Evaluation of the Groundwater in Hines Emerald Dragonfly Habitat

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U.S. Geological Survey
Thank You

- U.S. Fish and Wildlife Service
- Ryan Adams, Geophysical Technician, USGS
- Jennifer Sharpe, USGS
- George Roadcap, ISWS

  - Shared publication of the Northeast Regional Water Survey
HED Habitat

- Typically found near natural dolomite seeps
- This particular type of setting is relatively rare
- Continues to be stressed
  - Reduction in habitat
  - Loss of groundwater flow at seeps
  - Changes in water quality
USGS Goal:

- Understand the hydrogeology in the Lockport, Romeoville, and Crest Hill area and assess impacts to the primary HED habitat, Lockport Prairie Nature Preserve (LPNP)
Data Gathered

1. Placed level and water quality data loggers in monitoring wells on the Lockport Prairie to gather current trends.
2. Evapotranspiration Test
3. Periodic measurement of groundwater levels and specific conductivity in all the wells within the LPNP.
4. Synoptic Water Level Survey
   - Identify Cone of depressions, groundwater gradients and flow paths
   - baseline dataset against which future water levels can be evaluated.
Continuous Monitoring Data Locations

USGS has collected water level and water quality parameter data in a few wells around the LPNP area:

- One level troll place in MW 7D
- Aqua Trolls placed in MW 6A (currently in 6B due to drought) and MW 9A or MW 9B
- This provided a cross-sectional view of groundwater trends
Cross-sectional View

Graef, Anhalt, Schloemer and Associates, Inc
## Groundwater Elevation Over 10 Years

<table>
<thead>
<tr>
<th>MW</th>
<th>WL Difference from '01 to '12</th>
</tr>
</thead>
<tbody>
<tr>
<td>3A</td>
<td>-4.03</td>
</tr>
<tr>
<td>3B</td>
<td>-7.01</td>
</tr>
<tr>
<td>6A</td>
<td>-1.04</td>
</tr>
<tr>
<td>6B</td>
<td>-0.97</td>
</tr>
<tr>
<td>6C*</td>
<td>-2.34</td>
</tr>
<tr>
<td>7B</td>
<td>dry</td>
</tr>
<tr>
<td>7C</td>
<td>-2.36</td>
</tr>
<tr>
<td>7D</td>
<td>-2.47</td>
</tr>
<tr>
<td>9A</td>
<td>-2.07</td>
</tr>
<tr>
<td>9B</td>
<td>+2.69</td>
</tr>
</tbody>
</table>

* Avg Difference: -1.69 ft

![Graph showing groundwater elevation changes over 10 years for various MW locations.](image-url)
MW 7D Groundwater Elevation

![Graph showing MW 7D Groundwater Elevation](Graph.png)
GWE = Groundwater Elevation

Precipitation data from Rain Gage at Des Plaines River near Lemont
MW9A Groundwater Elevation
Comparison of Specific Conductance (SpC) from Bluffs to Prairie
Cross-Section with Averaged SpC Data

SpC Scale µS/cm

Legend:
- Well Screen Interval
- Groundwater Elevation on 12/15/01

Scale:
- Horiz.: 1" = 500'
- Vert.: 1" = 25'
- Vert. ex.: 20x

GEOLOGIC CROSS-SECTION A—A'

Lockport Prairie Nature Preserve
Ground Water Model
Lockport, Illinois
Evaporation Wells

Using the Diurnal fluctuation in the wetland, ET can be estimated.

ET=Sy(24h±s)
- ET=mm/day
- Sy=1.0 for standing water
- h= hourly rise in water level from midnight to 4 AM.
- s= net fall (+) or rise(-) of water table or water surface in one day (Mitsch and Gosselink, 2007)

ET= 5.321 mm/day
ETavg (all)= 6.85 mm/day
Calculating Discharge (\( Q \))

Using the Scale on the Cross-section done by GAS consultants; the area can be calculated.

\[ Q = -KA\left( \frac{\Delta h}{\Delta L} \right) \]

Vert: 1”=25’
Horiz.: 1”=500’
Calculating Discharge

- \( Q = -KA(\Delta h / \Delta L) \)
- \( K = 0.003728 \text{ ft/min} \)
- (slug tests on MW6A)
  - \( L = 617.50 \text{ ft} \) (Google Earth)
  - \( A^* = 9028.125 \text{ ft}^2 \)
- Avg \( Q = 6.015E-3 \text{ ft}^3/\text{min} \)
  - \( 526 \text{ ft}^3/\text{day} \)
  - 6A to 9A

Q of 6A to 9A

![Graph showing Q of 6A to 9A over time from 09/08/2011 to 03/08/2012]
Discharge (Q) 6B to 9B

- \( K = 0.000122 \, \text{ft/min} \) (from slug test)
- \( A = 12959.38 \, \text{ft}^2 \)
- \( L = 617.5 \, \text{ft} \)
- \( Q = 0.0447 \, \text{ft}^3/\text{min} \)
- =64.35 \, \text{ft}^3/\text{day}

Rain Event 8/26/12 = 2.37 inches
Synoptic Water Level

Nearly 100 water level measurements of all available monitoring wells within the vicinity of the Lockport Prairie were taken on July 19, 2012 by USGS, AECOM, Citgo, and local municipality water personnel.

Water levels were then used to create a contour map.

- used to identify and evaluate flow paths, cones of depression, and gradients.
Synoptic Water Level Survey Results

1. Quarry has a limited impact to its almost immediate surroundings.
2. Quarry may be influencing a groundwater divide
3. Crest Hill pumping appears to have significant impacts to the southern portion of the LPNP.
Comparison of Synoptic Water levels
1990 Roadcap (ISGS) Survey
Conclusions Based on Continuous Water level and SpC

- Water levels have decreased by 2 ft due to drought conditions this past year.
- This has caused a general decline in discharge (Q) specifically from MW6B to MW9B; however significant rain events provide instantaneous increases.
- Discharge is significantly greater in the shallow dolomite/sand & gravel than the deeper dolomite.
- SpC data was able to trace surface to groundwater recharge within the prairie.
Conclusions based on Water Level Survey

- The local impacts to the HED LPNP Habitat are the nearby municipality of Crest Hill.
- There appears to be a groundwater divide between the quarry and the Crest Hill supply wells.
- Groundwater flow direction has been slightly altered to flow more towards the northern part of the LPNP.
  - The city of Crest Hill captures some of the groundwater towards the south of the LPNP.
  - The cone of depression impact by the quarry is limited to areas immediately surrounding the quarry.
Thank You!