The LGMA Water Metrics take a system-based approach to assessing and managing risks associated with agricultural water:

Sources & Storage & Conveyance & Delivery

Before diving into the following sections:

Identify your water sources and distinct systems.
A distinct system can have a single source or multiple sources, but is determined by which lots or ranches the system serves.

Create a water system description for each distinct system.
You may use written descriptions, photographs, maps, drawings, and other means to describe each system. Your description should make it easy for someone to locate the visible (above-ground) elements of your system in the field.

Make sure to include:

- A unique name or identifier for each distinct system
- The location of permanent fixtures (e.g.: water district valves, gates, wells, canals, reservoirs, etc.)
- The ranches, lots, or fields served by each distinct system
- The direction(s) of water flow in each system

Determine how water from each distinct system will be used in production.

Categorize each distinct system as Type A or B.
Consider the sources, conveyance, and delivery for each distinct system and assess the hazards related to each, as you determine the overall system type. See Appendix A ("How do I know which type of ag water system I have?" and Table 1) for guidance.
What do I need to do?
Test any closed water sources you intend to use for overhead applications (e.g.: irrigation, pesticide spray, ice control, etc.) near harvest and which you believe are of Type A quality for generic E. coli. If tests show that they meet the acceptance criteria, the sources become certified as Type A.

When and how often?
Complete the baseline microbial assessment at any point before the first 21-day-to-scheduled-harvest window of the season. We recommend that you complete this 30-35 days before scheduled harvest so you have time to receive test results and troubleshoot if needed.

FREQUENCY: once per source

How to Certify a Type A Water Source:

Public + Private Municipal Sources
Certify municipal water sources as Type A using a Certificate of Analysis (COA) or annual water report that shows that generic E. coli levels fall within the Type A acceptance criteria.

Wells + Tertiary Treated Water Sources

Using Historical Data
Use the last five chronological water tests. The most recent test must have been conducted within six months of the beginning of the season.

Acceptance Criteria:
There must be no detectable generic E. coli in at least 4 of 5 samples. One sample can have up to 10 MPN of generic E. coli.

Using New Data
Collect three 100 milliliter samples from the water source and test for generic E. coli. Wait at least one week and repeat with another three samples.

Acceptance Criteria
There must be no detectable generic E. coli in at least 5 of 6 samples. One sample can have up to 10 MPN of generic E. coli.
What if the source samples do not meet the Type A Acceptance Criteria?

Type B water can be used for any application up to the 21-day-to-scheduled-harvest window and for non-foliar irrigation at any time.

Do not use this water for overhead applications within 21 days of scheduled harvest.

Assess the water source (conduct an agricultural water system assessment) to determine the cause of the problem. (See Appendix A)

If the water meets the Type B acceptance criteria, you can still use it as a type B water source for overhead irrigation up to the 21-days-to-scheduled-harvest window.

If you can’t identify or correct the issue, this is considered a Type B source and must be treated before using for overhead applications within 21 days of scheduled harvest.
What do I need to do?
Test any closed water systems you intend to use for overhead irrigation near harvest and which you believe are of Type A quality for generic *E. coli* at the furthest point in the delivery system. If tests show that they meet the acceptance criteria, the system becomes certified as Type A.

When and how often?
Complete the initial microbial water quality assessment at any point before the first 21-day-to-scheduled-harvest window of the season or if there is a material change to the system. A material change is one that may lead to degradation of the water quality.

We recommend that you complete the baseline and initial microbial system assessments 30-35 days before scheduled harvest so you have time to receive test results and troubleshoot if needed.

**FREQUENCY:** once per unique system per season

**How to Certify a Type A Water System:**

For any Type A water source, collect three 100 milliliter samples from the furthest point of the distribution system (i.e.: last sprinkler head) and test for generic *E. coli*.

**Acceptance Criteria**

There must be no detectable generic *E. coli* in at least 2 of 3 samples. One sample can have up to 10 MPN of generic *E. coli*.

What if the water quality is degraded by the distribution system?
If the water quality is degraded and does not meet Type A acceptance criteria at the end of the distribution system, do not use this water for overhead applications within 21 days of scheduled harvest.

