Framework for Monitoring Emerging Contaminants in the Lake Champlain Basin

Presentation to Vermont Citizens Advisory Committee

May 8, 2023
Lake Champlain Basin Program
Grand Isle VT and Virtual
Agenda

Team introductions
Program status
Program overview
Questions
Stone Team

Stone Environmental, Inc.
- Les Carver
- Dave Braun
- Jody Stryker, PhD

USGS
- Joe Ayotte

University of Vermont
- Raju Badireddy, PhD

Applied Analysis Solutions LLC
- Chris Holmes
Status of Program

The team was awarded two projects:

- 2023 - Framework for Monitoring Emerging Contaminants in the Lake Champlain Basin (Contract pending)
- 2024 - Framework for Monitoring Emerging Contaminants in the Lake Champlain Basin—Extended Monitoring (Proposal accepted)

Accessing funds from NOAA for the 2023 project has delayed the start of the program.

The 2023 project delay and the successful proposal for 2024 funding allows us to take a “longer view” and better integrate the scopes of work.

Once the 2023 funding is in place, we will convene the PAC and determine how best to utilize resources and plan field data collection.
Rationale and Objectives

Contribute to LCBP’s Opportunities for Action, Clean Water Goals, Objective I.B. Reduce Contaminants of Concern and Pathogens (LCPB, 2022) and LCBP’s Toxic Substance Management Strategy (LCBP, 2012)

Build on research of contaminants potentially reaching aquatic environments in the Lake Champlain Basin (LCB)

Investigate types of sources and contributing land uses of emerging contaminants (EC)

Evaluate risk of ECs, referencing ecological and human health toxicological benchmarks, where established

Use results to inform an EC monitoring framework developed in consultation with State agencies, our Project Advisory Committee, and LCBP for the waters of the Lake Champlain Basin
Workplan 1 - Overview

Background Development
- Project Advisory Committee
- Quality Assurance Project Plan
- Literature Review and Interviews
- Data Compilation and Analysis for Site Selection

Data Development
- Water and Sediment Sample Collection
- Water and Sediment Analysis

Framework Development
- Data Analysis & Long-Term EC Monitoring Plan Reporting

Data Development
Workplan 2 - Overview

Data Development
- Continue PAC Engagement
- Amend QAPP (as necessary)
- Additional Focused Water and Sediment Sample Collection
- Water and Sediment Sample Analysis

Framework Development
- Refine Data Analysis and Long-Term EC Monitoring Framework
- Reporting
Literature Review, Interviews, and Data Compilation

Compile database of EC concentration data from LCB studies
  • Associated sampling information (collection site, collection date, sampling method, etc.)
  • Provide human health and aquatic life benchmarks for reference

Assess information gained from interviews
  • Roadmaps for addressing EC of concern
  • On-going state agency monitoring

Analyze land use patterns and physical setting in watersheds
  • Sewersheds draining to WWTPs, stormwater outfalls, urban and agricultural streams, and bays

Select monitoring sites at discharge locations and in receiving waters
Selection of Monitoring Locations

1. Our primary interest is in measuring concentrations of emerging organic pollutants from current sources.
2. Historic and/or inorganic pollutants are not included. For example, PCBs, dioxins and furans, arsenic, mercury, and lead will not be considered and known contaminated sites (such as the Pine Street Barge Canal, the Plattsburgh Air Force Base, and the many former coal gasification plants) will be avoided.
3. With input from LCBP and the PAC, select monitoring locations to maximize the likelihood of detecting ECs.

<table>
<thead>
<tr>
<th>Site Type</th>
<th>Selection considerations</th>
<th>Analyses</th>
</tr>
</thead>
</table>
| WWTP effluent   | • Service area: Village center, commercial strip, residential/subdivision, institutional, or urban  
|                 | • Treatment type: activated sludge and aerated lagoon systems likely priorities. At least one lagoon serving a village center should be included | HPCP, pharmaceuticals, PFAS, microplastics  |
| CSOs            | • Overflow event frequency: six LCB municipalities have one or more especially active CSOs.  
|                 | • Sampling feasibility                                                                     |                                 |
|                 | • Geographic distribution, i.e., sample one active CSO in each community                   |                                 |
| Stormwater outfall | • Land use: relatively homogeneous urban, commercial, or residential land use in their drainage areas  
|                 | • Extent: medium to large storm drains (~10-50 inlets) without dry weather flow           | HPCP, pharmaceuticals, PFAS, microplastics  |
| Stream -- agricultural | • Intensity of agricultural use  
|                 | • Geographic distribution                                                                 |                                 |
| Stream -- urban  | • Predominantly urban or suburban watersheds                                                |                                 |
|                 | • Geographic distribution                                                                 |                                 |
| Lake -- shallow bay | • Urban vs. agricultural watershed areas  
|                 | • Geographic distribution                                                                 |                                 |
Sampling Plan—WWTPs and CSOs

Wastewater treatment plant

Candidate sites (select 4):
- Plattsburgh WRRF: Urban / activate sludge (extended)
- Burlington North WWTP: Residential / activated sludge
- Bartlett Bay WWTP: Commercial (strip) / activated sludge
- Pittsford WWTP: Village / activated sludge
- Hardwick WWTP: Village / aerated lagoon

Events: 2 per site (discrete)
Sampling method: effluent grab sample
Total water samples: 9

Combined sewer overflows

Candidate sites (select 4):
- Plattsburgh (#2 or #20)
- Burlington (Pine St.)
- Rutland (#1, #2, #3, or #5)
- Vergennes (#002)
- Montpelier (#1, #7, or #9)
- St. Albans (Lower Welden St.)

