APPENDIX C

STANDARD OPERATING PROCEDURES-FIELD

CLERMONT COUNTY WATER QUALITY MONITORING PROGRAM

CLERMONT COUNTY OFFICE OF ENVIRONMENTAL QUALITY

March, 2015

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Standard Operating Procedures

for the

YSI 600 Series Multi-Parameter Data Sonde

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Revision Number: 8
March, 2013

1.0 Introduction

This document contains information and directions on using the YSI 600 Series Multi-Parameter Data Sonde. This standard operating procedures document (SOP) has been developed to maintain properly functioning equipment, and to ensure the quality of the data collected. Procedures in this document were developed in accordance to the manufacturer's instructions for the 600 series sondes (http://ysi.com/media/pdfs/069300-YSI-6-Series-Manual-RevF.pdf) and follow the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices Manual (OEPA 2006).

2.0 Materials Needed

The following materials are needed for proper operation and maintenance of the YSI 600 series data sonde.

- YSI 600 Series data sonde (600R, 600XL, or 600 XLM) and 650 MDS hand-held unit
- Calibration Cable
- YSI SOP
- Calibration Sheet
- Calculator
- YSI maintenance kit (at Sewer Laboratory)
- Sharp Knife (for changing DO membrane)
- Distilled or De-ionized Water
- Permanent Marker (Sharpie)
- Calibration Standards
- Barometer (or access to barometric pressure readings)
- Towel

3.0 YSI 600 Series Data Sonde

The outside housing of the sonde should be kept free of sediments, bio-films, oils, etc. by cleaning with soap and water. The unit's operating range is 23°F to 113°F (-5°C to 45°C). Exposure of the unit to temperatures outside of this range may result in mechanical or electronic damage. When calibrating, connect the calibration cable to the data sonde first, and then to the YSI 650 MDS.

4.0 Sonde Set-up

Before calibration you will need to ensure the sonde is set-up properly.

4.1. **Power sonde**

power sonde ensures that battery power is drawn from the 650 or the 4220 flow meter. If power sonde is unchecked, then the sonde will rely on batteries to run. To check power sonde, under the 650 Main menu, go to system set up and scroll down to Power sonde, hit enter. This should always be checked unless you are conducting DO monitoring or logging internally (without the 650)

4.2. **Report Set up screen-**

This screen ensures that the 650 readout will display the parameter s of interest.From the 650 screen, go to sonde menu (650 will then connect to sonde), scroll down to report, hit enter. The following parameters should be selected

4.2.1.1. Date, time hh:mm:ss, Temp C, SpCond us/cm, pH, pH mV, ODO sat%, ODO mg/L, Battery volts

5.0 Calibration

Regular calibration of the YSI 600 series data sondes is absolutely necessary in order to ensure the quality of the data collected. When using the YSI sondes, the following calibration schedule and procedures should be followed.

5.1. **Calibration Schedule**

When using the YSI 600 Series data sonde to conduct discrete monitoring at different locations, the sonde should be calibrated each day prior to monitoring. Calibration sheets (Attachment 1) must be filled out

completely and turned over to OEQ upon completion of the study. The OEQ Project Manager should be notified as soon as practical about any operating problems with the data sondes.

The data sondes in place at the autosampler stations should be calibrated at least once every two weeks due to the amount of drift observed in DO readings taken after 2 weeks without calibration. More frequent calibration should be conducted if significant drift is noted during the bi-weekly. Significant drift is defined as greater than 15% and is tracked by OEQ on the calibration sheets (Attachment 1).

5.2. Calibration Procedures

Calibration of the data sondes should be conducted taking the following steps in the order presented below:

1. Clean the probe and probe guards
2. Inspect and if necessary, recondition the DO probe anodes
3. Inspect and if necessary, replace the DO membrane
4. Calibrate the conductivity sensor
5. Calibrate the pH sensor
6. Calibrate the DO sensor

Note that the temperature sensor is factory-set and does not require further calibration. DO membranes on 600 V2 series sondes don't need reconditions and the DO membrane is only changed annually.

5.2.1. Cleaning Procedures

Remove the probe guard and clean with soapy water and a bottle brush or pipe cleaner. Use a small pipe cleaner to clean the conductivity ports. Gently clean the pH probe as the glass bulb is prone to shattering. See probe maintenance below for information on cleaning a severely fouled pH probe. Run the brush in between the probes to remove excess dirt. If bio-fouling is observed during the summer months, a copper coating may be applied to the probes and probe guard, and a copper screen to the DO probe to deter biological growth.

5.2.2. Inspect/Recondition DO probe anodes

Examine the DO anodes at the tip of the DO sensor. These should be white or silver in color. If either or both of the anodes are significantly discolored, the probe should be resurfaced using the fine sanding disk contained in the maintenance kit.

First remove the DO membrane, if it has not been removed already. Dry the probe tip completely with lens cleaning tissue. Using the sanding disk, stroke the probe face ***in a direction parallel to the gold cathode***, using a motion similar to striking a match. Sanding in any other direction can permanently damage the probe. Usually, 10-15 strokes will be sufficient; however, in extreme cases, more sanding may be required to regenerate the original silver surface

After sanding, rinse the DO probe with de-ionized water, and then rinse the probe twice with KCl solution. After rinsing, fill the probe with KCl solution and replace the membrane, as described below.

1.

5.2.3. Inspect/Replace the DO membrane

Inspect the DO membrane. If the membrane is lightly soiled, it can be cleaned by lightly brushing the membrane under water using a fine paint brush or something similar (do not use a wire brush). The membrane should be changed once every 30 days, or if (1) air bubbles are visible under the membrane, (2) the membrane is wrinkled, or has a hole or a tear, (3) deposits of dried electrolyte are visible on the membrane or o-ring, or (4) if the DO probe shows unstable readings.

To change the probe, use the following procedure:

1. Remove the o-ring and the old membrane from the DO probe

2. Hold the sonde in a vertical position (a ring stand can be used for easier maintenance) and apply a few drops of KCl solution to the tip of the oxygen sensor. The fluid should completely fill the small moat around the electrodes and form a meniscus on the tip of the sensor. Be sure no air bubbles exist.
3. Stretch a DO membrane over the DO sensor, and then roll the o-ring over the end of the probe (be careful not to touch the membrane surface with your fingers). It is important that there are no wrinkles in or trapped air bubbles under the membrane. If there are, remove the membrane and repeat the procedure.
4. Trim off excess membrane with a sharp knife.
5. Be sure to thoroughly rinse off any excess KCL solution with DI water, as this can contaminate the conductivity calibration.

5.2.4. **Initiate Calibration**

To begin calibration, first connect the data sonde to the YSI 650 hand-held unit with the calibration cable. Remove the probe guard and secure the data sonde using a ring stand. From the hand held unit, select "Sonde Menu" to access the main menu.

5.2.5. Conductivity Calibration

Conductivity calibration solution can go bad a month after opening the bottle. Conductivity probes can also go months without calibration. So biweekly calibration is not always necessary. Don't re-use calibration solution. Record the date the standard was opened on the bottle and throw out any solution that was opened over 2 months ago.

Rinse a calibration cup once with water, and then rinse the cup again using a small amount of calibration solution. Rinse the probe also, first with water, then with a small amount of standard solution. Use a conductivity standard of 1.413 mS/cm (1413uS/cm). Fill the beaker with enough conductivity solution so that when the probe is submersed, the solution covers the vent hole on the side of the probe. Gently rotate and/or move the sonde up and down to remove any bubbles from the conductivity cell.

From the Main menu, select **Calibrate**. From the Calibrate menu, select **Conductivity**, and then **SpCond** to access the specific conductance calibration procedure. Enter the value of the calibration standard *in mS/cm*. When the conductivity reading is stable, record the *actual* conductivity reading on the calibration sheet. An example calibration sheet is included in Attachment A. Press **Enter** to calibrate. The screen should indicate that the calibration has been accepted. Record the *calibrated* conductivity reading on the data sheet. Press **Enter** again to exit the calibration screen.

When the calibration has been accepted, record the conductivity cell constant on the data sheet. Press the **Escape** key to return to the main menu, then select **Advanced**. The conductivity cell constant can be found in the **Advanced Menu** under **Cal Constants**. The acceptable range is 5.0 +/- 0.5. If the cal constants are out of range, don't accept the calibration. Then consult the YSI training manual for methods on how to uncal the sonde.

5.2.6. pH Calibration (two-point)

After conductivity has been calibrated, rinse the probe and the laboratory beaker with DI water, and then a small amount of pH 7 solution. Fill the beaker with enough pH 7 solution to cover the pH and Temp. sensor when submersed. Submerse the pH sensor into the solution.

Return to the Main menu and select **Calibrate**. From the calibrate menu, select **pH**, and then **2-point**. Input the value of the pH buffer (7, in this case) and then press **Enter**. When the pH reading is stable, record this value on the calibration data sheet. Press **Enter** again to calibrate. Record the calibrated pH value and the pH mV value on the data sheet. For pH 7, the milli-volt reading should be 0 +/- 50. Press **Enter** to exit the calibration screen.

Next, calibrate using a pH 10 buffer solution. Empty the lab beaker, rinse with water, and then rinse with a small amount of pH 10 solution. Also, rinse the probes, first with water and then with pH 10 solution. Fill the beaker with enough pH 10 solution to cover the pH and Temp. sensor when submersed. Submerse the pH sensor into the solution. Enter the value of the second buffer (10) at the prompt. When the pH reading is stable, record the actual pH value on the calibration sheet.

Press **Enter** again to calibrate. Record the calibrated pH value and the pH mV value on the data sheet. For pH 10, the milli-volt reading should be –180 +/- 50. Press **Enter** again to exit the calibration screen. Finally, calculate the difference between the pH mV readings for the pH 7 and pH 10 buffers. The acceptable range is between 165 and 180. Record this value on the data sheet. After calibration is complete, rinse the probes with water and reinstall the probe guard (being careful not to touch the DO sensor.)

5.2.7. Dissolved Oxygen Calibration

a) Before calibrating, the DO probe must be placed in a saturated environment for 10 minutes. Wrap the probe in a towel that has been soaked in water. The towel should cover the probe and go around the body at least twice. Alternatively, a small amount of water can be placed in a calibration cup, and the calibration cup placed on the sonde, but not threaded shut. The sonde should be allowed to sit for 10 minutes from the time it was placed in the saturated environment before calibration is started.

b)

After 10 minutes has passed, go to the "**Advanced**" menu to confirm that the RS-232 and the SDI-12 auto sleep function is enabled. Go to the "Run" menu and start the sonde in the "Discrete Run" mode at a 4-second interval. The DO% values should start high, and then begin to decrease (the first two readings may be corrupt and can be disregarded). *If the numbers climb steadily upward, there is a problem with the sensor and it should not be deployed*. Let this run for at least 60 seconds. After the readings have stabilized, record the DO charge on the data sheet. This number should be 50 +/- 25. D.O. Charge is not reported on the 600 V2 series sondes. Go back to the "**Advanced**" menu and disable the RS-232 auto sleep function to allow for calibration.

c) From the Calibrate menu, select **Dissolved Oxy**, and then **DO %.** Enter the current barometric pressure in mmHg (inches of Hg = 25.4 mmHg).

d)

e) Caution: Barometric pressures that appear in meteorological reports are generally corrected to sea level. To be useful in the calibration procedure, barometric pressure readings must be uncorrected. See the back of the calibration sheet (Attachment 1) for the method to convert corrected pressures to uncorrected pressures. If using the 650 with the barometer, this value will automatically populate and you don't have to convert the pressures.

When the DO% readings have shown no significant change, record the value on the calibration sheet, as well as the water temperature and DO concentration, in mg/L. Press Enter to calibrate. When the screen has indicated that the calibration has been accepted, enter the calibrated value on the data sheet (along with the temperature and DO concentration). Press **Enter** to exit the calibration screen.

f)

g) When the calibration is completed, go to the Advanced Menu, and then to Cal Constants. Record the DO Gain. The gain should be 1.0, with a range of –0.3 to +0.5.

Calibration of the sonde has now been completed. Disconnect the sonde from the 650. Return the sonde to the storage cup. A small amount of water should be placed in the cup to provide a moist environment for the probes. The sonde is now ready for deployment.

h)

6.0 Taking Readings / Deploying the Data Sonde

Once the sensors have been enabled and calibrated, and the report has been set to show the parameters of interest, the data sonde is ready to take readings. Prior to deployment, check the "**Advanced**" Menu autosleep settings. If the sonde will be deployed at flowmeter or will be collecting unattended readings (DO profiles) "Auto sleep RS232" should be enabled. If the sonde will be used for spot monitoring, "Auto sleep RS232" should be disabled. Transport the data sonde, still wrapped in the wet towel, to the appropriate sampling site or autosampler station for deployment. Read the date, time, and DO mg/L from the 4220 flowmeter and record onto the calibration sheet before and after deploying the calibrated sonde. Disconnect the current sonde from the field cable and Re-connect the calibrated sonde to the field cable. Take the used sonde back to the lab and store in a calibration cup with tap water until it is needed again. . Be sure to record the retrieved and deployed sonde ID on the calibration sheet.

7.0 Quality Assurance

To calculate precision, collect duplicate sonde readings for all recorded parameters at 10% of the total sampling sites. Duplicate readings should be taken immediately after initial readings, in a similar habitat, and located upstream from the initial readings.

8.0 Maintenance

At periodic intervals, additional maintenance may need to be performed. Each of the maintenance procedures described below should be conducted at a minimum of once a year (during winterization) and be recorded on a calibration sheet (Attachment 1).

9.0 Temperature Sensor

The temperature sensor does not require any scheduled maintenance.

(1)

9.1. Conductivity Sensor

The openings which allow fluid access to the conductivity electrodes must also be cleaned regularly. To clean the openings, dip the cleaning brush in clean water and insert it into each hole 15-20 times. In the event that deposits have formed on the electrodes, it may be necessary to use a mild detergent with the brush. After cleaning, check the response and accuracy of the conductivity cell with a calibration standard.

9.2. pH Sensor

Cleaning is required whenever deposits or contaminants appear on the glass probe. To clean the glass probe, use the following procedure:

1. Soak the probe for 10-15 minutes in clean water containing a few drops of commercial dishwashing liquid.
2. Rinse the probe in clean water and re-rinse with clean water.

If this does not restore good pH response, perform the following additional procedure:

1. Soak the probe for 30-60 minutes in one molar (I M) hydrochloric acid or pH 4 standard solution.
2. Rinse the probe in clean water and re-rinse with clean water.
3. To be certain that all traces of the acid are removed from the probe crevices, soak the probe in clean water for about an hour with occasional stirring.

9.3. DO Sensor

For maintenance of the DO sensor (i.e. resurfacing the electrodes and changing the membrane), see the instructions for dissolved oxygen provided above under **Section 4.2, Calibration**.

9.4. Cables

Cables should be kept clean and protected from abrasion, unnecessary tension, repetitive flexure (fatigue), and bending over sharp radii (such as the edge of a boat). Connections that plug into terminals are not

waterproof and should be kept dry at all times. When cables are not in use, be sure to insert all dummy plugs and dust caps to protect the electrical connectors.
6.6

10.0 Storage

10.1. For short term storage of the data sonde (less than 2 weeks)

1. Fill the calibration cup with ½" TAP water (DI water can damage the pH probe glass membrane) and screw onto the sonde. This keeps the sensors in 100% humidity.

10.2. For intermediate storage (> 2 weeks, < 2 months

10.2.1. Fill the calibration cup with TAP water (DI water can damage the pH probe glass membrane) and screw onto the sonde

10.2.2.

10.3. For long term storage (>2 months) of the YSI data sonde, follow the procedures listed below:

1. Remove batteries from the battery terminal
2. Make certain that the DO sensor has an undamaged membrane and electrolyte in place.
3. Clean the conductivity sensor with the brush provided in the maintenance kit.
4. Remove all probes, except DO, conductivity, and Temperature.
5. Plug the vacant ports with port plugs.
6. Fill the calibration cup with TAP water (DI water can damage the pH probe glass membrane) and screw onto the sonde
7. Place the pH sensor in the plastic boot/bottle
8. Fill the storage vessel (plastic bottle w/ hole in cap and O-ring), with a 2 molar solution of potassium chloride (KCl). The solution can be prepared by dissolving 74.6 g of KCl in 500 mL of distilled or deionized water. The pH sensor can also be stored in pH 4 buffer.
9. Insert the pH sensor into the storage vessel, and seal the vessel with the cap and O-ring.
10. At the end of the storage time, reconnect the pH sensor to the sonde and
11. remove the existing DO membrane and re-membrane the probe using new KCl solution.

Attachment 1
YSI 600 Series Calibration Sheet (Front)

CLERMONT COUNTY OFFICE OF ENVIRONMENTAL QUALITY
YSI 600 SERIES CALIBRATION SHEET

Analyst(s) _____

Equipment ID _____
Calibration Date _____

Intended Use _____ Autosamplers
_____ DO Monitoring
_____ Spot Monitoring

Autosampler Use:
Data Sonde retrieved from: _____
Data sonde re-deployed at: _____

DO membrane changed? Yes No
DO probe sanded? Yes No
Cond. Sensor cleaned? Yes No
pH Sensor cleaned? Yes No

CALIBRATION READINGS

1) Conductivity

Solution (µS/cm)	Actual	After Calibration
0.447	_____	_____
_____	_____	_____

Conductivity Cell Constant _____
(Acceptable range: 5.0 +/- 0.5)

2) pH

Buffer	Actual	After Calibration
7.00	_____	_____
10.00	_____	_____

		Range
mV (7.00)	_____	0 +/- 50 mV
mV (10.0)	_____	-180+/-50 mV

3) Dissolved Oxygen

	Actual	After Calibration
Temperature	_____	
Baro.Pressure (mmHg)	_____	
Percent Saturation	_____	_____
DO (mg/L)	_____	_____

	Actual	Range
DO Charge	_____	50 +/- 25
DO Gain	_____	0.7 to 1.5
D.O. Drift (1-abs(actual D.O./after calib D.O.))*100	_____	<15%

Equipment ID _____
Calibration Date _____

Intended Use: _____ Autosamplers
_____ DO Monitoring
_____ Spot Monitoring

Autosampler Use:
Data Sonde retrieved from: _____
Data sonde re-deployed at: _____

DO membrane changed?: Yes No
DO probe sanded? Yes No
Cond. Sensor cleaned? Yes No
pH Sensor cleaned? Yes No

CALIBRATION READINGS

1) Conductivity

Solution (µS/cm)	Actual	After Calibration
0.447	_____	_____
_____	_____	_____

Conductivity Cell Constant _____
(Acceptable range: 5.0 +/- 0.5)

2) pH

Buffer	Actual	After Calibration
7.00	_____	_____
10.00	_____	_____

		Range
mV (7.00)	_____	0 +/- 50 mV
mV (10.0)	_____	-180+/-50 mV

3) Dissolved Oxygen

	Actual	After Calibration
Temperature	_____	
Baro.Pressure (mmHg)	_____	
Percent Saturation	_____	_____
DO (mg/L)	_____	_____

	Actual	Range
DO Charge	_____	50 +/- 25
DO Gain	_____	0.7 to 1.5
D.O. Drift (1-abs(actual D.O./after calib D.O.))*100	_____	<15%

Bar. Pressure (inHg): _____
Notes: _____

Attachment 1
YSI 600 Series Calibration Sheet (Back)

Pressure Conversions

1. Inches to Metric Conversion
   1in = 25.4mm
   Example: 30.15in * (25.4mm/1in) = 765.8mm

2. Corrected to Uncorrected Pressure Conversion
   Obtain the corrected pressure from the National Weather Service.
   Corrected Pressure - (2.5 * (Elevation/100)) = Uncorrected Pressure
   Example: 765.8mm - (2.5 * (455/100)) = 754.4mm

Standard Operating Procedures

for

Discharge Calculation

and the

SonTek FlowTracker Handheld ADV

Clermont County Office of Environmental Quality
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Version 2
March, 2011

1.0 Introduction

This document describes the Clermont County Office of Environmental Quality's (OEQ) procedures for calculating stream discharge and directly measuring stream velocities in wadeable streams using the SonTek FlowTracker Handheld ADV. The FlowTracker is rated for measuring velocity ranging from 0.003 to 15 feet per second (0.001 to 4.5 meters per second) and uses the Mid Section equation (Attachment 1) to calculate discharge.

2.0 Field Equipment

The following equipment is needed to implement the sampling techniques

- FlowTracker Handheld ADV & Probe
- Wading rod
- Waders
- 100 meter measuring tape
- Laptop with FlowTracker Software or a desktop computer to run the beam test
- Stream Sampling Field Sheet

3.0 Preparing the FlowTracker

3.1 Mounting and Installation

Mount the handheld controller to the top-setting wading rod and secure the cable to the wading rod. This is necessary to protect the cable and reduce the amount of electronic noise. Mount the probe on the adaptor bracket to offset the probe to one side of the wading rod.

3.3 Basic Operation of the Handheld Controller

To turn the system on, hold the **On/Off** switch for 1 second. To turn the system off, ALWAYS return to the **Main Menu** first to ensure proper data storage. Then hold the **On/Off** switch for 4 seconds until the LCD screen resets. When turned on, the FlowTracker displays a wake up screen. Pressing **Enter** displays the **Main Menu**. From the **Main Menu**, press the appropriate key to access the desired function.

3.4 Pre-Deployment Diagnostics

Run a beam check (detailed in Section 5.2) prior to leaving the office. The remaining diagnostic tests can be conducted in the field.

Check the available space by checking the recorder Status (**2** in **System Functions Menu**). Download data and format the recorder as needed. Check the Temperature Data (**4 in Systems Function Menu**) to be sure it is reasonable for the environment. Check the Battery Life (**5 in systems Function Menu**) Check the battery power by pressing **5** from the **systems Functions menu**. The FlowTracker uses eight AA batteries: alkaline, NiMH, or NiCad. If the system will not be used for more than one month, remove the batteries. Table 3-4 Lists approximate new battery operating parameters. Check the raw velocity data (**6 in systems functions menu**) to be sure that SNR data is at least above 4dB and ideally around 10dB. Check the system clock (**9 in Systems Function Menu**) to ensure the correct time.

Table 3-4 Battery Operating Parameters

	Alkaline	NiMH (rechargeable)	NiCad (rechargeable)
New battery voltage	12.0 V	10.2 V	10.0 V
Approximate operating life	25 hours	15 hours	7 hours

4.0 Sample Site Selection

At the onset of flow measurement, record the stage of the stream using the staff gauge in place or by directly measuring stream depth at a permanent structure. Also note that flow is being measured on the

Stream Sampling Field Sheet (Attachment 1). Lay tape across the stream, beginning and ending at each bank. Ensure that the tape is at a right angle to the direction of flow.

A straight stream reach with a uniform bed is the ideal location for discharge measurements. If possible choose locations that are greater than 0.5 feet deep and are free of turbulence, eddies, and slack water. If necessary, small obstructions can be removed to provide more uniform flow conditions. Safety of field personnel must always be taken into consideration when selecting a monitoring site.

5.0 Discharge Measurements

5.1 Probe Orientation

Figure 5-1 shows the proper orientation of the probe for discharge measurements. The tag line is installed perpendicular to the primary flow direction. The red band (which marks receiver arm #1) should face downstream.

