LiquID™ *E.coli* Correlation Study on Oak Creek
June 2012

ZAPS Technologies set a goal to develop the first real-time flow-through technique for *E.coli* detection. This goal was accomplished through a partnership between ZAPS and Pacific Analytical Laboratory (PAL) of Corvallis, OR, using a LiquID Station installed during Oregon's wet season on Oak Creek, 1.7 miles downstream from a dairy farm. The location and timing of the correlation study were picked due to the hypothesized likelihood of *E.coli* entering the stream system in runoff during high rain events. It is important to note that this stream system is normally absent of *E.coli*, especially during Oregon's dry season, and does not represent a known or commonly contaminated hydrologic system.

LiquID, shown with antenna for remote uplink of data.

The correlation study design included two stages:

Stage 1 - Multiple grab samples were taken from the creek and analyzed using classic methods at PAL. Results were compared to raw fluorescence and absorption measurements continuously collected by the LiquID. These in turn were used to develop interference corrections and raw output correlation to the conventional units of MPN/100ml for *E.coli*.

Stage 2 - The information discovered during the first stage was used to determine the response of the LiquID Station relative to *E.coli* concentrations. This information was used to develop a complex multi-dimensional algorithm utilizing input values from several independent channel measurements made by the instrument. Time stamped grab samples were then correlated to the LiquID algorithmic output as demonstrated in the graph below.
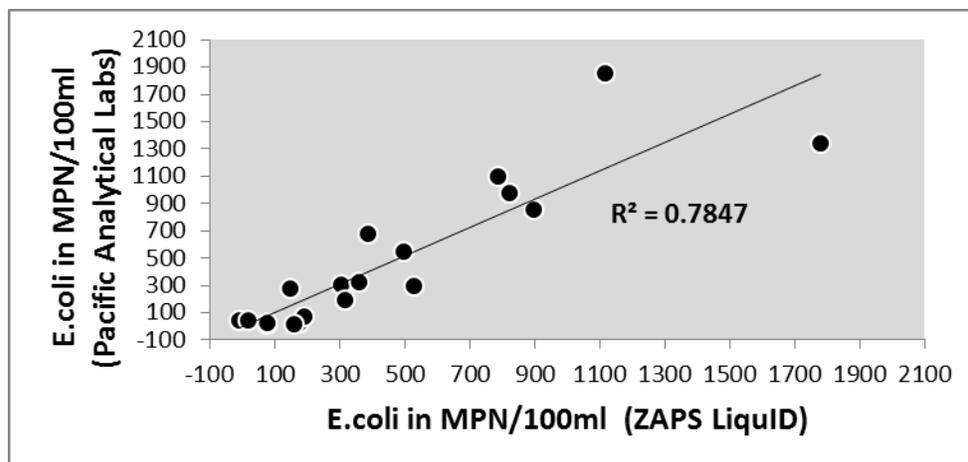

The LiquID Station continued to monitor Oak Creek water for several months after the algorithm was developed, reporting readings about every 2 minutes. Grab samples were taken during random *E.coli* events detected by LiquID. The following graph is a standard plot as viewed on the

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LiquID web-user interface (WUI), where users may select compounds, time frames, and instruments for real-time and/or historical data viewing. In this case *E.coli* over a seven day period was selected. PAL test results, indicated by the red stars, have been superimposed on the WUI view to illustrate the accuracy of the LiquID *E.coli* algorithm.
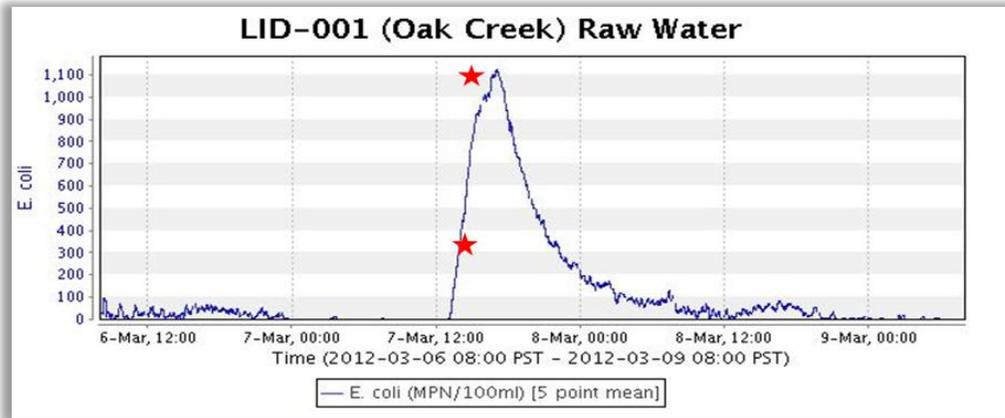
Further corroboration occurred serendipitously on April 10th, 2012 when a pipe at the dairy farm burst, dumping large levels of a manure slurry into Oak Creek. This event demonstrated the capability of the LiquID Station for automatic scaling as well as the unattended real-time tracking of *E.coli*. The shape of this event in time with a rapid rise followed by a protracted dilution is also consistent with hydrologic theory, further demonstrating the power of the LiquID Station to document the real effect over time of such an event on water quality.
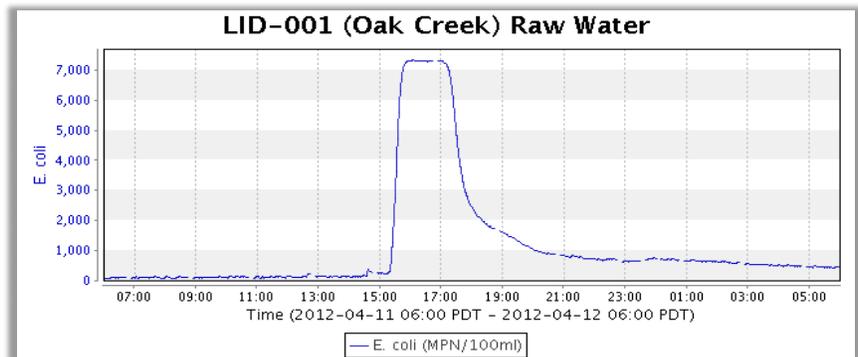
The capability to resolve fecal contamination events in real-time is a significant step forward in on-line monitoring and provides an efficient means to advance our understanding of the total impact of such contamination on the water quality of public water ways. Eventually such information could lead to better control systems and improved public health and safety.

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