Automated Lagrangian Water Quality Assessment System (ALWAS)*
Description and Possible Deployment Scenarios

Michigan Tech Research Institute (MTRI) and the University of Michigan Marine Hydrodynamic Lab's Automated Lagrangian Water Quality Assessment System (ALWAS) is an inexpensive, free-floating, water quality measuring and watershed evaluation system. It is capable of making a wide range of measurements rapidly and easily, storing the results for later retrieval and analysis. Current methods of collection either involve collecting water samples and returning them to a laboratory for measurement, or consist of manually inserting an array of expensive equipment into the water to be measured. These manually measured results may then be hand-analyzed, but typically are not further processed. In contrast, the ALWAS automatically measures the water as often as every 40 seconds, and uploads the results to a software package to process the data and insert it into a geographic information system (GIS) for more sophisticated review and display.

The system includes the buoy, water quality sensors, a microprocessor and recording device, GIS interface software, and a decision support system (DSS) that generates water quality maps based on the measurements. The buoy, as presently configured, measures these parameters at a user-selectable rate. The following parameters are recorded:

GPS Data, including geographic location (latitude and longitude), speed and heading, quality metric, number of visible satellites, time and date.

Water Properties, including temperature, depth, conductivity, salinity, total dissolved solids, pH, dissolved oxygen, turbidity, chlorophyll-a, oxidation reduction potential, nitrate, ammonium, chloride and blue-green algae. Ancillary data, including barometric pressure, battery voltage and remaining memory.

Presently the buoy (see Figure 1) can record up to 30 hours of data with all parameters being measured at 40-second intervals ALWAS also utilizes wireless technology to allow real-time readout of measurement values.

Figure 1. *Buoy operating in a North Slope of Alaska lake.*

Figures 2, 3, and 4 illustrate the GIS capabilities for visualization of the dissolved oxygen, pH and turbidity data, respectively. These observations, taken at the mouth of the Kalamazoo River at Lake Michigan on June 28, 2004, have been overlaid on a digital-orthophoto quarter-quadrangle (DOQQ).

Furthermore, the GIS-based DSS produces a water quality index (WQI), which is a composite value reflecting the overall water quality as a single number (Figure 5). The gradual transition in each parameter and the derived water quality index are consistent with known characteristics of the Kalamazoo River as it flows into Lake Michigan.

** Patent Pending*

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The turbid, low oxygen water of the river becomes diluted by the clear, comparatively oxygen rich water of the lake and accordingly the quality of the water improves.

On average, these samples were taken 42 seconds apart. The ALWAS system is available for purchase, or MTRI/ University of Michigan can collect measurements under a consulting activity.

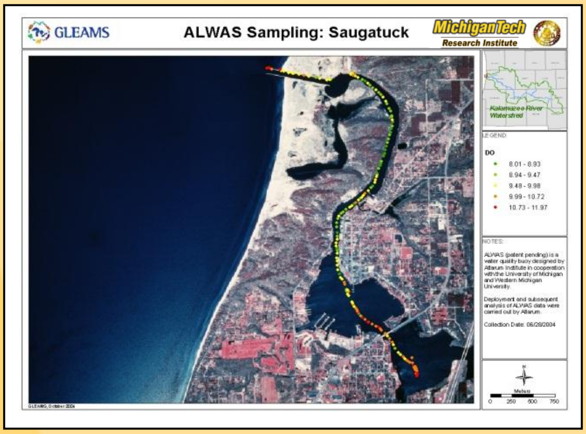

***Figure 2**. Dissolved Oxygen of Kalamazoo River, June 28, 2004*

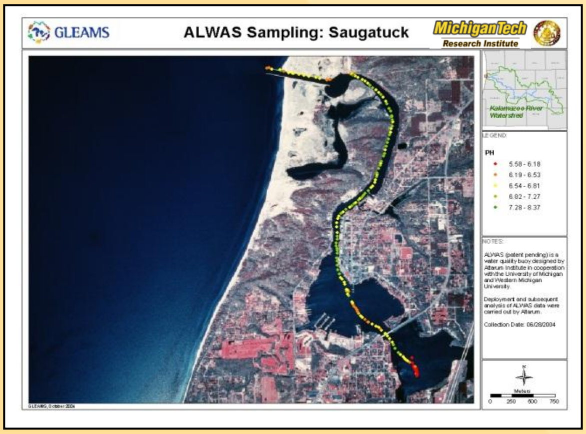

***Figure 3**. pH of Kalamazoo River, June 28, 2004*

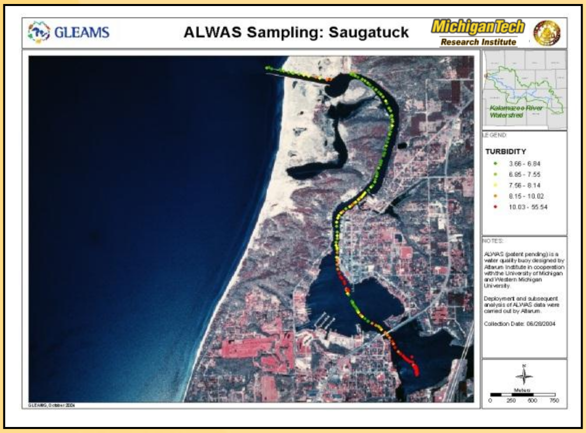

***Figure 4**. Turbidity of Kalamazoo River, June 28, 2004*

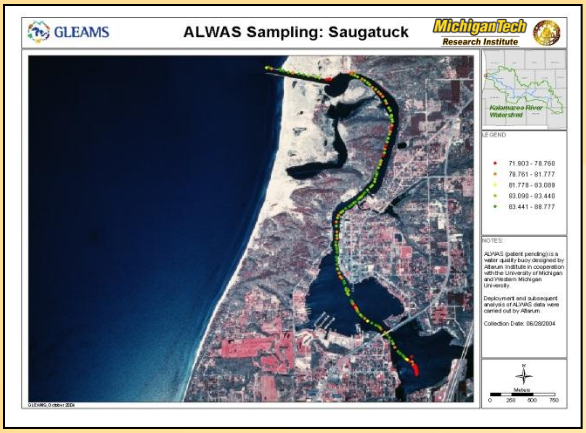

***Figure 5**. GIS Based Water Quality Index of Kalamazoo River, June 28, 2004*

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