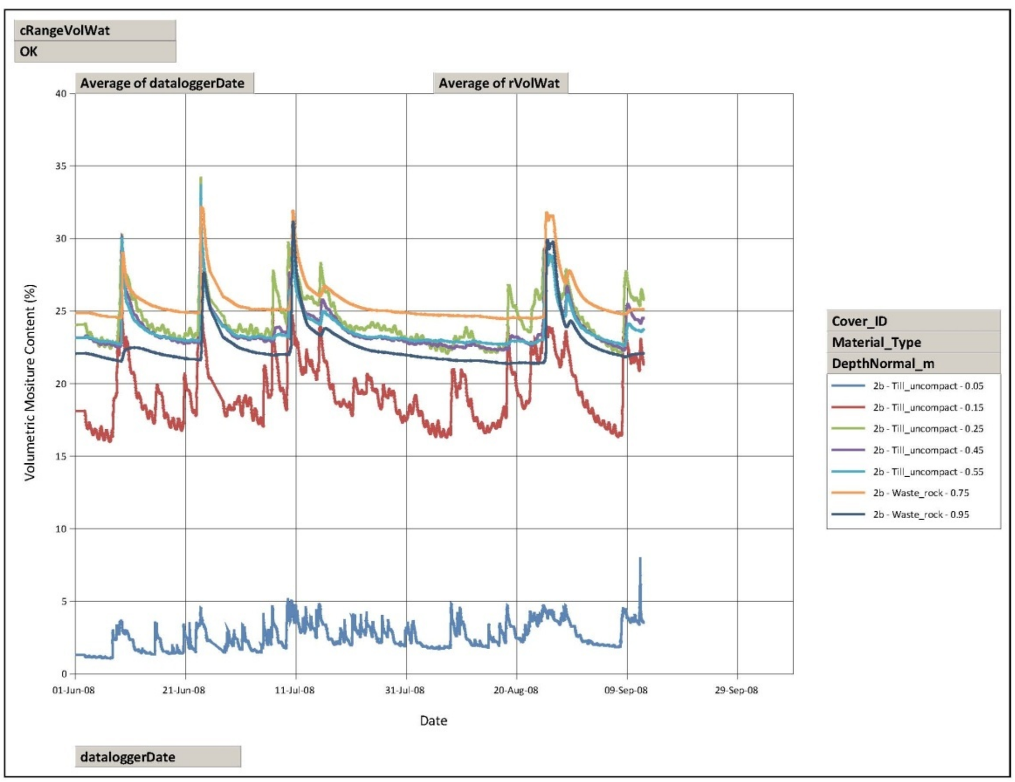

Figure 42: Volumetric moisture content measurements (taken every six hours) in CT#2B recorded by EnviroSCAN sensors connected to Campbell Scientific Data logger CR10X #1 (Array 130).

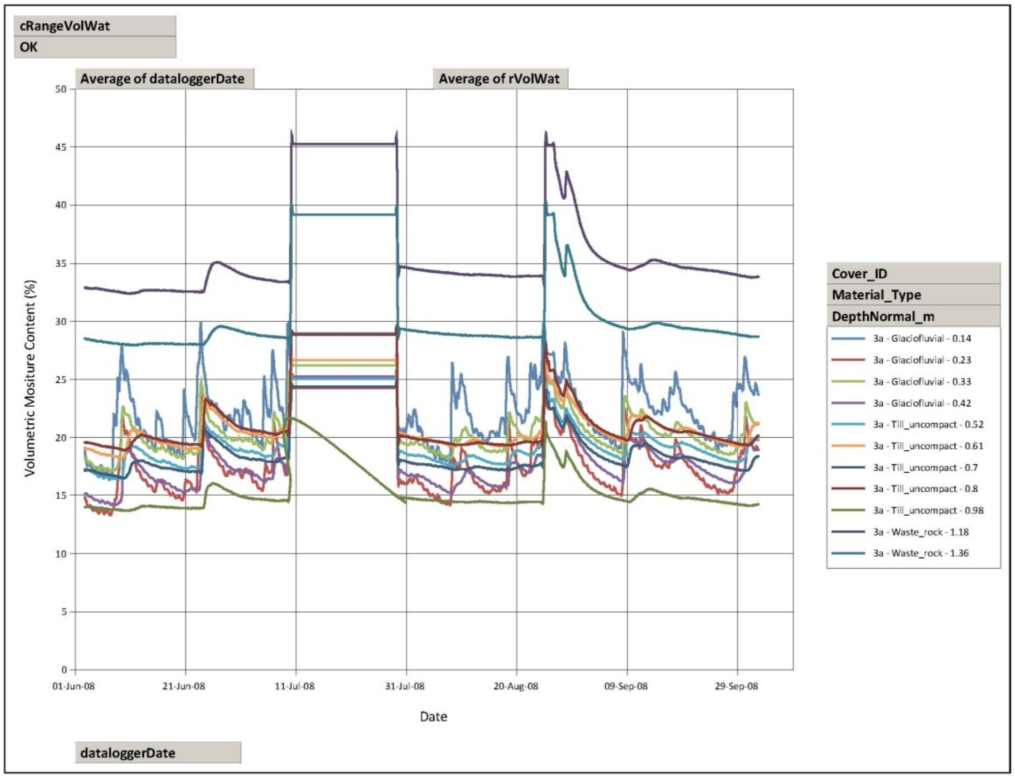

Figure 43: Volumetric moisture content measurements (taken every six hours) in CT#3A recorded by EnviroSCAN sensors connected to Campbell Scientific Data logger CR10X #2 (Array 168).

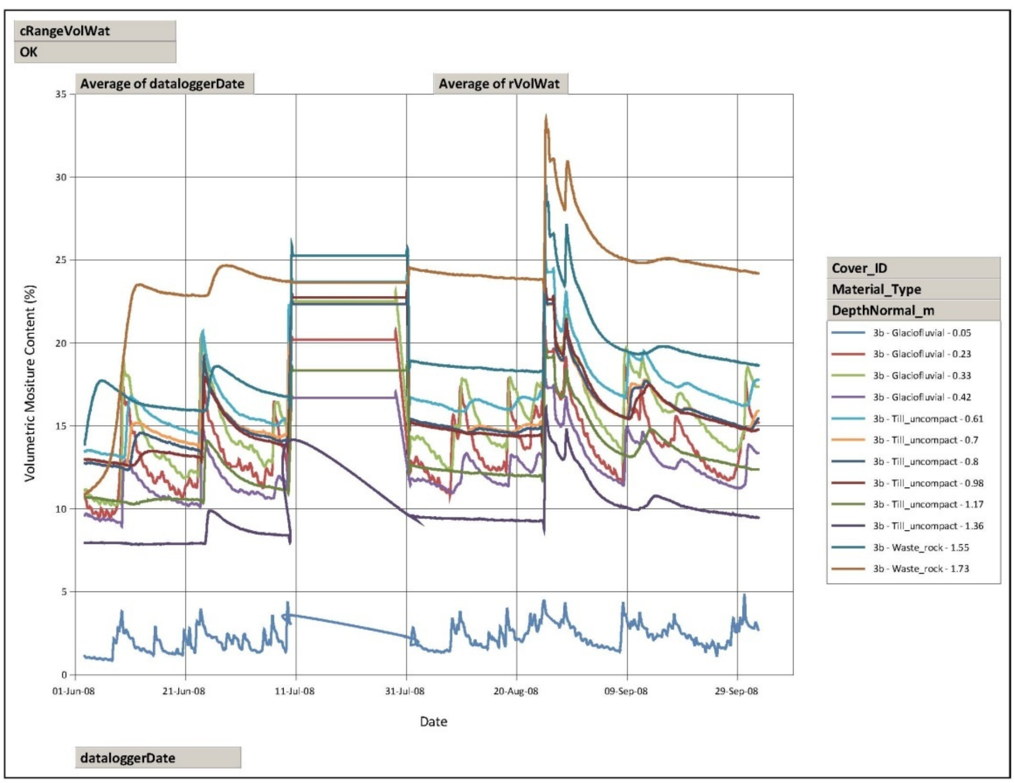

Figure 44: Volumetric moisture content measurements (taken every six hours) in CT#3B recorded by EnviroSCAN sensors connected to Campbell Scientific Data logger CR10X #2 (Array 168).

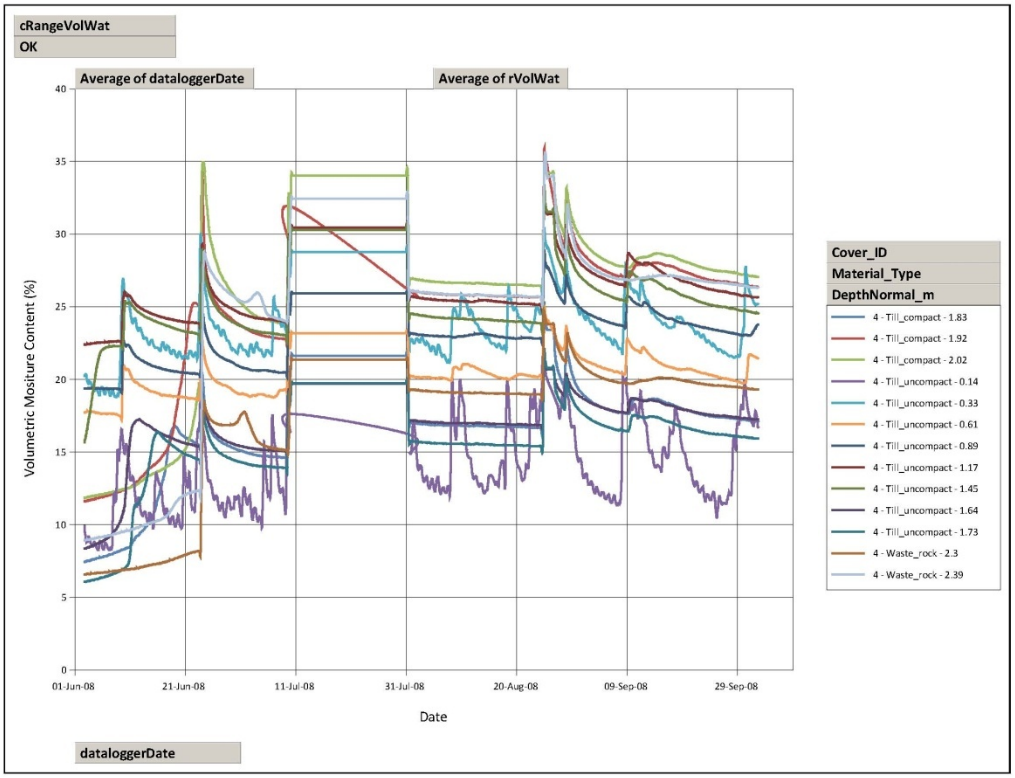

Figure 45: Volumetric moisture content measurements (taken every six hours) in CT#4 recorded by EnviroSCAN sensors connected to Campbell Scientific Data logger CR10X #2 (Array 168).

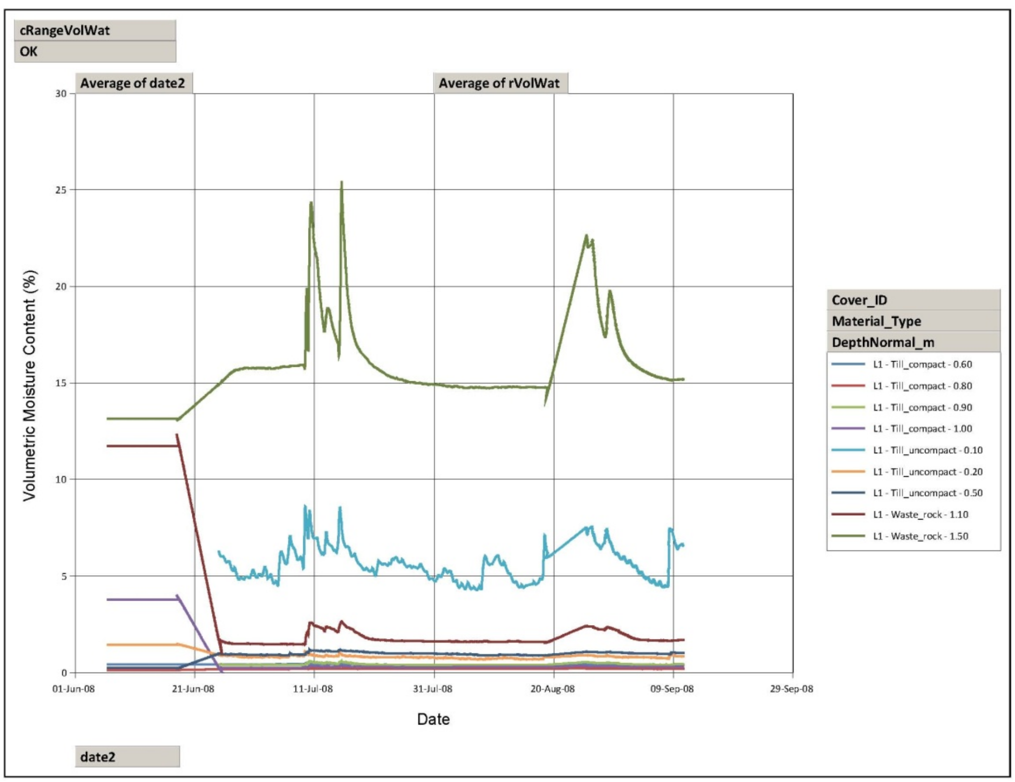

Figure 46: Volumetric moisture content measurements (taken every six hours) in L#1 recorded by EnviroSCAN sensors connected to Campbell Scientific Data logger CR1000.

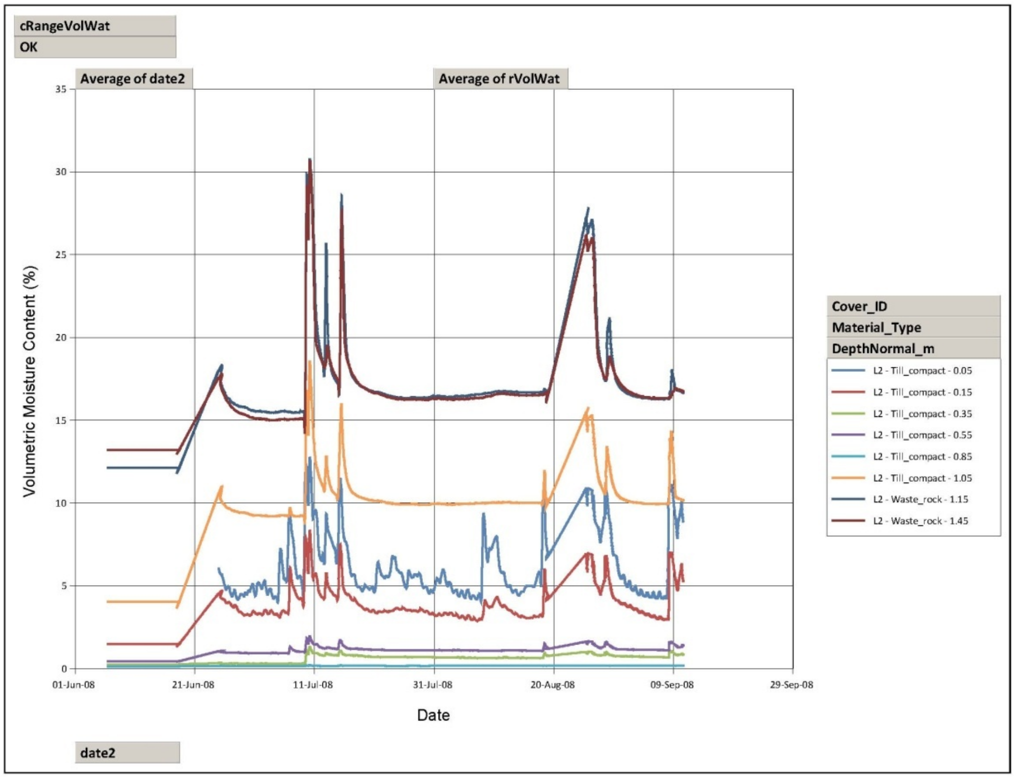

Figure 47: Volumetric moisture content measurements (taken every six hours) in L#2 recorded by EnviroSCAN sensors connected to Campbell Scientific Data logger CR1000.

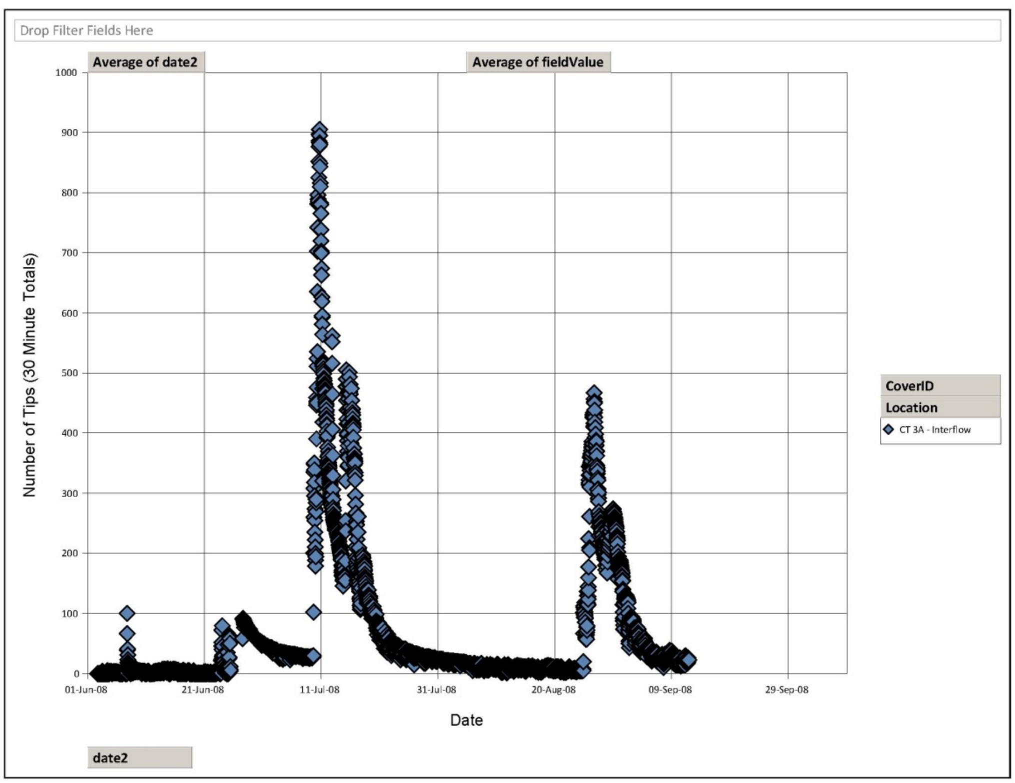

Figure 48: Interflow totals in CT#3A measured by a tipping bucket connected to Campbell Scientific Data logger CR10X #1.

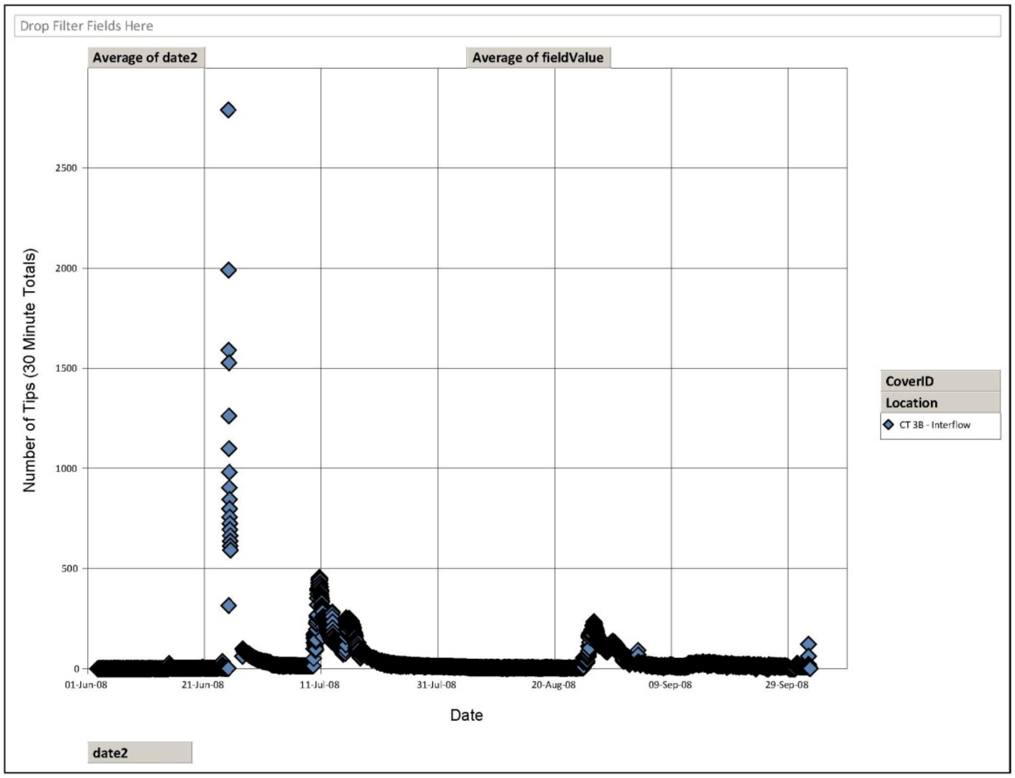

Figure 49: Interflow totals in CT#3B measured by a tipping bucket connected to Campbell Scientific Data logger CR10X #2 (Array 111).

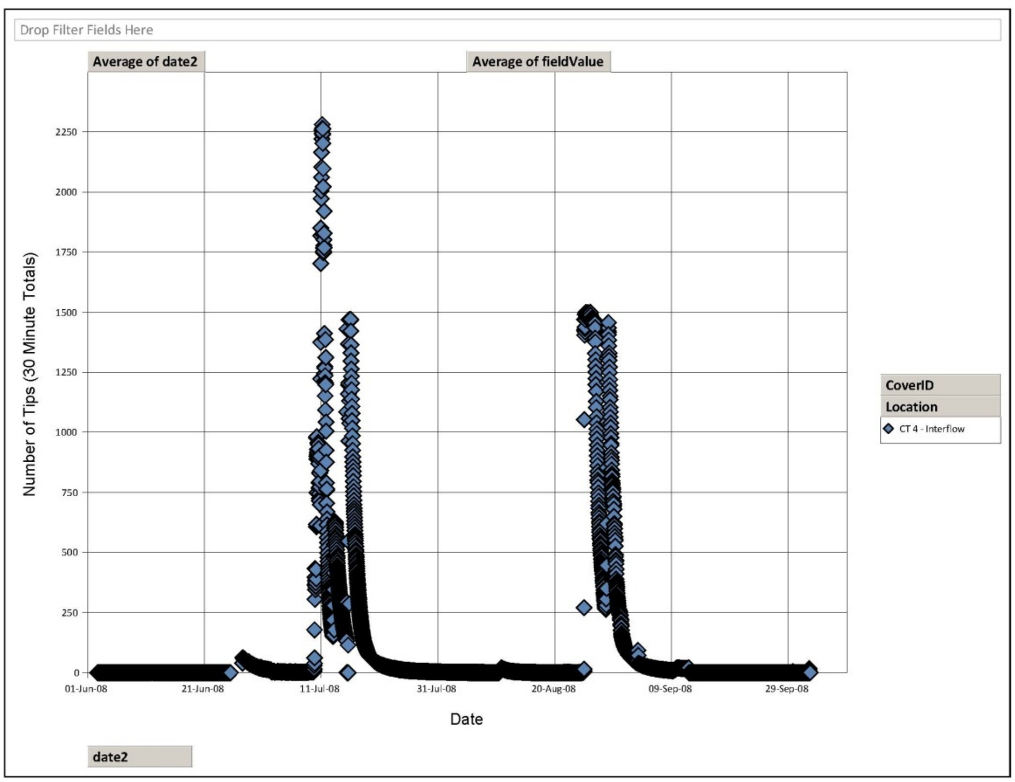

Figure 50: Interflow totals in CT#4 measured by a tipping bucket connected to Campbell Scientific Data logger CR10X #2 (Array 111).

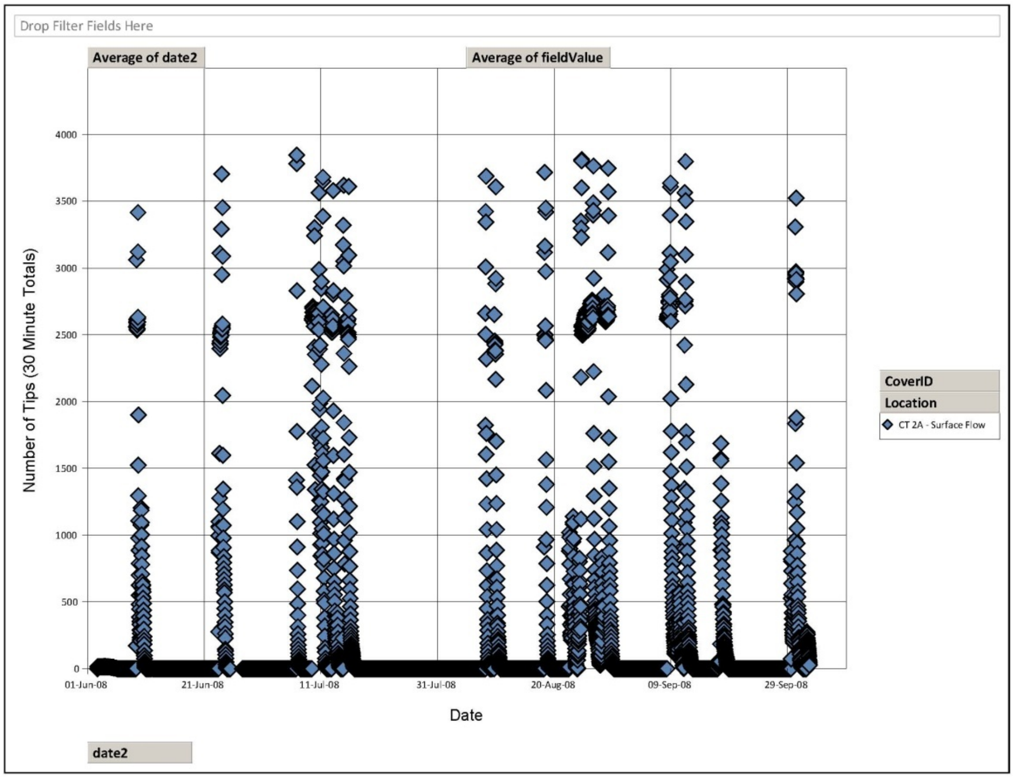

Figure 51: Surface flow totals in CT#2A measured by a tipping bucket connected to Campbell Scientific Data logger CR10X #2 (Array 111).

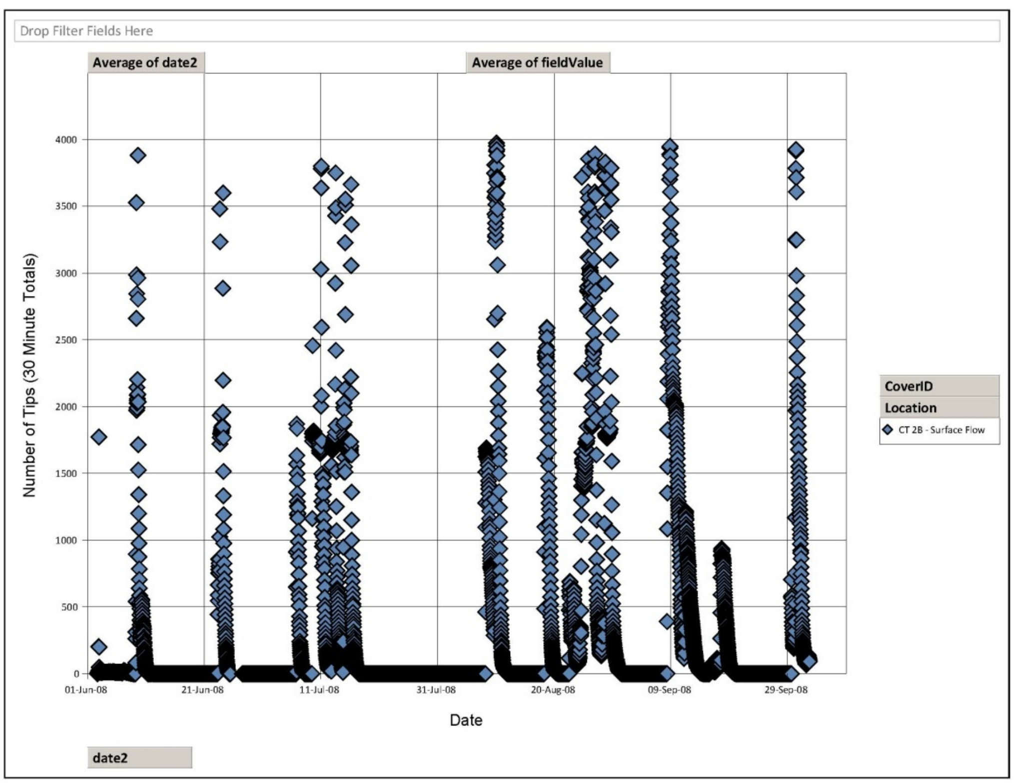

Figure 52: Surface flow totals in CT#2B measured by a tipping bucket connected to Campbell Scientific Data logger CR10X #2 (Array 111).

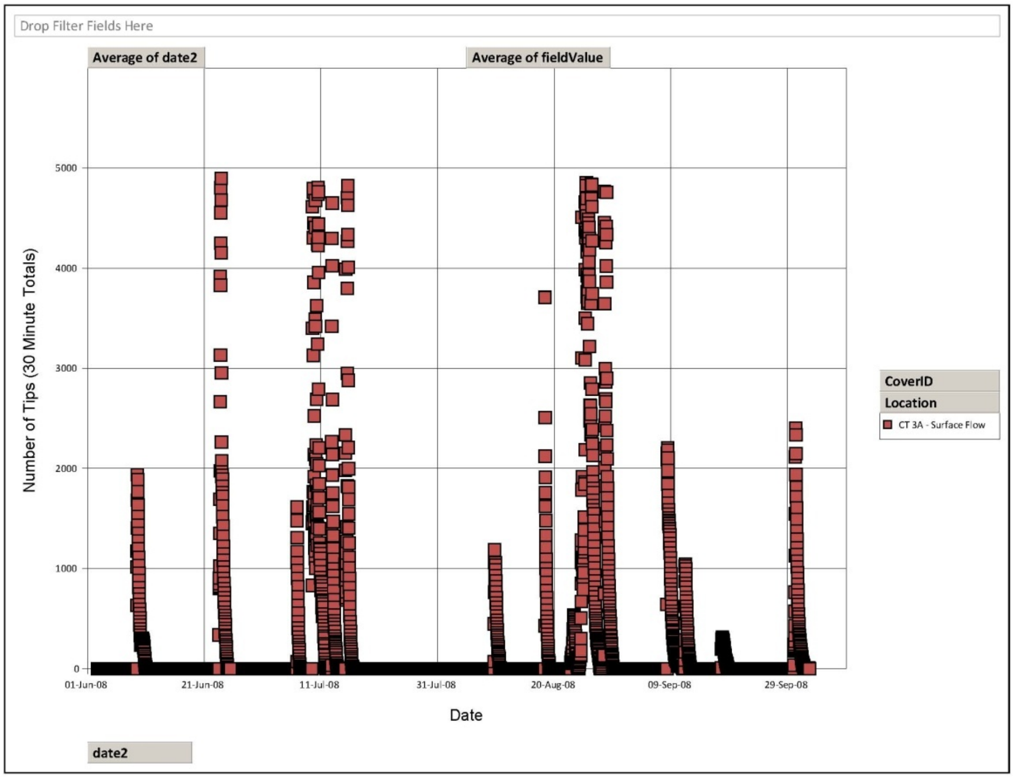

Figure 53: Surface flow totals in CT#3A measured by a tipping bucket connected to Campbell Scientific Data logger CR10X #2 (Array 111).

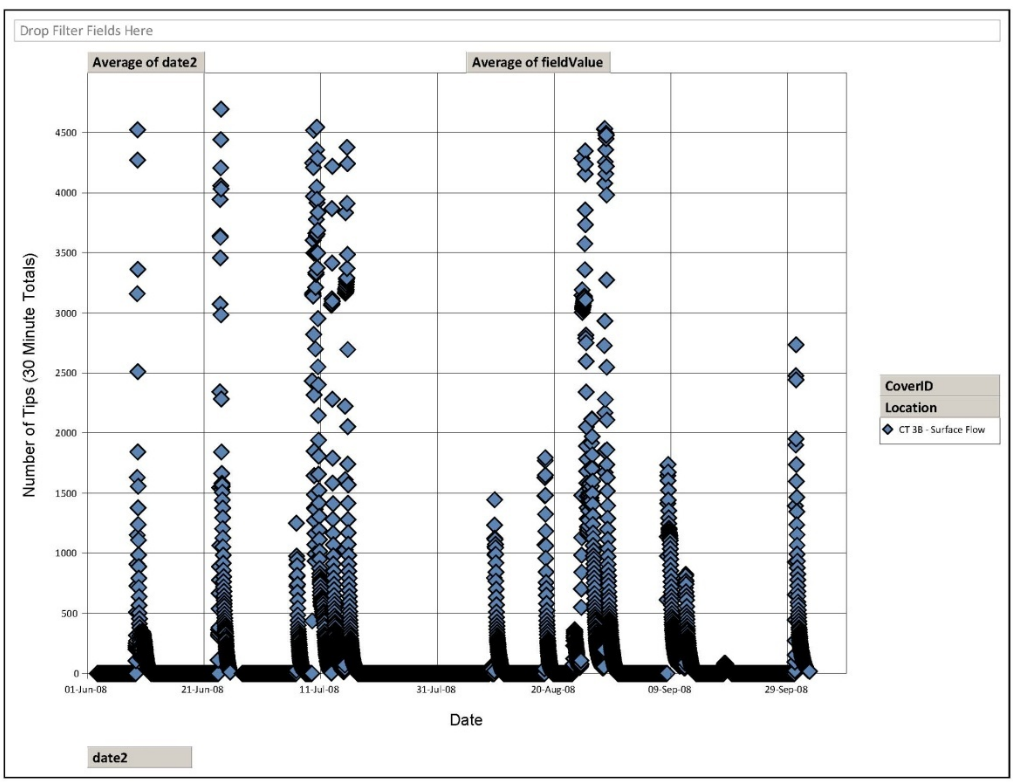

Figure 54: Surface flow totals in CT#3B measured by a tipping bucket connected to Campbell Scientific Data logger CR10X #2 (Array 111).

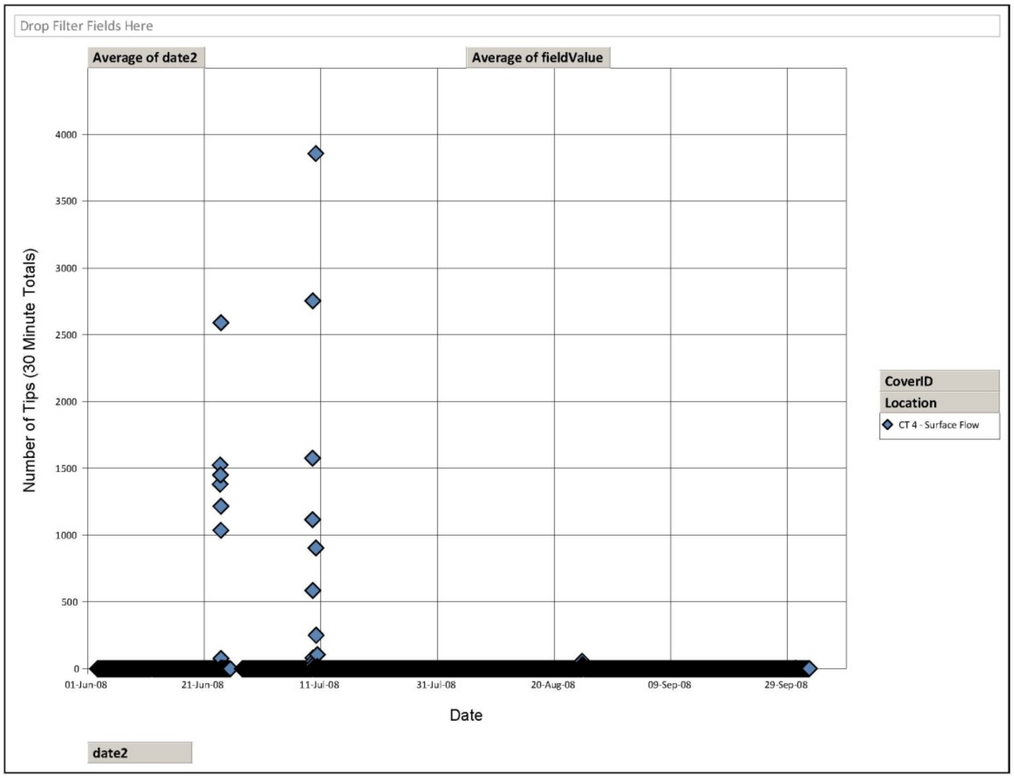

Figure 55: Surface flow totals in CT#4 measured by a tipping bucket connected to Campbell Scientific Data logger CR10X #2 (Array 111).

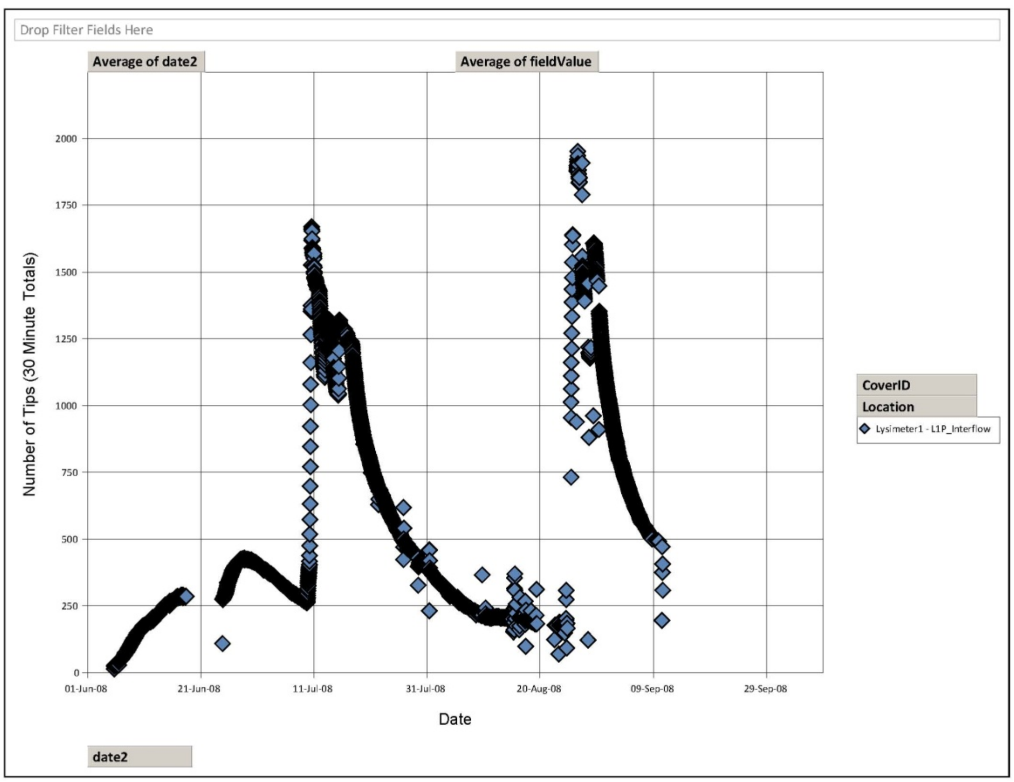

Figure 56: Peripheral interflow totals in L#1 measured by a tipping bucket connected to Campbell Scientific Data logger CR1000.

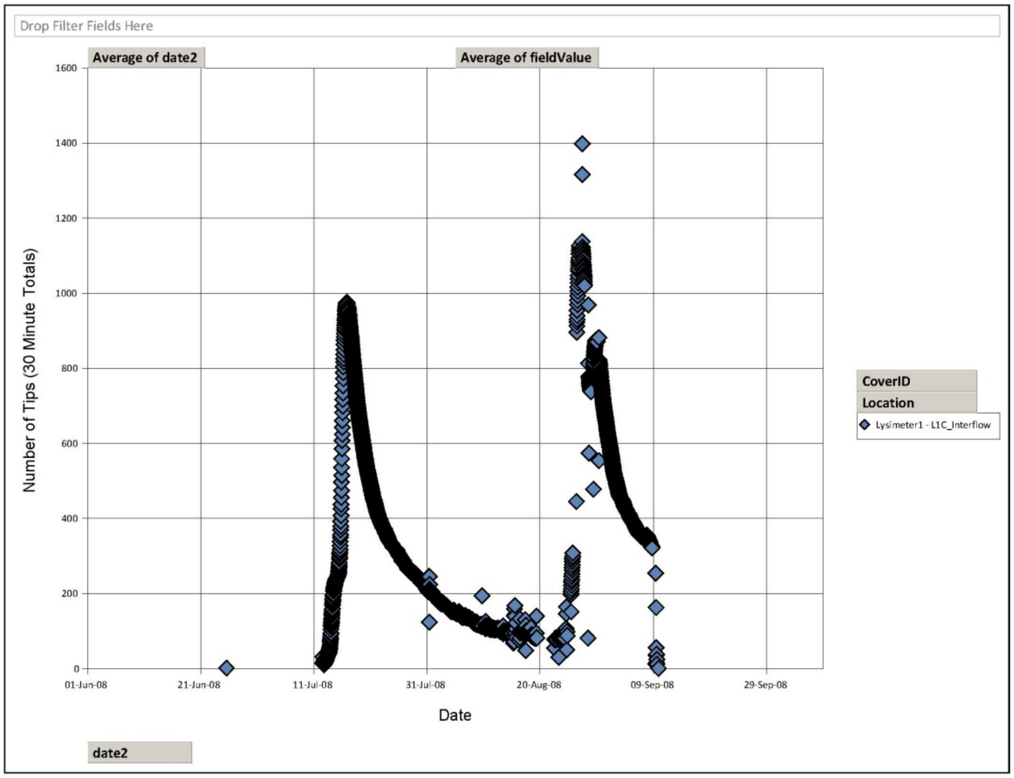

Figure 57: Central interflow totals in L#1 measured by a tipping bucket connected to Campbell Scientific Data logger CR1000.

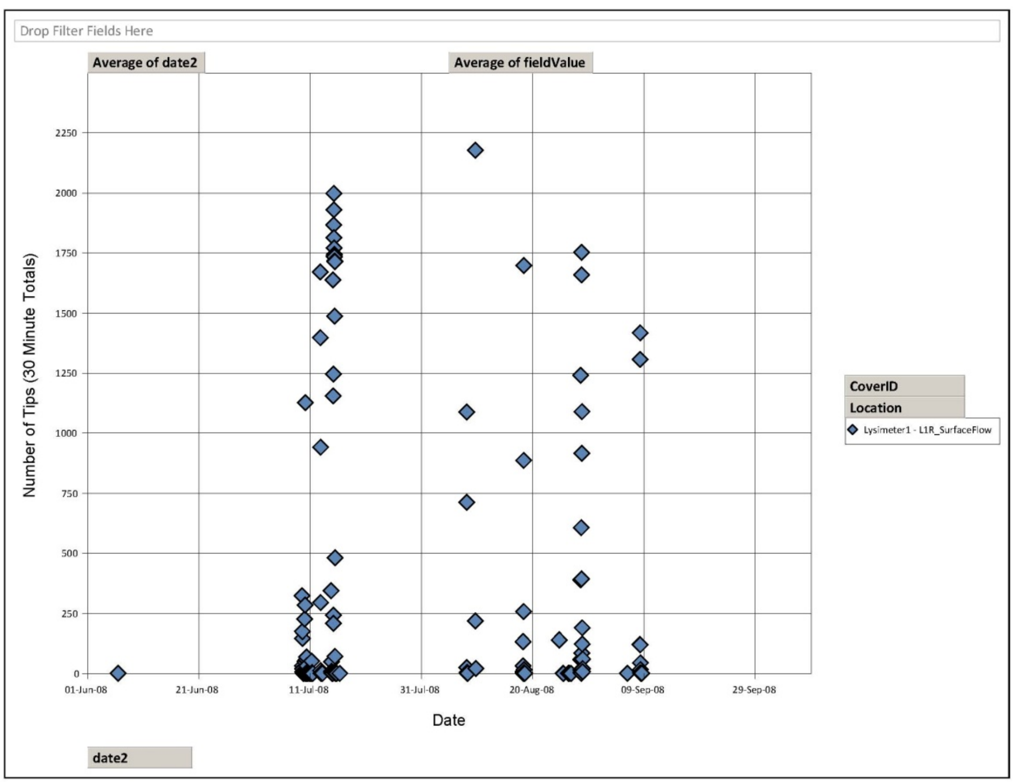

Figure 58: Surface flow totals in L#1 measured by a tipping bucket connected to Campbell Scientific CR1000 Data logger.