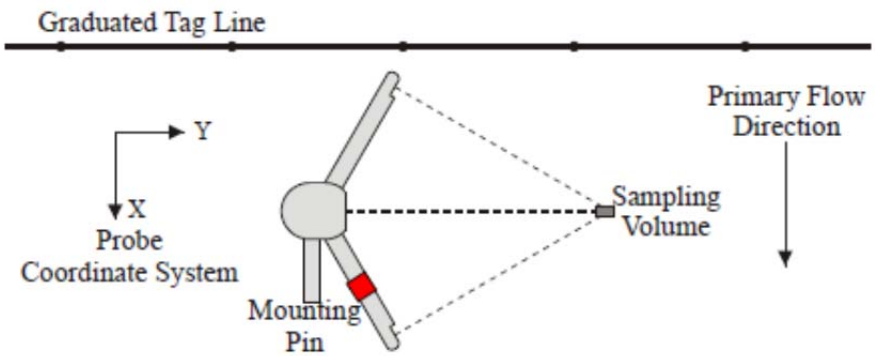


Figure 5-1 Proper Orientation of the Probe during Measurements

5.2 Discharge Mode

5.2.1 Measurement Set-up

From the **Main Menu**, press **3** to start **Data Run**. Specify the file name and extension, site and operator name. Run the automatic QC test by pressing **1** once prompted. Place the probe in moving water away from any underwater obstacles. If multiple warnings are received, run a Beam Check from a PC to evaluate performance in more detail.

5.2.2 Starting Edge Location

Press **Set Location** to set starting-edge location as it corresponds to the tag line (Loc). Press **Set Depth** to set starting-edge water depth (Dep). Correction Factor (CF) should read 0.0. Press **LEW/REW** to change the started edge of water (river-left or river-right). When complete press **next station** to continue.

5.2.3 Station Measurement Set-up

There should be 10-20 sections measured per discharge measurement. The stations should be set-up so that no station contains more than 5% of the total discharge. Press **Set Location** to set station location to the corresponding distance on the tag line (Loc). Press **Set Depth** to set water depth (Dep). Use **Method +** and **Method –** to select the method used for velocity at that station. The 0.6 method can be used if section depth is less than 2.5 ft. The Two-point method (0.2/0.8) should be used in sections with depths greater than 2.5 ft. The depth is referenced from the surface of the water down. Methods with more than one measurement can be recorded in either direction: from surface to the bottom or vice versa. If the user encounters an island in the measurement cross section, **method none** can be recorded twice to indicate that no measurement was possible there.

5.2.4. Station Measurement

When all values are specified and the probe is in position, press **Measure**. When the station is complete, a summary of velocity and quality control data is shown. A warning will be issued if the QC criteria are exceeded. See Table 5-2 for recommendations on passing QC checks if a warning is issued. Press **1** to accept the measurement and move on to the next section, press **2** to repeat the measurement. Repeat sections 5.2.3 & 5.2.4 to measure more stations.

5.2.5 Measurement Review

Between stations you can use **Next/Prev. Station** to scroll through completed stations. Four screens are available for completed stations, press **Enter** to scroll through screens. To view a temporary calculation of the total discharge (Total Q) for all completed stations use the **Calculate Disch.**

5.2.6 Measurement Editing

To delete an existing station, scroll to the desired station using the **Next Station** and **Previous Station** keys, and press the **Delete** key, entering **123** to confirm the deletion. To repeat the station, first delete the desired station, then enter the location, depth, and measurement method of the station to be repeated (the new station will automatically sort to the correct position based on the location value).

5.2.7 Calculating Discharge

Once all station data has been collected, press the **End Section** key. **Next Station** and **Previous Station** can be used to review data and the **Measure** key can be pressed to add new measurements if necessary. If the QC passed and all section measurements seem accurate, presss the **Calculate Disch**. key to complete the discharge calculations and close the file. After the final calculation is complete, nine screens of data are available and can be viewed by pressing **enter** to scroll through the screens. Press **0** to return to the **Main Menu**. **RETURN TO THE MAIN MENU BEFORE TURNING OFF THE SYSTEM TO SAVE ALL DATA.**

Table 5-2-Troubleshooting QC Failure Warnings

Warning	QC Criteria	Description	Suggested Action
Low SNR	None	SNR < 4 dB	• Improve SNR (§5.2)
Beam SNR	SNR Threshold	Difference in SNR for any 2 beams is > SNR Threshold.	• Look for underwater obstacles; repeat measurement. • Check probe operation (§4.1).
SNR Variation	None	One-second SNR data varies more than expected during a measurement. May indicate underwater interference or a highly aerated environment.	• Look for underwater obstacles; repeat measurement. • Look for environmental sources (e.g., aerated water).
SNR Change	SNR Threshold	SNR more than SNR Threshold different previous measurements; major change in measurement conditions.	• Look for underwater obstacles or other changes in river condition. • Repeat measurement
High σV	σV Threshold	σV > σV Threshold; adjusted based on previous data and measured velocity. May indicate interference or a highly turbulent environment.	• Look for underwater obstacles or a change in conditions. • Consider real turbulence levels in river. • Repeat measurement.
High Spikes	Spike Threshold	Spikes > Spike Threshold percent of samples. May indicate poor measurement conditions.	• Look for underwater obstacles or unusual conditions (e.g., aerated water). • Repeat measurement.
High Angle	Max Velocity Angle	Angle > Max Velocity Angle. May only indicate non-ideal measurement environment.	• Consider if measured angle is realistic. • Repeat measurement if needed.
High %Q	Max Section Discharge	%Q > Max Section Discharge. Station contains a large portion of the total discharge.	• Consider adding more stations.
Suspect Depth Value	Max Depth Change	Station depth differs from adjacent stations by more than Max Depth Change %. This may indicate a data entry problem.	• Verify station depth value. • Re-enter if needed.
Suspect Location Value	Max Location Change	Spacing between stations has changed by more than Max Location Change %. This may indicate a data entry problem.	• Verify station location value. • Re-enter if needed.
Location Out of Order / Location Outside Edge	None	Station location out of sequence or outside river edge. This may indicate a data entry problem.	• Verify station location value. • Re-enter if needed.
Bad Boundary QC	None	Boundary QC is FAIR or POOR. Indicates possible interference from underwater obstacles.	• Consider re-locating probe and repeating test. • Measurement can proceed if results are consistent.

5 Flow Tracker Windows Software

The software can be found on the CD or downloaded from the SonTek/YSI website at www.sontek.com.

5.1 Data download

Open the FlowTracker Software and click **Recorder**. To download the files, connect the FlowTracker Controller to a COM port on the computer and click **Connect**. To export the data to a file, select the data export options by clicking on **Program Settings** and choosing an output format. Then click open a Flow Tracker File and select the file of interest. To export data files and generate reports for multiple files click **Open Many FlowTracker Files/Folders**

5.2 Beam Check

This diagnostic procedure verifies FlowTracker performance and must be run in the office prior to an extended field trip. Hold the FlowTracker in a bucket of water, with some added turbidity (dirt), such that the probe is submerged and there is a boundary (surface, side, or bottom of bucket) within view (8-12") of the receiver. Connect the FlowTracker to the PC and turn the system on. Run the FlowTracker software and click **Connect**. Select Beam Check on the left side of the screen then, click start, collect around 20 pings, and click **record**. Click **averaging** to average the multiple pings. Figure 5-2 shows the output of the Beam Check. The output should show the Ringing, sampling volume, and Boundary Reflection features of the curves. The sampling volume peaks should be at the same location on the horizontal axis for both lines. If the Beam check output differs significantly from Figure 5-2, refer to the FlowTracker Technical Manual for more details.

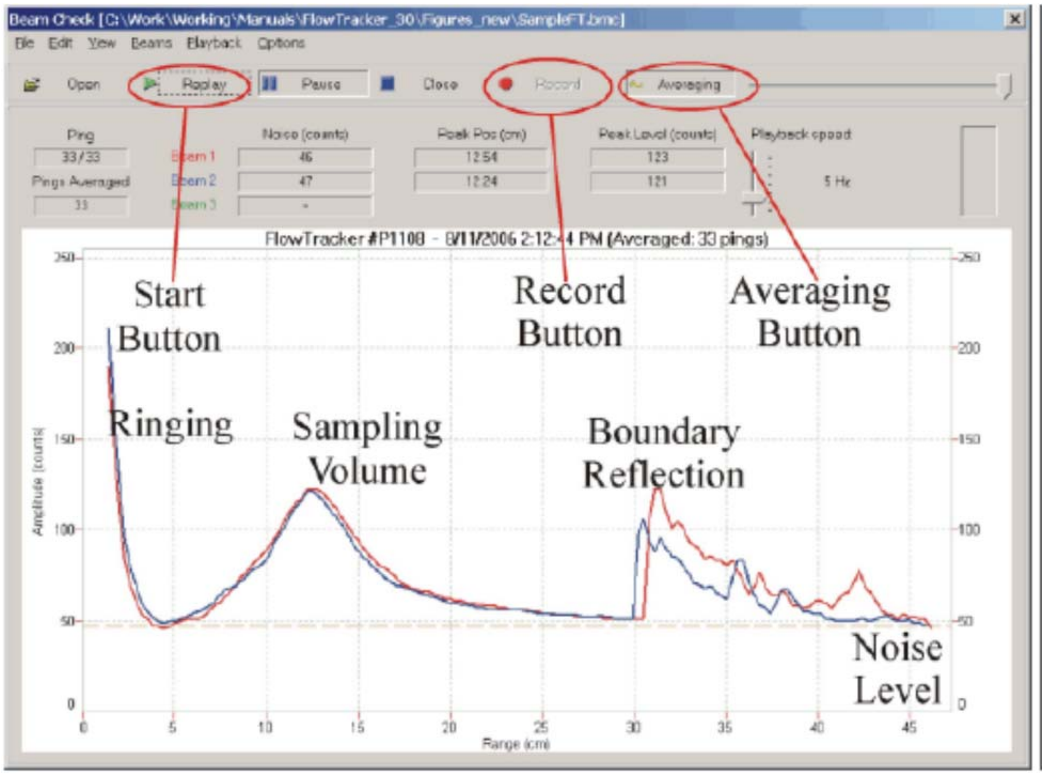


Figure 5-2 Beam Check Output Screen in FlowTracker SoftwareAttachment 1. OEQ Sampling Field Sheet

OEQ FIELD DATA SHEET

PROJECT NAME: _____ DATE: _____

SITE / RIVER NAME: _____ START TIME: _____

SITE LOCATION: _____ END TIME: _____

_____ SAMPLERS: _____

EQUIPMENT ID _____ _____

SAMPLE TYPE

GRAB COMPOSITE

CIRCLE ONE

SAMPLE MATRIX

SEDIMENT WATER

CIRCLE ONE

WEATHER CONDITIONS: SUNNY CLOUDY OVERCAST WINDY RAIN SNOW AIR TEMP (F): _____

(CIRCLE APPROPRIATE CONDITIONS)

RAINFALL _____ ir Last 24 hrs _____ 48 hr Gauge Used _____

STREAM TURBIDITY _____ Clear, _____Slightly turbid, _____Mid to heavy turbid

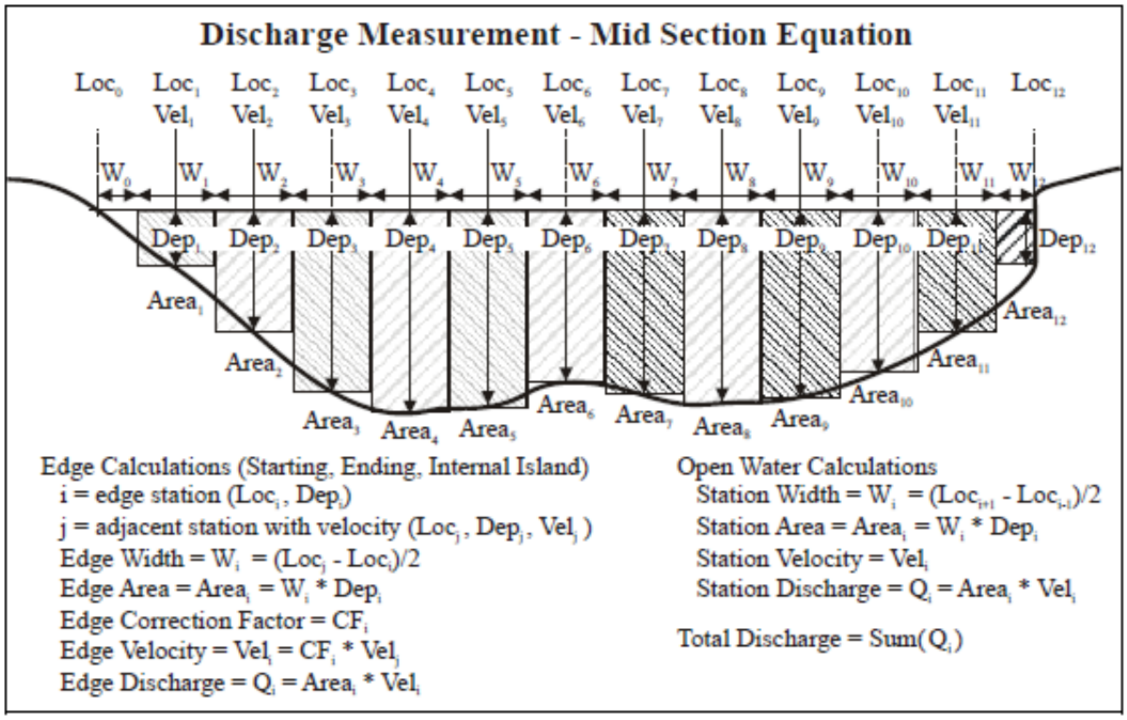
RIVER CONDITIONS: _____ Depth _____ Low Flow _____ Mod Flow _____ High Flow

SITE / SAMPLE ID	Flow (cfs)	TEMP. (C)	pH	D.O. (mg/L)	COND. (µS/cm)	SAMPLE TIME	Depth (ft)	surface depth (ft)	River Stage (ft)

FIELD OBSERVATIONS:

IF FOUND, RETURN TO:
Clermont County OEQ
4400 Haskell Lane
Batavia, OH 45103
(513) 732-7894

Attachment 2 Mid Section Discharge Equation and Schematic of Flow Measurements



Standard Operating Procedures

for

Discharge Calculation

and the

SonTek River Surveyor S5

Clermont County Office of Environmental Quality
4400 Haskell Lane
Batavia, Ohio 45103
(513) 732-7894

Version 1
March, 2015

1.0 Introduction

This document describes the Clermont County Office of Environmental Quality's (OEQ) procedures for calculating stream discharge and directly measuring stream discharge in nonwadeable or flooded streams using the SonTek River Surveyor S5 Acoustic Doppler Profiler (ADP). The river surveyor has a velocity range of 5 m and a discharge measurement range of 15 m using the vertical beam. The vertical beam helps measure during high-sediment flows and floods. The power communications module (PCM) uses 2.4 GHz radio to communicate with a laptop, or cell phone if desired. Data is stored internally and on the laptop so no data is lost if the radio connection is lost. We use a Son Tek Hydroboard II to take measurements from bridges or across stream channels.

2.0 Warning about Batteries

The PCM uses 16 AA alkaline or rechargeable batteries to operate. The PCM only runs on 8 batteries at once, enabling mid measurement battery replacement if necessary. In order to prevent overheating, disconnect the riversurveyor from the PCM whenever storing the system or during long periods of inactivity (several hours). For storage longer than 2 weeks, completely remove all batteries.

3.0 Field Equipment

The following equipment is needed to implement the sampling techniques

- Sampling Partner
- Umbrella hat
- Charged laptop
- USB hub
- Hydroboard
- River surveyor
- Rope
- Waders
- Rite-in-rain paper

4.0 Preparing the River Surveyor

4.1 Mounting and Installation

Install the batteries to the PCM. Attach the radio antenna to the PCM. Connect the PCM and ADP with the connector cable. Place the PCM into the hydroboard and strap down with the black straps. Place the ADP with transducers facing down into the circular mount in the hydroboard, aligning the black line on the ADP with the top of the mount (this black line places the transducer heads 0.1' below the water surface). Lock it into place with the compression clamp and place the pin in the clamp.

If the transducer head needs to be lowered due to high turbulence, you will need to calculate the transducer depth. This is defined as the distance from the vertical beam to the water surface. The distance for the S5 with the fairing to the white line is 4.5 in. If the ADP head is mounted flush with the fairing, simply subtract the distance of the white line to the waterline from 4.5 in. to get transducer depth. Transducer depth will be needed to start measurement.

Connect the PC to the radio antenna dongle. The antenna dongle has to be attached to the USB hub and not directly to the USB port in the laptop. This is due to a power issue where the antenna requires a powered USB device to function. The antenna recognizes the USB hub as a powered USB port.

5.0 HydroBoard II Set-up

The hydroboard can be used in velocities of up to 5 m/s (16.4 ft/s). Attach the tagline to a rope long enough for measurement from the bridge. Keep extra line (rope) in case the hydroboard wants to dive

during measurement. **Up to 800lbs of force can be put on the rope so do not wrap the rope around your body in any way!**

The stabilization fins can be adjusted to three different positions. Fully extended helps stabilize in fast current or high winds.

The tension of the hydroboard can be adjusted as shown in Figure 1. Low tension allows for flexing of the board and results in optimal performance in a wide range of velocity applications. The high tension setting can allow a greater level of control in a low flow setting.

A. High Tension B. Mid-Tension C. Low Tension

Figure 1

6.0 Pre-Measurement

Open up the River Surveyor Live software and connect to the instrument.

6.1 **Settings-** Run the system test. Enable smart pulse, disable composite tracks. In the Utilities section set the system time to match computer time. Select bottom track for track reference and vertical beam for depth reference. Coordinate system is not applicable to OEQ's set-up. Salinity should be set to 0.0.

6.2 **Compass Calibration –** This is necessary prior to each measurement. It is used to compensate for magnetic interference in the vicinity of the ADP. You want to pick a site for compass calibration as close to the location where the measurement will be made. Remove all sources of interference such as watches or cell phones prior to calibration.

Rotate the ADP through two complete circles while varying pitch and roll to the angles expected during the actual flow measurement. Click stop after the two rotations have been completed. If a good score cannot be achieved, try to reduce the speed of the rotations and increase the pitch and roll as much as possible or follow suggestions made by the error message. The magnetic influence is on a scale of 0-100, with 0 meaning no influence "good".

6.3 **Site Information-**Enter all relevant information to the site and measurement. Note site conditions in the comments section.

6.4 **Recorder**- Make sure there is adequate room on the record prior to measurement. The recorder menu is located on the systems tab. Data has to be downloaded from the PCM before post processing can begin.

6.5 **Measurement settings**-select appropriate starting edge. Left and right bank are determining by

looking downstream. A rated discharge or measurement quality can also be entered. These settings can be modified during post processing.

7.0 Measurement

One person will operate the hydroboard while the other person will operate the laptop. The measurement of discharge can be broken into three components, the start edge, the transect, and the end edge (Figure 2). The Transect component can be broken into the top, middle (measured), and bottom estimate as shown in Figure 3. The shore, top, and bottom measurements are estimated due to the minimum operating depth for the profiler, the mounting depth, and data contamination from the bottom cell measurement touching the riverbed. Click Start a Measurement (F5). Be sure that none of the indicators (top left) are red prior to measurement.

7.1 Following USGS protocol, you will collect at a minimum two passes over a period of 12 mins. Always do even # of passes.

7.2 Click Start edge. You need two valid velocity cells to start measurement. The vessel should be as stationary as possible while you collect a minimum of 10 samples. Enter the edge distance and shape.

7.3 Click Start Moving. Collect the transect data by moving the vessel across the channel in a steady speed and direction, keeping the boat speed to water speed ration < 1. After arriving at the end edge,

7.4 Click End Edge and enter the end edge distance and shape and collect 10 profiles in a stationary position.

7.5 Click End Transect when done and make one additional measurements before ending the measurement. When data collection is complete click the Abort button.

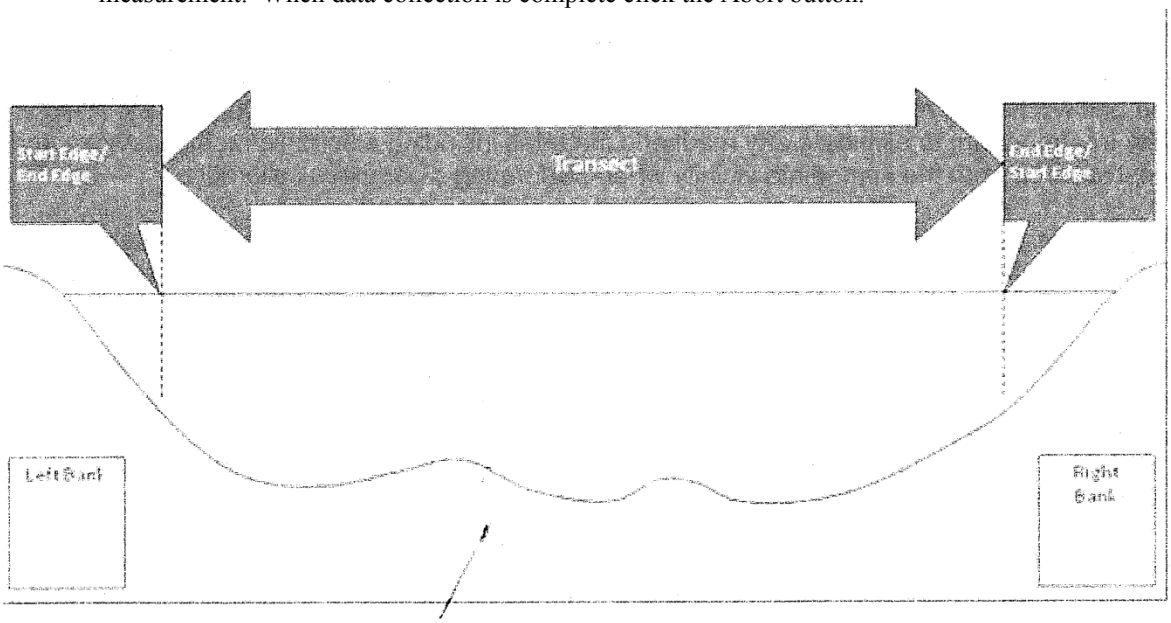


Figure 2

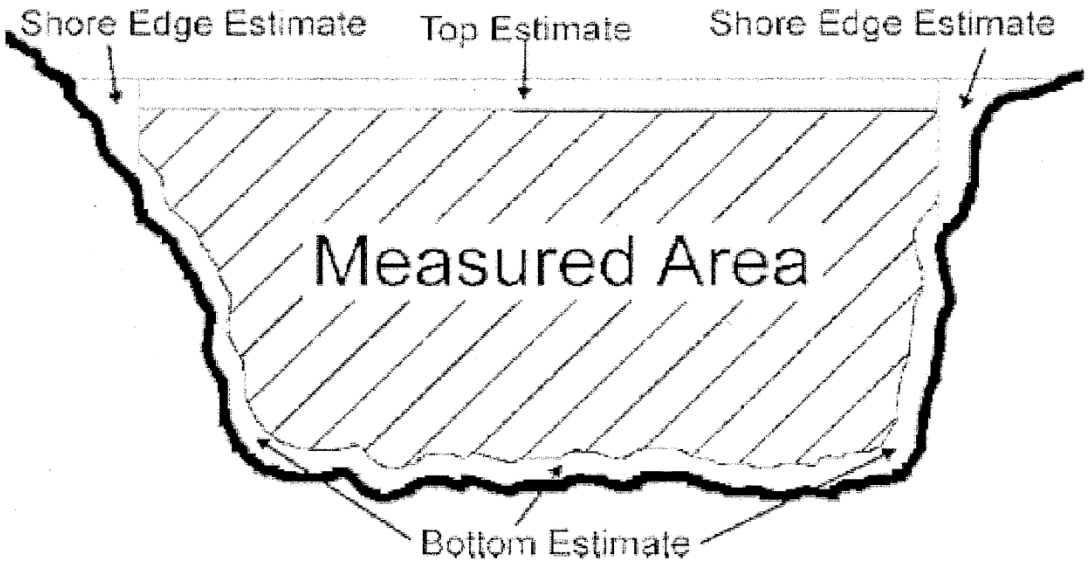


Figure 3

8.0 Measurement Review

Consult page 74 of the RiverSurveyor S5/M9 System Manual Firmware Version 3.5 for full discussion of post-processing.

