Chagrin River Watershed Partners, Inc.

Collaborative Learning Group Meeting

National Estuarine Research Reserve System Science Collaborative Grant

April 4, 2012
Project Partners

• Chagrin River Watershed Partners, Inc.
• Old Woman Creek National Estuarine Research Reserve
• Ohio Department of Natural Resources, Division of Soil and Water Resources
• Firelands Area Coastal Tributaries/Erie SWCD
Welcome

1. Introductions
2. Meeting objectives
3. Project timeline
4. Collaboration skill-building
2. Meeting Objectives

- Site Visit: Lake Metroparks Gully Brook Bioretention
- Provide updates on current project activities
- Share Perkins Township monitoring site update
- Gather input on data sources and needs
- Discuss and solicit interest in modeling workgroup
3. Project timeline

Evaluating Stormwater Solutions in Ohio

A project led by the Chagrin River Watershed Partners, Inc. and Old Woman Creek National Estuarine Research Reserve will develop science-based tools to help minimize the impact of stormwater on Ohio’s coastal communities and Lake Erie. The project team is collaborating with municipal and consulting engineers, stormwater utilities, developers, regulators, and watershed organizations to generate credible and locally verified performance information about innovative stormwater systems. Based on this, the team will develop credits and incentives, to encourage the use of the most effective systems.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share needs and barriers</td>
<td>Review and translate results and develop tools</td>
<td>Pre-pilot tools</td>
</tr>
<tr>
<td>Discuss approach for data products and tools</td>
<td>Review and update model zoning codes</td>
<td>Test final tools</td>
</tr>
<tr>
<td>Knowledge</td>
<td>Training on site characterization and BMP monitoring</td>
<td></td>
</tr>
<tr>
<td>Compile BMP installation costs</td>
<td>Monitor all 6 sites</td>
<td></td>
</tr>
<tr>
<td>Select 2 sites</td>
<td>Select 4 additional sites</td>
<td></td>
</tr>
<tr>
<td>Monitoring</td>
<td>Characterize, select, and instrument sites</td>
<td></td>
</tr>
<tr>
<td>Design assistance for 3 sites</td>
<td>Model current and projected rainfall scenarios</td>
<td></td>
</tr>
<tr>
<td>Modeling</td>
<td>Research and collect precipitation and BMP data</td>
<td></td>
</tr>
<tr>
<td>Calibrate, run, and validate model</td>
<td>Integrate BMP monitoring data into model</td>
<td></td>
</tr>
<tr>
<td>NOV 2011</td>
<td>APR 2012</td>
<td>JUN 2013</td>
</tr>
<tr>
<td></td>
<td>NOV 2012</td>
<td>NOV 2013</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SEPT 2014</td>
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</table>

Stormwater Tools and Products
- Trusted and accurate models
- Current and projected rainfall data
- Expanded and updated design guidance
- Proposed credits for stormwater utility programs
- Recommendations on state and local stormwater regulations
- Training and technical assistance
- Foundation for full BMP cost analysis
4. Collaboration Skill Building

- Positions and Interests
- Modes of Communication
Technical activities

1. Update on monitoring sites
2. Perkins Township presentation
3. Discussion – early monitoring lessons
4. Monitoring contractor RFQ
5. Design assistance RFP
1. Monitoring Sites

Reviewed & visited approximately 35 sites

Still in the running-

1. Mayfield Heights City Hall pervious concrete
2. Lake Metroparks Gully Brook bioretention
3. Parma Senior High School bioretention
4. Wiley Park Mayfield Village pervious pavers
5. Perkins Township multiple BMPs
6. Ritter Public Library pervious pavers
Mayfield Heights City Hall

- Porous Concrete – 3,380 sq. ft.
- Completed by URS July 2011
Lake Metroparks – Gully Brook
Lake Metroparks – Gully Brook

Two outlets
Parma Senior High School
Wiley Park 319 Mayfield Village

- Bioretention Cell – 650 square feet
- Pervious Pavers Parking Area – 8,000 square feet
- Design completed by Stephen Hovancsek & Associates, Inc.
- Constructed November 2011, Planting of bioretention to be in Spring 2012
Perkins Township Administration Building

- Perkins Township offices are relocating to an abandoned commercial strip plaza and is currently developing site plans to remove portions of parking and install a series of LID stormwater BMPs.
- Proposed BMPs include:
  - Pervious Concrete
  - Bioretention
- More information on this later
Ritter Library, Vermilion
Top 7 Monitoring Challenges

1. Hydrologic connection to other BMPs
2. Lack of BMP design detail
3. Non standard design criteria
4. Unable to quantify inflow
   • Multiple inflows
   • Hydrologic connections
   • Watershed unknown
5. Outlet not monitorable
   • Size of outlet pipe
   • Backwater effects
   • Multiple outflows
   • Catch basin size
6. Problematic BMP siting
7. Inadequate maintenance
Our Wish List - Ideal Site

1. Single BMP or first in a train
2. 3x3 or 4x4 catch basin
3. Single inflow with clearly-defined watershed
4. Single outlet with no tailwater effects
5. Designed to meet Rainwater & Land Development
6. As-builts
7. Infiltration is a design objective
8. Construction oversight ensures project built to spec
9. Maintenance plan
10. BMP sited away from streams or steep slopes
Is the outlet monitorable?

