Protecting Our Water Recreation Programs: Harmful Algal Blooms & E. coli

Kate Fickas, Ph.D.
Utah Division of Water Quality
Water Quality Health Advisory Panel
April 14, 2029
DWQ HAB Advisory Process

**Monitoring**

**Routine**
DWQ and partners monitor prioritized lakes on a monthly basis.

**Response**
DWQ and partners monitor lakes on advisory on a weekly basis.

**Data Collected**
Microcystin and Anatoxin-a Cell Count (Taxonomy)

**Detection**
Inform LHD
Present data collected along with DWQ recommendation. Assist in answering site specific questions.

**Communication**
Phone call with all stakeholders (i.e. DNR, USFS, etc.) for site specific context.

**Advisory**

**Signs**
Work with LHD and partners to post signs, make sure signs get posted.

**Communication**
Alert stakeholders to advisory decision. Post information, maps, and narrative about advisory on habs.utah.gov.
HAB Data Collected

Anatoxin-a
- Also known as Very Fast Death Factor (VFDF)
- Neurotoxin
- Produced by many cyanobacteria species, including those found in Utah waterbodies

Microcystin
- Hepatoxin
- Produced by many cyanobacteria species, including those found in Utah waterbodies

Cell Count & Taxonomy
- Number of HAB cells
- Species present within sample

Data Delivery
- 24 hours for response monitoring
- 72 hours for routine monitoring
2020 HAB Advisory Season Updates
# 2019 Advisory Thresholds

<table>
<thead>
<tr>
<th>Relative Probability of Acute Health Risk</th>
<th>Reported</th>
<th>Warning</th>
<th>Danger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td></td>
<td>Moderate</td>
<td>High</td>
</tr>
</tbody>
</table>

| Cyano Cell Density (cells/mL)            | <20,000  | 20,000  | >10,000,000 |
| Microcystin (ug/L)                       | <4       | 4       | >2,000    |
| Cylindrospermopsin (ug/L)                | <8       | 8       | >8       |
| Anatoxin-a (ug/L)                        | non-detect | Detection - 90 | >90 |

### Health Risks
- Variable/Negligible
  - Potential for long-term illness
  - Short term effects (e.g. skin and eye irritation, nausea, vomiting, diarrhea)

### Recommended Actions
- LHD specific
  - Issue Warning Advisory
    - Post Warning signs
    - No primary contact recreation
    - Weekly sampling minimum
  - Issue Danger Advisory
    - Post Danger signs
    - No recreation
    - Consider Closure
    - Weekly sampling minimum
## 2019 Advisory Thresholds

<table>
<thead>
<tr>
<th></th>
<th>Reported</th>
<th>Warning</th>
<th>Danger</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relative Probability of Acute Health Risk</strong></td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>Cyano Cell Density (cells/mL)</td>
<td>&lt;20,000</td>
<td>20,000</td>
<td>&gt;10,000,000</td>
</tr>
<tr>
<td>Microcystin (ug/L)</td>
<td>&lt;4</td>
<td>4</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Cylindrospermopsin (ug/L)</td>
<td>&lt;8</td>
<td>8</td>
<td>&gt;8</td>
</tr>
<tr>
<td>Anatoxin-a (ug/L)</td>
<td>non-detect</td>
<td>&gt;0.0</td>
<td>&gt;90</td>
</tr>
</tbody>
</table>

### Health Risks
- Variable/Negligible
  - Potential for long-term illness
  - Short term effects (e.g. skin and eye irritation, nausea, vomiting, diarrhea)
- Potential for acute poisoning
- Potential for long-term illness
- Short term effects (e.g. skin and eye irritation, nausea, vomiting, diarrhea)

### Recommended Actions
- **LHD specific**
  - Issue Warning Advisory
  - Post Warning signs
  - No primary contact recreation
  - Weekly sampling minimum

- **Issue Danger Advisory**
  - Post Danger signs
  - No recreation
  - Consider Closure
  - Weekly sampling minimum