Events: 2 per site (discrete)
Sampling method: autosampler (enable by flow)
Total water samples: 8
Sampling Plan—Stormwater and Streams

**Agricultural Streams**
Candidate streams (select 3-4 per regions)
   Rock River, Jewett Brook, Little Otter Creek, Hospital Creek, Lemon Fair River, Dead Creek, South Slang Creek
Events: 2 events (2023 low flow, 2024 spring storm)
Sampling method: grab sample composite by region
Total samples: 18 water, 9 sediment

**Urban Streams**
Candidate streams (select 3-4 per regions)
   Englesby Brook (Burlington), Potash Brook (S. Burlington), Stevens Brook (St. Albans), Morehouse Brook (Winooski), Moon Brook (Rutland), Mussey Brook (Rutland), East Creek (Rutland), Smith Creek (Colchester)
Events: 2 events (2023 low flow, 2024 spring storm)
Sampling method: grab sample composite by region
Total samples: 18 water, 9 sediment

**Stormwater Outfalls**
Candidate stormdrains: (select 3-4 per regions)
   >2000 in LCB
Events: 2 events (2023 & 2024 storms)
Sampling method: grab sample composite by region
Total samples: 18 water, 0 sediment
Sampling Plan—Shallow Bays

Candidate bays (select 4)
- Rock River Bay (of Mis. Bay)
- Goose Bay (of Mis. Bay)
- Lapans Bay
- St. Albans Bay
- Keeler Bay
- King Bay (NY)
- Burlington Bay
- Cumberland Bay (NY)
- Willsboro Bay (NY)
- Hawkins Bay
- Arnold Bay
- Fields Bay
- Hands Cove
- Beadles Cove

Events: 1 event (summer 2024)
Sampling method: spatial composite in bay
Total samples: 5 water, 5 sediment
Water and Sediment Analysis

Analytical Plan – Screening Methods

- **Pesticides** – USGS Method LCM57 Glyphosate and AMPA; LC/MS/MS for Neonicotinoids and other pesticides – 348 analytes
- **Pharmaceuticals** – USGS Method LCM56 GC/MS – 154 analytes
- **HPCP** – USGS Wastewater Method GCM37 LC/MS/MS – 219 analytes
- **Plastics** – ASTM Method D8332-20 – IR spectroscopy (UVM)
- **PFAS** – USEPA Method 537.1 (modified) LC/MS/MS – 24 analytes (contract lab)

### EC Class and Example Chemicals

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pesticides</strong></td>
<td>Neonicotinoids: acetamiprid, clothianidin, dinotefuran, imidacloprid, thiacloprid, thiamethoxam, and major metabolites; Herbicides: glyphosate, atrazine, metolachlor, acetochlor, and major metabolites</td>
</tr>
<tr>
<td><strong>Pharmaceuticals</strong></td>
<td>Examples include, caffeine, acetaminophen, nicotine, codeine, carbamazepine</td>
</tr>
<tr>
<td><strong>Home and Personal Care Products</strong></td>
<td>Examples include triclocarban, 4-nonylphenol, triclosan, and galaxolide; and plasticizers (phthalates, bisphenol A), tris(2-butoxyethyl) phosphate (TBEP), TCPP, NP2EO</td>
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<tr>
<td><strong>Microplastics</strong></td>
<td>size, shape, composition</td>
</tr>
<tr>
<td><strong>PFAS</strong></td>
<td>24 per- and poly-fluoroalkyl compounds</td>
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### Analytical Cost - Water

<table>
<thead>
<tr>
<th>Class</th>
<th>Unit Cost</th>
</tr>
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<tbody>
<tr>
<td>USGS - Herbicides</td>
<td>$500</td>
</tr>
<tr>
<td>USGS - Insecticides</td>
<td>$540</td>
</tr>
<tr>
<td>USGS - Pharmaceuticals</td>
<td>$717</td>
</tr>
<tr>
<td>USGS - Waste Water Schedule</td>
<td>$881</td>
</tr>
<tr>
<td>UVM - Plastics</td>
<td>$650</td>
</tr>
<tr>
<td>Contract Lab - PFAS</td>
<td>$250</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$3,538</strong></td>
</tr>
</tbody>
</table>

### Analytical Cost - Sediment

<table>
<thead>
<tr>
<th>Class</th>
<th>Unit Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>USGS - Waste Water Schedule</td>
<td>$1,100</td>
</tr>
<tr>
<td>UVM - Plastics</td>
<td>$650</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$1,750</strong></td>
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</table>
Long-Term Emerging Contaminants Monitoring Plan

The plan will:

• Provide direction to resource agencies in Vermont and New York concerning ways to structure and coordinate monitoring activities related to emerging contaminants to derive the greatest value

• Specify analytes, monitoring locations, and sampling timeframes

• Estimate level of effort and analytical costs to implement each component of the plan

• Provide an improved understanding of the occurrence and concentrations of emerging contaminants in LCB surface water and sediment
Questions