

LANDOWNERS GUIDE FOR RECREATIONAL MONITORING

ARIZONA DEPARTMENT OF
ENVIRONMENTAL QUALITY



Publication Number: TM-16-01

Landowners Guide for Recreational Monitoring

The Purpose of This Document

This document is meant to help land owners of highly recreated lakes or streams in Arizona protect and inform the citizens of Arizona about the benefits and risks of recreating in nature.

ADEQ Recreational Monitoring Program

The Arizona Department of Environmental Quality's (ADEQ) Recreational Monitoring Program will perform bacteriological monitoring on highly recreated streams and lakes in Arizona during the peak human use season of March to September. The goal of this program is to protect and inform the public about the waters they are recreating on and help avoid adverse health effects related to recreating in waters with fecal contamination.

ADEQ cannot regularly sample all lakes and streams on a regular basis, but instead will select popular waterbodies throughout Arizona. Land owners and local groups are key to routine sampling of these waterbodies. ADEQ's role is to bring awareness to the public and landowners about the benefits and risks of recreating in waterbodies throughout the state. ADEQ's Recreational Monitoring Program will provide the local land owners the infrastructure needed to complete the sampling and inform the public including:

- Signs
- Sampling Guidance
- Public Communication (one website for the entire state)
- Sampling Equipment

Enjoy the Outdoors, but Minimize Risk

Enjoying nature and the outdoors is part of a healthy lifestyle. Sedentary lifestyles are directly linked to increased rates of obesity and heart disease (<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2996155/>, <http://blogs.plos.org/obesitypanacea/files/2010/12/Published-Paper.pdf>). Conversely, active lifestyles reduce the risk of obesity and heart disease and lower overall mortality rates. Enjoying the outdoors is a part of this active lifestyle.

ADEQ's goal for the recreational monitoring program is to encourage the public to continue to enjoy the outdoors and to inform them about how to minimize their chances of getting sick while swimming or recreating in the beautiful waterbodies around the state.

DEQ and landowners regularly monitor some sites throughout Arizona, but not all sites are monitored. ADEQ recommends that the public not swim or recreate at sites where *E. coli* is above the state standard of 235 colony forming units per 100 ml. High levels of *E. coli* are caused by fecal contamination by either wildlife or humans and can cause serious illness. Swimming and recreating in natural waterbodies has some risk that can be minimized if the following precautions are taken:

- Don't swim / recreate in turbid water
- Don't swim / recreate within 48 hours of a major storm
- Use and properly dispose of swim diapers for young children
- Don't swim / recreate where there are a lot of cows/horses
- Pick up and properly dispose of your dog's waste
- Minimize/avoid submerging your head under water

- Don't swim / recreate if there is an algal bloom
- Don't swim / recreate in stagnant water

Why Monitor *E. coli*?

Bacteria are a natural and necessary part of the environment and only certain strains of bacteria can actually cause human illnesses. A bacterial pathogen, such as *Escherichia coli* (*E. coli*), can contaminate a stream or lake and poses a risk to human health causing gastroenteritis, diarrhea, or other symptoms. Not everyone will become ill after swimming in contaminated water, but the risk of illness is correlated to high bacterial densities (South Carolina Department of Health and Environmental Control).

Total and Fecal coliforms have been used as bacterial indicators since the 1920's, but in 1986 US EPA conducted a study on two fresh water beaches, Lake Erie in Pennsylvania and Keystone Lake in Oklahoma, surveying swimmers and non-swimmers 8-10 days after recreating on the lakes (Dufour 1984). Based on the survey's results of reported illnesses, EPA recommended that *E. coli* and enterococci showed the strongest relationship between water recreated illness from fecal contamination. EPA set the standard of 235 colony forming units (cfu)/100 ml of sample, Arizona adopted this standard in 1996.

E. coli, a specific bacterial subgroup of the total coliforms (see figure 1), is a naturally occurring bacterium that resides in the digestive tract of warm blooded animals (US EPA 2013). The presence of *E. coli* in water is indicative of fecal contamination and as bacterial densities increase the potential risk of illness increases.

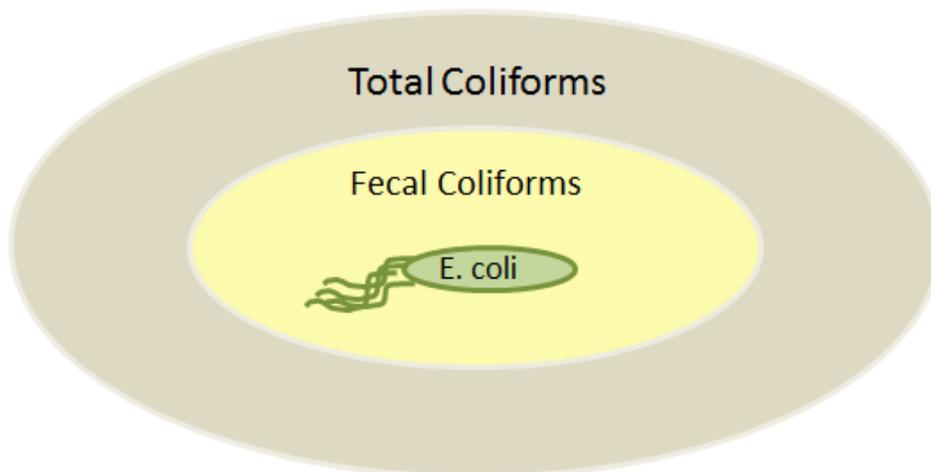


Figure 1. *E. coli*, fecal coliform and total coliforms.

