



# Real-time Water Quality Monitoring Using Remote Sensing

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## Abstract

The National Park Service (NPS) along with Clemson University are monitoring streamflow quality from construction of the Foothills Parkway. YSI water quality sondes are being used to measure pH, conductivity, and turbidity in three streams between Wears Valley, TN and Townsend, TN. A remote sensing system was designed and is being utilized at each measurement station. The system is wireless and allows streamflow data to be accessed real-time from an Internet database.

## Introduction

The Foothills Parkway project was started by Congress in 1944. The proposed highway, once completed, will run a total of 72 miles east to west along a ridge north of Great Smoky Mountains National Park in east Tennessee. Only 16 miles of the parkway are currently completed. There are several incomplete sections of the highway. One in particular, called the "missing link", is located in Wears Valley between Townsend and Gatlinburg. The "missing link" site is approximately 1.5 miles long and will contain an 800-ft bridge near the Wears Valley eastern access point.

Stormwater runoff from the construction sites has the potential to adversely affect water quality, as rain events can wash sediments and other pollutants downstream. Real-time data analysis using remote sensing systems allows for more immediate response in a situation where water quality is compromised. This project is part of the Intelligent River initiative.

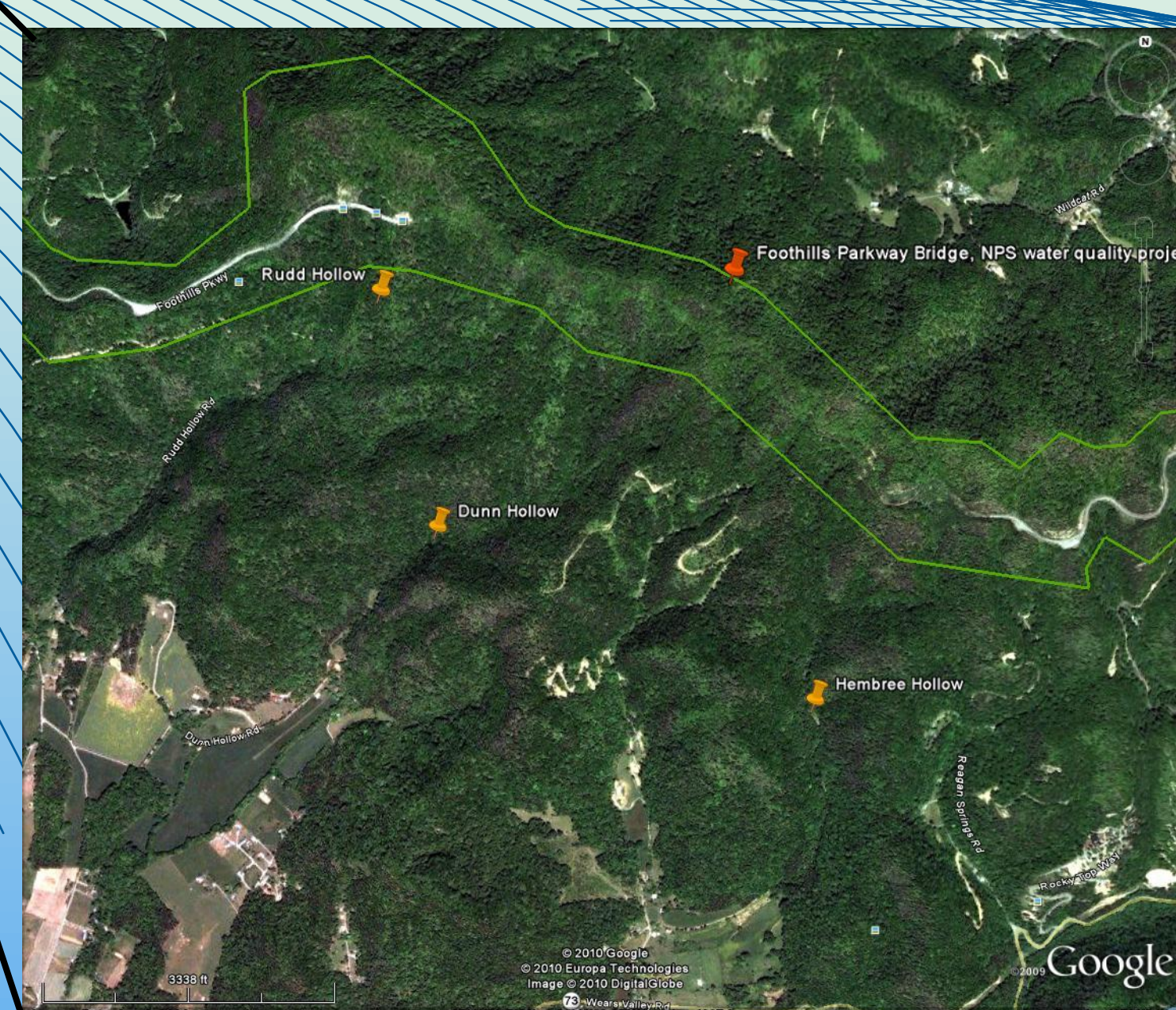


Fig. 1: Location of study area.



Fig. 2: Secondary hollow at Dunn site.

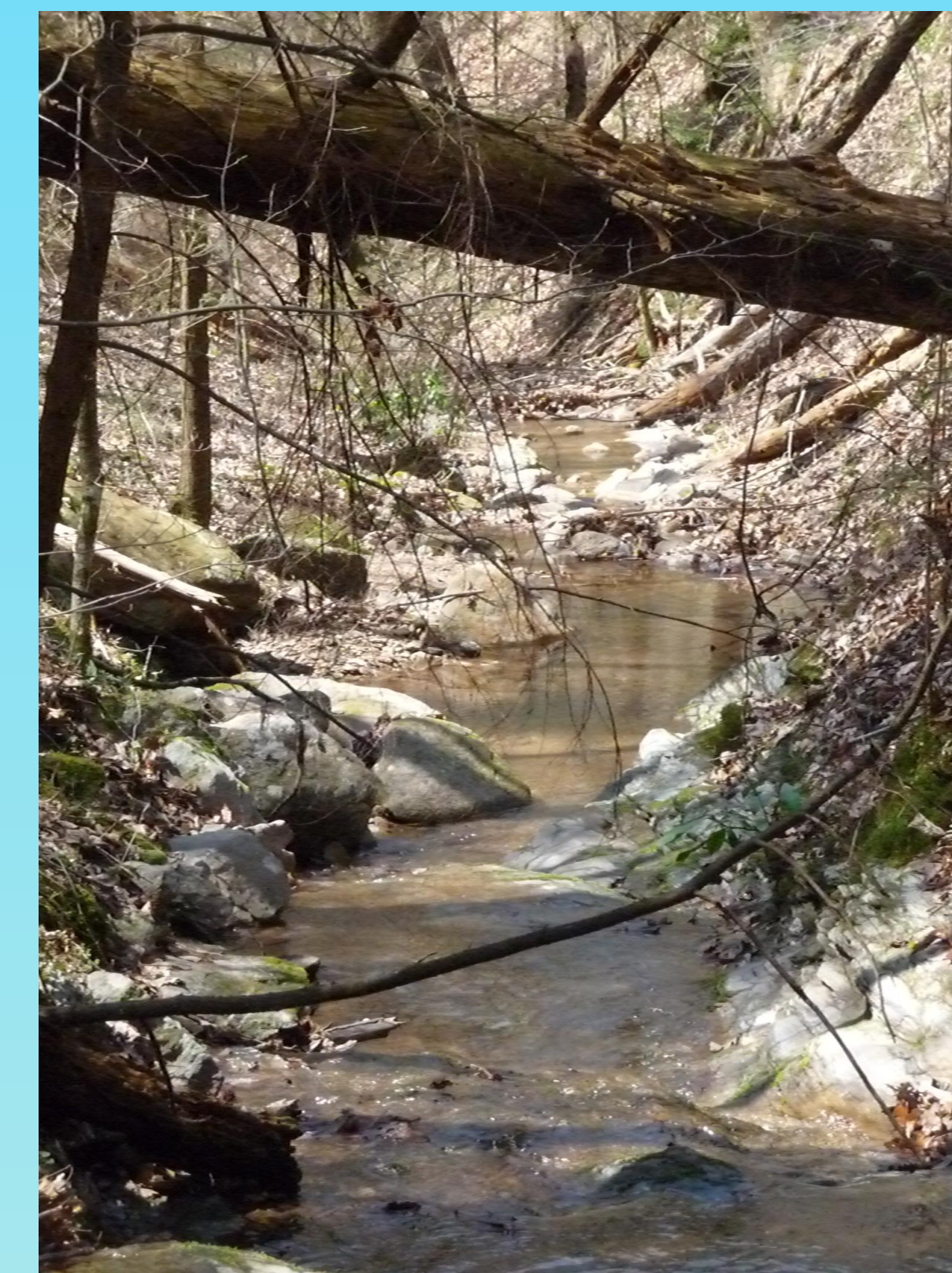


Fig. 3: Downstream view of Dunn Hollow site.