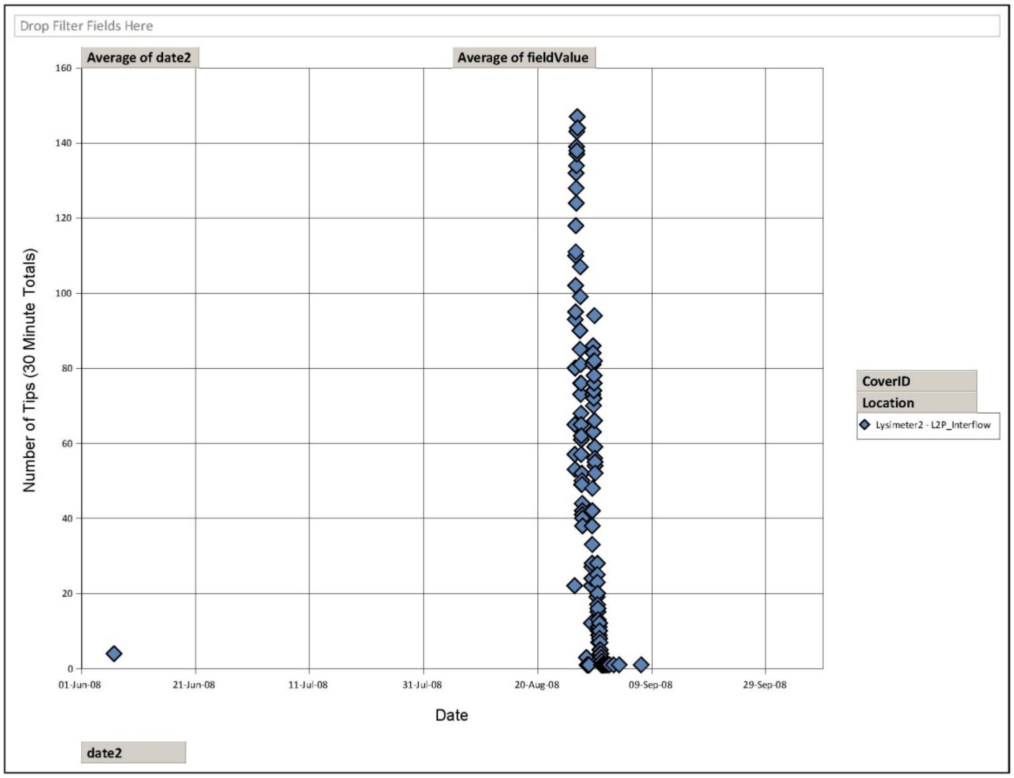

Figure 59: Peripheral interflow totals in L#2 measured by a tipping bucket connected to Campbell Scientific Data logger CR1000.

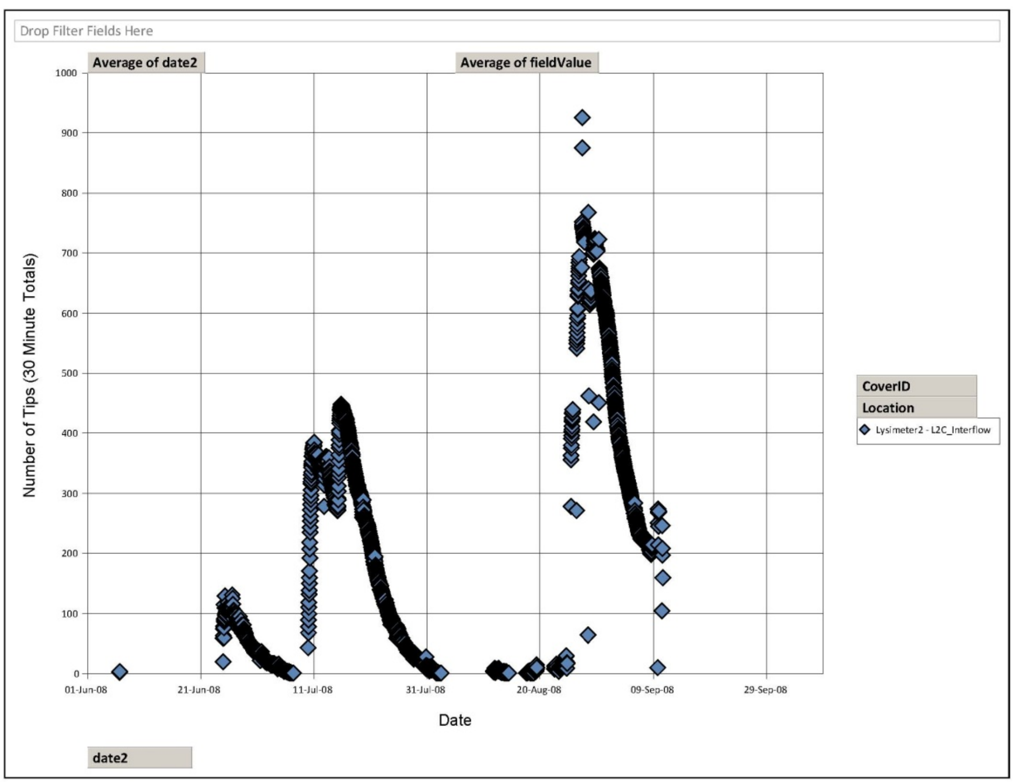

Figure 60: Central interflow totals in L#2 measured by a tipping bucket connected to Campbell Scientific Data logger CR1000.

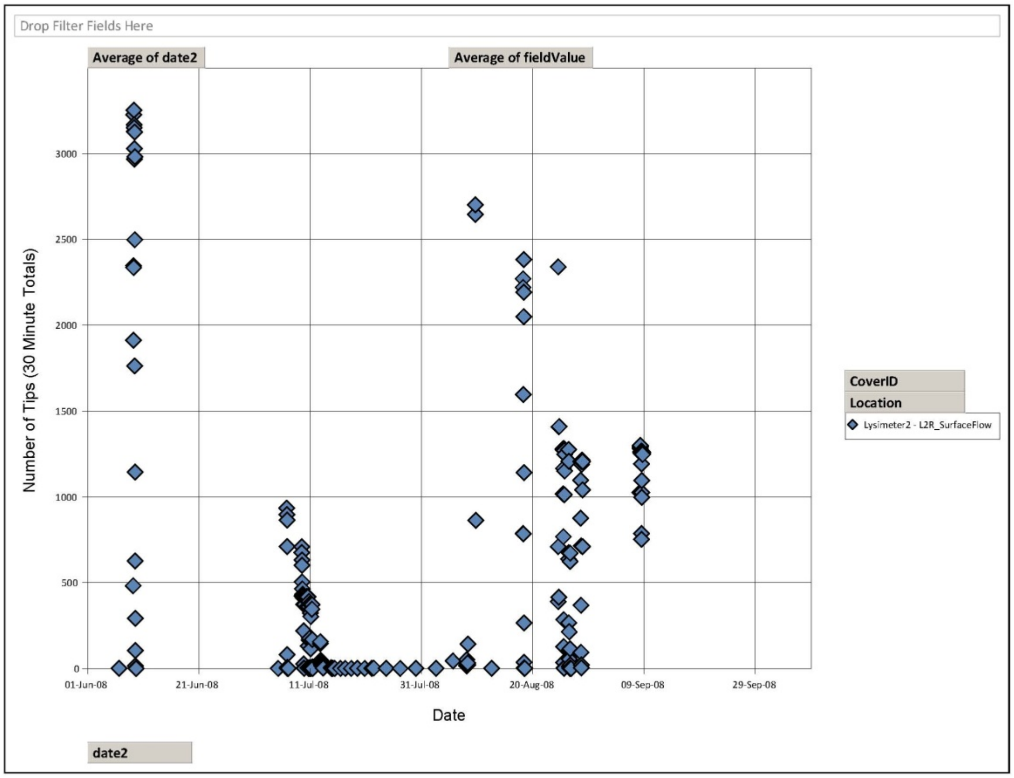

Figure 61: Surface flow totals in L#2 measured by a tipping bucket connected to Campbell Scientific Data logger CR1000.

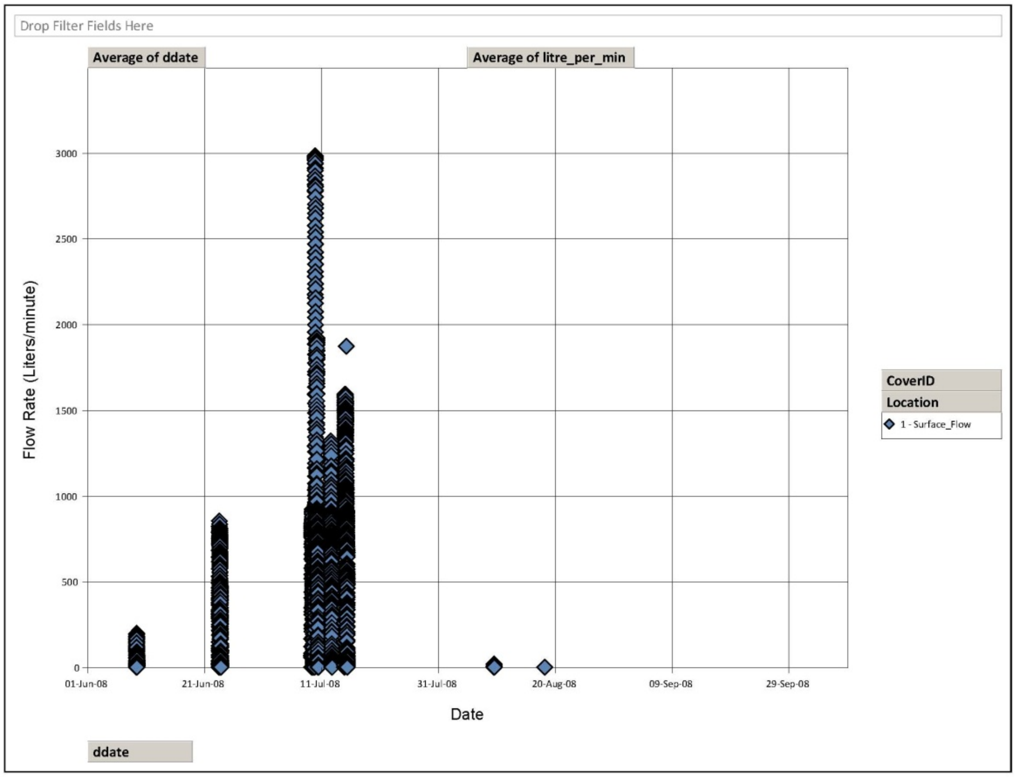

Figure 62: Surface runoff (measured every minute) on CT#1 by a Seametrics flowmeter connected to a Seametrics DL75 Data logger (File 0506051).

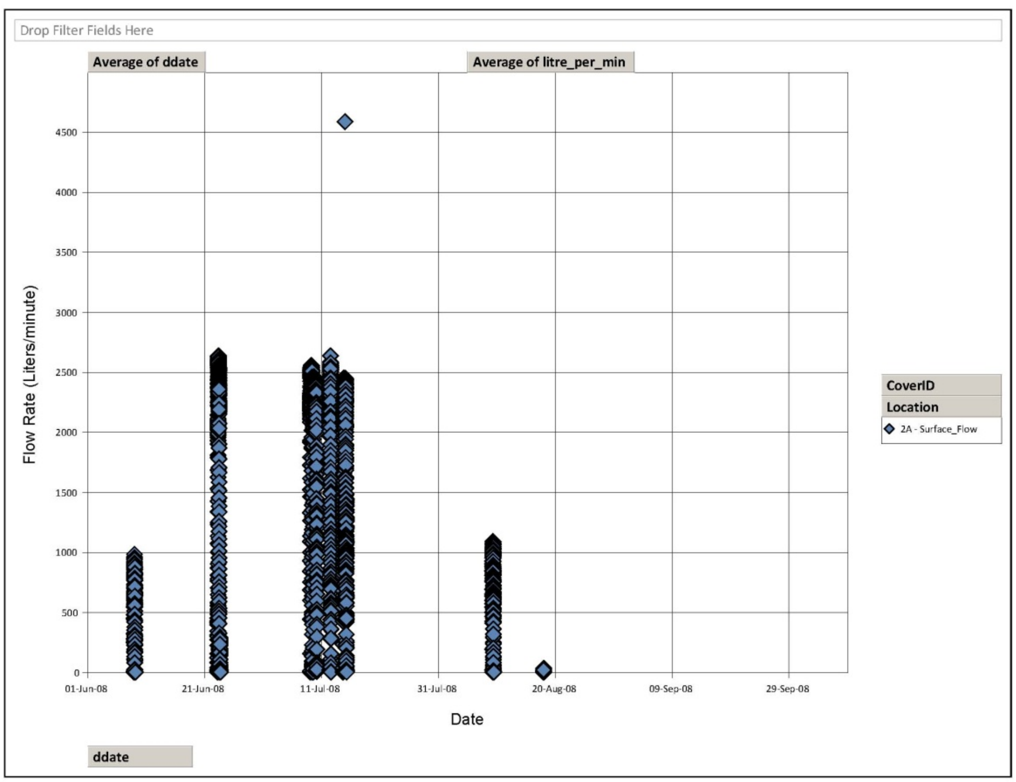

Figure 63: Surface runoff (measured every minute) on CT#2A by a Seametrics flowmeter connected to a Seametrics DL75 Data logger (File 0506052).

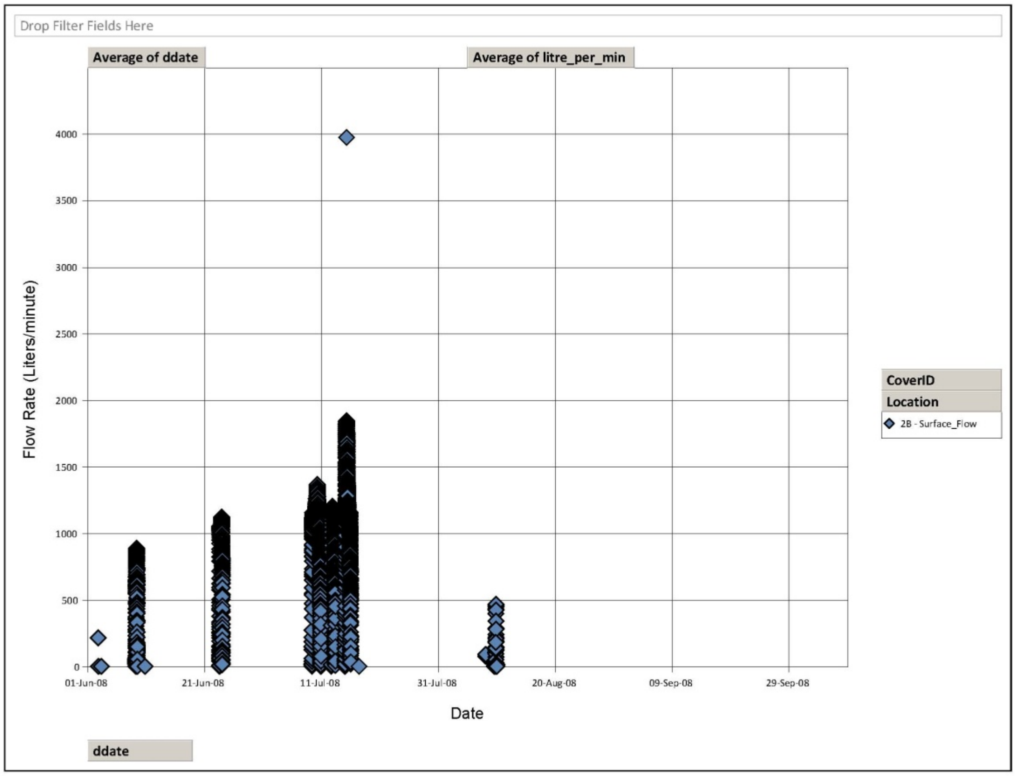

Figure 64: Surface runoff (measured every minute) on CT#2B by a Seametrics flowmeter connected to a Seametrics DL75 Data logger (File 0506053).

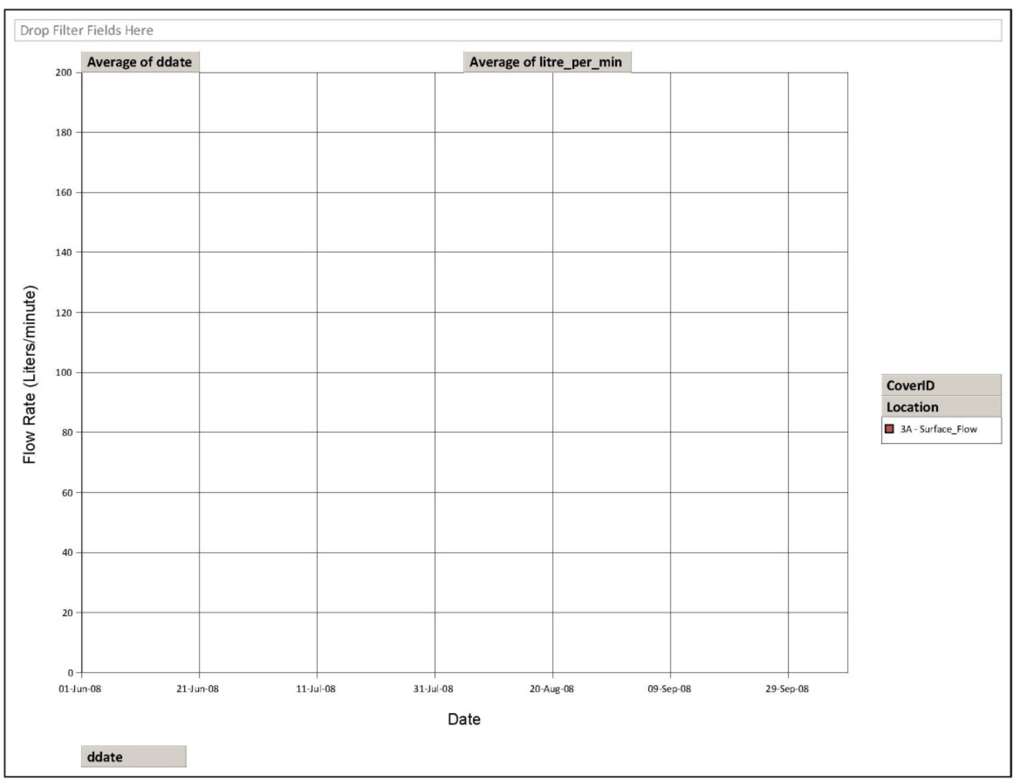

Figure 65: Surface runoff (measured every minute) on CT#3A by a Seametrics flowmeter connected to a Seametrics DL75 Data logger (File 0506054).

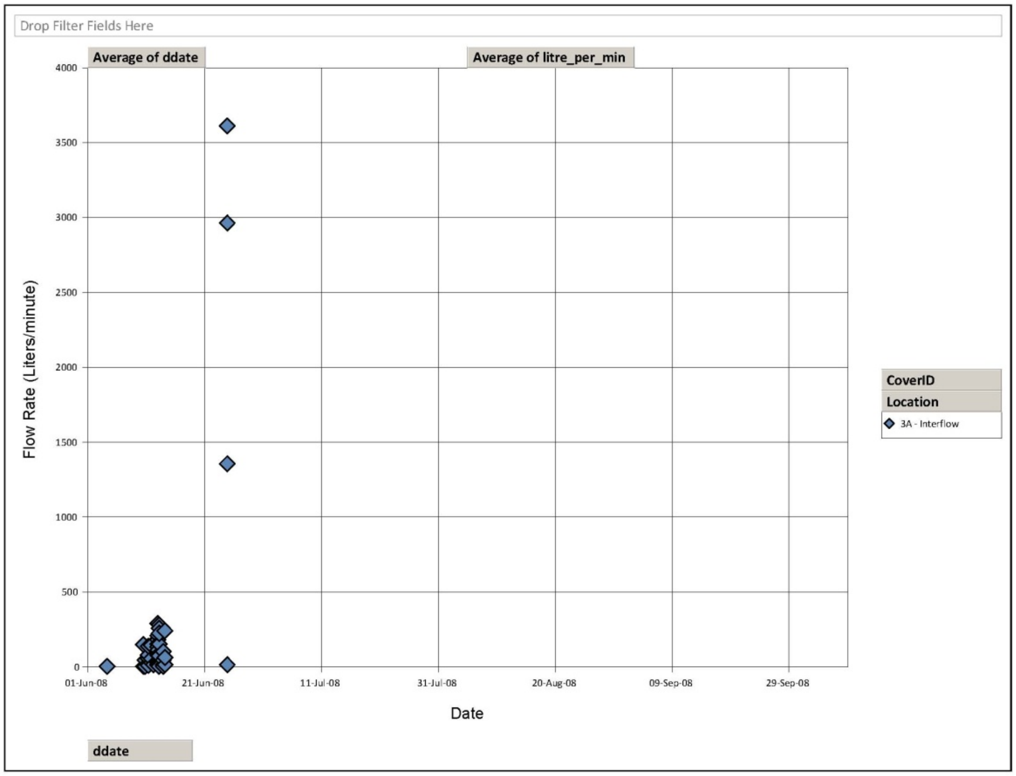

Figure 66: Interflow (measured every minute) on CT#3A by a Seametrics flowmeter connected to a Seametrics DL75 Data logger (File 02051709).

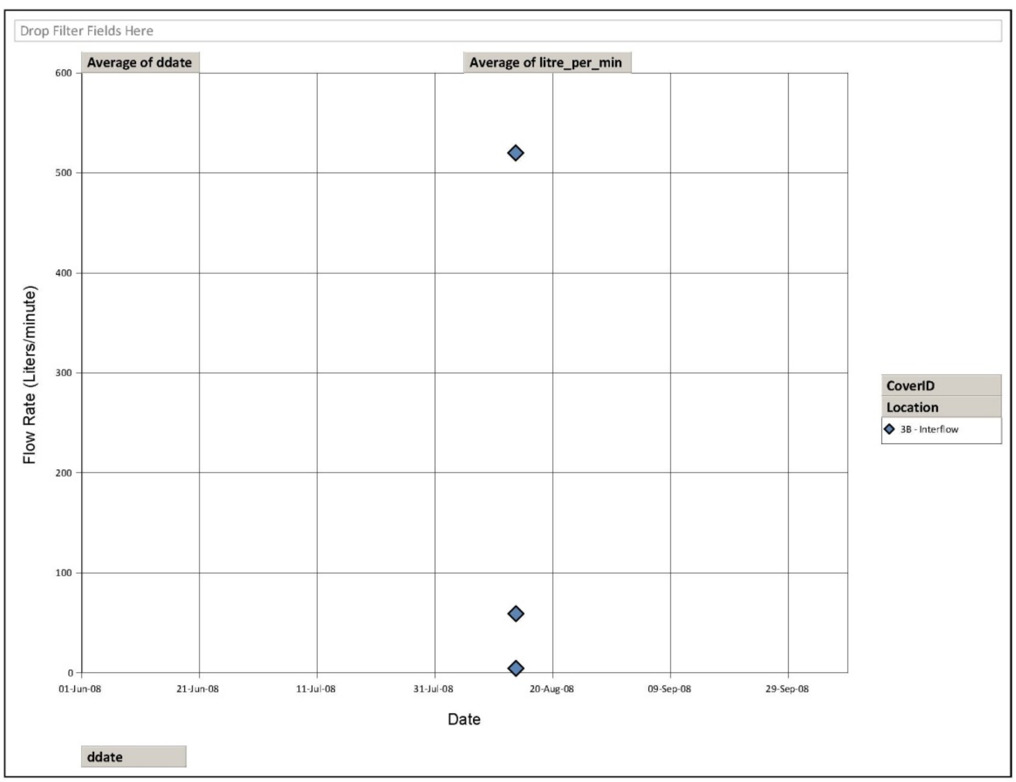

Figure 67: Interflow (measured every minute) in CT#3B by a Seametrics flowmeter connected to a Seametrics DL75 Data logger (File 02051710).

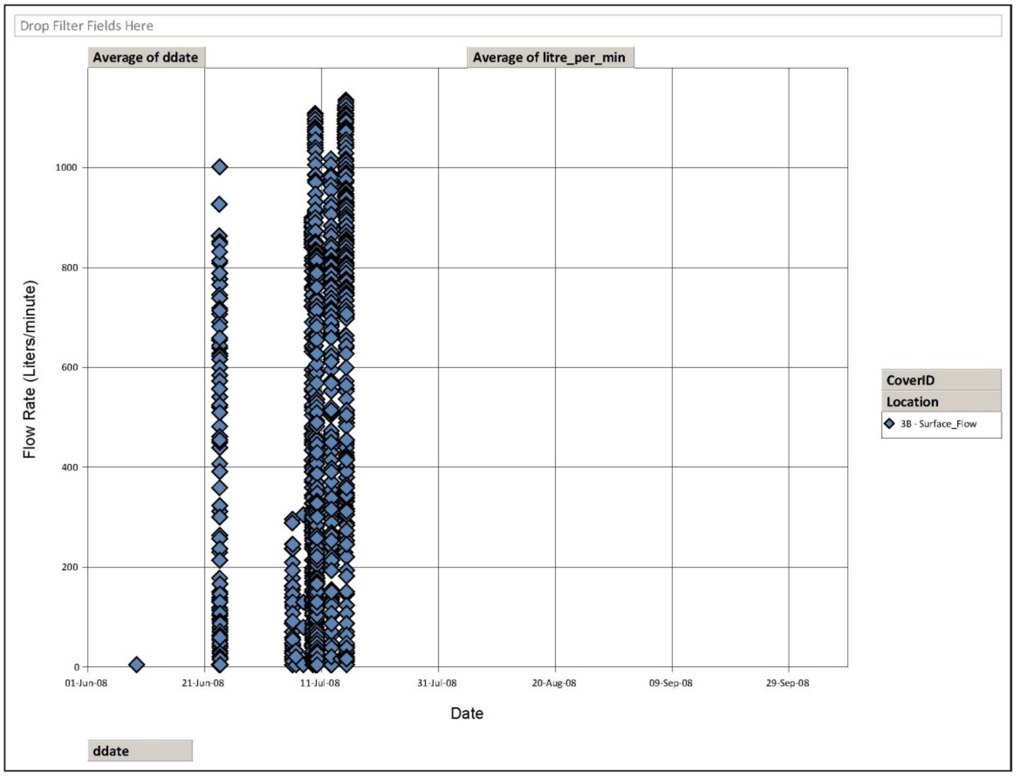

Figure 68: Surface runoff (measured every minute) on CT#3B by a Seametrics flowmeter connected to a Seametrics DL75 Data logger (File 0506054).

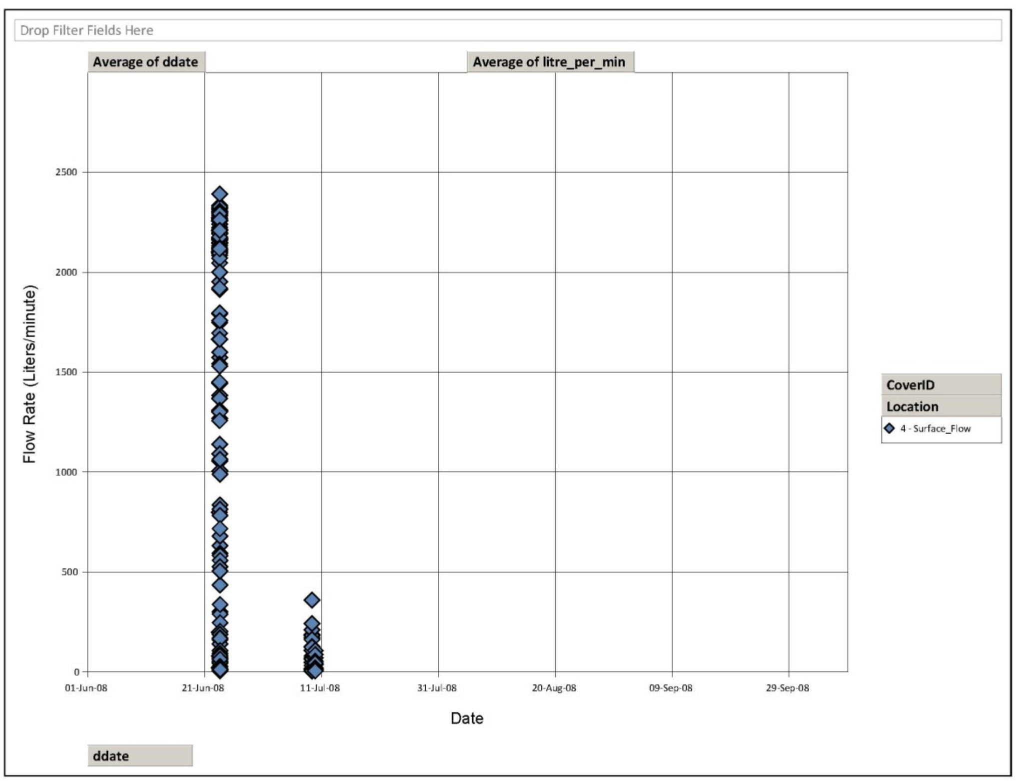

Figure 69: Surface runoff (measured every minute) on CT#4 by a Seametrics flowmeter connected to a Seametrics DL75 Data logger (File 0506058).

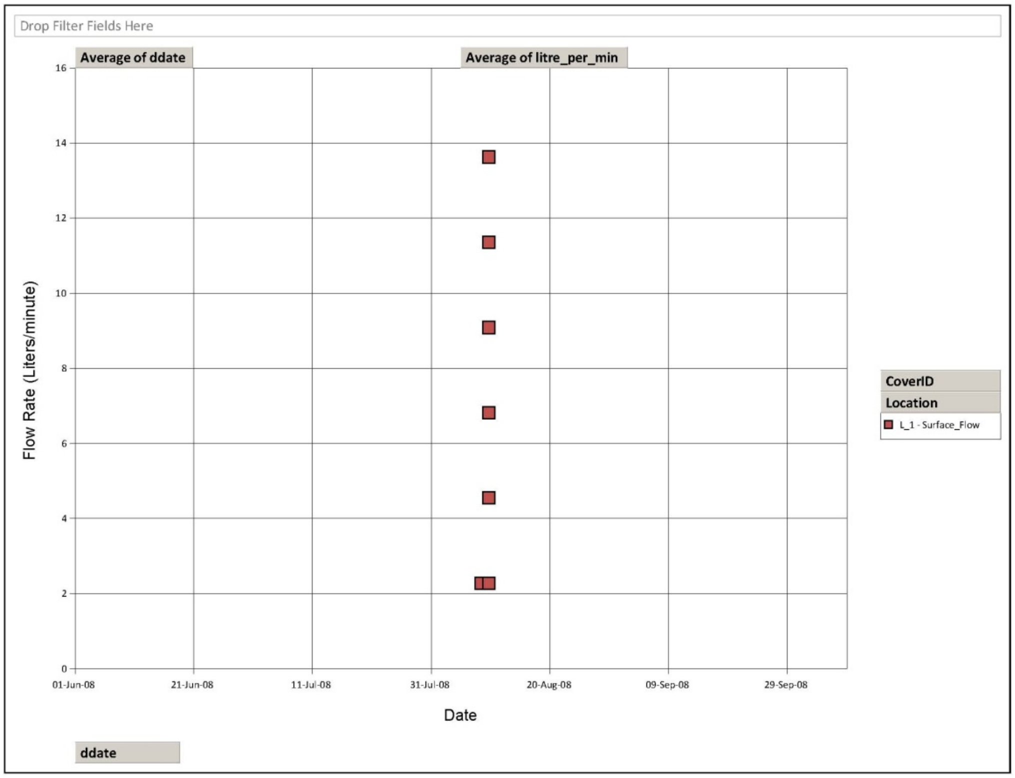

Figure 70: Surface runoff (measured every minute) on L#1 by a Seametrics flowmeter connected to a Seametrics DL75 Data logger (File 72649).

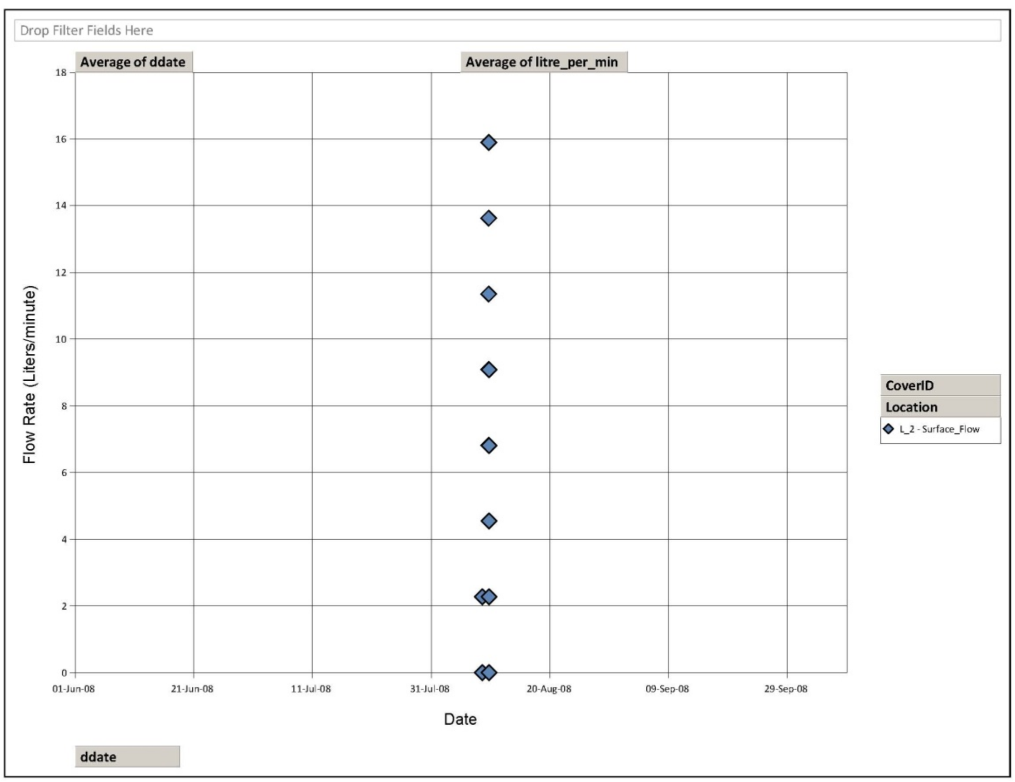

Figure 71: Surface runoff (measured every minute) in L#2 by a Seametrics flowmeter connected to a Seametrics DL75 Data logger (File 72651).

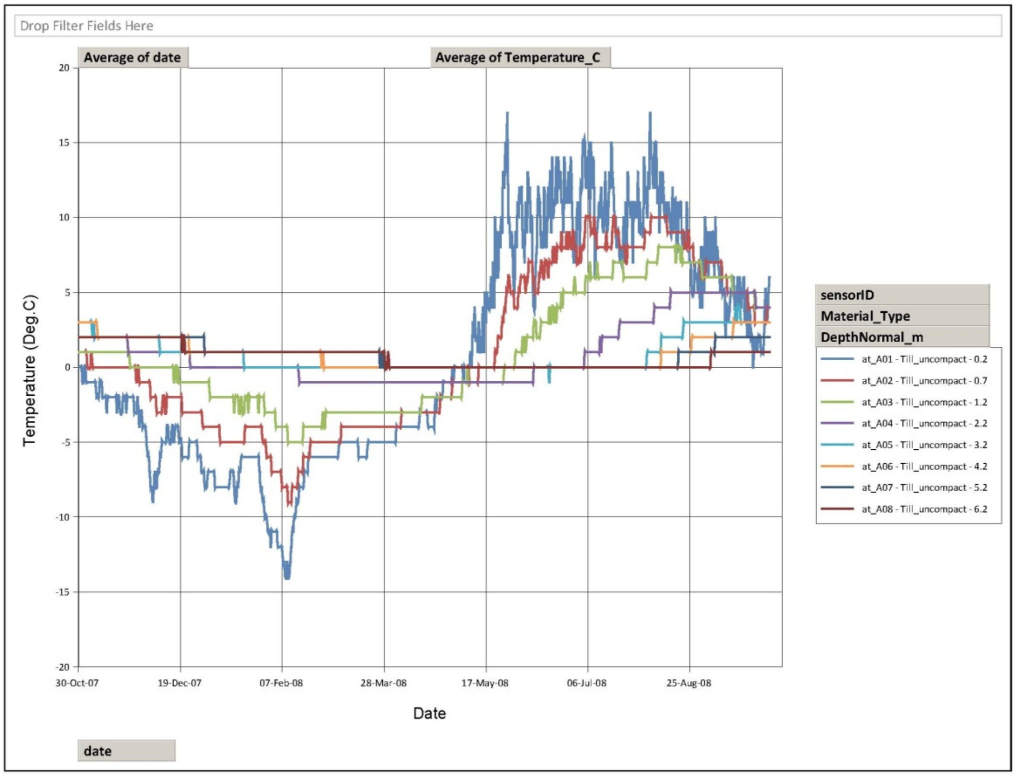

Figure 72: Soil temperature (measured every twelve hours) in Grum Overburden Dump by an M-squared thermistor string connected to a Lakewood Systems UL16 Data logger (Thermistor String A). Raw data displayed.

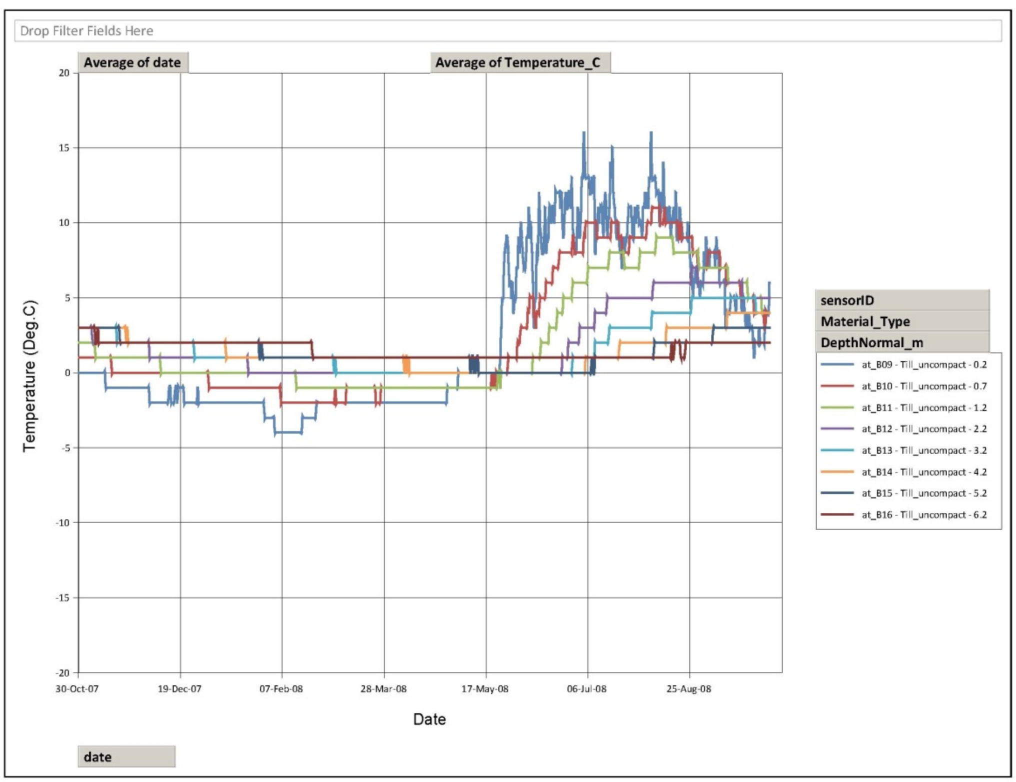

Figure 73: Soil temperature (measured every twelve hours) in Grum Overburden Dump by an M-squared thermistor string connected to a Lakewood Systems UL16 Data logger (Thermistor String B). Raw data displayed.

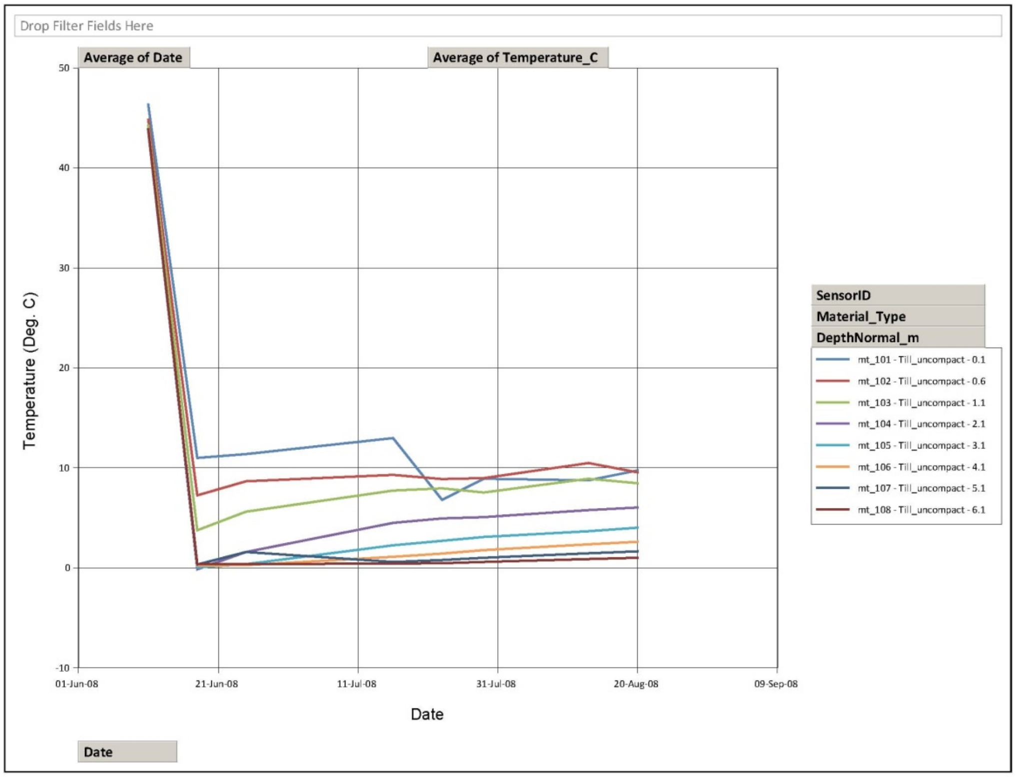

Figure 74: Monthly soil temperature measurements in Grum Overburden Dump by an M-Squared thermistor string measured manually (Thermistor String 1). Raw data expressed as resistances.

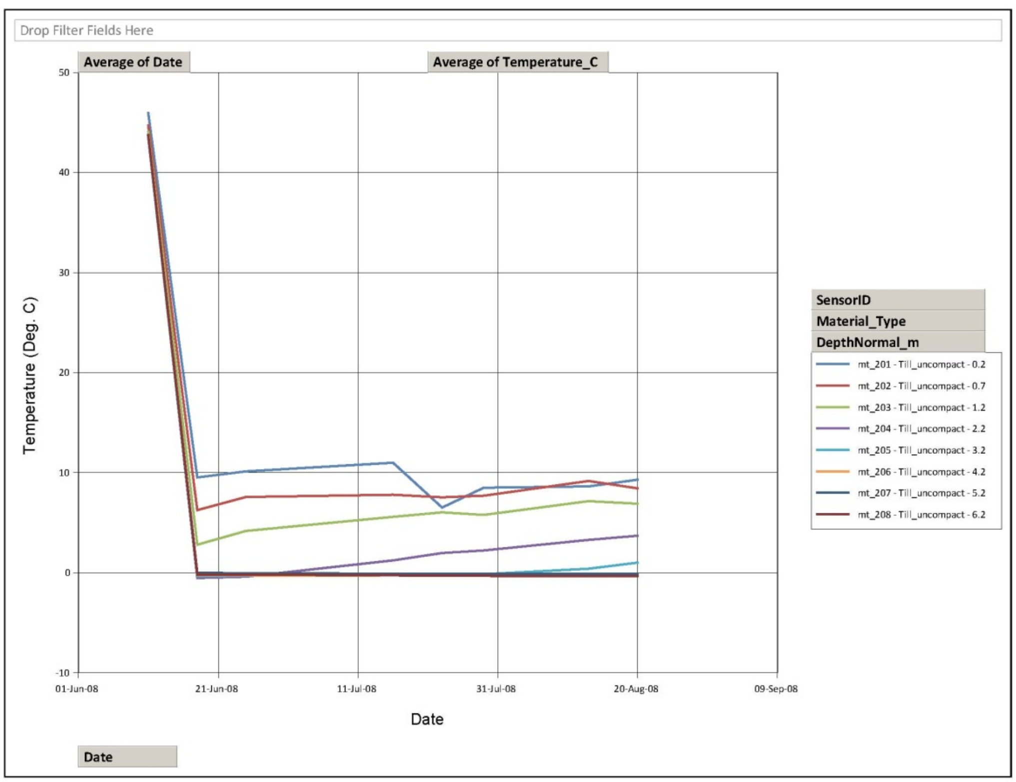

Figure 75: Monthly soil temperature measurements in Grum Overburden Dump by an M-Squared thermistor string measured manually (Thermistor String 2). Raw data expressed as resistances.