8.1 **Display**- Open data files with the .riv extension. Each measurement will be accessible via a data tab on the top of the window. On the top left you can toggle the toolbox button to show the toolbox window for post processing analysis. The chart toggle button will show or hide the discharge summary table. The table with a pencil button will open the program settings window where you can change English to metric units for example.

8.2 **Sidebar**- The display options in the sidebar can be adjusted by right clicking inside the sidebar and making selections. The graph portion of the sidebar displays the vertical profile through the water column. Double click on axis to change scale. Right click on display to customize the graph. Useful interpretations include water track versus velocity and summary versus discharge.

8.3 **Tab Window display**- The samples tab displays tabular data for all samples collected along with a contour and profile graph. The left side shows status icons for each sample. You can toggle through the profile by selecting the up and down arrows on the keyboard. On the transect tab, a good site will have the velocity vectors roughly perpendicular to the path of the boat.

8.4 **Discharge measurement summary**-You can compare each discharge measurement and errors. You can select data to include or exclude in the total discharge calculation. Links between open files and records on the discharge summary are as follows:

- An open file will update its corresponding discharge record with changes to settings or as sample number changes
- Closing a file leaves the record displayed in the discharge measurement summary, but the record will no longer update.
- Deleting the record severs the link to the data file. To add the record back, the file must be reopened
- Click on a record to switch to the matching data file
- Delete or uncheck a record to recomputed statistics.

9.0 Processing Data files

9.1 Open all files from a measurement site (under same flow conditions)

- Review the system settings. Make sure the settings are consistent amongst files. Go to

systems tab and cycle through each file (ctrl tab)

- If necessary, change the track and depth reference to best represent the best field measurement (in processing toolbox-system settings).
- Select the navigation tab to evaluate the collected data across the channel. Deactivate the UTM display and activate the autoscale option: available by right clicking.
- Use the sidebar tabular data to evaluate specific settings
- Visually review each measurement by clicking on each tab
- Make sure the magnetic declination is set to 0

9.2 On the transect tab, evaluate different plots by right clicking on the vertical axes.

- Plot the depth measurement by the vertical beam as well as bottom track depth. Make sure the VB and the BT depth scales are the same. Check for discrepancies
- Evaluate boat speed and water speed plotted on the same graph. Ideally, the boat speed should not exceed the water speed where possible.
- Make sure that the heading /pitch/roll and temperature are relatively constant.
- Verify that the SNR data and beams are valid with special focus on the edges and very shallow water
- Verify water velocity in ENU: U (up) and D (delta) should be close to zero.
- Make sure that the discharge curve and profile extrapolations are applicable (using processing toolbox-profile extrapolation).
- Verify that the SNRs are valid for the contour (graph at the bottom).
- Verify that the velocity cell cutoff on the contour plot is valid, also look at the screening distance and make sure that is graphically correct.

9.3 In the discharge measurement summary:

- References and coordinates should be the same
- Starting edges should alternate
- Date/times should be consecutive
- Duration of measurements should be similar
- Use the statistics to identify any outliers
- Channel width and discharge area should be similar
- Uncheck or delete problematic records

10.0 Maintenance

10.1 Transducers

Periodically clean transducer face by cleaning with a soapy water and a sponge or stiff non-metallic brush.

10.2 Cables and Connectors

Inspect for damage regularly and sometimes a light coat of silicone grease or spray on the connectors can facilitate connections. Make sure the silicone doesn't contain cleaners or solvents.

10.3 O-rings

Keep the O-rings on the battery compartment clean and free of debris. Make sure they do not get twisted or broken.

Standard Operating Procedures

for the

Manual Collection of Stream Water Samples

Clermont County Office of Environmental Quality
4400 Haskell Lane
Batavia, OH 45103
(513) 732-7894

Revision Number: 11
May, 2013

Introduction
This document describes the procedures for the collection of water chemistry samples from Clermont County streams and lakes. These methods allow for the collection of grab or composite samples utilizing a stainless steel bucket, or by directly collecting samples from the stream or lake. This standard operating procedures document (SOP) has been developed to maintain consistent data collection procedures, and to ensure the quality of the data collected.

1.0 Field Equipment
The following equipment is needed to implement the sampling techniques.

- Field Sampling Plan and SOP
- Stainless steel bucket with rope (for bank/bridge sampling)
- YSI 600R, XL, or XLM data sonde or DO/pH meter
- Field Data Sheet (Attachment 2)
- Chain of Custody Sheet (Attachment 3)
- Permanent Marker (Sharpie)
- Anti-bacterial soap
- Sterilized Latex gloves or Nitrile gloves
- Sample Bottles
- Coolers and Ice
- Blank Water (Distilled or Reagent Grade Deionized – RGDI)
- Waders

The following parameters can be collected with the sampling techniques presented below: alachlor, alkalinity, ammonia, atrazine, carbonaceous biochemical oxygen demand ($CBOD_{5\ or\ u}$), chlorophyll *a*, nitrate, nitrite, total hardness, total Kjeldahl nitrogen (TKN), simazine, total phosphorus, total recoverable metals, total dissolved solids (TDS), total suspended solids (TSS), total volatile suspended solids (TVSS), and total organic carbon (TOC). Dissolved organic carbon (DOC) and Orthophosphate samples can be collected with these methods as well; however, samples must be field filtered (refer to Attachment 1) if samples cannot be filtered in the laboratory within 15 minutes of sample collection.

2.0 Preparation
Before collecting samples, properly fill out the label (date, time, sampling point, sample ID number, analysis required, and the name of the collecting entity) on all bottles using a permanent marker and affix the labels to the bottles. Ideally, the labels are filled out (except date and time) and attached to the sample bottles before the sampling event occurs.

Prior to collecting samples, both the coolers and the sample bottles should be visually inspected for presence of any dirt, chemicals, or other contaminants. If a sample bottle has any contaminants present, discard it and use another. The coolers should be wiped down or washed with a mild soap and thoroughly rinsed if it has any contaminants present. In addition, all sampling equipment must be inspected for proper operation. If the plastic bucket or dipper was not cleaned the night before and placed under a protective covering, these should be rinsed once with tap water, once with 10% hydrochloric or nitric acid, and three times with deionized water prior to sampling.

The sampler's hands should be washed with a mild soap and water and rinsed well immediately before the sampling event begins. When actually collecting the samples, latex gloves shall be worn and care taken to avoid touching or otherwise contaminating the inner surface of the sample bottles or lids.

3.0 Procedures

Keep all sampling bottles closed until they are ready to be filled. At each collection site, the sampler will wear a new set of gloves for sample collection. If wading, approach the sampling site in a downstream to upstream direction, taking care to minimize any disturbance to the sampling site. If sampling from a boat or structure, collect the sample from the upstream side. Avoid placing the sampling device in contact with the streambed or bank. Once the sample is collected and sealed, the sample bottle should be immediately placed in a cooler and covered with ice.

3.1 Direct Sampling (No Sampling Equipment Utilized)

This method has been implemented to eliminate the use of sampling equipment (i.e. stainless steel bucket) for collecting surface water samples. The elimination of equipment reduces cleaning procedures and possible sources of contamination.

Keep sample bottles closed until they are to be filled. At the collection site, the sampler will wear a new set of gloves and detach the sample bottle lid. Fill the bottle by holding the bottle upright and lowering it into the stream directed toward the current until you have reached a depth of 6 to 12 inches below the surface. Avoid placing the sample bottle in contact with the streambed or bank. Allow the stream water to slowly enter the sample bottle. Do not overfill the sample bottle. Overfilling can cause loss of any sample preservative. Extra sample bottles will be available in case of preservative loss.

Occasionally, Corning™ Coliform Containers are used to collect *E. coli* or fecal coliform samples. These 110mL bottles have a locking lid to ensure sterility and a dechlorinating tablet (sodium thiosulfate) already included in the bottle. The lid, when pressed down completely, will form a watertight seal; a plastic tie is then fed through the appropriate holes in the lid to assure sample integrity. This tie must then be cut in order to open the bottle. The bottles have two raised marks near the lid: the first is a 100mL mark and the second is the EPA fill line. Bottles should be filled to the EPA fill line. Bacteria samples can also be collected in pre-sterilized amber sampling bottles provided by the Sewer District laboratory.

DOC and TOC samples will be collected in 40ml VOA bottles containing a preservative. Sample containers can therefore not be placed directly into the sampling media because over filling the bottles will dilute the preservative. A disposable 60cc syringe should be used to transfer the sample to the VOA bottle. When filling the VOA bottles, there should be no head space or bubbles, and a meniscus should be formed at the mouth of the bottle. If bubbles are present on the meniscus, wait for the bubbles to pop prior to closing the lid. Three 40 mL bottles should be filled per sampling site.

Alachlor, atrazine, and simazine will be collected in 1L or 1 qt. amber glass bottles with Teflon lined screw cap lids. The bottles contain 40-50 mg of sodium sulfite for de-chlorination prior to the addition of HCl. To mix up the sodium sulfite, the bottles must also be shaken prior to the addition of the HCl. Once the sample has been mixed, add 8 drops of HCl (provided by contract lab), then invert twice more. Two 1 L bottles should be filled per sample site.

Trace metals samples will be collected in polyethylene bottles using shoulder length gloves by directly submerging the bottle underwater and capping underwater. The “Clean Hands/Dirty Hands” technique must be used (Attachment 2).

Samples to be analyzed for Ortho-phosphorus, dissolved organic phosphorus or dissolved metals should be immediately field- filtered (within 15 minutes of collection time) following methods in Attachment 1.

After samples are collected, each sample bottle should be placed immediately in a cooler and covered with ice.

3.2 Sampling With Other Collection Devices

In some instances, it may not be possible to collect a stream sample without the use of additional sampling equipment (e.g. stainless steel bucket or 250 ml Teflon beaker) due to high flows or to avoid compromising preservatives. If such sampling equipment is needed, the following procedures should be used.

Step 1: Distilled or De-ionized Water Rinse

- Rinse the sampling equipment with distilled or de-ionized water/discard contents
- Repeat rinse once.

Step 2 – River Rinse

- River rinse by submerging the sampling equipment into the stream at the collection site. Take care not to collect sediment from the stream channel or lake bottom.
- Remove the equipment from the stream and discard its contents.
- Repeat rinse twice.

Step 3 – Sample Collection

- Lower the sampling equipment into the stream to obtain a surface grab sample, again taking care not to collect or disturb sediment from the stream channel or lake bottom.
- Remove the bucket from the stream.
- Fill the required sample bottles.
- Place sample bottles in cooler with ice.

At the end of each sampling day, rinse the sampling containers once with tap water, then with 10% hydrochloric acid or 10% Nitric Acid, and lastly three times each with de-ionized water and place under a protective covering.

4.0 Quality Assurance

Quality assurance samples should comprise at least 10 percent of the total number of stream samples collected.

4.1 Duplicate Samples

To collect duplicate grab samples fill the required bottles either simultaneously and side by side, or fill one bottle *immediately* (<30 seconds) after the other from the same spot. If using a stainless steel bucket or a dipper to collect duplicate samples, fill the different bottles for the same parameters from the same dipper or bucket drop. TKN sample duplicates should be taken only either simultaneously side by side, or with the use of a stainless steel bucket or dipper. Once the duplicate sample is collected and sealed, the sample bottle should be immediately placed in a cooler and covered with crushed ice.

4.2 Equipment Blanks

To collect equipment blanks, first place on a new pair of gloves. Rinse the sampling equipment used in sample collection twice with distilled or de-ionized water. Rinse the equipment a third time with distilled or de-ionized water to simulate a river rinse. Then fill the sample equipment with enough distilled or de-ionized water to fill the required sample bottles. Pour the distilled or de-ionized water directly from the sample equipment into the sample bottles. Once the equipment blanks are collected and sealed, the sample bottles should be immediately placed in a cooler and covered with ice.

4.3 Field Blanks

To collect field blanks, first put on a new pair of gloves, and then fill the required sample bottles directly from the reverse osmosis or de-ionized water container. Phosphated buffered, sterilized water must be used for bacteria field blanks. Once the field blanks are collected and sealed, the sample bottles should be immediately placed in a cooler and covered with ice.

4.4 Trip Blanks (Optional)

Depending on study design, a trip blank may be utilized. This is a sample of RGDI water taken from the laboratory to the sampling site and returned to the laboratory unopened.

4.5 Split Samples (Optional)

Split samples may be collected in order to check the precision of analyses by two or more different laboratories. Sample media should first be collected with the equipment sampling device (e.g. beaker or bucket) and equally divided between the two sample bottles. For $CBOD_5$, samples must be collected directly into sample bottles.

5.0 Chain of Custody Procedures

All samples are to be recorded on a Chain of Custody form with its identifying information. An example of the Chain of Custody form to be used is provided in Attachment 3.

Prior to submitting samples, all Chain of Custody forms must be filled out completely. The people conducting the sampling should be noted at the top of the form, along with the date of sample submittal. Each sample ID should be listed along with the collection date and time. Additional comments may be noted in the far right hand column of the form.

Upon submitting the samples to the laboratory, both the sampler and a laboratory staff member should compare the sample bottles with the information recorded on the Chain of Custody to assure that all sample bottles are present. When it has been determined that all samples are present and that all information on the Chain of Custody is correct, the Chain of Custody form is to be signed by both the sampler relinquishing the samples and the laboratory staff member receiving the samples. The original Chain of Custody shall be kept on file at the laboratory.

Attachment 1
Collection of Samples to be Field-Filtered

Introduction
This attachment describes the additional procedures needed for the collection of samples, where filtering is required in the field (dissolved organic carbon, ortho-phosphate). For filtration of dissolved metals see Attachment 2. If the sample is to be transported to the laboratory and filtered within 15 minutes of sample collection, the following procedures may be disregarded.

1.0.0 Additional Field Equipment
The following additional equipment is needed to implement the filtration method.

- Disposable 60cc Syringes (Luer-Lok tip)
- Disposable 25 mm Filter Cartridges (1µm Glass Fiber Filter and 0.45µm Nylon Membrane Filter)
- Samples Bottles

2.0.0 Procedures
A new disposable syringe and filter cartridge (syringe filtration unit) will be used for each sample.

2.1.0 Decontamination Procedures
The syringe filtration units must be cleaned before each sample is filtered.

Step 1 - Blank Water Rinse

- Rinse the inside of the syringe by plunging 50mls of blank water through the housing.
- Attach the filter cartridge to the syringe.
- Rinse the inside of the entire unit by plunging 50mls of blank water through the unit.

2.2.0 Sample Collection Procedures
A stainless steel bucket or Teflon beaker should be used to collect the stream sample prior to filtering. Samples can be filtered from the sampling device using the following procedures. If testing for dissolved organic carbon, the filter must be 0.45 um glass fiber, silver, nitrocellulose, or polypropylene. If nitrocellulose or polypropylene filters are used, they must be rinsed with DI water prior to filtering the sample.

Sample Filtration/Collection

- Fill the syringe filtration unit with sample from the appropriate collection device.
- Place the plunger into the syringe.
- Purge a small amount of sample volume through the filter.
- Discharge water through the filtration unit into a sample bottle.
- Repeat the previous three bullets until enough sample has been filtered into the sample bottle.
- Discard the syringe filtration unit.

3.0.0 Quality Assurance
Quality assurance samples should comprise at least 10 percent of the total number of stream samples collected.

3.1.0 Duplicate Samples
To collect duplicate samples continue to fill the syringe filtration unit from the same stainless steel bucket drop and filter into the required bottles.

3.2.0 Blanks
Blanks should be collected during each day of the survey. Once the blank is collected and sealed, the sample bottle should be immediately placed in a cooler and covered with crushed ice.

3.2.1 Field Blanks
Pour blank water from an unopened container directly into the sample bottle.

3.2.2 Equipment Blanks
Equipment blanks should be collected at the beginning and end of each survey day.

2. Unfiltered Equipment Blank
An equipment blank utilizing the appropriate collection device should be collected at the beginning of each survey day.

- Fill the appropriate collection device (Kemmerer, bailer, stainless steel bucket, or churn splitter) with enough blank water to fill the sample bottle.
- Purge a small amount of blank water from the appropriate collection device.
- Fill the required sample bottle.

3. Filtered Equipment Blank
An equipment blank utilizing the syringe filtration unit should be collected at the end of each survey day. The syringe filtration unit is decontaminated using the previously outlined procedure before the blank is collected.

- Fill the appropriate collection device (Kemmerer, bailer, stainless steel bucket, Teflon beaker, or churn splitter) with enough blank water to fill the sample bottle.
- Purge a small amount of blank water from the appropriate collection device.
- Fill the syringe filtration unit with sample from the appropriate collection device.
- Place the plunger into the syringe.
- Purge a small amount of blank water through the filter.
- Discharge water through the filtration unit into a sample bottle.
- Repeat the previous three bullets until enough volume has been filtered into the sample bottle.
- Discard the syringe filtration unit.

Attachment 2.

A. Clean Hands Dirty Hands Sampling Technique for trace metals analysis

1. Materials
    a. DI water
    b. Polyethylene sample bottles
    c. Gloves- wrist and shoulder length-non talc, polyethylene, latex, vinyl, or PVC
    d. Storage bags
    e. Plastic wrap
    f. Cooler
    g. Ice
2. At the site, all sampling personnel must put on clean gloves before commencing sample collection activity, with "clean hands" donning shoulder-length gloves. Note that "clean hands" should put on the shoulder-length polyethylene gloves and both "clean hands" and "dirty hands" should put on the PVC gloves.
3. "Dirty hands" must open the cooler or storage container, remove the double-bagged sample bottle from storage, and unzip the outer bag.
4. Next, "clean hands" opens the inside bag containing the sample bottle, removes the bottle, and reseals the inside bag. "Dirty hands" then reseals the outer bag.
5. Clean hands" unscrews the cap then submerges the sample bottle, and allows the bottle to partially fill with sample. "Clean hands" screws the cap on the bottle, shakes the bottle several times, and empties the rinsate away from the site. After two more rinsings, "clean hands" holds the bottle under water and allows bottle to fill with sample. After the bottle has filled (i.e., when no more bubbles appear), and while the bottle is still inverted so that the mouth of the bottle is underwater, "clean hands" replaces the cap of the bottle. In this way, the sample has never contacted the air.
6. Once the bottle lid has been replaced, "dirty hands" reopens the outer plastic bag, and "clean hands" opens the inside bag, places the bottle inside it, and zips the inner bag.
7. "Dirty hands" zips the outer bag

B. Field Filtration for dissolved metals

1. Materials
    a. Materials listed in section A.1.
    b. 0.45 µm, 15 mm diameter or larger, tortuous path capsule filters (Gelman Supor 12175 or equivalent)
    c. Peristaltic pump with tubing
    d. Glove bag
    e. Flouropolymer sample tubing
    f. SEBS resin pump tubing
2. Set up the filtration system inside the glove bag, using the shortest piece of pump tubing as is practicable. Place the peristaltic pump immediately outside of the glove bag and poke a small hole in the glove bag for passage of the tubing. Also, attach a short length of tubing to the outlet of the capsule filter.
3. "Clean hands" removes the water sample from the inner storage bag using the technique described in section A. above and places the sample inside the glove bag. "Clean hands" also places two clean empty sample bottles, a bottle containing reagent water, and a bottle for waste in the glove bag.
4. "Clean hands" removes the lid of the reagent water bottle and places the end of the pump tubing in the bottle.

5. "Dirty hands" starts the pump and passes approximately 200 mL of reagent water through the tubing and filter into the waste bottle. "Clean hands" then moves the outlet tubing to a clean bottle and collects the remaining reagent water as a blank."Dirty hands" stops the pump.
6. "Clean hands" removes the lid of the sample bottle and places the intake end of the tubing in the bottle.
7. "Dirty hands" starts the pump and passes approximately 50 mL through the tubing and filter into the remaining clean sample bottle and then stops the pump. "Clean hands" uses the filtrate to rinse the bottle, discards the waste sample, and returns the outlet tube to the sample bottle.
8. "Dirty hands" starts the pump and the remaining sample is processed through the filter and collected in the sample bottle. Preservation will occur in the laboratory.
9. "Clean hands" replaces the lid on the bottle, returns the bottle to the inside bag, and zips the bag. "Clean hands" then places the zipped bag into the outer bag held by "dirty hands."
10. "Dirty hands" zips the outer bag, and places the double-bagged sample bottle into a clean, ice-filled cooler for immediate shipment to the laboratory.

Attachment 3. Field Data Sheet

OEQ FIELD DATA SHEET

PROJECT NAME: _____ DATE: _____

SITE / RIVER NAME: _____ START TIME: _____

SITE LOCATION: _____ END TIME: _____

_____ SAMPLERS: _____

EQUIPMENT ID _____ _____

SAMPLE TYPE: GRAB COMPOSITE (CIRCLE ONE)

SAMPLE MATRIX: SEDIMENT WATER (CIRCLE ONE)

WEATHER CONDITIONS: SUNNY CLOUDY OVERCAST WINDY RAIN SNOW (CIRCLE APPROPRIATE CONDITIONS) AIR TEMP (F): _____

RAINFALL _____ in Last 24 hrs _____ 48 hr Gauge Used _____

STREAM TURBIDITY _____ Clear, _____Slightly turbid, _____Mid to heavy turbid

RIVER CONDITIONS: _____ Depth _____ Low Flow _____ Mod Flow _____ High Flow

SITE / SAMPLE ID	Flow (cfs)	TEMP. (C)	pH	D.O. (mg/L)	COND. (µS/cm)	SAMPLE TIME	Depth (ft)	surface depth (ft)	River Stage (ft)

FIELD OBSERVATIONS:

IF FOUND, RETURN TO:
Clermont County OEQ
4400 Haskell Lane
Batavia, OH 45103
(513) 732-7894

Attachment 4
Chain of Custody Form

CLERMONT COUNTY CHAIN OF CUSTODY REPORT

SAMPLERS (Signatures):
DATE:_____

SAMPLE INFORMATION								
LOCATION: PLANT CODE & STATION CODE or ADDRESS	SAMPLE DATE	SAMPLE TIME	AM/PM	SAMPLE TYPE (Check one)			# OF BOTTLES	ANALYSIS/COMMENTS
				COMPOSITE		GRAB		
				FLOW	TIMED			
FIELD								

RELINQUISHED BY: _____-_____ RECEIVED BY: _____ DATE: _____
TIME:_____

RELINQUISHED BY: _____ RECEIVED BY: _____ DATE: _____
TIME:_____

RECEIVED FOR LAB BY: _____ DATE: _____ TIME:_____ SAMPLES ON ICE? (Y/N)_____, T (Cº)?_____

Standard Operating Procedures

for the

ISCO Model 4220 Flow Meter

Clermont County Office of Environmental Quality
4400 Haskell Lane
Batavia, OH 45103
(513) 732-7894
Revision Number: 4
March, 2013

1.0 Introduction

This document describes the operating procedures for the ISCO Model 4220 Flow Meters that have been installed at the monitoring stations established by the Clermont County Office of Environmental Quality (OEQ). This SOP has been developed in accordance with the manufacturer's user's manual at
http://www.isco.com/pcfiles/PartPDF/SL000004/UP0013PC.pdf
to maintain continuity and ensure the quality of the data collected.

