Getting To Know Your Groundwater: Results From 10 Years of GET WET!

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In The Beginning...
Citizen Science for a Purpose

- Define the problem
- Identify an approach
- Recruit help
- Evaluate & Adjust
DUE TO THE PRESENT GROWTH RATE IN THE TOWN OF LAMOINE, THE LAMOINE CONSERVATION COMMISSION QUESTIONED:

WILL THERE BE AMPLE WATER RESOURCES TO SUPPLY THE GROWING POPULATION?

IS THERE A LIMIT TO THE AMOUNT OF SAND AND GRAVEL THAT CAN BE REMOVED BEFORE THE WATER RESOURCES ARE AFFECTED?
CAN GRAVEL MINING AND WATER SUPPLY WELLS COEXIST?

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Impact from Gravel Pits

- Water quality degradation is limited in: -Magnitude and Occurrence.

- Unable to determine changes in Quantity (Decline).

- Problems from former Landfill demonstrate importance of Pit Reclamation.

- Established baseline data to document any future changes.
The Birth of GET WET!

Mission-
Conservation Commission- Get Town Involved

Methods-
Build Interest Through the School
Establish Groundwater Monitoring Network
Train Teachers and Volunteers
Share Results
WHAT IS IN YOUR DRINKING WATER?

Groundwater Education
Through Water Evaluation and Testing

Groundwater Education
Through Water Evaluation and Testing!

An Introduction to GET WET!
John Peckenham
Mitchell Center, University of Maine

Presented at Lamoine Consolidated School
January 2015
WHY?

Vulnerability of Private Wells
Rural Health

Future of Local Water Resources
Mining
Development
Sea Level Change
Land Use Changes
WHERE DOES DRINKING WATER COME FROM?

Groundwater Sources:
- Aquifers
- Water Table

Surface Waters:
- Springs
- Streams
- Lakes
- Ponds
- Rivers
GET WET!

**Groundwater Education Through Water Evaluation and Testing.**

- Collect Data on Groundwater Quality
  - Student Scientists

- Share Findings with the Community
  - Schools
  - Community Volunteers
  - Local Government Officials

- Establish Groundwater Monitoring Network.
  - Random Sampling of Wells
CHEMICAL PARAMETERS

- pH and Conductivity
- Hardness
- Nitrate
- Chloride
- Iron/Total Metals
**BOTTLE ID NUMBER** ______________ Date __________ State __________

First Name _______________ Last Name _______________

School _______________ Town _______________

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**Get Wet!**

Groundwater Education Through Water Evaluation & Testing

Laboratory Station Sampling Sheet

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Maximum Safe Limit or Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CHLORIDE TEST</strong></td>
<td></td>
</tr>
<tr>
<td>Sample Result</td>
<td>Number of drops = _______ 250 mg/L</td>
</tr>
<tr>
<td></td>
<td>Multiply Number of drops by 20 = _______ Cl mg/L</td>
</tr>
<tr>
<td></td>
<td>Multiply the above Cl number by 1.6 = _______ NaCl mg/L</td>
</tr>
<tr>
<td><strong>NITRATE TEST</strong></td>
<td></td>
</tr>
<tr>
<td>Sample Result</td>
<td>mg/L</td>
</tr>
<tr>
<td></td>
<td>10 mg/L</td>
</tr>
<tr>
<td><strong>pH TEST</strong></td>
<td></td>
</tr>
<tr>
<td>Sample Result</td>
<td>___________________________</td>
</tr>
<tr>
<td></td>
<td>6.5-8.5</td>
</tr>
<tr>
<td><strong>HARDNESS TEST</strong></td>
<td></td>
</tr>
<tr>
<td>Sample Result: Number of Drops</td>
<td>_______ &lt; 75 (soft)-</td>
</tr>
<tr>
<td>Multiply by 17.1=</td>
<td>_______ mg/L</td>
</tr>
<tr>
<td></td>
<td>300 (hard)</td>
</tr>
<tr>
<td><strong>IRON TEST</strong></td>
<td></td>
</tr>
<tr>
<td>Sample Result</td>
<td>mg/L</td>
</tr>
<tr>
<td></td>
<td>0.3 mg/L</td>
</tr>
<tr>
<td><strong>CONDUCTIVITY TEST</strong></td>
<td></td>
</tr>
<tr>
<td>Sample Result</td>
<td>μS/cm</td>
</tr>
<tr>
<td></td>
<td>625 μS/cm</td>
</tr>
</tbody>
</table>
ANALYZING DRINKING WATER
Testing and Improving the Model

Community Engagement and Trust
- USDA Funding with Jessica Leahy
  - Teresa Thornton
  - Crista Straub

Validation and Science Methods
- USGS/WRRI Funding
  - Evaluate Student Data
  - Quality Assurance
With the help of Mount Saint Mary College biology and education student Veronica Schneider, Pine Bush STARS Academy students Jenna Pontillo, grade eight, and Linda Simon, grade 11, test water samples for hardness.

Pine Bush students get immersed in water testing

PINE BUSH – Educators from the Orange County Water Authority (OCWA) and Mount Saint Mary College made a big splash at Pine Bush STARS Academy when they visited the science class to demonstrate various water testing techniques.

Offered at no charge to local school districts, the OCWA program sports the title GET WET (Groundwater Education Through Water Evaluation and Testing).

As OCWA attempts to create a complete “map” of groundwater quality for all of Orange County, they’ve used the program to immerse students into hands-on science learning. The STARS students are helping to generate data for the national STARS Database.

WET experience allows them to see the power of opening up the classroom to a collaborative program focusing on research, and seeing the very real effects this program has on students,” he said.

According to OCWA conservation education coordinator Ed Helbig, fully one-third of Orange County’s population gets its drinking water from private wells.

