November 16, 2020, updated 2023-01-06 and 2024-04-05

To: WWALS water quality testers

Re: **Quality assurance and quality control (QA/QC)**

Dear Testers,

Thank you very much for volunteering to be a WWALS water quality team member.

As more testers are coming on board, it is useful to review and document our quality control methods.

This document mostly concentrates on bacterial tests and results, since we use those to track contamination events in our waterways, and we have access to quite a bit of comparable data from Valdosta, GA, several Florida agencies, and other sources.

Why Quality Assurance is Important

Mutual Support

All WWALS testers have already been through the Georgia Adopt-A-Stream (AAS) testing training, which provides the details on how to do the testing, including basic quality assurance.

AAS Bacterial Monitoring Presentation

https://adoptastream.georgia.gov/document/document/bacterial-qaqc-workshop-presentationno-backgroundmay-2022/download

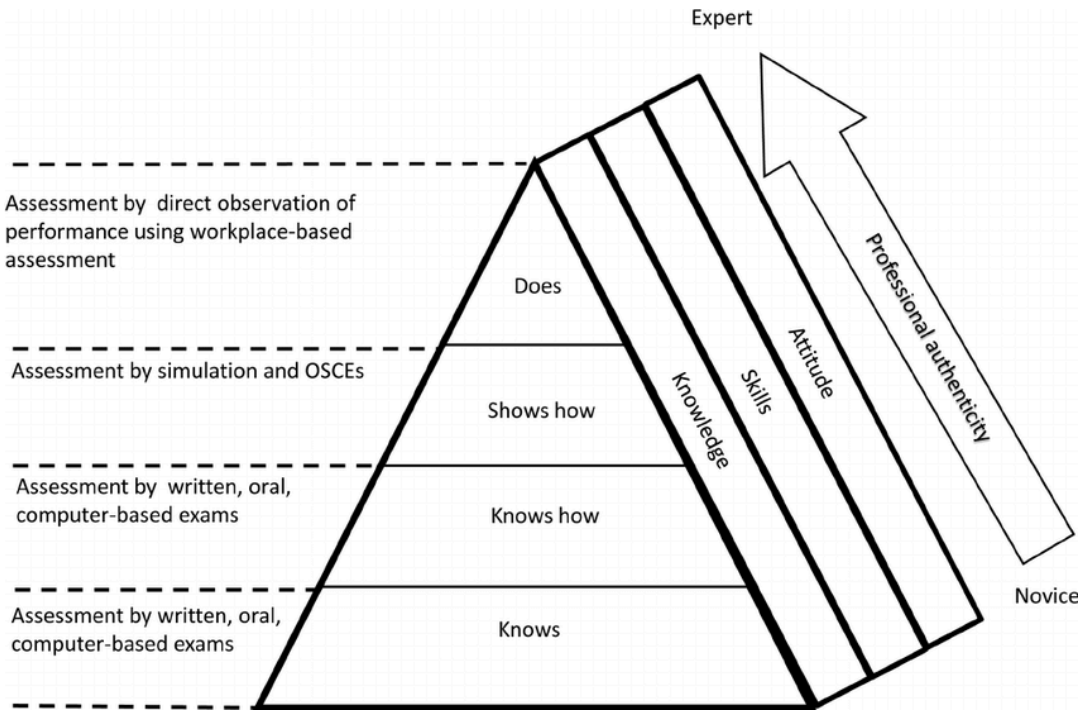
AAS Bacterial Monitoring Manual

https://adoptastream.georgia.gov/document/document/bacterial-manual-updated-address/download

AAS's instructions are essentially the same as 3M's own *PetriFilm Interpretation Guide:*

https://multimedia.3m.com/mws/media/236246O/petrifilm-ecoli-coliform-interpretation-guide.pdf

Why is the present document necessary, then? The Miller Pyramid is a useful illustration:



Miller's pyramid of clinical competence Modified from Miller, G.E. The assessment of clinical skills/competence/performance. Acad. Med. 1990;65(9):s63–s67. Via Jill Marie Norris.

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WWALS advocates for conservation and stewardship of the surface waters and groundwater of the Suwannee River Basin and Estuary, in south Georgia and north Florida, among them the Withlacoochee, Willacoochee, Alapaha, Little, Santa Fe, and Suwannee River watersheds, through education, awareness, environmental monitoring, and citizen activities.

The AAS training has three of those four levels (Knows, Knows how, and Shows how). This document is about the fourth layer (Does), which we have in our own WQ testing program:

1. Actually doing the tests in the field is different from a training situation.
2. Our conditions are sufficiently different from other locations that our testers often encounter extreme cases or what may be normal here but is not elsewhere: blackwater rivers with tannic acid blocking sunlight below a few feet, warm river water, rapid changes in levels and flow, multiple related creeks and rivers, permeable limestone substrate exchanging surface water with groundwater, more frequent testing, etc.
3. We have multiple sources and types of contamination that we are trying to sort out: manure runoff from cattle, horses, pigs, etc., septic tanks, apparent illegal dumping, and sewage spills.
4. Testing by government agencies is so sparse that WWALS is often the first to discover a new water quality phenomenon.
5. Last but probably most important: our testers need support so they're not individually going out on a limb when they may be the first to detect something important.

