

# Tricks From a Creative Scientist:



How Felt Fish, *E. coli* Processing Mats, Friendly Field Forms, and Animated Micro-Video Lessons Can Engage Volunteers, Make Science Fun, and Decrease Data Errors



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March 23rd, 2019



# Arizona Waterbody Statistics



## Streams

- ~100.000 Miles



## Lakes

- ~257



## Wetlands

- ~870 Square Miles

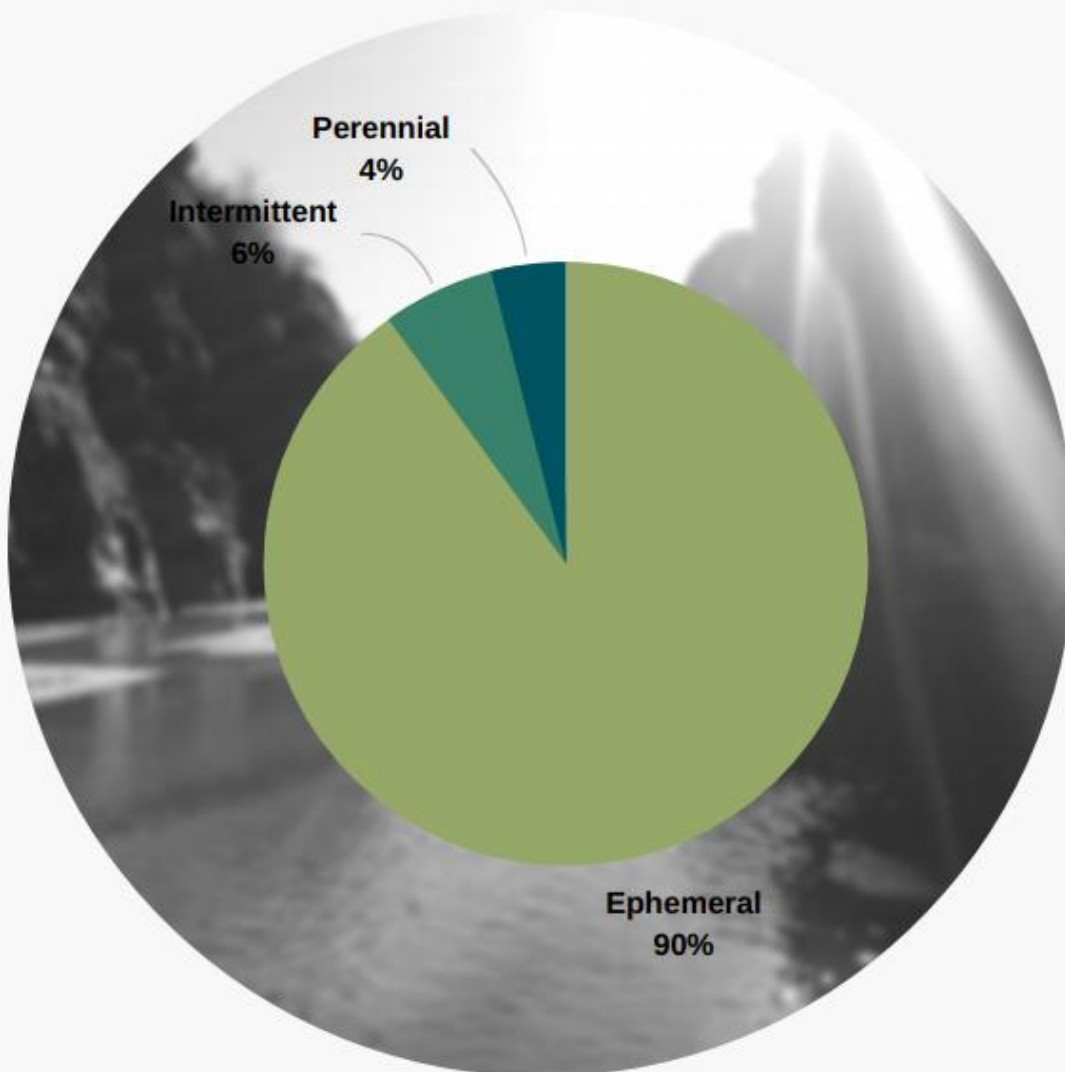


## ADEQ Staff

- ~8 Monitoring Unit
- ~6 Watershed Protection Unit

**CITIZEN SCIENCE  
TO THE RESCUE!**





## ARIZONA STREAMS

**30 Groups**

**6500 Records**



# Collecting Credible Data

## ADEQ SURFACE WATER MONITORING

### WATER QUALITY



Field Conditions



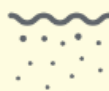
E. coli



Metals



Nutrients



Sediment

### FLOW



CFS



Time Lapse

### ECOSYSTEM



Riparian



