GLOBALG.A.P. US National Technical Working Group (NTWG) Topic Guideline:

Preharvest Water Risk Assessment

Introduction

The **US National Technical Working Group (NTWG)** has developed this guideline to assist producers in meeting the IFA and HPSS principles and criteria. The content and examples illustrate the general approach to developing a microbiological risk assessment for preharvest water that aligns with GLOBALG.A.P. standards. Producers should also address chemical and physical risks, although those risks are not covered in this guideline. Producers should develop/utilize specific procedures, documents, and records that are relevant to their own operations.

What is a Water Risk Assessment?

The water risk assessment is the process of identifying water-related hazards, evaluating the likelihood and severity of an adverse event, and developing the mitigation procedures needed to keep water and water-distribution systems fit for their use. It is a written, repeatable process — not a one-time judgment.

Why do a Water Risk Assessment?

➤ Provides insight and actionable steps to take to minimize the risk of contamination events from water
➤ Creates a structured look at every aspect of water on the operation, from incoming source to outgoing tail-water, and any change that could affect risk
➤ A documented assessment also supports and defends the grower's decision-making in audits and investigations

When to do a Water Risk Assessment?

Conduct the water risk assessment at least annually, before the start of the growing season, and again whenever risks might change:

- ➤ adverse events (flood, hurricane, contamination)
- ➤ new commodities
- ➤ new sites
- ➤ new water sources
- ➤ new application methods,
- ➤ changes in upstream land use
- ➤ after maintenance such as cleaning or dredging, or treatment-system changes

➤ Producers who are subject to the requirements in the Produce Safety Rule are required to conduct agricultural water assessments once annually, and whenever a significant change occurs that increases the likelihood that a known or reasonably foreseeable hazard will be introduced into or onto produce or food contact surfaces.
➤The FDA has developed an Agricultural Water Assessment Builder. More information, along with access to the Builder, is available here: https://www.fda.gov/food/food-safety-modernization-act-fsma/agricultural-water-assessment-builder

What about Water Sampling?

Testing is monitoring, not mitigation

➤ Water sampling is part of monitoring – it tells the producer whether the assessment and controls are working. It does not, on its own, reduce risk
➤ Mitigation comes from controls: extending die-off intervals, treating the water, substituting the source, changing the application mehtod, or maintaining the distribution system

Action Steps

STEP 01

➤ **Identify the parts of your water system**

Map each distinct water path on the operation. For each path, document:

- Source: where the water comes from — well, canal, river, pond, reservoir, municipal, captured rainwater, reused tail-water, recirculated, hydroponic
- Conveyance: how it arrives — open canal, lined ditch, closed piping, tank, pump, wellhead
- Application method: drip, furrow, flood, microsprinkler, overhead, fan jet
- Crop: harvestable part of the crop, contact with water, eaten without cooking
- Crop characteristics: surface properties (netted, rough), susceptibility to bruising, infiltration or internalization

Note: Water that may come into contact with product, even incidentally, during or after harvest shall be also considered for the postharvest water risk assessment.

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Action Steps

STEP 02

➤ Identify microbiological, chemical, and physical hazards for each part of the system

For each source, distribution segment, and application path, ask whether microbiological (M), chemical (C), and physical (P) hazards are present. Consider:

- Animal access to the source or distribution system: livestock, wildlife, pests
- Upstream or adjacent users and topography: animal agriculture, industrial discharges, municipal effluent, neighboring farms with different practices, hills with surface water storage
- Lack of control over the source: shared canal, public waterway
- Degree of physical protection: open vs. covered; lined vs. unlined; screened intakes
- History of testing: past positives, trends, exceedances, consistency of results, or lack of history
- Incidents in the surrounding area: neighbor outbreaks, regional advisories, recalls
- Prior outbreaks linked to this commodity or region: e.g., *Salmonella* on tomatoes, *Cyclospora* on sweet peas
- Environmental conditions and recent weather: heavy rain, flooding, hurricanes, drought concentrating contaminants
- Timing of irigation, other applications: crop development stage, water applications prior to harvest including irrigation, fertilizer, plant protection

Note: Once a hazard is identified as credible at a given part of the system, score its likelihood and severity using the scales in Annex 1: Risk Framework. Repeat for each hazard category at each part of the system.