## Site Description

The sites are located in forested areas consisting mostly of poplars, oaks, and other hardwood trees. Dunn Hollow and Rudd Hollow are forested watersheds that are completely undeveloped other than the future Foothills Parkway that will be installed on the ridge above the watershed, Hembree Hollow watershed is mostly undeveloped other than an existing dirt drive that the owner installed to access the property for hunting and camping activities.

Hembree Hollow is approximately 30 acres and is composed of Ramsey Slaty silt loam. Dunn Hollow, the largest site, has an area of roughly 60 acres and also consists of Ramsey Slaty silt loam. Rudd Hollow is approximately 20 acres and also has Ramsey Slaty silt loam. The average slope for the sites is roughly 70%.

Bedrock comprises a large portion of stream substrate with other portions consisting of silty soils. The three watershed streams would be classified as an "A1" stream on the Rosgen Stream Classification System..

## Acknowledgements:

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Real Time Monitoring to Support Environmental Impact Management Strategies for Road Construction Activities on Foothills Parkway: Wears Valley, Bridge Number 2.

## System Description

The system consists of four major components: (1) a water quality sonde, (2) a data logger, (3) a wireless modem, and (4) an Internet database. The sonde collects data and transfers the data to the logger, where the information is stored. The logger then sends the data to a modem, which sends the data wirelessly to an online database. The sonde, data logger, and modem are all hardwired in the system. The system is powered by two 12-volt batteries, which are charged with a solar panel. The sondes stores data internally, so if the wireless system is temporarily inaccessible, the data will still be recorded.



Fig. 4: Hembree station.



Fig. 5: Sonde in stream at Dunn site.

## Sample Data

Changes in water quality parameters can indicate if a problem has occurred or will occur. For instance, a spike in turbidity could indicate that an abnormally large amount of sediment was deposited into the stream from an upstream source, such as the construction sites for the Parkway.