Pebble Count



Reach Habitat



Channel Structure

### LIVING ORGANISMS



Macroinvertebrates



Algae

### WET DRY MAPPING



Desktop



GPS

### IMPLEMENTATIONS



Vegetation



Erosion



Mine



## CREDIBLE DATA



SAP/QAPP



Annual Training



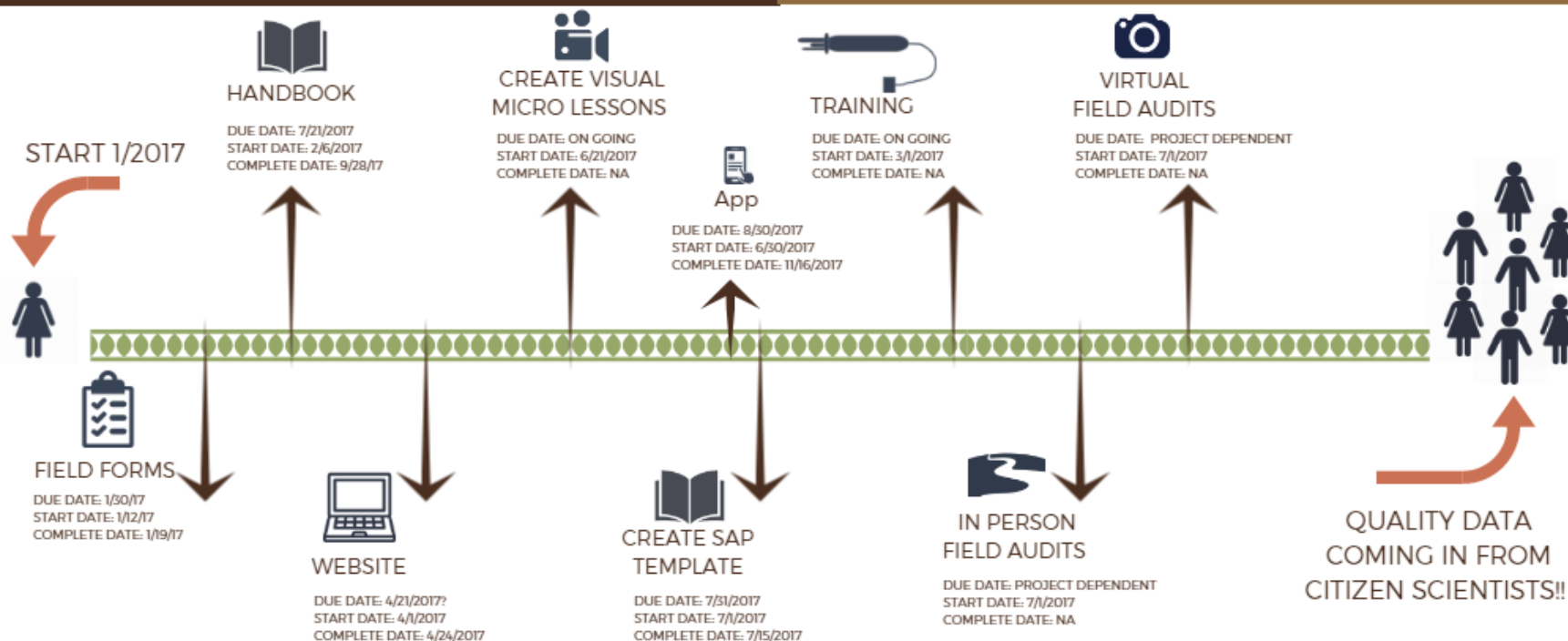
Audit

## ARIZONA WATER WATCH CITIZEN SCIENCE PROGRAM

PROVIDE RESOURCES AND GUIDANCE TO  
VOLUNTEERS IN ARIZONA. ALIGN ADEQ  
MONITORING GOALS WITH LOCAL GROUPS' NEEDS  
AND COLLECT DEFENSIBLE HIGH QUALITY DATA!

“ NEVER DOUBT THAT A SMALL GROUP OF  
THOUGHTFUL CITIZENS CAN CHANGE THE WORLD.  
INDEED, IT'S THE ONLY THING THAT EVER HAS. ”

-MARGARET MEAD





# SHARE INFORMATION IN MULTIPLE WAYS

## VOLUNTEER RESOURCES

### STEP 1

#### IN PERSON TRAINING

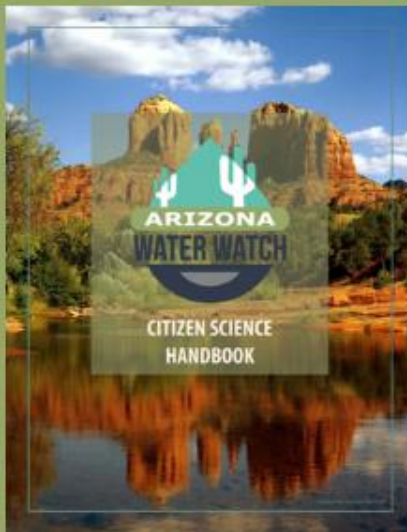
- Classroom setting (felt stream)
- At sampling site