Assess the water system (conduct an agricultural water system assessment--see Appendix A) to determine the cause of the problem.
If the water meets the Type B acceptance criteria, you can still use it as a type B water source for overhead irrigation up to the 21-days-to-scheduled-harvest window.

If you can’t identify or correct the issue, this is considered a Type B source and must be treated before using for overhead applications within 21 days of scheduled harvest.

Type B water can be used for any application **up to** the 21-day-to-scheduled-harvest window and for non-foliar irrigation at any time.
What do I need to do?
Test any water systems you have certified as Type A for generic \textit{E. coli} at the furthest point in the delivery system. If tests show that they meet the acceptance criteria, the systems are then verified as Type A.

When and how often?
Complete routine verification at some point after completing the Initial Microbial Water Quality Assessment.

\textbf{FREQUENCY: once per unique system per season}

How to Verify a Type A Water System:

For any certified Type A water system, collect three 100 milliliter samples from the furthest point of the distribution system (i.e.: last sprinkler head) and test for generic \textit{E. coli}.

\textbf{Acceptance Criteria}

There must be no detectable generic \textit{E. coli} in at least 2 of 3 samples. One sample can have up to 10 MPN of generic \textit{E. coli}.

What if the water quality is degraded by the distribution system?

If the water quality is degraded and does not meet Type A acceptance criteria at the end of the distribution system, do not use this water for overhead applications within 21 days of scheduled harvest.

Assess the water system (conduct an agricultural water system assessment—see Appendix A) to determine the cause of the problem.

If the water meets the Type B acceptance criteria, you can still use it as a type B water source for overhead irrigation up to the 21-days-to-scheduled-harvest window or for non-foliar irrigation at any time.

If you can’t identify or correct the issue, this is considered a Type B system and the water must be treated before using in overhead applications within 21 days of scheduled harvest.
What if I performed my routine verification testing during the 21-day-to-scheduled-harvest window, but the water did not meet Type A criteria?

Perform a Level 1 Assessment (Table 2F in the Metrics):

During the next irrigation event, collect and test five 100 milliliter samples from any point in the delivery system. One of the samples must be from the furthest point of the delivery system (i.e.: last sprinkler head).

Test the samples and confirm that they meet the Level 1 Acceptance Criteria (at left).

If the water meets the Level 1 Assessment acceptance criteria, you may continue using the system as Type A.

What if the water does not meet the Level 1 Assessment acceptance criteria?

If the water does not meet the Level 1 Assessment acceptance criteria, test the product for STECs (including *E. Coli* O157:H7) and *Salmonella* before harvesting. If product tests positive for any of these human pathogens, do not harvest it for the fresh market.
What do I need to do?

Before the 21-days-to-scheduled-harvest window, set up your water treatment system(s). Collect water samples from the manufacturer’s recommended location and test to make sure they meet the manufacturer’s parameters for a system that is working correctly. If not, adjust the system until they do, then create an SOP for setup.

When and how often?

Complete the initial irrigation water treatment assessment during an irrigation event before the first 21-day-to-scheduled-harvest window of the season and again if there is a material change to the system. A material change is one that may lead to degradation of the water quality.

We recommend that you complete the initial irrigation water treatment assessment for each system at least 30-35 days before scheduled harvest so you have time to troubleshoot if needed.

FREQUENCY: once per unique system per season

How to Set Up Your Water Treatment System:

Before the 21-days-to-scheduled-harvest window, set up your water treatment system and allow it to stabilize (e.g.: pressure, flow rates). The system must be stabilized before you take samples to make sure that the treatment has made it through the system and that samples are representative of treated water.

Collect a 100 milliliter water sample from the manufacturer or label’s recommended location in the distribution system (usually either the first or last sprinkler head). Wait at least 20 minutes, and then take another sample. Repeat until you have three samples.

Acceptance Criteria

Test the samples for the parameters suggested by your treatment system’s manufacturer or other applicable resource to make sure that the system is working as it should. The Metrics suggest a few parameters to start with. Check the product label or manufacturer’s instructions to determine which additional values to test for.
What if the water sample levels are not where they should be?

It may take a few rounds of troubleshooting and assessment before you find the correct settings for your water treatment systems. Start your assessments early so everything is ready to go by the time you need to start using treated water.