There are a variety of sources of fecal contamination including, wildlife, septic tanks, livestock, pets, and rain runoff. Methods of fecal source identification do exist, but are outside the scope of this program.

Arizona *E. coli* Standards

E. coli is the primary indicator used to protect recreational uses in Arizona's rivers and streams. The standard for *E. coli* for swimming/full body contact is 235 colony forming units per 100 mL and is listed in Arizona's Administrative Code R18-11-109.

When to Advise the Public

The flow diagram (figure 2) outlines a general process for *E. coli* sampling and the steps to follow if an exceedance occurs. In this example there are two different entities involved; ADEQ and the land owner. It is also possible that sampling would only be done by the land owner.

In this example, ADEQ staff collect the initial *E. coli* sample. If this sample is greater than the 235 cfu/100mL standard then a follow up sample shall be collected the following day. If the verification sample also exceeds the standard, then ADEQ will contact the land owner directly to advise that the public stay out of the water until *E. coli* falls below the standard. No advisory is needed if either the initial sample or verification sample is below the standard. (Note if multiple samples are taken in the same day or at the same site then these results will be averaged into one value). ADEQ will post this information on the website. The land owner will use signs on site to notify the public that the water is unsafe.

At this point the land owner should sample daily for *E. coli* until results are less than the standard. ADEQ recommends sampling at least weekly after the advisory has been lifted during the peak recreational season. The land owner should notify ADEQ that the advisory has been lifted so that the statewide website can be updated.

For example, during a three day weekend ADEQ staff would collect an *E. coli* sample on a Thursday. Using the Colilert method, results could be obtained within 18-24 hours depending upon which media was used. If an *E. coli* exceedance, a result >235 cfl/100 ml, was found another *E. coli* sample from the same site location would be taken. If the verification *E. coli* sample was under the 235 cfu/100ml standard the process would end and the recreation area would remain open. However, if the verification *E. coli* sample resulted in another exceedance, the land owner would be notified and ADEQ's website would be updated immediately informing the public on the suggested beach advisory.