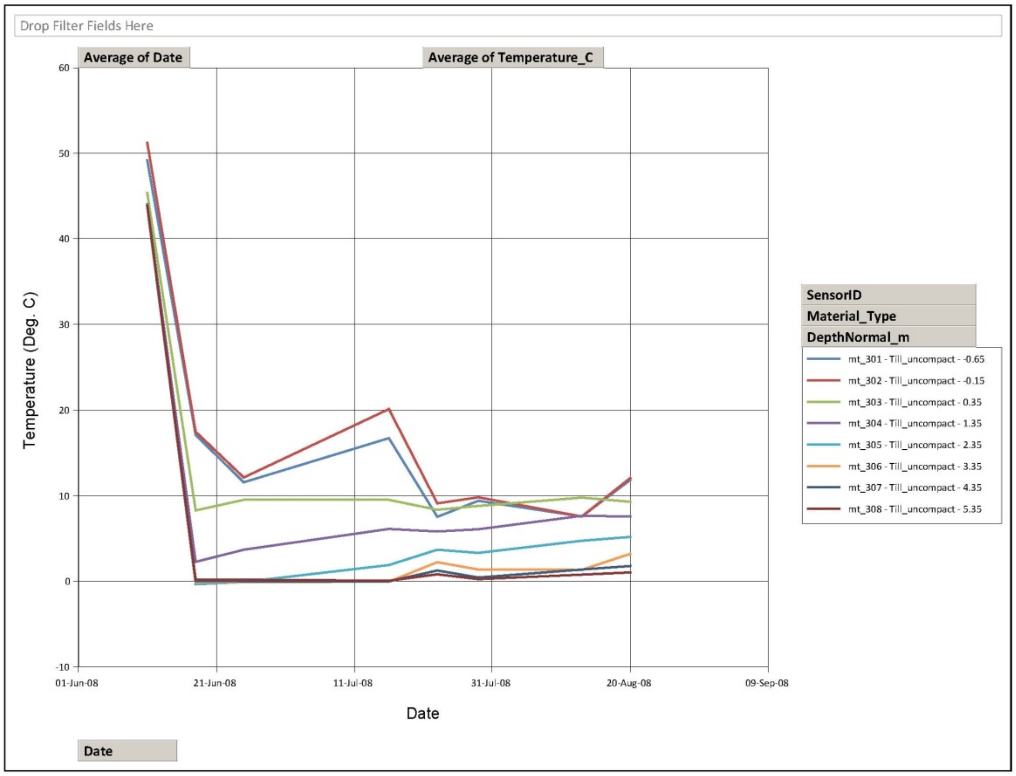

Figure 76: Monthly soil temperature measurements in Grum Overburden Dump by an M-Squared thermistor string measured manually (Thermistor String 3). Raw data expressed as resistances.

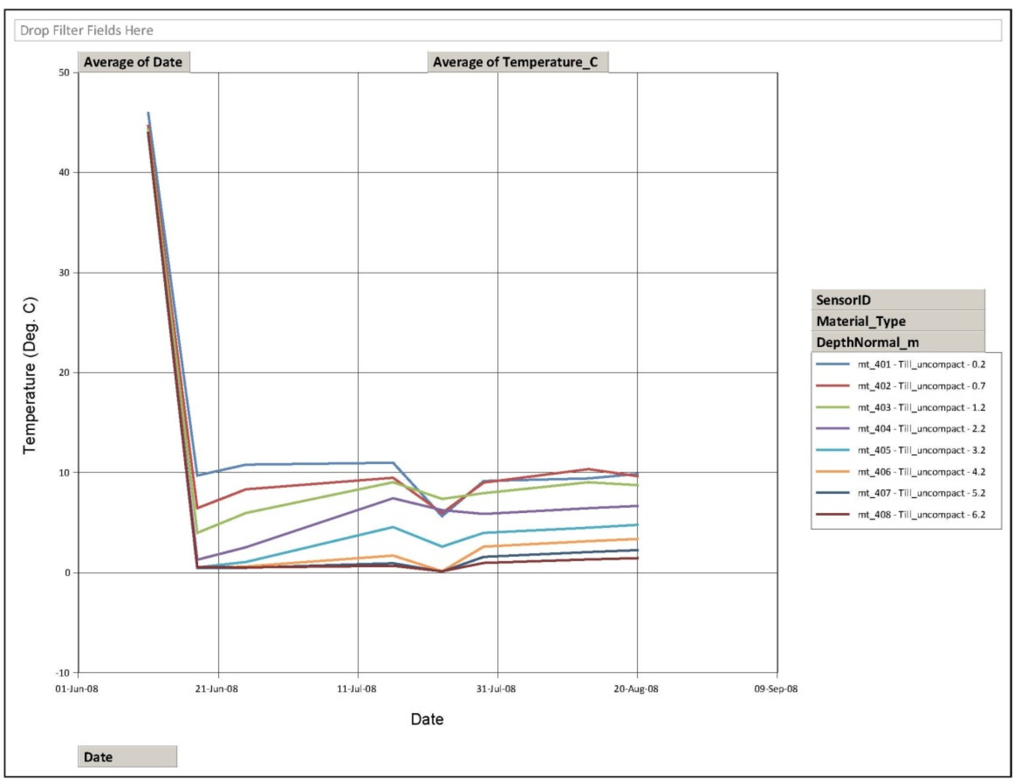

Figure 77: Monthly soil temperature measurements in Grum Overburden Dump by an M-Squared thermistor string measured manually (Thermistor String 4). Raw data expressed as resistances.

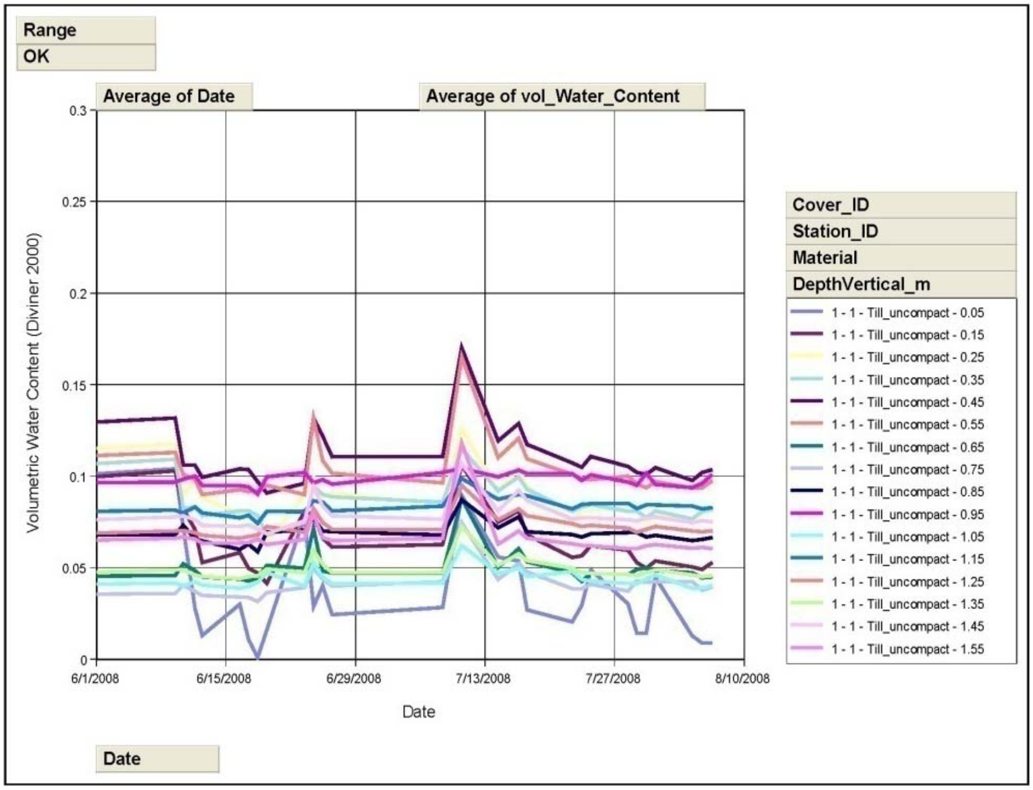

Figure 78: Daily volumetric moisture content in CT#1 (Station #1) measured manually by a Sentek Diviner 2000.

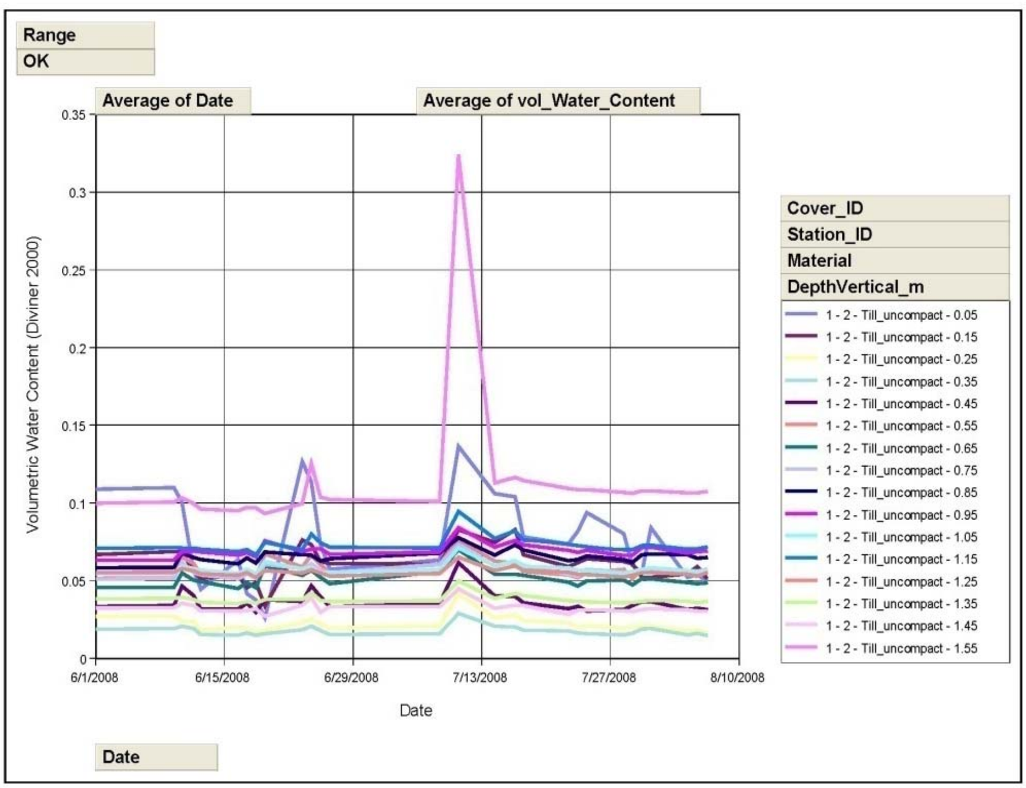

Figure 79: Daily volumetric moisture content in CT#1 (Station #2) measured manually by a Sentek Diviner 2000.

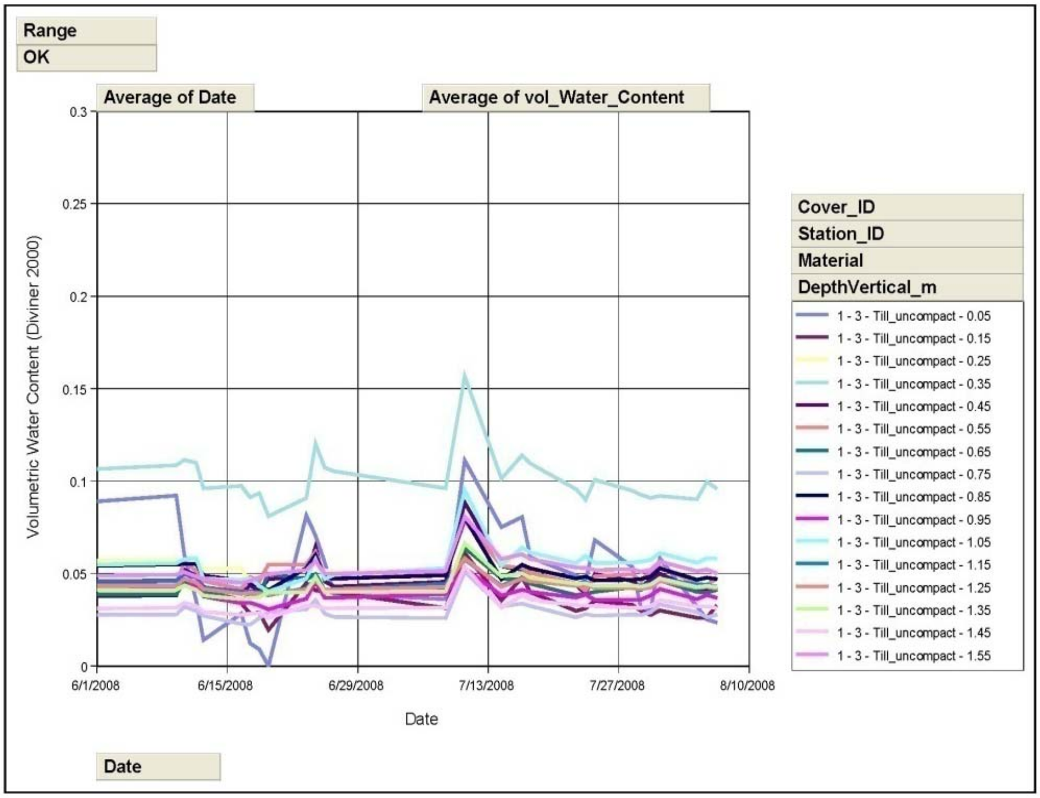

Figure 80: Daily volumetric moisture content in CT#1 (Station #3) measured manually by a Sentek Diviner 2000.

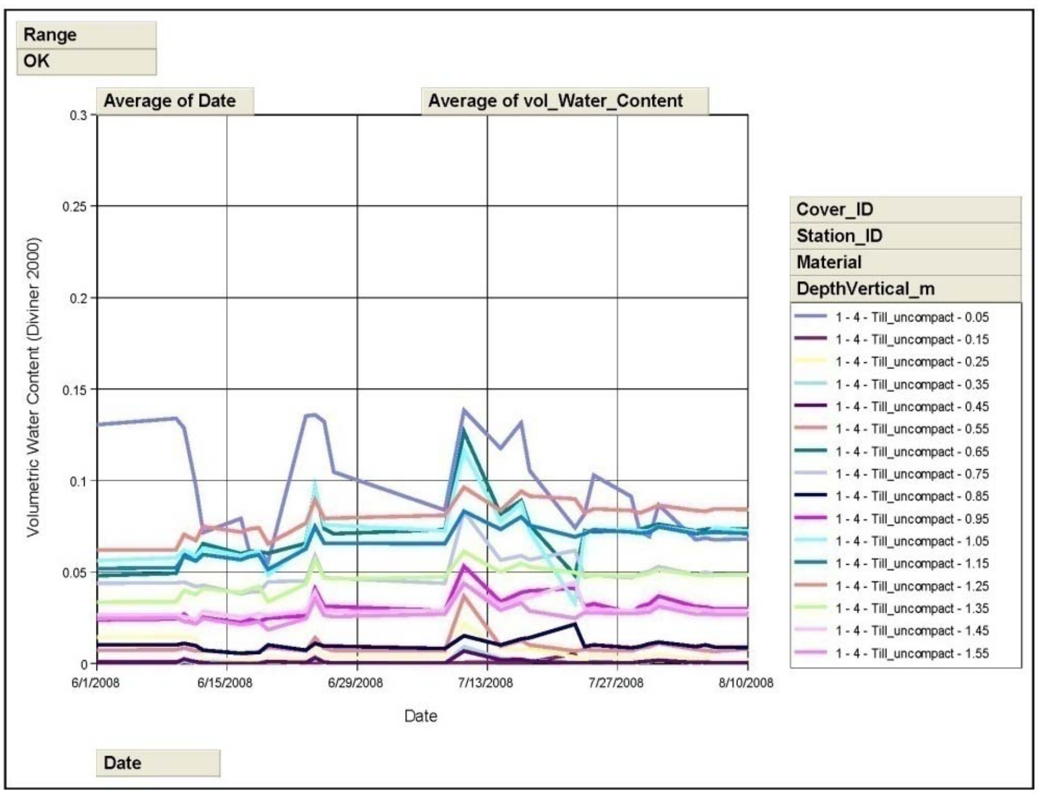

Figure 81: Daily volumetric moisture content in CT#1 (Station #4) measured manually by a Sentek Diviner 2000.

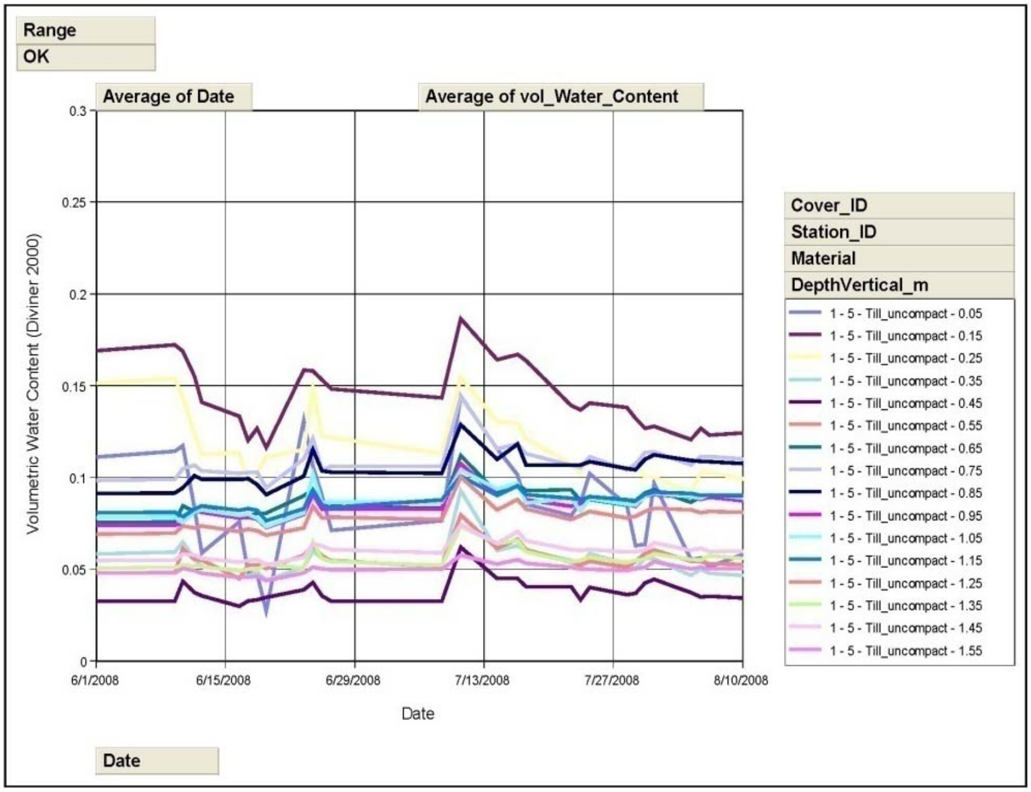

Figure 82: Daily volumetric moisture content in CT#1 (Station #5) measured manually by a Sentek Diviner 2000.

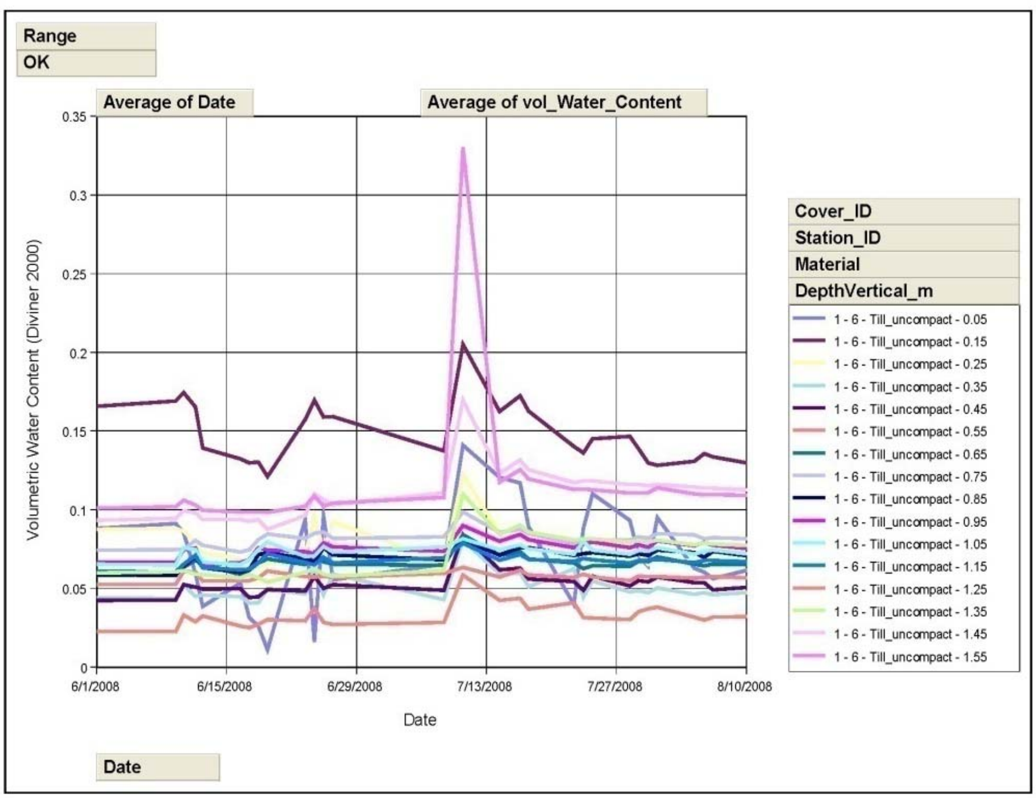

Figure 83: Daily volumetric moisture content in CT#1 (Station #6) measured manually by a Sentek Diviner 2000.

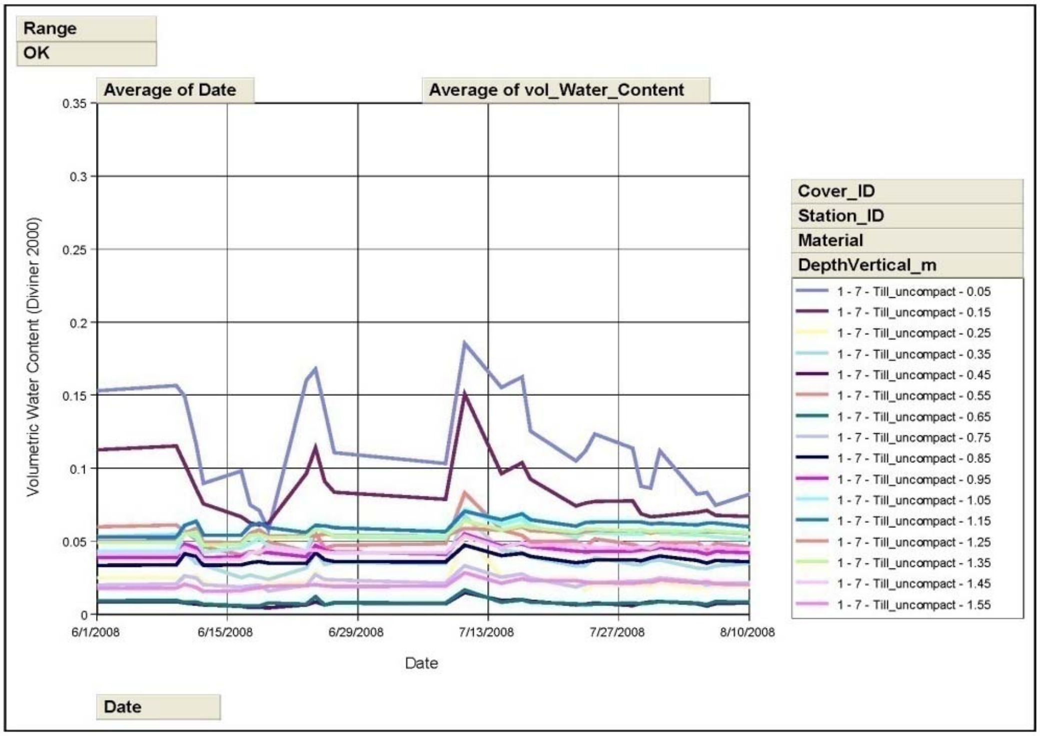

Figure 84: Daily volumetric moisture content in CT#2A (Station #9) measured manually by a Sentek Diviner 2000.

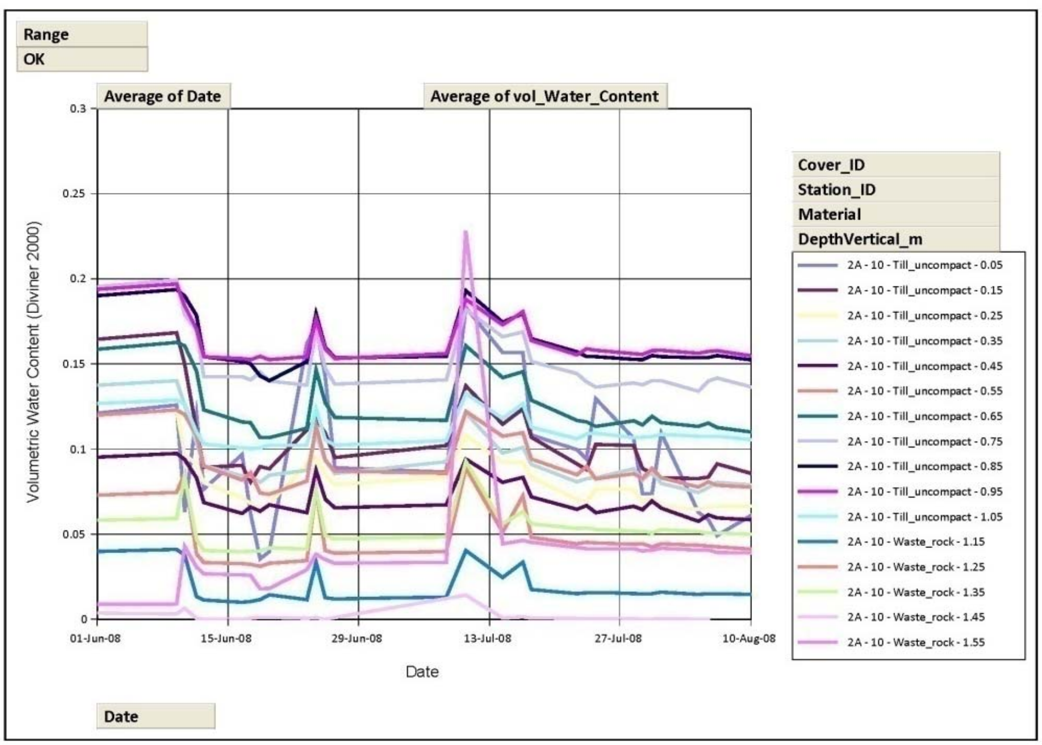

Figure 85: Daily volumetric moisture content in CT#2A (Station #10) measured manually by a Sentek Diviner 2000.

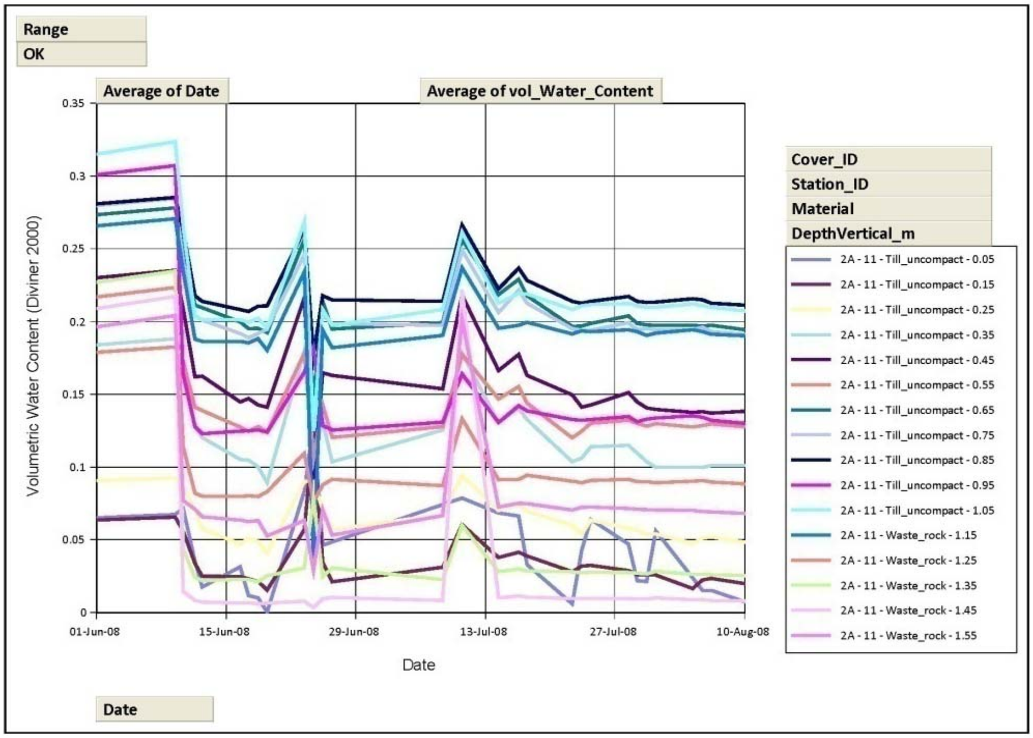

Figure 86: Daily volumetric moisture content in CT#2A (Station #11) measured manually by a Sentek Diviner 2000.

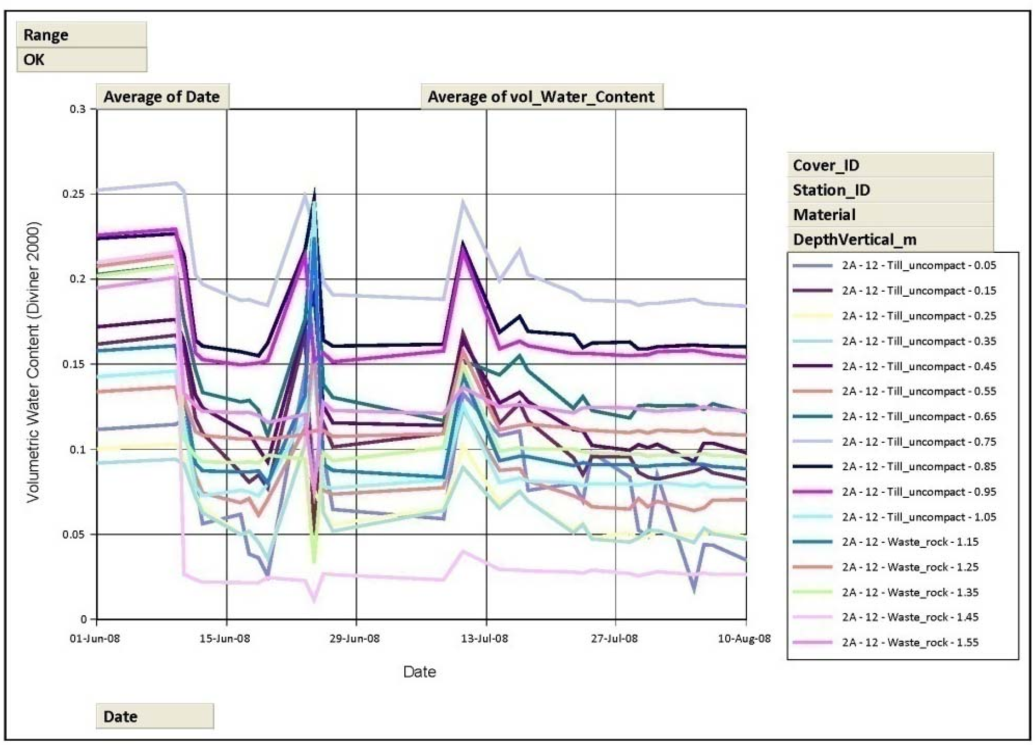

Figure 87: Daily volumetric moisture content in CT#2A (Station #12) measured manually by a Sentek Diviner 2000.

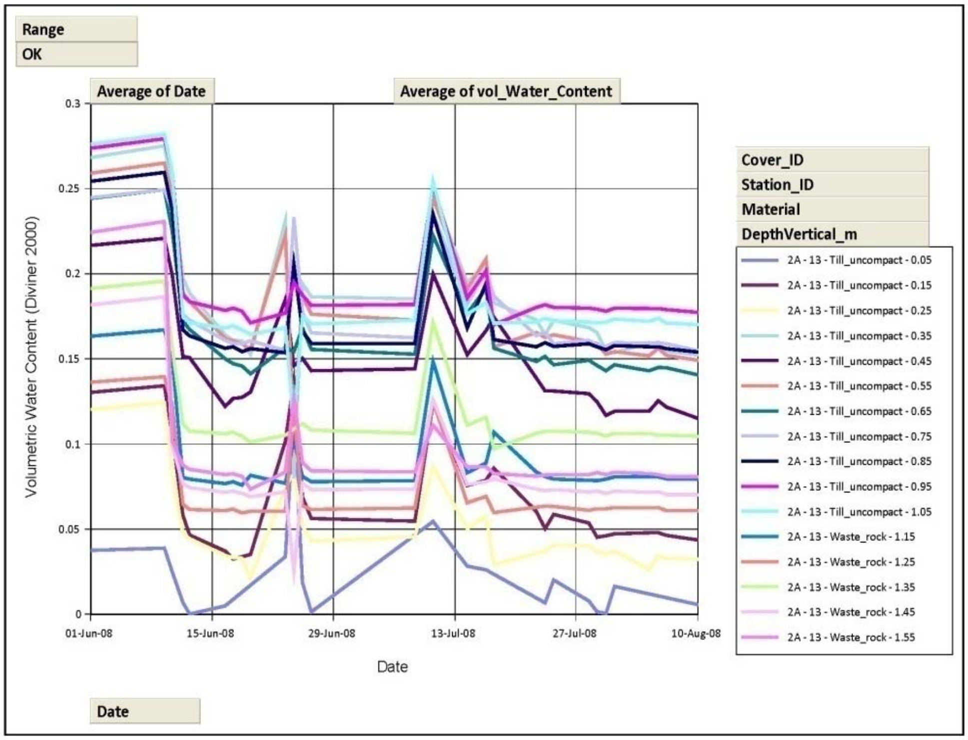

Figure 88: Daily volumetric moisture content in CT#2A (Station #13) measured manually by a Sentek Diviner 2000.

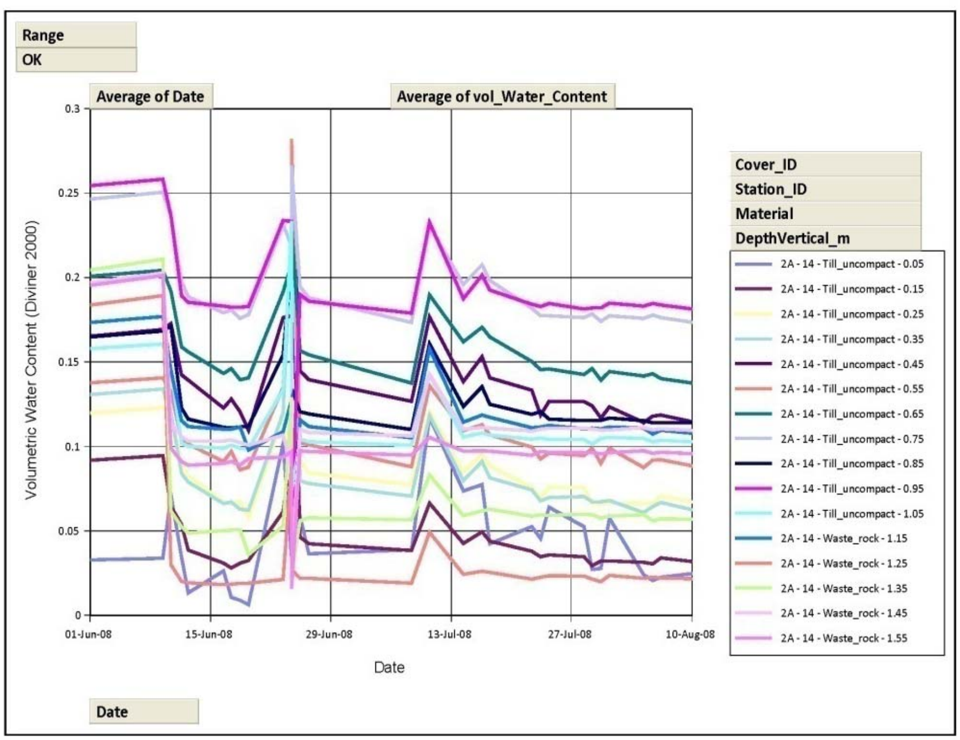

Figure 89: Daily volumetric moisture content in CT#2A (Station #14) measured manually by a Sentek Diviner 2000.

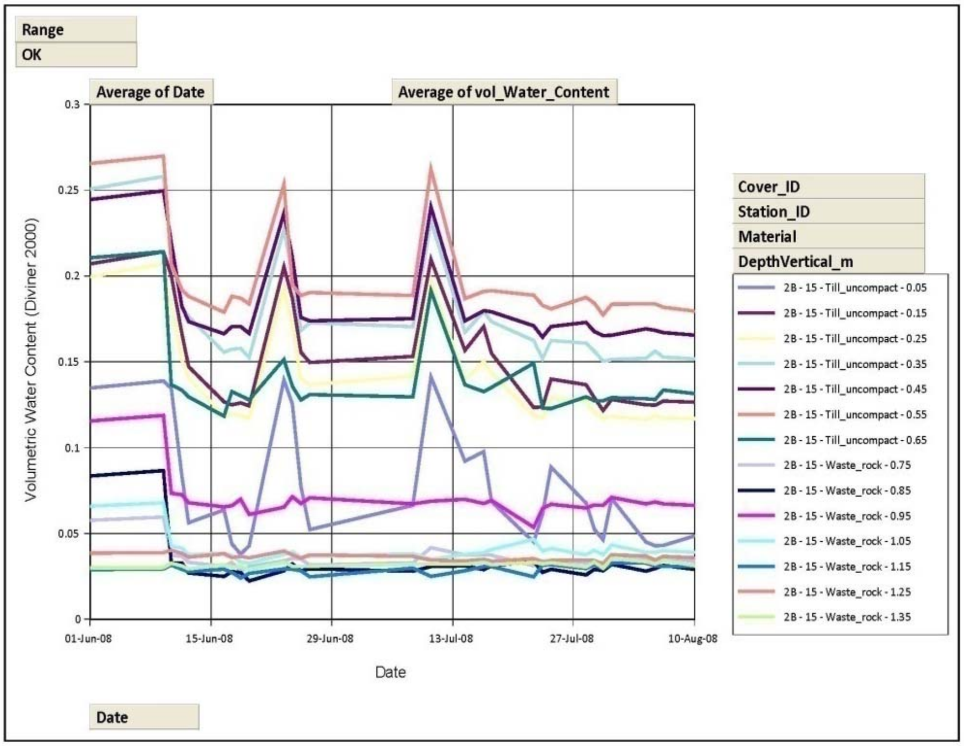

Figure 90: Daily volumetric moisture content in CT#2B (Station #15) measured manually by a Sentek Diviner 2000.

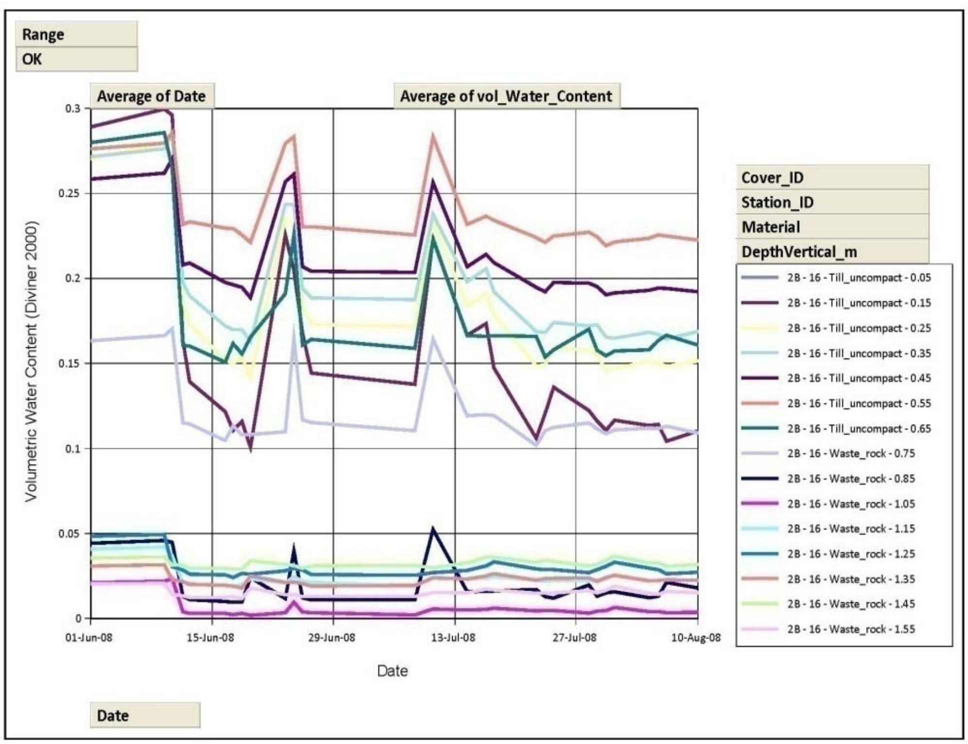

Figure 91: Daily volumetric moisture content in CT#2B (Station #16) measured manually by a Sentek Diviner 2000.

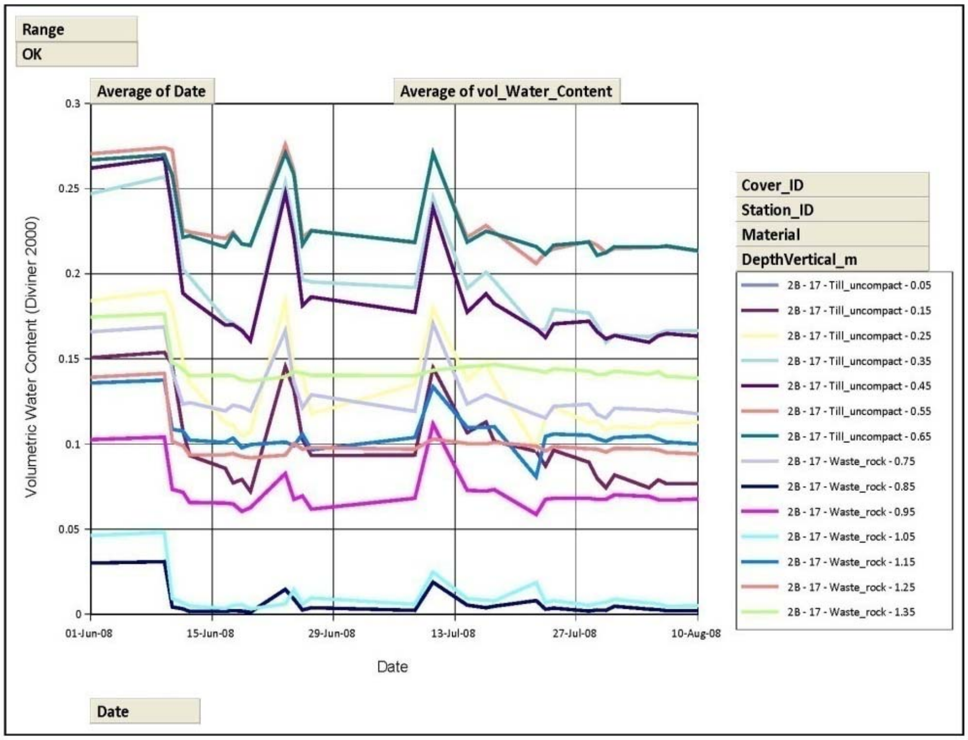

Figure 92: Daily volumetric moisture content in CT#2B (Station #17) measured manually by a Sentek Diviner 2000.

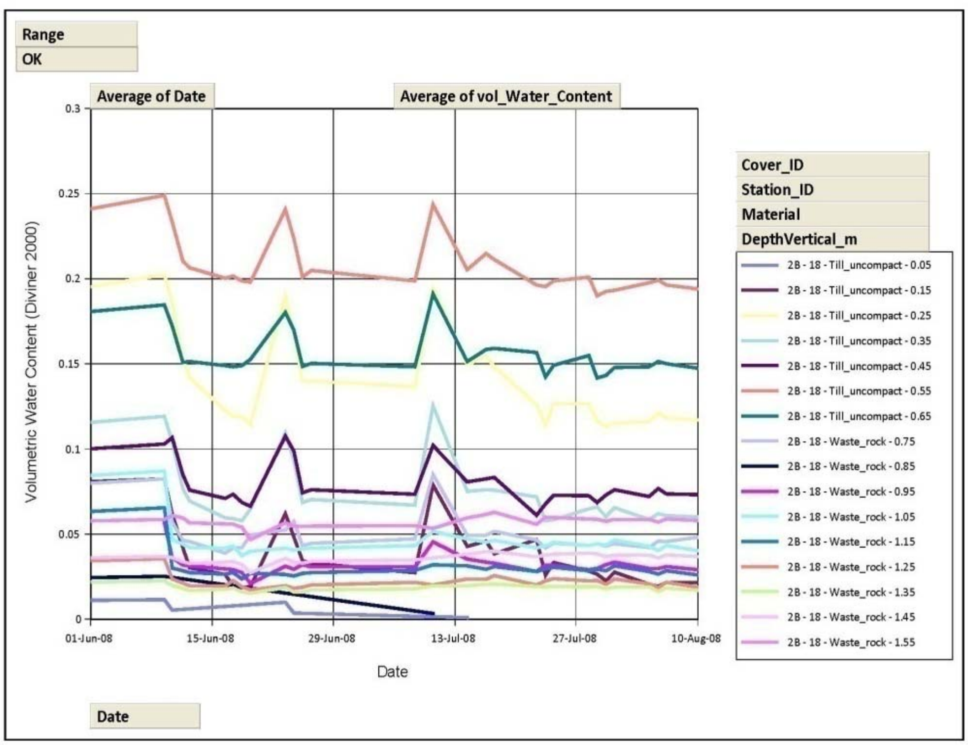

Figure 93: Daily volumetric moisture content in CT#2B (Station #18) measured manually by a Sentek Diviner 2000.