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Division of Water Quality
# 2020 Advisory Threshold Changes

<table>
<thead>
<tr>
<th>Parameter</th>
<th>2019</th>
<th>2020</th>
<th>Benchmarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Microcystin</strong></td>
<td>4 ug/L</td>
<td>8 ug/L</td>
<td>2019 EPA Recommended Human Health Recreational Ambient Water Quality Criteria or Swimming Advisories for Microcysts and Cylindrospermopsin</td>
</tr>
<tr>
<td><strong>Cylindrospermopsin</strong></td>
<td>8 ug/L</td>
<td>15 ug/L</td>
<td>2019 EPA Recommended Human Health Recreational Ambient Water Quality Criteria or Swimming Advisories for Microcysts and Cylindrospermopsin</td>
</tr>
<tr>
<td><strong>Anatoxin-a</strong></td>
<td>&gt;0.0 ug/L</td>
<td>15 ug/L</td>
<td>2019 EPA Recommended Human Health Recreational Ambient Water Quality Criteria or Swimming Advisories for Microcysts and Cylindrospermopsin State of Oregon</td>
</tr>
<tr>
<td><strong>Toxigenic Cyanobacteria Cell Density</strong></td>
<td>20,000 cells/mL</td>
<td>100,000 cells/mL</td>
<td>2019 EPA Recommended Human Health Recreational Ambient Water Quality Criteria or Swimming Advisories for Microcysts and Cylindrospermopsin World Health Organization, 2003. Guidelines for safe recreational water environments, Volume 1, Chapter 8: Algae and cyanobacteria in freshwater.</td>
</tr>
</tbody>
</table>
“Pre-Advisory” Tier: Health Watch

This is **not a formal advisory level**. Rather, these are lines of evidence that a cyano bloom is present or may become more severe. Increased monitoring and surveillance are strongly recommended. Indicators may include:

- Visual reports
- Reports of animal or human illness
- Detection of cyanotoxins below thresholds
- Detectable levels should be defined using appropriate QA/QC procedures

Consider cautioning users of the waterbody depending on specifics of the event and waterbody.
Admin Draft 2020 Guidance

<table>
<thead>
<tr>
<th>Observed / Potential Bloom</th>
<th>Warning Advisory</th>
<th>Danger Advisory</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cyanobacterial Cell Density (cells/mL)</strong></td>
<td>5,000 - 100,000</td>
<td>10,000,000</td>
</tr>
<tr>
<td>Human symptoms have been reported within this range. An advisory should be issued at 100,000 cells/mL. Below 100,000 cells/mL, take into account other contextual information and consider issuing an advisory.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Microcystins (µg/L)</strong></td>
<td>8</td>
<td>2,000</td>
</tr>
<tr>
<td><strong>Cylindrospermopsin (µg/L)</strong></td>
<td>15 *</td>
<td></td>
</tr>
<tr>
<td><strong>Anatoxin-a (µg/L)</strong></td>
<td>15</td>
<td>90</td>
</tr>
<tr>
<td><strong>Health Risks</strong></td>
<td>Issue WARNING advisory</td>
<td>Issue DANGER advisory</td>
</tr>
<tr>
<td>Potential for long-term illness</td>
<td>Potential for acute poisoning</td>
<td></td>
</tr>
<tr>
<td>Short-term effects (e.g., skin and eye irritation, nausea, vomiting, diarrhea)</td>
<td>Short-term effects (e.g., skin and eye irritation, nausea, vomiting, diarrhea)</td>
<td></td>
</tr>
<tr>
<td><strong>Recommended Actions</strong></td>
<td>Post WARNING signs</td>
<td>Consider CLOSURE</td>
</tr>
<tr>
<td>Sampling recommended at least weekly</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Guidance sources

3 EPA, 2019. Recommended human health recreational ambient water quality criteria or swimming advisories for microcystins and cylindrospermopsin.