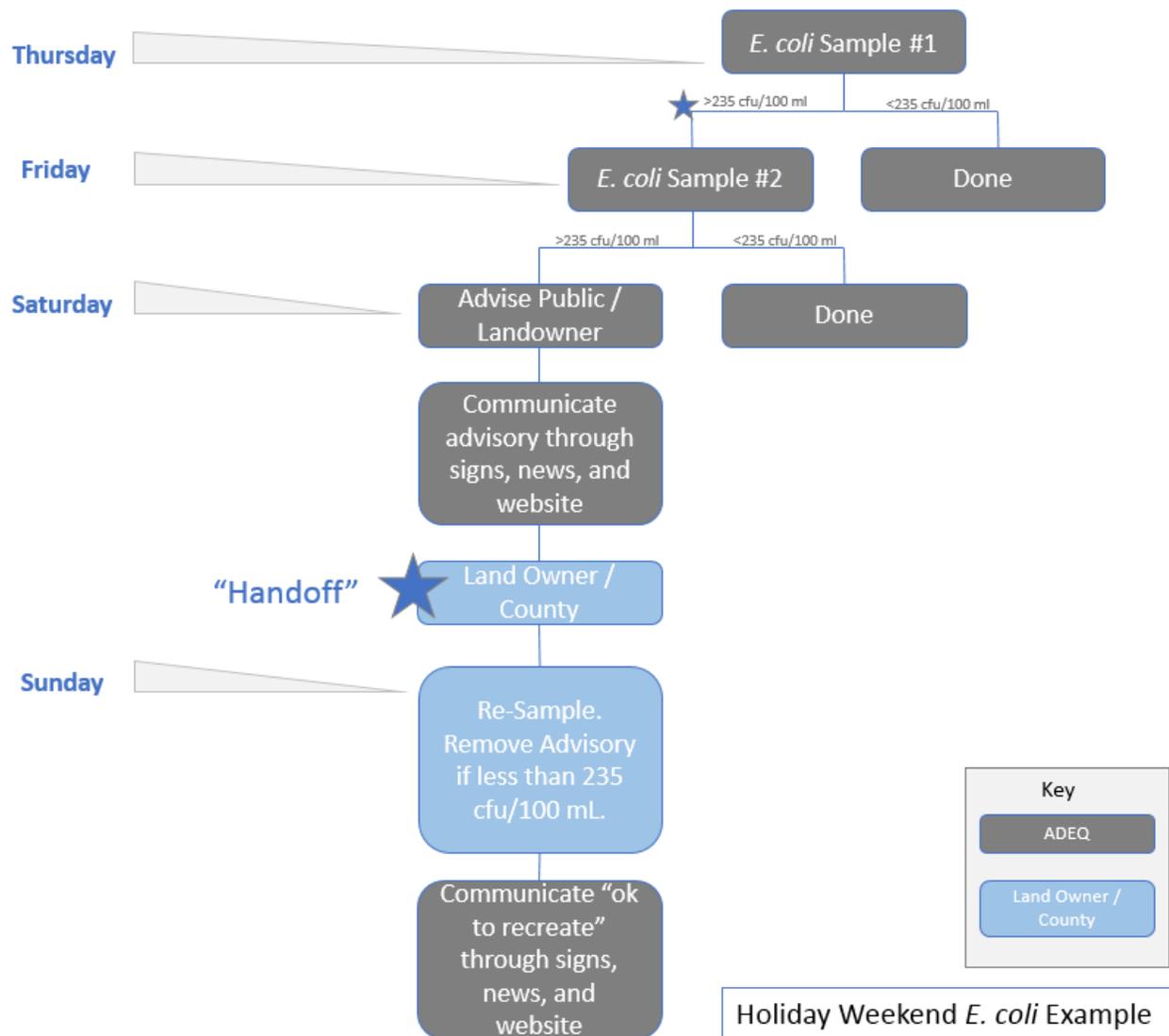


Figure 2. Possible advisory scenario.

Collecting Credible Data

ADEQ’s “credible and scientifically defensible data” requirements are established in Arizona’s Administrative Code R18-11-602. Data will be considered credible as long as a sample plan and a quality assurance plan has been shared with ADEQ. If assistance is needed in creating these documents, ADEQ will provide guidance.

E. coli Collection

E. coli samples are collected wearing gloves and using a sealed, sterile 100ml bottle submerged in the stream / lake. Bottles are available either through the lab that you are using or through IDEXX. Stream samples should be opened while facing upstream. The bottle should be opened and recapped under water during sampling so that surface contaminants are not sampled. Samples must be kept on ice and processed within six hours of sample collection (ADEQ Standard Operating Procedures, 2015).

The location of the sample should be representative of where recreational use is occurring. Samples should be taken at knee depth near the bank/shore of the chosen water body. Exercise caution not to stir up sediment and prevent any cross contamination that might occur during the sampling process. If able, collect locational data (latitude /longitude) at the sampling location and record any site specific information (number of recreators, current weather events, noticeable trash, etc.).

Equipment Needed:

- Sterile 100 ml bottle
- Gloves
- Ice chest with ice
- Field Form
- Pencil
- GPS

E. coli Processing

E. coli samples must be processed either by a lab or using specialized equipment. Not all land owners will have access to training and equipment needed to process the *E. coli* samples. ADEQ does have some extra *E. coli* equipment available and is willing to train landowners how to use it. Please contact Meghan Smart at 602-771-4506 or at ms14@azdeq.gov for more information. Regardless of whether the lab processes the sample or it is processed on site it must be processed within 6 hours of collection.

Option 1. Have a Lab Process Your Sample

Most environmental labs do *E. coli* sampling. The cost of a single sample is approximately \$20.00. Local labs can be found using an internet search or the yellow pages. It is important to get the samples to the lab within 6 hours of sample collection. Use a chain of custody to document the transfer of the sample to the lab.

Option 2. Process the Sample Yourself

To process your own samples you will need a sealer, an incubator, a black light, reagents and quantitrays. A full set up cost roughly \$7,000 but once you have the equipment the cost per sample is only around \$5 or \$6 dollars.

The following details how to process *E. coli* samples. Gloves must be worn during the entire process.

1. Turn on sealer. It will take approximately 15 minutes to warm to operating temperature.
2. Verify that the incubator is operating at 35 +/- 0.5°C.



FIGURE 3. Colilert Sealer (left) and incubator (right).

3. Check level of water in bottle against 100ml line, if too much water is present, decant to the 100ml line.
4. Pour the contents of one reagent packet into each sample bottle. When opening the reagent packets, avoid inhaling the media.
5. Cap vessel and shake gently until dissolved and allow the foam at the top the bottle to settle. Chilled samples will take longer to dissolve the reagent. A hot water bath can be used to warm chilled samples prior to adding reagent.
6. Use a permanent marker to label the foil side of the Quanti-Tray with the sample identification, date and time of collection.
7. Use one hand to hold a Quanti-Tray upright with the well side facing the palm. Gently pull foil tab to separate the foil from the tray. Avoid touching the inside of the foil or tray.
8. Squeeze the upper part of the Quanti-Tray so that the Quanti-Tray bends towards the palm.
9. Pour the reagent/sample mixture directly into the Quanti-Tray avoiding contact with the foil tab. Tap the small wells 2-3 times to release any air bubbles.
10. Place the sample-filled Quanti-Tray onto the Quanti-Tray/2000 rubber insert of the Quanti-Tray Sealer with the well side (plastic) of the Quanti-Tray facing down.
11. Once all samples have been processed note the "time in the incubator" on the back of the Quanti-Tray and place the samples in the incubator.
12. Remove samples from the incubator after 18-22 hours for Colilert 18.
13. Wells that are yellow under plain light are positive for total coliforms. Wells that are yellow and then fluoresce under a black light are positive for *E. coli*. Sample results are obtained by counting and recording the number of large and small yellow, fluorescing wells. Once the number of large and small wells is obtained the "most probable number" (MPN) is recorded from the MPN table (TABLE 1).
14. Results must be noted on the field sheets, field notebook, or some other type of record.