Action Steps

STEP 03

➤ Score and rank, then choose mitigation

Multiply likelihood × severity for each hazard line item to get the score and approximate risk level

- Set a clear action threshold: a common practice is that any risk at Medium or above must have at least one documented mitigation procedure. Mitigation options are detailed in "Mitigation Strategies"

STEP 04

➤ Monitor

Monitoring confirms that the assessment and the controls are still appropriate. Required monitoring includes:

- Review any locally available agency or watershed water-quality data
- Water-system assessment / inspection at least once per year, plus inspection of in-use equipment and any abnormal situation (puddles, sudden spikes in use, visible debris)
- Water sampling — frequency and analysis based on risk

STEP 05

➤ Document

Maintain records that demonstrate the program is operating. At a minimum:

- Irrigation logs showing timing and duration of application, especially the last application before harvest, specify if there are different water sources or irrigation methods
- Pesticide application records with timing of last application, block/field/orchard/ranch
- Harvest records linking each lot to the appropriate /block/ranch and the time between last water use and harvest
- All water sample results with timing, location, method, and lab accreditation
- Mitigation SOPs, treatment validation, and corrective-action records, where needed

Water Testing Frequency Based on Risk

Sampling frequency is based on the risk level. The minimum required by most certification standards is one sample per year for water that contacts the harvestable part of the crop; that is the floor for low-risk situations, not a target. Commodity-specific schemes (e.g., LGMA for leafy greens) may require more frequent testing or specific analysis — **always default to the most stringent applicable requirement**. Where past results show exceedances, high variability in test results, or where the assessment lands in High, consider an increase in frequency.

Risk Level	Minimum Sampling Frequncy	Analysis	Trigger Re-Sampling When...
➤ **LOW**	May not be needed or one sample per year	Generic *E. coli*	Change in source, well work, nearby land-use change, or flood event
➤ **MEDIUM**	Three samples during use, for example, initial season use, during harvest, during peaks	Generic *E. coli*	Heavy rain (≥1"), turbidity spikes, livestock movement nearby, treatment system alarm, or any single sample exceeding an action limit
➤ **HIGH**	At least monthly, during use	Generic *E. coli*	Controlled environmental agriculture production with leafy greens, until baseline is established; visible contamination event; treatment failure; or upstream incident, until issue normalizes

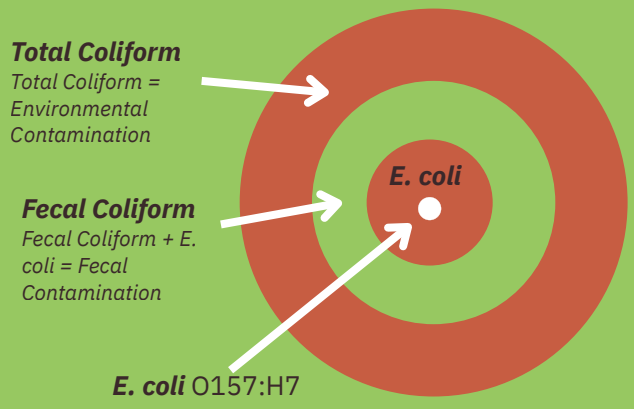
➤ **Note:** the analyzed organism or indicator shall be region, crop, context specific, such as *Salmonella,* etc.

What to test for?

Generally, testing for the presence of generic *E. coli* will provide the best indicator for evidence of fecal contamination in water. Other indicators may vary, depending on the environmental conditions and adjacent risks.

Total coliform bacteria	Found in the environment (e.g., soil or vegetation). Results indicate there may be a way for pathogens to enter the system.
Fecal coliform bacteria	Sub-group of total coliform bacteria. Often indicates recent fecal contamination, meaning that there is a greater risk that pathogens are present.
Escherichia coli (E. coli)	Sub-group of the fecal coliform group. Some strains can cause illness. The presence of *E. coli* almost always indicates recent fecal contamination, meaning there is a greater risk that pathogens are present.

Total Coliform, Fecal Coliform and E. coli



A note about E. coli: Most outbreaks have been caused by a specific strain of *E. coli* bacteria known as *E. coli* O157:H7. When a water sample is reported as *"E. coli* present," it does not mean that *E. coli* O157:H7 is present and in fact, it is probably not present. However, it does indicate recent fecal contamination.