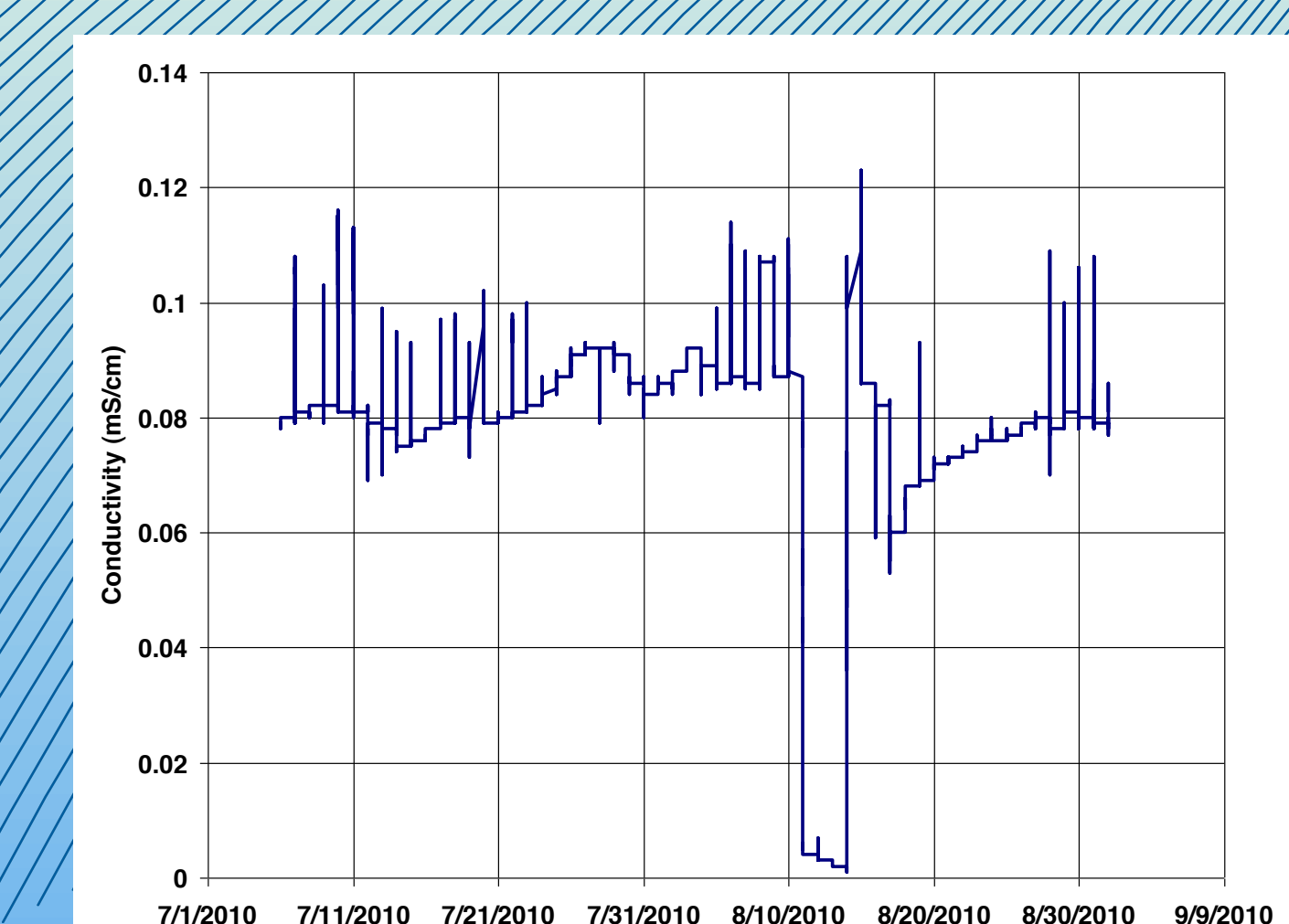
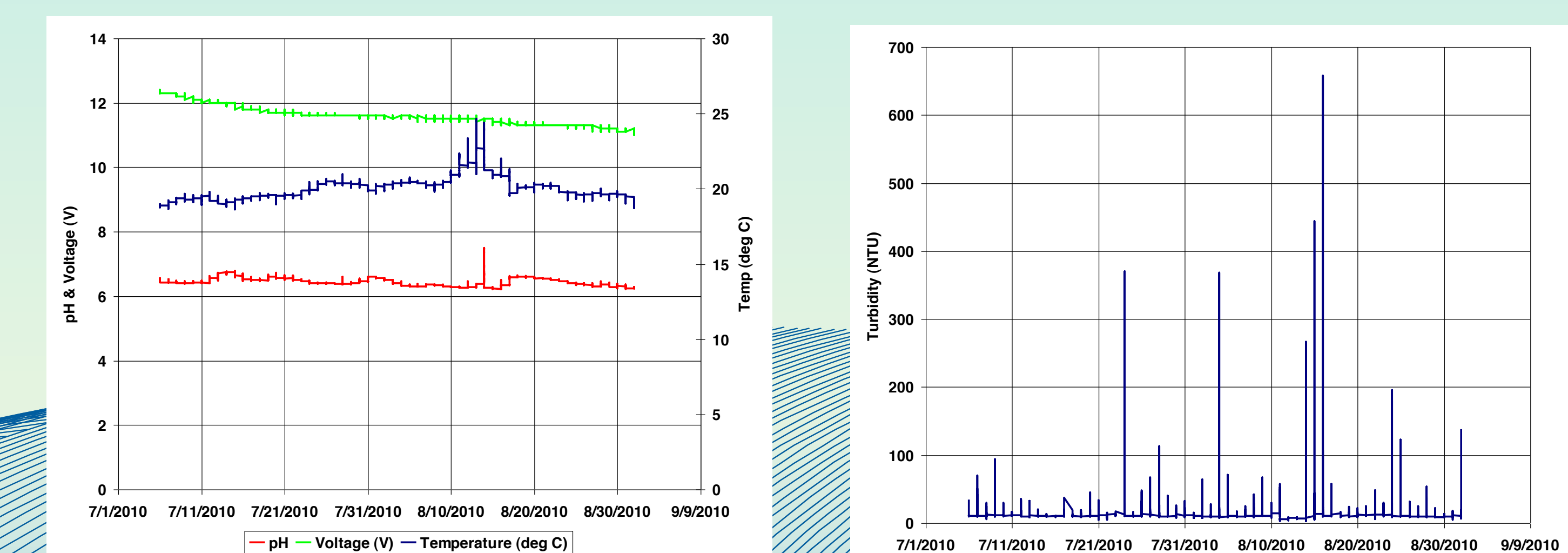


Fig. 6: Sample of data recorded by sonde at Dunn Hollow site.