2.0 Flow Meter Locations

Clermont County has installed ISCO Model 4220 Flow Meters at its four automatic sampling stations in the East Fork watershed. Site maps are provided in Attachment 1. These locations are:

1. East Fork River Mile 34.8 at Main Street bridge in Williamsburg
2. Grassy Fork – located in Marathon at the Glancy Corner-Marathon Road bridge
3. Stonelick Creek – located at the State Route 50 bridge, just west of SR 222
4. Shaylor Creek – located at the Baldwin Road bridge

B. 3.0 Programming the Flow Meter

There are nine program steps that control all aspects of the flow meter's operation. The LCD display will prompt the user through each of the programming steps. To begin programming the flow meter, turn the flow meter on, wait for the display to settle, then press the **Enter/Program Step** key. After this, follow the step by step instructions provided for each station in Appendix 1. Specific Programming instructions are also contained in the *ISCO Model 4220 Flow Meter Instruction Manual*. All personnel should always have a copy of this instruction manual available when attempting to program the flow meters.

Each of the nine program steps are summarized below. The specific programming instructions for each of Clermont County's ISCO flow meters are included in Attachment 2. When on site, the user may obtain a printout of a complete list of program choices by exiting the program and pressing the **Print Program** key when the display returns to the normal operating condition.

If programming is stopped for more than two minutes, the flow meter will time out, and whatever is on the display will revert to the "normal" display (level and parameter measurements displayed). The program consists of nine steps and multiple substeps. Generally, all substeps must be completed before stopping, or the flow meter will reject the changes made for that step after it times out. The flow meter keeps in memory any changes made for the finished steps. Steps not finished will return to the previous selection.

To go to a particular program step without passing through all the steps of the entire program, press the **Go To Program Step** key, then enter the number of the step you want to program.

3.1 Description of Program Steps

Step 1: Operating Mode
The Operating Mode determines how the flow meter is set up. In this step, there are two choices – **Program** and **Setup**. **Program** advances the user to Step 2 (Flow Conversion Type). **Setup** selects various housekeeping features for the flow meter, including internal clock, site identification, measurement setup, hysteresis, report contents, operation of the display backlight, and program lock. Programming worksheets for each of Clermont's stream flow meters are included in Attachment A.

Step 2: Flow Conversion Type
This step determines how the flow meter calculates flow rate and total flow. Clermont County does not have current flow rating curves. If these are developed, this information will be programmed into the ISCO Flow Meter.

Step 3: Adjust Level/Parameters
This step calibrates the measuring sensors that provide the flow meter with level and other information. To calibrate the stream level sensor, measure the stream stage using the staff gage mounted at each of the sampling locations. Enter this value with the numeric keys. At the EFRM 34.8 location in Williamsburg, there is no staff gage and the USGS wire weight gage mounted on the Main Street bridge is used to measure stream level. The key to the box containing the gage is kept in the autosampler shed. Lower the weight until it just comes in contact with the stream's bottom. Using the graduated disk, which is marked in increments of 0.01 feet, measure the distance from the stream bottom to the stream surface. Record this depth on the field inspection sheet as the actual depth and enter this value into the flow meter. .

Dissolved oxygen (DO), pH, temperature and conductivity are measured at each site using a YSI 600R Multi Parameter Water Quality Meter. The YSI data sonde should be calibrated once every two weeks during the warm weather months (May through October), and once a month during the remainder of the year (if deployed). YSI calibration procedures are included in *Standard Operating Procedures for YSI Equipment* (Clermont OEQ, May 2001).

Step 4: Reset Totalizer
This step may be bypassed, as the installation of each of the County's flow meters are permanent. If the flow meters are moved, the flow meter's internal flow totalizers should be reset as the meter is moved from site to site. To reset the totalizer, refer to instructions contained in the *ISCO Model 4220 Flow Meter Instruction Manual*.

Step 5: Sampler Pacing
This step allows the flow meter to signal the ISCO autosampler to collect a sample after a certain volume of stream water has passed. At this time, Clermont does not utilize this option, and this step is disabled during the programming process.

Step 6: Sampler Enable
This step enables the flow meter to control the autosampler's ability to run its own program. If enabled, this allows the flow meter to stop operation of the sampler, which is useful for stormwater monitoring. Currently, the autosamplers are enabled when the streams being monitored reach or exceed a certain depth. These depths are provided in the programming instructions for each site, included as Attachment 2. When the conditional stream depth is no longer met, the autosampler is disabled.

Step 7: Alarm Dialout Mode
This feature allows the flow meter to be programmed to signal a remote location through a telephone line. At this time, Clermont has not programmed any of its autosamplers to utilize this feature.

Step 8: Printer
All Model 4220 Flow Meters have a built-in printer. The flow meter is capable of printing alphanumeric messages on the chart, as well as three separate data lines, including level, flow rate, pH, DO, temperature or rainfall (rainfall is printed as a bargraph). This step allows the user to program the printer's chart speed and to determine the type of data to be plotted.

Step 9: Reports/History
This step allows the user to program the flow meter to print out regular reports that summarize data recorded by the flow meter over a period of time. The flow meter allows to separate reports to be created and lets the user define the information to be included. Note that the contents of the report are defined in Step 1: Setup. This step merely lets the user turn this option off or on and to set the timing. The **History** option provides a record of up to 50 changes made to the flow meter's program or operation events.

4.0 Calibrating Flow Meter

At least once a month, the flow meter depth reading should be calibrated to actual stream depth. All information should be recorded on the Inspection and Calibration sheet included in Attachment 3. To calibrate the depth, use the following procedures.

- Record the flow meter's stream depth reading on the calibration sheet
- First, directly measure the existing stream depth at the site of the submersed probe. Record this on the calibration sheet.
- Press the **Go To Program Step** key on the flow meter. Enter Step 3.
- The display will read **Port To Adjust**. Select **(Level)**.
- The display will then read **Enter Current Level**. Enter the measured stream depth in feet.
- Exit the programming mode.

5.0 Downloading Data from the Flow Meter

Clermont County uses ISCO FLOWLINK software for data acquisition, storage, retrieval and analysis. Data stored by the flow meter is retrieved remotely via a telephone modem or using a laptop computer with the FLOWLINK software. Data should be downloaded from each flow meter on a bi-weekly basis.

To download the data directly onto a laptop computer at the sampling location:

- Connect the laptop (with FLOWLINK software installed) to the flow meter at the 6-pin connector located on the side of the controller.
- Open FLOWLINK. A message stating "Regular data maintenance will now be performed" will appear. Press "Cancel."
- A screen with the options to direct connect or modem connect will appear. Press the direct connect button.
- Once connected, press the "Interrogate" button. A progress bar will appear, displaying the number of data packets received. When the download is complete, the progress bar will disappear.
- If time permits, the data should be briefly checked in the field to make sure no problems occurred. Otherwise, the data should be examined and transferred to the FLOWLINK database in the office as soon as possible.

To copy the data from any particular station onto a disk, use the following procedure:

- Open Flowlink. (Select "Cancel" when asked to perform regular database maintenance or when asked to connect)
- Open the "Graphs and Tables" folder shown in the left hand window. Open the data table for the flow meter station of interest.
- Click the graph icon (or right click and select "Properties"). Click on the "Time Scale" tab.
- Under Section 1, select the starting date and time for which you want to download data. (Typically, "Last Month" or "This Month" will be appropriate)
- Under Section 2, select the time span for which you want to download data. Typically "One Month" will be appropriate. Leave the Summary Interval as five minutes.
- Once selected, the time range should be displayed in the box located in the lower right hand corner. If this is correct, select "OK." The data to be downloaded will now be shown in table form.
- From the menu bar, select File/Export. In the "To File" space, select the A: drive, and give the file an appropriate name (ex. A:\Kain_Jun01. Once entered, click the "Export" button. When completed, a message should appear stating "The data was exported successfully." Select "OK"
- Close out of the Export screen. Repeat the process for the remaining stations.

To download data from a sampling location remotely via telephone modem:

- Open FLOWLINK. A message stating "Regular data maintenance will now be performed" will appear. Press "Cancel."
- Open the "Sites" folder shown in the right-hand window. Select the flow meter location to be interrogated.
- Click on the "Connect" tab in the lower right-hand corner of the screen. The computer will now dial the phone number for the station and attempt to connect with it.
- Once connected, click on the "Retrieve Data" tab next to the "Connect Tab" at the bottom of the screen. The flow meter will now transfer all stored data to the FLOWLINK data file for that station on the county's computer server.

C. 6.0 Flow Meter Maintenance

During each visit to the automatic sampling stations, field personnel should inspect the flow meter and perform maintenance if necessary. Items to be inspected and maintained include the desiccant canisters, the submerged probe, printer paper supply and printer ribbon, the flow meter casing. The depth probe and YSI meter should be calibrated once every two weeks during the warm weather months (May through October), and once every month during the remainder of the year (if deployed). **Calibration procedures are described under Section 3.1, Description of Program Steps/ Adjust Level/Parameters**. A Flow Meter Inspection and Calibration Sheet (shown in Attachment 2) should be filled out completely after each site visit.

6.1 Desiccant Canisters

The ISCO Model 4220 has an internal and external desiccant canister to absorb moisture that can be damaging to the flow meter equipment. There is also a desiccant canister attached to the Quick Disconnect Box installed at the East Fork River Mile 34.8 station. Each canister contains silica gel that changes from blue to pink when saturated. Field personnel should check all canisters each time the flow meter is visited. If the desiccant is saturated, it must be replaced.

The external desiccant canister is located on top of the flow meter cabinet. If the desiccant has turned pink and needs to be recharged, remove the old canister by snapping it out of the two clamps. The canister can be opened and the saturated desiccant can be emptied into a glass jar provided by the Sewer Disctrict wastewater lab. New desiccant can be placed into the canister, or a replacement canister can be installed. To install the canister containing the new/recharged desiccant, snap the cartridge into the clamps. Then attach the tubing between the top of the desiccant cartridge and the black plastic elbow fitting mounted on the side of the case near the top.

To locate the internal desiccant canister, open the flow meter case lid. The canister has a window on its side that appears blue when the desiccant is dry. When the window is pink, the desiccant needs to be regenerated. If the desiccant is saturated, remove the canister from the flow meter by pulling outward on the spring clamp. The canister containing the saturated desiccant should be brought to the Sewer District laboratory to be regenerated. Replace the canister with the spare canister containing the dry desiccant. Install the new desiccant canister by pressing it under the bracket, with its viewing window lined up with the circular hole in the bracket. When the desiccant canisters have been changed, the flow meter lid should be tightly latched.

6.2 Care of the Submerged Probe and Cables

The submerged probe and cable require little periodic maintenance. The probe and cable should be visually inspected each time the flow meter station is visited. Inspect the probes entrance ports. The probe only needs to be cleaned if all ports are blocked. Inspect the cable for damage or wear. Field personnel should also check the LCD display on the flow meter to make sure reasonable readings are being obtained.

It is generally not necessary to clean accumulated materials from the vicinity of the probe. In the event that all entrance ports in the submerged probe housing become blocked, the probe may be cleaned using the following procedure:

- Remove the submerged probe and its mounting apparatus from the flow stream.
- Scrape any accumulated solids off the exterior of the submerged probe body with a brush.
- ***Gently*** flush the inside cavity of the submerged probe with water. Do not use tools to try to remove matter lodged in the submerged probe's ports or cavity.

If the submerged probe cannot be cleaned sufficiently in this manner, the probe may be disassembled for cleaning. This should be done with extreme care. Consult the *ISCO Model 4220 Flow Meter Instruction Manual* if this is necessary.

If dirt and/or moisture block the reference tube between the desiccant cartridge and the submerged probe connector on the flow meter, or if the blockage is inside an extension cable for the submerged probe, you may be able to clear the blockage from the tube by applying compressed air. However, if the blockage is inside the submerged probe's cable, it cannot be removed without ruining the probe. This problem can be avoided by preventing submersion of the reference tube inlet and maintaining the desiccators.

6.3 Changing the Roll of Paper

The printer will shut down when the paper runs out. The roll is nearly empty when a 1-inch wide pink band appears on the left side of the chart. To change the roll:

- *Remove take up roll from printer*: Pull the handle on the left side of the take-up roll straight out until the roll slips off the printer. To remove the paper roll from the take up spool, snap the white end cap free from the two black catches on the end of the spool.
- *Remove feed spool from printer*: Remove the feed spool by pulling on the handle extending from the right side of the printer. Remove the empty roll from the feed spool by removing the white end cap as described above.
- *Insert new roll onto feed spool*: Slide the new roll onto the feed spool so it unrolls from the back side - facing away from you. Line up the slots in the cardboard tube with the raised guides on the spool. Reattach the white end cap by wedging the two catches on the end of the spool into the two slots on the white end cap.
- *Feed the paper into the printer*: Peel the paper back. Cut off the end of the roll if it is torn. Fold the paper over on itself so that the end is straight and stiff. Unroll a few inches of the paper and set the roll on top of the cabinet. Feed the paper down the back of the internal printer to where it touches the roller. Make sure the paper gets past the lever for the paper sensing switch. Press the **Chart Advance** key until the paper comes through the printer mechanism. When the paper comes through, reinstall the feed spool with the new roll on it by snapping it into the printer assembly.
- *Attach paper to take-up roll:* Run a few inches through the printer, using the **Chart Advance** key; then unfold the end. Put the cardboard tube from the empty roll on the take up spindle and reattach the white end cap. Use a piece of tape to attach the end of the new paper to the cardboard tube. Roll some of the paper onto the spool so that it will wind clockwise, facing away from you. Reinstall the take-up roll into the top of the printer. When the takeup spool is back in place, push the **Paper Reroll** key to remove any slackness in the paper.

6.4 Ink Ribbon Replacement

When the characters on the chart become difficult to read, the printer ribbon should be replaced. To replace the ribbon:

- Turn the unit off.
- Remove the paper take –up spool and unroll enough paper so the two ribbon spools can be clearly seen.
- Take hold of one of the spools and rotate it slightly, loosening the ribbon.
- Lift gently until the spool comes free of its shaft. Do the same with the other spool.
- Lift the chart and take-up spool out of the way and remove the ink ribbon from the printer mechanism, noting how it threads through the unit.
- Thread the new ink ribbon through the printer mechanism.
- Locate the three small pins on each ink ribbon spool and turn the spools so the pins face the gears on the two ribbon shafts.
- Replace the two spools on their respective shafts, pushing the detector levels out of the way so the spools will easily re-engage their gears.
- Gently rotate each spool to tighten the ink ribbon. Reinstall the paper take-up roll if necessary.

1. 6.5 Care of the Flow Meter Case

The flow meter case lid should be kept tightly latched at all times, except when it is necessary to change the flow meter program or the chart. The flow meter should not be routinely operated with the case lid open, as this will expose the internal components to dirt and moisture.

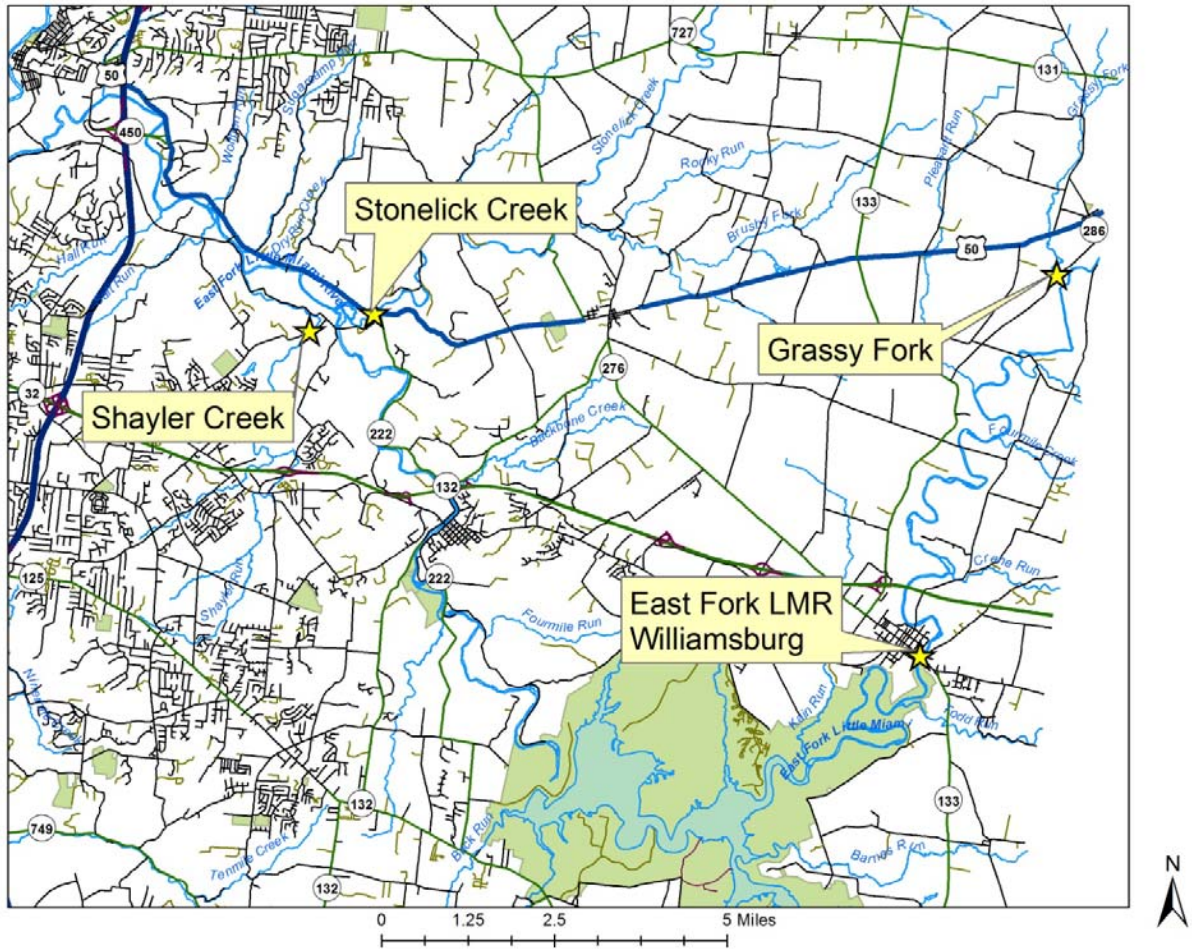
From time to time, the case seal should be inspected and cleaned if necessary. The seal should be kept free of dirt, sand, etc. To clean the seal, carefully wipe it with a damp cloth. Also, keep the rubber gasket in the lid clean. This can be cleaned with a small brush and a damp cloth. The case itself can be cleaned with soapy water; however, the case lid must be shut and all the M/S connectors on the side of the lid should be capped prior to cleaning.

6.6 System Reset

If the flow meter does not appear to be operating normally, try to restart the processor by turning the unit off, waiting a few minutes, and then turning the unit back on. If problems continue, contact the OEQ office as soon as possible.