Large Wells Positive

IDEXX Quanti-Tray®/2000 MPN Table (per 100ml)

Small Wells Positive

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
0	-1	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.1	15.1	16.1	17.1	18.1	19.1	20.2	21.2	22.2	23.3	24.3
1	1.0	2.0	3.0	4.0	5.0	6.0	7.1	8.1	9.1	10.1	11.1	12.1	13.2	14.2	15.2	16.2	17.3	18.3	19.3	20.4	21.4	22.4	23.5	24.5	25.6
2	2.0	3.0	4.1	5.1	6.1	7.1	8.1	9.2	10.2	11.2	12.2	13.3	14.3	15.4	16.4	17.4	18.5	19.5	20.6	21.6	22.7	23.7	24.8	25.8	26.9
3	3.1	4.1	5.1	6.1	7.2	8.2	9.2	10.3	11.3	12.4	13.4	14.5	15.5	16.5	17.6	18.6	19.7	20.8	21.8	22.9	23.9	25.0	26.1	27.1	28.2
4	4.1	5.2	6.2	7.2	8.3	9.3	10.4	11.4	12.5	13.5	14.6	15.6	16.7	17.8	18.8	19.9	21.0	22.0	23.1	24.2	25.3	26.3	27.4	28.5	29.6
5	5.2	6.3	7.3	8.4	9.4	10.5	11.5	12.6	13.7	14.7	15.8	16.9	17.9	19.0	20.1	21.2	22.2	23.3	24.4	25.5	26.6	27.7	28.8	29.9	31.0
6	6.3	7.4	8.4	9.5	10.6	11.6	12.7	13.8	14.9	16.0	17.0	18.1	19.2	20.3	21.4	22.5	23.6	24.7	25.8	26.9	28.0	29.1	30.2	31.3	32.4
7	7.5	8.5	9.6	10.7	11.8	12.8	13.9	15.0	16.1	17.2	18.3	19.4	20.5	21.6	22.7	23.8	24.9	26.0	27.1	28.3	29.4	30.5	31.6	32.8	33.9
8	8.6	9.7	10.8	11.9	13.0	14.1	15.2	16.3	17.4	18.5	19.6	20.7	21.8	22.9	24.1	25.2	26.3	27.4	28.6	29.7	30.8	32.0	33.1	34.3	35.4
9	9.8	10.9	12.0	13.1	14.2	15.3	16.4	17.6	18.7	19.8	20.9	22.0	23.2	24.3	25.4	26.6	27.7	28.9	30.0	31.2	32.3	33.5	34.6	35.8	37.0
10	11.0	12.1	13.2	14.4	15.5	16.6	17.7	18.9	20.0	21.1	22.3	23.4	24.6	25.7	26.9	28.0	29.2	30.3	31.5	32.7	33.8	35.0	36.2	37.4	38.6
11	12.2	13.4	14.5	15.6	16.8	17.9	19.1	20.2	21.4	22.5	23.7	24.8	26.0	27.2	28.3	29.5	30.7	31.9	33.0	34.2	35.4	36.6	37.8	39.0	40.2
12	13.5	14.8	15.9	16.9	18.1	19.3	20.4	21.6	22.8	23.9	25.1	26.3	27.5	28.6	29.8	31.0	32.2	33.4	34.6	35.8	37.0	38.2	39.5	40.7	41.9
13	14.8	16.0	17.1	18.3	19.5	20.6	21.8	23.0	24.2	25.4	26.6	27.8	29.0	30.2	31.4	32.6	33.8	35.0	36.2	37.5	38.7	39.9	41.2	42.4	43.6
14	16.1	17.3	18.5	19.7	20.9	22.1	23.3	24.5	25.7	26.9	28.1	29.3	30.5	31.7	33.0	34.2	35.4	36.7	37.9	39.1	40.4	41.6	42.9	44.2	45.4
15	17.5	18.7	19.9	21.1	22.3	23.5	24.7	25.9	27.2	28.4	29.6	30.9	32.1	33.3	34.6	35.8	37.1	38.4	39.6	40.9	42.2	43.4	44.7	46.0	47.3
16	18.9	20.1	21.3	22.6	23.8	25.0	26.2	27.5	28.7	30.0	31.2	32.5	33.7	35.0	36.3	37.5	38.8	40.1	41.4	42.7	44.0	45.3	46.6	47.9	49.2
17	20.3	21.6	22.8	24.1	25.3	26.6	27.8	29.1	30.3	31.6	32.9	34.1	35.4	36.7	38.0	39.3	40.6	41.9	43.2	44.5	45.9	47.2	48.5	49.8	51.2
18	21.8	23.1	24.3	25.6	26.9	28.1	29.4	30.7	32.0	33.3	34.6	35.9	37.2	38.5	39.8	41.1	42.4	43.8	45.1	46.5	47.8	49.2	50.5	51.9	53.2
19	23.3	24.6	25.9	27.2	28.5	29.8	31.1	32.4	33.7	35.0	36.3	37.6	39.0	40.3	41.6	43.0	44.3	45.7	47.1	48.4	49.8	51.2	52.6	54.0	55.4
20	24.9	26.2	27.5	28.8	30.1	31.5	32.8	34.1	35.4	36.8	38.1	39.5	40.8	42.2	43.6	44.9	46.3	47.7	49.1	50.5	51.9	53.3	54.7	56.1	57.6
21	26.5	27.9	29.2	30.5	31.8	33.2	34.5	35.9	37.3	38.6	40.0	41.4	42.8	44.1	45.5	46.9	48.4	49.8	51.2	52.6	54.1	55.5	56.9	58.4	59.9
22	28.2	29.5	30.9	32.3	33.6	35.0	36.4	37.7	39.1	40.5	41.9	43.3	44.8	46.2	47.6	49.0	50.5	51.9	53.4	54.8	56.3	57.8	59.3	60.8	62.3
23	29.9	31.3	32.7	34.1	35.5	36.8	38.3	39.7	41.1	42.5	43.9	45.4	46.8	48.3	49.7	51.2	52.7	54.2	55.6	57.1	58.6	60.2	61.7	63.2	64.7
24	31.7	33.1	34.5	35.9	37.3	38.8	40.2	41.7	43.1	44.6	46.0	47.5	49.0	50.5	52.0	53.5	55.0	56.5	58.0	59.5	61.1	62.6	64.2	65.8	67.3
25	33.6	35.0	36.4	37.9	39.3	40.8	42.2	43.7	45.2	46.7	48.2	49.7	51.2	52.7	54.3	55.8	57.3	58.9	60.5	62.0	63.6	65.2	66.8	68.4	70.0