* Data are sparse on where cylindrospermopsin advisory break points should be. Consult with UDEQ and UDOH as needed on this issue.
Utah DEQ/DOH Timeline

- **August 2019**: Propose new thresholds to Utah Conference of Local Environmental Health Administrators (CLEHA)
- **December 2019**: Propose new thresholds to Utah Health Advisory Panel
- **January 2020**: Finalize new thresholds, publish on HAB website, submit for public comment
- **May 2020**: Implement new thresholds in 2020 monitoring season
## Public Comment Summary

<table>
<thead>
<tr>
<th>Comment (broad)</th>
<th>UDOH/UDWQ Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Issue with using cyanobacteria cell counts for protecting public health in</td>
<td>Detail UDOH/UDWQ rationale for using cyanobacteria (includes benchmarking with EPA, WHO, peer reviewed studies and other states, communication efficiencies and more)</td>
</tr>
<tr>
<td>recreational waters</td>
<td></td>
</tr>
<tr>
<td>2. Confusion if advisories are based on non-toxigenic species</td>
<td>Note that UDWQ only reports and makes advisory recommendations based on toxigenic species; make clear in guidance</td>
</tr>
<tr>
<td>3. Issue and confusion with guidance table formatting</td>
<td>Make guidance table less cluttered and add ‘toxigenic’ to cyanobacteria cell count sections</td>
</tr>
</tbody>
</table>
## Final Draft 2020 Guidance

<table>
<thead>
<tr>
<th>Observed / Potential Bloom</th>
<th>Warning Advisory</th>
<th>Danger Advisory</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Toxicogenic Cyanobacterial Cell Density (cells/ml)</strong></td>
<td>100,000&lt;sup&gt;A&lt;/sup&gt;</td>
<td>10,000,000</td>
</tr>
<tr>
<td><strong>Microcystins (µg/L)</strong>&lt;sup&gt;1,2&lt;/sup&gt;</td>
<td>8</td>
<td>2,000</td>
</tr>
<tr>
<td><strong>Cylindrospermopsin (µg/L)</strong>&lt;sup&gt;2&lt;/sup&gt;</td>
<td>15&lt;sup&gt;B&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>Anatoxin-a (µg/L)</strong>&lt;sup&gt;3,4,5&lt;/sup&gt;</td>
<td>15</td>
<td>90</td>
</tr>
<tr>
<td><strong>Health Risks</strong>&lt;sup&gt;1,2,3&lt;/sup&gt;</td>
<td>Potential for long-term illness</td>
<td>Potential for acute poisoning</td>
</tr>
<tr>
<td></td>
<td>Short-term effects (e.g., skin and eye irritation, nausea, vomiting, diarrhea)</td>
<td>Potential for long-term illness</td>
</tr>
<tr>
<td></td>
<td>Short-term effects (e.g., skin and eye irritation, nausea, vomiting, diarrhea)</td>
<td></td>
</tr>
<tr>
<td><strong>Recommended Actions</strong></td>
<td>Issue WARNING advisory to avoid primary contact recreation</td>
<td>Issue DANGER advisory to stay away from the waterbody</td>
</tr>
<tr>
<td></td>
<td>Post WARNING signs</td>
<td>Post DANGER signs</td>
</tr>
<tr>
<td></td>
<td>Sampling recommended at least weekly</td>
<td>Consider CLOSURE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sampling recommended at least weekly</td>
</tr>
</tbody>
</table>

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<sup>1</sup> WHO, 1999. Toxic cyanobacteria in water.

<sup>2</sup> WHO, 2003. Guidelines for safe recreational water environments, Volume 1, Chapter 8: Algae and cyanobacteria in fresh water.

<sup>3</sup> EPA, 2019. Recommended human health recreational ambient water quality criteria or swimming advisories for microcystins and cylindrospermopsin.


<sup>A</sup> Human symptoms have been reported between 5,000 – 100,000 cells ml (EPA 2019). At 5,000 – 100,000 cells/ml, LHDs should take into account contextual information and consider issuing an advisory.