In-pipe Weir

Surface Weir
Is the outlet monitorable?

1. Free overfall – most important characteristic
2. Township LID Projects

Presented By:
Perkins Township
John Hancock & Associates, Inc.
Erie Soil & Water Conservation District
Existing Conditions
Proposed LID Practices
East Section
Breaking Barriers
LID Education ....What is LID?

- Township Acceptance
- Public Education
- Public Acceptance
- Political Entities
- Local Zoning
- The Value of LID
- Contractors, Developers & Engineers
Money Talks...

Traditional vs LID/Green
Estimates

- Experienced Contractors: Certified with Ohio Concrete
- 3 local businesses- 3 bids for comparative costs
- In-house work- budget reductions
- Supplies: Pervious Concrete-quick mix, 57’s, fabric, plastic covering, and equipment
- Not a true “Apples to Apples” comparison due to existing structures
<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
<th>QUANTITY</th>
<th>UNIT COST</th>
<th>TOTAL</th>
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<tbody>
<tr>
<td>5th Budget Outline</td>
<td>$126,524.60</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Vs</td>
<td>$43,578.30</td>
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</table>

Estimates for Pervious Pavement figured at $8-10 from Ohio Concrete

Estimates for Bioretention figured at $18,000/ac by UNH in 2007
1st Estimate from Smith Paving:

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Unit</th>
<th>Description</th>
<th>Unit Price</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>13250</td>
<td>BF</td>
<td>Excavation for 8&quot; Conc Perv</td>
<td>$1.00</td>
<td>$13,250.00</td>
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<td>13</td>
<td>21450</td>
<td>BF</td>
<td>Excavation &amp; 12&quot; SV for 8&quot; Conc Perv</td>
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<tr>
<td>14</td>
<td>1420</td>
<td>LF</td>
<td>Excavation for Curb</td>
<td>$3.25</td>
<td>$4,640.00</td>
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<tr>
<td>16</td>
<td>3</td>
<td>EA</td>
<td>Monitor Well - Supplied by Type</td>
<td>$275.00</td>
<td>$825.00</td>
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<tr>
<td>17</td>
<td>840</td>
<td>LF</td>
<td>4&quot; perforated tile</td>
<td>$65.00</td>
<td>$54,000.00</td>
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<tr>
<td>18</td>
<td>230</td>
<td>LF</td>
<td>8&quot; PV C Conduit</td>
<td>$12.00</td>
<td>$2,760.00</td>
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<tr>
<td>19</td>
<td>2</td>
<td>BA</td>
<td>Catch Basin 22B</td>
<td>$1,200.00</td>
<td>$2,400.00</td>
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<tr>
<td>20</td>
<td>700</td>
<td>LF</td>
<td>8&quot; PVC Conduit</td>
<td>$3.00</td>
<td>$2,100.00</td>
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<tr>
<td>21</td>
<td>2395</td>
<td>BF</td>
<td>Curb Tiled Fabric Below 57&quot;</td>
<td>$2.25</td>
<td>$5,437.50</td>
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<td>22</td>
<td>9350</td>
<td>BF</td>
<td>8&quot; Plain Concrete Pavement</td>
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<td>$24,505.00</td>
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<tr>
<td>23</td>
<td>13250</td>
<td>BF</td>
<td>8&quot; Plain Concrete Pavement</td>
<td>$2.20</td>
<td>$29,050.00</td>
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<td>24</td>
<td>1460</td>
<td>LF</td>
<td>Type 6 Curb</td>
<td>$10.75</td>
<td>$15,865.50</td>
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<tr>
<td>25</td>
<td>12150</td>
<td>BF</td>
<td>8&quot; Pervious Concrete Pavement</td>
<td>$5.50</td>
<td>$67,525.00</td>
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</tbody>
</table>

