# Susitna Hydrology Project

# ESG138-1 Groundwater Station

# Data Measurement and Recording Standards

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**Groundwater Station**

Data-Collection Objectives: Meteorological data to evaluate the potential for hydro-electric power generation in the Susitna River region.

Time Recording Standard: **Always** Alaska Standard Time (UTC – 9).

Datalogger Scan Interval Standard: 3 seconds.

Time Measurement Standards:

* Hourly readings are recorded at the end of the hour; therefore, the hourly average water temperature, for example, with a 60-second scan interval and a time stamp of 14:00 is measured from 13:01 to 14:00:00. For a 60-second scan interval, the hourly average would be the average of 60 min = 60 values.
* Quarter-hourly readings are recorded every fifteen minutes starting at the top of the hour.
* Instantaneous readings are taken at the time specified by the time stamp.
* A day begins at midnight (00:00:00) and ends at midnight (23:59:55). All daily data are from the day prior to the date of the time stamp. For example, if the time stamp reads 09/09/2007 00:00 or 09/09/2007 12:00:00 AM, the data are from 09/08/2007.

Data Retrieval Interval: Data will be retrieved hourly.

Data Reporting Interval: Hourly

# Images

Camera: Moultrie Game camera; not connected to data logger.

Memory Card: 16GB SD Flash Memory Card

Flash Card Capacity: ~20,000 Images or over 1 year

Images Taken: On camera’s internal time interval.

Images Saved on Camera Memory Card: Half-hourly Lo-Resolution

Images Saved on Datalogger: Not connected to data logger.

Image Trigger Interval: 30-minutes

Data Retrieval: Manually, during station visits.

# Water Height

Sensor: Two CS451 (Campbell Scientific, inc) pressure transducer, SDI-12 type sensors. Note INW PT-12s may be substituted for one or more of the CS451s.

Pressure Measurement Range: 0-7.25 psig

Output Units: cm, ft (water height above sensor), psig

Scan Interval: 60 seconds

Output to Tables:

* Fifteen-Minute Water Table:
	+ Fifteen-Minute Sample Water Height: Fifteen minute sample (point) reading recorded at the top of the hour, 15, 30, and 45 minutes past the hour for each sensor.
	+ Fifteen-Minute Average Water Height: Fifteen minute average of all 15 readings recorded at the top of the hour, 15, 30, and 45 minutes past the hour for each sensor.
	+ Fifteen-Minute Maximum Water Height: Fifteen minute maximum of all 15 readings recorded at the top of the hour, 15, 30, and 45 minutes past the hour for each sensor.
	+ Fifteen-Minute Minimum Water Height: Fifteen minute minimum of all 15 readings recorded at the top of the hour, 15, 30, and 45 minutes past the hour for each sensor.
* Hourly Climate Table:
	+ Hourly Sample Water Height: Sample at the top of each hour for each sensor.
* Daily Table:
	+ Daily Average Water Height: Average of all readings for the previous day for each sensor.
	+ Daily Maximum Water Height: Maximum water height for the previous day for each sensor.
	+ Daily Minimum Water Height: Minimum water height for the previous day for each sensor.

# Water Temperature

Sensor: Two CS451 (Campbell Scientific, inc) pressure transducer, SDI-12 type sensors. Note INW PT-12s may be substituted for one or more of the CS451s.

Operating Range: -10°C to 80°C

Output Units: °C

Scan Interval: 60 seconds

Output to Tables:

* Fifteen-Minute Water Table:
	+ Fifteen-Minute Average Water Temperature: Fifteen minute average of all 15 readings recorded at the top of the hour, 15, 30, and 45 minutes past the hour for each sensor.
	+ Fifteen-Minute Maximum Water Temperature: The highest reading taken during the previous fifteen minutes for each sensor.
	+ Fifteen-Minute Minimum Water Temperature: The lowest reading taken during the previous fifteen minutes for each sensor.
* Hourly Climate Table:
	+ Hourly Sample Water Temperature: Sample at the top of each hour for each sensor.
* Daily Table:
	+ Daily Average Water Temperature: Average of all readings for the previous day for each sensor.
	+ Daily Maximum Water Temperature: the highest reading taken during the previous day for each sensor.
	+ Daily Minimum Water Temperature: the lowest reading taken during the previous day for each sensor.