<sup>B</sup> Data are sparse on where cylindrospermopsin advisory break points should be. Consult with UDEQ and UDOH as needed on this issue.
Permanent Signs - State Parks

• Put on State Park waterbody beaches

• **Will not replace warning and danger signs or advisory process**
  ○ Serve as more permanent and continuous caution to recreators
  ○ Placeholder if advisory signs cannot be placed immediately after detection of HAB above threshold
2020 E. coli Program
2020 Program Re-build Goals

Joint program support (in spirit and practice!) across UDWQ, UDOH, and state health agencies

Credible, timely data and communication to support advisory decisions

Quickly identify waterbodies that pose unacceptable exposure to human pathogens
Assessment vs. Advisory

- Long-term monitoring for the purpose of assessment listing
- Clean Water Act
  - Restore and maintain the chemical, biological, and physical integrity of the Nation’s waters
  - National Goal – “Fishable and Swimmable”
  - Primarily focused on point sources of pollution
  - Amended in 1987 to address nonpoint sources
- Short-term monitoring for the purpose of advisory and response
- Uses rapid monitoring and data collection to protect recreational human health more instantaneously
Working towards a cohesive strategy

**Identified issues with current program**

1. Currently disjointed program implementation across LHDs
2. Lacks consistent response protocol (data sharing, TAT, response, etc.)
3. Lacks DOH/LHD input
4. Advisory criteria lack a connection to current recreational health risks
5. Priorities not efficiently or clearly conveyed to cooperative agencies
   a. currently focuses on an assessment or TMDL context
6. Missing multiple efficiencies to align with HAB program
Inform CLEHA that E. coli program will be rebuilt for 2020

Propose to HAP that E. coli program will be rebuilt for 2020

Propose new strategies to CLEHA. Request membership for E. coli working group

E. coli working group kickoff

Finalize advisory guidances, communication, and monitoring plans. Publish on website. Host workshop (jointly with annual HAB workshop)

Implement Waterborne Pathogen Advisory for 2020 monitoring season
Joint DOH/DWQ/LHD advisory guidance

Workgroup objectives and tasks

1. Review/update advisory objectives and implementation
   a. Science and literature review
   b. Benchmarking across states

2. Establish priority waterbodies
   a. Develop transparent method
   b. DWQ's at-risk identification
   c. LHD input for local high recreation waters
   d. Cooperator input for local high recreation waters

3. Communication
   a. Align with current HAB program processes
Objective 1: Science/Policy Review - Benchmark with States

1. Advisory Process
2. Advisory Thresholds
3. Communication and Signs

Breakout groups from work group: LHDs, DWQ, DOH, cooperators
Objective 1: Science/Policy Review-Benchmarking: Process and Thresholds

- Majority of states do not require a validation sample within 24 hours
  - However, this was requested by most Utah LHDs; data supports use
- Utah is the only Intermountain state not using the latest EPA Beach Action Value (BAV)
Objective 1: Science/Policy Review - E. coli Beach Action Value

New in the EPA 2012 RWQC document were:

1. Values that protect public health similarly in both marine and fresh waters
2. A new tool for use in notification programs: Beach Action Value, or BAV for use in notification/advisory programs.
3. A single threshold rather than different values based on use intensity

“EPA suggests that states use a BAV as a conservative, precautionary tool for making beach notification decisions”

Currently: 409 cfu, based on EPA 1986 RWQC document and Utah WQ assessment criteria

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Estimated Illness Rate (NGI): 36 per 1,000 primary contact recreators</th>
<th>Estimated Illness Rate (NGI): 32 per 1,000 primary contact recreators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BAV (Units per 100 mL)</td>
<td>BAV (Units per 100 mL)</td>
</tr>
<tr>
<td>Enterococci – culturable (fresh and marine)(^a)</td>
<td>70 cfu</td>
<td>OR</td>
</tr>
<tr>
<td>E. coli – culturable (fresh) (^b)</td>
<td>235 cfu</td>
<td>60 cfu</td>
</tr>
<tr>
<td>Enterococcus spp. – qPCR (fresh and marine) (^c)</td>
<td>1,000 cce</td>
<td>190 cfu</td>
</tr>
</tbody>
</table>

\(^a\) Enterococci measured using EPA Method 1600 (U.S. EPA, 2002a), or another equivalent method that measures culturable enterococci.