26	35.5	36.9	38.4	39.9	41.4	42.8	44.3	45.9	47.4	48.9	50.4	52.0	53.5	55.1	56.7	58.2	59.8	61.4	63.0	64.7	66.3	67.9	69.6	71.2	72.9
27	37.4	38.9	40.4	42.0	43.5	45.0	46.5	48.1	49.6	51.2	52.8	54.4	56.0	57.6	59.2	60.8	62.4	64.1	65.7	67.4	69.1	70.8	72.5	74.2	75.9
28	39.5	41.0	42.6	44.1	45.7	47.3	48.8	50.4	52.0	53.6	55.2	56.9	58.5	60.2	61.8	63.5	65.2	66.9	68.6	70.3	72.0	73.7	75.5	77.3	79.0
29	41.7	43.2	44.8	46.4	48.0	49.6	51.2	52.8	54.5	56.1	57.8	59.5	61.2	62.9	64.6	66.3	68.0	69.8	71.5	73.3	75.1	76.9	78.7	80.5	82.4
30	43.9	45.5	47.1	48.7	50.4	52.0	53.7	55.4	57.1	58.8	60.5	62.2	64.0	65.7	67.5	69.3	71.0	72.9	74.7	76.5	78.3	80.2	82.1	84.0	85.9
31	46.2	47.9	49.5	51.2	52.9	54.6	56.3	58.1	59.8	61.6	63.3	65.1	66.9	68.7	70.5	72.4	74.2	76.1	78.0	79.9	81.8	83.7	85.7	87.6	89.6
32	48.7	50.4	52.1	53.8	55.6	57.3	59.1	60.9	62.7	64.5	66.3	68.2	70.0	71.9	73.8	75.7	77.6	79.5	81.5	83.5	85.4	87.5	89.5	91.5	93.6
33	51.2	53.0	54.8	56.5	58.3	60.2	62.0	63.8	65.7	67.6	69.5	71.4	73.3	75.2	77.2	79.2	81.2	83.2	85.2	87.3	89.3	91.4	93.5	95.7	97.8
34	53.9	55.7	57.6	59.4	61.3	63.1	65.0	67.0	68.9	70.8	72.8	74.8	76.8	78.8	80.8	82.9	85.0	87.1	89.2	91.4	93.5	95.7	97.9	100.2	102.4
35	56.8	58.6	60.5	62.4	64.4	66.3	68.3	70.3	72.3	74.3	76.3	78.4	80.5	82.6	84.7	86.9	89.1	91.3	93.5	95.7	98.0	100.3	102.6	105.0	107.3
36	59.8	61.7	63.7	65.7	67.7	69.7	71.7	73.8	75.9	78.0	80.1	82.3	84.5	86.7	88.9	91.2	93.5	95.8	98.1	100.5	102.9	105.3	107.7	110.2	112.7
37	62.9	65.0	67.0	69.1	71.2	73.3	75.4	77.6	79.8	82.0	84.2	86.5	88.8	91.1	93.4	95.8	98.2	100.6	103.1	105.6	108.1	110.7	113.3	115.9	118.6
38	66.3	68.4	70.6	72.7	74.9	77.1	79.4	81.6	83.9	86.2	88.6	91.0	93.4	95.8	98.3	100.8	103.4	105.9	108.6	111.2	113.9	116.6	119.4	122.2	125.0
39	70.0	72.2	74.4	76.7	78.9	81.3	83.6	86.0	88.4	90.9	93.4	95.9	98.4	101.0	103.6	106.3	109.0	111.8	114.6	117.4	120.3	123.2	126.1	129.2	132.2
40	73.8	76.2	78.5	80.9	83.3	85.7	88.2	90.8	93.3	95.9	98.5	101.2	103.9	106.7	109.5	112.4	115.3	118.2	121.2	124.3	127.4	130.5	133.7	137.0	140.3
41	78.0	80.5	83.0	85.5	88.0	90.6	93.3	95.9	98.7	101.4	104.3	107.1	110.0	113.0	116.0	119.1	122.2	125.4	128.7	132.0	135.4	138.8	142.3	145.9	149.5
42	82.6	85.2	87.8	90.5	93.2	96.0	98.8	101.7	104.6	107.6	110.6	113.7	116.9	120.1	123.4	126.7	130.1	133.6	137.2	140.8	144.5	148.3	152.2	156.1	160.2
43	87.6	90.4	93.2	96.0	99.0	101.9	105.0	108.1	111.2	114.5	117.8	121.1	124.6	128.1	131.7	135.4	139.1	143.0	147.0	151.0	155.2	159.4	163.8	168.2	172.8
44	93.1	96.1	99.1	102.2	105.4	108.6	111.9	115.3	118.7	122.3	125.9	129.6	133.4	137.4	141.4	145.5	149.7	154.1	158.5	163.1	167.9	172.7	177.7	182.9	188.2
45	99.3	102.5	105.8	109.2	112.8	116.2	119.8	123.6	127.4	131.4	135.4	139.6	143.9	148.3	152.9	157.6	162.4	167.4	172.6	178.0	183.5	189.2	195.1	201.2	207.5
46	106.3	109.8	113.4	117.2	121.0	125.0	129.1	133.3	137.6	142.1	146.7	151.5	156.5	161.6	167.0	172.5	178.2	184.2	190.4	196.8	203.5	210.5	217.8	225.4	233.3
47	114.3	118.3	122.4	126.6	130.9	135.4	140.1	145.0	150.0	155.3	160.7	166.4	172.3	178.5	185.0	191.8	198.9	206.4	214.2	222.4	231.0	240.0	249.5	259.5	270.0
48	123.9	128.4	133.1	137.9	143.0	148.3	153.9	159.7	165.8	172.2	178.9	186.0	193.5	201.4	209.8	218.7	228.2	238.2	248.9	260.3	272.3	285.1	298.7	313.0	328.2
49	135.5	140.8	146.4	152.3	158.5	165.0	172.0	179.3	187.2	195.6	204.6	214.3	224.7	235.9	248.1	261.3	275.5	290.9	307.6	325.5	344				