### STEP 2

#### WRITTEN RESOURCES

- AWW binder
- Website
- Handbook



### STEP 3

#### VISUAL REMINDERS

- Cartoon micro-video lessons
- E. coli processing mat



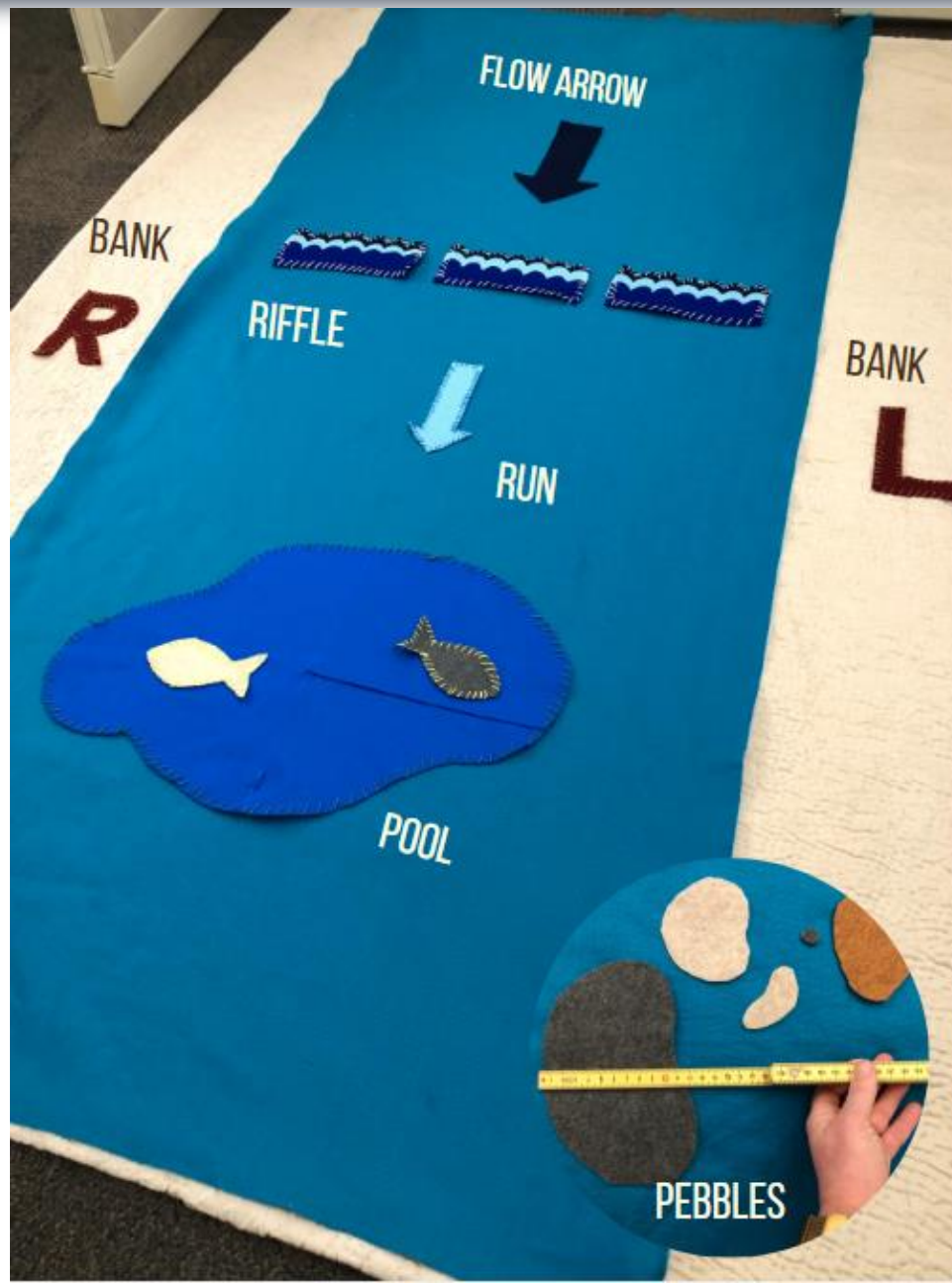


# In Person Training – “Classroom Setting”

- Basement
- Living Room
- Museum
- 1800's Cabin
- 1930's Ranch House
- Historic Library
- 1910 Homestead House
- College Campus
- AZ State Parks
- Forest Service Ranger Stations
- Community Centers







## FELT FABRIC STREAM



Water Sample  
Collection Site



Multi-Parameter  
Probe Placement



Float Method



Right and Left  
Bank Identification



Pebble Count

# In Person Training – Stream Setting

- At one of their sampling sites
  - Easy access
  - Shade
- Bring forms to be filled out by everyone
- Collect a sample
  - Let the volunteers take the lead





# Written Resources – Visually Field Forms

THEN

ADEQ Number \_\_\_\_\_

