**LiquID™**

# BOD & cBOD: A Path Forward
## Analysis using HMA

Hybrid Multispectral Analysis (HMA) provides a rapid and precise technique for characterizing the driving force behind oxygen demand in a real-time basis. In the HMA approach, high intensity light is used to identify molecular bonds and particles in the sample stream characterizing the potential demand of the oxidants and oxidizers present. The HMA approach's use of light allows for a very rapid and precise characterization of the sample stream without the need of surrogate microbial seeds or other sample disruptions.  The end result is a more continuous, direct and efficient form of monitoring.

Because the HMA approach has been conceived and developed in connection with the current methodology it is demonstrated to scale similarly. As shown in the following graph, comparison data generated using the HMA method correlate well with measurements made using the traditional laboratory approach. This graph compares a total of 100 grab samples taken from 11 different LiquID™ stations and tested by 7 different certified labs. The grab samples were performed at 6 wastewater raw influent and 5 wastewater final effluent locations. This is an important point because it connects the new method to the historical data record and to current regulatory permits. The ability to link the new method to those measurements collected in the past is a key step required for defining acceptable limits within which the new method can be evaluated.



METHOD CONTINUITY — BOD (mg/l) – ZAPS using HMA (y-axis) vs. BOD (mg/l) – standard method 5210B (x-axis)
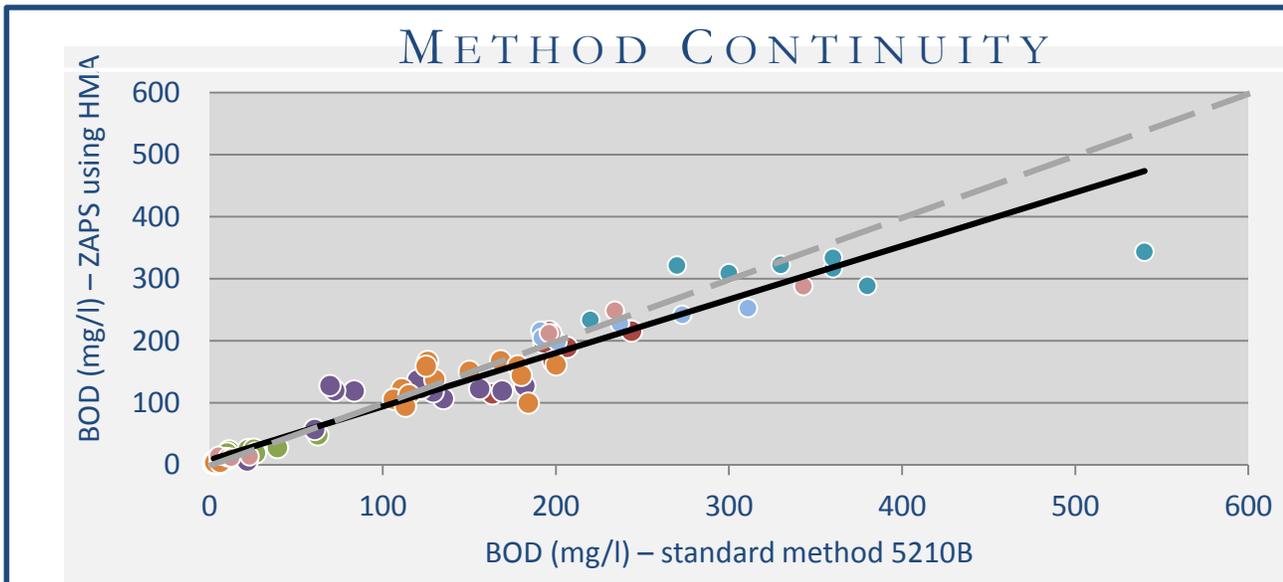
| LiquID Data vs. Standard Method 5210B | |
|---|---|
| Installation Locations | 7 |
| Number of LiquID Stations | 11 |
| Grab Samples (N) | 100 |
| Correlation (R²) | 0.94 |