\(^b\) E. coli measured using EPA Method 1603 (U.S. EPA, 2002b), or any other equivalent method that measures culturable E. coli.

Objective 2: Identifying Priority Waterbodies

a. Develop transparent method
b. DWQ’s at-risk identification
c. LHD input for local high recreation waters
d. Cooperator input for local high recreation waters
What is risk?

‘Primary contact recreation typically includes activities where immersion and ingestion are likely and there is a high degree of bodily contact with the water, such as swimming, bathing, surfing, waterskiing, tubing, skin diving, water play by children, or similar water-contact activities.’

EPA Recreational Water Quality Criteria (2012)
Objective 2: Created list of ‘at-risk’ sites for 2020

Comprised of:
- DWQ identified beaches
- list of local high exposure risk waterbodies/beaches
Objective 2: Waterborne Pathogen Site Prioritization

- Call for priority monitoring locations from LHDs
- Prioritize sites based on recreational exposure risk:

<table>
<thead>
<tr>
<th>Annual Visitation Ranking</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10000</td>
<td>0</td>
</tr>
<tr>
<td>10000 - 40000</td>
<td>1</td>
</tr>
<tr>
<td>40000 - 150000</td>
<td>2</td>
</tr>
<tr>
<td>&gt;150000</td>
<td>3</td>
</tr>
</tbody>
</table>

| Urban Areas                | 1 |
| Urban/Ag Influences        | 1 |
| Past high values (> 235 MPN/100mL) | 1 |
| Past advisory              | 2 |
| Advertised for swimming    | 2 |
| Advertised for rafting/paddleboarding | 1 |
## Objective 2: Waterborne Pathogen Site Prioritization