Mitigation Strategies

When a hazard scores at or above the action threshold (typically medium), one or more mitigation strategies should be implemented and documented. Strategies move down the list when prior options are either not feasible or insufficient — the most reliable controls are those that eliminate the exposure pathway rather than rely on time or treatment alone.

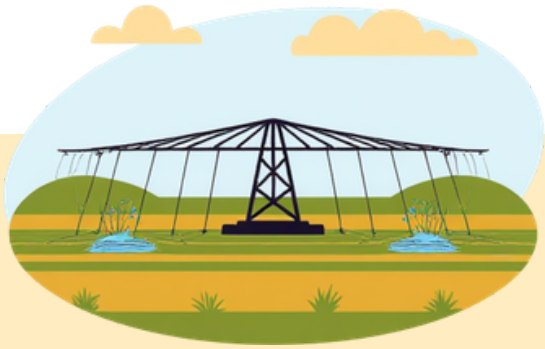
Strategy	How It Works	When to Use It
Microbial die-off window	Extend the interval between the last water application and harvest so that sunlight, desiccation, and time reduce microbial loads on the crop. Use a documented calculator (e.g., the University of Arizona die-off calculator) and record the interval for every block and harvest	First-line control when overhead or contact irrigation is used in-season with a water source that is not consistently below action thresholds
Water treatment	Apply a validated treatment such as chlorine, peracetic acid, chlorine dioxide, ozone, or UV. Follow label instructions, validate treatment for the contact time and water quality of the operation, and monitor continuously (e.g., chlorine residual, ORP, UV intensity)	When the source must be used but cannot meet thresholds on its own, and especially for post-harvest, food-contact, and reused water
Source substitution	Switch to a lower-risk source (e.g., municipal or deep-well water) or change which source is used at high-risk timings (e.g., use canal for pre-plant and municipal for last application)	When treatment is infeasible, fails repeatedly, or is uneconomic; or when source quality is trending in the wrong direction
Change application method	Redesign the irrigation system so the water no longer contacts the edible portion — for example, replace overhead with subsurface drip, or use micro-sprinklers oriented away from the canopy	When source risk cannot be eliminated and treatment is not adequate; engineering controls remove the exposure pathway
Eliminate / discontinue use	Stop using the source for the high-risk application. For pesticide carrier water that contacts the edible portion, switch to a potable carrier or reformulate the application	When no other mitigation reduces risk to an acceptable band, or when the cost of mitigation exceeds the value of continued use
System maintenance & protection	Fence off intakes, screen and filter inlets, repair canal/pond banks, exclude wildlife and livestock, clean reservoirs on a schedule, and inspect distribution lines for breaks and back-siphon risks	Always; these controls reduce likelihood across all categories and are required regardless of risk band

Common first move: microbial die-off interval

➤ For overhead or other contact applications using surface water, the most common mitigation is increasing the window between the last application and harvest so microbial loads decline by sunlight, desiccation, and time. Use a published calculator *(such as the University of Arizona online tool at **https://agwater.arizona.edu/onlinecalc/**)* and record the interval for every block.

Records to Maintain

- **Written water risk assessment:** one per source × use × method combination
- **Water system map:** sources, intakes, storage, treatment, distribution, and points of use
- **All laboratory reports** and accreditation information
- **Treatment validation and verification logs** (e.g., chlorine residual, UV intensity, filter pressure differentials)
- **Irrigation,** pesticide-application, and harvest records that link water use to lot information
- **Corrective action** records for every exceedance, contamination event, or system failure
- **Equipment maintenance:** well maintenance, drip tape cleaning
- **Training records** for staff who collect samples or operate treatment equipment
- **Annual review record** signed by the food-safety lead and owner/manager



Annual Review and Continuious Improvement

Review the entire assessment at least:

- Once per year before the start of the growing season
- Any time a triggering event occurs

The annual review should compare the prior year's lab results, confirm that controls remained effective, document any reclassifications, and update the sampling schedule accordingly.

ANNEX 1: Quantitative Risk Framework Example

Every water-related risk is rated on two 5-point scales — likelihood and severity — and the two scores are multiplied to produce a single risk score between 1 and 25. The score is mapped to one of three risk levels (low, medium, high), each of which carries a defined required action and a defined sampling frequency.