# Large Wells Positive	IDEXX Quanti-Tray®/2000 MPN Table (per 100ml)																																															
	# Small Wells Positive																																															
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48																								
0	25.3	26.4	27.4	28.4	29.5	30.5	31.5	32.6	33.6	34.7	35.7	36.8	37.8	38.9	40.0	41.0	42.1	43.1	44.2	45.3	46.3	47.4	48.5	49.5																								
1	26.6	27.7	28.7	29.8	30.8	31.9	32.9	34.0	35.0	36.1	37.2	38.2	39.3	40.4	41.4	42.5	43.6	44.7	45.7	46.8	47.9	49.0	50.1	51.2																								
2	27.9	29.0	30.0	31.1	32.2	33.2	34.3	35.4	36.5	37.5	38.6	39.7	40.8	41.9	43.0	44.0	45.1	46.2	47.3	48.4	49.5	50.6	51.7	52.8																								
3	29.3	30.4	31.4	32.5	33.6	34.7	35.8	36.8	37.9	39.0	40.1	41.2	42.3	43.4	44.5	45.6	46.7	47.8	48.9	50.0	51.2	52.3	53.4	54.5																								
4	30.7	31.8	32.8	33.9	35.0	36.1	37.2	38.3	39.4	40.5	41.6	42.8	43.9	45.0	46.1	47.2	48.3	49.5	50.6	51.7	52.9	54.0	55.1	56.3																								
5	32.1	33.2	34.3	35.4	36.5	37.6	38.7	39.9	41.0	42.1	43.2	44.4	45.5	46.6	47.7	48.9	50.0	51.2	52.3	53.5	54.6	55.8	56.9	58.1																								
6	33.5	34.7	35.8	36.9	38.0	39.2	40.3	41.4	42.6	43.7	44.8	46.0	47.1	48.3	49.4	50.6	51.7	52.9	54.1	55.2	56.4	57.6	58.7	59.9																								
7	35.0	36.2	37.3	38.4	39.6	40.7	41.9	43.0	44.2	45.3	46.5	47.7	48.8	50.0	51.2	52.3	53.5	54.7	55.9	57.1	58.3	59.4	60.6	61.8																								
8	36.6	37.7	38.9	40.0	41.2	42.3	43.5	44.7	45.9	47.0	48.2	49.4	50.6	51.8	53.0	54.1	55.3	56.5	57.7	59.0	60.2	61.4	62.6	63.8																								
9	38.1	39.3	40.5	41.8	42.8	44.0	45.2	46.4	47.6	48.8	50.0	51.2	52.4	53.6	54.8	56.0	57.2	58.4	59.7	60.9	62.1	63.4	64.6	65.8																								
10	39.7	40.9	42.1	43.3	44.5	45.7	46.9	48.1	49.3	50.6	51.8	53.0	54.2	55.5	56.7	57.9	59.2	60.4	61.7	62.9	64.2	65.4	66.7	67.9																								
11	41.4	42.6	43.8	45.0	46.3	47.5	48.7	49.9	51.2	52.4	53.7	54.9	56.1	57.4	58.6	59.9	61.2	62.4	63.7	65.0	66.3	67.5	68.8	70.1																								
12	43.1	44.3	45.6	46.8	48.1	49.3	50.6	51.8	53.1	54.3	55.6	56.8	58.1	59.4	60.7	62.0	63.2	64.5	65.8	67.1	68.4	69.7	71.0	72.4																								
13	44.9	46.1	47.4	48.6	49.9	51.2	52.5	53.7	55.0	56.3	57.6	58.9	60.2	61.5	62.8	64.1	65.4	66.7	68.0	69.3	70.7	72.0	73.3	74.7																								
14	46.7	48.0	49.3	50.5	51.8	53.1	54.4	55.7	57.0	58.3	59.6	60.9	62.3	63.6	64.9	66.3	67.6	68.9	70.3	71.6	73.0	74.4	75.7	77.1																								
15	48.6	49.9	51.2	52.5	53.8	55.1	56.4	57.8	59.1	60.4	61.8	63.1	64.5	65.8	67.2	68.5	69.9	71.3	72.6	74.0	75.4	76.8	78.2	79.6																								
16	50.5	51.8	53.2	54.5	55.8	57.2	58.5	59.9	61.2	62.6	64.0	65.3	66.7	68.1	69.5	70.9	72.3	73.7	75.1	76.5	77.9	79.3	80.8	82.2																								
17	52.5	53.9	55.2	56.6	58.0	59.3	60.7	62.1	63.5	64.9	66.3	67.7	69.1	70.5	71.9	73.3	74.8	76.2	77.6	79.0	80.5	82.0	83.5	84.9																								
18	54.6	56.0	57.4	58.8	60.2	61.6	63.0	64.4	65.8	67.2	68.6	70.0	71.5	73.0	74.4	75.9	77.3	78.8	80.3	81.8	83.3	84.8	86.3	87.8																								
19	56.8	58.2	59.6	61.0	62.4	63.8	65.3	66.8	68.2	69.7	71.1	72.6	74.1	75.5	77.0	78.5	80.0	81.5	83.1	84.6	86.1	87.6	89.2	90.7																								
20	59.0	60.4	61.9	63.3	64.8	66.3	67.7	69.2	70.7	72.2	73.7	75.2	76.7	78.2	79.8	81.3	82.8	84.4	85.9	87.5	89.1	90.7	92.2	93.8																								
21	61.3	62.8	64.3	65.8	67.3	68.8	70.3	71.8	73.3	74.9	76.4	77.9	79.5	81.1	82.6	84.2	85.8	87.4	89.0	90.6	92.2	93.8	95.4	97.1																								
22	63.8	65.3	66.8	68.3	69.8	71.4	72.9	74.5	76.1	77.6	79.2	80.8	82.4	84.0	85.6	87.2	88.9	90.5	92.1	93.8	95.5	97.1	98.8	100.5																								
23	66.3	67.8	69.4	71.0	72.5	74.1	75.7	77.3	78.9	80.5	82.2	83.8	85.4	87.1	88.7	90.4	92.1	93.8	95.5	97.2	98.9	100.6	102.4	104.1																								
24	68.9	70.5	72.1	73.7	75.3	77.0	78.6	80.3	81.9	83.6	85.2	86.9	88.6	90.3	92.0	93.8	95.5	97.2	99.0	100.7	102.5	104.3	106.1	107.9																								
25	71.7	73.3	75.0	76.8	78.3	80.0	81.7	83.3	85.1	86.8	88.5	90.2	92.0	93.7	95.5	97.3	99.1	100.9	102.7	104.5	106.3	108.2	110.0	111.9																								