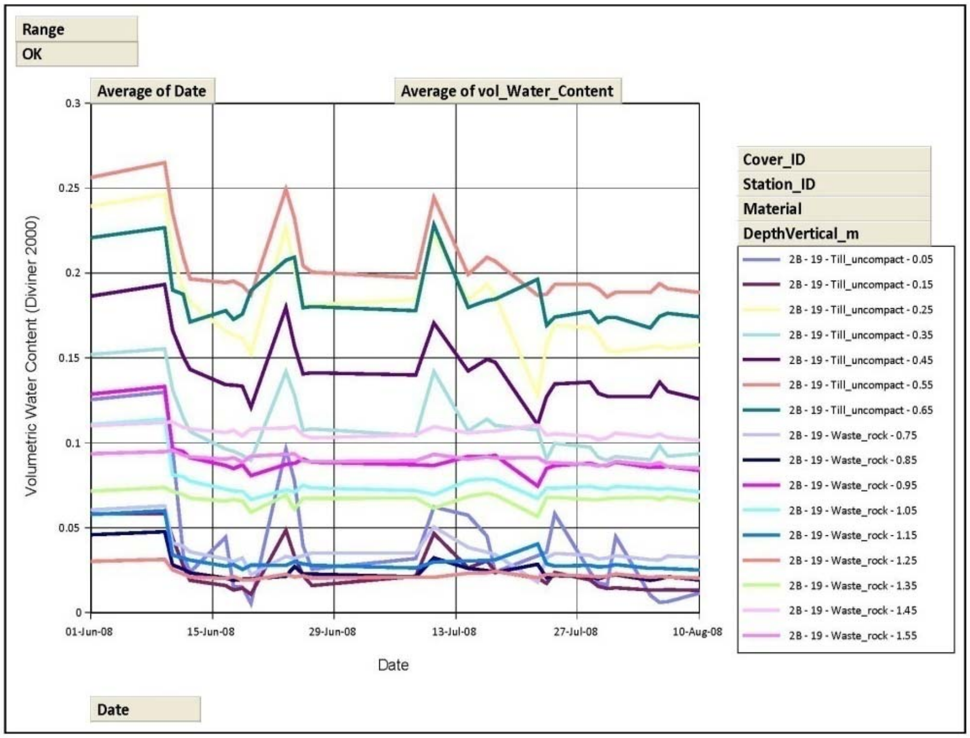

Figure 94: Daily volumetric moisture content in CT#2B (Station #19) measured manually by a Sentek Diviner 2000.

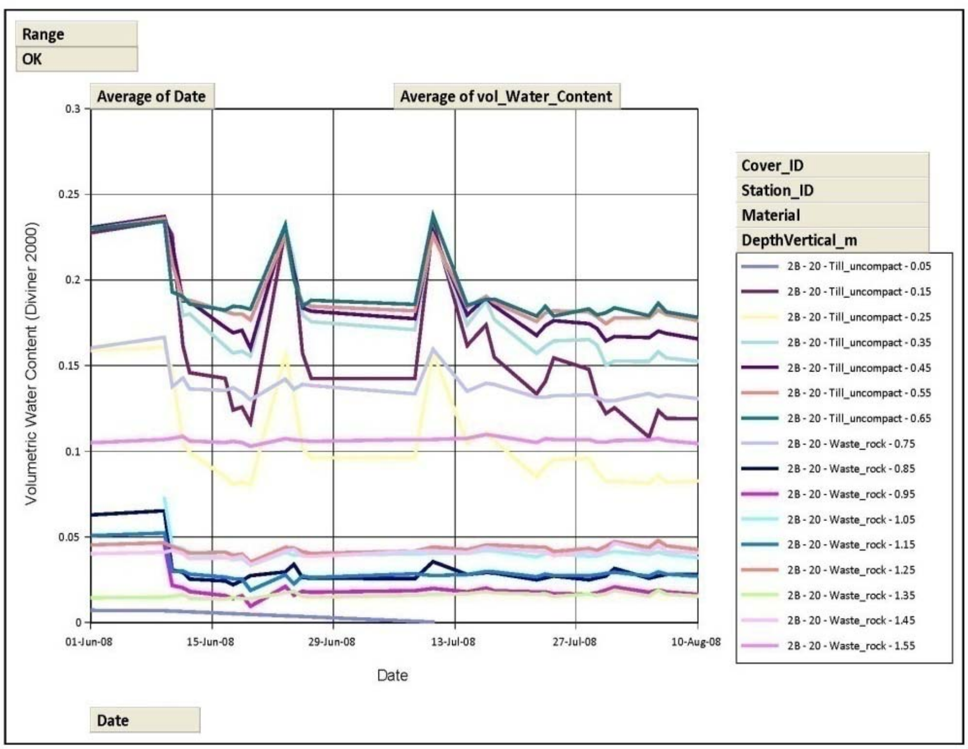

Figure 95: Daily volumetric moisture content in CT#2B (Station #20) measured manually by a Sentek Diviner 2000.

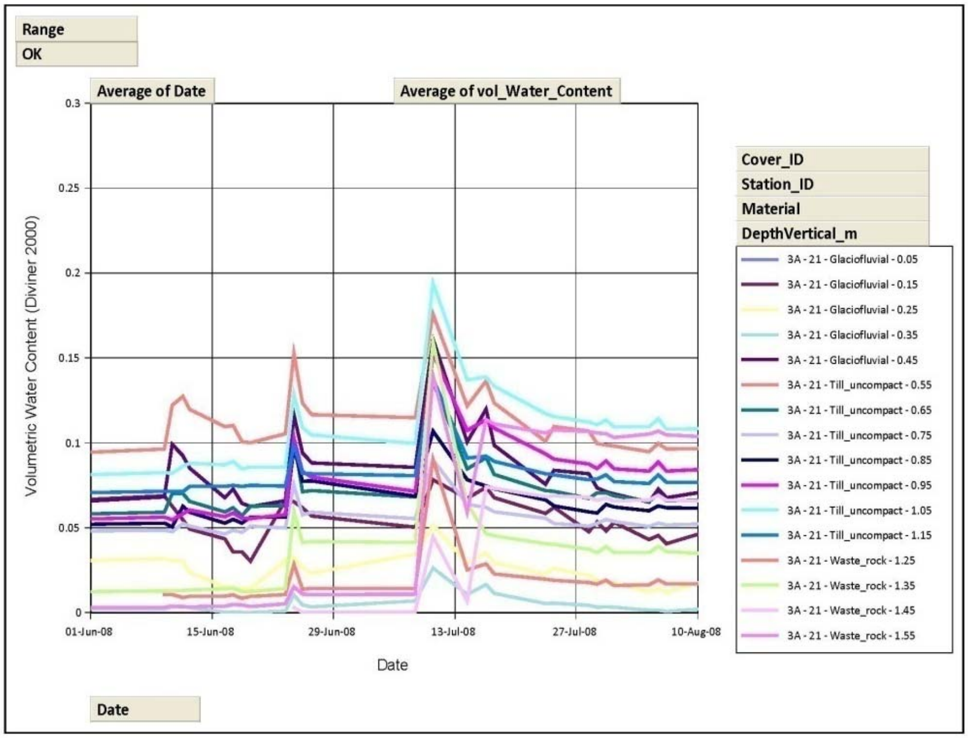

Figure 96: Daily volumetric moisture content in CT#3A (Station #21) measured manually by a Sentek Diviner 2000.

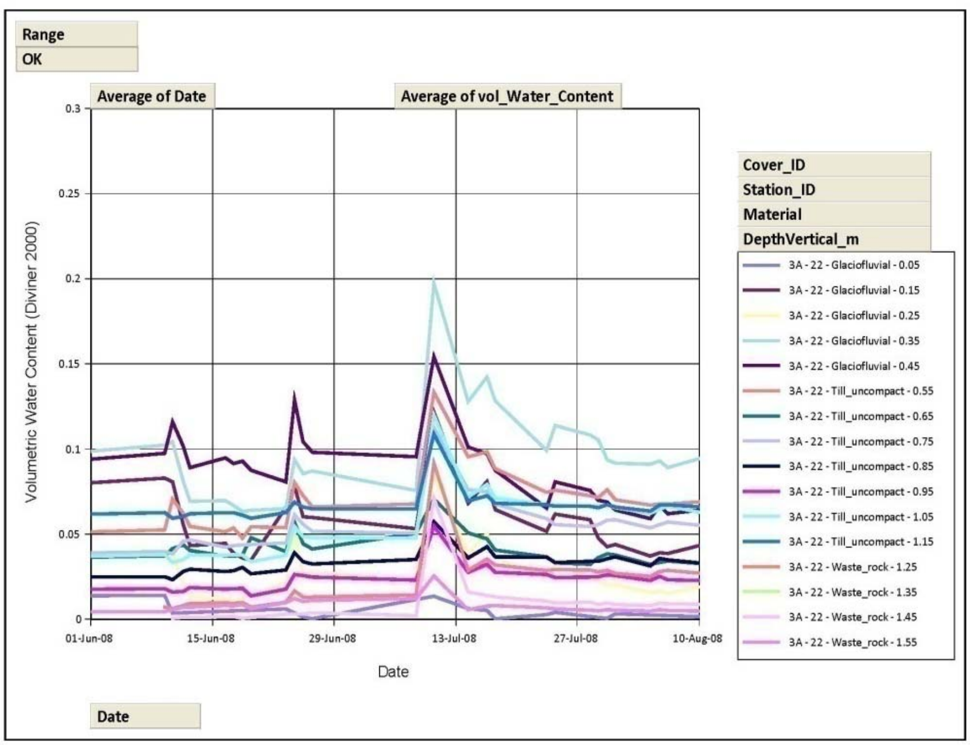

Figure 97: Daily volumetric moisture content in CT#3A (Station #22) measured manually by a Sentek Diviner 2000.

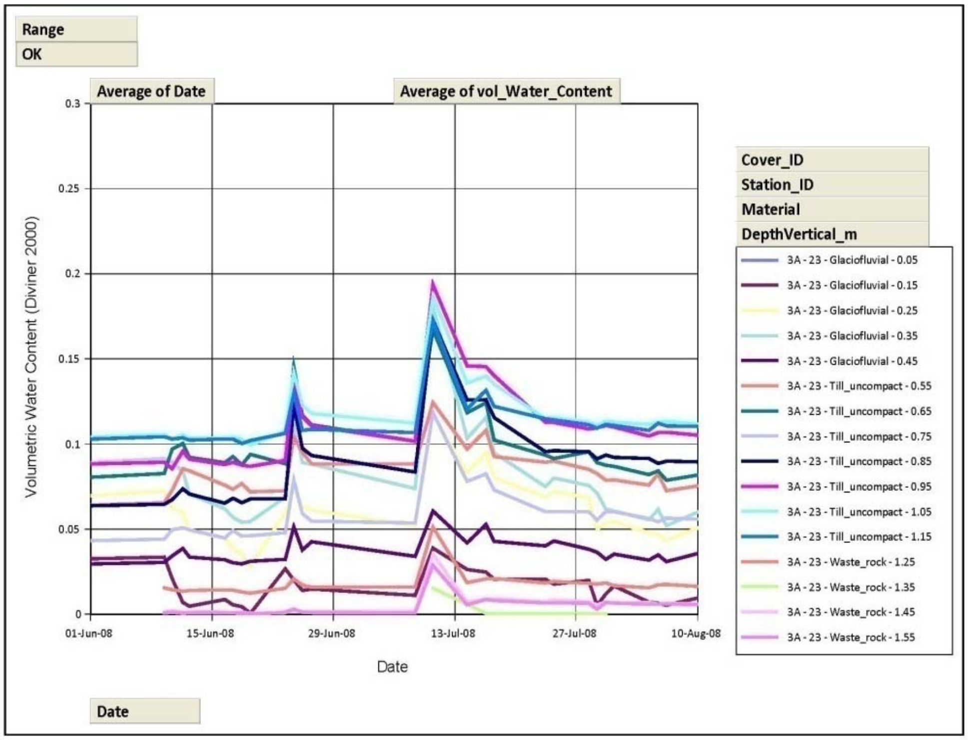

Figure 98: Daily volumetric moisture content in CT#3A (Station #23) measured manually by a Sentek Diviner 2000.

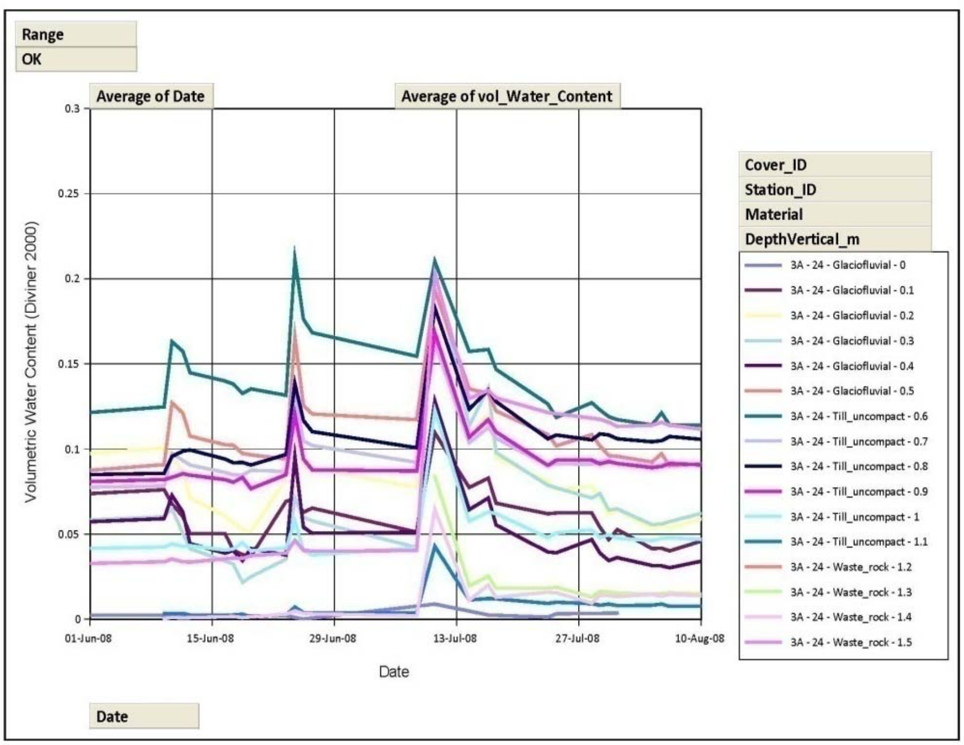

Figure 99: Daily volumetric moisture content in CT#3A (Station #24) measured manually by a Sentek Diviner 2000.

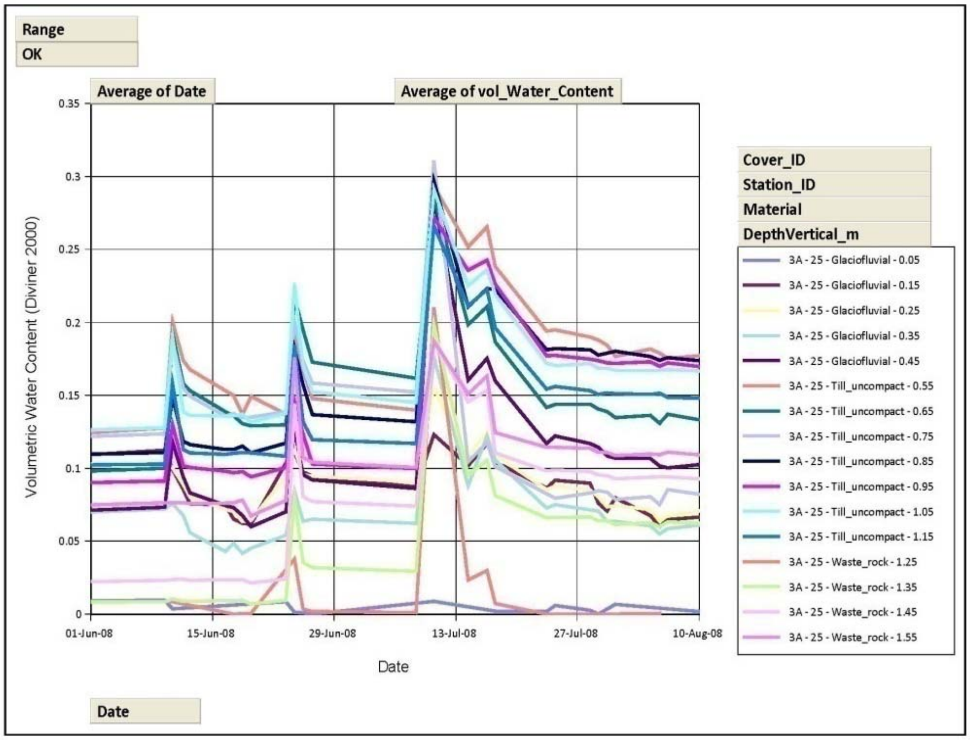

Figure 100: Daily volumetric moisture content in CT#3A (Station #25) measured manually by a Sentek Diviner 2000.

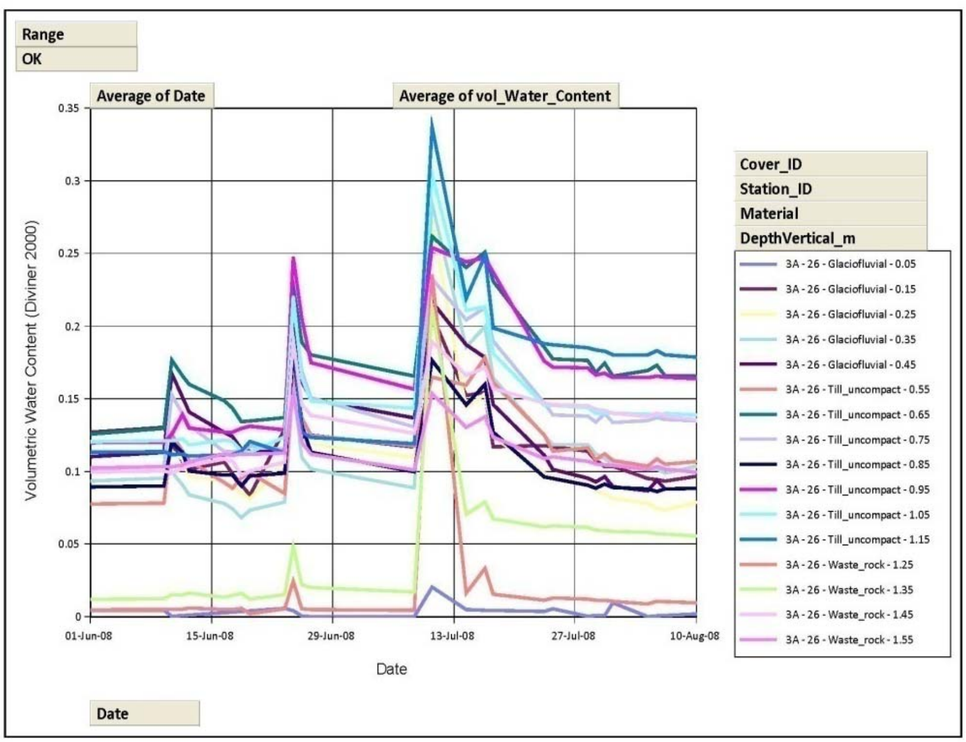

Figure 101: Daily volumetric moisture content in CT#3A (Station #26) measured manually by a Sentek Diviner 2000.

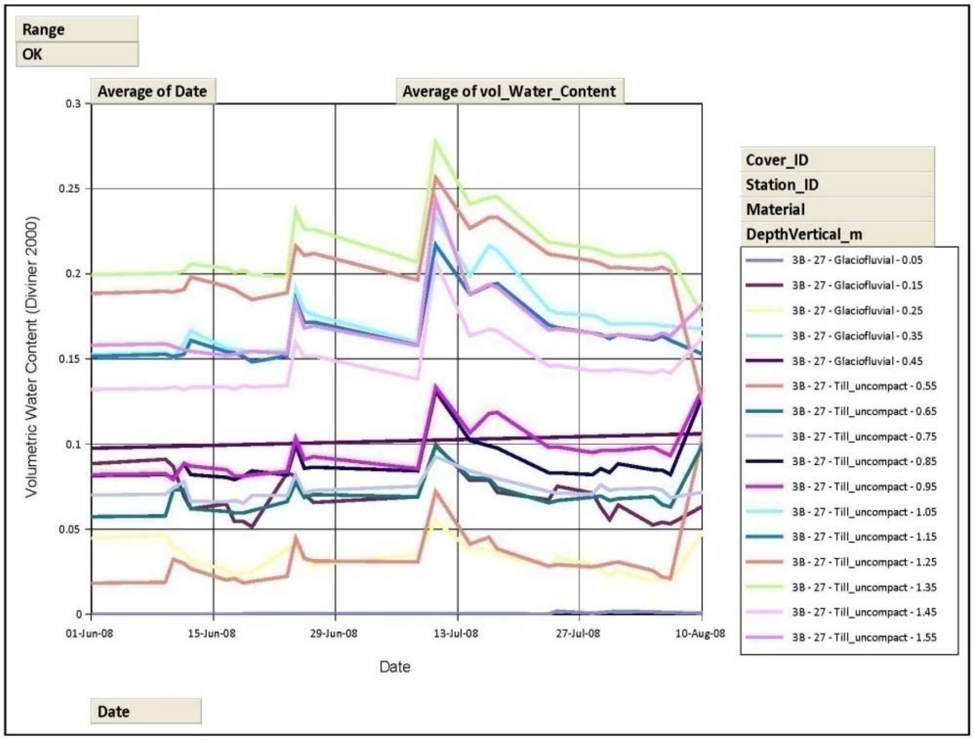

Figure 102: Daily volumetric moisture content in CT#3B (Station #27) measured manually by a Sentek Diviner 2000.

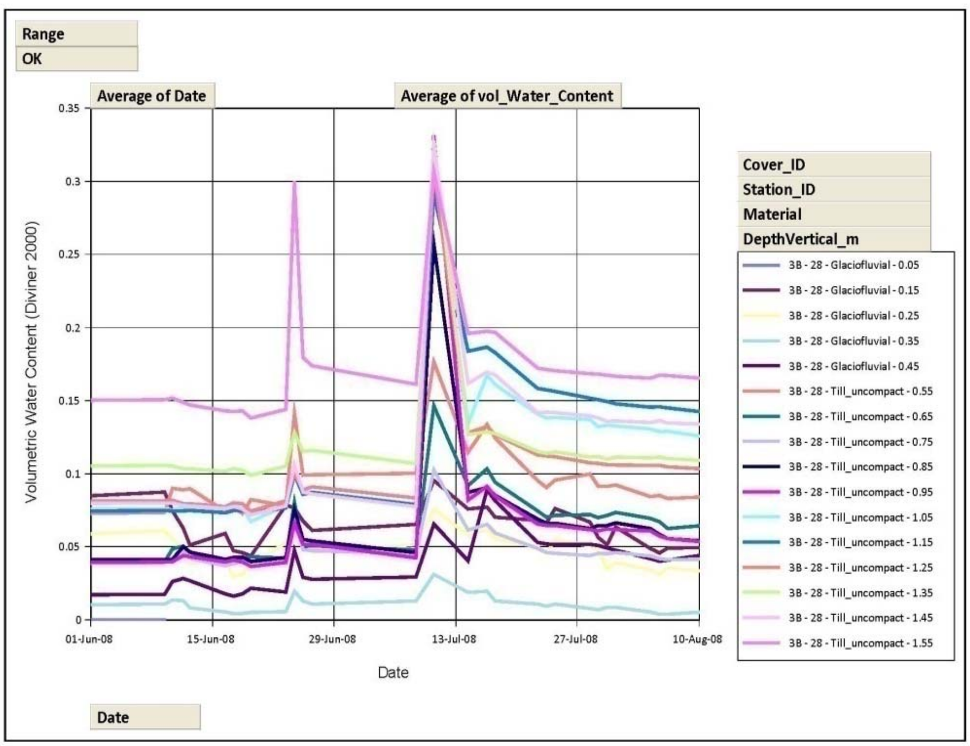

Figure 103: Daily volumetric moisture content in CT#3B (Station #28) measured manually by a Sentek Diviner 2000.

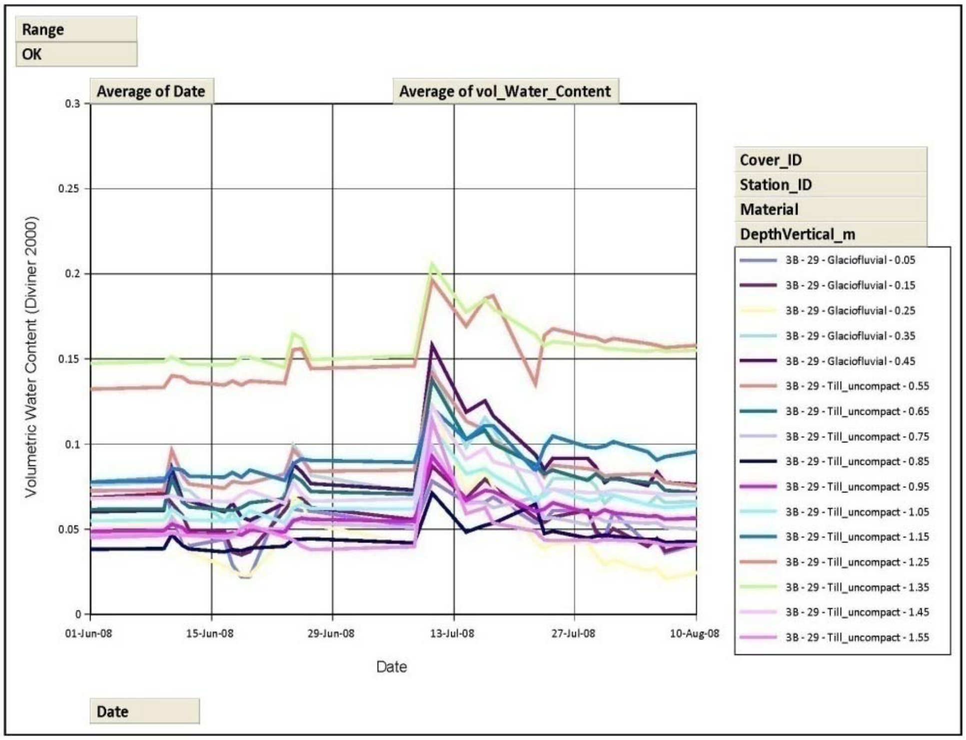

Figure 104: Daily volumetric moisture content in CT#3B (Station #29) measured manually by a Sentek Diviner 2000.

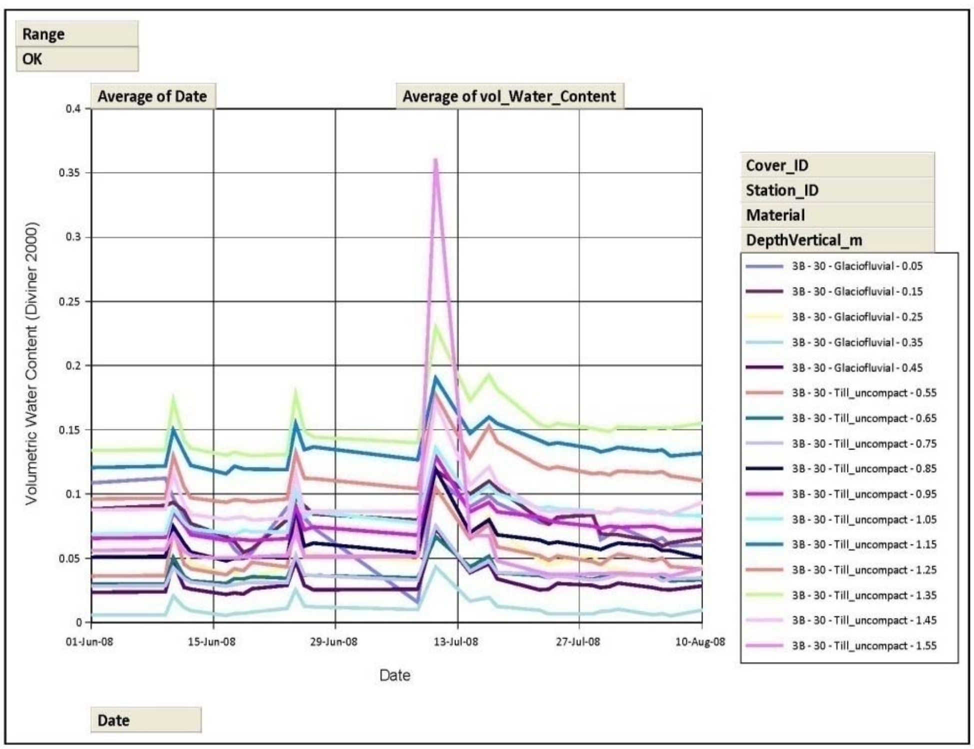

Figure 105: Daily volumetric moisture content in CT#3B (Station #30) measured manually by a Sentek Diviner 2000.

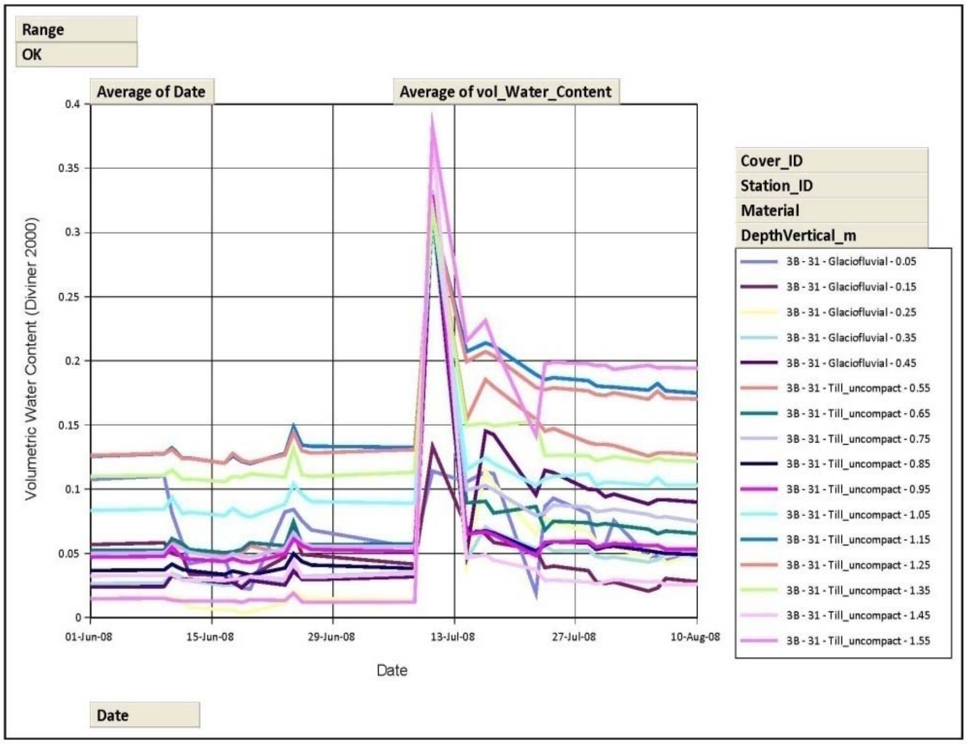

Figure 106: Daily volumetric moisture content in CT#3B (Station #31) measured manually by a Sentek Diviner 2000.

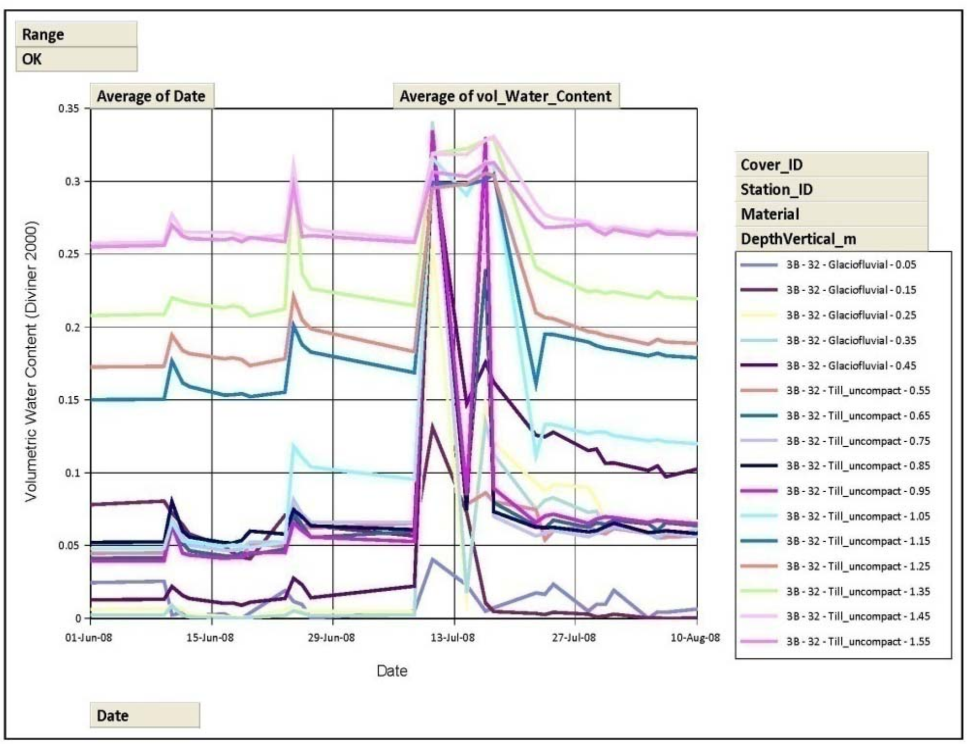

Figure 107: Daily volumetric moisture content in CT#3B (Station #32) measured manually by a Sentek Diviner 2000.

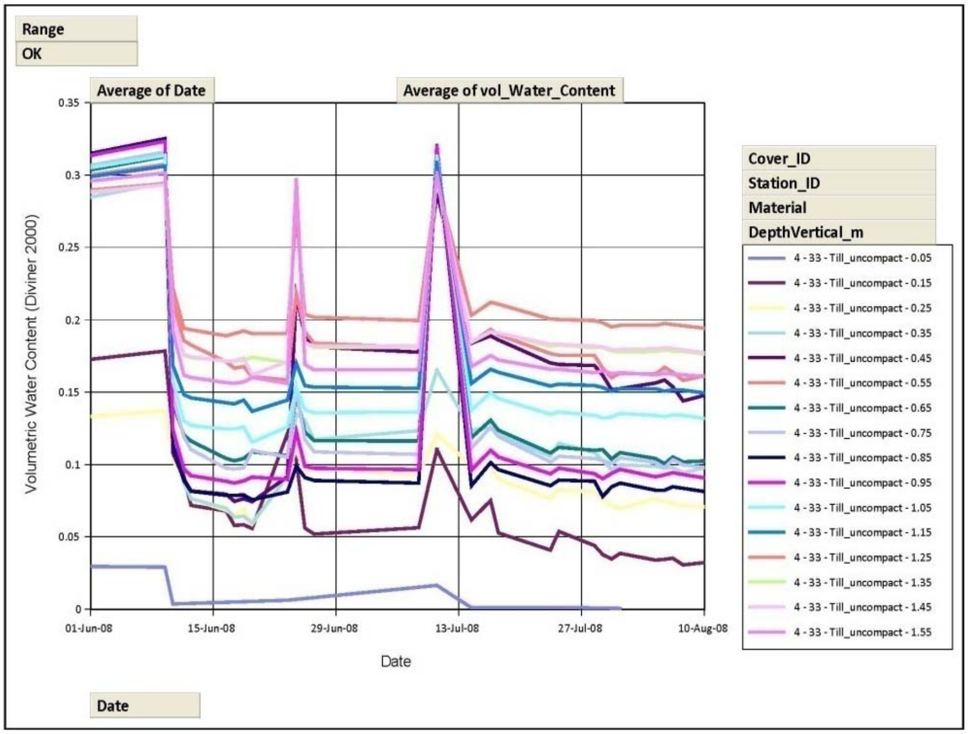

Figure 108: Daily volumetric moisture content in CT#4 (Station #33) measured manually by a Sentek Diviner 2000.

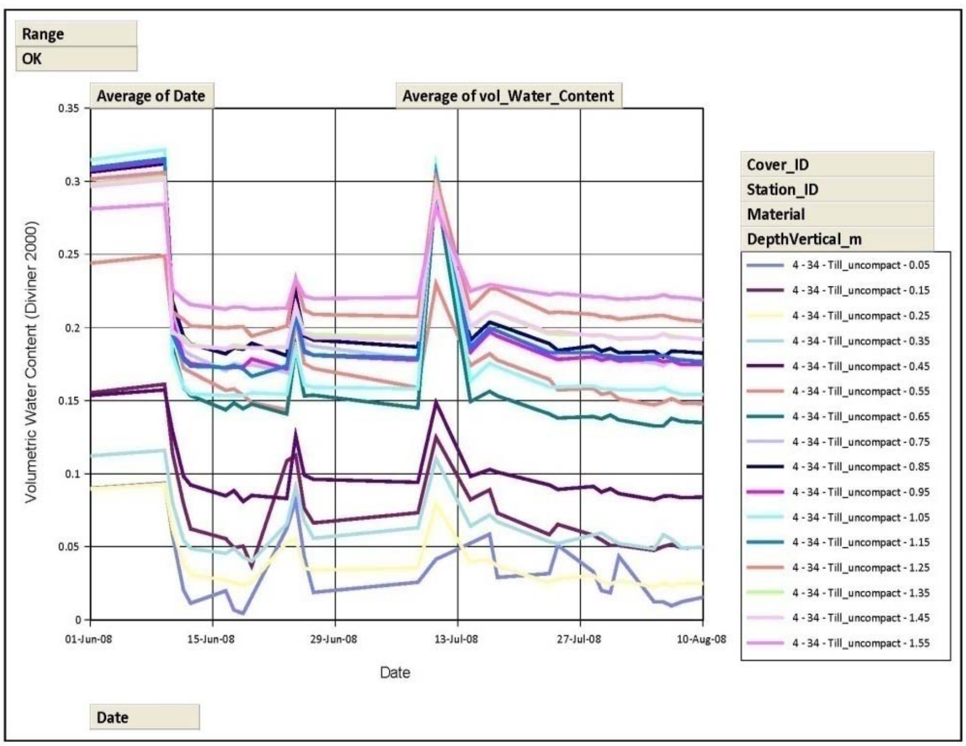

Figure 109: Daily volumetric moisture content in CT#4 (Station #34) measured manually by a Sentek Diviner 2000.

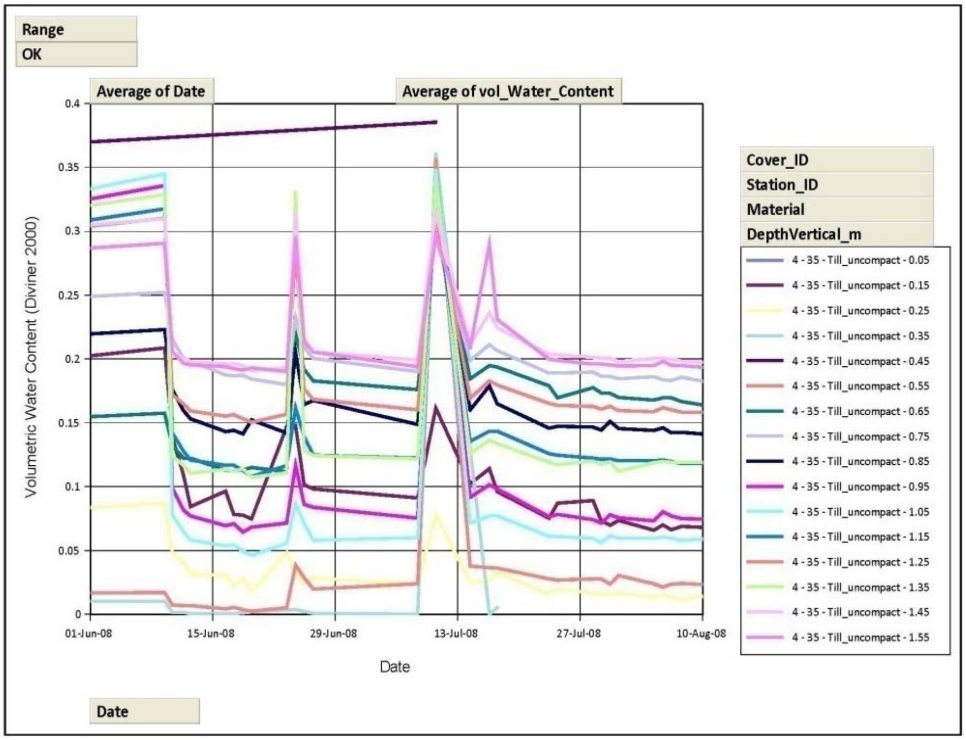

Figure 110: Daily volumetric moisture content in CT#4 (Station #35) measured manually by a Sentek Diviner 2000.

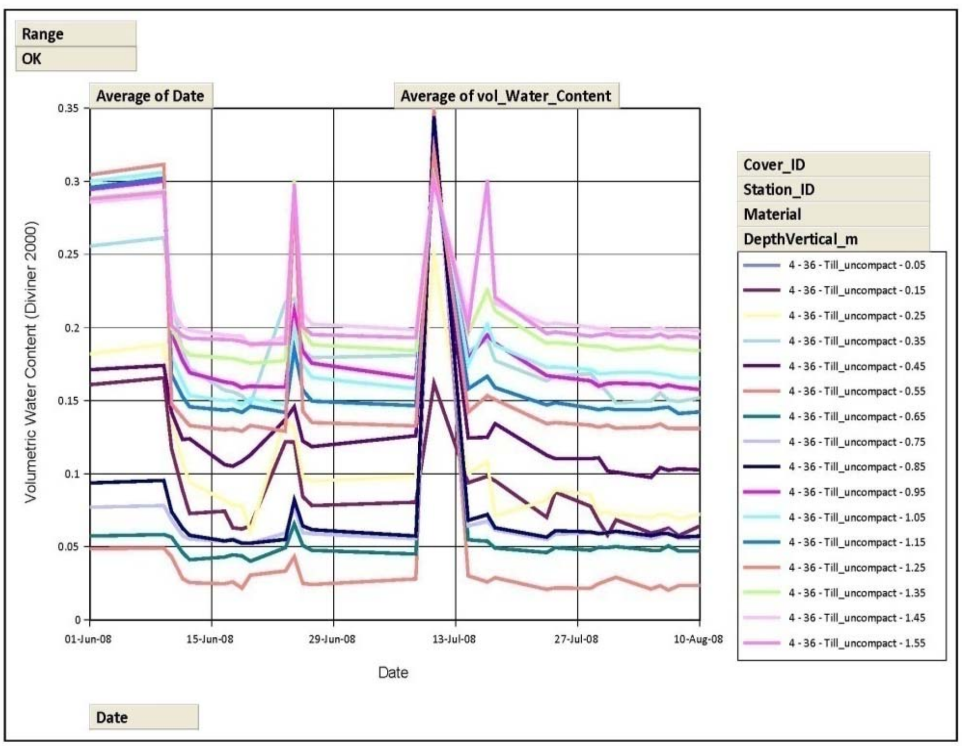

Figure 111: Daily volumetric moisture content in CT#4 (Station #36) measured manually by a Sentek Diviner 2000.

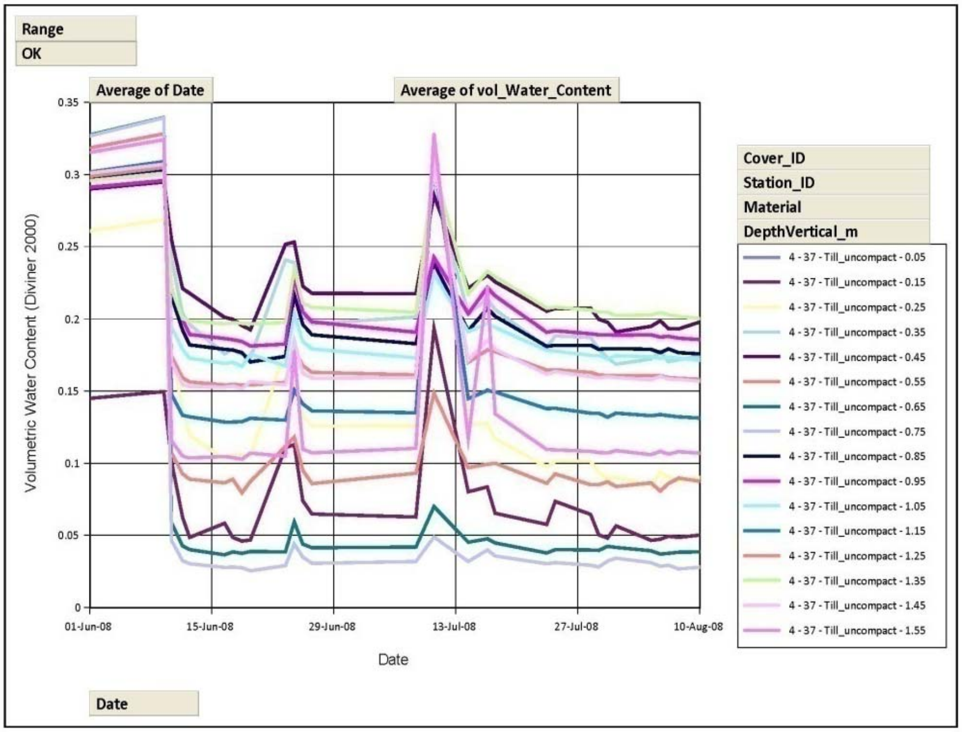

Figure 112: Daily volumetric moisture content in CT#4 (Station #37) measured manually by a Sentek Diviner 2000.