**ADEQ**  
Arizona Department  
of Environmental Quality

**CITIZEN SCIENTISTS FIELD DATA FORM**

**PROJECT NAME:** \_\_\_\_\_

ADEQ Site Code \_\_\_\_\_ Date \_\_\_\_\_ Water Sample Time \_\_\_\_\_

Site Name \_\_\_\_\_ Field Crew \_\_\_\_\_

GPS Coordinates \_\_\_\_\_ GPS Projection \_\_\_\_\_

**FIELD DATA**

Air Temp.		°C	Sp. Cond.		µS/cm	Weather Conditions:	
Water Temp.		°C	ORP		mV		
D.O.		mg/L	Turbidity	Avg=	NTU	Sample 1=	NTU
D.O. %		%	Standard Range (e.g., 0-10)			Sample 2=	NTU
pH		SU	Calibration	Cal=	NTU	Sample 3=	NTU
				Read=	NTU		

**FIELD CALIBRATIONS**

% D.O. \_\_\_\_\_ Barometric Pressure (mm Hg) = \_\_\_\_\_ Post-cal. Reading = \_\_\_\_\_ %

**SAMPLE COLLECTION INFORMATION**

☐ Grab ☐ Reach pole

Circle where sample taken LEW-----¼-----½-----¾-----REW Riffle ☐ Run ☐ Pool ☐

**E. COLI**

Reagent Colilert 18 (incubation time = 18-22 hrs) ☐ Colilert 24 (incubation time = 24-28 hrs) ☐