**ZAPS TECHNOLOGIES**

In addition to the point-in-time correlation of HMA-based BOD/cBOD to the traditional method, the higher frequency of data supplied by HMA-based BOD/cBOD allows that data to be averaged to the frequency referred to by existing permit structures. Commonly, current BOD/cBOD sampling is performed on a daily composite basis consisting of many samples taken over the course of a day and analyzed in a batch. The graph below represents 6 **months of daily composite regulatory cBOD measurements** performed at a municipal (NELAC certified laboratory producing legally defensible Class A data) taken from the raw influent of a wastewater treatment plant **compared to daily averages using the HMA approach (LiquID)**. Although over 106,000 reported parameter readings were generated by the LiquID over this 6 month period, each 2-minute reported value actually consists of over a thousand combined measurements of scattering, absorption and fluorescence lending additional statistical strength to each reported value.

## HIGH RESOLUTION DATA AVERAGING
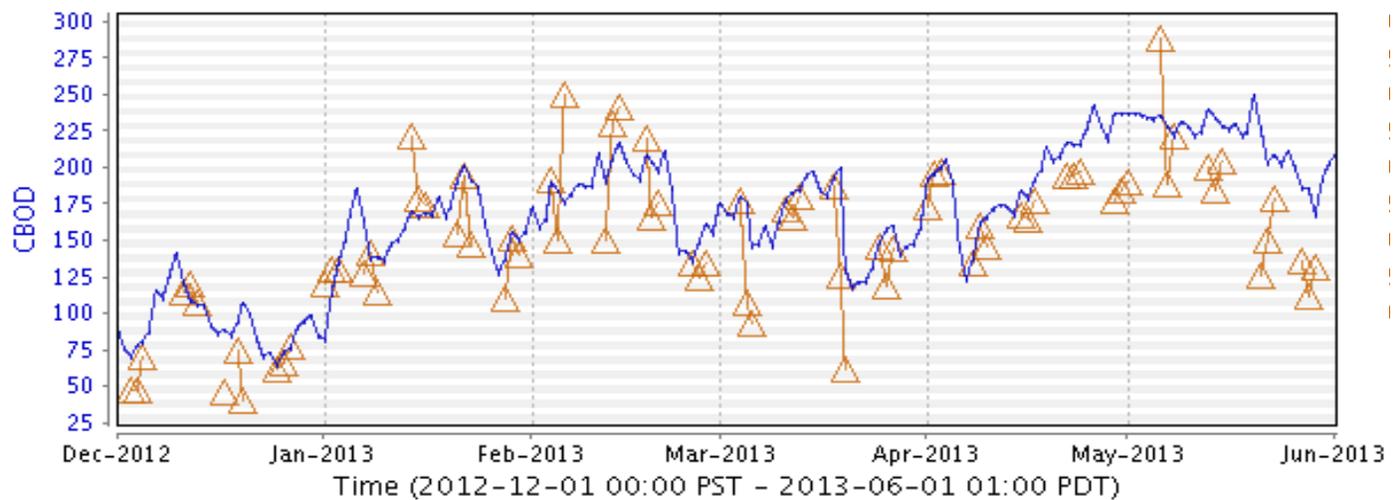


|  | Traditional Lab | HMA (LiquID) |
|---|---|---|
| Readings (#) | 65 (3/week) | 106,226 (>4,000/week) |
| Data Type | Daily Composite | Daily Average |
| Data availability | 5-day delay | Every 2 min. |
| Correlation |  | R² = 0.71 |

**Note: The LiquID data strictly represents data generated by the LiquID (a regular daily average) as opposed to the flow-weighted composite value produced by the municipal lab. In practice, flow (or other) data can be combined with real time data as dictated by the relevant permit.**

The HMA approach provides a much higher resolution view into what these values actually represent, a view that cannot be achieved using the current standard method. Data gathered continuously over a 24-hour period record the typical diurnal nature of a wastewater treatment plant for process control and analysis, while preserving the overall average represented by composite sampling.

## Contact ZAPS for More Information

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