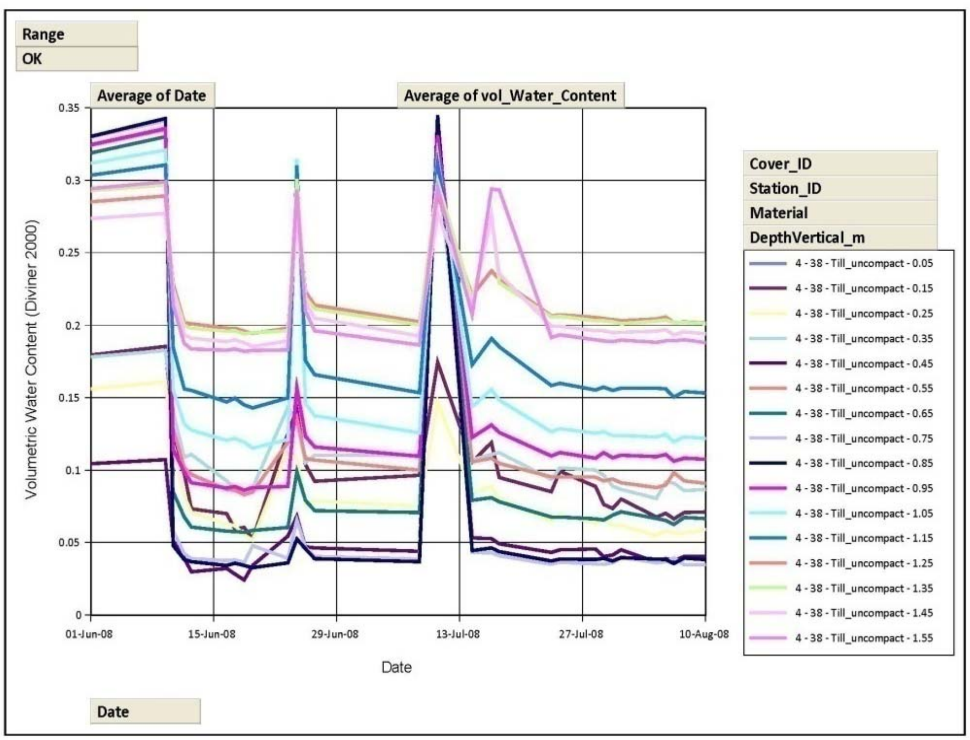

Figure 113: Daily volumetric moisture content in CT#4 (Station #38) measured manually by a Sentek Diviner 2000.

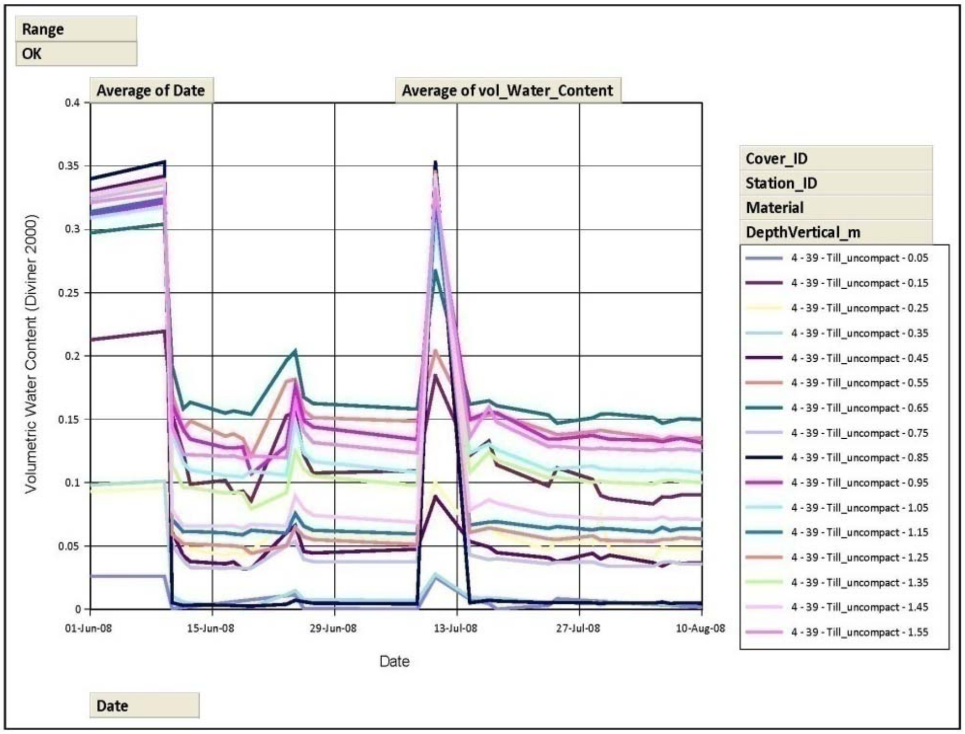

Figure 114: Daily volumetric moisture content in CT#4 (Station #39) measured manually by a Sentek Diviner 2000.

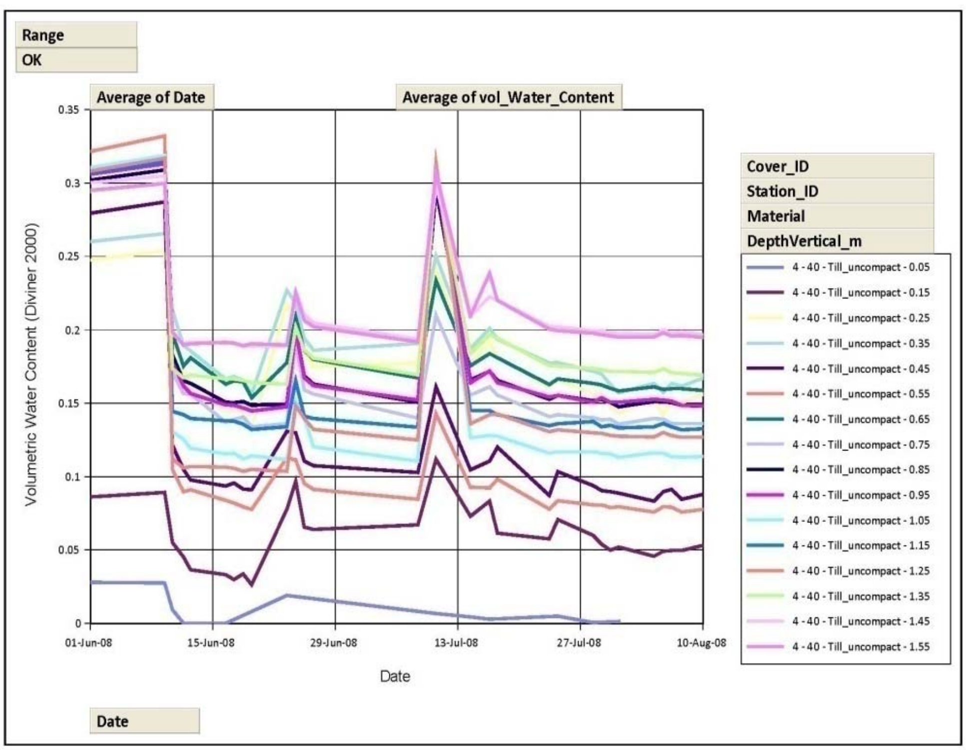

Figure 115: Daily volumetric moisture content in CT#4 (Station #40) measured manually by a Sentek Diviner 2000.

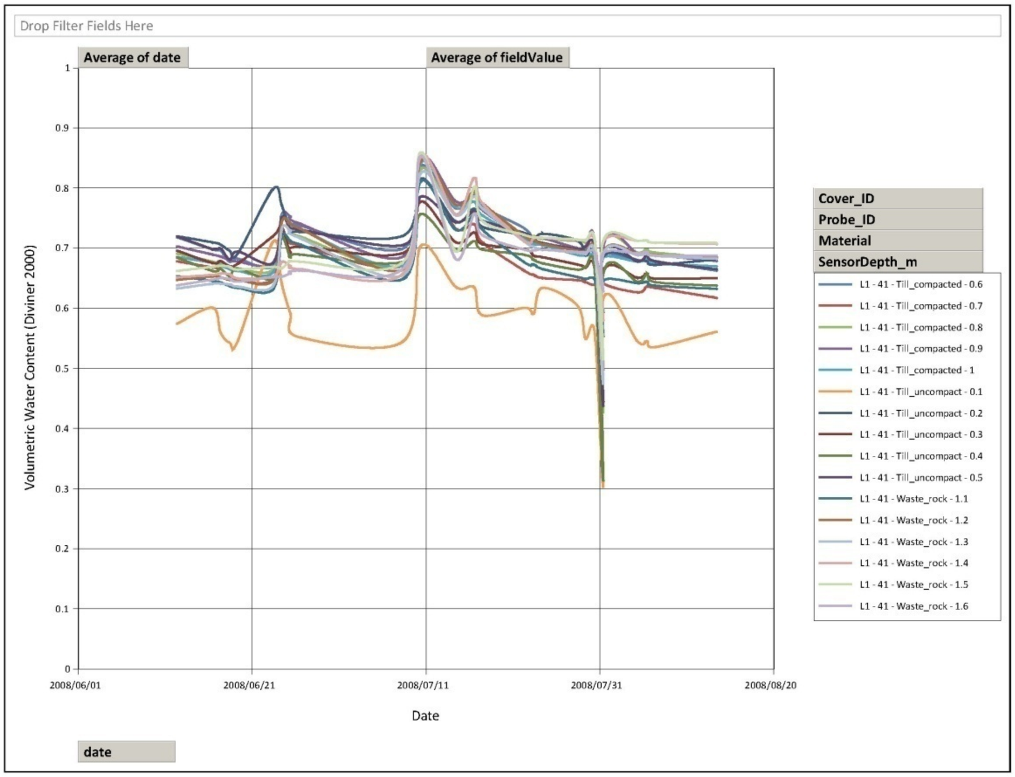

Figure 116: Daily volumetric moisture content in L1 (Station #41) measured manually by a Sentek Diviner 2000.

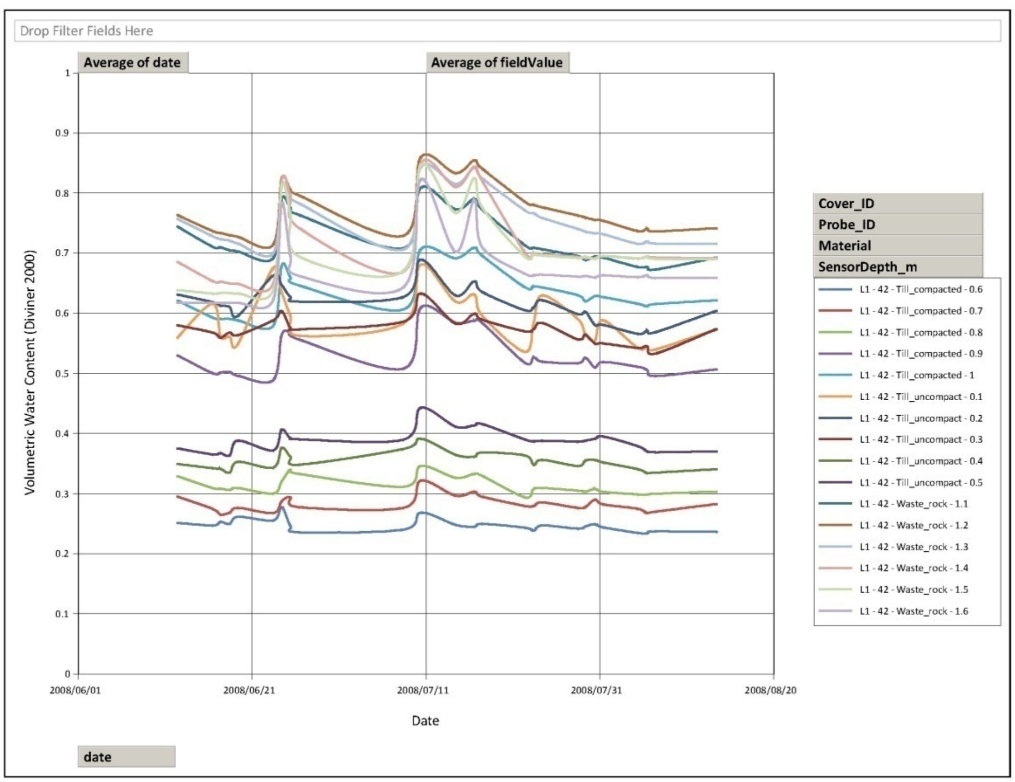

Figure 117: Daily volumetric moisture content in L1 (Station #42) measured manually by a Sentek Diviner 2000.

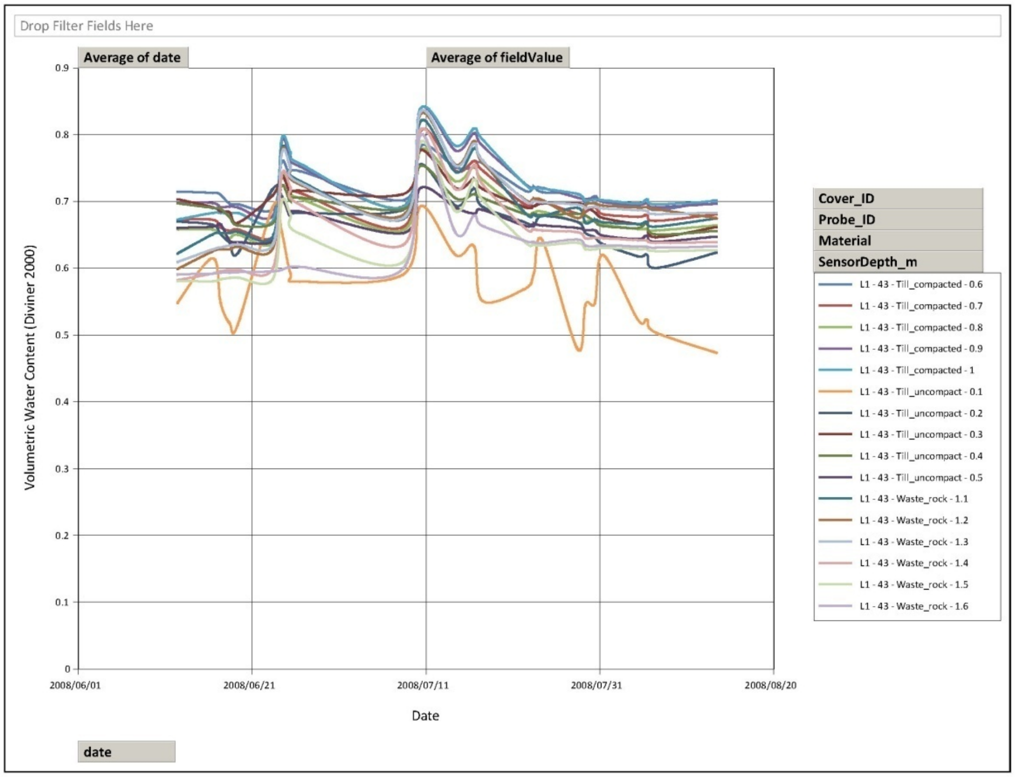

Figure 118: Daily volumetric moisture content in L1 (Station #43) measured manually by a Sentek Diviner 2000.

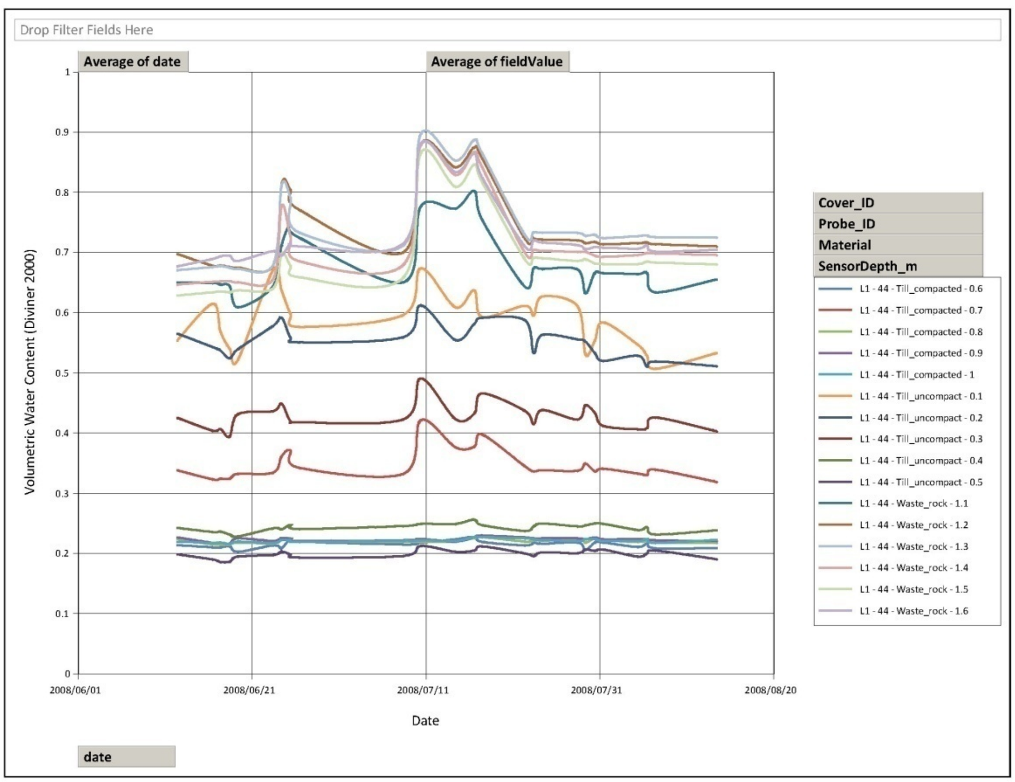

Figure 119: Daily volumetric moisture content in L1 (Station #44) measured manually by a Sentek Diviner 2000.

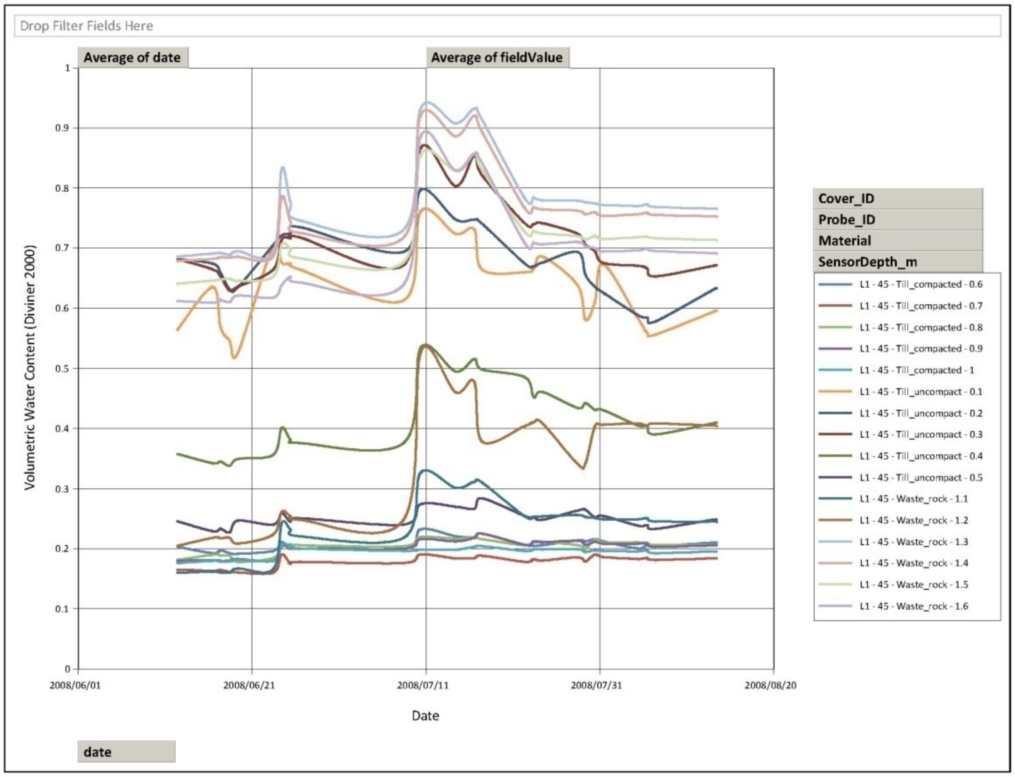

Figure 120: Daily volumetric moisture content in L1 (Station #45) measured manually by a Sentek Diviner 2000.

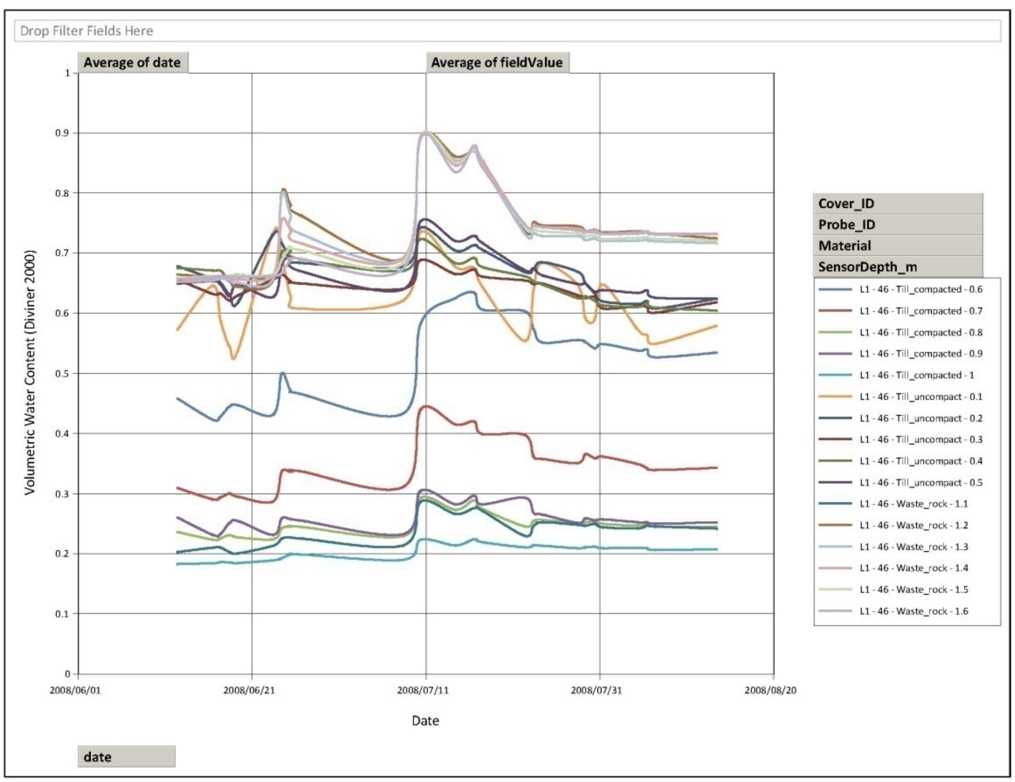

Figure 121: Daily volumetric moisture content in L1 (Station #46) measured manually by a Sentek Diviner 2000.

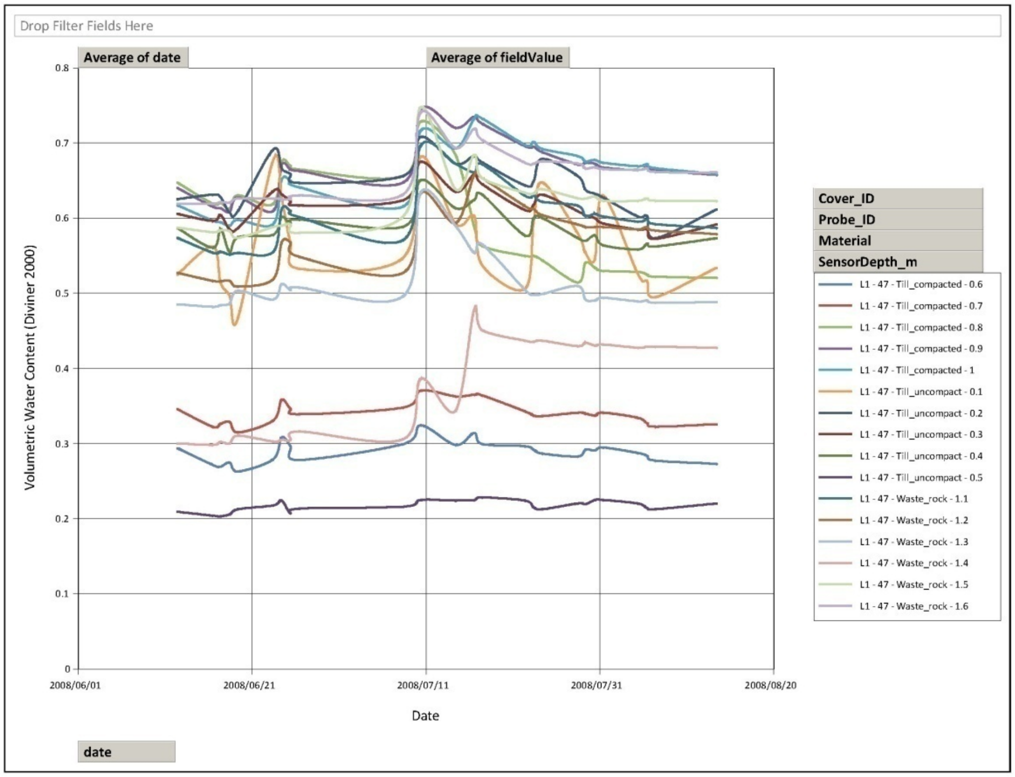

Figure 122: Daily volumetric moisture content in L1 (Station #47) measured manually by a Sentek Diviner 2000.

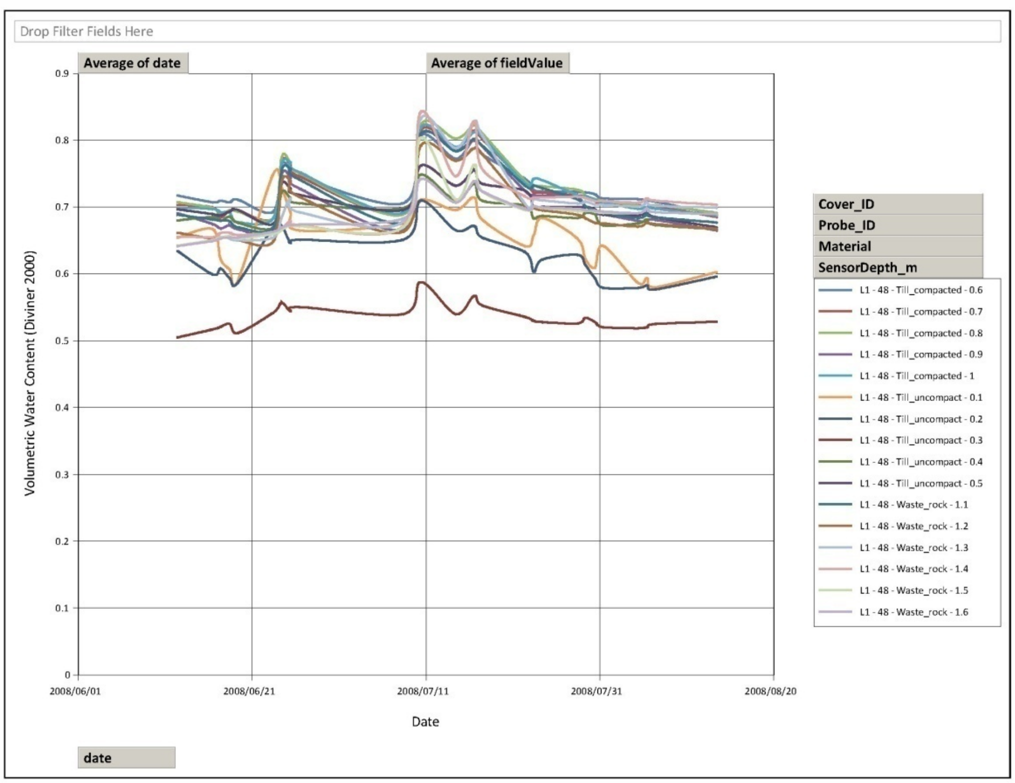

Figure 123: Daily volumetric moisture content in L1 (Station #48) measured manually by a Sentek Diviner 2000.

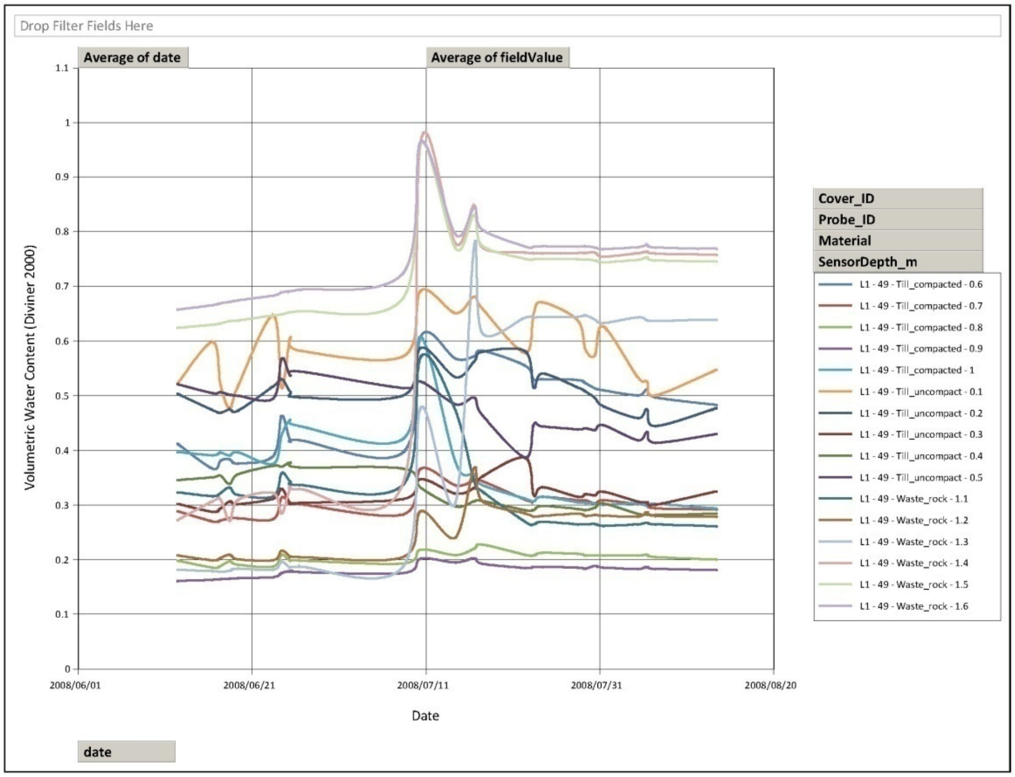

Figure 124: Daily volumetric moisture content in L1(Station #49) measured manually by a Sentek Diviner 2000.

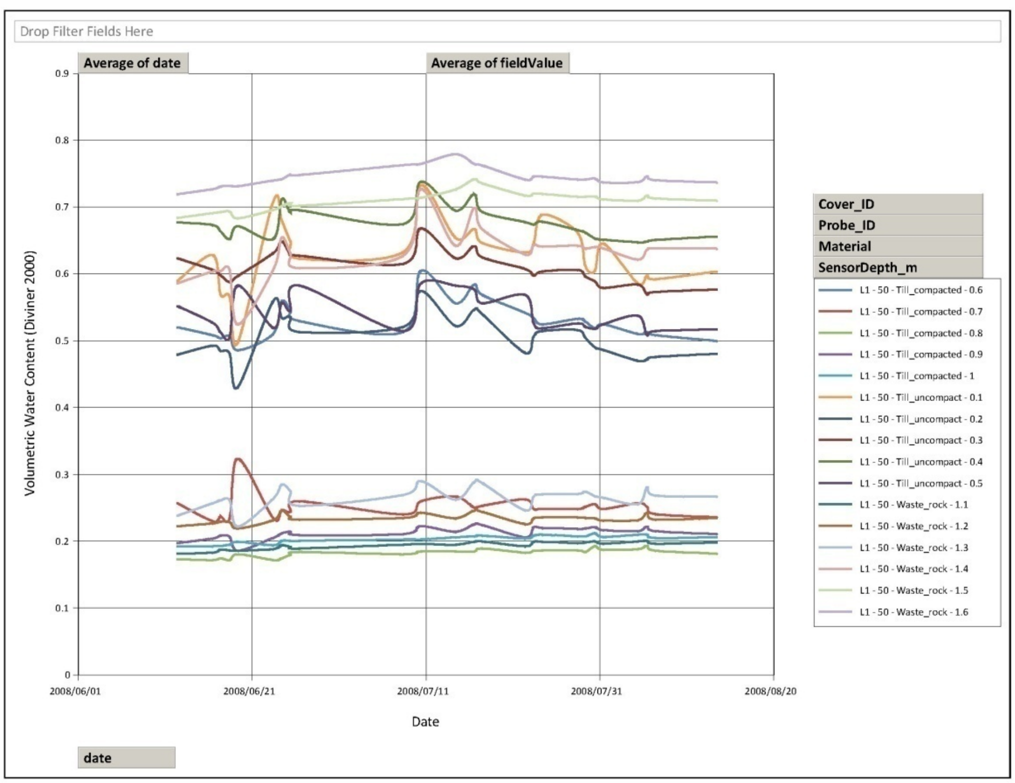

Figure 125: Daily volumetric moisture content in L1 (Station #50) measured manually by a Sentek Diviner 2000.

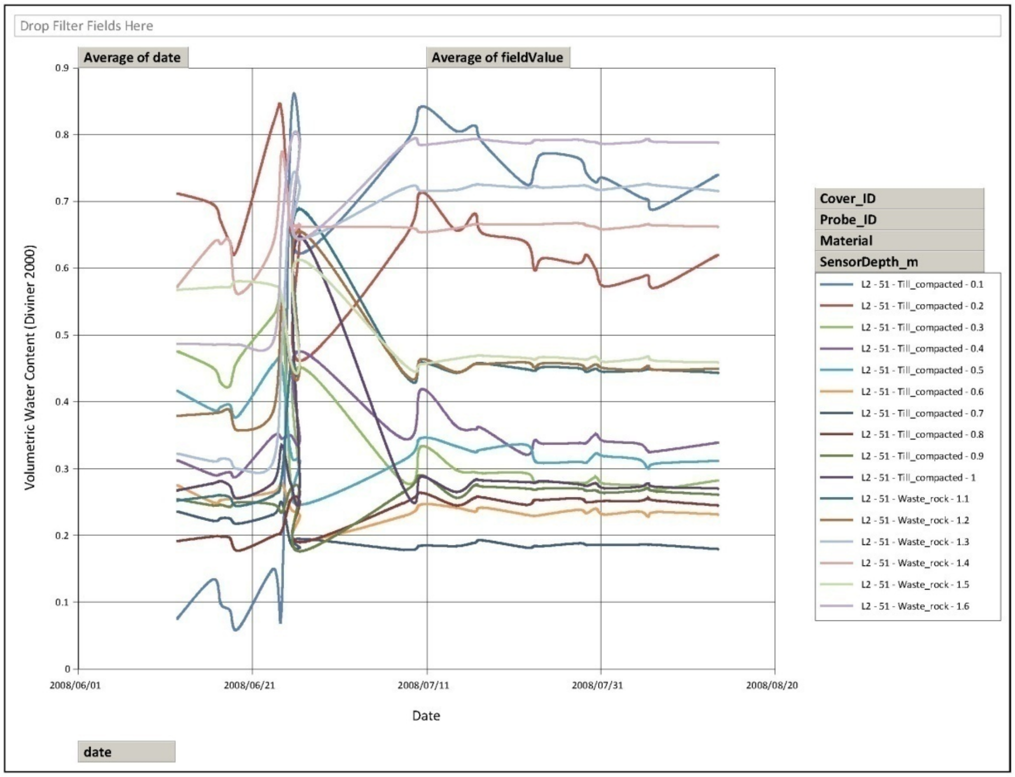

Figure 126: Daily volumetric moisture content in L2 (Station #51) measured manually by a Sentek Diviner 2000.

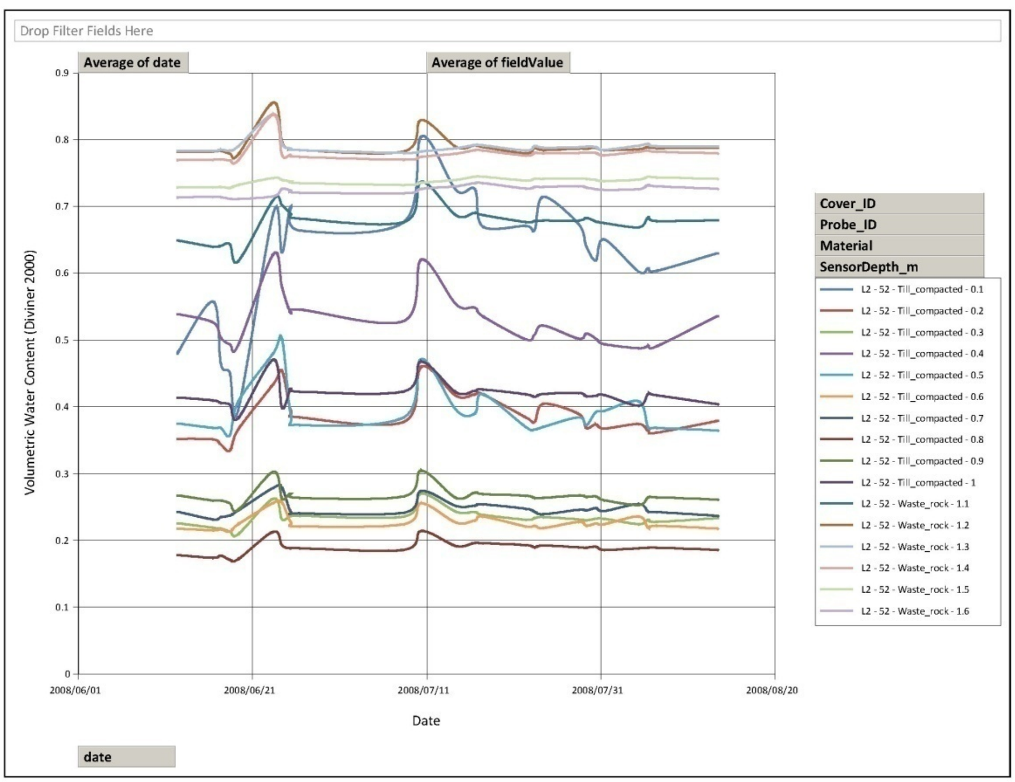

Figure 127: Daily volumetric moisture content in L2 (Station #52) measured manually by a Sentek Diviner 2000.

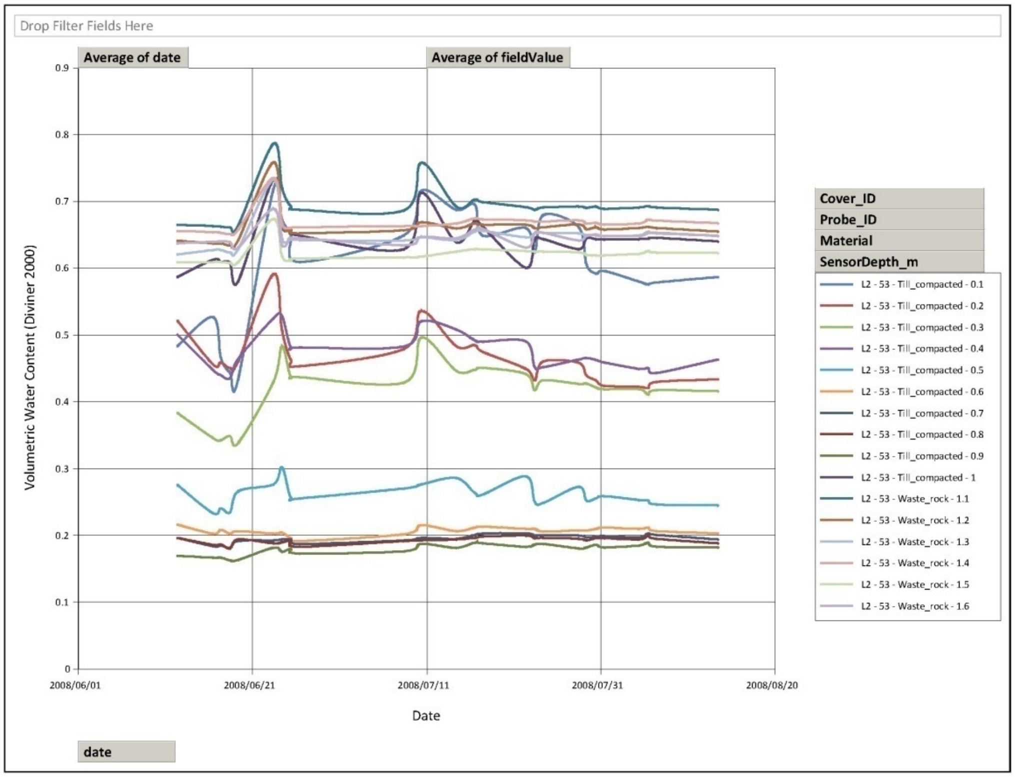

Figure 128: Daily volumetric moisture content in L2 (Station #53) measured manually by a Sentek Diviner 2000.

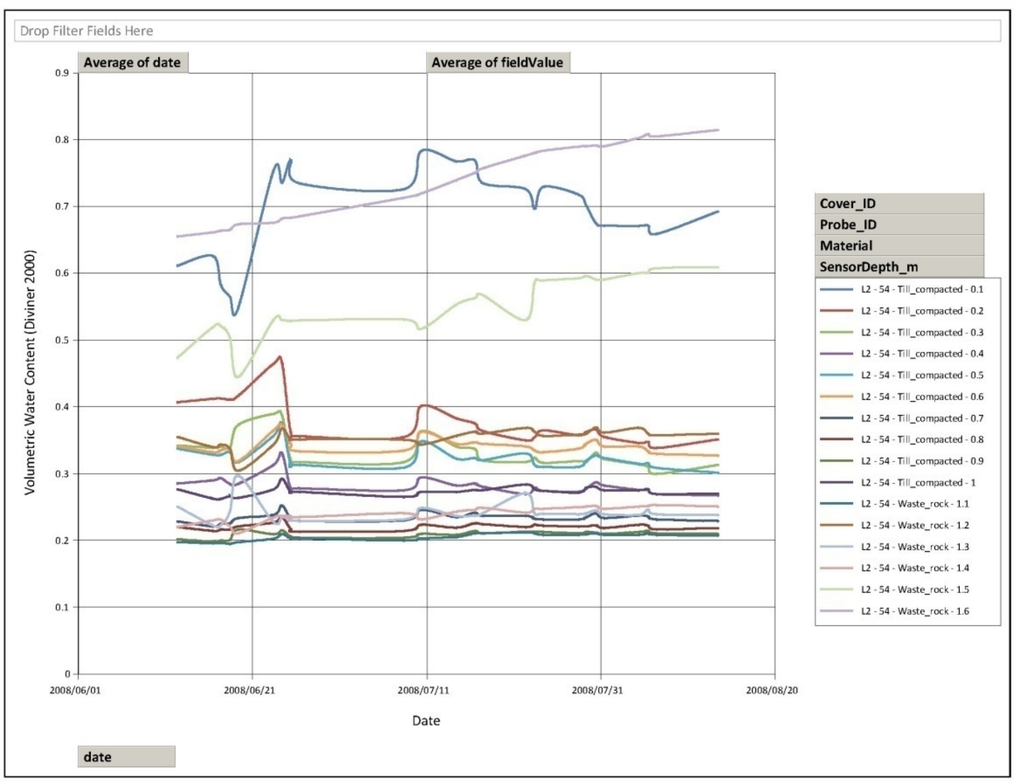

Figure 129: Daily volumetric moisture content in L2 (Station #54) measured manually by a Sentek Diviner 2000.

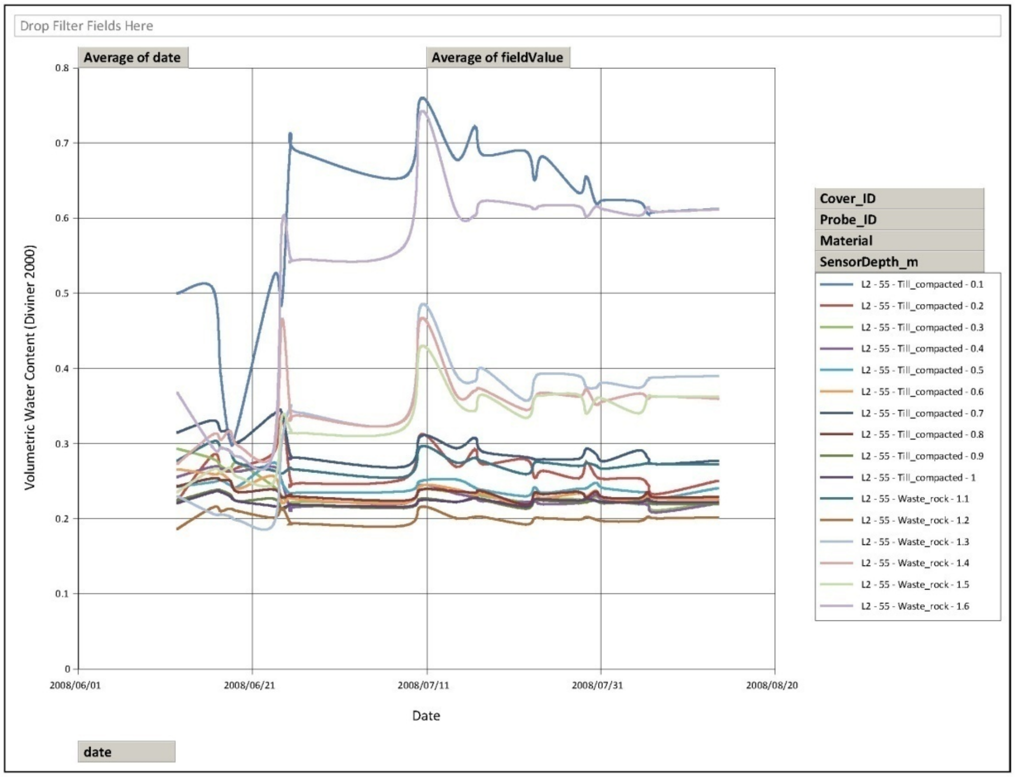

Figure 130: Daily volumetric moisture content in L2 (Station #55) measured manually by a Sentek Diviner 2000.