Dilutions None ☐ 1:10 ☐ 1:100 ☐

Collection Time	Regular		Incubation Time-in	Regular		Enumeration Time	Regular	
	Duplicate			Duplicate			Duplicate	
	Blank			Blank			Blank	
Number Positive Large Wells	Regular		Number of Positive Small Wells	Regular		Most Probable Number (see table)	Regular	
	Duplicate			Duplicate			Duplicate	
	Blank			Blank			Blank	

Flag (incubation/holding time exceeded?) ☐ Holding time is 6 hrs from collection.

**FIELD NOTES**

NOTE ANY DEVIATIONS FROM SOPs, CHANGE IN SAMPLE LOCATION, AND ANY OTHER USEFUL INFORMATION REGARDING DATA COLLECTED AT THIS SITE.

Form Checked by \_\_\_\_\_

NOW

AWW # \_\_\_\_\_

**ARIZONA WATER WATCH**

**ADEQ CITIZEN SCIENCE DATA FORM**

**PROJECT NAME:** \_\_\_\_\_ **FIELD CREW:** \_\_\_\_\_

**SITE NAME:** \_\_\_\_\_ **ADEQ SITE ID:** \_\_\_\_\_

\_\_\_\_/\_\_\_\_/2017 \_\_\_\_\_ AM \_\_\_\_\_ PM LATITUDE: \_\_\_\_\_ LONGITUDE: \_\_\_\_\_

NAD 83

**FIELD DATA: FILL IN THE BLANKS**

AIR TEMPERATURE: \_\_\_\_\_ °C

WATER TEMPERATURE: \_\_\_\_\_ °C

DISSOLVED OXYGEN: \_\_\_\_\_ mg/L \_\_\_\_\_ %

pH: \_\_\_\_\_ SU

SPECIFIC CONDUCTIVITY: \_\_\_\_\_ µS/cm

TOTAL DISSOLVED SOLIDS: \_\_\_\_\_ mg/L

TURBIDITY \_\_\_\_\_ NTU

**SAMPLE COLLECTION INFO: CIRCLE ALL APPLICABLE INFORMATION IN EACH SECTION**

GRAB POLE

LOOKING DOWNSTREAM LEW-----¾-----½-----¼-----REW

RIFFLE RUN POOL

Samples Collected \_\_\_\_\_ QC SAMPLE NAME: \_\_\_\_\_

E. COLI METALS NUTRIENTS SSC INORGANICS

B D B D B D B D

CIRCLE IF APPLICABLE B=BLANK D=Duplicate

**E. COLI: CIRCLE AND FILL IN APPLICABLE INFORMATION**

DILUTION: NONE 1:10 1:100 MEDIA: COLILERT 18 COLILERT 24

COLLECTED INCUBATED COUNTED LRG. WELL SM. WELL MPN

REGULAR:

DUPLICATE:

DI BLANK: NA \_\_\_\_\_ AM \_\_\_\_\_ PM \_\_\_\_\_ AM \_\_\_\_\_ PM \_\_\_\_\_ AM \_\_\_\_\_ PM

1 of 2

## Handbook Snippets:

- Increase visuals
- Breakdown form details
- Label equipment
  - Calibration details step by step
- Updated annually
  - Change is inevitable!

### APPENDIX C: INSITU SMARTROLL CALIBRATION GUIDE



#### PREPARATION

1. Remove Stainless Steel Restrictor.
2. Take the orange pH port plug out of the sonde unit.
3. Locate the pH probe in the sensor storage bottle and remove.
4. Insert probe into unit.
5. Reattach Stainless Steel Restrictor.
6. Store sensor storage bottle in safe location.
7. Put batteries into battery pack.
8. Attach cable to battery pack and sonde.
9. Turn on Battery Pack and Ipad.