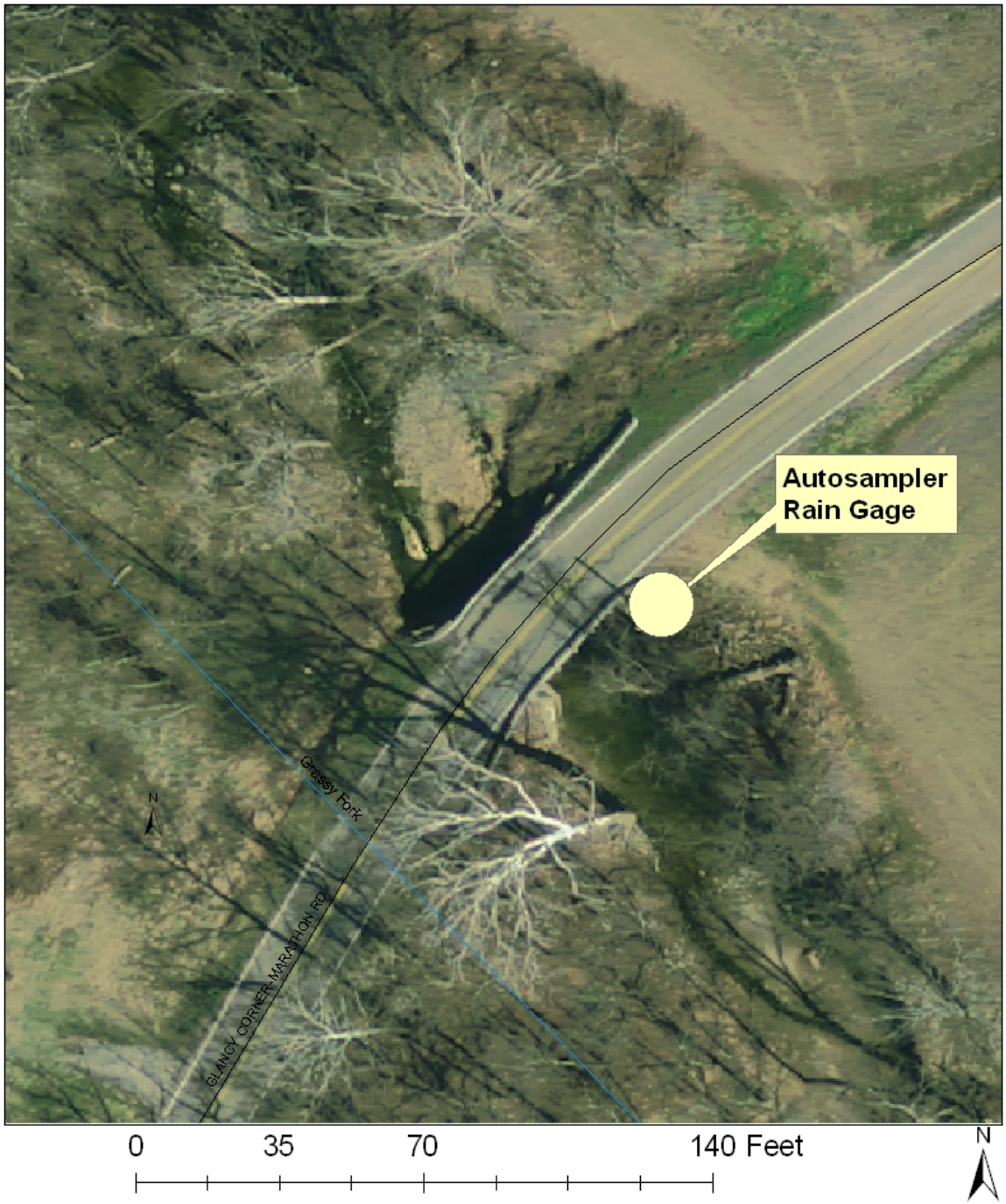
Attachment 1

Clermont County OEQ Monitoring Stations



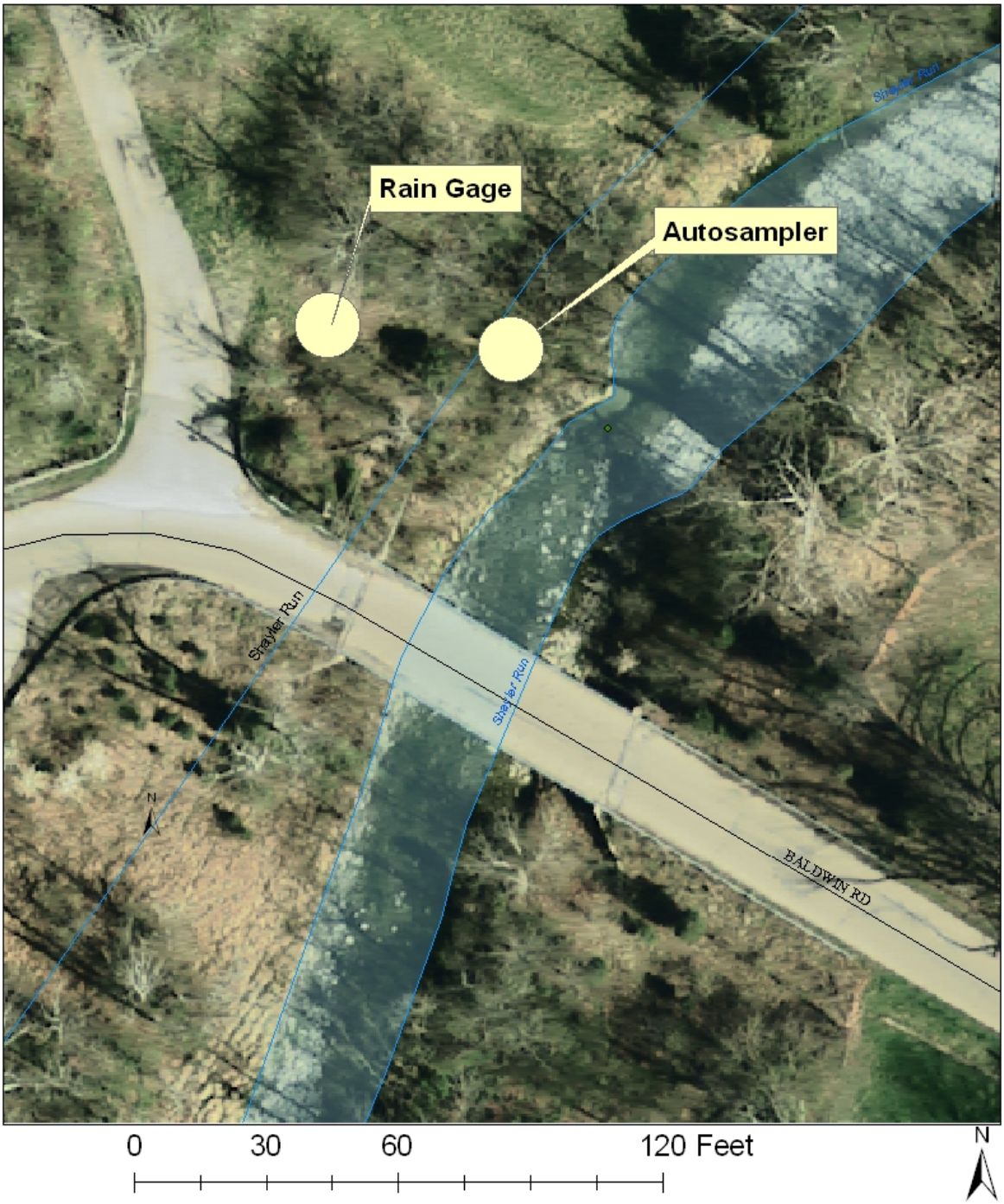
EFRM34.8-Williamsburg
Autosampler Station

Grassy Fork
Autosampler Station

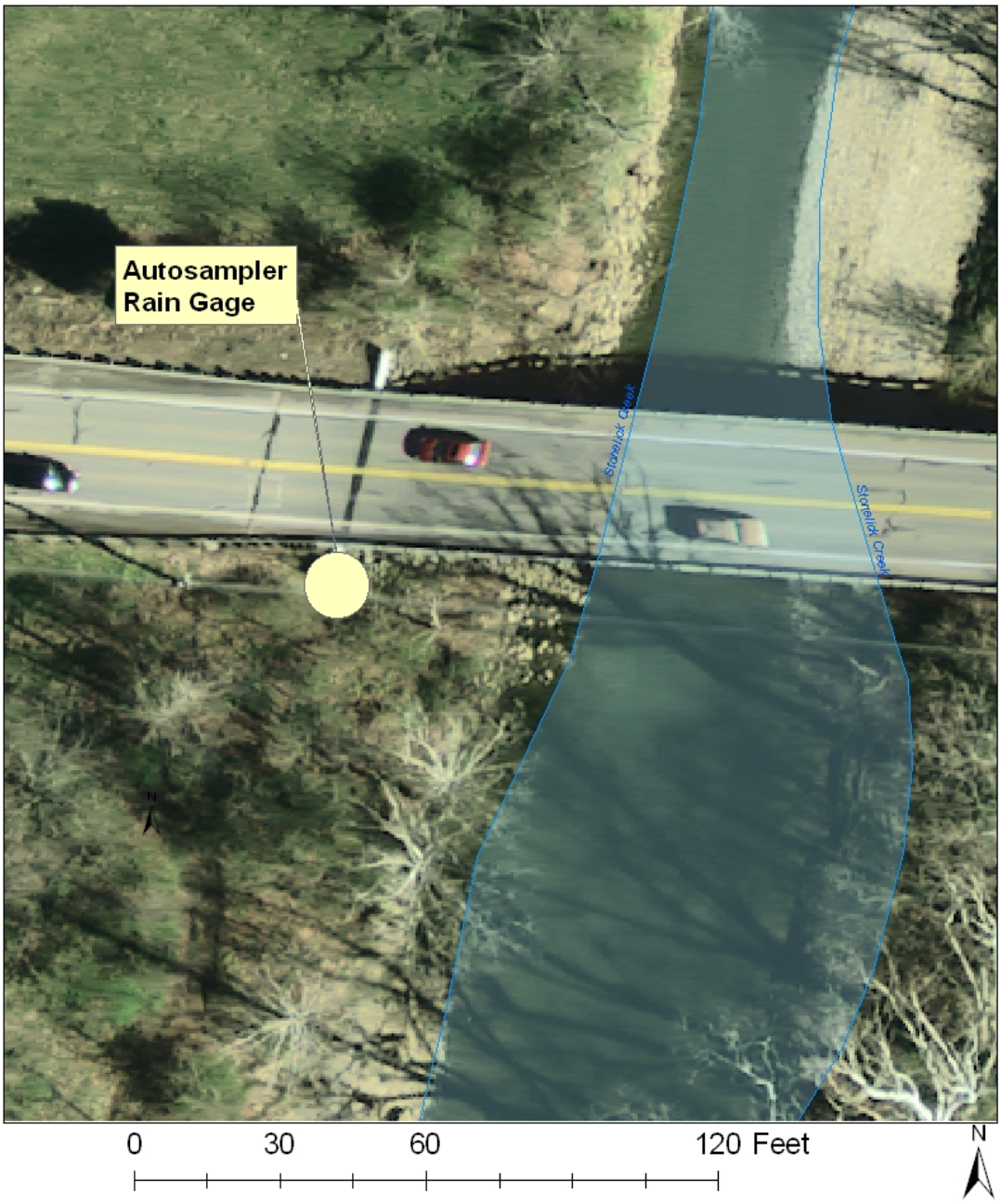


II.

Shayler Run
Autosampler Station



Stonelick Creek
Autosampler Station



Attachment 2
Programming Instructions for
Clermont County ISCO Model 4220 Flow Meters

To go to a particular program step without passing through all nine steps of the program, press the Go To Program Step key, then enter the number of the step you want to program.

Step 1: Setup

1. Turn on the machine. Wait for the display to settle. Then press the **Enter/Program Step (Enter)** key. The **Select Option** screen will appear.
2. From the **Select Option** screen, choose **Setup**.
3. From the **Setup Options** screen, choose **Set Clock**
4. Enter the Year (4 digits), the month (01 to 12), the day (01 to 31), the hour (01 to 24), and the minute (00 to 59).
5. Return to **Setup Options** screen, select **Site ID**.
6. Enter the three digit site ID as follows:
   Williamsburg– 348
   Stonelick Creek – 050
   Shayler Creek – 129
   Grassy Fork – 002
7. Return to **Setup Options** screen, select **Measurement Setup**
8. From **Measurement Setup**, select **Level Reading Interval**
9. For **Level Reading Interval**, select **5 minutes**. Press Enter. The **Measurement Setup** menu will reappear.
10. From **Measurement Setup**, select **YSI 600 Reading Interval**
11. For **YSI 600 Reading Interval**, select **5 minutes**. Press Enter. The **Setup Options** menu will reappear.
12. From **Setup Options**, select **Status**
13. Press enter until the **Supply Voltage** screen appears. The voltage value should be between 10.5 to 13.5.
14. Return to **Setup Options** screen, select **Enable/Alarm Hysteresis**
15. **Level Enable/Alarm** will appear on the display. Select 0.00 feet.
16. **YSI-pH Enable/Alarm Hysteresis** will appear. Select 0.00 pH units.
17. **YSI-DO Enable/Alarm Hysteresis** will appear. Select 0.00 ppm/mg/L.
18. **YSI-Conductivity Enable/Alarm Hysteresis** will appear. Select 0.00 mS/cm.
19. **YSI-Temperature Enable/Alarm Hysteresis** will appear. Select 0.00 Deg.
20. Return to **Setup Options** screen, select **Optional Outputs**
21. From **Optional Outputs**, select **Analog Output**
22. From **Analog Output**, select **4-20 External mA**
23. From **4-20 External mA**, select **Off**
24. Return to **Optional Outputs**, select **Serial Output**
25. From **Serial Output**, select **Off**
26. Return to **Optional Outputs**, select **Alarm Box**
27. From **Alarm Box**, select **Off**
28. Return to **Setup Options** screen, select **Report Setup**

29. From **Report Setup** menu, select Report A
30. From **Report Setup, Report A**, select **Flow**
31. **Level In Report** will appear. Select **Yes**.
32. **Flow Rate in Report** will appear. Select **No.**
33. **Rainfall in Report** will appear. Select **No.**
34. The **Report Setup** menu will reappear. Select **DO/pH**
35. At **pH or DO in Report,** select **No**
36. At **Temperature in Report**, select **No**
37. The **Report Setup** menu will reappear. Select **YSI 600**.
38. **YSI Data In Report** will appear. Select **Yes**.
39. Press **Exit** to leave the program. Then press **Enter** and reselect **Setup**.
40. From **Setup Options**, select **LCD Backlight**
41. From **LCD Backlight Mode**, press **Key** press **Timeout**
42. From **Setup Options**, select **Language**
43. From **Language**, select **English**.
44. From **Setup Options**, select **Program Lock**
45. From **Program Lock**, select **Off**.
46. The Setup menu will reappear. Select **Program**.
47. **Units of Level Measurement** will appear. Select **Ft**.
48. **Flow Rate Units of Measure** will appear. Select **Not Measured**.
49. **Rain Gauge** will appear. Select **Not Measured**.
50. **pH Units of Measure** will appear. Select **Not Measured**.
51. **DO Units** will appear. Select **Not Measured**.
52. **Temperature Units** will appear. Select **Not Measured**.
53. **YSI 600 Connected** will appear. Select **Yes**.
54. **YSI 600-pH Units of Measure** will appear. Select **pH**.
55. **YSI 600-DO Units** will appear. Select **MG/L**.
56. **YSI 600-Conductivity Parameter** will appear. Select **SpCond**.
57. **YSI-600 Temperature Units** will appear. Select **ºC**.

Step 2: Flow Conversion. This step is not utilized. The flow meter will automatically proceed to Step 3.

Step 3: Port to Adjust: Stream depth readings are calibrated under this step. For calibration of YSI parameters, see *Standard Operating Procedures for the YSI Multi Parameter Water Quality Monitor.*

1. Directly measure stream depth using staff gage. Record stream depth.
2. Select Step 3. **Port to Adjust** will appear.
3. At **Port to Adjust**, select **(Level).**
4. **Enter Current Level** will appear. Enter measured stream depth in feet.
5. Exit Step 3.

Step 4: Reset Totalizer. This step is not utilized. The flow meter will automatically proceed to Step 5.

Step 5: Sampler Pacing: This step is not utilized. When programming, select Step 5. **Sampler Pacing** will appear. Select **Disable**. The flow meter will then advance to Step 6.

Step 6: Sampler Enable. Under this step, the stream depth at which the ISCO Autosampler will begin collecting samples is programmed. The programmed depth will be dependent upon sampler location, time of year, and existing flow conditions. This depth should be re-programmed once per month, at a minimum.

1. Upon going to Step 6, the display will read **Sampler Enable Mode**. Select **Conditional**.
2. After this, the display will read **Level: Greater Than _.__- Feet**. Enter the stream depth at which you want the ISCO autosampler to begin collecting samples. This will vary based on stream, time of year, and existing flow conditions.
3. At **Select Operator**, select **Done**.
4. At **When Enable Condition Is No Longer Met**, select **Keep Enables**
5. At **Enable Currently Latched, Reset**, select **No**
6. At **Printer On/Off With Enable**, select **Yes**

Step 7: Alarm Dialout Mode.
This step is not utilized, as no cellular modems have been installed at any of the sampling stations. When programming, select Step 7. At **Alarm Dialout**, select **Disable**. The flow meter will then advance to Step 8.

Step 8: Printer

1. The first display will show **Enter Printer Speed**. Select **1”/hr**.
2. At **Input for Printer Line A**, select **Level**
3. At **Printer Line A Bottom Scale**, enter **0.10** feet.
4. At **Printer Line A Full Scale**, enter maximum stream depth expected. This will depend upon the sampling location. This may also need to be adjusted based upon the time of year and existing flow conditions.
5. At **Input for Printer Line B**, select **pH.**
6. At **Printer Line B Bottom Scale**, enter **6.0** pH.
7. At **Printer Line B Full Scale**, enter **9.0** pH.
8. At **Input for Printer Line C**, select **DO**
9. At **Printer Line C Bottom Scale**, enter **2.0** MG/L.
10. At **Printer Line C Full Scale**, enter **12.0** MG/L.
11. At **Plot Rainfall on Chart**, select **No.**

Step 9: Reports/History

1. The first display under Step 9 will read **Report Generator A**. Select **Off**.
2. At **Report Generator B**, select **Off.**
3. At **Print Flow Meter History**, select **No**
4. At **Clear History**, select **No**
5. The flow meter will then exit programming and return to the normal display.

Attachment 3

Clermont County OEQ
Autosampler / Flow Meter Inspection Sheet

Clermont County OEQ
Monitoring Station/Sampler Field Inspection Sheet

Inspected by: _____

Inspection Date: _____

Site:	Shayler Run	Stonelick	GRSSY0.2	GRSSY3.0	GRSSY3.2	EFRM34.8
Date:						
Time:						
Refrigeration Unit:						
Refrigerator Temperature						
Adjusted? (y/n)						
Stream Depth:						
Flow Meter Depth Reading (ft)						
Actual Stream Depth (gauge)						
Depth Reading Calibrated? (y/n)						
Desiccant Canisters						
Internal Canister (y/n/ok)						
Quick Disconnect Canister (y/n/ok)						
Cleaning / Maintenance - Inspected						
Strainer (y/n/ok)						
Suction Line (y/n/ok)						
Pump Tube (y/n/ok)						
Air Filter (y/n) Jan,Apr, July, Oct						
Rain Gauge						
Funnel Cleaned (y/n/ok)						
Balanced (y/n/ok)						
Vermin						
Mice? (y/n) /treated? (y/n/ok)						
Ants? (y/n)/ treated? (y/n/ok)						

Problems / Concerns / General Notes

Standard Operating Procedures

for the

ISCO Model 4110 Flow Meter

Clermont County Office of Environmental Quality
4400 Haskell Lane
Batavia, OH 45103
(513) 732-7894
Revision Number: 1
February, 2015

1.0 Introduction

This document describes the operating procedures for the ISCO Model 4110 Flow Meters that have been installed at the monitoring stations established by the Clermont County Office of Environmental Quality (OEQ). This SOP has been developed to maintain continuity and ensure the quality of the data collected.

3.0 Flow Meter Locations

Clermont County has installed ISCO Model 4110 Flow Meters at its two automatic sampling stations in the East Fork watershed. The 4110 use ultra sonic level sensors mounted on a boom extending over the stream channel. Site maps are provided in Attachment 1. These locations are:

5. CWLUS, Tributary to Grassy Fork, upstream of agricultural BMP at Cornwell's farm, 6028 Marathon-Edenton Rd.
6. CWLBP, Tributary to Grassy Fork, at downstream of agricultural BMP at Cornwell's farm,6028 Marathon-Edenton Rd.

A.

B. 3.0 Programming the Flow Meter

Clermont County uses ISCO FLOWLINK software for data acquisition, storage, retrieval and analysis. Data stored by the flow meter is retrieved remotely via a modem or using a laptop computer with the FLOWLINK software. To program the 4110, connect the 4110 to a computer and enter the 4110's program with Flowlink. BE SURE TO REPLACE PORT CAPS AFTER DISCONNECTING FROM INSTRUMENT. Flowlink provides all programming instructions for the flow logger. Specific Programming instructions are also contained in the help section of Flowlink.

Sampler Enabling and Pacing

Visit the Sampler Enabling and Pacing tab in Flowlink to program the 4110 to enable a sampler. Select the type of measurement (level, flow, time or rainfall) and the set point for enabling and/or disabling the sampler. You can also use logical operators, AND, OR, and NOT, to combine data types. Sampler pacing is also set in this tab.

5.0 Calibrating Flow Meter

At least once a month, the flow meter depth reading should be calibrated to actual stream depth. All information should be recorded and stored in the period of record. To calibrate the depth, use the following procedures.

- Record the flow meter's stream depth reading on the calibration sheet
- Directly measure the existing stream depth at the site of the submersed probe using the plumb gage. Record this on the calibration sheet.
- With the laptop connected to the 4110, go to the measurement tab in Flowlink. Enter the existing stream depth into the current level box.
- Click Apply in the lower right hand corner of the window.

5.0 Downloading Data from the Flow Meter

Data should be downloaded from each flow meter on a bi-weekly basis. The signal strength should be recording each time data is downloaded. To view the signal strength, visit the measurements tab.
To download the data directly onto a laptop computer at the sampling location:

- Connect the laptop (with FLOWLINK software installed) to the flow meter at the 6-pin connector located on the side of the controller.
- A screen with the options to direct connect or modem connect will appear. Press the direct connect button and select communication port 1
- Once connected, click "retrieve data". A progress bar will appear, displaying the number of data packets received. When the download is complete, the progress bar will disappear.
- The data should be briefly checked in the field to make sure no problems occurred.
- The data should be examined and transferred to the FLOWLINK database in the office as soon as possible.

To download data from a sampling location remotely via telephone modem:

- In Flowlink, open the "Sites" folder shown in the right-hand window. Select the flow meter location to be interrogated.
- Click on the "Connect" tab in the lower right-hand corner of the screen. The computer will now dial the phone number for the station and attempt to connect with it.
- Once connected, click on the "Retrieve Data" tab next to the "Connect Tab" at the bottom of the screen. The flow meter will now transfer all stored data to the FLOWLINK data file for that station on the county's computer server.

C. 6.0 Flow Meter Maintenance

Sites should be visited biweekly during the winter and wet weather season and monthly to perform maintenance and download data. During each visit to the automatic sampling stations, field personnel should inspect the flow meter and perform maintenance if necessary. Items to be inspected and maintained include the desiccant canisters, the ultra sonic sensor, sensor depth reading accuracy, signal strength, obstructions near the ultra-sonic sensing field, battery charge and the flow meter casing. Any maintenance should be recorded and logged in the period of record.

6.1 Desiccant Canisters

The ISCO Model 4110 has an internal desiccant bag and external desiccant canister to absorb moisture that can be damaging to the flow meter equipment. The canister contains silica gel that changes from blue to pink when saturated. Field personnel should check the external canisters each time the flow meter is visited. The humidity indicator on the back of the 4110 casing should also be checked. If the indicator is pink, the internal desiccant bag needs replaced.

The external desiccant canister is located on the inside of the flow meter door. If the desiccant has turned pink and needs to be recharged, remove the old canister. New desiccant can be placed into the canister, or a replacement canister can be installed. The desiccant is recharged and stored at the Wastewater lab.

To locate the internal desiccant bag, the back of the flow meter must be removed, exposing the electronics compartment. This desiccant cannot be recharged, so a new bag must be purchased from ISCO. Extras are sometimes stored at the Wastewater Lab.

6.2 Cleaning and care of the Ultra-sonic Level Sensor (USLS) and 4110

Both units can be cleaned with soap and water. Care sure be taken to ensure all seals are tight on the 4110 prior to cleaning. The USLS cannot operate properly when dirty so be sure to inspect periodically and clean when necessary, especially if the sensor has been submerged during a storm event.

Vegetation and debris should be kept clear of the USLS field (area in the stream channel below the sensor). Weeding should be conducted in the growing season during maintenance visits. The grass near the boom

and shelter or anywhere where it may be difficult for a mower to reach, should also be trimmed during the growing season.

The flow meter case lid should be kept tightly latched at all times, except when it is necessary to change batteries or check desiccant. The flow meter should not be routinely operated with the case lid open, as this will expose the internal components to dirt and moisture.

From time to time, the case seal should be inspected and cleaned if necessary. The seal should be kept free of dirt, sand, etc. To clean the seal, carefully wipe it with a damp cloth. Also, keep the rubber gasket in the lid clean. This can be cleaned with a small brush and a damp cloth. The case itself can be cleaned with soapy water; however, the case lid must be shut and all the M/S connectors on the side of the lid should be capped prior to cleaning.

6.3 Signal Strength

The signal strength should be recording each time data is downloaded. To view the signal strength, visit the measurements tab. When there is water in the channel, the signal strength should be 85% or greater. If the signal strength is less than 85%, the sensor may need a level adjustment or vegetation or other obstructions nearby the sensor should be removed.