# Water Electrical Conductivity

Sensor: Two CS547A Probes.

Operating Range: 0°C to +50°C; 0.005 to 7.0 mS cm-1.

Cell Constant: Individually calibrated. The cell constant (Kc) is found on a label near the termination of the cable.

Output Units: kΩ, mS cm-1

Scan Interval: 60 minutes

Output to Tables:

* Fifteen-Minute Water Table:
	+ Fifteen-Minute Sample Water Electrical Conductivity: Fifteen minute sample (point) reading recorded at the top of the hour, 15, 30, and 45 minutes past the hour for each sensor.
	+ Fifteen-Minute Average Water Electrical Conductivity: Fifteen minute average of all 15 readings recorded at the top of the hour, 15, 30, and 45 minutes past the hour for each sensor.
	+ Fifteen-Minute Maximum Water Electrical Conductivity: Fifteen minute maximum of all 15 readings recorded at the top of the hour, 15, 30, and 45 minutes past the hour for each sensor.
	+ Fifteen-Minute Minimum Water Electrical Conductivity: Fifteen minute minimum of all 15 readings recorded at the top of the hour, 15, 30, and 45 minutes past the hour for each sensor.
* Hourly Climate Table:
	+ Hourly Sample Water Electrical Electrical Conductivity: Measured at the top of the hour for each sensor.
* Hourly Raw Table:
	+ Hourly Sample Water Electrical Conductivity: Top of the hour measurement of water electrical conductivity each sensor, uncorrected for temperature.
	+ Hourly Average Water Electrical Conductivity: Hourly average water electrical conductivity for each sensor, uncorrected for temperature.
* Daily Table:
	+ Daily Average Water Electrical Conductivity: Average of all readings for the previous day for each sensor.
	+ Daily Maximum Water Electrical Conductivity: Maximum of all readings for the previous day for each sensor.
	+ Daily Minimum Water Electrical Conductivity: Minimum of all readings for the previous day for each sensor.

# Water Temperature at Electrical Conductivity Sensors

Sensor: Two CS547A Probes with Betatherm 100K6A1 thermistors.

Operating Range: 0°C to +50°C

Output Units: °C.

Scan Interval: 60 minutes

Output to Tables:

* Fifteen-Minute Water Table:
	+ Fifteen-Minute Average Water Temperature: Fifteen minute average of all 15 readings recorded at the top of the hour, 15, 30, and 45 minutes past the hour for each sensor.
	+ Fifteen-Minute Maximum Water Temperature: The highest reading taken during the previous fifteen minutes for each sensor.
	+ Fifteen-Minute Minimum Water Temperature: The lowest reading taken during the previous fifteen minutes for each sensor.
* Hourly Climate Table:
	+ Hourly Sample Water Temperature: Measured at the top of the hour for each sensor.
* Daily Table:
	+ Daily Average Water Temperature: Average of all readings for the previous day for each sensor.
	+ Daily Maximum Water Temperature: Maximum of all readings for the previous day for each sensor.
	+ Daily Minimum Water Temperature: Minimum of all readings for the previous day for each sensor.

# Soil Temperature Profile

Sensor: Two GWS YSI Soil Profile Temperature Probes each with Twelve YSI Series 44033 thermistors.

Installation: Vertically in a drilled hole.

Depths: 0, 5, 10, 15, 20, 30, 40, 60, 80, 100, 120, 150 cm, 1-12 thermistors (based on actual depth of bored drill hole)

Output Units: kΩ, °C.