26	74.6	76.3	78.0	79.7	81.4	83.1	84.8	86.6	88.4	90.1	91.9	93.7	95.5	97.3	99.2	101.0	102.9	104.7	106.6	108.5	110.4	112.3	114.2	116.2																								
27	77.6	79.4	81.1	82.9	84.6	86.4	88.2	90.0	91.9	93.7	95.5	97.4	99.3	101.2	103.1	105.0	106.9	108.8	110.8	112.7	114.7	116.7	118.7	120.7																								
28	80.8	82.6	84.4	86.3	88.1	89.9	91.8	93.7	95.6	97.5	99.4	101.3	103.3	105.2	107.2	109.2	111.2	113.2	115.2	117.3	119.3	121.4	123.5	125.6																								
29	84.2	86.1	87.9	89.8	91.7	93.7	95.6	97.5	99.5	101.5	103.5	105.5	107.5	109.5	111.6	113.7	115.7	117.8	120.0	122.1	124.2	126.4	128.6	130.8																								
30	87.8	89.7	91.7	93.6	95.6	97.6	99.6	101.6	103.7	105.7	107.8	109.9	112.0	114.2	116.3	118.5	120.6	122.8	125.1	127.3	129.5	131.8	134.1	136.4																								
31	91.6	93.6	95.6	97.7	99.7	101.8	103.9	106.0	108.2	110.3	112.5	114.7	116.9	119.1	121.4	123.6	125.9	128.2	130.5	132.8	135.3	137.7	140.1	142.5																								
32	95.7	97.8	99.9	102.0	104.2	106.3	108.5	110.7	113.0	115.2	117.5	119.8	122.1	124.5	126.8	129.2	131.6	134.0	136.5	139.0	141.5	144.0	146.6	149.1																								
33	100.0	102.2	104.4	106.6	108.9	111.2	113.5	115.8	118.2	120.5	122.9	125.4	127.8	130.3	132.9	135.3	137.8	140.4	143.0	145.6	148.3	150.9	153.7	156.4																								
34	104.7	107.0	109.3	111.7	114.0	116.4	118.9	121.3	123.8	126.3	128.8	131.4	134.0	136.6	139.2	141.9	144.6	147.4	150.1	152.9	155.7	158.6	161.5	164.4																								
35	109.7	112.2	114.6	117.1	119.6	122.2	124.7	127.3	129.9	132.6	135.3	138.0	140.8	143.6	146.4	149.2	152.1	155.0	158.0	161.0	164.0	167.1	170.2	173.3																								
36	115.2	117.8	120.4	123.0	125.7	128.4	131.1	133.9	136.7	139.5	142.4	145.3	148.3	151.3	154.3	157.3	160.5	163.6	166.8	170.0	173.3	176.6	179.9	183.3																								
37	121.3	124.0	126.8	129.6	132.4	135.3	138.2	141.2	144.2	147.3	150.3	153.5	156.7	159.9	163.1	166.5	169.8	173.2	176.7	180.2	183.7	187.3	191.0	194.7																								
38	127.9	130.8	133.8	136.8	139.8	143.0	146.2	149.4	152.6	155.9	159.2	162.6	166.1	169.6	173.2	176.8	180.4	184.2	188.0	191.8	195.7	199.7	203.7	207.7																								
39	135.3	138.5	141.7	145.0	148.3	151.7	155.1	158.6	162.1	165.7	169.4	173.1	176.9	180.7	184.7	188.7	192.7	196.8	201.0	205.3	209.6	214.0	218.5	223.0																								
40	143.7	147.1	150.6	154.2	157.8	161.5	165.3	169.1	173.0	177.0	181.1	185.2	189.4	193.7	198.1	202.5	207.1	211.7	216.4	221.1	226.0	231.0	236.0	241.1																								
41	153.2	157.0	160.9	164.8	168.9	173.0	177.2	181.5	185.8	190.3	194.8	199.5	204.2	209.1	214.0	219.1	224.2	229.4	234.8	240.2	245.8	251.5	257.2	263.1																								
42	164.3	168.6	172.9	177.3	181.9	186.5	191.3	196.1	201.1	206.2	211.4	216.7	222.2	227.7	233.4	239.2	245.2	251.3	257.5	263.8	270.3	276.9	283.6	290.5																								
43	177.5	182.3	187.3	192.4	197.6	202.9	208.4	214.0	219.8	225.8	231.8	238.1	244.5	251.0	257.7	264.6	271.7	278.9	286.3	293.8	301.5	309.4	317.4	325.7																								
44	193.8	199.3	205.1	211.0	217.2	223.5	230.0	236.7	243.6	250.8	258.1	265.6	273.3	281.2	289.4	297.8	306.3	315.1	324.1	333.3	342.8	352.4	362.3	372.4																								
45	214.1	220.9	227.9	235.2	242.7	250.4	258.4	266.7	275.3	284.1	293.3	302.6	312.3	322.3	332.5	343.0	353.8	364.9	376.2	387.9	399.8	412.0	424.5	437.4																								
46	241.5	250.0	258.9	268.2	277.8	287.8	298.1	308.8	319.9	331.4	343.3	355.5	368.1	381.1	394.5	408.3	422.5	437.1	452.0	467.4	483.3	499.6	516.3	533.5																								
47	280.9	292.4	304.4	316.9	330.0	343.6	357.8	372.5	387.7	403.4	419.8	436.6	454.1	472.1	490.7	509.9	529.8	550.4	571.7	593.8	616.7	640.5	665.3	691.0																								
48	344.1	360.9	378.4	396.8	416.0	436.0	456.9	478.6	501.2	524.7	549.3	574.8	601.5	629.4	658.6	689.3	721.5	755.6	791.5	829.7	870.4	913.9	960.6	1011.2																								
49	481.1	488.4	517.2	547.5	579.4	613.1	648.8	686.7	727.0	770.1	816.4	866.4	920.8	980.4	1046.2	1119.9	1203.3	1299.7	1413.6	1553.1	1732.9	1986.3	2419.6	>2419.6																								