6.4 Batteries

Two 6-volt lantern batteries are used to power the 4110's deployed at Cornwell's farm. These should be installed so that the springs contact the brass leads in the battery compartment. Under most conditions, two fully charged, 6-volt alkaline batteries will power the 4110 for as long as 3 months when readings are taken at 15-minute intervals. Remaining battery life can be checked on the Basic Info tab when connected to Flowlink.

Attachment 1

Standard Operating Procedures

for the

ISCO Model 6700FR and 6712FR Refrigerated Samplers

Clermont County Office of Environmental Quality
4400 Haskell Lane
Batavia, OH 45103
(513) 732-7894

Revision Number: 4
March, 2013

1.0 Introduction

This document describes the operating procedures for the ISCO Model 6700FR Refrigerated Samplers that have been installed at the automatic sampling stations established by the Clermont County Office of Environmental Quality (OEQ). This SOP has been developed to maintain continuity and ensure the quality of the data collected.

The ISCO 6700FR Refrigerated Sampler ("autosampler") is a programmable liquid sampler suited for general purpose sampling, as well as storm based sampling. The autosampler can be interfaced with a variety of equipment, including ISCO flow meters for flow proportional sampling, and YSI 600 Series data sondes. For more detail and technical specifications of the ISCO 6700 Sampler, refer to the *6700FR Refrigerated Sampler Instruction Manual* (ISCO, 1997, found at http://www.isco.com/pcfiles/PartPDF/SL000002/UP000LUN.pdf). For technical support, call ISCO at (800) 228-4373.

2.0 Autosampler Locations

Clermont County has installed ISCO 6700 Autosamplers at four sampling stations in the East Fork watershed. Site maps are provided in Attachment 1. These locations are:

7. East Fork River Mile 34.8 – located at the Village of Williamsburg Main Street bridge
8. Stonelick Creek – located at the US 50 bridge
9. Shayler Creek – located at the Baldwin Road bridge
10. Grassy Fork – located at the Glancy Corner-Marathon Road bridge

D.

3.0 Programming the Autosampler

First, turn on the sampler, if it is not currently running. The On/Off key is labeled with an icon that looks like a vertical bar inside a circle. The start up screen appears first and remains on the display for about eight seconds. The main menu screen appears next. The Main Menu has four options: RUN, PROGRAM, VIEW REPORT and OTHER FUNCTIONS.

Next, check the autosampler clock to make sure that the date and time are correct. To change the clock settings, select OTHER FUNCTIONS, then MAINTENANCE, and then SET CLOCK. Enter the time and date. Use a 24-hour clock for times and the day-month-year format for the dates. Return to the Main Menu by pressing the Stop key (which resembles a red, upside-down triangle in a circle)

At the main menu, select PROGRAM. This will lead the user through a series of steps using the Quick View screens. To edit a current selection, press an arrow key until the current selection blinks, and then press the Enter key. The display will then show all the possible options for that programming step. One menu option always blinks. Pressing the Enter key will select the blinking option. To select an option, use the arrow keys to highlight the desired option so that it is blinking and then press Enter. This will return the user to the Quick View display, now showing the new option selected. To move to the next programming step, use the arrow keys to highlight the forward arrow (↓) on the display, and then press the Enter key. To move back to a previous screen, highlight the reverse arrow (↑) and press Enter. After programming is complete, select "Yes" when asked "Do you want to start this program now?" The display should then read "Program Disabled," which means the sampler is waiting for the appropriate flow conditions to be met before it initiates the sampling program. The programs for each of Clermont County's five automatic samplers are included in Attachment 2. Note that changing the data storage interval, module setup, hardware setup, or selecting a new stored program will result in stored data being lost. Download all data before making these changes.

4.0 Installing the Sampler Bottles

Install the 24-bottle kit with clean bottles by sliding it into the cooling compartment until the rack drops over the two semicircular ramps that hold it in place. Check the kit's alignment by rotating the distributor arm with the programming steps…***Do NOT rotate the distributor manually! Moving the arm manually damages the distributor***

drive. If you see any misalignment, adjust the posts and ramps until the discharge tube at the end of the arm stops over each bottle.

4.1 Moving the Distributor

Never rotate the distributor manually. To test to see if the distributor positions itself correctly over the sample bottles, select OTHER FUNCTIONS from the main menu. From the next screen, select MANUAL FUNCTIONS, and then select MOVE DISTRIBUTOR. The next screen will state "GO TO BOTTLE ____ (1-24). Enter the bottle number to which you want the distributor to move.

5.0 Sample Bottle Recovery

The autosampler will automatically cease operation after all 24 bottles have been filled. Before removing the rack, place lids on the bottles so that the samples do not spill. Remove the bottle rack by lifting the front edge of the rack slightly to disengage it from the two ramps. Then pull it straight out of the refrigerator. Be careful not to catch the distributor arm against the bottles.

6.0 Viewing / Downloading Data from the Autosampler

6.1 Viewing Real Time Data

Real-time data is viewed using the ISCO 4220 flow meters installed at each autosampler location.

6.2 Downloading Data

Data is recorded and logged by an ISCO 4220 Flow Meter. Clermont County uses ISCO FLOWLINK software for data acquisition, storage, retrieval and analysis. Ordinarily, data is downloaded remotely via a telephone modem installed on the flow meter. Data can also be directly downloaded onto a laptop computer at the autosampler location. For instructions on how to download data from the ISCO Flow Meter, consult Standard Operating Procedures for the ISCO Model 4220 Flow Meter *(OEQ, March, 2011).*

7.0 Collecting Grab Samples

To collect a grab sample, select OTHER FUNCTIONS from the main menu. From the next screen, select MANUAL FUNCTIONS, and then select GRAB SAMPLE. Then enter the desired sample volume, in milliliters. After this has been input, press the Enter key when ready.

If you wish to collect the grab sample in a container other than the first sample bottle in the 24-bottle kit, first disconnect the pump tube from the bulkhead fitting, then place the end of the tube over the sample container and follow the steps presented in the paragraph above. After the grab sample has been collected, reconnect the pump tube to the bulkhead fitting.

8.0 Calibrating the Sample Volume

The sampler should deliver accurate sample volumes without calibration. If the actual sample volumes vary significantly from the programmed values, first check the suction line for proper installation. Be sure the line slopes continuously downhill to the stream so that it drains completely after each sampling cycle. Then compare the actual length of the suction line to the suction line length settings in the program to see that they match. Also check the pump tube for excessive wear and replace it if necessary.

If calibration is necessary, disconnect the pump tube from the bulkhead fitting. Place the end of the tube over a collection container, preferably a graduated cylinder. Select OTHER FUNCTIONS from the main menu. From the next screen, select MANUAL FUNCTIONS, and then select CALIBRATE VOLUME. Then enter the desired volume in milliliters. Press the Enter key when ready to calibrate. The autosampler will then pump a sample into the collection container. When completed, the display screen will ask for VOLUME DELIVERED. Enter the

actual volume pumped. The display will then restate this volume and ask ARE YOU SURE? YES/NO. Select YES if the volume delivered matches the volume displayed on this screen. After calibration is completed, reconnect the pump tube to the bulkhead fitting.

9.0 Autosampler Maintenance

Each autosampler should be visited once every month throughout the year. During each visit to the automatic sampling stations, field personnel should inspect the autosampler and perform maintenance if necessary. A "Autosampler Field Inspection Sheet (shown in Attachment 3) should be filled out completely after each site visit.

Maintenance items include:

1. Check Clock Settings
2. Record the refrigerator's inside temperature.
3. Clean the bottles, suction line, strainer and pump tube.
4. Inspect the pump tube for wear. Replace if necessary.
5. Clean the refrigerator interior and exterior periodically
6. Clean the refrigerator's air filter every three months
7. Clean the condenser coil annually.
8. When the battery warning appears on the display, replace the controller's internal battery

9.1 Check Clock Settings

To change the clock settings, select OTHER FUNCTIONS, then MAINTENANCE, and then SET CLOCK. Enter the time and date. Use a 24-hour clock for times and the day-month-year format for the dates.

9.2 Record Refrigerator's Inside Temperature

Record the refrigerator's inside temperature on the field inspection sheet using the thermometer inside the refrigerator. The temperature should be 4°C.

9.3 Cleaning Bottles, Suction Line, Strainer and Pump Tube

After use, sample bottles should be returned to the Sewer District wastewater lab for cleaning. Laboratory standard operating procedures will be used to clean all bottles.

To clean the suction line, pump tube and discharge tubes, place the end of the suction line in a cleaning solution and pump it through the delivery system. If items are severely contaminated, replace them. Clean strainers with a brush and soapy water.

The pump can be manually operated in either the forward or reverse direction. From the main menu, select OTHER FUNCTIONS. From the next screen, select MANUAL FUNCTIONS, and then select OPERATE PUMP. Select the pump direction from the following screen, and press the red Stop key when finished.

9.4 Inspect the Pump Tube/Replace if Necessary

Inspect the pump tube periodically. Replace the tube when it cracks or appears worn. The sampler tracks the pump count. When the counter reaches the default count of 1,000,000, the sampler displays a message

"WARNING! REPLACE PUMP TUBE." To replace the pump tube, refer to Pages 71-72 of the 6700FR Refrigerated Sampler Instruction Manual *(ISCO, 1997).*

9.5 Cleaning the Refrigerator

To keep the refrigerator's exterior and interior free from corrosive solutions, grease, oil and other debris, clean it periodically with soapy water using a sponge or a non-metallic brush. Wipe the refrigerator dry after cleaning. If necessary, clean the controller with warm soapy water. To

prevent moisture damage, always cap the connectors at the back of the controller tightly. Make sure the pump drain hole (located on the bottom right-hand side of the pump, beneath the pump band) is open and free of debris or buildup.

9.6 Cleaning the Refrigerator's Air Filter

The refrigerator's air filter should be cleaned about every three months, or more frequently if necessary. To clean the filter:

- Disconnect power from the refrigerator
- Remove the screws securing the refrigerator's grille.
- Remove the grille and filter.
- Wash the filter in hot, soapy water. After washing, treat the filter with a standard filter coat.

9.7 Cleaning the Condenser Coil

The refrigerator's condenser and surrounding areas should be cleaned annually. To clean the condenser:

- Disconnect power from the refrigerator
- Remove the refrigerator's back panel
- Vacuum the fan, compressor and surrounding areas.
- Check the fan for freedom of movement. If the fan and fan motor do not rotate freely, the motor needs to be replaced.
- Remove the front grille and filter. Vacuum the condenser coil and surrounding areas.
- Clean the filter before replacing it.
- Replace the back panel and front grille.

9.8 Replacing the Internal Battery

A lithium battery housed inside the controller requires replacement every five years. The sampler displays a warning within one month of its expected life. If the warning is displayed, do not attempt to replace the battery yourself. Contact OEQ as soon as possible at (513) 732-7894 or (513) 732-7745.

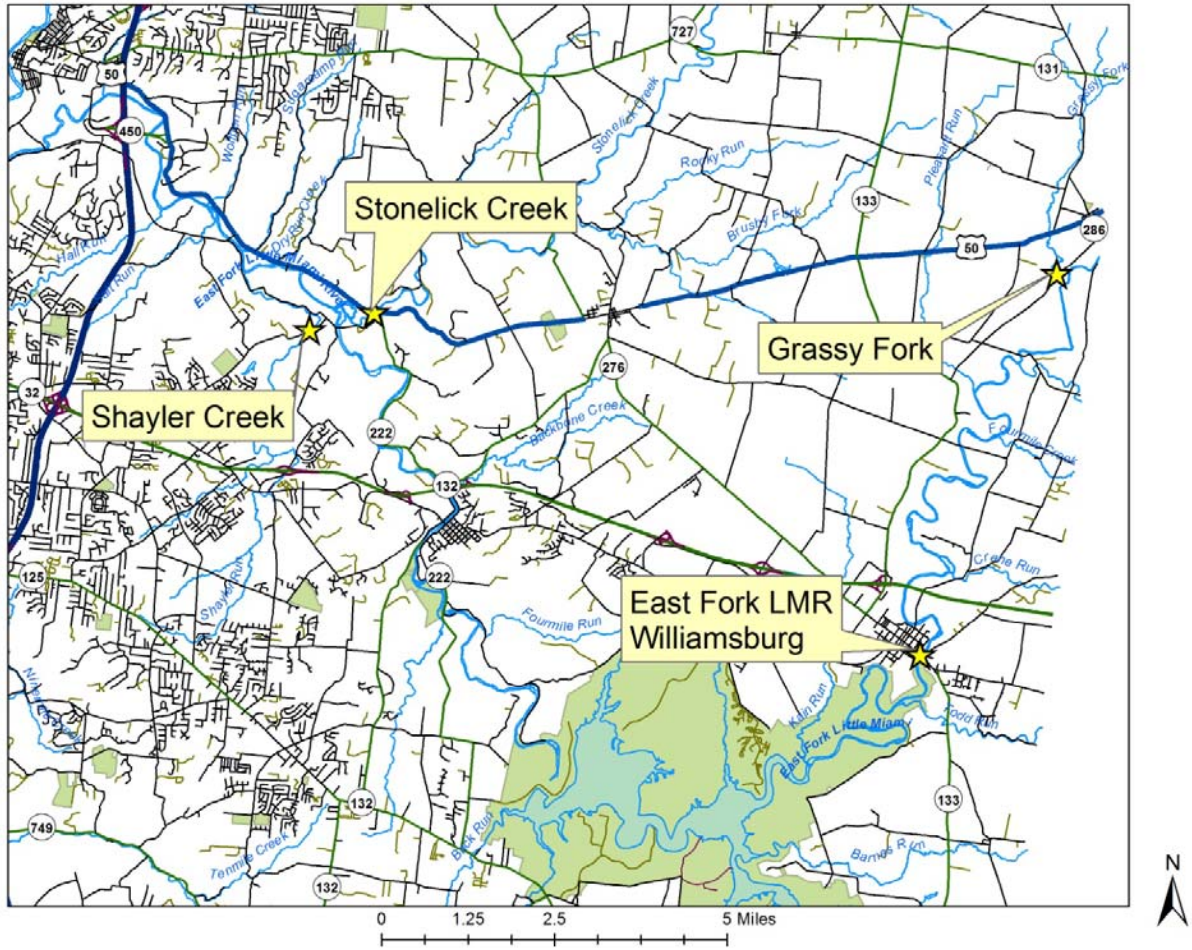
9.9 Additional Maintenance Activities at EFRM 34.8 (Williamsburg)

9.9.1. Check desiccant on Quick Disconnect Box, mounted on the Main Street bridge.

Each desiccant canister contains silica gel that changes from blue to pink when saturated. You may also encounter another desiccant that changes color from green to orange when saturated. Field personnel should check all canisters each time the station is visited. If the desiccant is saturated, it must be replaced. Saturated desiccant can be returned to the Sewer District wastewater laboratory to be recharged.

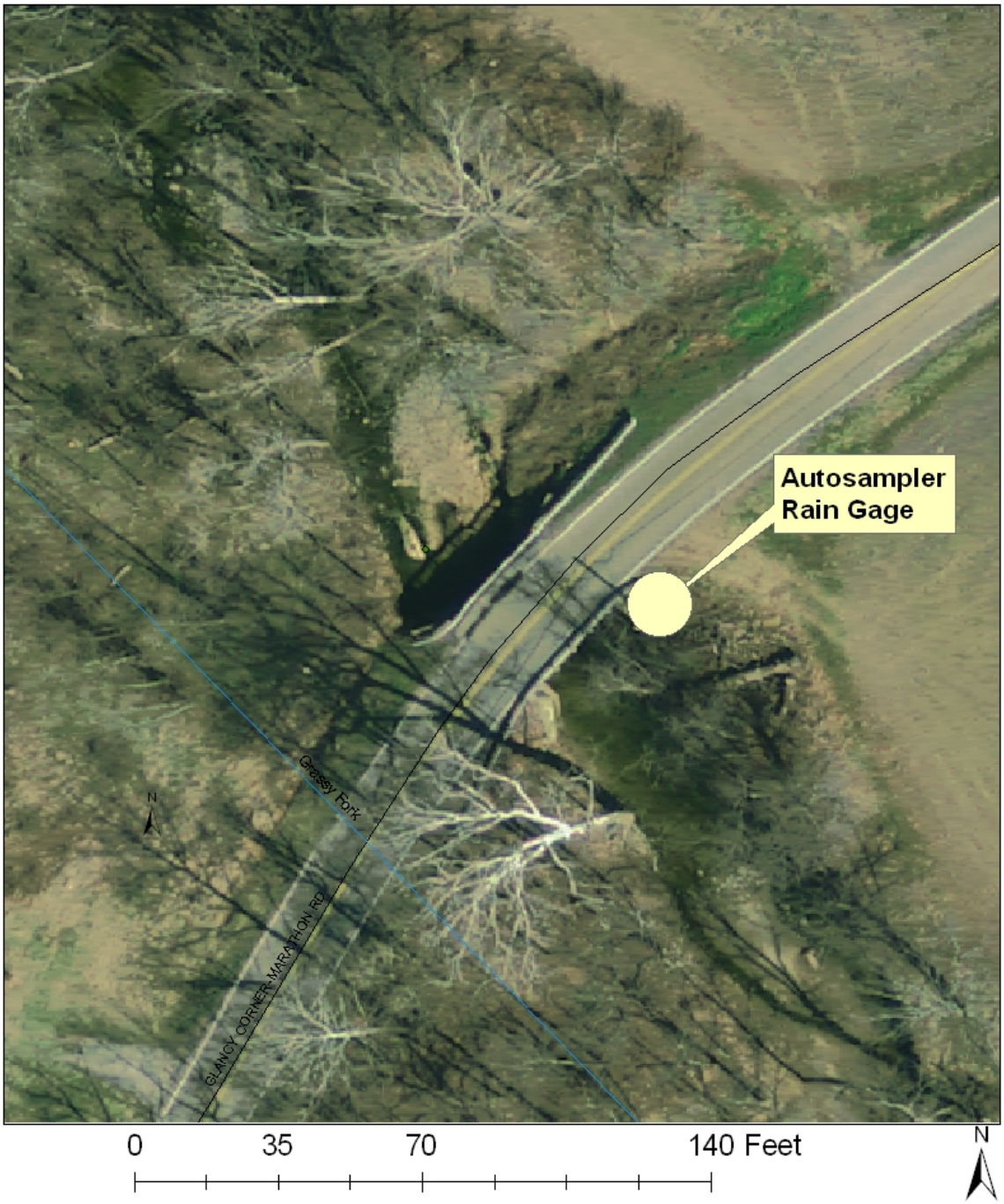
ATTACHMENT 1:

Clermont County OEQ Monitoring Stations

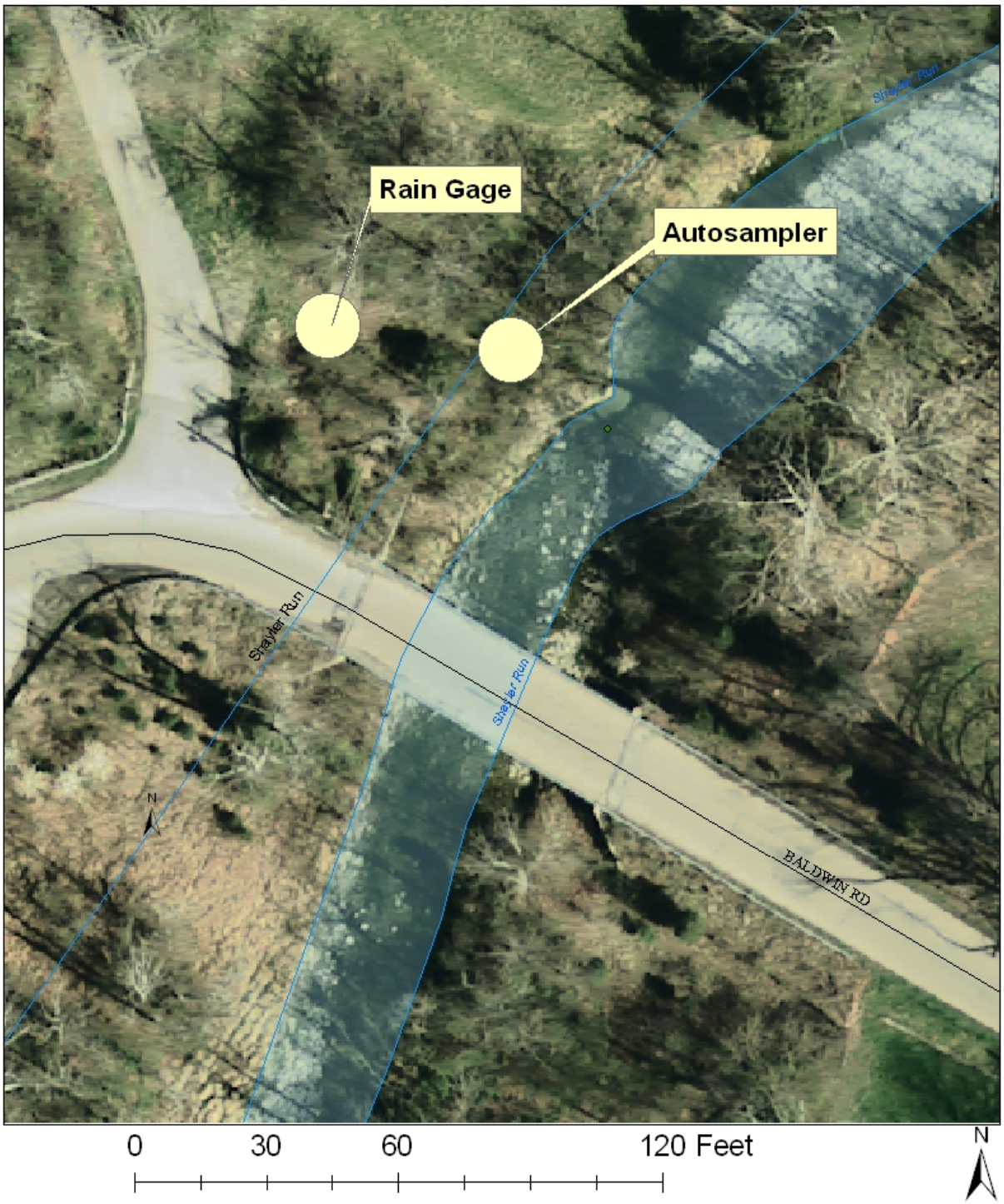


EFRM34.8-Williamsburg Autosampler Station

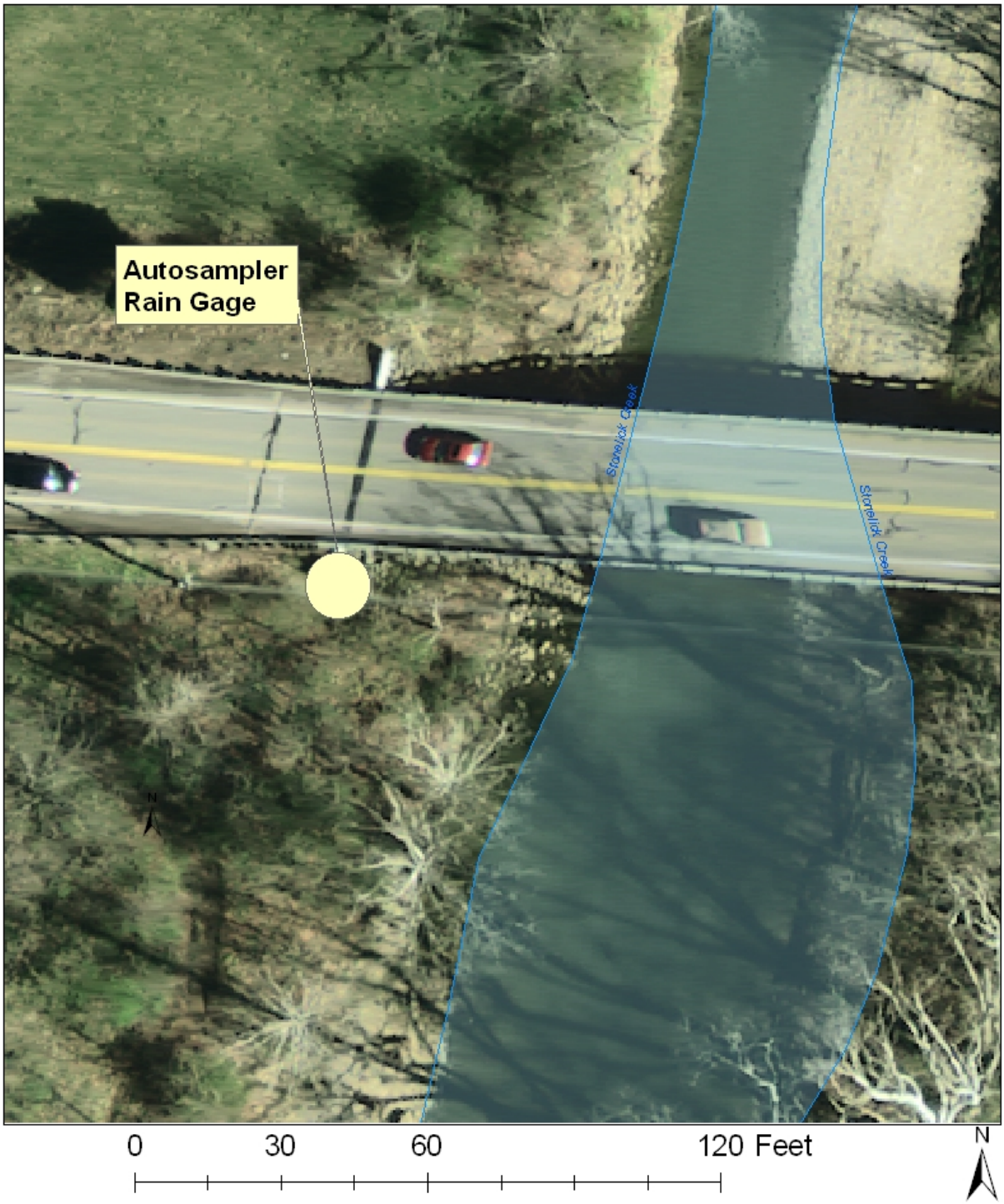
Grassy Fork
Autosampler Station



Shayler Run
Autosampler Station



Stonelick Creek
Autosampler Station



ATTACHMENT 2

AUTOSAMPLER PROGRAMS

ISCO 6700FR REFRIGERATED SAMPLER
QUICK VIEW PROGRAMMING SCREENS
EAST FORK RIVER MILE 34.8

1

PROGRAM NAME
EFRM348 D1

SITE DESCRIPTION
WILLIM348

2.

