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December 30, 2009

Memorandum

OFFICE OF SURFACE WATER TECHNICAL MEMORANDUM 2010.02

SUBJECT: Flow Meter Quality-Assurance Check - SonTek/YSI FlowTracker Acoustic Doppler Velocimeter

The purpose of this memorandum is to establish policy regarding routine quality-assurance (QA) checks on SonTek/YSI<sup>1</sup> FlowTracker acoustic Doppler velocimeters (ADV) used for making velocity and discharge measurements in the U.S. Geological Survey (USGS). This memorandum states the policy and provides a description of how the QA program will work.

Although this memorandum is specific to the FlowTracker, it is the intent of the USGS Office of Surface Water (OSW) and the Hydrologic Instrumentation Facility (HIF) to expand this program to include other velocity meters as they become available and more widely used throughout the Water Resources Discipline (WRD). Separate guidance will be issued to cover other meters as they are added to the program; the purpose and structure of the overall program will remain the same regardless of the velocity meter type or manufacturer.

### **FlowTracker Quality Assurance Program Policy**

Beginning in fiscal year 2010, the OSW is implementing a QA program for checking the calibration and documenting the performance of all FlowTrackers used in the USGS. Every FlowTracker used for making velocity and discharge measurements in the USGS will be required to be checked by the Hydrologic Instrumentation Facility's Hydraulic Laboratory (HIF-HL) at least once every three years.

As a part of this program, every FlowTracker used in the USGS is required to be registered and tracked in a database maintained by the HIF. USGS Water Science Centers (WSC) will be notified when a FlowTracker is due for a QA check based on the information in the database. FlowTrackers selected for QA checks will be sent to the HIF-HL. The HIF-HL will check the meter's ability to 1) measure 2 velocities, 18.0 cm/s (0.59 ft/s) and 33.5 cm/s (1.1 ft/s), within the manufacturer's tolerances for accuracy and precision; 2) measure the temperature within  $\pm 2$  degrees Celsius of a National Institute of Standards and Technology (NIST) traceable reference thermometer; and 3) pass peak signal position and signal-to-noise difference (beam check) tests. FlowTrackers passing the QA check will be shipped back to the WSC. Meters failing the QA check will, at the

WSC's option, be sent directly to the manufacturer for repairs and rechecked by HIF-HL, or removed from service. The repair costs will be the responsibility of the WSC.

Existing registered meters may continue in use until they are scheduled for a QA check sometime during the first 3 years. In addition to QA checks on existing FlowTrackers, all new FlowTrackers purchased directly from SonTek/YSI and/or meters sent to the HIF or to SonTek/YSI for repair, must be QA checked in the HIF-HL before being placed into service for the first time or back in service. Meters purchased through the HIF will be QA checked as part of the HIF's standard QA/QC process.

### **How the QA Program Will Work**

**Registration of FlowTrackers** - FlowTrackers in use by the USGS must be registered in a central database developed and maintained by the HIF. Data entry into the FlowTracker database will be made using a web-based user interface. The URL for the registration interface is <http://1stop.usgs.gov/flowtracker/>. After the user logs into the interface using their Lotus User ID, the following information needs to be entered to register each meter:

1. meter serial number;
2. probe type (2D or 3D);
3. probe cable length (2 meter, 3 meter, or 5 meter);
4. primary contact name and email address
5. secondary contact name and email address;
6. office location (the WSC is automatically included in the database based on the user ID of the person entering the meter information); and
7. the date of purchase.

The OSW is requesting that all FlowTrackers be registered by February 5, 2010. The completion of registration by this date will allow the QA checking to start during the second quarter of Fiscal Year 2010.

The HIF obtained a list from SonTek/YSI of all the FlowTrackers sold to the USGS, including the serial number and the date purchased; this information has already been entered into the HIF registration system database and is accessible through a pull-down menu. Those WSCs that 1) have purchased FlowTrackers from the HIF after August 15, 2009, 2) have purchased FlowTrackers with ARRA funding, or 3) rent FlowTrackers from the HIF, need only update items 4 through 6 in the above list (items 1, 2, 3, and 7 remain as is). These meters have already been entered into the database and only require editing.

**Notification that QA check is due and scheduling** - The HIF will send an email to the primary and secondary contacts listed in the FlowTracker database and the Data Chief of the WSC, requesting that the office contact the HIF-HL to schedule the QA check of their meter. The QA checks will be spread out over the entire fiscal year to distribute the workload at the HIF-HL. Emails will be sent out at the beginning of each quarter so the WSCs can schedule the shipping of their meters around their scheduled field work. The

number of meters scheduled for QA checks from any one office in any one year will not exceed  $1/3 + 1$  of the meters registered at the WSC office. Following the QA check and any associated updates to firmware and hardware, the meter will be returned to its owner. If requested by the WSC, a replacement meter can be loaned to the WSC office at no cost. If meters are scheduled 1 to 2 weeks ahead of time with the HIF-HL, it is anticipated that turnaround time will be less than 5 working days.

**QA check at HIF-HL** - When a meter arrives at the HIF-HL it will be inspected for physical damage. A beam check will then be conducted and recorded to verify the meter is working correctly. The meter will then be towed at 2 speeds in the HIF-HL small acoustic towing tank. The towing speeds are 18 cm/s (0.59 ft/s), the speed used by SonTek/YSI to generate the beam transformation matrix, and 33.5 cm/s (1.1 ft/s). The 18 cm/s speed is used to verify that the transformation matrix is still valid at the speed at which it was generated, and the second speed is used to verify that the transformation matrix is valid at a speed other than the one used to generate it. The HIF-HL will also measure the temperature within  $\pm 2$  degrees Celsius of a NIST traceable reference thermometer. If the existing transformation matrix is found to be invalid, the meter will be recalibrated using the SonTek/YSI routines and a new matrix loaded into the unit. (Copies of the old and new matrices will be kept on file.) The report describing a summary of the meter's performance during the QA check will be emailed to the contacts in the database and the WSC Data Chief. An electronic copy of the QA report, as well as the meter's QA check data files, will be accessible from the database once the meter has been checked.

If electronic or physical problems are found with the meter, the WSC office will be contacted and given the option to remove the meter from service or have the HIF send the meter to the manufacturer for repair at the expense of the WSC. Repaired meters will have the QA checks repeated by the HIF-HL before return to the WSC.

### **WSC Costs**

The cost to the WSCs for the QA check of their FlowTrackers will be the cost of shipping the meters to the HIF-HL using a trackable method and any repair costs that may be required. The cost of the FlowTracker QA check and return shipping will be covered by the OSW.

It is possible that a WSC may want to have a FlowTracker QA checked outside of the normal 3-year cycle outlined in this memorandum. This may be necessary as a result of the meter being physically harmed in some way or because the routine field QA checks show a problem. If a WSC wishes to have a FlowTracker QA checked or recalibrated, they can contact the HIF and schedule the meter for the QA check. The cost for QA checking or recalibration of a meter is currently \$200.00 per meter (subject to change).

### **Additional Information**

If you have any questions regarding the FlowTracker database, you can contact Karen Ray at [ktray@usgs.gov](mailto:ktray@usgs.gov) (228-688-1528). If you have any questions regarding the FlowTracker QA program or meter calibrations/performance checking, please contact Kirk Thibodeaux at [kgthibod@usgs.gov](mailto:kgthibod@usgs.gov) (228-688-1508).

<sup>1</sup> Any use of trade, product, or firm names in this document is for descriptive purposes only and does not imply endorsement by the U.S. Government.