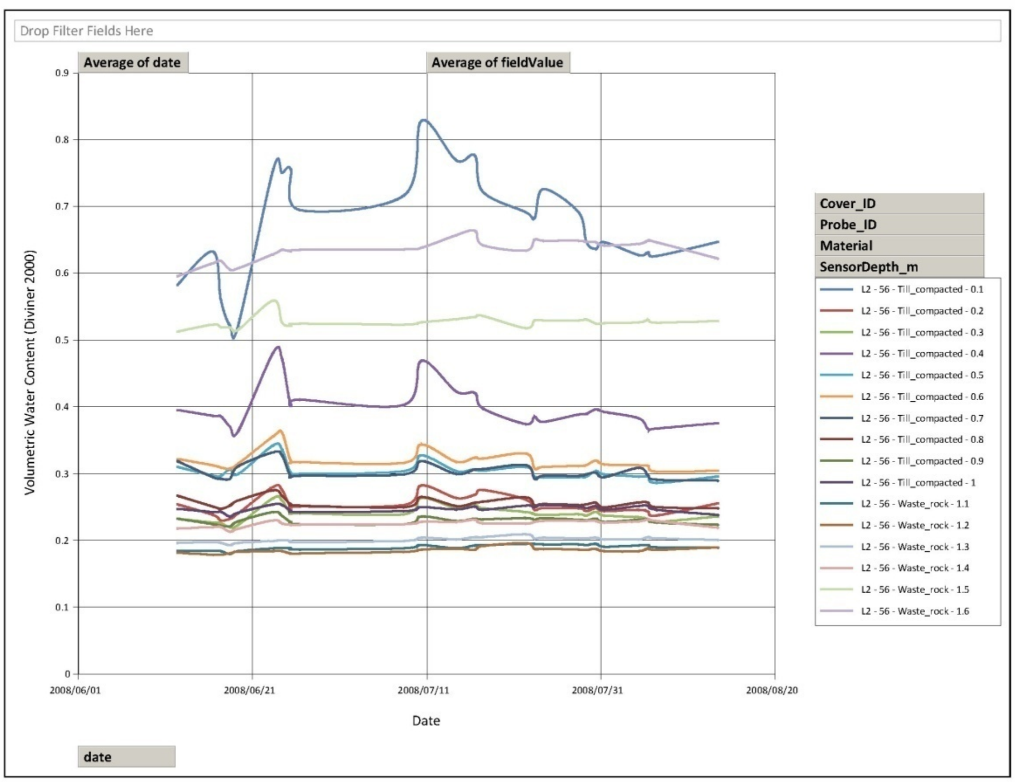

Figure 131: Daily volumetric moisture content in L2 (Station #56) measured manually by a Sentek Diviner 2000.

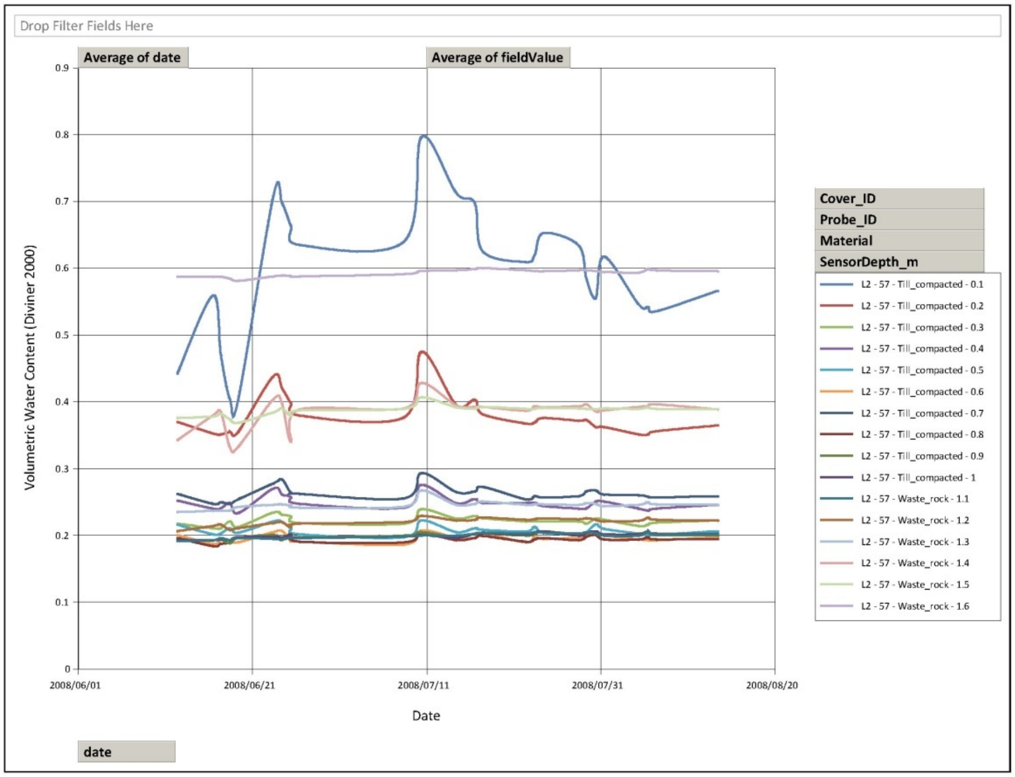

Figure 132: Daily volumetric moisture content in L2 (Station #57) measured manually by a Sentek Diviner 2000.

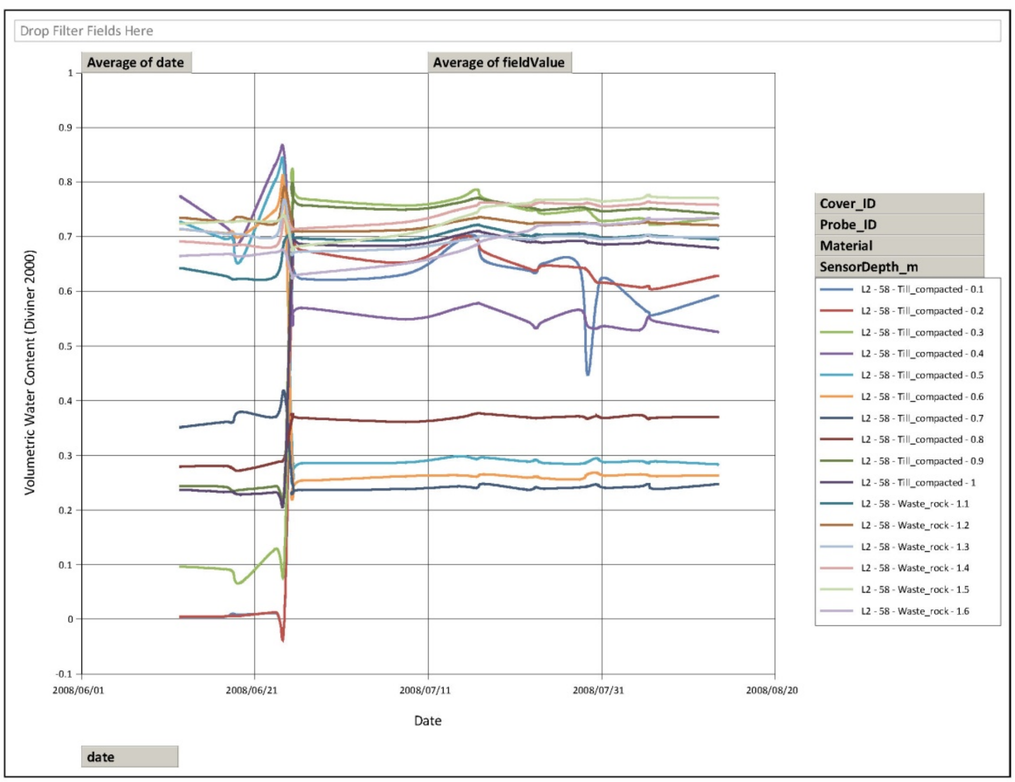

Figure 133: Daily volumetric moisture content in L2 (Station #58) measured manually by a Sentek Diviner 2000.

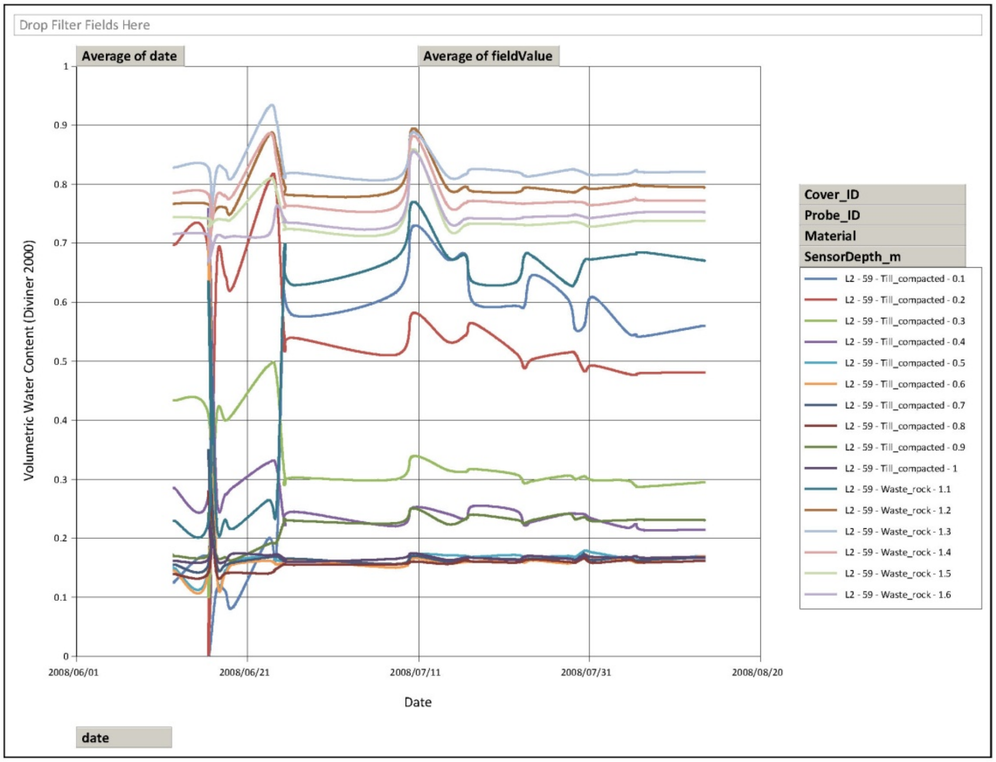

Figure 134: Daily volumetric moisture content in L2 (Station #59) measured manually by a Sentek Diviner 2000.

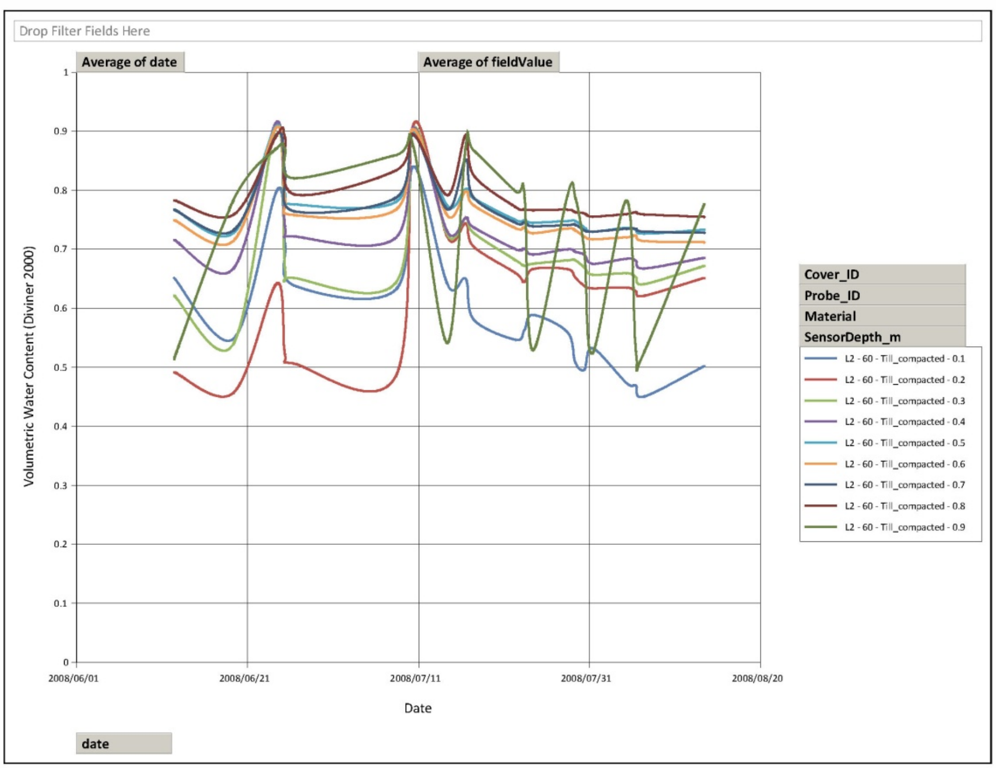

Figure 135: Daily volumetric moisture content in L2 (Station #60) measured manually by a Sentek Diviner 2000.

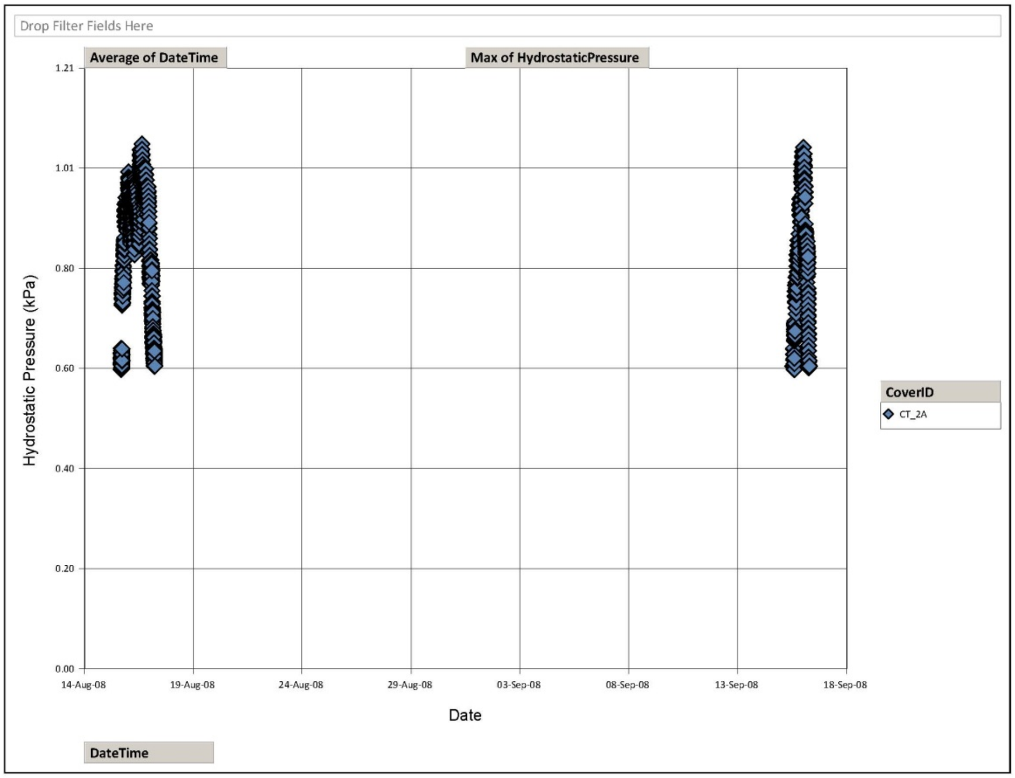

Figure 136: Hydrostatic pressure measured using the HOBO water level logger installed on CT#2A. Only significant values are displayed.

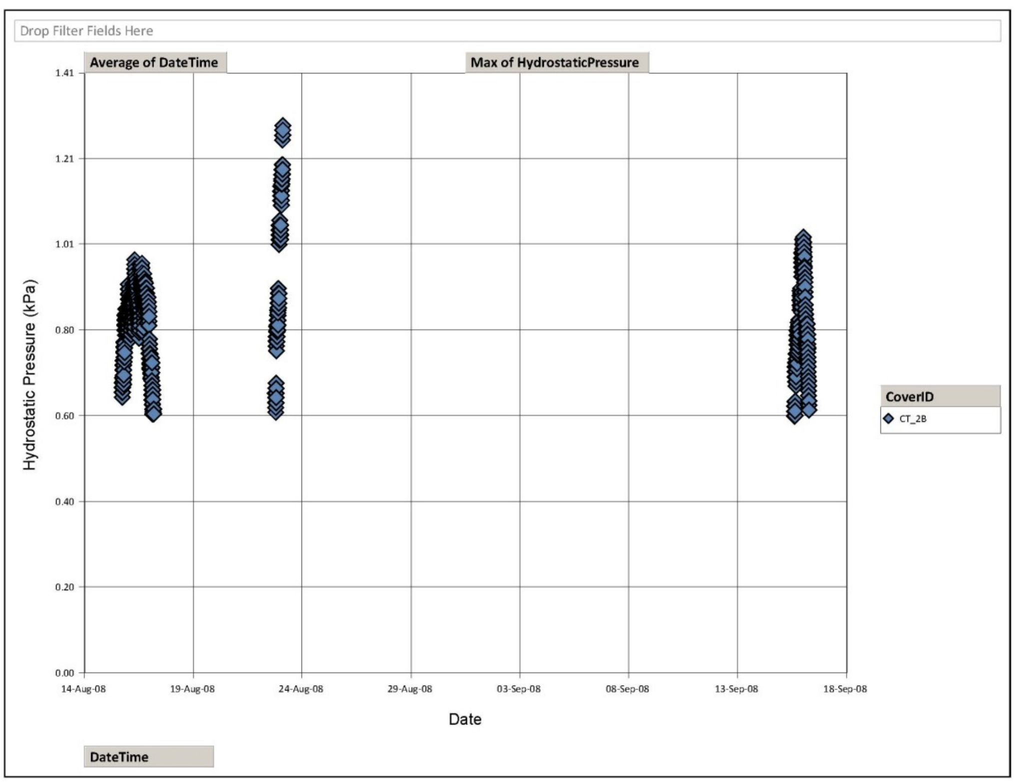

Figure 137: Hydrostatic pressure measured using the HOBO water level logger installed on CT#2B. Only significant values are displayed.

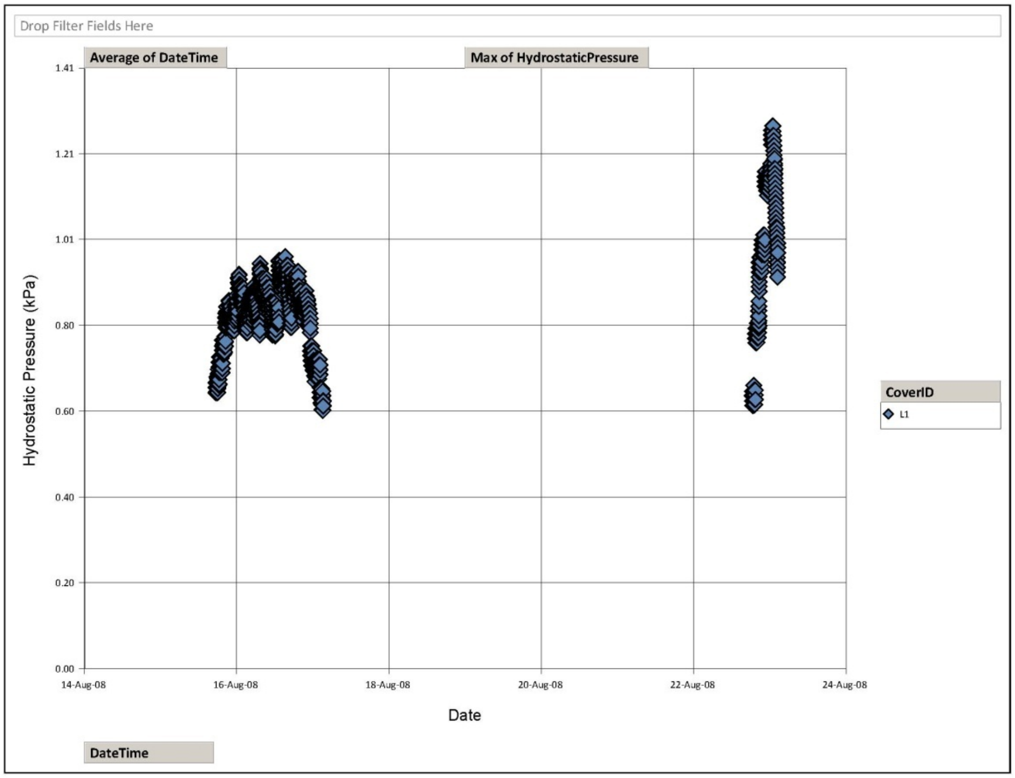

Figure 138: Hydrostatic pressure measured using the HOBO water level logger installed on L#1. Only significant values are displayed.

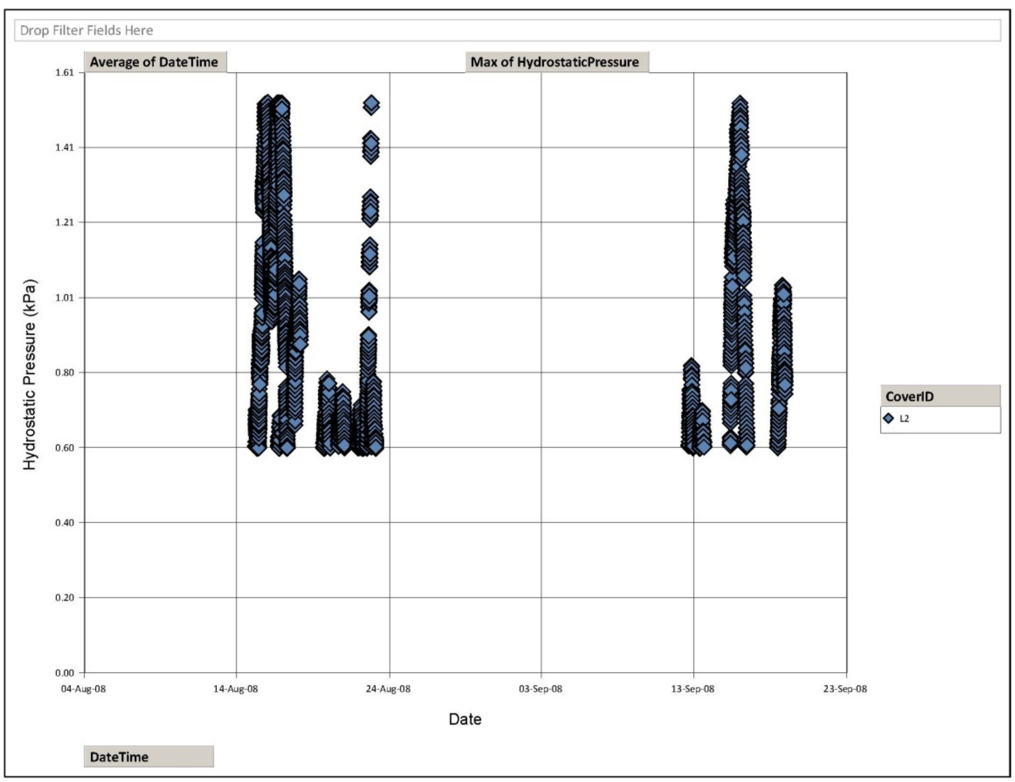

Figure 139: Hydrostatic pressure measured using the HOBO water level logger installed on L#2. Only significant values are displayed.

Appendices

Appendix A

Additional Climatic Data Calculated and Stored by Davis Instruments Vantage Pro Data Logger

Parameter	Description	Verification
Dew Point	Dew-point is the temperature to which air must be cooled for saturation (100% relative humidity) to occur, providing there is no change in water content. The dew-point is an important measurement used to predict the formation of dew, frost, and fog. Dew-point is also a good indicator of the air's actual water vapour content, unlike relative humidity, which takes the air's temperature into account. High dew-point indicates high vapour content; low dew-point indicates low vapour content. In addition a high dew-point indicates a better chance of rain and severe thunder storms.	Checked
Wind Run	Wind run is measurement of the "amount" of wind passing the station during a given period of time, expressed in either "miles of wind" or "kilometres of wind". WeatherLink calculates wind run by multiplying the average wind speed for each archive record by the archive interval.	Checked
Wind Chill	Wind chill takes into account how the speed of the wind affects our perception of air temperature. Your body warms the surrounding air molecules by transferring heat from your skin. If there's no air movement, this insulating layer of warm air molecules stays next to your body and offers some protection from cooler air molecules. Wind disperses this layer of warm air, causing the air temperature to "feel" colder. The faster the wind blows, the quicker the layer of warm air is dispersed, and the colder you feel. Above 76.7ºF (24.8ºC), wind movement has no effect on the apparent temperature. WeatherLink versions 5.1 and later use the Osczevski (1995) equation to calculate wind chill. This is the method adopted by the US National Weather Service in September of 2001.	Checked
Heat Index	The Heat Index uses the temperature and the relative humidity to determine how hot the air actually "feels." When humidity is low, the apparent temperature will be lower than the air temperature, since perspiration evaporates rapidly to cool the body. However, when humidity is high (*i.e.*, the air is saturated with water vapour) the apparent temperature "feels" higher than the actual air temperature, because perspiration evaporates more slowly. WeatherLink uses the Steadman (1979 & 1998) formula to calculate Heat Index, which is more accurate than the method used by the Vantage Pro console and is calculated for all temperatures.	Checked
THW Index	The THW Index uses humidity, temperature and wind to calculate an apparent temperature that incorporates the cooling effects of wind on our perception of temperature.	Checked
THSW Index	The THSW Index uses humidity, temperature, the cooling effects of wind and the heating effects of direct solar radiation to calculate an apparent temperature.	Checked
Solar Energy	The amount of accumulated solar radiation energy over a period of time is measured in Langleys.	Checked
UV Dose	Measured in MED which stands for Minimum Erythemal Dose, defined as the amount of sunlight exposure necessary to induce a barely perceptible redness of the skin within 24 hours after sun exposure. In other words, exposure to 1 MED will result in a reddening of the skin. Because different skin types burn at different rates, 1 MED for persons with very dark skin is different from 1 MED for persons with very light skin.	Checked
Heating DD	One heating degree–day is the amount of heat required to keep a structure at 65ºF when the outside temperature remains one degree below the 65ºF threshold for 24 hours. One heating degree–day is also the amount of heat required to keep that structure at 65ºF when the temperature remains 24ºF below that 65º threshold for 1 hour.	Checked
Cooling DD	One cooling degree–day is the amount of cooling required to keep a structure at 65ºF when the outside temperature remains one degree above the 65ºF threshold for 24 hours. One cooling degree–day is also the amount of cooling required to keep that structure at 65ºF when the temperature remains 24ºF above that 65º threshold for 1 hour.	Checked
Inside Temp	The temperature measured inside the console	Checked
Inside Humidity	The relative humidity measured inside the console	Transient problems
ET	Evapotranspiration is the measure of the quantity of moisture transpiring from the leaves of a crop and evaporating from the ground. ET values are calculated from measured data on wind run, air temperature, relative humidity, and solar radiation. The ET value is calculated once each hour using the data averaged over the prior hour	Checked

Appendix B

Summary of Saturated Hydraulic Conductivity and In-Situ Density Measurements

Appendix B.1
Summary of In-Situ Hydraulic Conductivity Testing Results

In-situ Hydraulic Conductivity Testing Results

Test Type	Test Section	Hydraulic Conductivity [cm/s]	Tested by	Comments	Average Ksat [cm/sec]
Guelph w/ tension infiltrometer	CT#2A_1	1.93E-04	JM		1.97E-04
Guelph w/ tension infiltrometer	CT#2A_2	2.02E-04	JM		
Guelph w/ tension infiltrometer	CT#2B_1	2.08E-04	JM		1.20E-04
Guelph w/ tension infiltrometer	CT#2B_2	9.74E-05	JM		
Guelph w/ tension infiltrometer	CT#2B_3	5.40E-05	JM		
Guelph w/ tension infiltrometer	CT#4_1	6.60E-04	JM		3.83E-04
Guelph w/ tension infiltrometer	CT#4_2	8.38E-05	JM		
Guelph w/ tension infiltrometer	CT#4_3	6.73E-04	JM		
Guelph w/ tension infiltrometer	CT#4_5	8.62E-04	JM		
Guelph w/ tension infiltrometer	CT#4_6	1.05E-05	JM		
Guelph w/ tension infiltrometer	CT#4_7	2.58E-04	JM		
Guelph w/ tension infiltrometer	CT#4_8	1.32E-04	JM		
Guelph w/ tension infiltrometer	L#2_1	1.42E-04	JM		1.35E-04
Guelph w/ tension infiltrometer	L#2_2	1.28E-04	JM		
Single Ring Infiltrometer	CT#2A_1	1.53E-04	JM		1.11E-04
Single Ring Infiltrometer	CT#2A_2	9.70E-05	JM		
Single Ring Infiltrometer	CT#2A_3	8.19E-05	JM		
Single Ring Infiltrometer	CT#2B_1	6.65E-06	JM		4.42E-05
Single Ring Infiltrometer	CT#2B_2	3.11E-06	JM		
Single Ring Infiltrometer	CT#2B_3	1.04E-04	JM		
Single Ring Infiltrometer	CT#2B_4	6.29E-05	JM		
Single Ring Infiltrometer	CT#4_1	2.91E-05	JM		2.36E-05
Single Ring Infiltrometer	CT#4_2	1.13E-05	JM		
Single Ring Infiltrometer	CT#4_3	1.79E-05	JM		
Single Ring Infiltrometer	CT#4_4	7.28E-06	JM		
Single Ring Infiltrometer	CT#4_5	1.34E-05	JM		
Single Ring Infiltrometer	CT#4_6	4.93E-05	JM		
Single Ring Infiltrometer	CT#4_7	3.68E-05	JM		
Single Ring Infiltrometer	L#2_1	1.13E-05	JM		3.14E-05
Single Ring Infiltrometer	L#2_2	2.04E-05	JM		
Single Ring Infiltrometer	L#2_3	4.23E-05	JM		
Single Ring Infiltrometer	L#2_4	5.15E-05	JM		

Appendix B.2
Summary of In-Situ Density Measurements

In-situ Density Testing Results

Test #	Probe depth [mm]	Location			Moisture content [%]	Dry Density [kg/m3]	Compaction [%]	Observations
		Cover	Row #	Column #				
1	200	CT#4	1	1	5.5	2,058	96.6	
2	200	CT#4	1	2	3.6	2,140	100.5	
3	200	CT#4	1	3	4.4	2,209	103.7	
4	200	CT#4	2	1	5.1	2,158	101.3	
5	200	CT#4	2	2	4.8	2,109	99	
6	200	CT#4	2	3	52	2,148	100.8	
7	200	CT#4	3	1	5.8	2,067	97	
8	200	CT#4	3	2	5	2,089	98.1	
9	200	CT#4	3	3	5.4	2,093	98.2	
10	200	CT#4	4	1	4.5	1,936	90.9	
11	200	CT#4	4	2	5.5	2,111	99.1	
12	200	CT#4	4	3	3.7	2,138	100.4	
13	200	CT#4	5	1	3.8	2,010	94.3	
14	200	CT#4	5	2	4.9	2,195	103.1	
15	200	CT#4	5	3	4.5	2,219	104.2	
16	200	CT#4	6	1	4.6	2,152	101	
17	200	CT#4	6	2	4	2,061	96.8	
18	200	CT#4	6	3	4.6	2,165	101.7	
19	200	CT#3A	1	1	2.8	2,048	96.2	
20	200	CT#3A	1	2	2.5	2,103	98.7	
21	200	CT#3A	1	3	2.5	2,001	93.9	
22	200	CT#3A	2	1	3.1	2,019	94.8	
23	200	CT#3A	2	2	2.5	1,967	92.4	
24	200	CT#3A	2	3	3.5	2,074	97.4	
25	200	CT#3A	3	1	4.3	2,146	100.7	
26	200	CT#3A	3	2	2.3	1,939	91	
27	200	CT#3A	3	3	3	2,061	96.8	
28	200	CT#3A	4	1	3.1	2,027	92.5	
29	200	CT#3A	4	2	3.1	1,984	93.2	
30	200	CT#3A	4	3	3	2,046	96.1	
31	200	CT#3B	1	1	1.9	1,997	93.8	
32	200	CT#3B	1	2	3	2,017	94.7	
33	200	CT#3B	1	3	2.7	2,052	96.4	
34	200	CT#3B	2	1	2.4	1,947	91.4	
35	200	CT#3B	2	2	3.2	1,955	91.8	
36	200	CT#3B	2	3	2.7	2,045	96	
37	200	CT#3B	3	1	1.9	1,981	93	
38	200	CT#3B	3	2	3.5	1,900	89.2	
39	200	CT#3B	3	3	2.6	2,050	96.3	
40	200	CT#3B	4	1	3	2,249	105.6	
41	200	CT#3B	4	2	3.3	1,986	93.2	
42	200	CT#3B	4	3	2.5	1,997	93.8	
43	200	CT#1	1	1	5.2	2,096	98.4	
44	200	CT#1	1	2	4.4	2,088	98	
45	200	CT#1	1	3	5	2,073	97.3	
46	200	CT#1	2	1	6.2	1,984	93.2	
47	200	CT#1	2	2	6.2	2,043	95.9	
48	200	CT#1	2	3	5.5	2,053	96.4	
49	200	CT#1	3	1	4.9	2,044	96	
50	200	CT#1	3	2	6.5	1,997	93.8	

Test #	**Probe depth [mm]**	**Location**			**Moisture content [%]**	**Dry Density [kg/m3]**	**Compaction [%]**	**Observations**
		Cover	**Row #**	**Column #**				
51	200	CT#1	3	3	5.4	1,992	93.5	
52	200	CT#1	4	1	4.3	2,155	101.2	
53	200	CT#1	4	2	5.9	1,707	80.1*	*Void Encountered
54	200	CT#1	4	3	5.7	1,978	92.9	
55	200	CT#1	5	1	5	2,046	96.1	
56	200	CT#1	5	2	5.9	1,985	93.2	
57	200	CT#1	5	3	5.3	2,082	97.8	
58	200	CT#1	6	1	6.7	2,037	95.6	
59	200	CT#1	6	2	6.7	2,066	97	
60	200	CT#1	6	3	5.3	2,162	101.5	
61	200	CT#2B	1	1	4.3	2,131	100.1	
62	200	CT#2B	1	2	4.7	2,136	100.3	
63	200	CT#2B	1	3	5.4	2,033	95.5	
64	200	CT#2B	2	1	5.1	2,106	98.9	
65	200	CT#2B	2	2	4	2,181	102.4	
66	200	CT#2B	2	3	5.2	2,097	98.4	
67	200	CT#2B	3	1	5.2	2,092	98.2	
68	200	CT#2B	3	2	5.3	2,137	100.4	
69	200	CT#2B	3	3	6.1	2,077	97.5	
70	200	CT#2B	4	1	7.3	2,068	97.1	
71	200	CT#2B	4	2	5.2	2,083	97.8	
72	200	CT#2B	4	3	5.8	2,107	98.9	
73	200	CT#2A	1	1	6.3	2,117	99.4	
74	200	CT#2A	1	2	5.4	2,109	99	
75	200	CT#2A	1	3	4.7	2,150	100.9	
76	200	CT#2A	2	1	5.1	2,201	103.3	
77	200	CT#2A	2	2	5.1	2,196	101.8	
78	200	CT#2A	2	3	4.4	2,190	102.8	
79	200	CT#2A	3	1	5.2	2,127	99.8	
80	200	CT#2A	3	2	4.8	2,091	98.2	
81	200	CT#2A	3	3	5.5	2,151	101	
82	200	CT#2A	4	1	5	2,043	95.9	
83	200	CT#2A	4	2	4.8	2,147	100.8	
84	200	CT#2A	4	3	5.2	2,173	102	
85	200	L#2	1	1	5.5	2,206	103.6	
86	200	L#2	1	2	5.4	2,149	100.9	
87	200	L#2	1	3	5.3	2,222	104.3	
88	200	L#2	2	1	5.1	2,203	103.4	
89	200	L#2	2	2	4.9	2,102	98.7	
90	200	L#2	2	3	5.1	2,060	96.7	
91	200	L#2	3	1	5.6	2,129	99.9	
92	200	L#2	3	2	4.6	2,192	102.9	
93	200	L#2	3	3	6	2,085	97.9	
94	200	L#2	4	1	5.4	2,146	100.7	
95	200	L#2	4	2	5.5	2,075	97.4	
96	200	L#2	4	3	4.8	2,173	102	
97	200	L#1	1	1	6.8	1,669	78.4	
98	200	L#1	1	2	4.2	1,679	78.8	
99	200	L#1	1	3	6	1,805	84.8	

Appendix C
Individual Calculation Sheets for Saturated Hydraulic Conductivity Data

Appendix C.1

Guelph Infiltrometer Field Data Sheets

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Guelph Infiltrometer Calculation Sheet

CT#2A_1

Location:	CT#2A_1	**Investigator:**	JM
Date:	August 11, 2008	**Depth of Well Hole:**	Tension Infiltrometer attachment used.
Test No:	12		
Dominant Soil Type:	Glacial Till		

			Head =	-50	mm					Head =	-122	mm	
			Reservoir(s) used:	INNER						Reservoir(s) used:	INNER		
Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R1 (cm/min)	Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R2 (cm/min)
1	14:00			26.80			1	14:42			30.40		
2	14:03	0:03:00	0:03:00	35.30	8.50	2.83	2	14:44	0:02:00	0:02:00	32.70	2.30	1.15
3	14:06	0:06:00	0:03:00	42.30	7.00	2.33	3	14:47	0:05:00	0:03:00	36.60	3.90	1.30
4	14:08	0:08:00	0:02:00	46.90	4.60	2.30	4	14:50	0:08:00	0:03:00	40.70	4.10	1.37
5	14:10	0:10:00	0:02:00	51.20	4.30	2.15	5	14:53	0:11:00	0:03:00	44.80	4.10	1.37
6	14:12	0:12:00	0:02:00	55.40	4.20	2.10	6	14:57	0:15:00	0:04:00	49.90	5.10	1.28
7	14:14	0:14:00	0:02:00	59.50	4.10	2.05	7	15:00	0:18:00	0:03:00	53.70	3.80	1.27
8	14:16	0:16:00	0:02:00	63.10	3.60	1.80	8	15:03	0:21:00	0:03:00	57.60	3.90	1.30
9	14:18	0:18:00	0:02:00	67.00	3.90	1.95	9	15:06	0:24:00	0:03:00	61.40	3.80	1.27
10	14:20	0:20:00	0:02:00	70.90	3.90	1.95	10	15:10	0:28:00	0:04:00	66.30	4.90	1.23
11	14:22	0:22:55	0:02:55	76.00	5.10	1.75	11						
12							12						
13	14:25	0:25:00		30.50			13						
14	14:26	0:26:00	0:01:00	33.00	2.50	2.50	14						
15	14:28	0:28:00	0:02:00	38.00	5.00	2.50	15						
16	14:30	0:30:00	0:02:00	43.10	5.10	2.55	16						
17	14:32	0:32:00	0:02:00	48.10	5.00	2.50	17						
18							18						
19							19						
20							20						
21							21						
22							22						
23							23						
24							24						
25							25						
Steady rate for three consecutive readings (R1)						2.513	Steady rate for three consecutive readings (R2)						1.267

Saturated Hydraulic Conductivity, K_s = 1.93E-04 cm/s

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Guelph Infiltrometer Calculation Sheet

CT#2A_2

Location:	CT#2A_2	**Investigator:**	JM
Date:	August 11, 2008	**Depth of Well Hole:**	Tension Infiltrometer attachment used.
Test No:	13		
Dominant Soil Type:	Galcial till		

Head =	-50 mm					
Reservoir(s) used:	INNER					
Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R1 (cm/min)
1	15:41			28.10		
2	15:42	1'	1.0	31.40	3.00	3.00
3	15:43	2'	1.0	34.40	3.30	3.30
4	15:44	3'	1.0	37.20	2.80	2.80
5	15:45	4'	1.0	40.10	2.90	2.90
6	15:46	5'	1.0	42.90	2.80	2.80
7	15:47	6'	1.0	45.60	2.70	2.70
8	15:48	7'	1.0	48.40	2.80	2.80
9	15:49	8'	1.0	51.00	2.60	2.60
10	15:50	9'	1.0	53.60	2.60	2.60
11	15:51	10'	1.0	56.10	2.50	2.50
12	15:52	11'	1.0	58.70	2.60	2.60
13	15:53	12'	1.0	60.90	2.20	2.20
14	15:54	13'	1.0	63.50	2.60	2.60
15	15:55	14'	1.0	65.90	2.40	2.40
16	15:56	15'	1.0	68.20	2.30	2.30
17	15:57	16'	1.0	70.50	2.30	2.30
18	15:58	17'	1.0	72.80	2.30	2.30
19	15:59	18'	1.0	75.00	2.20	2.20
20						
21						
22						
23						
24						
25						
Steady rate for three consecutive readings (R1)						2.275

Head =	-107 mm					
Reservoir(s) used:	INNER					
Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R2 (cm/min)
1	16:07			31.60		
2	16:09	0:02:00	0:02:00	34.10	2.50	1.25
3	16:11	0:04:00	0:02:00	36.80	2.70	1.35
4	16:13	0:06:00	0:02:00	39.60	2.80	1.40
5	16:15	0:08:00	0:02:00	42.30	2.70	1.35
6	16:18	0:11:00	0:03:00	46.60	4.30	1.43
7	16:21	0:14:00	0:03:00	50.60	4.00	1.33
8	16:24	0:17:00	0:03:00	54.70	4.10	1.37
9	16:27	0:20:00	0:03:00	58.20	3.50	1.17
10	16:30	0:23:00	0:03:00	62.10	3.90	1.30
11	16:33	0:26:00	0:03:00	65.70	3.60	1.20
12	16:36	0:29:00	0:03:00	69.40	3.70	1.23
13	16:39	0:32:00	0:03:00	73.10	3.70	1.23
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
Steady rate for three consecutive readings (R2)						1.222

Saturated Hydraulic Conductivity, K_s = 2.02E-04 cm/s

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Guelph Infiltrometer Calculation Sheet

CT#2B_1

Location:	CT#2B_1	**Investigator:**	JM
Date:	August 10, 2008	**Depth of Well Hole:**	Tension Infiltrometer attachment used.
Test No:	9		
Dominant Soil Type:	Glacial Till		

			Head =	-98	mm					Head =	-46	mm	
			Reservoir(s) used:	INNER						Reservoir(s) used:	INNER		
Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R1 (cm/min)	Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R2 (cm/min)
1	17:23			27.90			1	18:15			27.80		
2	17:24	0:01:00	0:01:00	28.90	1.00	1.00	2	18:17	0:02:00	0:02:00	31.50	3.70	1.85
3	17:26	0:03:00	0:02:00	30.80	1.90	0.95	3	18:19	0:04:00	0:02:00	35.10	3.60	1.80
4	17:28	0:05:00	0:02:00	32.40	1.60	0.80	4	18:22	0:07:00	0:03:00	40.20	5.10	1.70
5	17:30	0:07:00	0:02:00	34.10	1.70	0.85	5	18:26	0:11:00	0:04:00	47.10	6.90	1.73
6	17:37	0:14:00	0:07:00	39.50	5.40	0.77	6	18:29	0:14:00	0:03:00	51.90	4.80	1.60
7	17:45	0:22:00	0:08:00	45.10	5.60	0.70	7	18:33	0:18:00	0:04:00	58.10	6.20	1.55
8	17:50	0:27:00	0:05:00	48.50	3.40	0.68	8	18:36	0:21:00	0:03:00	62.80	4.70	1.57
9	17:55	0:32:00	0:05:00	51.60	3.10	0.62	9	18:39	0:24:00	0:03:00	67.20	4.40	1.47
10	18:00	0:37:00	0:05:00	55.10	3.50	0.70	10	18:42	0:27:00	0:03:00	71.60	4.40	1.47
11	18:05	0:42:00	0:05:00	58.10	3.00	0.60	11						
12	18:10	0:47:00	0:05:00	60.90	2.80	0.56	12						
13							13						
14							14						
15							15						
16							16						
17							17						
18							18						
19							19						
20							20						
21							21						
22							22						
23							23						
24							24						
25							25						
Steady rate for three consecutive readings (R1)						0.620	Steady rate for three consecutive readings (R2)						1.500

Saturated Hydraulic Conductivity, K_s = 2.08E-04 cm/s

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Guelph Infiltrometer Calculation Sheet

CT#2B_2

Location:	CT#2B_2	**Investigator:**	JM
Date:	August 10, 2008	**Depth of Well Hole:**	Tension Infiltrometer attachment used.
Test No:	10		
Dominant Soil Type:	Galcial Till		

Head =				-46	mm		Head =				-109	mm	
Reservoir(s) used:				INNER			Reservoir(s) used:				INNER		
Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R1 (cm/min)	Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R2 (cm/min)
1	18:56			31.60			1	19:13			27.20		
2	18:57	0:01:00	0:01:00	33.40	1.80	1.80	2	19:20	0:07:00	0:07:00	32.00	4.80	0.69
3	18:58	0:02:00	0:01:00	35.00	1.60	1.60	3	19:25	0:12:00	0:05:00	36.90	4.90	0.98
4	18:59	0:03:00	0:01:00	36.90	1.90	1.90	4	19:30	0:17:00	0:05:00	41.90	5.00	1.00
5	19:00	0:04:00	0:01:00	38.50	1.60	1.60	5	19:35	0:22:00	0:05:00	47.00	5.10	1.02
6	19:01	0:05:00	0:01:00	40.20	1.70	1.70	6	19:40	0:27:00	0:05:00	52.20	5.20	1.04
7	19:02	0:06:00	0:01:00	41.90	1.70	1.70	7	19:45	0:32:00	0:05:00	57.10	4.90	0.98
8	19:03	0:07:00	0:01:00	43.60	1.70	1.70	8	19:50	0:37:00	0:05:00	62.00	4.90	0.98
9	19:04	0:08:00	0:01:00	45.20	1.60	1.60	9						
10	19:05	0:09:00	0:01:00	46.60	1.40	1.40	10						
11	19:06	0:10:00	0:01:00	48.30	1.70	1.70	11						
12	19:07	0:11:00	0:01:00	49.90	1.60	1.60	12						
13							13						
14							14						
15							15						
16							16						
17							17						
18							18						
19							19						
20							20						
21							21						
22							22						
23							23						
24							24						
25							25						
Steady rate for three consecutive readings (R1)						1.625	Steady rate for three consecutive readings (R2)						1.000