UNITS SELECTED

LENGTH: FT
TEMPERATURE: °C

3.

UNITS SELECTED

FLOW RATE: CFS
FLOW VOLUME: MGAL

4.

SUBMERGED PROBE

LEVEL ONLY

Note:

CURRENT LEVEL IS:

_____ FT

Level reading should be calibrated during each site visit

7.

5 MINUTE DATA INTERVAL

24, 1000 ML BOTTLES
10 FT SUCTION LINE
AUTOSUCTION HEAD
2 RINSES, 1 RETRIES

8.

ONE PART PROGRAM

9.

PACING:

TIME, EVERY
2 HOURS, 0 MINUTES

10.

DISTRIBUTION

11.

VOLUME

900 ML SAMPLES

12.

ENABLE

LEVEL > ___ FT

Enter should be initiated

13.

ENABLE
REPEATABLE ENABLE
NO SAMPLE AT DISABLE
SAMPLE AT ENABLE

14.

ENABLE

COUNTDOWN CONTINUES
WHILE DISABLED

15.

ENABLE

0 PAUSES & RESUMES

16.

NO DELAY TO START

17.

PROGRAMMING COMPLETE

RUN THIS PROGRAM NOW
YES / NO

Select "YES."

18.

START AT BOTTLE ___
(0-24)

Enter "1" Display should then read "PROGRAM DISABLED" Program will be initiated when stream level exceeds that entered in Step 12.

ISCO 6700FR REFRIGERATED SAMPLER
QUICK VIEW PROGRAMMING SCREENS

SHAYLER RUN

1. PROGRAM DESCRIPTION
SHAYLER1
SITE DESCRIPTION:
SHAYLER CR

2. UNITS SELECTED:

LENGTH: FT

3. 5 MINUTE
DATA INTERVAL

4. 24, 1000 ML BOTTLES
35 FT SUCTION LINE
AUTOSUCTION HEAD
2 RINSES, 1 RETRIES

5. ONE PART PROGRAM

6. PACING:

TIME, EVERY
2 HOURS, 0 MINUTES

7. DISTRIBUTION:

4 BOTTLES / SAMPLE

8. VOLUME:

900 ML SAMPLES

9. ENABLE

NONE PROGRAMMED

10. ENABLE
ONCE ENABLED,
STAY ENABLED
SAMPLE AT ENABLE

11. ENABLE

0 PAUSES & RESUMES

12. NO DELAY TO START

13. PROGRAMMING COMPLETE

RUN THIS PROGRAM NOW?
YES / NO

Select "Yes"

14. START AT BOTTLE ___
(0-24)

Enter "1" Display should then read "PROGRAM

DISABLED" Program will be initiated when stream level exceeds that programmed in flow meter.

ISCO 6700FR REFRIGERATED SAMPLER
QUICK VIEW PROGRAMMING SCREENS

STONELICK CREEK

1. SITE DESCRIPTION:

   STEFLMR

2. 24, 1000 ml BTLS

   10 ft SUCTION LINE

3. PACING:

   TIME, EVERY
   O HOURS, 30 MINUTES

4. DISTRIBUTION:

   4 BOTTLES / SAMPLE

5. 900 ml SAMPLES

6. NO DELAY TO START

7. PROGRAMMING COMPLETE

   RUN THIS PROGRAM NOW
   YES / NO

   Select "Yes"

8. START AT BOTTLE ___
   (0-24)

   Enter "1" Display should then read "PROGRAM DISABLED" Program will be initiated when stream level exceeds that programmed in flow meter.

ISCO 6700FR REFRIGERATED SAMPLER
QUICK VIEW PROGRAMMING SCREENS

GRASSY FORK

1. PROGRAM DESCRIPTION
   GRASSY02
   SITE DESCRIPTION:
   GCMRD

2. UNITS SELECTED:

   LENGTH: FT

3.

24, 1000 ML BOTTLES 24 FT SUCTION LINE AUTOSUCTION HEAD 1 RINSES, 1 RETRIES

4.

ONE PART PROGRAM

5.

PACING: TIME, EVERY 2 HOURS, 0 MINUTES

6.

DISTRIBUTION: 4 BOTTLES / SAMPLE

7.

VOLUME: 900 ML SAMPLES

8.

ENABLE NONE PROGRAMMED

9.

ENABLE ONCE ENABLED, STAY ENABLED SAMPLE AT ENABLE

10.

ENABLE 0 PAUSES & RESUMES

11.

NO DELAY TO START

12.

PROGRAMMING COMPLETE RUN THIS PROGRAM NOW? YES / NO

Select “Yes”

13.

START AT BOTTLE ___ (0-24)

Enter “1” Display should then read “PROGRAM DISABLED” Program will be initiated when stream level exceeds that programmed in flow meter.

ATTACHMENT 3

Clermont County OEQ

Monitoring Station Field Inspection Sheet Inspected by: _____

Inspection Date: _____

Site:	Shayler Run	Stonelick	Grassy Fork	EFRM34.8
Date:				
Time:				
Refrigeration Unit:				
Refrigerator Temperature				
Adjusted?				
Stream Depth:				
Flow Meter Depth Reading (ft)				
Actual Stream Depth (gauge)				
Depth Reading Calibrated?				
Desiccant Canisters				
Internal Canister				
Quick Disconnect Canister				
Cleaning / Maintenance - Inspected?				
Strainer				
Suction Line				
Pump Tube				
Refrigerator Air Filter (1x/3months)				
Rain Gauge				
Funnel Cleaned				
Balanced				
Vermin				
Mice				
Ants				

Problems / Concerns / General Notes

Standard Operating Procedures

for the

ISCO Avalanche Refrigerated Portable Samplers

And

ISCO Portable Samplers

Clermont County Office of Environmental Quality
4400 Haskell Lane
Batavia, OH 45103
(513) 732-7894

Revision Number: 3
a) February, 2015

b)

1.0 Introduction

This document describes the operating procedures for the ISCO Portable Autosamplers owned by the Clermont County Office of Environmental Quality (OEQ). OEQ has both 6712 refrigerated autosamplers (Avalanche) and non-refrigerated (6700 & 6712) portable samplers. The programming features of the two different samplers are very similar. This SOP has been developed to maintain continuity and ensure the quality of the data collected.

The ISCO 6712 Portable Sampler is a programmable liquid sampler suited for general purpose sampling, as well as storm based sampling. The autosampler can be interfaced with a variety of equipment, including ISCO submerged probe modules and flow meters for flow proportional sampling, rain gages, and YSI 600 Series data sondes. For more detail and technical specifications of the ISCO Avalanche or ISCO 6712 Sampler refer to the Avalanche Installation and Operation Guide (ISCO, 2011, found at http://www.isco.com/pcfiles/PartPDF/SL000004/UP0017YD.pdf) or the 6712 Sampler Guide . For technical support, call ISCO at (800) 228-4373.

2.0 Autosampler Locations

This sampler is designed to be portable and can therefore be used at multiple locations.

3.0 Autosampler Preparation and Set-up

3.1 Supplies

Necessary

- Autosampler
- Power cable
- Bottles
- Bottle rack
- Stainless steel cable
- padlocks and keys
- 720 Flow module
- 25’ length Submerged probe.
- 3/8” tubing & strainer (strainer not necessary in pipe)
- Tape measure to measure suction line length
- Box cutter, wire cutters, zip-ties
- Plumb tape gage
- Water level gage indicator solution
- Field sheet (Attachment 1) & clipboard
- Ice for non-refrigerated samplers

Optional depending on Application Set-up

- Pneumatic dolly
- 12-V, 100 amp hour, deep cycle battery
- Battery box
- Chain for battery box
- Camouflage tarp, hammer, & nails
- Thel-mar weir if applicable
- Rebar & mallet for submerged probe anchor (if not already installed)

1.0 Safety glasses, 2 gallons of water for emergency battery acid rinse

3.2 Battery Preparation & Care

The Avalanche (refrigerated) autosamplers can run off a 12-V dual cycle marine battery which will need to be charged prior to deployment if they are not being charged via solar panel in the field (see Solar Panel SOP). The portable autosamplers can run off of the rechargeable 12 V NiCad batteries for one sampling event. Both batteries should be re-charged following every sampling event and/or checked monthly (if collecting data in 15 min increments) to ensure sufficient charge. They will not hold charge as long during cold temperatures. The lead acid batteries should be charged in the storage box outside of the Engineer’s wing at Haskell Lane or in another well ventilated area. The time required to fully charge each battery using the Shumacker Automatic battery charger, SE-70MA, is about 5 hours. If the “automatic” switch is set, the

battery charge will be maintained by the charger and can be left connected to the battery for longer than 5 hours. The green LED light is lit, charging has stopped and the charger is now in "maintain mode". If the charge is below 1%, charge in manual mode for 5 minutes, then switch to "maintain mode"

BATTERY CARE:

- Batteries should be fully charged prior to first deployment
- Water batteries after charging unless plates are exposed before charging
    - Plates should be covered by 1/8" water before charging
    - Water level should be ¼" below cell cover.
    - Use deionized water to fill cells
- Don't discharge batteries below 10.8V
- If batteries are sitting unused, they should be boosted every 2-3 months
- A good battery will read a voltage of 12.7-13.2 V once 100% charged
    - If 12.4 or less, than battery is sulfated and needs replaced.
    - If the deep cycle batteries need to be replaced at any time, ISCO recommends any 100 amp hour deep cycle battery.

SAFETY PRECAUTIONS

- Do not smoke near battery
- Do not drop metal objects onto battery as it might short circuit.
- Don't store near any objects that might generate sparks
- Always unplug charger when not in use
- Don't connect clips to metal objects or together for storage
- Wear safety goggles and gloves when handling batteries
- Don't set the charger on top of the battery or above the battery when charging
- Face away from the battery when making the final connection or first break of connection

3.3 Autosampler Set-up

3.3.1 Transport the materials to the sampling site. Locate a spot for the autosampler along the bank that is relatively hidden from view, outside of the channel, yet within 25 ft. of where the level sensor will be anchored.

3.3.2 Set up the anchor and secure the level sensor to the anchor, do not bend the sensor casing and be sure to keep the exposed end of the cable out of the water. If the suction line will be connected to the anchor, be sure to set the anchor *outside* of an eddy or the bottom of a pool.

3.3.3 Secure the end of the suction line (with strainer) to the anchor with zip ties. Cut the tubing to the appropriate length (in 1' intervals) and attach to the pump tubing. Be sure to use the shortest length possible. The threaded end of the coupler goes to the suction tube while the other end goes into the pump tube.

3.3.4 Place the bottles with lids removed and bottle rack inside the autosampler. Connect the level sensor to the 720 flow module and the flow module to the side of autosampler control box.

3.3.5 If triggering the sampler with a 4220 flow meter or 4110 flow meter, connect the flow meter to the flow meter port with the connector cable.

3.3.6 A 4110 flow meter can trigger the autosampler to sample, but data from a 4110 cannot be transmitted via the 6712ci cellular modem. Data from a 720 flow module can be transmitted.

3.3.7 Place the battery inside of the battery box . Disconnect the positive and negative clips via the yellow connector, this will break the circuit while you are connecting the battery. Connect the clips to the battery. Close the box and secure with chain and lock.

3.3.8 Loop the stainless steel cable around at tree and run one end of the cable through the eye loop of the end of the cable near the tree. Then run the loose end of the cable through the chain on the battery box and the handles of the autosampler. Lock the eye loop of this end of the cable back onto itself.

3.3.9 Plug the power cable into the sampler and turn on (720 must be connected before you turn on the autosampler or it won't recognize it).

4.0 Programming the Autosampler

First, turn on the sampler, if it is not currently running. The On/Off key is labeled with an icon that looks like a vertical bar inside a circle. The start up screen appears first and remains on the display for about eight seconds. The main menu screen appears next. The Main Menu has four options: RUN, PROGRAM, VIEW REPORT and OTHER FUNCTIONS. The programs used for GRSSY3.0 and GRSSY3.2 are listed in Attachment 1. These are examples of programs typically used by OEQ, but can be modified depending on project type, location and hydrograph characteristics, and various sampler enable and trigger scenarios. A thorough understanding of the site conditions, e.g. hydrology and project goals necessary to determine sampler enable and pacing settings.

Type in 6712.2, the autosampler will turn off and then back on. This kicks you into to advanced programming mode which will allow 2 part programs and sample enable abilities.

Next, check the autosampler clock to make sure that the date and time are correct. To change the clock settings, select OTHER FUNCTIONS, then MAINTENANCE, and then SET CLOCK. Enter the time and date. Use a 24-hour clock for times and the day-month-year format for the dates. Return to the Main Menu by pressing the Stop key (which resembles a red, upside-down triangle in a circle).

At the main menu, select PROGRAM. This will lead the user through a series of steps using the Quick View screens. To edit a current selection, press an arrow key until the current selection blinks, and then press the Enter key. The display will then show all the possible options for that programming step. One menu option always blinks. Pressing the Enter key will select the blinking option. To select an option, use the arrow keys to highlight the desired option so that it is blinking and then press Enter. This will return the user to the Quick View display, now showing the new option selected. To move to the next programming step, use the arrow keys to highlight the forward arrow (↓) on the display, and then press the Enter key. To move back to a previous screen, highlight the reverse arrow (↑) and press Enter. *Calibration of the level sensor using the staff gage or plumb gage will be necessary prior to every sampling event. You will also need to enter the length of the suction line.* After programming is complete, select "Yes" when asked "Do you want to start this program now?" The display should then read "Program Disabled," which means the sampler is waiting for the appropriate flow conditions to be met before it initiates the sampling program. Note that changing the data storage interval, module setup, hardware setup, or selecting a new stored program will result in stored data being lost. Download all data before making these changes.

5.0 Installing the Sampler Bottles

Install the 24 (autosampler) or 14(refrigerated autosampler)-bottle kit with clean bottles by dropping it into the compartment until the rack drops over the two semicircular ramps that hold it in place. Place a shopping bag of ice in the middle of the bottle rack of the non-refrigerated samplers.

6.0 Sample Bottle Recovery

The autosampler will automatically cease operation after all bottles have been filled. Before removing the rack, place lids on the bottles so that the samples do not spill. Remove the bottle rack by pulling up on the rack with the two handles. Place the bottles, inside the rack, into a cooler or place a bag of ice on the inside of the bottle rack. If removing the bottles from sample rack, be sure to label them.

7.0 Viewing / Downloading Data from the Autosampler

7.1 Viewing Data

Viewing data can be accomplished by selecting VIEW REPORT on the main display screen

following a sampling event or VIEW DATA while in the paused state of a current program. Each sampling report will be deleted once the sampler is enabled again.

7.2 Downloading Data

Data can be directly downloaded onto a laptop computer equipped with Flowlink software at the autosampler location.

8.0 Refrigeration (Avalanche Autosamplers only)

The sampler's refrigerator is disabled until the completion of the first sample collection in a sequence. After the first sample and until completion of the sequence the refrigeration is set to cool to 1°C to enable appropriate cooling of freshly collected sample water. One hour after the sampling sequence is complete, the temperature switches to a setting of 3°C +/- 1°C. The measured temperature is reported as FR_TEMP on the run state displays and in the stored data.

9.0 Calibrating the Sample Volume

The sampler should deliver accurate sample volumes without calibration. If the actual sample volumes vary significantly from the programmed values, first check the suction line for proper installation. Be sure the line slopes continuously downhill to the stream so that it drains completely after each sampling cycle. Then compare the actual length of the suction line to the suction line length settings in the program to see that they match. Also check the pump tube for excessive wear and replace it if necessary.

If calibration is necessary, disconnect the pump tube from the bulkhead fitting. Place the end of the tube over a collection container, preferably a graduated cylinder. Select OTHER FUNCTIONS from the main menu. From the next screen, select MANUAL FUNCTIONS, and then select CALIBRATE VOLUME. Then enter the desired volume in milliliters. Press the Enter key when ready to calibrate. The autosampler will then pump a sample into the collection container. When completed, the display screen will ask for VOLUME DELIVERED. Enter the actual volume pumped. The display will then restate this volume and ask ARE YOU SURE? YES/NO. Select YES if the volume delivered matches the volume displayed on this screen. After calibration is completed, reconnect the pump tube to the bulkhead fitting.

10.0 Autosampler Maintenance

Maintenance should be performed on samplers prior to each sampling event when left out in the field. During each visit to the portable samplers, field personnel should inspect the autosampler and perform maintenance if necessary. A "Autosampler Field Inspection Sheet (shown in Attachment 2) should be filled out completely after each site visit.

Maintenance items include:

9. Check Clock Settings
10. Clean the bottles, suction line, strainer and pump tube.
11. Inspect the pump tube for wear. Replace if necessary.
12. Clean the refrigerator interior and exterior periodically
13. Defrost the refrigerator compartment if necessary

10.1 Check Clock Settings

To change the clock settings, select OTHER FUNCTIONS, then MAINTENANCE, and then SET CLOCK. Enter the time and date. Use a 24-hour clock for times and the day-month-year format for the dates.

10.2 Cleaning Bottles, Suction Line, Strainer and Pump Tube

After use, sample bottles should be returned to the Sewer District wastewater lab for cleaning. Laboratory standard operating procedures will be used to clean all bottles.

To clean the suction line, pump tube and discharge tubes, place the end of the suction line in a cleaning solution and pump it through the delivery system. If items are severely contaminated, replace them. Clean strainers with a brush and soapy water.

The pump can be manually operated in either the forward or reverse direction. From the main menu, select OTHER FUNCTIONS. From the next screen, select MANUAL FUNCTIONS, and then select OPERATE PUMP. Select the pump direction from the following screen, and press the red Stop key when finished.

10.3 Inspect the Pump Tube/Replace if Necessary

Inspect the pump tube periodically. Replace the tube when it cracks or appears worn. The sampler tracks the pump count. When the counter reaches the default count of 1,000,000, the sampler displays a message

"WARNING! REPLACE PUMP TUBE." To replace the pump tube, refer to Pages 9-9 of the Avalanche Installation and Operation Guide (ISCO, 2011).

10.4 Cleaning the Refrigerator

To keep the refrigerator's exterior and interior free from corrosive solutions, grease, oil and other debris, clean it periodically with soapy water using a sponge or a non-metallic brush. Wipe the refrigerator dry after cleaning. Water that has collected in the refrigerated compartment can be drained by removing the plug at the bottom of the compartment. If necessary, clean the controller with warm soapy water. To prevent moisture damage, always cap the connectors at the back of the controller tightly. Make sure the pump drain hole (located on the bottom right-hand side of the pump, beneath the pump band) is open and free of debris or buildup.

10.5 Defrosting the Refrigerator

If ice forms on the walls of the interior compartment, remove the power and allow the ice to melt. Drain the melted ice or mop up with a towel.

10.6 Replacing the Desiccant

If the humidity indicator located on the right of the keypad is turning pink or white, the humidity inside the control box is too high and the desiccant bag should be replaced. Refer to the instructions for the appropriate autosampler on how to open the control box.

