Stretch Potential with Data Loggers Reel Material

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1. Introduction

A data logger is a programmable, electronic instrument that records data over periods of time. Data loggers are used in many different industries to help analyze environmental situations. Data loggers can record water level, temperature, barometric pressure, and precipitation.

Groundwater measurements are used to measure water flow, direction of flow, storage potential, recharge rate, discharge rate, aquifer characteristics and water quantity/quality. Agencies and hydrologists use data loggers to monitor groundwater for general site investigations, and for contaminant plume monitoring on: spill sites, remediation sites, chemical storage facilities, landfill sites and hazardous waste storage sites

2. Project Overview

Many different agencies/hydrologists use different types of suspension cables for data loggers, I will analyze four different materials and evaluate which material yields the most accurate measurements of groundwater levels in wells. Accurate measurement of water levels in wells helps industries comply with regulations, develop economically, and provides reliable data.

In this project we used four Solinst model 3001 Leveloggers™ to measure water levels, and one Solinst Levelogger™ to measure barometric pressure. The Solinst leveloggers™ were attached to:

-Berkeley Fireline™ 30lbs low stretch test fishing line
-Generic Dacron fishing line 80lb test
-Starr products stainless steel 1/16" Aircraft Cable T304
- Generic polyester rope 3/8"

The majority of our research consisted of lab-experiments and field experiments. The controlled lab experiment was designed to test the stretch of each material by hanging a data logger on a 8 ft section of suspension line and recording water levels for 7 days. The field experiment at the University of Idaho well #2 was designed to test the stretch of a 60 ft section of each material in the well and recording water levels for 30 days. We conducted the scientific research and compiled our findings into a technical report useful to those wishing to improve accuracy in measuring water levels in wells.

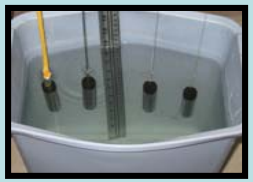
The objectives of the investigation were to evaluate and quantify potential stretch in four different materials commonly used to suspend data loggers in wells.

3. Methods

To accomplish the objectives of the investigation we first evaluated potential noise and drift in the four data loggers (Jar Experiment). The data were analyzed to delineate the accuracy and sensitivity of each data logger under strictly controlled conditions (i.e., no water level changes).

To evaluate potential stretch and other noise recorded by the data loggers, the data loggers were suspended from the ceiling of the Hydrology Lab in McClure Hall 110 into a bucket of water for a seven day period. The data were analyzed to further delineate the accuracy and sensitivity of each data logger under controlled laboratory conditions.

To evaluate potential stretch under field conditions, the data loggers were placed in well UI #2 to measure water levels under actual field conditions, The data were analyzed to delineate the accuracy and sensitivity of each data logger under field conditions.



4. Discussion

The stainless steel suspension cable was considered to represent our "control" conditions because its tensile strength was far greater than the other materials. Stainless steel cable was assumed to be the least likely stretch under the weight of the data logger (about 3 ounces). The assumption was made that the data logger suspended by stainless steel most accurately measured the water levels; the sensitivity of each data logger (factory identical) was assumed identical for each data logger. The stainless steel suspended data logger was evaluated for potential noise or drift. To evaluate potential noise and drift, all four data loggers recorded water levels for constant water level conditions (Sealed Jar Experiment) for a period of seven days. The recorded water levels for each data logger were then subtracted from one another to quantify the differences inherent in the electronics of each data logger. The following graph shows selected results of the lab data experiment. The Berkeley Fireline™ fishing line was found to stretch consistently compared to the stainless steel cable over the 7-day test period. Polyester rope and the Dacron fishing line were found to be comparable to the stainless steel cable, in terms of stretch, under the weight of the data loggers over the 7-day test period.

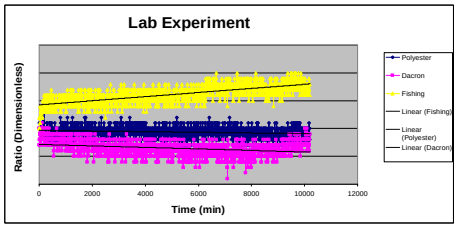


Figure 1: Shows lab experiment and the stretch of each material used

The following graphs show the results of the field experiment conducted in well UI#2 (Figure 1). Data are presented for the polyester rope and the Berkeley Fireline™ fishing line only. Experimental complications precluded completion of the experiment for the Dacron fishing line. Figure 2 shows consistent stretch of the polyester rope over the 28-day well experiment compared to the stainless steel cable. Figure 3 shows that the Berkeley Fireline™ fishing line stretched significantly over the first 5 days of the 28-day well experiment, and then stretched minimally for the remaining 23 days.

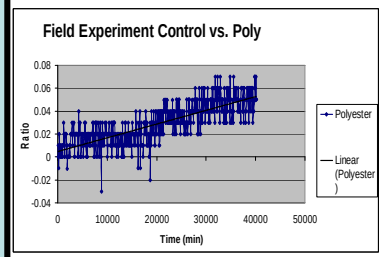


Figure 2: Well Experiment Control vs. Polyester

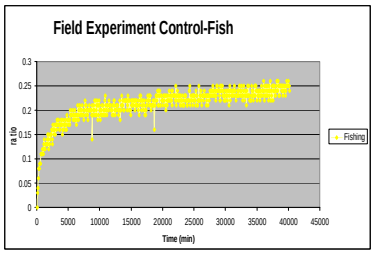


Figure 3: Well Experiment Control vs. Fishing

5. Conclusions

In the lab experiment, the Berkeley Fireline™ fishing line showed the most measured stretch; while the Dacron fishing line and the polyester rope showed an insignificant amount of stretch.

In the well experiment, polyester rope showed continual stretch over the 28-day measurement period with a total measured stretch of 0.05 feet. In the well experiment the Berkeley Fireline™ fishing line showed continual stretch over the entire 28-day measurement period with a total stretch of 0.025 feet.

Reference

Solinst EQUIPCO Sales and Services Corp. (2006). Retrieved February, 26, 2007. http://www.solinst.com/index2.html.

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