# Written Resources – AWW Binder



The form is titled 'CITIZEN SCIENCE FIELD AUDIT'. It includes a 'CHECKLIST ITEM' column with 18 items, a 'NOTES' column, and an 'INTERNAL USE' section for 'AUDITOR NAME' and 'AUDIT DATE'.

CHECKLIST ITEM: Check Box if Filled	NOTES
<input type="checkbox"/> Call ahead to arrange probe prior to sampling	
<input type="checkbox"/> Calibrated DO at site	
<input type="checkbox"/> Place multi-probe facing upstream	
<input type="checkbox"/> Properly lock/unlock device	
<input type="checkbox"/> Wipe probe cable (if needed)	
<input type="checkbox"/> Wear gloves when sampling	
<input type="checkbox"/> Completely fill probe with water	
<input type="checkbox"/> Collect flow in water flow gage	
<input type="checkbox"/> DO sample collected	
<input type="checkbox"/> Note on donations from handbook	
<input type="checkbox"/> Sample at depth if needed	
<input type="checkbox"/> Sample placed on ice	
<input type="checkbox"/> Use proper sun/shade meters	
<input type="checkbox"/> Proper division (solidity and 2 coil)	
<input type="checkbox"/> Include instructions on photo sampling	
<input type="checkbox"/> 2 hour 2 coil holding time met	
<input type="checkbox"/> Flood down surface area with stream	
<input type="checkbox"/> Wipe gloves when processing 2 coil	
<input type="checkbox"/> Properly labeled 2 coil bags	
<input type="checkbox"/> Check and interpret read 2 coil in 30 hours	
<input type="checkbox"/> Post collection of multi-probe	

INTERNAL USE:  
AUDITOR NAME: \_\_\_\_\_  
AUDIT DATE: \_\_\_\_\_



AWW Binder: Sample Plan, Audit Form, Contact Information, Water Quality Resources, App Details, and So Much More!

**ADEQ**  
Arizona Department  
of Environmental Quality

SEARCH  GO

HOME | ABOUT US | PERMITS | PROGRAMS | FOR BUSINESSES | RECORDS CENTER | EMAPS | ONLINE SERVICES

**ARIZONA WATER WATCH MOBILE APP**  
Submit waterbody photos and data and become a Citizen Scientist in less than three minutes!

**ARIZONA WATER WATCH**

Download the Mobile App >

< RETURN TO LEARN MORE ABOUT THE WATER QUALITY DIVISION

## Arizona Water Watch

Revised on: 2017-11-16 19:55

As a desert state, water is one Arizona's most precious resources that people and animals rely on to live and vital to our recreational enjoyment as well. To enhance statewide surface water protection efforts, ADEQ established Arizona Water Watch, offering Arizonan residents and visitors ages 10 through retirement the opportunity to help ADEQ monitor the health of our waters and inform measures to protect it for future generations. Anyone can become a Citizen Scientist by collaborating with professionals in scientific research, which Arizona Water Watch provides several ways to do!

### Download the Free Mobile App

Smartphone users can easily submit photos and data for any stream, wash, river or lake in the state within a few minutes | [Learn more >](#)

App users who have made submissions can check here to see their photos and data plotted on a GIS map of Arizona (updated quarterly) | [Go to Map >](#)

### Join the Citizen Science Water Monitoring Program

Citizen Science Water Monitoring is a volunteer program for children (age 10+), teens, college students, adults, retirees and ADEQ scientists to work together on scientific research and environmental protection of Arizona's waterways.

As a Citizen Science volunteer, you will:

- Receive training so you can collect and prepare water samples for testing

#### CONTACT

Program Coordinator  
Ph: 602.771.4506  
Email >

#### CALENDAR

Upcoming Training - Coming Soon

#### RESOURCES

Download the Free Mobile App >  
Subscribe to Receive Updates >  
Arizona Water Quality Map >  
Citizen Science Handbook >  
E. coli Processing Mat >  
Stream Vital Signs Guide >  
Tips to Help Protect AZ Waters >