Saturated Hydraulic Conductivity, K_s = 9.74E-05 cm/s

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Guelph Infiltrometer Calculation Sheet **CT#2B_3**

Location:	CT#2B_3	**Investigator:**	JM
Date:	August 11, 2008	**Depth of Well Hole:**	Tension Infiltrometer attachment used.
Test No:	11		
Dominant Soil Type:	Glacial Till		

			Head =	-111	mm					Head =	-50	mm	
			Reservoir(s) used:	INNER						Reservoir(s) used:	INNER		
Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R1 (cm/min)	Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R2 (cm/min)
1	10:49			30.10			1	13:05			27.00		
2	10:52	0:03:00	0:03:00	32.90	2.80	0.93	2	13:10	0:04:30	0:04:30	31.30	4.30	0.96
3	10:55	0:06:00	0:03:00	35.60	2.70	0.90	3	13:13	0:07:30	0:03:00	34.40	3.10	1.03
4	11:01	0:12:00	0:06:00	40.80	5.20	0.87	4	13:15	0:09:30	0:02:00	36.50	2.10	1.05
5	11:04	0:15:00	0:03:00	42.60	1.80	0.60	5	13:17	0:11:30	0:02:00	38.60	2.10	1.05
6	11:07	0:18:00	0:03:00	44.60	2.00	0.67	6	13:19	0:13:30	0:02:00	40.60	2.00	1.00
7	11:10	0:21:00	0:03:00	46.80	2.20	0.73	7						
8	11:15	0:26:00	0:05:00	50.00	3.20	0.64	8						
9	11:21	0:32:00	0:06:00	54.00	4.00	0.67	9						
10	11:25	0:36:00	0:04:00	56.80	2.80	0.70	10						
11	11:30	0:41:00	0:05:00	59.40	2.60	0.52	11						
12	11:40	0:51:00	0:10:00	65.50	6.10	0.61	12						
13	11:50	1:01:00	0:10:00	71.30	5.80	0.58	13						
14	11:55	1:06:00	0:05:00	73.90	2.60	0.52	14						
15							15						
16	12:07	1:18:00		39.10			16						
17	12:20	1:31:00	0:13:00	48.80	9.70	0.75	17						
18	12:35	1:46:00	0:15:00	58.90	10.10	0.67	18						
19	12:55	2:06:00	0:20:00	72.20	13.30	0.67	19						
20							20						
21							21						
22							22						
23							23						
24							24						
25							25						
Steady rate for three consecutive readings (R1)						0.695	Steady rate for three consecutive readings (R2)						1.033

Saturated Hydraulic Conductivity, K_s = 5.40E-05 cm/s

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Guelph Infiltrometer Calculation Sheet

CT#4_1

Location:	CT#4_1	**Investigator:**	JM
Date:	August 7, 2008	**Depth of Well Hole:**	Tension Infiltrometer attachment used.
Test No:	2		
Dominant Soil Type:	Compacted (?) Till		

			Head =	-240	mm					Head =	-91	mm	
			Reservoir(s) used:	INNER						Reservoir(s) used:	INNER		
Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R1 (cm/min)	Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R2 (cm/min)
1	10:57			Full			1	1:04			30.00		
2	11:06	0:09:30	0:09:30	0.90			2	1:05	0:01:00	0:01:00	34.00	4.00	4.00
3	11:22	0:25:30	0:16:00	9.80	8.90	0.56	3	1:06	0:02:00	0:01:00	38.90	4.90	4.90
4	11:45	0:48:00	0:22:30	2.40	-7.40	-0.33	4	1:07	0:03:00	0:01:00	42.00	3.10	3.10
5	11:55	0:58:00	0:10:00	33.80	31.40	3.14	5	1:08	0:04:00	0:01:00	46.00	4.00	4.00
6	12:05	1:08:00	0:10:00	39.30	5.50	0.55	6	1:09	0:05:00	0:01:00	49.60	3.60	3.60
7	12:15	1:18:00	0:10:00	44.10	4.80	0.48	7	1:10	0:06:00	0:01:00	53.40	3.80	3.80
8	12:25	1:28:00	0:10:00	48.70	4.60	0.46	8	1:11	0:07:00	0:01:00	57.00	3.60	3.60
9	12:35	1:38:00	0:10:00	53.00	4.30	0.43	9	1:12	0:08:00	0:01:00	60.50	3.50	3.50
10	12:45	1:48:00	0:10:00	57.30	4.30	0.43	10	1:13	0:09:00	0:01:00	63.80	3.30	3.30
11	12:55	1:58:00	0:10:00	61.60	4.30	0.43	11	1:14	0:10:00	0:01:00	67.10	3.30	3.30
12							12	1:15	0:11:00	0:01:00	70.40	3.30	3.30
13							13	1:16	0:12:00	0:01:00	73.70	3.30	3.30
14							14						
15							15						
16							16						
17							17						
18							18						
19							19						
20							20						
21							21						
22							22						
23							23						
24							24						
25							25						
Steady rate for three consecutive readings (R1)						0.430	Steady rate for three consecutive readings (R2)						3.300

Saturated Hydraulic Conductivity, K_s = 6.60E-04 cm/s

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Guelph Infiltrometer Calculation Sheet

CT#4_2

Location:	CT#4_2	**Investigator:**	JM
Date:	August 7, 2008	**Depth of Well Hole:**	Tension Infiltrometer attachment used.
Test No:	3		
Dominant Soil Type:	Till		

Head =				-239	mm		Head =				-80	mm	
Reservoir(s) used:				INNER			Reservoir(s) used:				INNER		
Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R1 (cm/min)	Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R2 (cm/min)
1	1:29			29.40			1	2:37			27.30		
2	1:34	0:05:30	0:05:30	33.80	4.40	0.80	2	2:38	0:01:00	0:01:00	28.80	1.50	1.50
3	1:42	0:13:30	0:08:00	41.10	7.30	0.91	3	2:39	0:02:00	0:01:00	30.50	1.70	1.70
4	1:46	0:17:00	0:03:30	44.10	3.00	0.86	4	2:40	0:03:00	0:01:00	32.20	1.70	1.70
5	1:50	0:21:00	0:04:00	47.20	3.10	0.77	5	2:41	0:04:00	0:01:00	34.10	1.90	1.90
6	1:55	0:26:00	0:05:00	51.10	3.90	0.78	6	2:42	0:05:00	0:01:00			
7	2:00	0:31:00	0:05:00	54.90	3.80	0.76	7	2:43	0:06:00	0:01:00	37.10		
8	2:05	0:36:11	0:05:11				8	2:44	0:07:00	0:01:00	38.70	1.60	1.60
9	2:08	0:39:00	0:02:49	60.30	60.30	21.41	9	2:46	0:09:00	0:02:00	42.00	3.30	1.65
10	2:20	0:51:00	0:12:00	67.90	7.60	0.63	10	2:47	0:10:00	0:01:00	43.30	1.30	1.30
11	2:25	0:56:00	0:05:00	71.00	3.10	0.62	11	2:48	0:11:00	0:01:00	44.90	1.60	1.60
12	2:30	1:01:00	0:05:00	74.00	3.00	0.60	12	2:49	0:12:00	0:01:00	46.40	1.50	1.50
13							13	2:50	0:13:00	0:01:00	47.90	1.50	1.50
14							14						
15							15						
16							16						
17							17						
18							18						
19							19						
20							20						
21							21						
22							22						
23							23						
24							24						
25							25						
Steady rate for three consecutive readings (R1)						0.618	Steady rate for three consecutive readings (R2)						1.533

Saturated Hydraulic Conductivity, K_s = 8.38E-05 cm/s

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Guelph Infiltrometer Calculation Sheet

CT#4_3

Location:	CT#4_3	**Investigator:**	JM
Date:	August 7, 2008	**Depth of Well Hole:**	Tension Infiltrometer attachment used.
Test No:	4		
Dominant Soil Type:	Till		

Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R1 (cm/min)	Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R2 (cm/min)
			Head =	-249	mm					Head =	-95	mm	
			Reservoir(s) used:	INNER						Reservoir(s) used:	INNER		
1	3:36			27.60			1	4:38			34.80		
2	3:45	0:09:30	0:09:30	30.70	3.10	0.33	2	4:39	0:01:00	0:01:00	38.10	3.30	3.30
3	3:55	0:19:00	0:09:30	33.60	2.90	0.31	3	4:41	0:03:00	0:02:00	43.90	5.80	2.90
4	4:06	0:30:00	0:11:00	36.30	2.70	0.25	4	4:42	0:04:00	0:01:00	46.60	2.70	2.70
5	4:15	0:39:00	0:09:00	38.60	2.30	0.26	5	4:43	0:05:00	0:01:00	49.10	2.50	2.50
6	4:25	0:49:00	0:10:00	40.90	2.30	0.23	6	4:44	0:06:00	0:01:00	51.70	2.60	2.60
7	4:35	0:59:00	0:10:00	43.10	2.20	0.22	7	4:45	0:07:00	0:01:00	54.50	2.80	2.80
8							8	4:46	0:08:00	0:01:00	57.00	2.50	2.50
9							9	4:49	0:11:00	0:03:00	64.10	7.10	2.37
10							10						
11							11						
12							12						
13							13						
14							14						
15							15						
16							16						
17							17						
18							18						
19							19						
20							20						
21							21						
22							22						
23							23						
24							24						
25							25						
Steady rate for three consecutive readings (R1)						0.238	Steady rate for three consecutive readings (R2)						2.553

Saturated Hydraulic Conductivity, K_s = 6.73E-04 cm/s

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Guelph Infiltrometer Calculation Sheet

CT#4_5

Location:	CT#4_5	**Investigator:**	JM
Date:	August 9, 2008	**Depth of Well Hole:**	
Test No:	6		Tension Infiltrometer attachment used.
Dominant Soil Type:	Compacted glacial till		

			Head =	-72	mm					Head =	-36	mm	
			Reservoir(s) used:	INNER						Reservoir(s) used:	INNER		
Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R1 (cm/min)	Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R2 (cm/min)
1	0	0:00:00	0.0	28.50	0.00	0.000	1	0	0:00:00	0.0	36.80	0.00	0.000
2	1	0:01:00	1.0	29.30	0.80	0.800	2	0.5	0:00:30	0.5	39.00	2.20	4.400
3	2	0:02:00	1.0	30.00	0.70	0.700	3	1	0:01:00	0.5	41.00	2.00	4.000
4	3	0:03:00	1.0	30.80	0.80	0.800	4	2	0:02:00	1.0	44.60	3.60	3.600
5	5	0:05:00	2.0	32.30	1.50	0.750	5	3	0:03:00	1.0	47.80	3.20	3.200
6	7	0:07:00	2.0	34.00	1.70	0.850	6	4	0:04:00	1.0	51.00	3.20	3.200
7	9	0:09:00	2.0	35.40	1.40	0.700	7	5	0:05:00	1.0	53.80	2.80	2.800
8	11	0:11:00	2.0	37.10	1.70	0.850	8	6	0:06:00	1.0	56.80	3.00	3.000
9	12	0:12:00	1.0	37.80	0.70	0.700	9	7	0:07:00	1.0	59.60	2.80	2.800
10	13	0:13:00	1.0	38.50	0.70	0.700	10	8	0:08:00	1.0	62.30	2.70	2.700
11							11						
12							12						
13							13						
14							14						
15							15						
16							16						
17							17						
18							18						
19							19						
20							20						
21							21						
22							22						
23							23						
24							24						
25							25						
Steady rate for three consecutive readings (R1)						0.761	Steady rate for three consecutive readings (R2)						2.825

Saturated Hydraulic Conductivity, K_s = 8.62E-04 cm/s

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Guelph Infiltrometer Calculation Sheet

CT#4_6

Location:	CT#4_6	**Investigator:**	JM
Date:	aug 10 2008	**Depth of Well Hole:**	Tension Infiltrometer attachment used.
Test No:	7a		
Dominant Soil Type:	Glacial Till		

			Head =	-113	mm					Head =	-50	mm	
			Reservoir(s) used:	INNER						Reservoir(s) used:	INNER		
Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R1 (cm/min)	Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R2 (cm/min)
1	10:25			26.90			1	11:08			26.4		
2	10:30	0:05:00	0:05:00	28.00	1.10	0.22	2	11:16	0:08:00	0:08:00	28.6	2.20	0.27
3	10:40	0:15:00	0:10:00	30.20	2.20	0.22	3	11:20	0:12:00	0:04:00	29.7	1.10	0.28
4	10:55	0:30:00	0:15:00	33.30	3.10	0.21	4	11:30	0:22:00	0:10:00	32.6	2.90	0.29
5	11:05	0:40:00	0:10:00	35.60	2.30	0.23	5	11:40	0:32:00	0:10:00	35.5	2.90	0.29
6							6	11:50	0:42:00	0:10:00	38.4	2.90	0.29
7							7						
8							8						
9							9						
10							10						
11							11						
12							12						
13							13						
14							14						
15							15						
16							16						
17							17						
18							18						
19							19						
20							20						
21							21						
22							22						
23							23						
24							24						
25							25						
Steady rate for three consecutive readings (R1)						0.219	Steady rate for three consecutive readings (R2)						0.290

Saturated Hydraulic Conductivity, K_s = 1.05E-05 cm/s

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Guelph Infiltrometer Calculation Sheet

CT#4_7

Location:	CT#4_7	**Investigator:**	JM
Date:	August 10, 2008	**Depth of Well Hole:**	Tension Infiltrometer attachment used.
Test No:	7b		
Dominant Soil Type:	Glacial Till		

			Head =	-99	mm					Head =	-47	mm	
			Reservoir(s) used:	INNER						Reservoir(s) used:	INNER		
Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R1 (cm/min)	Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R2 (cm/min)
1	12:36			27.40			1	13:12			28.90		
2	12:40	0:04:00	0:04:00	30.40	3.00	0.75	2	13:13	0:01:00	0:01:00	31.70	2.80	2.80
3	12:47	0:11:00	0:07:00	35.00	4.60	0.66	3	13:14	0:02:00	0:01:00	34.20	2.50	2.50
4	12:55	0:19:00	0:08:00	40.10	5.10	0.64	4	13:15	0:03:00	0:01:00	36.50	2.30	2.30
5	13:00	0:24:00	0:05:00	43.10	3.00	0.60	5	13:16	0:04:00	0:01:00	38.90	2.40	2.40
6	13:05	0:29:00	0:05:00	46.10	3.00	0.60	6	13:17	0:05:00	0:01:00	40.90	2.00	2.00
7	13:10	0:34:00	0:05:00	49.10	3.00	0.60	7	13:18	0:06:00	0:01:00	43.20	2.30	2.30
8							8	13:20	0:08:00	0:02:00	46.90	3.70	1.85
9							9	13:21	0:09:00	0:01:00	48.60	1.70	1.70
10							10	13:23	0:11:00	0:02:00	52.50	3.90	1.95
11							11	13:25	0:13:00	0:02:00	56.00	3.50	1.75
12							12	13:28	0:16:00	0:03:00	61.40	5.40	1.80
13							13	13:30	0:18:00	0:02:00	64.70	3.30	1.65
14							14	13:32	0:20:00	0:02:00	68.10	3.40	1.70
15							15	13:34	0:22:00	0:02:00	71.10	3.00	1.50
16							16	13:36	0:24:00	0:02:00	74.40	3.30	1.65
17							17	13:37	0:25:00	0:01:00	75.90	1.50	1.50
18							18						
19							19						
20							20						
21							21						
22							22						
23							23						
24							24						
25							25						
Steady rate for three consecutive readings (R1)						0.600	Steady rate for three consecutive readings (R2)						1.600

Saturated Hydraulic Conductivity, K_s = 2.58E-04 cm/s

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Guelph Infiltrometer Calculation Sheet

CT#4_8

Location:	CT#4_8	**Investigator:**	JM
Date:	August 10, 2008	**Depth of Well Hole:**	Tension Infiltrometer attachment used.
Test No:	8		
Dominant Soil Type:	Glacial Till		

			Head =	-47	mm					Head =	-98	mm	
			Reservoir(s) used:	BOTH						Reservoir(s) used:	INNER		
Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R1 (cm/min)	Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R2 (cm/min)
1	14:18			33.90			1	15:43			26.90		
2	14:25	0:07:00	0:07:00	34.70	0.80	0.114	2	15:56	0:13:00	0:13:00	29.00	2.10	0.16
3	14:35	0:17:00	0:10:00	35.70	1.00	0.10	3	15:58	0:15:00	0:02:00	30.10	1.10	0.55
4	14:45	0:27:00	0:10:00	36.60	0.90	0.09	4	16:00	0:17:00	0:02:00	31.50	1.40	0.70
5	14:55	0:37:00	0:10:00	37.40	0.80	0.08	5	16:02	0:19:00	0:02:00	32.60	1.10	0.55
6	15:05	0:47:00	0:10:00	38.30	0.90	0.09	6	16:05	0:22:00	0:03:00	34.50	1.90	0.63
7							7	16:15	0:32:00	0:10:00	41.60	7.10	0.71
8							8	16:20	0:37:00	0:05:00	45.00	3.40	0.68
9							9	16:25	0:42:00	0:05:00	48.70	3.70	0.74
10							10	16:32	0:49:00	0:07:00	54.30	5.60	0.80
11							11	16:40	0:57:00	0:08:00	60.30	6.00	0.75
12							12	16:45	1:02:00	0:05:00	64.20	3.90	0.78
13							13	16:50	1:07:00	0:05:00	68.30	4.10	0.82
14							14						
15							15						
16							16						
17							17						
18							18						
19							19						
20							20						
21							21						
22							22						
23							23						
24							24						
25							25						
Steady rate for three consecutive readings (R1)						0.087	Steady rate for three consecutive readings (R2)						0.778

Saturated Hydraulic Conductivity, K_s = 1.32E-04 cm/s

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Guelph Infiltrometer Calculation Sheet

L#2_1

Location:	L#2_1	**Investigator:**	JM
Date:	August 11, 2008	**Depth of Well Hole:**	Tension Infiltrometer attachment used.
Test No:	14		
Dominant Soil Type:	Compacted till		

			Head =	-48	mm					Head =	-105	mm	
			Reservoir(s) used:	BOTH						Reservoir(s) used:	INNER		
Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R1 (cm/min)	Reading Number	Time	Elapsed Time	Time Interval (min)	Water Level in Reservoir (cm)	Water Level Change (cm)	Rate of Water Level Change, R2 (cm/min)
1	17:13	-	-	32.20			1	18:02			28.20		
2	17:25	12'	12.0	35.10	2.90	0.240	2	18:05	2'30"	2.5	32.00	3.80	1.520
3	17:35	22'	10.0	36.70	1.60	0.160	3	18:07	4'30"	2.0	35.70	3.70	1.850
4	17:45	32'	10.0	38.20	1.50	0.150	4	18:10	7'30"	3.0	40.90	5.20	1.730
5	17:50	37'	5.0	39.00	0.80	0.160	5	18:13	10'30"	3.0	46.10	5.20	1.730
6							6	18:16	13'30"	3.0	51.30	5.20	1.730
7							7	18:19	16'30"	3.0	56.40	5.10	1.700
8							8						
9							9						
10							10						
11							11						
12							12						
13							13						
14							14						
15							15						
16							16						
17							17						
18							18						
19							19						
20							20						
21							21						
22							22						
23							23						
24							24						
25							25						
Steady rate for three consecutive readings (R1)						0.157	Steady rate for three consecutive readings (R2)						1.723

Saturated Hydraulic Conductivity, K_s = 1.42E-04 cm/s

Appendix C.2
Ring Infiltrometer Field Data Sheets

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Ring Infiltrometer Calculation Sheet

Location: Vangorda Waste Rock Dump
Date: 12-Aug-08
Test-Pit-No: CT#2A-1 (NW)
Operator: JM

Inner Diameter of Ring:	59	cm
Inner Area of Ring:	2734.0	cm2
Lateral Divergence:	5	cm
Depth of Wetting Front:	15	cm
Water Entry Value:	-1.5	cm
Average Depth of Water in Ring:	8.8	cm
Reference head:	22.2	cm

No.	Time t	Δt	Time Elapsed	Level reading	Water level	Change in Water Level	Infiltration Rate
	dd/mm/yy hh:mm	min	min	cm	cm	cm	cm/hr
1	12/08/2008 11:13			11.5	10.7		
	12/08/2008 14:54	221	221	15.6	6.6	4.1	1.11
2	12/08/2008 14:54						
	12/08/2008 18:36	222	443	17.5	4.7	1.9	0.51
3	12/08/2008 18:36						
	13/08/08 9:15	879	1322	N/A			
4							
5	13/08/2008 9:30			8.8	13.4		
	13/08/08 13:22	232	232	13.5	8.7	4.7	1.22
6	13/08/08 13:22						
	14/08/08 9:15	1193	1425	N/A			
7							
8							
9							
10							

Average Infiltration Rate:	0.95	cm/hr
Infiltration Rate (account for lateral divergence):	0.69	cm/hr
Effective Saturated Hydraulic Conductivity K_{fs}:	**1.53E-04**	**cm/sec**

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Ring Infiltrometer Calculation Sheet

Location: Vangorda Waste Rock Dump
Date: 12-Aug-08
Test-Pit-No: CT#2A_2 (MID)
Operator: JM

Inner Diameter of Ring:	59	cm
Inner Area of Ring:	2734.0	cm2
Lateral Divergence:	5	cm
Depth of Wetting Front:	15	cm
Water Entry Value:	-1.5	cm
Average Depth of Water in Ring:	10.3	cm
Reference head:	25.7	cm

No.	Time t	Δt	Time Elapsed	Level reading	Water level	Change in Water Level	Infiltration Rate
	dd/mm/yy hh:mm	min	min	cm	cm	cm	cm/hr
1	12/08/2008 11:20			14.0	11.7		
	12/08/2008 14:55	215	215	15.7	10.0	1.7	0.47
2	12/08/2008 14:55						
	12/08/2008 18:38	223	438	19.2	6.5	3.5	0.94
3	12/08/2008 18:38						
	13/08/08 9:13	875	1313	N/A			
4							
5	13/08/2008 9:30			9.7	16.0		
	13/08/08 13:21	231	231	12.5	13.2	2.8	0.73
6	13/08/08 13:21						
	14/08/08 9:15	1194	1425	21.3	4.4	8.8	0.44
7							
8							
9							
10							

Average Infiltration Rate:	0.65	cm/hr
Infiltration Rate (account for lateral divergence):	0.47	cm/hr
Effective Saturated Hydraulic Conductivity K_{fs}:	**9.70E-05**	**cm/sec**

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Ring Infiltrometer Calculation Sheet

Location: Vangorda Waste Rock Dump
Date: August 12,2008
Test-Pit-No: CT#2A_3 (SW)
Operator: JM

Inner Diameter of Ring: 59 cm
Inner Area of Ring: 2734.0 cm2
Lateral Divergence: 5 cm
Depth of Wetting Front: 15 cm
Water Entry Value: -1.5 cm
Average Depth of Water in Ring: 9.2 cm
Reference head: 21 cm

No.	Time t	Δt	Time Elapsed	Level reading	Water level	Change in Water Level	Infiltration Rate
	dd/mm/yy hh:mm	min	min	cm	cm	cm	cm/hr
1	12/08/2008 11:34			8.5	12.5		
	12/08/2008 14:56	202	202	11.5	9.5	3.0	0.89
2	12/08/2008 14:56						
	12/08/2008 18:39	223	425	13.4	7.6	1.9	0.51
3	12/08/2008 18:39						
	13/08/08 9:12	873	1298	18.5	2.5	5.1	0.35
4							
5	13/08/2008 9:30			7.0	14.0		
	13/08/08 13:21	231	231	9.0	12.0	2.0	0.52
6	13/08/08 13:21						
	14/08/08 9:15	1194	1425	15.0	6.0	6.0	0.30
7							
8							
9							
10							

Average Infiltration Rate: 0.51 cm/hr
Infiltration Rate (account for lateral divergence): 0.38 cm/hr
Effective Saturated Hydraulic Conductivity K_{fs}: **8.19E-05 cm/sec**

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Ring Infiltrometer Calculation Sheet

Location: Vangorda Waste Rock Dump
Date: 09-Aug-08
Test-Pit-No: CT#2B_1 (SE)
Operator: JM

Inner Diameter of Ring: 59 cm
Inner Area of Ring: 2734.0 cm2
Lateral Divergence: 5 cm
Depth of Wetting Front: 15 cm
Water Entry Value: -1.5 cm
Average Depth of Water in Ring: 12.5 cm
Reference head: 20 cm

No.	Time t	Δt	Time Elapsed	Level reading	Water level	Change in Water Level	Infiltration Rate
	dd/mm/yy hh:mm	min	min	cm	cm	cm	cm/hr
1	08/09/2008 10:23			6.5	13.5		
	08/09/2008 15:41	318	318	6.5	13.5	0.0	0.00
2	08/09/2008 15:41						
	08/09/2008 19:48	247	565	6.8	13.2	0.3	0.07
3	08/09/2008 19:48						
	10/08/2008 9:56	-42352	-41787	7.5	12.5	0.7	0.00
4	10/08/2008 9:56						
	10/08/2008 14:31	275	-41512	7.7	12.3	0.2	0.04
5	10/08/2008 14:31						
	10/08/2008 17:29	178	-41334	8.0	12.0	0.3	0.10
6	10/08/2008 17:29						
	10/08/2008 19:58	149	-41185	8.2	11.8	0.2	0.08
7	10/08/2008 19:58						
	11/08/2008 8:52	774	-40411	8.8	11.2	0.6	0.05
8							
9							
10							

Average Infiltration Rate: 0.05 cm/hr
Infiltration Rate (account for lateral divergence): 0.04 cm/hr
Effective Saturated Hydraulic Conductivity K_{fs}: **6.65E-06 cm/sec**

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Ring Infiltrometer Calculation Sheet

Location: Vangorda Waste Rock Dump
Date: 09-Aug-08
Test-Pit-No: CT#2B_2 (NE)
Operator: JM

Inner Diameter of Ring: 59 cm
Inner Area of Ring: 2734.0 cm2
Lateral Divergence: 5 cm
Depth of Wetting Front: 15 cm
Water Entry Value: -1.5 cm
Average Depth of Water in Ring: 13.2 cm
Reference head: 17 cm

No.	Time t	Δt	Time Elapsed	Level reading	Water level	Change in Water Level	Infiltration Rate
	dd/mm/yy hh:mm	min	min	cm	cm	cm	cm/hr
1	08/09/2008 10:22			3.5	13.5		
	08/09/2008 15:42	320	320	3.5	13.5	0.0	0.00
2	08/09/2008 15:42						
	08/09/2008 19:47	245	565	3.5	13.5	0.0	0.00
3	08/09/2008 19:47						
	10/08/2008 9:55	-42352	-41787	4.0	13.0	0.5	0.00
4	10/08/2008 9:55						
	10/08/2008 14:32	277	-41510	3.5	13.5	-0.5	-0.11
5	10/08/2008 14:32						
	10/08/2008 17:27	175	-41335	4.0	13.0	0.5	0.17
6	10/08/2008 17:27						
	10/08/2008 19:57	150	-41185	4.2	12.8	0.2	0.08
7	10/08/2008 19:57						
	11/08/2008 8:59	782	-40403	4.5	12.5	0.3	0.02
8							
9							
10							

Average Infiltration Rate: 0.02 cm/hr
Infiltration Rate (account for lateral divergence): 0.02 cm/hr
Effective Saturated Hydraulic Conductivity K_{fs}: **3.11E-06 cm/sec**

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Ring Infiltrometer Calculation Sheet

Location: Vangorda Waste Rock Dump
Date: 12-Aug-08
Test-Pit-No: CT#2B_3 (NW)
Operator: JM

Inner Diameter of Ring:	59	cm
Inner Area of Ring:	2734.0	cm2
Lateral Divergence:	5	cm
Depth of Wetting Front:	15	cm
Water Entry Value:	-1.5	cm
Average Depth of Water in Ring:	8.6	cm
Reference head:	21.5	cm

No.	Time t	Δt	Time Elapsed	Level reading	Water level	Change in Water Level	Infiltration Rate
	dd/mm/yy hh:mm	min	min	cm	cm	cm	cm/hr
1	12/08/2008 11:56			11.2	10.3		
	12/08/2008 14:53	177	177	15.0	6.5	3.8	1.29
2	12/08/2008 14:53						
	12/08/2008 18:35	222	399	16.3	5.2	1.3	0.35
3	12/08/2008 18:35						
	13/08/08 9:40	905	1304	N/A			
4							
5	13/08/08 9:45			8	13.5		
	13/08/08 13:23	218	218	10.0	11.5	2.0	0.55
6	13/08/08 13:23						
	14/08/08 9:15	1192	1410	17.0	4.5	7.0	0.35
7							
8							
9							
10							

Average Infiltration Rate:	0.64	cm/hr
Infiltration Rate (account for lateral divergence):	0.46	cm/hr
Effective Saturated Hydraulic Conductivity K_{fs}:	**1.04E-04**	**cm/sec**

Ring Infiltrometer Calculation Sheet

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Location: Vangorda Waste Rock Dump
Date: 12-Aug-08
Test-Pit-No: CT#2B_4 (SE)
Operator: JM

Inner Diameter of Ring: 59 cm
Inner Area of Ring: 2734.0 cm2
Lateral Divergence: 5 cm
Depth of Wetting Front: 15 cm
Water Entry Value: -1.5 cm
Average Depth of Water in Ring: 6.8 cm
Reference head: 22.3 cm

No.	Time t	Δt	Time Elapsed	Level reading	Water level	Change in Water Level	Infiltration Rate
	dd/mm/yy hh:mm	min	min	cm	cm	cm	cm/hr
1	12/08/2008 12:00			13.0	9.3		
	12/08/2008 14:52	172	172	15.5	6.8	2.5	0.87
2	12/08/2008 14:52						
	12/08/2008 18:34	222	394	16.5	5.8	1.0	0.27
3	12/08/2008 18:34						
	13/08/08 9:40	906	1300	19.2	3.1	2.7	0.18
4							
5	13/08/2008 9:45			13.1	9.2		
	13/08/08 13:24	219	219	14.0	8.3	0.9	0.25
6	13/08/08 13:24						
	14/08/08 9:15	1191	1410	17.3	5.0	3.3	0.17
7							
8							
9							
10							

Average Infiltration Rate: 0.35 cm/hr
Infiltration Rate (account for lateral divergence): 0.25 cm/hr
Effective Saturated Hydraulic Conductivity K_{fs}: **6.29E-05 cm/sec**

Ring Infiltrometer Calculation Sheet

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Location: Vangorda Waste Rock Dump
Date: 08-Aug-08
Test-Pit-No: CT#4_1 (SW)
Operator: JM

Inner Diameter of Ring:	59	cm
Inner Area of Ring:	2734.0	cm2
Lateral Divergence:	10	cm
Depth of Wetting Front:	15	cm
Water Entry Value:	-1.5	cm
Average Depth of Water in Ring:	12.0	cm
Reference head:	23	cm

No.	Time t	Δt	Time Elapsed	Level reading	Water level	Change in Water Level	Infiltration Rate
	dd/mm/yy hh:mm	min	min	cm	cm	cm	cm/hr
1	08/08/2008 10:50			6.5	16.5		
	08/08/2008 14:20	210	210	7.6	15.4	1.1	0.31
2	08/08/2008 14:20						
	08/08/2008 17:16	176	386	8.5	14.5	0.9	0.31
3	08/08/2008 17:16						
	08/08/2008 19:58	162	548	9.0	14.0	0.5	0.19
4	08/08/2008 19:58						
	09/08/2008 9:06	788	1336	11.2	11.8	2.2	0.17
5	09/08/2008 9:06						
	09/08/2008 15:34	388	1724	12.2	10.8	1.0	0.15
6	09/08/2008 15:34						
	09/08/2008 19:54	260	1984	13.0	10.0	0.8	0.18
7	09/08/2008 19:54						
	10/08/2008 9:46	832	2816	14.8	8.2	1.8	0.13
8	10/08/2008 9:46						
	10/08/2008 14:22	276	3092	16.0	7.0	1.2	0.26
9							
10							

Average Infiltration Rate:	0.21	cm/hr
Infiltration Rate (account for lateral divergence):	0.12	cm/hr
Effective Saturated Hydraulic Conductivity K_{fs}:	**2.91E-05**	**cm/sec**

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Ring Infiltrometer Calculation Sheet

Location: Vangorda Waste Rock Dump
Date: 08-Aug-08
Test-Pit-No: CT#4_2 (SE)
Operator: JM

Inner Diameter of Ring: 59 cm
Inner Area of Ring: 2734.0 cm2
Lateral Divergence: 5 cm
Depth of Wetting Front: 15 cm
Water Entry Value: -1.5 cm
Average Depth of Water in Ring: 12.0 cm
Reference head: 16 cm

No.	Time t	Δt	Time Elapsed	Level reading	Water level	Change in Water Level	Infiltration Rate
	dd/mm/yy hh:mm	min	min	cm	cm	cm	cm/hr
1	08/08/2008 11:15			1.8	14.2		
	08/08/2008 14:20	185	185	2.0	14.0	0.2	0.06
2	08/08/2008 14:20						
	08/08/2008 17:15	175	360	2.3	13.7	0.3	0.10
3	08/08/2008 17:15						
	08/08/2008 19:56	161	521	2.5	13.5	0.2	0.07
4	08/08/2008 19:56						
	09/08/2008 9:05	789	1310	3.7	12.3	1.2	0.09
5	09/08/2008 9:05						
	09/08/2008 15:32	387	1697	4.2	11.8	0.5	0.08
6	09/08/2008 15:32						
	09/08/2008 19:54	262	1959	4.5	11.5	0.3	0.07
7	09/08/2008 19:54						
	10/08/2008 9:48	834	2793	5.5	10.5	1.0	0.07
8	10/08/2008 9:48						
	10/08/2008 14:21	273	3066	5.9	10.1	0.4	0.09
9	10/08/2008 14:21						
	11/08/2008 9:09	1128	4194	7.7	8.3	1.8	0.10
10							

Average Infiltration Rate: 0.08 cm/hr
Infiltration Rate (account for lateral divergence): 0.06 cm/hr
Effective Saturated Hydraulic Conductivity K_{fs}: **1.13E-05 cm/sec**

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Ring Infiltrometer Calculation Sheet

Location: Vangorda Waste Rock Dump
Date: 08-Aug-08
Test-Pit-No: CT#4_3 (MID)
Operator: JM

Inner Diameter of Ring: 59 cm
Inner Area of Ring: 2734.0 cm2
Lateral Divergence: 5 cm
Depth of Wetting Front: 15 cm
Water Entry Value: -1.5 cm
Average Depth of Water in Ring: 6.4 cm
Reference head: 20 cm

No.	Time t	Δt	Time Elapsed	Level reading	Water level	Change in Water Level	Infiltration Rate
	dd/mm/yy hh:mm	min	min	cm	cm	cm	cm/hr
1	08/08/2008 11:40			11.0	9.0		
	08/08/2008 14:21	161	161	11.2	8.8	0.2	0.07
2	08/08/2008 14:21						
	08/08/2008 17:18	177	338	11.5	8.5	0.3	0.10
3	08/08/2008 17:18						
	08/08/2008 20:00	162	500	12.0	8.0	0.5	0.19
4	08/08/2008 20:00						
	09/08/2008 9:07	787	1287	13.4	6.6	1.4	0.11
5	09/08/2008 9:07						
	09/08/2008 15:35	388	1675	14.0	6.0	0.6	0.09
6	09/08/2008 15:35						
	09/08/2008 19:53	258	1933	14.2	5.8	0.2	0.05
7	09/08/2008 19:53						
	10/08/2008 9:49	836	2769	15.7	4.3	1.5	0.11
8	10/08/2008 9:49						
	10/08/2008 14:20	271	3040	15.4	4.6	-0.3	-0.07
9	10/08/2008 14:20						
	11/08/2008 2:20	720	3760	18.0	2.0	2.6	0.22
10							

Average Infiltration Rate: 0.10 cm/hr
Infiltration Rate (account for lateral divergence): 0.07 cm/hr
Effective Saturated Hydraulic Conductivity K_{fs}: **1.79E-05 cm/sec**

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Ring Infiltrometer Calculation Sheet

Location: Vangorda Waste Rock Dump
Date: 08-Aug-08
Test-Pit-No: CT#4_4 (NE)
Operator: JM

Inner Diameter of Ring: 59 cm
Inner Area of Ring: 2734.0 cm2
Lateral Divergence: 5 cm
Depth of Wetting Front: 15 cm
Water Entry Value: -1.5 cm
Average Depth of Water in Ring: 17.9 cm
Reference head: 23 cm

No.	Time t	Δt	Time Elapsed	Level reading	Water level	Change in Water Level	Infiltration Rate
	dd/mm/yy hh:mm	min	min	cm	cm	cm	cm/hr
1	08/08/2008 12:00			3.5	19.5		
	08/08/2008 14:24	144	144	3.5	19.5	0.0	0.00
2	08/08/2008 14:24						
	08/08/2008 17:20	176	320	3.5	19.5	0.0	0.00
3	08/08/2008 17:20						
	08/08/2008 20:01	161	481	4.0	19.0	0.5	0.19
4	08/08/2008 20:01						
	09/08/2008 9:09	788	1269	4.8	18.2	0.8	0.06
5	09/08/2008 9:09						
	09/08/2008 15:36	387	1656	5.2	17.8	0.4	0.06
6	09/08/2008 15:36						
	09/08/2008 19:52	256	1912	5.7	17.3	0.5	0.12
7	09/08/2008 19:52						
	10/08/2008 9:50	838	2750	6.4	16.6	0.7	0.05
8	10/08/2008 9:50						
	10/08/2008 14:23	273	3023	6.6	16.4	0.2	0.04
9	10/08/2008 14:23						
	11/08/2008 9:20	1137	4160	8.1	14.9	1.5	0.08
10							

Average Infiltration Rate: 0.07 cm/hr
Infiltration Rate (account for lateral divergence): 0.05 cm/hr
Effective Saturated Hydraulic Conductivity K_{fs}: **7.28E-06 cm/sec**

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Ring Infiltrometer Calculation Sheet

Location: Vangorda Waste Rock Dump
Date: 08-Aug-08
Test-Pit-No: CT#4_5 (NW)
Operator: JM

Inner Diameter of Ring:	59	cm
Inner Area of Ring:	2734.0	cm2
Lateral Divergence:	5	cm
Depth of Wetting Front:	15	cm
Water Entry Value:	-1.5	cm
Average Depth of Water in Ring:	4.3	cm
Reference head:	18	cm

No.	Time t	Δt	Time Elapsed	Level reading	Water level	Change in Water Level	Infiltration Rate
	dd/mm/yy hh:mm	min	min	cm	cm	cm	cm/hr
1	08/08/2008 11:41			12.0	6.0		
	08/08/2008 14:23	162	162	12.0	6.0	0.0	0.00
2	08/08/2008 14:23						
	08/08/2008 17:19	176	338	12.5	5.5	0.5	0.17
3	08/08/2008 17:19						
	08/08/2008 20:01	162	500	12.5	5.5	0.0	0.00
4	08/08/2008 20:01						
	09/08/2008 9:08	787	1287	13.5	4.5	1.0	0.08
5	09/08/2008 9:08						
	09/08/2008 15:35	387	1674	14.0	4.0	0.5	0.08
6	09/08/2008 15:35						
	09/08/2008 19:51	256	1930	14.2	3.8	0.2	0.05
7	09/08/2008 19:51						
	10/08/2008 9:49	838	2768	14.6	3.4	0.4	0.03
8	10/08/2008 9:49						
	10/08/2008 14:23	274	3042	15.0	3.0	0.4	0.09
9	10/08/2008 14:23						
	11/08/2008 9:19	1136	4178	16.5	1.5	1.5	0.08
10							

Average Infiltration Rate:	0.06	cm/hr
Infiltration Rate (account for lateral divergence):	0.05	cm/hr
Effective Saturated Hydraulic Conductivity K_{fs}:	**1.34E-05**	**cm/sec**

SRK Consulting
Engineers and Scientists

Ring Infiltrometer Calculation Sheet

Location: Vangorda Waste Rock Dump
Date: 12-Aug-08
Test-Pit-No: CT#4_6 (NW)
Operator: JM

Inner Diameter of Ring:	59	cm
Inner Area of Ring:	2734.0	cm2
Lateral Divergence:	5	cm
Depth of Wetting Front:	15	cm
Water Entry Value:	-1.5	cm
Average Depth of Water in Ring:	10.1	cm
Reference head:	18.4	cm

No.	Time t	Δt	Time Elapsed	Level reading	Water level	Change in Water Level	Infiltration Rate
	dd/mm/yy hh:mm	min	min	cm	cm	cm	cm/hr
1	12/08/2008 10:39			5.3	13.1		
	12/08/2008 15:04	265	265	7.0	11.4	1.7	0.38
2	12/08/2008 15:04						
	12/08/2008 18:31	207	472	8.5	9.9	1.5	0.43
3	12/08/2008 18:31						
	13/08/2008 9:00	869	1341	11.6	6.8	3.1	0.21
4							
5	13/08/2008 9:05			6.0	12.4		
	13/08/2008 13:28	263	1604	7.5	10.9	1.5	0.34
6	13/08/2008 13:28						
	14/08/2008 9:20	1192	2796	12.4	6.0	4.9	0.25
7							
8							
9							
10							

Average Infiltration Rate:	0.32	cm/hr
Infiltration Rate (account for lateral divergence):	0.24	cm/hr
Effective Saturated Hydraulic Conductivity K_{fs}:	**4.93E-05**	**cm/sec**

SRK Consulting
Engineers and Scientists

Ring Infiltrometer Calculation Sheet

Location: Vangorda Waste Rock Dump
Date: 12-Aug-08
Test-Pit-No: CT#4_7 (SW)
Operator: JM

Inner Diameter of Ring:	59	cm
Inner Area of Ring:	2734.0	cm2
Lateral Divergence:	5	cm
Depth of Wetting Front:	15	cm
Water Entry Value:	-1.5	cm
Average Depth of Water in Ring:	7.8	cm
Reference head:	18	cm

No.	Time t	Δt	Time Elapsed	Level reading	Water level	Change in Water Level	Infiltration Rate
	dd/mm/yy hh:mm	min	min	cm	cm	cm	cm/hr
1	12/08/2008 10:25			8.8	9.2		
	12/08/2008 15:05	280	280	10.4	7.6	1.6	0.34
2	12/08/2008 15:05						
	12/08/2008 18:30	205	485	11.0	7.0	0.6	0.18
3	12/08/2008 18:30						
	13/08/2008 9:01	871	1356	13.2	4.8	2.2	0.15
4							
5	13/08/2008 9:05			7.5	10.5		
	13/08/2008 13:28	263	263	8.5	9.5	1.0	0.23
6	13/08/2008 13:28						
	14/08/2008 9:20	1192	1455	12.0	6.0	3.5	0.18
7							
8							
9							
10							

Average Infiltration Rate:	0.21	cm/hr
Infiltration Rate (account for lateral divergence):	0.16	cm/hr
Effective Saturated Hydraulic Conductivity K_{fs}:	**3.68E-05**	**cm/sec**

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Ring Infiltrometer Calculation Sheet

Location: Vangorda Waste Rock Dump
Date: 08-Aug-08
Test-Pit-No: L#2_1 (SE)
Operator: JM

Inner Diameter of Ring:	59	cm
Inner Area of Ring:	2734.0	cm2
Lateral Divergence:	5	cm
Depth of Wetting Front:	15	cm
Water Entry Value:	-1.5	cm
Average Depth of Water in Ring:	11.8	cm
Reference head:	23	cm

No.	Time t	Δt	Time Elapsed	Level reading	Water level	Change in Water Level	Infiltration Rate
	dd/mm/yy hh:mm	min	min	cm	cm	cm	cm/hr
1	08/08/2008 14:28			8.3	14.7		
	08/08/2008 20:02	334	334	9.0	14.0	0.7	0.13
2	08/08/2008 20:02						
	09/08/2008 8:58	776	1110	10.5	12.5	1.5	0.12
3	09/08/2008 8:58						
	09/08/2008 15:39	401	1511	10.8	12.2	0.3	0.04
4	09/08/2008 15:39						
	09/08/2008 19:46	247	1758	11.5	11.5	0.7	0.17
5	09/08/2008 19:46						
	10/08/2008 9:58	852	2610	12.0	11.0	0.5	0.04
6	10/08/2008 9:58						
	10/08/2008 14:28	270	2880	12.0	11.0	0.0	0.00
7	10/08/2008 14:28						
	10/08/2008 17:33	185	3065	12.0	11.0	0.0	0.00
8	10/08/2008 17:33						
	10/08/2008 20:02	149	3214	12.5	10.5	0.5	0.20
9	10/08/2008 20:02						
	11/08/2008 9:01	779	3993	13.0	10.0	0.5	0.04
10							

Average Infiltration Rate:	0.08	cm/hr
Infiltration Rate (account for lateral divergence):	0.06	cm/hr
Effective Saturated Hydraulic Conductivity K_{fs}:	**1.13E-05**	**cm/sec**

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Ring Infiltrometer Calculation Sheet

Location: Vangorda Waste Rock Dump
Date: 08-Aug-08
Test-Pit-No: L#2_2 (NW)
Operator: JM

Inner Diameter of Ring: 59 cm
Inner Area of Ring: 2734.0 cm2
Lateral Divergence: 5 cm
Depth of Wetting Front: 15 cm
Water Entry Value: -1.5 cm
Average Depth of Water in Ring: 8.4 cm
Reference head: 19 cm

No.	Time t	Δt	Time Elapsed	Level reading	Water level	Change in Water Level	Infiltration Rate
	dd/mm/yy hh:mm	min	min	cm	cm	cm	cm/hr
1	08/08/2008 14:26			6.0	13.0		
	08/08/2008 17:24	178	178	6.5	12.5	0.5	0.17
2	08/08/2008 17:24						
	08/08/2008 20:04	160	338	7.0	12.0	0.5	0.19
3	08/08/2008 20:04						
	09/08/2008 8:57	773	1111	9.6	9.4	2.6	0.20
4	09/08/2008 8:57						
	09/08/2008 15:38	401	1512	10.5	8.5	0.9	0.13
5	09/08/2008 15:38						
	09/08/2008 19:45	247	1759	11.0	8.0	0.5	0.12
6	09/08/2008 19:45						
	10/08/2008 9:59	854	2613	12.3	6.7	1.3	0.09
7	10/08/2008 9:59						
	10/08/2008 14:29	270	2883	13.0	6.0	0.7	0.16
8	10/08/2008 14:29						
	10/08/2008 17:32	183	3066	13.0	6.0	0.0	0.00
9	10/08/2008 17:32						
	10/08/2008 20:00	148	3214	13.3	5.7	0.3	0.12
10	10/08/2008 20:00						
	11/08/2008 9:01	781	3995	14.0	5.0	0.7	0.05

Average Infiltration Rate: 0.12 cm/hr
Infiltration Rate (account for lateral divergence): 0.09 cm/hr
Effective Saturated Hydraulic Conductivity K_{fs}: **2.04E-05 cm/sec**

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Ring Infiltrometer Calculation Sheet

Location: Vangorda Waste Rock Dump
Date: 12-Aug-08
Test-Pit-No: L#2_3 (SE)
Operator: JM

Inner Diameter of Ring: 59 cm
Inner Area of Ring: 2734.0 cm2
Lateral Divergence: 5 cm
Depth of Wetting Front: 15 cm
Water Entry Value: -1.5 cm
Average Depth of Water in Ring: 9.0 cm
Reference head: 24 cm

No.	Time t	Δt	Time Elapsed	Level reading	Water level	Change in Water Level	Infiltration Rate
	dd/mm/yy hh:mm	min	min	cm	cm	cm	cm/hr
1	12/08/2008 10:57			13.2	10.8		
	12/08/2008 14:57	240	240	14.8	9.2	1.6	0.40
2	12/08/2008 14:57						
	12/08/2008 18:41	224	464	15.8	8.2	1.0	0.27
3	12/08/2008 18:41						
	13/08/2008 9:08	867	1331	18.7	5.3	2.9	0.20
4							
5	13/08/2008 9:12			12.3	11.7		
	13/08/08 13:21	249	249	13.5	10.5	1.2	0.29
6	13/08/08 13:21						
	14/08/2008 9:18	1197	1446	16.7	7.3	3.2	0.16
7							
8							
9							
10							

Average Infiltration Rate: 0.26 cm/hr
Infiltration Rate (account for lateral divergence): 0.19 cm/hr
Effective Saturated Hydraulic Conductivity K_{fs}: **4.23E-05 cm/sec**

Ring Infiltrometer Calculation Sheet

SRK Consulting
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Location: Vangorda Waste Rock Dump
Date: 12-Aug-08
Test-Pit-No: L#2_4 (NW)
Operator: JM

Inner Diameter of Ring:	59	cm
Inner Area of Ring:	2734.0	cm2
Lateral Divergence:	5	cm
Depth of Wetting Front:	15	cm
Water Entry Value:	-1.5	cm
Average Depth of Water in Ring:	8.7	cm
Reference head:	22.5	cm

No.	Time t	Δt	Time Elapsed	Level reading	Water level	Change in Water Level	Infiltration Rate
	dd/mm/yy hh:mm	min	min	cm	cm	cm	cm/hr
1	12/08/2008 11:01			11.0	11.5		
	12/08/2008 14:58	237	237	12.8	9.7	1.8	0.46
2	12/08/2008 14:58						
	12/08/2008 18:46	228	465	14.0	8.5	1.2	0.32
3	12/08/2008 18:46						
	13/08/08 9:10	864	1329	17.5	5.0	3.5	0.24
4							
5	13/08/2008 9:12			11.5	11.0		
	13/08/08 13:20	248	248	13.0	9.5	1.5	0.36
6	13/08/08 13:20						
	14/08/08 9:18	1198	1446	17.0	5.5	4.0	0.20
7							
8							
9							
10							

Average Infiltration Rate:	0.32	cm/hr
Infiltration Rate (account for lateral divergence):	0.23	cm/hr
Effective Saturated Hydraulic Conductivity K_{fs}:	**5.15E-05**	**cm/sec**

Appendix D
Field Measurements of In-Situ Density

EBA Engineering

FIELD DENSITY REPORT

All tests performed in accordance with ASTM Standards
Ref. ASTM D2922-71 Standard Proctor (ASTM D698-70T)
ASTM D3017-72 Modified Proctor (ASTM D1557-70T)

Project: Anvil Range - Waste Rock Cover Pads. Project Number:
Address: Faro YT. Contractor:
Client: SRK
Date Backfill Placed: DateTested: Aug 12/2008 Attention:
Tested By: J. Purves Machine Number: 60841 Temperature: 11 °C

Soil Description: Till, Cover Pad Material

Max. Dry Density (kg/m³): 2130 STD D 3256
Optimum Moisture Content: STD M 702

Test Number	2008 001		002		003	
Location	CT #4 Row 1 #1		CT #4 Row 1 #2		CT #4 Row 1 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	5.5%		3.6%		4.4%	
γDry (kg/m³)	2058		2140		2209	
Specified Compaction	95%		95%		95%	
Compaction (%)	96.6%		100.5%		~~103.7%~~	103.7

Test Number	004		005		006	
Location	CT #4 Row 2 #1		CT #4 Row 2 #2		CT #4 Row 2 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200	Row 1	200		200	
γWet (kg/m³)		Row 2				
Moisture Content (%)	5.1%	Row 3	4.8%		5.2%	
γDry (kg/m³)	2158	Row 4	2109		2148	
Specified Compaction	95%	Row 5 2R#3	95%		95%	
Compaction (%)	101.3%		99.0%		100.8%	

Remarks:

Data presented hereon is for the sole use of the stipulated client. EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of EBA.