If your water samples do not match the manufacturer or product label’s reference ranges, you may need to adjust your system settings.

Refer to the manufacturer’s instructions or contact the company for help.

Make the necessary adjustments and repeat the treatment system assessment until the water sample values are correct.

NEXT STEP: Create an SOP

Once you have found the correct settings for your water treatment systems, create an SOP for setting up and operating each system. Include enough detail for another person to easily operate the system, such as:

- Location and name of the system
- Supplies needed for setup
- Step-by-step instructions for setup and monitoring
- Required records
- Corrective actions

Your SOPs must also establish a frequency for monitoring the treatment system during each irrigation event to ensure that they are working correctly at all times.

You may choose to conduct documented monitoring events a given number of times (e.g.: once or twice per irrigation event), or at given time intervals (e.g.: every hour while irrigating). Whatever frequency you choose must be enough to ensure that the treated water is consistently safe and consistently meets the microbial quality required by the LGMA Metrics for its intended use.

A monitoring event may include completing a checklist for system parameters, testing sanitizer levels in treated water, or visual inspections. Each monitoring activity must be documented.

Your SOP should list activities that should be completed during a monitoring event as well as specific parameters to monitor and desired values, ranges, or observations.
What do I need to do?

After setting up your treatment system (see B to A Step 1), collect a sample of untreated water and test for total coliforms. Then collect three treated water samples from the end of the distribution system and test for generic *E. coli*. If they meet the acceptance criteria, the system becomes certified as Type B to A.

When and how often?

Complete the initial microbial water treatment assessment during an irrigation event before the first 21-day-to-scheduled-harvest window of the season and if there is a material change to the system. A material change is one that may lead to degradation of the water quality.

We recommend that you complete the initial irrigation water treatment assessment for each distinct system at least 30–35 days before scheduled harvest so you have time to troubleshoot if needed.

**FREQUENCY:** once per unique system per season

How to Certify a Type B to A Treatment System:

After setting up your water treatment system and verifying that it works correctly (B to A Step 1), collect a 100 milliliter sample of untreated water from your source.

With the treatment system running, collect a 100 milliliter sample of water from the end of the distribution system (i.e.: last sprinkler head). Wait at least 20 minutes, then take another sample. Repeat until you have three samples of treated water.

Test the untreated sample for Total Coliforms and the treated samples for generic *E. Coli* and Total Coliforms.

**Acceptance Criteria - *E. Coli***

There must be no detectable generic *E. coli* in at least 2 of 3 samples. One sample can have up to 10 MPN of generic *E. coli*.
Data Monitoring Criteria - Total Coliforms

All three treated water samples should have 99 MPN or less of Total Coliforms or an adequate log reduction from the pre-treatment sample (see Appendix A for the log reduction protocol). If the water does not meet the Total Coliform requirement but meets the generic E. coli acceptance criteria, you may still use it as Type B to A water. However, you must perform Root Cause Analysis (see Appendix R) to find and fix the problem.

What if the water does not meet the Generic E. coli acceptance criteria?

Do not use this water for overhead applications within 21 days of scheduled harvest.

Conduct an agricultural water system assessment to determine the cause of the problem. See the Agricultural Water System Assessment form for guidance.

If the water meets the Type B acceptance criteria, you can still use it as a type B water source for overhead irrigation up to the 21-days-to-scheduled-harvest window or for non-foliar irrigation at any time.

If you can’t identify or correct the issue, this is considered a Type B system. Continue assessing the source and system and adjusting the treatment so that your treated water meets the Type A acceptance criteria for generic E. coli.
STEP 3

Water Treatment System Monitoring

What do I need to do?
Monitor any water treatment systems that are in use to make sure they meet the manufacturer’s parameters for a system that is working correctly. Follow the SOPs you created during the Initial Irrigation Water Treatment Assessment (pg BA1-2).

When and how often?
Monitor the system whenever you irrigate with treated water, whether within or outside of the 21-days-to-scheduled-harvest window. Your SOPs should describe the frequency and monitoring requirements.

FREQUENCY: monitor each unique system at the frequency established by your SOP(s), but at least once per irrigation event.

How to Monitor Your Water Treatment System:

Make sure your system is running and has stabilized (e.g.: pressure, flow rates).

