

Vermont Automates Collection of Water Quality Monitoring Data

Vermont's Agency of Natural Resources engaged Stone Environmental to develop software applications to automate and digitize the collection of field data for seven state water quality monitoring programs.

Applications for the monitoring programs—including the state's spring phosphorus monitoring program and its biomonitoring program—varied in need from simple and minimal GPS-based data capture to complex forms with many sub-forms and intelligent fields. The project presented unusual challenges, such as the need to design custom tally forms for pebbles and fish. In addition, the forms had to be intuitive and ergonomic for rapid data capture.

Immediately Accessible Water Quality Data

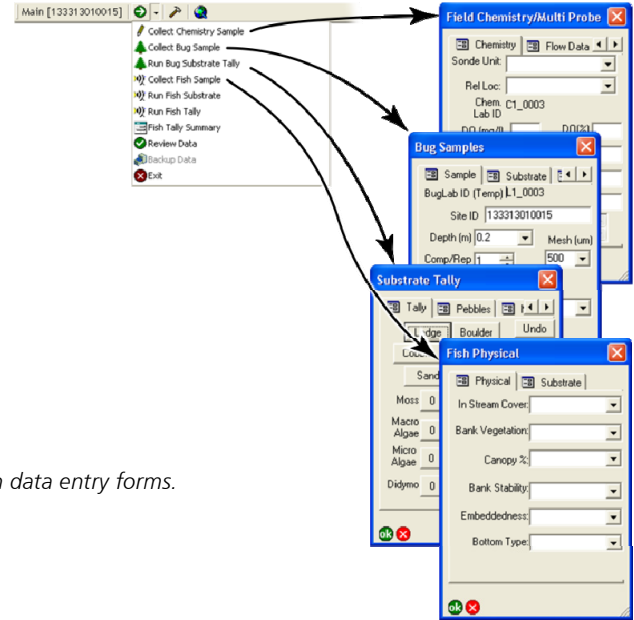
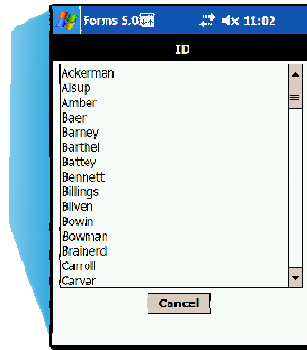
While migrating from paper to electronic forms can be challenging, well-designed electronic field data collection

forms on mobile devices offer many benefits: automated consistency and validation checks, automatic calculations, pick-lists of large sets of pre-created values, and the automatic movement of data from the mobile devices to the back-end databases, to name a few.

The new automated process that Stone developed used these inherent benefits of the digital platform, along with custom problem solving to improve the reliability of the agency's field data. The newly streamlined forms offer intelligent data collection and allow agency staff to conduct rapid analyses of the quality of Vermont's rivers, lakes, and wetlands. Where staff used to spend their office time importing the data collected from the paper forms to their computer system, now the staff can dedicate more time to understanding that data.



Stone scientists tested each water quality data collection application in the field.



Screenshots of mobile application data entry forms.

Mobile Full Featured Database Applications

In order to improve upon the existing dynamic and complex nature of the paper forms that the agency was using for data collection, Stone employed features in the more recent versions of ArcPad to allow modeling of complex table relationships in the ArcPad input files. Stone based its design of the ArcPad input files on the SQL Server and Access databases the state was using to store the collected data. This meant that when it was time to move data collected in the field back to the databases in the office, the database data types, domains, field lengths, relationships, and even the names of tables and fields were already in place. This greatly simplified the data transfer process.

Automation of Data Flow

While the challenge of transforming data types and relationships from one database schema to another was avoided, Stone found it necessary to provide a custom solution to automate the agency's ArcPad data check-outs and check-ins.

The impetus for the custom data movement automation was based on the agency only having one ArcInfo-level license, which is required to perform the check-in operation.

Stone developed a series of operating system level scripts and environment changes to create a batch check-in system for the day's ArcPad data. As each user returned from collecting data, the system automated the movement of the new field data from the mobile devices into a central bin of new data files for the day on the network.

Stone set up various operating system level scripts and ArcGIS Python GeoProcessing scripts to run overnight to properly check in each of the ArcPad data files to the central spatial database. Because this was done overnight, the single ArcInfo-level license was free for use during the day.

Total Care

Upon completion of the applications, Stone provided training for the agency's field staff on the use of the constructed forms and data upload and download, as well as to the agency's computer system staff on how to manage the automated data movement system.

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