Likelihood Scale:

Score	Rating	Descrption	Typical Frequency Indicator
1	**Rare**	Hazard occurrence is highly improbable under normal operating conditions	May occur only in exceptional circumstances; less than once in 5+ years
2	**Unlikely**	Hazard could occur but is not expected during a typical season	Approximately once every 2-5 years
3	**Possible**	Hazard might occur occasionally; conditions for occurrence are present	Approximately once per year or once per growing season
4	**Likely**	Hazard will probably occur in most circumstances	Several times per year or multiple times per growing season
5	**Almost Certain**	Hazard is expected to occur regularly; recurring contamination pathway	Monthly or more often; ongoing exposure

Severity Scale:

Score	Rating	Descrption	Public Health & Ops Impact
1	**Insignificant**	No measurable contamination of edible product; no public health concern	No illness expected; no recall risk; minor housekeeping action
2	**Minor**	Limited microbial or chemical presence; below action thresholds	Localized quality issue; treatable on-farm; minimal cost
3	**Moderate**	Contamination approaches or briefly exceeds action thresholds	Possible localized illness; corrective action required; lot-level impact
4	**Major**	Confirmed contamination of edible product or water touching edible product	Outbreak potential; product hold or recall; regulatory engagement
5	**Catastrophic**	Severe contamination with known pathogens or toxic chemicals at unsafe levels	Multi-state outbreak risk; full recall; potential business closure

ANNEX 1: Quantitative Risk Framework Example

Find the row matching your likelihood score and the column matching your severity score. The cell value is the risk score; the color identifies the risk level.

Risk Matrix (Likelihood × Severity)

Likelihood ↓ / Severity →	1 Insignificant	2 Minor	3 Moderate	4 Major	5 Significant
5 Almost Certain	5	10	15	20	25
4 Likely	4	8	12	16	20
3 Possible	3	6	9	12	15
2 Unlikely	2	4	6	8	10
1 Rare	1	2	3	4	5

Risk Levels and Example Actions

Risk Level	Score Range	Interpretation	Example Actions
LOW	1- 4	Acceptable risk; routine management is sufficient	Maintain existing controls; document and review annually
MEDIUM	5 - 12	Tolerable risk; controls required and must be verified; trigger mitigation procedures	Implement additional controls, increase monitoring, document corrective actions
HIGH	13 - 25	Unacceptable; immediate action required to reduce exposure or substitute source	Cease use until mitigated; treat, substitute, or eliminate the hazard pathway

A matrix is a tool, not a substitute for judgment.

Numerical scores help a producer take the guesswork out of prioritizing issues. Risks are continuous and change over time, and qualitative factors - operator experience, local history, commodity behavior, weather, and fruit development stage - must be weighed alongside the score. The matrix supports expert judgment; it does not replace it.

ANNEX 2: Qualitative Risk Examples

The following are examples, not absolute classifications. The actual score depends on the specific source, use, and application method on the farm and on local evidence (lab results, land-use surveys, treatment validation). Always consider qualitative factors: timing, crop development stage, weather (temperature, humidity, UV), and whether the commodity is rarely consumed raw.

Water Sources

Risk Level	Example	Why it Falls Here
HIGH	Open surface water (rivers, lakes, reservoirs, irrigation canals) — especially downstream of livestock operations, wildlife concentrations, or untreated municipal discharges	Direct exposure to fecal contamination, runoff, and human waste; high microbial variability; little or no control over upstream users
HIGH	Untreated reclaimed wastewater or tailwater reuse used on edible portions	May contain pathogens, chemicals, and pharmaceutical residues unless validated treatment is documented
MEDIUM	Ground water from shallow wells (<50 ft) or wells with compromised casings; covered reservoirs that occasionally receive surface inflow	Indirect contamination pathway possible via shallow groundwater, well-head intrusion, or storm events
MEDIUM	Surface water that has been treated and monitored (e.g., chlorination, UV) on-farm to a defined target	Residual variability and treatment failure remain credible failure modes
LOW	Municipal (city) water meeting Safe Drinking Water Act potable standards	Treated, monitored, and regulated upstream; verified by utility reports
LOW	Properly constructed deep wells (>100 ft), sealed casing, protected wellhead, no surface intrusion history	Confined aquifer; documented isolation from surface contamination