For all these reasons our testers need to support each other in details of how to test and especially in interpreting test results. Anyone can make a mistake, so many eyes review.

This is why all our testers are added to the WWALS Testing Committee and its email list, wwals-testing@googlegroups.com (the testing list). And it is why we use that list to coordinate testing support, including mutual review of results.

Credibility

The credibility of WWALS for water quality testing is hard-won, and we cannot afford to squander it. See *Current Situation of Water Quality Testing, Suwannee River Basin 2020-08-02*.
http://wwals.net/2020/08/02/current-situation-of-water-quality-testing-suwannee-river-basin-2020-08-02/

These days, relations with the City of Valdosta are cordial, so the anecdote below may be considered ancient history, merely to illustrate the hard-won aspect.

Suzy Hall got **4,966** cfu/100 mL E. coli on the Withlacoochee River at Knights Ferry on December 21, 2019 and **6,766** on December 24. Those are both well above the AAS 1,000 alert limit. The City of Valdosta really did not want to believe those numbers. However, when FDEP got **3,667** at State Line on December 26, that seemed to us like confirmation.

Nonetheless, Valdosta got (we discovered weeks later and only after more than one open records request) 295 at Knights Ferry on December 26, and misinterpreted that as evidence against those WWALS results, not realizing that contamination washes downstream rapidly.

We helped persuade Lowndes County to test at Knights Ferry, Nankin, and State Line. When Lowndes got sky-high results at all three locations on January 6, and the Florida

Department of Environmental Protection (FDEP) got even higher results at State Line that same day, we were vindicated. Valdosta was belittling our WWALS test results in a public meeting on January 8, until the Chair of the Florida Counties Rivers Task Force in that same meeting revealed those FDEP results, reading from a WWALS report, which we had presented to the Task Force earlier that same day in Madison, Florida.

After discussions with the Lowndes County Chairman, the county also started testing on Okapilco Creek in Brooks County, which quickly revealed high results there preceding high results on the Withlacoochee River. Combined with WWALS tests in Brooks County and FDEP DNA markers, the trail of one source of contamination led to dairy cattle.

Valdosta is testing regularly now, not only at all of the above locations on the Withlacoochee River, but also at US 84 on Okapilco Creek in Brooks County. Their data is immensely useful. And it appears that Valdosta now understands that contamination that starts at Knights Ferry without appearing upstream is evidence that it did not come from Valdosta.

Our credibility is very important to our ongoing relations with some of the dairy farmers in Brooks County and elsewhere. It is also important in developing relations with horse farmers and others.

Our WWALS hard-won credibility is also related to the Georgia Power water quality testing grant. https://wwals.net/?p=53196 We never would have gotten that grant without the credibility.

As new testers come on board, it is important that we assure quality control.

When to test

1. Georgia Adopt-A-Stream (AAS) is most interested in baselines, so AAS recommends testing monthly or perhaps every two weeks.
    a. WWALS needs baselines, so please test at least monthly.
    b. AAS recommends ***not*** testing immediately after a rain, not for at least a day.

2. WWALS also needs tests to follow contamination events.
    a. WWALS needs tests soon after a rain, sometimes even during the rain.
    b. So after a big rain, please test as soon as you can.
    c. While high test results continue to appear for an event, please continue testing.
    d. Of course, safety first: don't test during a thunderstorm or when there is any danger of flash floods or slipping into the stream.

3. Please test on and before weekends if you can (we understand most of you have jobs).
    a. If testing on Thursday before a weekend, try to get your results ready for review by noon Friday for Friday afternoon publication.
    b. If testing on a weekend, try to have Saturday results ready for review by Sunday evening for Monday publication, and for Sunday by Monday evening for Tuesday publication.

Plating samples

1. Please remember to label each plate with location, time, date, and sample number (1, 2, or 3).

2. Use the pipette to put the water near the edge with the film cover hinge, and then slowly roll the cover down over the plate and press lightly with the plating spreader.

3. If there are any remaining spots not covered, there are two methods you can use:
    a. Put the little round 3M plate spreader centered on the plate. Apply a small amount of pressure. Hold for one minute.
    b. Slowly and carefully tip the plate towards each blank spot until the water flows to the edge.

If there are still spots uncovered by the test water, discard that plate and try again with another.