<table>
<thead>
<tr>
<th>Waterbody</th>
<th>SP 2019 Visitations</th>
<th>visitation points</th>
<th>Located in an urban area</th>
<th>urban area points</th>
<th>nearby urban or ag Influence</th>
<th>urban/ag Influence points</th>
<th>past high levels (&gt;230) 2012-2019</th>
<th>high level points</th>
<th>Advertised for swimming</th>
<th>swimming points</th>
<th>Comments</th>
<th>Total points</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Utah Lake</td>
<td>127222</td>
<td>2</td>
<td>yes</td>
<td>1</td>
<td>advisory</td>
<td></td>
<td>2</td>
<td>yes</td>
<td></td>
<td>Provo, orem, American Fork, I-15</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>Deer Creek</td>
<td>412627</td>
<td>3</td>
<td>yes</td>
<td>1</td>
<td>yes</td>
<td></td>
<td>1</td>
<td>Yes</td>
<td></td>
<td>Heber watershed/Provo River</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>Rockport</td>
<td>136905</td>
<td>2</td>
<td>yes</td>
<td>1</td>
<td>advisory</td>
<td></td>
<td>2</td>
<td>Yes</td>
<td></td>
<td>Weber River drainage</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>Bear Lake</td>
<td>382767</td>
<td>3</td>
<td>yes</td>
<td>1</td>
<td>advisory</td>
<td></td>
<td>0</td>
<td>Yes</td>
<td></td>
<td>2 stream outflow by Rendezvous</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>Willard Bay</td>
<td>517106</td>
<td>3</td>
<td>yes</td>
<td>1</td>
<td>no</td>
<td></td>
<td>1</td>
<td>yes</td>
<td></td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>Starvation</td>
<td>111225</td>
<td>3</td>
<td>yes</td>
<td>1</td>
<td>no</td>
<td></td>
<td>0</td>
<td>yes</td>
<td></td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>Jordanelle</td>
<td>598154</td>
<td>3</td>
<td>no</td>
<td>0</td>
<td>0</td>
<td></td>
<td>0</td>
<td>Yes</td>
<td></td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>East Canyon</td>
<td>143195</td>
<td>2</td>
<td>yes</td>
<td>1</td>
<td>no</td>
<td></td>
<td>0</td>
<td>yes</td>
<td></td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>Green River</td>
<td>81428</td>
<td>2</td>
<td>yes</td>
<td>1</td>
<td>no</td>
<td>river rafting</td>
<td>1</td>
<td>Yes</td>
<td></td>
<td>1 River Rafting</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>Sand Hollow</td>
<td>627527</td>
<td>3</td>
<td>no</td>
<td>0</td>
<td>yes</td>
<td></td>
<td>2</td>
<td>yes</td>
<td></td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>12</td>
<td>Hyrum</td>
<td>97083</td>
<td>2</td>
<td>yes</td>
<td>1</td>
<td>yes</td>
<td></td>
<td>2</td>
<td>yes</td>
<td></td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>13</td>
<td>Yuba</td>
<td>103601</td>
<td>2</td>
<td>yes</td>
<td>1</td>
<td>no</td>
<td></td>
<td>0</td>
<td>yes</td>
<td></td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>14</td>
<td>Highland Glen</td>
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<td>1</td>
<td>yes</td>
<td>1</td>
<td>yes</td>
<td></td>
<td>1</td>
<td>yes</td>
<td></td>
<td>2 in town</td>
<td>5</td>
</tr>
<tr>
<td>15</td>
<td>Manilla Creek Pond</td>
<td>yes</td>
<td>1</td>
<td>yes</td>
<td>1</td>
<td>yes</td>
<td></td>
<td>1</td>
<td>yes</td>
<td></td>
<td>2 in town</td>
<td>5</td>
</tr>
<tr>
<td>16</td>
<td>Mill Creek (Mocel)</td>
<td>yes</td>
<td>1</td>
<td>yes</td>
<td>1</td>
<td>yes</td>
<td></td>
<td>1</td>
<td>yes</td>
<td></td>
<td>2 in Moab, used by club for swim</td>
<td>5</td>
</tr>
<tr>
<td>17</td>
<td>Gunlock</td>
<td>58288</td>
<td>2</td>
<td>yes</td>
<td>1</td>
<td>no</td>
<td></td>
<td>0</td>
<td>yes</td>
<td></td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>18</td>
<td>Echo</td>
<td>56487</td>
<td>2</td>
<td>yes</td>
<td>1</td>
<td>no</td>
<td></td>
<td>0</td>
<td>Yes</td>
<td></td>
<td>2 new state park in 2019</td>
<td>5</td>
</tr>
</tbody>
</table>
Objective 2: Waterborne Pathogen Site Prioritization

How will the prioritization be used?

Determine how to best allocate resources

- DWQ monitoring assistance
- Monitoring supplies
- Speed of response follow-up monitoring
  - recommend within 24 hours as much as possible
- Placement of signs where resources are limited
Objective 2: Monitoring Network

Network of LHDs and Cooperators through the state with E. coli monitoring equipment.
Objective 2: Waterborne Pathogen site prioritization

- Currently have 64 priority waterbodies identified.

- Monitor sites monthly May - October.

- During a normal season, the main challenge will be the follow-up and advisory response, especially in more rural areas.

- As possible, post signs where sampling is more challenging or lower priority
Objective 3: Improve Program Communication

1. Within DWQ
2. DWQ and LHDs/cooperators
3. Public
4. Media
Objective 3: Waterborne Pathogen Communication

Key Messages
1. Take time before playtime. Check water conditions before you go.
2. Don’t swallow water when you swim.
3. Wash your hands with clean water before eating, preparing food, or touching your mouth.
Questions/Discussion