

Development of a low-cost remote water quality monitoring system in acid mine drainage impaired watersheds¹

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Abstract: The efficiency of watershed management and acid mine drainage (AMD) treatment depends on the frequency of monitoring water quality. Remote water quality monitoring can improve watershed management by collected ongoing data in difficult to reach or infrequently visited locations. However, this is often very costly and difficult to implement. This study focused on designing and building a low-cost remote water quality monitoring system and deploying it in an AMD impaired stream. System development was achieved by integrating low cost computing technology, power management, monitoring sensors, and ‘disruption tolerant networking’ (DTN). DTN is a communications protocol that supports data transfer even in regions with either no cellular coverage or unreliable coverage. The test system was used to measure pH, specific conductivity, and temperature at 15 minute intervals. The composite system is made up of three main components which include the data acquisition node, communication module, and the cloud database. The data acquisition node is made up of the sensor nodes which include pH, conductivity and temperature sensors, a credit-card sized computer, and microcontroller powered by a solar panel. Data was transmitted using a data mule (computer or smart phone that automatically transfers data from the computer) and was then uploaded to cloud storage. A side-by-side test between the low cost water quality monitoring system and a reference YSI 600 XLM sonde was conducted to demonstrate the effectiveness of the low cost system.

Additional Key Words: geochemistry, sensors, acid mine drainage treatment

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