Scan Interval: 60 seconds

Output to Tables:

* Hourly Subsurface Table:
	+ Hourly Sample Soil Temperature: Recorded at the top of each hour. (twelve values for each probe, one for each thermistor).
	+ Hourly Average Soil Temperature: Average of the 60 one-minute readings for the previous hour. (twelve values for each probe, one for each thermistor).
* Hourly Raw Table:
	+ Hourly Sample Sensor Resistance: Recorded at the top of each hour. "Raw" data in kΩ. (twelve values for each probe, one for each thermistor)
	+ Hourly Average Sensor Resistance: Average of the 60 one-minute readings for the previous hour. "Raw" data in kΩ. (twelve values for each probe, one for each thermistor).
* Hourly Climate Table:
	+ Hourly Sample Soil Temperature: Recorded at the top of each hour. (twelve values for each probe, one for each thermistor).
* Daily Table:
	+ Daily Average Soil Temperature: Average of all temperature readings for the previous day ending at midnight AST. (twelve values for each probe, one for each thermistor).

# Battery Voltage

Sensor: CH200

Output Units: V.

Scan Interval: 60 seconds

Output to Tables:

* Hourly Diagnostics Table:
	+ Hourly Sample CR1000 Battery Voltage: Measured at the top of the hour.
	+ Hourly Average CR1000 Battery Voltage: Average of the 60 one-minute readings for the previous hour.
	+ Hourly Maximum CR1000 Battery Voltage: The highest reading from the previous hour.
	+ Hourly Minimum CR1000 Battery Voltage: The lowest reading from the previous hour.

# Battery Current

Sensor: CH200

Output Units: A.

Scan Interval: 60 seconds

Output to Tables:

* Hourly Diagnostics Table:
	+ Hourly Sample CR1000 Battery Current: Measured at the top of the hour.
	+ Hourly Average CR1000 Battery Current: Average of the 60 one-minute readings for the previous hour.
	+ Hourly Maximum CR1000 Battery Current: The highest reading from the previous hour.
	+ Hourly Minimum CR1000 Battery Current: The lowest reading from the previous hour.

# Load Current

Sensor: CH200

Output Units: A.

Scan Interval: 60 seconds

Output to Tables:

* Hourly Diagnostics Table:
	+ Hourly Sample Load Current: Measured at the top of the hour.
	+ Hourly Average Load Current: Average of the 60 one-minute readings for the previous hour.
	+ Hourly Maximum Load Current: The highest reading from the previous hour.
	+ Hourly Minimum CR1000 Battery Current: The lowest reading from the previous hour.

# Solar Panel Voltage

Sensor: CH200

Output Units: V.

Scan Interval: 60 seconds

Output to Tables:

* Hourly Diagnostics Table:
	+ Hourly Sample Solar Panel Voltage: Hourly reading at the top of the hour.
	+ Hourly Average Solar Panel Voltage: Average of the 60 one-minute readings for the previous hour.
	+ Hourly Maximum Solar Panel Voltage: The highest reading from the previous hour.
	+ Hourly Minimum Solar Panel Voltage: The lowest reading from the previous hour.

# Solar Panel Current

Sensor: CH200

Output Units: A.

Scan Interval: 60 seconds

Output to Tables:

* Hourly Diagnostics Table:
	+ Hourly Sample Solar Panel Current: Hourly reading at the top of the hour.
	+ Hourly Average Solar Panel Current: Average of the 60 one-minute readings for the previous hour.
	+ Hourly Maximum Solar Panel Current: The highest reading from the previous hour.
	+ Hourly Minimum Solar Panel Current: The lowest reading from the previous hour.

# Datalogger (CR1000) Panel Temperature

Sensor: CR1000 Internal thermistor

Output Units: °C.

Scan Interval: 60 seconds

Output to Tables:

* Hourly Diagnostics Table:
	+ Hourly Average CR1000 Panel Temperature: Average of the 60 one-minute readings for the previous hour.

# Voltage Regulator (CH200) Temperature

Sensor: CH200

Output Units: °C.

Scan Interval: 60 seconds

Output to Tables:

* Hourly Diagnostics Table:
	+ Hourly Average CR1000 Panel Temperature: Average of the 60 one-minute readings for the previous hour.

# Resulting Final Storage Data Tables:

See Datalogger Output Files Excel Document

**Notes**

Definitions:

Scan interval = sampling duration = scan rate

Time of maximum or minimum values is not recorded

Sample reading = instantaneous reading

Beginning of the hour = top of the hour