Follow the SOPs you created during the Initial Irrigation Water Treatment Assessment (pg BA1-2) to make sure that your system is working as it should. These SOPs should outline specific activities to conduct and parameters to monitor, as well as values, ranges, or observations that indicate that the system is working properly.

Document the monitoring event(s) as laid out in the SOPs.

What if the system is not working correctly?
If your system parameters do not match the desired specifications outlined in your SOPs, complete the corrective actions outlined in the SOPs to bring the system back into compliance. Don't forget to document them!
What if the system is not working correctly? (cont.)

After completing the corrective actions, collect three 100 milliliter samples from the furthest point in the distribution system. Test them for generic *E. coli* and Total Coliforms.

If the water meets Type A acceptance criteria, no further action is needed and you may continue using the system as Type B to A.

If the samples do not meet the acceptance criteria, the water that was used was Type B.

### Type A Acceptance Criteria

There must be no detectable generic *E. coli* in at least 2 of 3 samples. One sample can have up to 10 MPN of generic *E. coli*.

What if Type B quality water contacted the edible portion of the crop within 21 days of scheduled harvest?

If the water contacted the edible portion of the crop within 21 days of scheduled harvest, test the product for STECs (including *E. Coli O157:H7*) and *Salmonella* before harvesting. If product tests positive for any of these human pathogens, do not harvest it for the fresh market.

If product tests positive for human pathogens, do not harvest for the fresh market.
Routine Verification of Microbial Water Quality

**What do I need to do?**

Test your treatment system monthly when it is in use by collecting three samples of treated water from the end of the distribution system and testing for generic *E. coli* and Total Coliforms.

When irrigating the first crop of the season that falls within the "21-days-to-scheduled-harvest" window, collect and test three samples from the end of your delivery system. Wait at least three days and repeat with another three samples.

**When and how often?**

Test the microbial quality of your treated water once a month throughout the season and twice during the first "21-days-to-scheduled-harvest" window of the season.

**FREQUENCY:** test each unique system monthly and conduct a set of two tests once per unique system per season.

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**How to Verify the Microbial Quality of Type B to A Treated Water:**

Each month you use your water treatment system, collect three 100 milliliter samples of treated water from the end of the distribution system (i.e.: last sprinkler head) or the manufacturer’s recommended location. Test samples for generic *E. coli* and Total Coliforms.

During the first irrigation event of the season that falls within the "21-days-to-scheduled-harvest" window, collect and test one set of three samples for generic *E. coli* and Total Coliforms. Wait at least three days, then collect and test three more samples.

**Acceptance Criteria - *E. Coli***

For each sample set, there must be no detectable generic *E. coli* in at least 2 of 3 samples. One sample can have up to 10 MPN of generic *E. coli.*
Perform a Level 1 Assessment (Table 2F in the Metrics):

During the next irrigation event, collect and test five 100 milliliter samples from any point in the delivery system. One of the samples must be from the furthest point of the delivery system (i.e.: last sprinkler head).

Test the samples and confirm that they meet the Level 1 Acceptance Criteria (at left).

If the water meets the Level 1 Assessment acceptance criteria, you may continue using the system as Type A.

What if I performed routine verification testing during the "21-days-to-scheduled-harvest" window, but the water did not meet the generic *E. coli* acceptance criteria?

**Level 1 Assessment Acceptance Criteria**

There must be no detectable generic *E. coli* in at least 4 of 5 samples. One sample can have up to 10 MPN of generic *E. coli*.

Perform a Level 1 Assessment (Table 2F in the Metrics):

During the next irrigation event, collect and test five 100 milliliter samples from any point in the delivery system. One of the samples must be from the furthest point of the delivery system (i.e.: last sprinkler head).

Test the samples and confirm that they meet the Level 1 Acceptance Criteria (at left).

If the water meets the Level 1 Assessment acceptance criteria, you may continue using the system as Type A.

What if the water does not meet the Level 1 Assessment acceptance criteria?

If the water does not meet the Level 1 Assessment acceptance criteria, test the product for STECs (including *E. Coli* O157:H7 and *Salmonella*) before harvesting. If product tests positive for any of these human pathogens, do not harvest it for the fresh market.

If product tests positive for human pathogens, do not harvest for the fresh market.