“In Orange County, private well owners are not required to test or report their home’s well-water quality,” Helbig said. “There is no mechanism for water scientists and resource managers to obtain water quality data from individual private wells. So far this...
Nitrate. Two methods were evaluated for nitrate determinations, both based on colorimetric quantification using either ampoules or test strips. In all replicates, no nitrate was detectable in deionized water, tap water, or well water. Additional repeated measurements were performed on standardized samples and in all cases the 95% CI was ±0 mg/l (Table 3). The precision of each method (RSD = 0%) exceeded design specifications for the ranges of nitrate measured (Table 1).

Method Trueness

Method trueness or accuracy was assessed by performing repeated analyses of standardized samples. The number of measurements made varied from 9 to 50. The standards were made fresh before each test run. Results were evaluated using difference diagrams that compared results by the difference of the sample result from the standard value. This technique provided a limit of agreement based on the 95% CI for the range of differences, bias, bias trends, and conformity with method expectations based on the specified CV. This conformity analysis was based on the difference from the standard value.

![Difference Diagram for Chloride against Standard (n = 51). Dashed lines indicate the limits of agreement and the dotted line bounds the range of expected differences based on method specifications. Coincident points have been jittered along the y-axis to distinguish overlap.](image)

**TABLE 4. Method Trueness Assessment Summary.**

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Method</th>
<th>Number of Measurements</th>
<th>Maximum Difference from Standard (%)</th>
<th>Limits of Agreement (units)</th>
<th>Samples Meeting Method Goals (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloride</td>
<td>Hach titration</td>
<td>50</td>
<td>+400</td>
<td>±20</td>
<td>33</td>
</tr>
<tr>
<td>Hardness</td>
<td>Hach titration</td>
<td>12</td>
<td>+14</td>
<td>±19</td>
<td>25</td>
</tr>
<tr>
<td>Iron</td>
<td>Hach test strips</td>
<td>15</td>
<td>+100</td>
<td>±0.48</td>
<td>20</td>
</tr>
<tr>
<td>Metals (total)</td>
<td>ITS test strips</td>
<td>15</td>
<td>+233</td>
<td>±0.68</td>
<td>33</td>
</tr>
<tr>
<td>Nitrate</td>
<td>CHEMetrics</td>
<td>21</td>
<td>-83</td>
<td>±1.2</td>
<td>0</td>
</tr>
<tr>
<td>Nitrate</td>
<td>ITS test strips</td>
<td>51</td>
<td>-100</td>
<td>±5.5</td>
<td>65</td>
</tr>
<tr>
<td>pH</td>
<td>H2</td>
<td>20</td>
<td>+0.6</td>
<td>±0.30</td>
<td>100</td>
</tr>
<tr>
<td>pH</td>
<td>pH155</td>
<td>20</td>
<td>+0.6</td>
<td>±0.24</td>
<td>100</td>
</tr>
<tr>
<td>pH</td>
<td>pH600</td>
<td>20</td>
<td>+0.6</td>
<td>±0.39</td>
<td>100</td>
</tr>
</tbody>
</table>

Note: ITS, Industrial Test Systems.
Measures of Success

1. New Collaborators & New Locations
2. Local Actions
3. Student Achievements
4. Continuity
MAINE
Penobscot Watershed (3 towns)
Androscoggin Watershed (3 towns)
Frenchman Bay Watershed (4 towns)
Nezinscot River Watershed (3 towns)
Acton Watershed
Androscoggin County
Sagadahoc County

RHODE ISLAND
Scituate Watershed (4 towns)

CONNECTICUT
Pawcatuck Watershed (3 towns)

VERMONT
Connecticut River Watershed (2 towns)

NEW HAMPSHIRE
Connecticut River Watershed (4 towns)
Ossipee Watershed (6 towns)
Wakefield Watershed

FLORIDA
Eastern Lake Okeechobee Watershed (3 towns)

NEW YORK
Wackill River Watershed
Neversink River Watershed
Wawayanda Creek Watershed
Hudson River Watershed
Ramapo River Watershed
Neversink River Watershed
Wawayanda Creek Watershed
Hudson River Watershed
Ramapo River Watershed
Pakapasink Creek Watershed
Dwaar Kill Watershed
Tin Brook Watershed
Otter Kill Watershed
Shawangunk Kill Watershed
Monhagen Brook Watershed
Masonic Creek Watershed
Rutgers Creek Watershed
Warwick Brook Watershed
Greenwood Lake Watershed
Pochuck Creek Watershed
Wackill River Watershed
Quassaick Creek Watershed
Moodna Creek Watershed
Pine Bush Watershed
Valley Central Watersheds
Middletown Watersheds
Port Jervis Watersheds
JOURNAL ARTICLES:

Thornton, T. 2015. Encouraging the Next Generation to Manage and Protect Water Resources. In progress

Thornton, T. and Leahy, J. 2015. “Factors that Contribute to the Recruitment of Professionals and Government Employees as Science Research Volunteers in the K-12 Classroom.” In progress


PRESENTATIONS:

Thornton, T. 2014. “Community-based environmental Monitoring Research as a STEM program.” Green Schools Annual Conference, West Palm Beach, FL


Thornton, T. 2013. “Community-Based Environmental Monitoring Research as Curriculum.” Green Schools National Conference, West Palm Beach, FL
SECONDARY STUDENT CONFERENCE PRESENTATIONS:

SELECTED PAPERS relating to GET WET!


SELECTED POSTERS relating to GET WET!


ANY QUESTIONS?

TODAY’S SPECIAL

CORRECT AND INCORRECT ANSWERS-SAME LOW PRICE
http://getweth2oed.org/

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