ANNEX 2: Qualitative Risk Examples

Water Uses

Risk Level	Example	Why it Falls Here
HIGH	Product food contact just before or at harvest, handwash water, equipment and food-contact-surface cleaning	Direct contact with the harvested product; pathogen cross-contamination can affect entire lots
HIGH	Water used to mix or apply pesticides, fertilizers, or foliar sprays that contact the edible portion close to harvest	Contaminants are delivered directly to product surfaces with little or no die-off time
MEDIUM	Overhead irrigation applied during fruit/leaf development but with a defined preharvest interval that allows microbial die-off	Contact occurs, but time-to-harvest reduces pathogen survival; relies on die-off assumptions
MEDIUM	Frost protection and overhead crop cooling that intermittently wet the canopy and edible portion (e.g., apple cooling sprays)	Intermittent contact under controlled conditions; small but real route of exposure
LOW	Pre-plant land preparation and early-season irrigation before any edible portion has developed	Long interval before harvest and no direct product contact at time of use
LOW	Water used only for non-food-contact surfaces, dust suppression on roads with no probable product contact, or equipment areas isolated from harvested product	No direct pathway to the edible portion of the crop

Application Methods

Risk Level	Example	Why it Falls Here
HIGH	Direct-contact application: overhead spray bars, overhead irrigation, traveling guns, aerial application, and spray dilutions on crops eaten raw, especially close to harvest	Maximum surface wetting of the edible portion; aerosol drift extends exposure
HIGH	Flood or furrow irrigation where water pools against or splashes onto low-growing edible portions (e.g., strawberries, melons)	Edible portion makes contact with potentially contaminated surface water and soil slurry
MEDIUM	Possible product contact irrigation: fan jets, microsprinklers, or low-elevation spray that may touch hanging fruit or lower canopy	Limited but possible contact with edible portion; design and orientation determine whether contact actually occurs
MEDIUM	Surface drip with frequent line damage, emitter spray, or runoff that reaches the edible portion	Intended as no-contact, but failure modes routinely produce contact events
LOW	No product contact irrigation: drip irrigation delivering water to the root zone	No direct contact with the edible portion under normal operation
LOW	Subsurface drip (SDI) with buried, intact lines, or targeted basal hand watering directed at soil only	Application path is engineered away from the edible surface

References

- U.S. Food and Drug Administration. 21 CFR Part 112 (Produce Safety Rule), Subpart E — Agricultural Water. **FDA Subpart E reference**
- University of Arizona — Agricultural Water Microbial Die-off Calculator – **agwater.arizona.edu/onlinecalc**
- Virginia Cooperative Extension. FST-428: On-farm risk assessment for agricultural water – **pubs.ext.vt.edu/FST-428**
- Produce Safety Alliance. Grower Training Curriculum, Module 5: Agricultural Water – **Revised Module 5-1 Handout**
- International Fresh Produce Association (IFPA) – **Water risk assessment guidance for fresh produce**
- California Leafy Greens Marketing Agreement (LGMA). Commodity – **Specific Food Safety Guidelines**
- ISO 31000 — Risk management — **Guidelines (general risk-rating methodology)**

Examples

➤ Example Template

Site Name:	
Crop(s):	
Water Source Description: *(referenced in the site map)*	

Source Type	☐	Surface	☐	Ground	☐ Municipal	Specify:
Water Treatment	☐	No	☐	Yes	Specify:	
Water Use Points						

1. **Risk Identification and Assessment (based on existing water testing results - attached)**

Risk Category	Description	Risk Level (Low/Medium/High)	Control Measures
Physical contamination			
Microbial contamination			
Chemical contamination			

2. **Water Testing Plan**

Parameter	Acceptable Threshold	Frequency	Responsible Party	Method/ Standard

3. **Risk Summary Conclusion**

Overall Risk Level:	
Water Use: *(including considerations on the timing of water use, product characteristics, and product contact)*	

Performed by *(Name)* **:** **Position:** **Date** *(MM/DD/YYY)***:**

Examples

➤ Completed Example Template #1

Site Name:	The Corn Maze
Crop(s):	Butternut Squash, red and green kobocha, sugar pumpkin
Water Source Description: *(referenced in the site map)*	Pond

Source Type	X	Surface		Ground		Municipal	Specify:
Water Treatment	X	No		Yes	Specify: N/A	
Water Use Points	Ferti-irrigation system, overhea irrigation, and foliar applications					

1. **Risk Identification and Assessment (based on existing water testing results - attached)**