#### FORMS

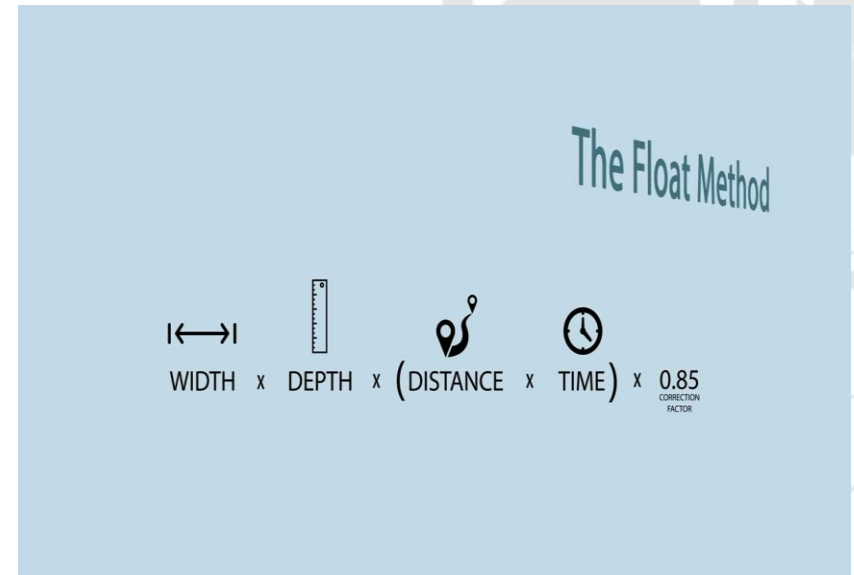
Field Data >  
Flow Measurement >  
Volunteer Monthly Timesheet >  
Volunteer Registration | Photo Release >

## AWW Website:

- Access to resources
  - Download handbook, forms, Etc.
  - Visual equipment loaner Library (coming soon)
  - Listserv signup
  - Training calendar

# Visual Reminder: Micro - Video Lesson

- Short “how-to” video
- Friendly cartoon format
- Lessons available
  - Float Method
  - Turbidity
  - Multi-Parameter Probe
  - E. coli



# Visual Reminder: E. coli Processing Mat



**CITIZEN SCIENCE**  
**E. coli**  
**Processing Mat**

Wipe down mat, place equipment on images below, and follow step by step instructions.









**1**

Turn on sealer and incubator

Incubator should be turned on 4 hours prior to sampling

Set Incubator Temp to:

**35 °C**

Temperature Range  
+/- 0.5°C

**2**

Put gloves on

**3**

Add information to E. coli sampling tray:

- Site ID
- Date
- Time added to incubator
- Time out (to be filled in after 24 hours incubation)

**4**

Add media to E. coli bottle

**5**

Invert E. coli bottle until media is completely dissolved

1 of 2

the tray  
the rubber  
mat

food the  
mat into the  
small cells  
(te side up)

the tray  
the rubber  
mat and place  
the tray into the  
preheated  
incubator

Turn the sealer off



Gently rock/tap  
bubbles from the  
bottom of the tray





Not to scale

Not to scale

3 of 3



Reduce errors by  
following the steps



# Volunteer Recognition

★ ★ ★  
**2017** SAMPLING SEASON

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

**CITIZEN SCIENTIST**

CERTIFICATE OF APPRECIATION

**MENELIK HUME**

for an outstanding season collecting  
quality data records and aiding  
Arizona's streams!

GRANTED THIS DAY OF NOVEMBER, 2017



ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

**CITIZEN SCIENTIST**  
**2018**

This certificate of appreciation is awarded to

**ANNE TOWNSEND**

for an outstanding season collecting over 200 water quality records and  
aiding in the protection of Arizona's streams!

GRANTED THIS DAY OF MARCH 4TH, 2019.



MEGHAN SMART  
ADEQ Citizen Science  
Coordinator

*Thank  
You*



# How Can Citizen Science Help You?



- **Equation for success!**
- **Think outside the box!**
- **Creativity and Science go together!**





## Meghan Smart

602-771-4506

Smart.Meghan@azdeq.gov

### Arizona Water Watch Website:

<http://www.azdeq.gov/programs/azww>