Reporting plates

1. Please take in-focus well-lighted pictures of your plates, by either of two methods:
    a. With a camera, such as your phone camera, or a separate camera.
    b. Using a scanner. This is the easiest way to get well-lighted in-focus images.
2. Put those pictures under the WWALS google drive folder WWALS WQ Results: https://drive.google.com/drive/folders/1vGR_hT8zja1PwVtxFqAEf5g7iKaB5vCJ?usp=sharing
    a. Under that folder, put pictures into the appropriate subfolder for each testing location.
    b. If there already is an appropriate site folder, such as *State Line Boat Ramp Highway 31*, go ahead and put your plate pictures for that location in there.
    c. If there is not an appropriate site folder, create one by clicking on the *New* button in the upper left and then *Folder*. (See below for smartphone method.*) Put your plate pictures for that location into that new site folder.
    d. Also, within the site folder, it helps to make a date folder with the date the sample was collected, such as 2020-11-15--us-84-withlacoochee. (See below for smartphone method.*) That way, pictures of the location and pictures of the plates can go in the date folder.
    e. How to upload: in the date folder, click *New* and then *File Upload*. (See below for smartphone method.*)
    f. Please remember to include a picture of your control (blank) plate or plates.
    g. Please use filenames that reflect the location, date, and plate number.
    h. Also upload photographs you took at the sample location if you can.

- * Smartphone method:
    a. If you got to googledrive through the web interface, you can try telling your phone to use the desktop site.
    b. Easier is to get the googledrive app.
    c. In the Drive app, search for WWALS WQ Results, and click on that folder.
    d. Navigate to the folder for your location by scrolling until you find it, or use search in page.
    e. If you need to make a folder, for site or date, click on + New, then on Folder.
    f. To upload, click on +New and then Upload.
    g. Beware that many phones will not actually upload any large files unless you're connected to wifi.

Review of plates

Counting *E. coli* colonies on Petrifilms can be quite subjective. How blue is blue? Are there really bubbles? How much of a colony overlaps the edge? How high is TNTC (Too Numerous To Count)? When is the background purple enough to declare TNTC?

For all these reasons, we need multiple eyes reviewing each set of plates before we publish data from them. This review does not have to take long, once we get used to doing it routinely.

1. Once you have uploaded your plate pictures,
    a. Email to wwals-testing@googlegroups.com (the testing list)
    b. With a new Subject that reflects what your plates measure (date, locations)
    c. And in the body of the message include your counts for each plate and your proposed results for each location, as in 1 + 2 + 1 for 133 cfu/100 mL.
    d. Also include in the email message a link to the date folder.
2. Other testers:
    a. Please review each new set of plate pictures, see if you agree with the counts, and reply to the above message in wwals-testing@googlegroups.com with your opinion, even if it is just "I agree with the original tester's interpretation."
    b. If you find anything that could be otherwise interpreted, *it is very important to reply with your interpretation and why.*
    c. We need *at least two responses from testers other than the original tester*.
    d. If there is any difference of opinion, discuss on the testing list until there is agreement.
3. If there is any difference of opinion about interpretation of a given set of plates for a location and date, it must be resolved before publication.
    a. If there are three identical interpretations (the original tester plus two others) and no others, that is resolved.
    b. It helps if the testing Committee Chair declares a resolution, even if it is just "everybody agrees."
    c. If necessary, a WWALS trainer can declare a resolution.
    d. If there is no resolution, we do ***NOT*** publish the data.
    e. However, **most of the time, everybody agrees, usually quickly.**
4. Once there is agreement or a declared interpretation, unless there is some really important and unusual reason, *please do not change the result*.

Comparison to other sources of data

Partly due to years of examples set by WWALS, not to mention nagging, we have a plethora of other bacterial data to compare, and sometimes even chemical tracers and DNA markers.

For where to find the latest Valdosta and Florida data, see: http://wwals.net/issues/testing/

1. Supposedly the Valdosta data are also in Georgia Adopt-A-Stream, where we do put WWALS data as each location and data is confirmed by the above review: https://aas.gaepd.org/Group.aspx?ID=1727

2. As quickly as we can, we also put all this data into the WWALS composite spreadsheet, along with rainfall and sewage spill data: https://docs.google.com/spreadsheets/d/1I_W-lB8Sfe04UKdO5ufexq3OVMYG_0eBIEDX0gixJ-Q/view?usp=sharing

3. WWALS updates Swim Guide with the results from other sources. https://www.theswimguide.org/search/?q=withlacoochee

Volunteers needed help update the WWALS composite spreadsheet and Swim Guide.

Publishing results

Please do ***not*** announce any bacterial testing results until they have been reviewed by the above methods *and passed review with a resolution as above*.

1. Typically *after successful review* we put the results in the various public repositories:
    a. The tester puts the passed results in the AAS database.
    b. WWALS puts the results in the WWALS composite spreadsheet.
    c. WWALS updates Swim Guide with the WWALS results.
    d. It is important for the results to be the same in the AAS database and the WWALS composite spreadsheet and Swim Guide.

2. Then we publicise the results.
    a. WWALS posts the results in a blog post, shared on the usual social media (facebook, instagram, twitter).
    b. Do feel free to share those posts on as many relevant facebook groups and pages as you know of, as well as through other social media.
    c. The AAS data and the WWALS composite spreadsheet are publicly visible and can also be shared.
    d. WWALS may even send out a press release for especially significant results.

Thanks to all WWALS testers for following this review process, which will become easy and fast as we get used to it. Please suggest any potential revisions through the testing list, wwals-testing@googlegroups.com.