TABLE 1 IDEXX Quanti-Tray/2000 MPN TABLE

Area Sampling Covers

For a stream, the advisory applies to the entire reach (from one tributary to the next).</

ADEQ's Responsibilities

- Sample highly recreated waterbodies throughout Arizona
- Notify the landowner within 6 hours of verifying an exceedance of *E. coli*.
- Provide a sign template that will provide a consistent message throughout Arizona
- Update the website based on data collected by ADEQ staff and by external organizations.
- Provide guidance to landowners on how to sample, where to sample, when to sample and how to inform and protect the public when the water is unsafe to recreate in.
- Provide loaner equipment and supplies to land owners for *E. coli* sampling.

Landowner Responsibilities – When there is a Verified Exceedance

- Post a sign advising the public to avoid water contact due to high bacteria levels.
- Conduct daily follow-up sampling until *E. coli* falls below standards.
- Identify and address possible sources of *E. coli*
- Notify ADEQ when the advisory is lifted due to a sample below the standard so we can update the website.

Landowner Responsibilities – Normal Operation

- Ideally, conduct regular (weekly) *E. coli* monitoring during peak use to protect the public
- Communicate how to minimize risk

Outreach and Communication

Signs

Land owners should advise the public not to recreate when there is a verified exceedance of the *E. coli* standard. Post signs at conspicuous areas of the affected area, including the point of entry if possible. ADEQ has created an 8.5' x11' paper sized sign template for consistent messaging to the public across the state.

ADEQ Website

ADEQ staff will update the Recreational Monitoring webpage within 6 hours of obtaining the verification *E. coli* result exceedance. ADEQ will also update the website when the land owner notifies ADEQ that sampling has been conducted and bacteria levels are below the state standard.