Risk Category	Description	Risk Level (Low/Medium/High)	Control Measures
Physical contamination	Plastics, debris, organic waste, such as algae bloom	Medium	**a.** The filtering system protects the crops from physical contamination. **b.** Monitoring and inspection of the pond and the irrigation system. **d.** Harvesting excessive weeds and removing accumulated sediments
Microbial contamination	Vegetative bacteria, such as pathogenic E. coli; parasites such as Cyclospora; and viruses such as Norovirus can be introduced from runoffs	Low, considering these products are rarely consumed raw	**a.** Vegetated buffers to prevent runoffs. **b.** Monitor presence of wildlife. **c.** Pond water is not allowed for use on the sanitation of food contact surfaces or handwashing, even with treatment
Chemical contamination	Agricultural runoff (pesticides, fertilizers)	Medium	**a.** Strict control of fertilizer and plant protection products (pesticides) storage and use. **b.** Disposal of agrochemicals tank washings and leftovers in a way that prevents water source contamination

2. **Water Testing Plan**

Parameter	Acceptable Threshold	Frequency	Responsible Party	Method/ Standard
Not required by the plan				

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Examples

3. **Risk Summary Conclusion**

Overall Risk Level:	Low. Water testing is not required given that this is a product rarely consumed raw, as long as control measures are in place. This evaluation only considers water used in the ferti-irrigation system, overhead irrigation, and foliar applications
Water Use: *(including considerations on the timing of water use, product characteristics, and product contact)*	Suitable for pre-harvest use, even in contact with the product, with routine monitoring and preventive controls in place. Not authorized for handwashing or sanitation of product-contact surfaces

Performed by *(Name)* **:** Maria Turnstole | **Position:** Manager of QC | **Date** *(MM/DD/YYY)*: 07/18/2025

➤ Completed Example Template #2

Site Name:	Blue Ranch
Crop(s):	Blueberry
Water Source Description: *(referenced in the site map)*	Canal

Source Type	X	Surface		Ground		Municipal	Specify:
Water Treatment	X	No		Yes	Specify: N/A		
Water Use Points	Ferti-irrigation system, overhea irrigation, and foliar applications						

1. **Risk Identification and Assessment (based on existing water testing results - attached)**

Risk Category	Description	Risk Level (Low/Medium/High)	Control Measures
Physical contamination	Type of physical contamination in the water source: plastics, debris, organic waste	Low	**a.** The filtering system protects the crop from physical contamination. **b.** Monitoring and inspection of the system
Microbial contamination	Type of microbial contamination in the water source: pathogenic E. coli, and other vegetative bacteria from upstream users, human and animal. Water is suitable for use based on the test results	Medium	**a.** Water testing, see section 2. **b.** The Water District has established measures to prevent contamination from humans or livestock, and these controls are strictly implemented onsite. **c.** Canal water is not allowed for use on the sanitation of food contact surfaces or handwashing, even with treatment

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Examples

Risk Category	**Description**	**Risk Level** (Low/Medium/High)	**Control Measures**
Chemical contamination	Chemicals of concern hadn't been detected. Water District tests attached	Low	Continually monitor water district results and alerts

2. **Water Testing Plan**

Parameter	**Acceptable Threshold**	**Frequency**	**Responsible Party**	**Method/ Standard**
E. coli	≤126 MPN	4 / year Pre-harvest, during harvest	Food Safety Representative	Colilert (AOAC Method 991.15)

3. **Risk Summary Conclusion**

Overall Risk Level:	Medium, due to the use of surface water and the existing testing results
Water Use: *(including considerations on the timing of water use, product characteristics, and product contact)*	Suitable for foliar applications but not for handwashing or product-contact surfaces, with routine verification and preventive controls in place

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Position: Food Safety Manager

Date *(MM/DD/YYY)*: 09/22/2022

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GLOBALG.A.P. US National Technical Working Group (NTWG)
Topic Guideline: **Preharvest Water Risk Assessment**

National technical working groups (NTWGs) consist of GLOBALG.A.P. Community Members, qualified experts, and relevant stakeholders in a specific country. Participants may include producer organizations, certification bodies (CBs), retailers, supply chain members, and more.

Together, **NTWG** members work to identify adaptation and implementation challenges based on local legislation or structural conditions. They then develop guidelines, helping producers and CBs to apply and audit against GLOBALG.A.P. principles and criteria (P&Cs) at a local level.

Interested in joining the **US NTWG**?

Visit www.globalgap.org/about/ntwgs or contact northamerica@globalgap.org.

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