The testing services reported herein have been performed by an EBA technician to recognized Industry standards, unless otherwise noted, No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, EBA will provide it upon written request.

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EBA Engineering

FIELD DENSITY REPORT

All tests performed in accordance with ASTM Standards
Ref. ASTM D2922-71 Standard Proctor (ASTM D698-70T)
ASTM D3017-72 Modified Proctor (ASTM D1557-70T)

Project: Anvil Range - Waste Rock Cover Pads
Address: FARO, Y.T.
Project Number:
Contractor: SRK
Client:
Date Backfill Placed: DateTested: Aug 12/08
Attention:
Tested By: John Purves
Machine Number: 60841 Temperature: 11 °C

Soil Description: Till, Cover Pad Material

Max. Dry Density (kg/m³): 2130 STDD 3256
Optimum Moisture Content: STDM 702

Test Number	2008 007		2008 008		2008 009	
Location	CT#4 Row 3 #1		CT#4 Row 3 #2		CT#4 Row 3 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	5.8%		5.0%		5.4%	
γDry (kg/m³)	2067		2089		2093	
Specified Compaction	95%		95%		95%	
Compaction (%)	97.0%		98.1%		98.2%	

Test Number	2008 010		2008 011		2008 012	
Location	CT#4 Row 4 Ø #1		CT#4 Row 4 #2		CT#4 Row 4 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	4.5%		5.5%		3.7%	
γDry (kg/m³)	1936		2111		2138	
Specified Compaction	95%		95%		95%	
Compaction (%)	90.9%		99.1		100.4%	

Remarks:

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FIELD DENSITY REPORT

All tests performed in accordance with ASTM Standards
Ref. ASTM D2922-71 Standard Proctor (ASTM D698-70T)
ASTM D3017-72 Modified Proctor (ASTM D1557-70T)

Project: Anvil Range, Waste Rock Cover Pads
Project Number:
Address: Faro, Y.T.
Contractor:
Client: SRK
Date Backfill Placed: — DateTested: Aug/12/08
Attention:
Tested By: John Purves
Machine Number: 60841 Temperature: 11 °C

Soil Description: Till, Cover Pad Material

Max. Dry Density (kg/m³): 2130 STDD 3256
Optimum Moisture Content: STDM 702

Test Number	2008 013		014		015	
Location	CT #4 Row 5 #1		CT #4 Row 5 #2		CT #4 Row 5 #3	
Depth from Grade	∅		∅		∅	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	3.8%		4.9%		4.5%	
γDry (kg/m³)	2010		2195		2219	
Specified Compaction	95%		95%		95%	
Compaction (%)	94.3		103.1%		104.2%	

Test Number	016		017		018	
Location	CT #4 Row 6 #1		CT #4 Row 6 #2		CT #4 Row 6 #3	
Depth from Grade	∅		∅		∅	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	4.6%		4.0%		~~3.4%~~	4.6%
γDry (kg/m³)	2152		2061		~~2297~~	2165
Specified Compaction	95%		95%		95%	
Compaction (%)	101.0%		96.8%		~~[illegible]~~	101.7%

Remarks:

Data presented hereon is for the sole use of the stipulated client. EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of EBA.

The testing services reported herein have been performed by an EBA technician to recognized Industry standards, unless otherwise noted, No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, EBA will provide it upon written request.

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EBA Engineering

FIELD DENSITY REPORT

All tests performed in accordance with ASTM Standards
Ref. ASTM D2922-71 Standard Proctor (ASTM D698-70T)
ASTM D3017-72 Modified Proctor (ASTM D1557-70T)

Project: Anvil Range - Waste Rock Cover Pads
Address: Faro, Y.T.

Project Number:
Contractor:
Client: SRK

Date Backfill Placed: —
Date Tested: Aug 12/08
Attention:
Tested By: John Purves
Machine Number: 60841
Temperature: 11 °C

Soil Description: , Cover Pad Material
gravel and Sand, some silt
Max. Dry Density (kg/m³): 2130
STDD 3256
Optimum Moisture Content:
STDM 702

Test Number	2008 019		020		021	
Location	CT# 3A Row 1 #1		CT# 3A Row 1 #2		CT# 3A Row 1 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	2.8%		2.5%		2.5%	
γDry (kg/m³)	2048		2103		2001	
Specified Compaction	95%		95%		95%	
Compaction (%)	96.2%		98.7%		93.9%	

Test Number	022		023		024	
Location	CT# 3A Row 2 #1		CT# 3A Row 2 #2		CT# 3A Row 2 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	3.1%		2.5%		3.5%	
γDry (kg/m³)	2019		1967		2074	
Specified Compaction	95%		95%		95%	
Compaction (%)	94.8%		92.4%		97.4%	

Remarks:

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FIELD DENSITY REPORT

All tests performed in accordance with ASTM Standards
Ref. ASTM D2922-71 Standard Proctor (ASTM D698-70T)
ASTM D3017-72 Modified Proctor (ASTM D1557-70T)

Project: Anvil Range, Waste Rock Cover Pads
Project Number:
Address: Faro Y.T.
Contractor:
Client: SRK
Date Backfill Placed: DateTested: Aug 12 08
Attention:
Tested By: J Purves
Machine Number: 60841 Temperature: 11 °C

Soil Description: [illegible], Cover Pad Material
gravel, Sand, and some silt
Max. Dry Density (kg/m³): 2130 STDD 3256
Optimum Moisture Content: STDM 702

Test Number	2008 025		026		027	
Location	CT#3A Row 3 #1		CT#3A Row 3 #2		CT#3A Row 3 #3	
Depth from Grade	∅		∅		∅	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	4.3%		2.3%		3.0%	
γDry (kg/m³)	2146		1939		2061	
Specified Compaction	95%		95%		95%	
Compaction (%)	100.7%		91.0%		96.8%	

Test Number	028		029		030	
Location	CT#3A Row 4 #1		CT# 3A Row 4 #2		CT#3A Row 4 #3	
Depth from Grade	∅		∅		∅	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	3.1%		3.1%		3.0%	
γDry (kg/m³)	2027		1984		2046	
Specified Compaction	95%		95%		95%	
Compaction (%)	92.5%		93.2%		96.1%	

Remarks:

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FIELD DENSITY REPORT

All tests performed in accordance with ASTM Standards

Ref. ASTM D2922-71 Standard Proctor (ASTM D698-70T)
ASTM D3017-72 Modified Proctor (ASTM D1557-70T)

Project: Anvil Range, Waste Rock cover Pads
Address: Faro Y.T.

Project Number:
Contractor:
Client: SRK

Date Backfill Placed: DateTested: Aug 12th 08
Attention:

Tested By: J Purves
Machine Number: 60841 Temperature: 11 °C

Soil Description: gravel Sand, and Some Silt, Cover Pad Material

Max. Dry Density (kg/m³): 2130 STDD 3256
Optimum Moisture Content: STDM 702

Test Number	2008 031	032	033
Location	CT#3B Row1 #1	CT#3B Row1 #2	CT#3B Row1 #3
Depth from Grade	Ø	Ø	Ø
Depth of Probe	200	200	200
γWet (kg/m³)			
Moisture Content (%)	1.9%	3.0%	2.7%
γDry (kg/m³)	1997	2017	2052
Specified Compaction	95%	95%	95%
Compaction (%)	93.8%	94.7%	96.4%

Test Number	034	035	036
Location	CT#3B Row2 #1	CT#3B Row2 #2	CT#3B Row2 #3
Depth from Grade	Ø	Ø	Ø
Depth of Probe	200	200	200
γWet (kg/m³)			
Moisture Content (%)	2.4%	3.2%	2.7%
γDry (kg/m³)	1947	1955	2045
Specified Compaction	95%	95%	95%
Compaction (%)	91.4%	91.8%	96.0%

Remarks:

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FIELD DENSITY REPORT

All tests performed in accordance with ASTM Standards
Ref. ASTM D2922-71 Standard Proctor (ASTM D698-70T)
ASTM D3017-72 Modified Proctor (ASTM D1557-70T)

Project: Anvil Range, Waste Rock cover Pads
Address: Faro YT

Project Number:
Contractor:
Client: SRK
Attention:

Date Backfill Placed: DateTested: Aug 12 08
Tested By: J Purves
Machine Number: 60841 Temperature: 11 °C

Soil Description: gravel, Sand, and some silt, Cover Pad Material

Max. Dry Density (kg/m³): 2130 STDD 3256
Optimum Moisture Content: STDM 702

Test Number	2008 037		038		039	
Location	CT#3B Row 3 #1		CT#3B Row 3 #2		CT#3B Row 3 #3	
Depth from Grade	ø		ø		ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	1.9%		3.5%		2.6%	
γDry (kg/m³)	1981		1900		2050	
Specified Compaction	95%		95%		95%	
Compaction (%)	93.0%		89.2%		96.3%	

Test Number	040		041		042	
Location	CT#3B Row 4 #1		CT#3B Row 4 #2		CT#3B Row 4 #3	
Depth from Grade	ø		ø		ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	3.0%		3.3%		2.5%	
γDry (kg/m³)	2249		1986		1997	
Specified Compaction	95%		95%		95%	
Compaction (%)	105.6%		93.2%		93.8%	

Remarks:

EBA Engineering

FIELD DENSITY REPORT

All tests performed in accordance with ASTM Standards
Ref. ASTM D2922-71 Standard Proctor (ASTM D698-70T)
ASTM D3017-72 Modified Proctor (ASTM D1557-70T)

Project: Anvil Range, WasteRock Cover Pads
Address: Faro YT
Project Number:
Contractor:
Client: SRK
Date Backfill Placed: ______ DateTested: Aug12/08
Attention:
Tested By: J Purves
Machine Number: 60841 Temperature: 11 °C

Soil Description: Till, Cover Pad Material

Max. Dry Density (kg/m³): 2130 STDD 3256
Optimum Moisture Content: STDM 702

Test Number	2008 043		044		045	
Location	CT#1 Row 1 #1		CT#1 Row 1 #2		CT#1 Row 1 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	5.2%		4.4%		5.0%	
γDry (kg/m³)	2096		2088		2073	
Specified Compaction	95%		95%		95%	
Compaction (%)	98.4%		98.0%		97.3%	

Test Number	046		047		048	
Location	CT#1 Row2 #1		CT#1 Row2 #2		CT#1 Row2 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	6.2%		6.2%		5.5%	
γDry (kg/m³)	1984		2043		2053	
Specified Compaction	95%		95%		95%	
Compaction (%)	93.2%		95.9%		96.4%	

Remarks:

eba

2142.CDR

EBA Engineering

FIELD DENSITY REPORT

All tests performed in accordance with ASTM Standards
Ref. ASTM D2922-71 Standard Proctor (ASTM D698-70T)
ASTM D3017-72 Modified Proctor (ASTM D1557-70T)

Project: Anvil/Range Waste Rock cover pads
Project Number:
Address: Faro YT
Contractor:
Client: SRK
Date Backfill Placed: DateTested: Aug/12/08
Attention:
Tested By: J Purves
Machine Number: 60841 Temperature: 11 °C

Soil Description: Till, Cover Pad Material

Max. Dry Density (kg/m³): 2130 STDD 3256
Optimum Moisture Content: STDM 702

Test Number	2008 049		050		051	
Location	CT#1 Row3 #1		CT#1 Row3 #2		CT#1 Row3 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	4.9%		6.5%		5.4%	
γDry (kg/m³)	2044		1997		1992	
Specified Compaction	95%		95%		95%	
Compaction (%)	96.0%		93.8%		93.5%	

Test Number	052		053		054	
Location	CT#1 Row4 #1		CT#1 Row4 #2		CT#1 Row4 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	4.3%		5.9%		5.7%	
γDry (kg/m³)	2155		1707		1978	
Specified Compaction	95%		95%		95%	
Compaction (%)	101.2%		80.1% *		92.9%	

Remarks: * Void Encountered.

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FIELD DENSITY REPORT

All tests performed in accordance with ASTM Standards
Ref. ASTM D2922-71 Standard Proctor (ASTM D698-70T)
ASTM D3017-72 Modified Proctor (ASTM D1557-70T)

Project: Anvil Range, Waste Rock cover Pads
Address: Faro Y.T.
Date Backfill Placed: ________ DateTested: Aug 12/08
Tested By: J Purves

Project Number: ________
Contractor: ________
Client: SRK
Attention: ________
Machine Number: 60841 Temperature: 11 °C

Soil Description: Till, Cover Pad Material

Max. Dry Density (kg/m³): 2130 STDD 3256
Optimum Moisture Content: STDM 702

Test Number	2008 055		056		057	
Location	CT #1 Row 5 #1		CT #1 Row 5 #2		CT #1 Row 5 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	5.0%		5.9%		5.3%	
γDry (kg/m³)	2046		1985		2082	
Specified Compaction	95%		95%		95%	
Compaction (%)	96.1%		93.2%		97.8%	

Test Number	058		059		060	
Location	CT #1 Row 6 #1		CT #1 Row 6 #2		CT #1 Row 6 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	6.7%		6.7%		5.3%	
γDry (kg/m³)	2037		2066		2162	
Specified Compaction	95%		95%		95%	
Compaction (%)	95.6%		97.0%		101.5%	

Remarks: ________

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EBA Engineering

FIELD DENSITY REPORT

All tests performed in accordance with ASTM Standards
Ref. ASTM D2922-71 Standard Proctor (ASTM D698-70T)
ASTM D3017-72 Modified Proctor (ASTM D1557-70T)

Project: Anvil Range, Waste Rock Cover Pads
Address: Faro YT

Project Number:
Contractor:
Client: SRK

Date Backfill Placed: ______ DateTested: Aug 12 08
Attention:

Tested By: J Porves
Machine Number: 60841 Temperature: 11 °C

Soil Description: Till, Cover Pad Material

Max. Dry Density (kg/m³): 2130 STDD 3256
Optimum Moisture Content: STDM 702

Test Number	2008 061		061		063	
Location	CT2B Row 1 #1		CT#2B Row1 #2		CT#2B Row1 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	4.3%		4.7%		5.4%	
γDry (kg/m³)	2131		2136		2033	
Specified Compaction	95%		95%		95%	
Compaction (%)	100.1%		100.3%		95.5%	

Test Number	064		065		066	
Location	CT#2B Row 2 #1		CT#2B Row2 #2		CT#2B Row2 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	5.1%		4.8%		5.2%	
γDry (kg/m³)	2106		2181		2097	
Specified Compaction	95%		95%		95%	
Compaction (%)	98.9%		102.4%		98.4%	

Remarks:

eba

2142.CDR

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FIELD DENSITY REPORT

All tests performed in accordance with ASTM Standards
Ref. ASTM D2922-71 Standard Proctor (ASTM D698-70T)
ASTM D3017-72 Modified Proctor (ASTM D1557-70T)

Project: Anvil Range, Waste Rock Cover Pads
Address: Faro Y.T.

Project Number:
Contractor:
Client: SRK

Date Backfill Placed: DateTested: Aug 12th 08
Attention:
Tested By: J Purves
Machine Number: 60841 Temperature: 11 °C

Soil Description: Till, Cover Pad Material

Max. Dry Density (kg/m³): 2130 STDD 3256
Optimum Moisture Content: STDM 702

Test Number	2008 067	068	069
Location	CT#2B Row3 #1	CT#2B Row3 #2	CT#2B Row3 #3
Depth from Grade	Ø	Ø	Ø
Depth of Probe	200	200	200
γWet (kg/m³)			
Moisture Content (%)	5.2%	5.3%	6.1%
γDry (kg/m³)	2092	2137	2077
Specified Compaction	95%	95%	95%
Compaction (%)	98.2%	100.4%	97.5%

Test Number	070	071	072
Location	CT#2B Row4 #1	CT#2B Row4 #2	CT#2B Row4 #3
Depth from Grade	Ø	Ø	Ø
Depth of Probe	200	200	200
γWet (kg/m³)			
Moisture Content (%)	7.3%	5.2%	5.8%
γDry (kg/m³)	2068	2083	2107
Specified Compaction	95%	95%	95%
Compaction (%)	97.1%	97.8	98.9%

Remarks:

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FIELD DENSITY REPORT

All tests performed in accordance with ASTM Standards
Ref. ASTM D2922-71 Standard Proctor (ASTM D698-70T)
ASTM D3017-72 Modified Proctor (ASTM D1557-70T)

Project: Anvil Range Waste Rock cover Pads
Project Number:
Address: Faro YT
Contractor:
Client: SRK
Date Backfill Placed: DateTested: Aug/12/08
Attention:
Tested By: J Purves
Machine Number: 60841 Temperature: 11 °C

Soil Description: Till, cover Pad Material

Max. Dry Density (kg/m³): 2130 STDD 3256
Optimum Moisture Content: STDD 702

Test Number	2008 073		074		075	
Location	CT#2A Row 1 #1		CT#2A Row 1 #2		CT#2A Row 1 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	6.3%		5.4%		4.7%	
γDry (kg/m³)	2117		2109		2150	
Specified Compaction	95%		95%		95%	
Compaction (%)	99.4%		99.0%		100.9%	

Test Number	076		077		078	
Location	CT#2A Row2 #1		CT#2A Row2 #2		CT#2A Row2 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	5.1%		5.1%		4.4%	
γDry (kg/m³)	2201		2169		2190	
Specified Compaction	95%		95%		95%	
Compaction (%)	103.3%		101.8%		102.8%	

Remarks:

eba

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FIELD DENSITY REPORT

All tests performed in accordance with ASTM Standards
Ref. ASTM D2922-71 Standard Proctor (ASTM D698-70T)
ASTM D3017-72 Modified Proctor (ASTM D1557-70T)

Project: Anvil Range, Waste Rock cover Pads
Project Number:
Address: Faro YT
Contractor:
Client: SRK
Date Backfill Placed: DateTested: Aug 12/08
Attention:
Tested By: J Purves
Machine Number: 60841 Temperature: 11 °C

Soil Description: Till, Cover Pad Material

Max. Dry Density (kg/m³): 2130 STDD 3256
Optimum Moisture Content: STDM 702

Test Number	2008 079		080		081	
Location	CT#2A Row3 #1		CT#2A Row3 #2		CT#2A Row3 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	5.2%		4.8%		5.5%	
γDry (kg/m³)	2127		2091		2151	
Specified Compaction	95%		95%		95%	
Compaction (%)	99.8%		98.2%		101.0%	

Test Number	082		083		084	
Location	CT#2A Row4 #1		CT#2A Row4 #2		CT#2A Row4 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	5.0%		4.8%		5.2%	
γDry (kg/m³)	2043		2147		2173	
Specified Compaction	95%		95%		95%	
Compaction (%)	95.9%		100.8%		102.0%	

Remarks:

eba

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FIELD DENSITY REPORT

All tests performed in accordance with ASTM Standards
Ref. ASTM D2922-71 Standard Proctor (ASTM D698-70T)
ASTM D3017-72 Modified Proctor (ASTM D1557-70T)

Project: Anvil Range Waste Rock Cover Pads
Project Number:
Address: Faro Y.T.
Contractor:
Client: SRK
Date Backfill Placed:
Date Tested: Aug 12th 08
Attention:
Tested By: J Purves
Machine Number: 60841
Temperature: 11 °C

Soil Description: Till, Cover Pad Material

Max. Dry Density (kg/m³): 2130 STDD 3256
Optimum Moisture Content: STDM 702

Test Number	2008 085		086		087	
Location	L#2 Row1 #1		L#2 Row1 #2		L#2 Row1 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	5.5%		5.4%		5.3%	
γDry (kg/m³)	2206		2149		2222	
Specified Compaction	95%		95%		95%	
Compaction (%)	103.6%		100.9%		104.3%	

Test Number	088		089		090	
Location	L#2 Row2 #1		L#2 Row2 #2		L#2 Row2 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	5.1%		4.9%		5.1%	
γDry (kg/m³)	2203		2102		2060	
Specified Compaction	95%		95%		95%	
Compaction (%)	103.4%		98.7%		96.7%	

Remarks:

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FIELD DENSITY REPORT

All tests performed in accordance with ASTM Standards
Ref. ASTM D2922-71 Standard Proctor (ASTM D698-70T)
ASTM D3017-72 Modified Proctor (ASTM D1557-70T)

Project: Anvil Range, Waste Rock Cover Pads
Address: Faro YT

Date Backfill Placed: ______ Date Tested: Aug 12th 08
Tested By: J Purves

Project Number: ______
Contractor: ______
Client: SRK
Attention: ______
Machine Number: 60841 Temperature: 11 °C

Soil Description: Till, Cover Pad Material

Max. Dry Density (kg/m³): 2130 STDD 3256
Optimum Moisture Content: STDM 702

Test Number	2008 091		092		093	
Location	L#2 Row#3 #1		L#2 Row#3 #2		L#2 Row3 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	5.6%		4.6%		6.0%	
γDry (kg/m³)	2129		2192		2085	
Specified Compaction	95%		95%		95%	
Compaction (%)	99.9%		102.9%		97.9%	

Test Number	094		095		096	
Location	L#2 Row 4 #1		L#2 Row4 #2		L#2 Row4 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	5.4%		5.5%		4.8%	
γDry (kg/m³)	2146		2075		2173	
Specified Compaction	95%		95%		95%	
Compaction (%)	100.7%		97.4%		102.0%	

Remarks: ______

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FIELD DENSITY REPORT

All tests performed in accordance with ASTM Standards
Ref. ASTM D2922-71 Standard Proctor (ASTM D698-70T)
ASTM D3017-72 Modified Proctor (ASTM D1557-70T)

Project: Anvil Range, Waste Rock Cover Pads
Address: Faro YT

Date Backfill Placed: ______ DateTested: Aug 12th 08
Tested By: J Purves

Project Number: ______
Contractor: ______
Client: SRK
Attention: ______
Machine Number: 6084 Temperature: 11 °C

Soil Description: Till, Cover Pad Material

Max. Dry Density (kg/m³): 2130 STDD 3256
Optimum Moisture Content: STDM 702

Test Number	2008 097		098		099	
Location	L#1 Row 1 #1		L#1 Row 1 #2		L#1 Row 1 #3	
Depth from Grade	Ø		Ø		Ø	
Depth of Probe	200		200		200	
γWet (kg/m³)						
Moisture Content (%)	6.8%		4.2%		6.0%	
γDry (kg/m³)	1669		1679		1805	
Specified Compaction	95%		95%		95%	
Compaction (%)	78.4%		78.8%		84.8%	

Test Number						
Location						
Depth from Grade						
Depth of Probe						
γWet (kg/m³)						
Moisture Content (%)						
γDry (kg/m³)						
Specified Compaction						
Compaction (%)						

Remarks: ______

eba

2142.CDR

Appendix E
2008 Flow Monitoring System Upgrade

1 Upgrade of the automated data collection system

As observed during the 2006 monitoring season (SRK 2007), a significant amount of flow representing run-off was reporting to the flow meters through the drain pipes at very low flow rates (i.e. dripping). These volumes could not be measured by the SeaMetrics flow meters designed for a minimum flow rate of 0.19 L/second (www.seametrics.com). To correct the situation, an upgrade of the run-off monitoring system was included among the tasks to be performed under the 2007/08 Project 17a (Appendix A).

The upgrade was to consist of the installation of six tipping bucket flow gauges as backup low-flow monitoring devices, following the model of the existing interflow monitoring system. In August 2007 six Texas Electronics model TE525M tipping bucket flow gauges were acquired and installed on site on the outside of the Vangorda monitoring hut attached to the south wall of the hut. The flow gauges were designed for measuring rainfall, with resolution of 0.1 mm/tip and accuracy of 5% at a flow rate of 0.39 x 10^{-3} L/second, which insures adequate accuracy for the low flow conditions observed on site.

The 2 inch drainage pipes were re-routed from the inside of the monitoring hut in such way that each pipe intercepts the funnel of one flow gauge. A Tee with a branch diameter of ½ inch and a flow-through diameter of 2 inch was installed at the vertical of each tipping bucket flow gauge, and a short section of ½ inch pipe was attached to the Tee, making the connection between the drainage pipe and the funnel of the flow gauge, to reduce splashing. In this way, at low flow the water would be dripping through the pipe into the funnel, and at high flow the excess water (which can not drain through the ½ inch pipe) would simply discharge straight from the 2 inch PVC drainage pipe after the volume was measured by the SeaMetrics flow meter.

The automated data collection was resolved by employing a Campbell Scientific SDM-SW8A device that allows the simultaneous monitoring of up to 8 tipping bucket flow gauges using one single control port of CR10X #1 data logger. The six TE525 flow gauges were connected to channels 1 through 6 of the SDM device, and the remaining channels were occupied by transferring two of the existing tipping bucket flow gauges (TBR#1 and TBR#2 measuring interflow) from CR10X #2. The total number of channels will be expanded to 15 in 2008 by installing a second SDM-SW8A device in parallel to the first one (15 will be the final number of tipping bucket flow gauges after the monitoring instruments of the lysimeter test will be installed in 2008). The shortcoming of using SDM devices to monitor flow is the fact that flow events are recorded as total flow at a 30 minutes resolution rather than instantaneously (as in the case of flow gauges connected directly to data loggers).

As part of streamlining the automated data collection, the connections of the CS229 Thermal Conductivity sensors pertaining to CT#2A and CT#2B were transferred from CR10X #1 to CR10X #2. The programs controlling data collection and processing by the CR10X data loggers were modified to reflect the changes in the structure and order of the monitored instruments. Monitoring data was collected according to the new structure staring with August 30, 2007.

Appendix F
Field Diagnostic Data Sheets

SRK Consulting
ARMC Waste Rock and Tailings Trial Covers- Information Data Sheet

for Maritz Rykaart

Date and Time:	June 10, 2008 8:30AM
Downloaded by:	Chris Croy Mike Brewer Lovejoy Fulton

Davis Instruments Data Loggers (Weather Stations on CT#1 and CT#2A/2B)

	CT#1		CT#2A/2B
Data successfully downloaded:	y	Data successfully downloaded:	y
Diagnostic test run:	y	Diagnostic test run:	y
Diagnostic test results:		Diagnostic test results:	
Console battery voltage:	DNR	Console battery voltage:	DNR

Special Comments: **Weather Station 2A/2B appears to be missing outside weather parameters, perhaps radio communication not working**

Campbell Scientific CR10X Data Loggers (Located in Monitoring Hut)

	CR10X-1		CR10X-2
Data successfully downloaded:	y	Data successfully downloaded:	y
Diagnostic test run:	y	Diagnostic test run:	y
Diagnoistic Test Results:		Diagnoistic Test Results:	
Battery Voltage:	DNR	Battery Voltage:	DNR
Solar panel feed voltage if <11v	n/a	Solar panel feed voltage if <11v	n/a

Special Comments:

Seametrics Data Loggers (Flowmeters in Monitoring Hut)

	Data successfully downloaded	Battery O.K.
CT#1 (DL#1):	y	y
CT#2A (DL32):	y	y
CT#2B (DL#3):	y	y
CT#3A (DL#4):	y	y
CT#3A-I (DL#5):	y	y
CT#3B (DL#6):	y	y
CT#3B-I (DL#7):	y	y
CT#4 (DL#8):	y	y
CT#4-I (DL#9):	y	y
Has the daily flow check data been attached:		y

Special Comments:

Lakewood Systems Data Logger (Thermistors on Grum O/B Dump)

Data successfully downloaded: y

Manual readings taken on:

String #1:	y	String #3:	y
String #2:	y	String #4:	y

Special Comments: **Thermistors Read on June 11, 2008**

Diviner 2000 Data Logger (Manual Moisture Content Probe)

Data successfully downloaded: y

Special Comments:

Tailings Trial Cover Survey (Rose Creek Tailings)

Date completed:	10-Jun-08
Completed by:	Chris Croy Mike Brewer Lovejoy Fulton
Survey Data Forwarded Via: E-mail:	y
Fax:	

Special Comments:

SRK Consulting
ARMC Waste Rock and Tailings Trial Covers- Information Data Sheet

for Jozsef Miskolczi

Date and Time:	18/06/2008 9:30:00AM
Downloaded by:	Chris Croy Mike Brewer Lovejoy Fulton

Davis Instruments Data Loggers (Weather Stations on CT#1 and CT#2A/2B)

	CT#1	CT#2A/2B
Data successfully downloaded:	y	y
Diagnostic test run:	y	y
Diagnostic test results:		
Console battery voltage:	3.35 V	3.36 V

Special Comments:

Campbell Scientific CR10X Data Loggers (Located in Monitoring Hut)

	CR10X-1	CR10X-2	CR1000
Data successfully downloaded:	y	y	y
Diagnostic test run:	y	y	y
Diagnoistic Test Results:			
Battery Voltage:	14.21 V	13.69 V	12.42 V
Solar panel feed voltage if <11v	n/a	n/a	n/a

Special Comments:

Seametrics Data Loggers (Flowmeters in Monitoring Hut)

	Data successfully downloaded	Battery O.K.
CT#1 (DL#1):	y	y
CT#2A (DL32):	y	y
CT#2B (DL#3):	y	y
CT#3A (DL#4):	y	y
CT#3A-I (DL#5):	y	y
CT#3B (DL#6):	y	y
CT#3B-I (DL#7):	y	y
CT#4 (DL#8):	y	y
CT#4-I (DL#9):	y	y

Special Comments:

Lakewood Systems Data Logger (Thermistors on Grum O/B Dump)

Data successfully downloaded: y

Manual readings taken on:

String #1:	y	String #3:	y
String #2:	y	String #4:	y

Special Comments:

Diviner 2000 Data Logger (Manual Moisture Content Probe)

Data successfully downloaded: y

Special Comments:

Tailings Trial Cover Survey (Rose Creek Tailings)

Date completed:

Completed by:

Survey Data Forwarded Via: E-mail: Fax:

Special Comments:

SRK Consulting
ARMC Waste Rock and Tailings Trial Covers- Information Data Sheet

for Jozsef Miskolczi

Date and Time:	25/06/2008 10:00AM
Downloaded by:	Chris Croy Lovejoy Fulton

Davis Instruments Data Loggers (Weather Stations on CT#1 and CT#2A/2B)

	CT#1	CT#2A/2B
Data successfully downloaded:	y	y
Diagnostic test run:	n	n
Diagnostic test results:		
Console battery voltage:	n/a	n/a

Special Comments:

Campbell Scientific CR10X Data Loggers (Located in Monitoring Hut)

	CR10X-1	CR10X-2	CR1000
Data successfully downloaded:	y	y	y
Diagnostic test run:	n	n	n
Diagnoistic Test Results:			
Battery Voltage:	n/a	n/a	n/a
Solar panel feed voltage if <11v	n/a	n/a	n/a

Special Comments:

Seametrics Data Loggers (Flowmeters in Monitoring Hut)

	Data successfully downloaded	Battery O.K.
CT#1 (DL#1):	y	y
CT#2A (DL32):	y	y
CT#2B (DL#3):	y	y
CT#3A (DL#4):	y	y
CT#3A-I (DL#5):	y	y
CT#3B (DL#6):	y	y
CT#3B-I (DL#7):	y	y
CT#4 (DL#8):	y	y
CT#4-I (DL#9):	y	y

Special Comments:

Lakewood Systems Data Logger (Thermistors on Grum O/B Dump)

Data successfully downloaded: y

Manual readings taken on:

String #1:	y	String #3:	y
String #2:	y	String #4:	y

Special Comments:

Diviner 2000 Data Logger (Manual Moisture Content Probe)

Data successfully downloaded: y

Special Comments:

Tailings Trial Cover Survey (Rose Creek Tailings)

Date completed:	24-Jun-08
Completed by:	Chris Croy Lovejoy Fulton
Survey Data Forwarded Via: E-mail:	y
Fax:	

Special Comments:

SRK Consulting
ARMC Waste Rock and Tailings Trial Covers- Information Data Sheet

for Jozsef Miskolczi

Date and Time:	10/07/2008 10:00AM
Downloaded by:	Chris Croy Lovejoy Fulton

Davis Instruments Data Loggers (Weather Stations on CT#1 and CT#2A/2B)

	CT#1		CT#2A/2B
Data successfully downloaded:	y	Data successfully downloaded:	y
Diagnostic test run:	y	Diagnostic test run:	y
Diagnostic test results:		Diagnostic test results:	
Console battery voltage:	3.32 V	Console battery voltage:	3.35 V

Special Comments:

Campbell Scientific CR10X Data Loggers (Located in Monitoring Hut)

	CR10X-1	CR10X-2	CR1000
Data successfully downloaded:	y	y	y
Diagnostic test run:	y	y	y
Diagnoistic Test Results:			
Battery Voltage:	13.68 V	13.31 V	12.11 V
Solar panel feed voltage if <11v	n/a	n/a	n/a

Special Comments:

Seametrics Data Loggers (Flowmeters in Monitoring Hut)

	Data successfully downloaded	Battery O.K.
CT#1 (DL#1):	y	y
CT#2A (DL32):	y	y
CT#2B (DL#3):	y	y
CT#3A (DL#4):	y	y
CT#3A-I (DL#5):	y	y
CT#3B (DL#6):	y	y
CT#3B-I (DL#7):	y	y
CT#4 (DL#8):	y	y
CT#4-I (DL#9):	y	y

Special Comments: flowmeters in new hut also successfully downloaded

Lakewood Systems Data Logger (Thermistors on Grum O/B Dump)

Data successfully downloaded: n

Manual readings taken on:

String #1:	n	String #3:	n
String #2:	n	String #4:	n

Special Comments: **Could not reach thermistors due to heavy rain and erosion**

Diviner 2000 Data Logger (Manual Moisture Content Probe)

Data successfully downloaded: y

Special Comments:

Date completed:	10-Jul-08
Completed by:	Chris Croy Joy Fulton
Survey Data Forwarded Via: E-mail:	y
Fax:	

Special Comments:

SRK Consulting
ARMC Waste Rock and Tailings Trial Covers- Information Data Sheet

for Jozsef Miskolczi

Date and Time:	16/07/2008 10:00AM
Downloaded by:	Chris Croy Mike Brewer Joy Fulton

Davis Instruments Data Loggers (Weather Stations on CT#1 and CT#2A/2B)

	CT#1		CT#2A/2B
Data successfully downloaded:	y	Data successfully downloaded:	y
Diagnostic test run:	y	Diagnostic test run:	y
Diagnostic test results:		Diagnostic test results:	
Console battery voltage:	3.35V	Console battery voltage:	3.33V

Special Comments:

Campbell Scientific CR10X Data Loggers (Located in Monitoring Hut)

	CR10X-1	CR10X-2	CR1000
Data successfully downloaded:	y	y	y
Diagnostic test run:	y	y	y
Diagnoistic Test Results:			
Battery Voltage:	13.88V	14.45V	12.09V
Solar panel feed voltage if <11v	n/a	n/a	n/a

Special Comments:

Seametrics Data Loggers (Flowmeters in Monitoring Hut)

	Data successfully downloaded	Battery O.K.
CT#1 (DL#1):	y	y
CT#2A (DL32):	y	y
CT#2B (DL#3):	y	y
CT#3A (DL#4):	y	y
CT#3A-I (DL#5):	y	y
CT#3B (DL#6):	y	y
CT#3B-I (DL#7):	y	y
CT#4 (DL#8):	y	y
CT#4-I (DL#9):	y	y

Special Comments: flowmeters in new hut also successfully downloaded

Lakewood Systems Data Logger (Thermistors on Grum O/B Dump)

Data successfully downloaded: y

Manual readings taken on:

String #1:	y	String #3:	y
String #2:	y	String #4:	y

Special Comments:

Diviner 2000 Data Logger (Manual Moisture Content Probe)

Data successfully downloaded: y

Special Comments:

Date completed:

Completed by:

Survey Data Forwarded Via: E-mail:

Fax:

Special Comments:

SRK Consulting
ARMC Waste Rock and Tailings Trial Covers- Information Data Sheet

for Jozsef Miskolczi

Date:	7/23/2008 0:00
Downloaded by:	Mike Brewer Joy Fulton

Davis Instruments Data Loggers (Weather Stations on CT#1 and CT#2A/2B)

	CT#1		CT#2A/2B
Data successfully downloaded:	y	Data successfully downloaded:	y
Diagnostic test run:	n	Diagnostic test run:	n
Diagnostic test results:		Diagnostic test results:	
Console battery voltage:		Console battery voltage:	

Special Comments:

Campbell Scientific CR10X Data Loggers (Located in Monitoring Hut)

	CR10X-1	CR10X-2	CR1000
Data successfully downloaded:	y	y	y
Diagnostic test run:	n	n	n
Diagnoistic Test Results:			
Battery Voltage:			
Solar panel feed voltage if <11v			

Special Comments:

Seametrics Data Loggers (Flowmeters in Monitoring Hut)

	Data successfully downloaded	Battery O.K.
CT#1 (DL#1):	y	y
CT#2A (DL32):	y	y
CT#2B (DL#3):	y	y
CT#3A (DL#4):	y	y
CT#3A-I (DL#5):	y	y
CT#3B (DL#6):	y	y
CT#3B-I (DL#7):	y	y
CT#4 (DL#8):	y	y
CT#4-I (DL#9):	y	y

Special Comments: flowmeters in new hut also successfully downloaded

Lakewood Systems Data Logger (Thermistors on Grum O/B Dump)

Data successfully downloaded: y

Manual readings taken on:

String #1:	y	String #3:	y
String #2:	y	String #4:	y

Special Comments:

Diviner 2000 Data Logger (Manual Moisture Content Probe)

Data successfully downloaded: y

Special Comments:

Date completed:

Completed by:

Survey Data Forwarded Via: E-mail:

Fax:

Special Comments:

SRK Consulting

ARMC Waste Rock and Tailings Trial Covers- Information Data Sheet

for Jozsef Miskolczi

Date and Time:	13/08/2008 9:00AM
Downloaded by:	Chris Croy Mike Brewer Lovejoy Fulton

Davis Instruments Data Loggers (Weather Stations on CT#1 and CT#2A/2B)

	CT#1		CT#2A/2B
Data successfully downloaded:	y	Data successfully downloaded:	y
Diagnostic test run:	y	Diagnostic test run:	y
Diagnostic test results:		Diagnostic test results:	
Console battery voltage:	3.34 V	Console battery voltage:	3.32 V
Special Comments:			

Campbell Scientific CR10X Data Loggers (Located in Monitoring Hut)

	CR10X-1	CR10X-2	CR1000
Data successfully downloaded:	y	y	y
Diagnostic test run:	y	y	y
Diagnoistic Test Results:			
Battery Voltage:	13.81 V	15.02 V	12.76 V
Solar panel feed voltage if <11v	n/a	n/a	n/a
Special Comments:			

Seametrics Data Loggers (Flowmeters in Monitoring Hut)

	Data successfully downloaded	Battery O.K.
CT#1 (DL#1):	y	y
CT#2A (DL32):	y	y
CT#2B (DL#3):	y	y
CT#3A (DL#4):	y	y
CT#3A-I (DL#5):	y	y
CT#3B (DL#6):	y	y
CT#3B-I (DL#7):	y	y
CT#4 (DL#8):	y	y
CT#4-I (DL#9):	y	y
Special Comments:	flowmeters in new hut also successfully downloaded	

Lakewood Systems Data Logger (Thermistors on Grum O/B Dump)

Data successfully downloaded:	y		
Manual readings taken on:			
String #1:	y	String #3:	y
String #2:	y	String #4:	y
Special Comments:			

Diviner 2000 Data Logger (Manual Moisture Content Probe)

Data successfully downloaded:	y
Special Comments:	

Date completed:		
Completed by:		
Survey Data Forwarded Via:	E-mail:	
	Fax:	
Special Comments:		