ATTACHMENT 1:

OEQ AUTOSAMPLER DATA SHEET

AUTOSAMPLER LOCATION: _____ ENABLE DATE: _____

SITE / RIVER NAME: _____ ENABLE TIME: _____

BOTTLE COLLECTION DATE: _____ END DATE: _____

BOTTLE COLLECTION TIME: _____ END TIME: _____

SAMPLERS: _____ ENABLE LEVEL (ft) _____

WEATHER CONDITIONS: _____ PACING: _____ (A)

SUNNY CLOUDY OVERCAST WINDY RAIN SNOW _____ (B)

SAMPLE TYPE

GRAB COMPOSITE

CIRCLE ONE

SAMPLE MATRIX

SEDIMENT WATER

CIRCLE ONE

AIR TEMP (F): _____

RAINFALL Last 24 hrs Gauge Used _____
last 48 hrs

bottle #	sample time/date	Collection Date/ Time
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		

site ID (in database)	composite bottle #'s	Date of 1st bottle	Time of 1st bottle	level (ft)	48 hr rain	Flow Q (cfs)

Date	Time	720 Stage (ft)	2150 Stage (ft)	Stream stage (ft)	Notes

FIELD OBSERVATIONS:

IF FOUND, RETURN TO:
Clermont County OEQ
4400 Haskell Lane
Batavia, OH 45103
(513) 732-7894

ATTACHMENT 2

Clermont County OEQ
Monitoring Station/Sampler Field Inspection Sheet

Inspected by: _____

Inspection Date: _____

Site:	Shayler Run	Stonelick	GRSSY0.2	GRSSY3.0	GRSSY3.2	EFRM34.8
Date:						
Time:						
Refrigeration Unit:						
Refrigerator Temperature						
Adjusted? (y/n)						
Stream Depth:						
Flow Meter Depth Reading (ft)						
Actual Stream Depth (gauge)						
Depth Reading Calibrated? (y/n)						
Desiccant Canisters						
Internal Canister (y/n/ok)						
Quick Disconnect Canister (y/n/ok)						
Cleaning / Maintenance - Inspected						
Strainer (y/n/ok)						
Suction Line (y/n/ok)						
Pump Tube (y/n/ok)						
Air Filter (y/n) Jan,Apr, July, Oct						
Rain Gauge						
Funnel Cleaned (y/n/ok)						
Balanced (y/n/ok)						
Vermin						
Mice? (y/n) /treated? (y/n/ok)						
Ants? (y/n)/ treated? (y/n/ok)						

Problems / Concerns / General Notes

AUTOSAMPLER PROGRAMS

ISCO 6700FR REFRIGERATED SAMPLER

QUICK VIEW PROGRAMMING SCREENS

Grassy Fork at Marathon-Edenton Rd. GRSSY3.0

2

PROGRAM NAME
GRSSY30

SITE DESCRIPTION
MRTHN EDTN

2.

UNITS SELECTED

LENGTH: FT
TEMPERATURE: °C

4.

SUBMERGED PROBE

LEVEL ONLY

4.

CURRENT LEVEL IS:

_____ FT

Level reading should be calibrated during each site visit

5.

5 MINUTE DATA INTERVAL

6.

14, 950 ML BOTTLES
10 FT SUCTION LINE
AUTOSUCTION HEAD
2 RINSES, 1 RETRIES

7.

TWO-PART PROGRAM
BOTTLE ASSIGNMENTS
1-6 TO 'A'
7-14 TO 'B'

8.

'A' PACING:

TIME, EVERY
0 HOURS, 30 MINUTES

9.

'A' DISTRIBUTION

2 BOTTLES/SAMPLE

10.

'A' VOLUME

500 ML SAMPLES

Enter stream level at which program should be initiated

11.	‘A’ ENABLE: LEVEL >2.000 ft	12.	‘A’ ENABLE: ONCE ENABLED, STAY ENABLED SAMPLE AT ENABLE
13.	‘A’ ENABLE 0 PAUSES & RESUMES	14.	‘B’ PACING: TIME, EVERY 1 HOURS, 0 MINUTES
15.	‘B’ DISTRIBUTION: SEQUENTIAL	16.	‘B’ VOLUME 500 ml SAMPLES
17.	‘B’ ENABLE WHEN ‘A’ IS DONE	18.	‘B’ ENABLE ONCE ENABLED, STAY ENABLED NO SAMPLE AT ENABLE
19.	‘B’ ENABLE 60 MINUTE DELAY TO START OF SAMPLING	20.	‘B’ ENABLE 0 PAUSES & RESUMES
21.	NO DELAY TO START	22.	PROGRAMMING COMPLETE RUN THIS PROGRAM NOW? **YES** NO

Enter “YES” Display should then read “PROGRAM DISABLED” Program will be initiated when stream level exceeds that entered in Step 11.

ISCO 6700FR REFRIGERATED SAMPLER

QUICK VIEW PROGRAMMING SCREENS

Grassy Fork at St. Rt. 131. GRSSY3.2

3

PROGRAM NAME GRSSY32 SITE DESCRIPTION STRT 131 WBR

2.

UNITS SELECTED LENGTH: FT TEMPERATURE: °C

5.

SUBMERGED PROBE LEVEL ONLY

4.

CURRENT LEVEL IS: _____ FT

Level reading should be calibrated during each site visit

5.

5 MINUTE DATA INTERVAL

6.

14, 950 ML BOTTLES 10 FT SUCTION LINE AUTOSUCTION HEAD 2 RINSES, 1 RETRIES

7.

TWO-PART PROGRAM BOTTLE ASSIGNMENTS 1-6 TO ‘A’ 7-14 TO ‘B’

8.

‘A’ PACING: TIME, EVERY 0 HOURS, 30 MINUTES

9.

‘A’ DISTRIBUTION 2 BOTTLES/SAMPLE

10.

‘A’ VOLUME 500 ML SAMPLES

Enter stream level at which program should be initiated

11.

‘A’ ENABLE: LEVEL >2.000 ft

12.

‘A’ ENABLE: ONCE ENABLED, STAY ENABLED SAMPLE AT ENABLE

13.

‘A’ ENABLE 0 PAUSES & RESUMES

14.

‘B’ PACING: TIME, EVERY 1 HOURS, 0 MINUTES

15.

‘B’ DISTRIBUTION: SEQUENTIAL

16.

‘B’ VOLUME 500 ml SAMPLES

17.

‘B’ ENABLE WHEN ‘A’ IS DONE

18.

‘B’ ENABLE ONCE ENABLED, STAY ENABLED NO SAMPLE AT ENABLE

19.

‘B’ ENABLE 60 MINUTE DELAY TO START OF SAMPLING

20.

‘B’ ENABLE 0 PAUSES & RESUMES

21.

NO DELAY TO START

22.

PROGRAMMING COMPLETE RUN THIS PROGRAM NOW? **YES** NO

Enter “YES” Display should then read “PROGRAM DISABLED” Program will be initiated when stream level exceeds that entered in Step 11.

Standard Operating Procedures

for the

ISCO Model 675 Logging Rain Gage

Clermont County Office of Environmental Quality
4400 Haskell Lane
Batavia, OH 45103
(513) 732-7894

Revision Number: 4
February, 2015

1.0 Introduction

This document describes the operating procedures for the ISCO Model 675 Logging Rain Gauges that have been installed by the Clermont County Office of Environmental Quality (OEQ) at five locations in the East Fork Little Miami River watershed. This SOP has been developed to maintain continuity and ensure the quality of the data collected.

4.0 Rain Gauge Description

The ISCO Logging Rain Gauge utilizes a tipping bucket to provide accurate rainfall measurements from 0.01 inches to 22 inches per hour. The rain gauge is mounted inside a cylinder and has an eight-inch opening at the top to collect rain. Rain falls through a screen, through a funnel and into the tipping bucket mechanism. The units can operate in a free-standing mode. Powered by an on-board battery and storing data to an on-board data logger, or they can operate in tandem with an ISCO Model 4220 or 4110 Flow Meters, receiving power from the flow meter and transmitting data to a data logger in the flow meter. This latter arrangement is currently being used by Clermont County at each of its autosampler stations. Procedures for both modes of operation are described in this document.

5.0 Rain Gauge Locations

Clermont County has installed ISCO Model 4220 or 4110 Flow Meters at five locations in the East Fork watershed. Each gauge is placed in an open location, with no structures or vegetation to interfere with the rainfall. The gauge locations are:

11. East Fork River Mile 34.8 – located at the Village of Williamsburg Main Street bridge
12. Stonelick Creek – located at the U.S. Route 50 bridge, just west of State Route 222
13. Shayler Creek – located at the Baldwin Road bridge
14. Grassy Fork – located at the Glancy Corner-Marathon Road bridge
15. CWLUS, Tributary to Grassy Fork, upstream of agricultural BMP at Cornwell's farm, 6028 Marathon-Edenton Rd.

Aerial photographs of each site are included in Attachment 1.

6.0 Equipment

Equipment needed for rain gauge interrogation and maintenance include:

- Rain Gauge SOP
- Stepping stool
- Laptop computer with FLOWLINK/connecting cable
- Phillips head screwdriver
- Socket wrench with 11/32" attachment (if changing batteries)
- Paper towels, disinfectant and Q-tips
- Pressurized air duster for cleaning (optional)

7.0 Interrogation

5.1. Operating in Free-Standing Mode

The Rain Gauge contains a Logging Device that electronically records and exports the data via ISCO FLOWLINK software. The Logging Device has an 80kB memory, which will provide 800 days of storage at 15-minute intervals, or approximately 53 days of storage at 1-minute intervals. Currently, the rain gauges are set up to record rainfall at 15-minute increments.

Data from each of the rain gauges should be downloaded on a monthly basis, at a minimum. To download the data, connect the laptop (with FLOWLINK software installed) to the rain gauge at the 6-pin connector located on the
outside of the rain gauge. Open FLOWLINK. A message stating "Regular data maintenance will now be performed" will appear. Press "Cancel." A screen with the options to direct connect or modem connect will appear. Press the direct connect button. Once connected, press the "Interrogate" button. A progress bar will appear, displaying the number of data packets received. When the download is complete, the

progress bar will disappear. If time permits, the data should be briefly checked in the field to make sure no problems occurred. Otherwise, the data should be examined and transferred to the rainfall database in the office as soon as possible.

5.2 Operating In Tandem with ISCO 4220 or 4110 Flow Meter

When operating in tandem with an ISCO Flow Meter, rainfall data can be downloaded from the flow meter directly onto a laptop computer or downloaded remotely via a modem. Procedures for both methods of data collection are described in Standard Operating Procedures for both the 4220 and 4110 flow meters.

6.0 Maintenance

Generally, no maintenance of the ISCO Rain Gauge is required. During each site visit, any debris that has collected on the screen on top of the rain gauge and in the funnel should be removed. To access the funnel, remove the screws holding the screen to the rain gauge casing and remove the screen. The funnel can be lifted out gently for cleaning.

During each site visit, the cover should be removed and the gauge should be checked for dust/debris accumulation and insect infestation. Any accumulation should be cleaned out. The built-in bubble level should also be inspected to ensure that the rain gauge is balanced. If the bubble level is not centered, the balance can be adjusted by rotating any one of the three balance knobs located on the base of the rain gauge.

It is important to note that the rain gauge is factory-calibrated and adjusted. No attempts to make any adjustments to the jewel-pivot screws should be made. This could damage the rain gauge instrumentation.

7.0 Battery Replacement

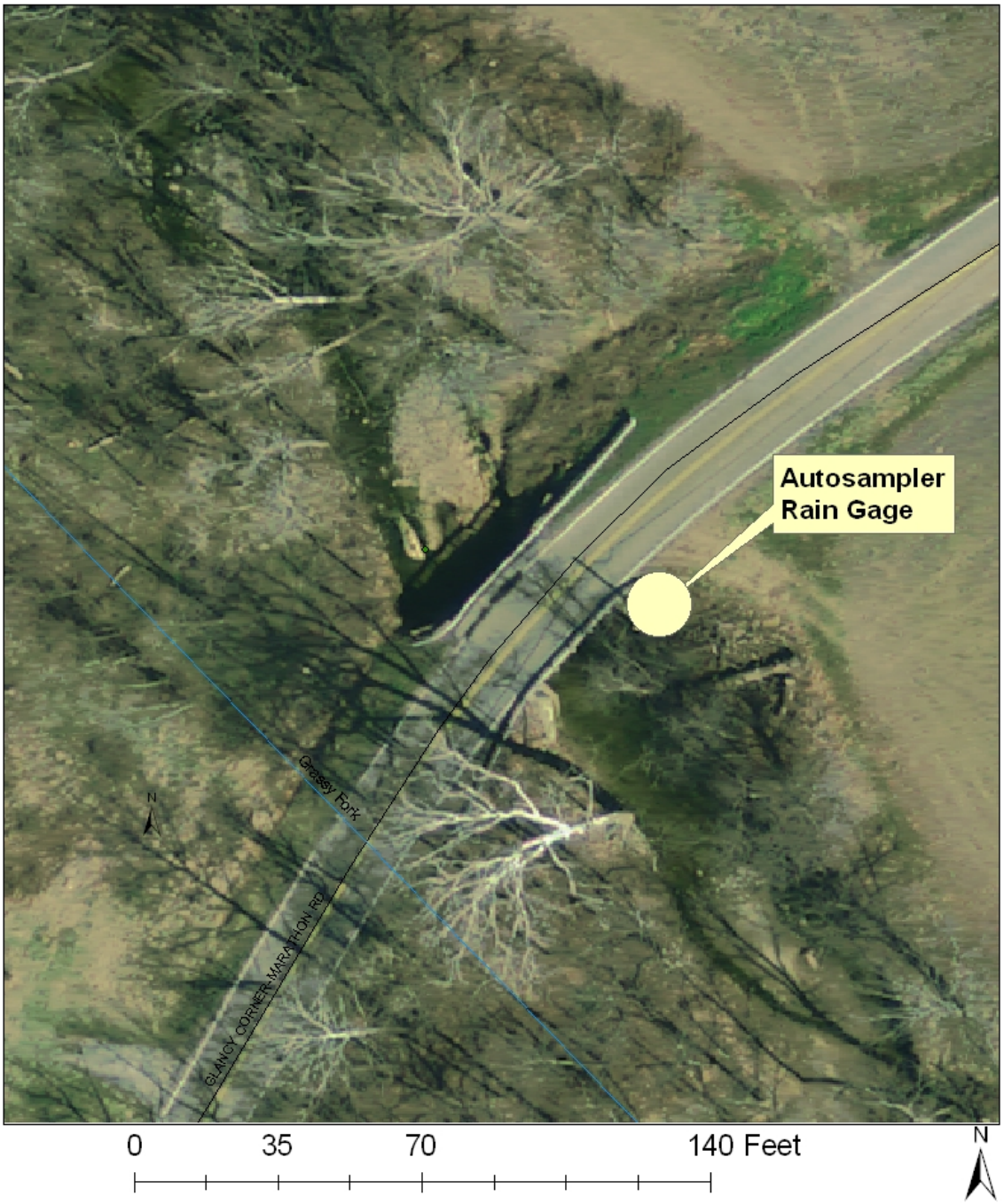
If the rain gauge is operating in free-standing mode and the battery in the data logger is to be replaced, all data must first be downloaded or else it will be lost. To replace the battery, use the following procedures:

- Unlatch and remove the outer casing
- Disconnect the white plug from the data logger. Remove upper casing (and bring to van or easier place to work)
- Once removed, a blue box attached to the inside of the casing will be visible. Remove the blue box to access the battery. Remove the four Phillips head screws and the two nuts holding the box in place. It is easier to locate and remove the two rear screws if the funnel, located on top of the rain gauge, is removed. To remove the funnel, remove the tops screen and gently lift the funnel from the rain gauge.
- Once the blue box has been lifted, remove the 9-Volt lithium battery and replace it with a new 9-Volt lithium battery. A 9-Volt alkaline battery can be substituted, but the rated battery life will be reduced.
- After the new battery has been installed, replace the blue box. Reattach the funnel to the top of the upper casing. Re-connect the white plug from the data logger. Place the outer casing back to the original position and clamp the casing.
- Connect the laptop to the rain gauge as stated above and open Flowlink. Open a connection to the rain gauge
- Once connected, click on the “Site Setup” tab. Then push the button to synchronize the data logger date and time with the date and time displayed on the laptop computer (first make sure that the laptop date and time are correct).

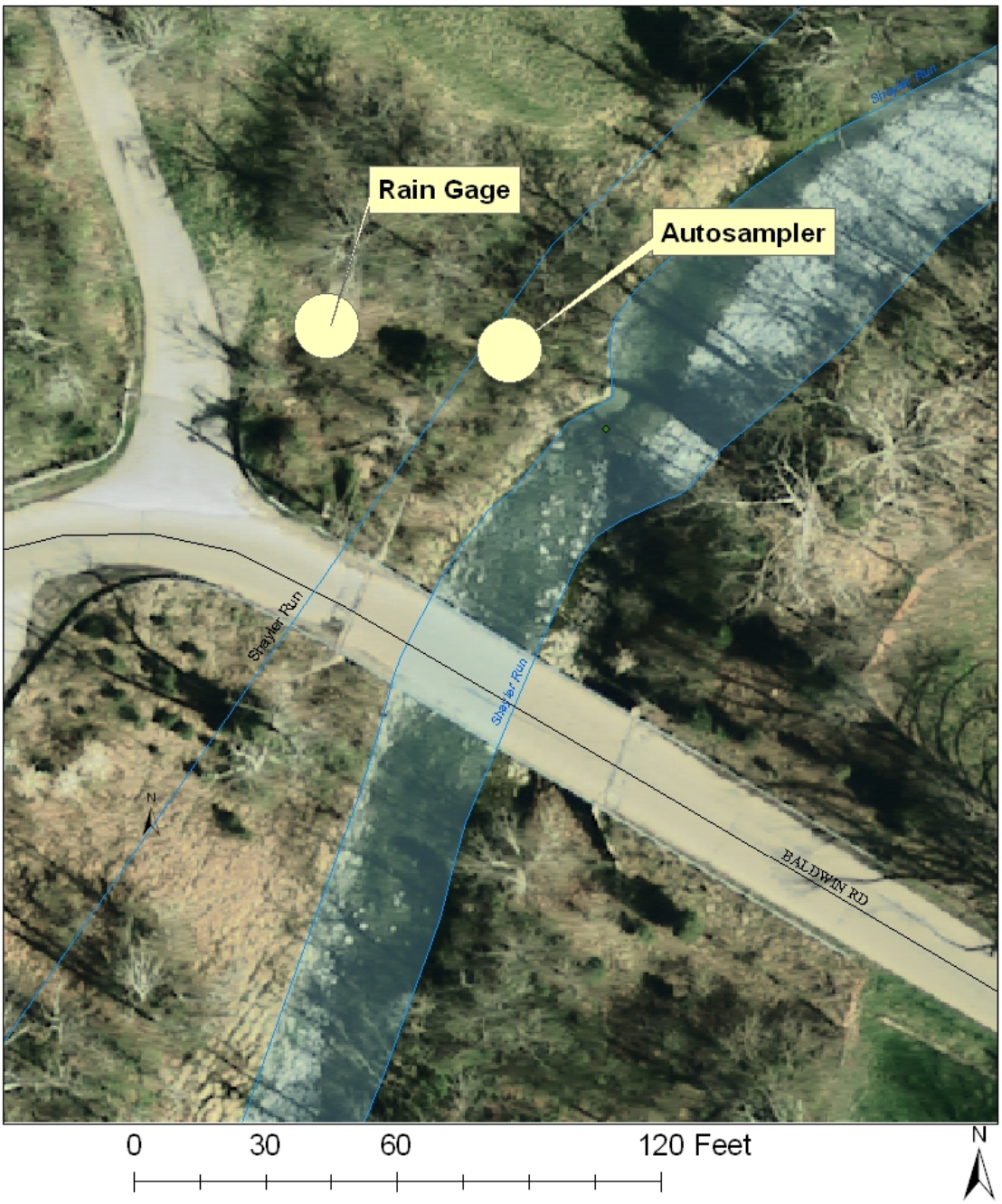
ATTACHMENT 1
RAIN GAGE LOCATIONS

EFRM34.8-Williamsburg
Autosampler Station

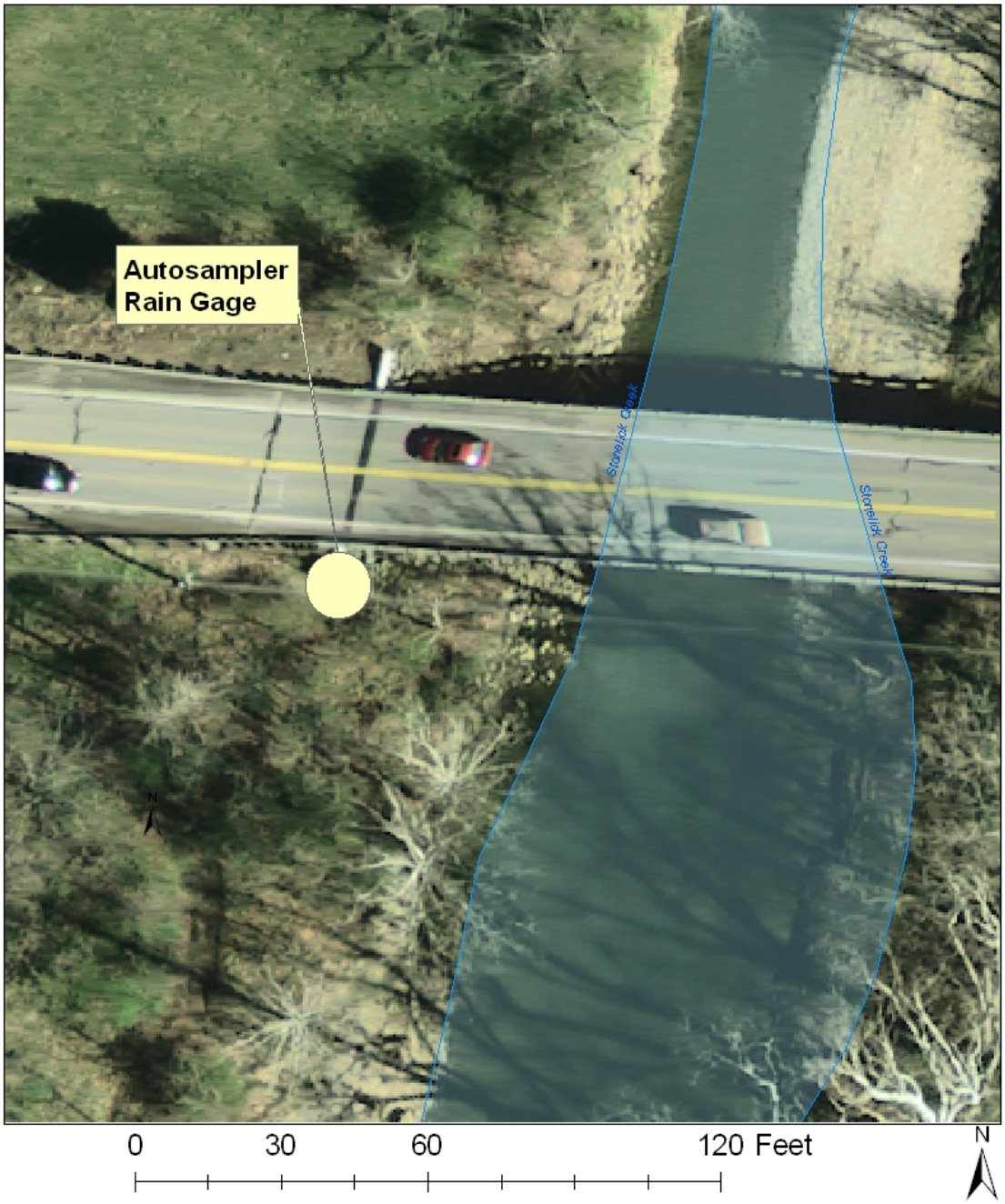
Grassy Fork
Autosampler Station



Shayler Run
Autosampler Station



Stonelick Creek
Autosampler Station



CWLUS Monitoring Station