**Total:** $152,350

Excavation, Pervious Concrete = $9.50/sq ft
### 2nd Budget Outline

**$203,214.00**  
**Vs**  
**$123,464.00**  

*Now includes estimates from Smith and Erie Blacktop*
2nd Estimate from RMH Concrete:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Catch Basin Installation</td>
<td>2</td>
<td>EA</td>
<td>$1,895.00</td>
<td>$3,790.00</td>
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<tr>
<td>2</td>
<td>8' SDR-35 Storm Sewer</td>
<td>99</td>
<td>FT</td>
<td>$27.25</td>
<td>$2,697.75</td>
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<tr>
<td>3</td>
<td>6' SDR-35 Storm Sewer</td>
<td>211</td>
<td>FT</td>
<td>$33.15</td>
<td>$4,884.65</td>
</tr>
<tr>
<td>4</td>
<td>4' SDR-35 underdrain</td>
<td>660</td>
<td>FT</td>
<td>$7.95</td>
<td>$5,247.00</td>
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<tr>
<td>5</td>
<td>Type 8 Concrete Curb</td>
<td>1,200</td>
<td>FT</td>
<td>$11.00</td>
<td>$13,200.00</td>
</tr>
<tr>
<td>6</td>
<td>Combination Curb and 4&quot; Sidewalk</td>
<td>2,700</td>
<td>SF</td>
<td>$5.75</td>
<td>$15,525.00</td>
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<tr>
<td>7</td>
<td>8' Heavy Duty Concrete Pavement</td>
<td>19,525</td>
<td>SF</td>
<td>$5.19</td>
<td>$101,334.75</td>
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<tr>
<td>8</td>
<td>6' Light Duty Concrete Pavement</td>
<td>14,265</td>
<td>SF</td>
<td>$4.69</td>
<td>$66,996.65</td>
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<tr>
<td>9</td>
<td>6' Pervious Concrete Pavement</td>
<td>10,630</td>
<td>SF</td>
<td>$6.95</td>
<td>$73,878.50</td>
</tr>
</tbody>
</table>

Total: $287,554.30

Pervious Concrete = $6.95/sq ft

Total: $73,878.50
Design & Space

• Considered Green Roofs & Rain Water Harvesting
• Have to work with what is existing (catch basins, driveway, traditional piping systems, location of building, etc)
• Drainage/Watershed areas
• Getting the equipment in/out (impervious & Pervious Concrete timing important)
Drainage Areas to help determine location of LID practices
Timing is Important!

• Grant applications: developing/collaborating/establishing partners, summiting, approvals/notifications, awarding the grant funds, implementation, reporting & wrap ups

• Erosion & Sediment Controls: Construction sequencing-reduce sediment clogging systems, Utilities/grading, seeding timeframes-stabilize site

• Seasons: winter ground freezing, spring floods, summer droughts (establish seeding), etc

• Education: bringing in the public and others on project to make them feel included and take ownership for community projects

• Media: news articles, website, radio etc (want to see finished product, clean site, established color, grasses etc)
Monitoring Equipment

- Size of monitoring equipment
- Size of catch basins
- Cost
- Number of Inlets/Outlets
- When to plan for installation? (construction sequencing)
- Approval from trustees
Alternative Solutions

• Recycled materials
• Milling
• Asphalt verses Concrete
Going with the flow..

- Changes to designs, budgets, timing
Building A Successful Project:

- Getting the right people at the table
- **Understand limitations:** Space, Budget, Environmental Concerns, Local Regulations (Zoning/Storm Water), State Regulations (OEPA), Timeframes, Barriers
- **Partnerships Created:** Local, Government, County, Businesses
- **Knowledge of Opportunities:** Grants, Design Assistance
3. Discussion of Perkins Site – Lessons and Challenges

- Cost premium for infiltration in redevelopment
- Lack of credit for infiltration
4. General Monitoring Update

- Exploring partnerships with universities and private consulting firms that have monitoring capacity
- Draft scope of services and RFQ will be sent to CLG members by end of week for comments
- Potential contractors:
  - CRWP Engineers and Sponsoring Members
  - OSU Ag Engineering Program
  - Voinovich Center at OU
  - Heidelberg Water Quality Lab
  - Case Western Reserve University
  - University of Akron
  - Cleveland State University
  - NEORSD
  - TetraTech
  - Fondriest Environmental
  - Others?
5. Design Assistance RFP

1. Distributed beginning today!

2. Deadline for submittal – 5/1/2012

3. Key elements:
   - Priority BMPs and selection criteria informed by CLG input
   - Primary BMPs - Pervious pavement or bioretention
   - Secondary BMPs - Grass filter strips, water quality swales, or dry detention basin retrofits
   - Maximum award - $15,000 per site
   - Designer/owner of selected sites to participate in CLG

4. Next steps
   - Please spread the word!
   - CLG to discuss proposals in July
Exploring Modeling Needs

1. Survey feedback
2. Research update
3. CLG input on modeling approach
Do you use any of the following models?

- I do not currently use stormwater models
- StreamStats
- Runoff Reduction Method
- Simple Method
- This is outside the scope of my professional role
- SWMM
- Rational Method
- Curve Number (TR-55) and CN Based Software (HydroCad, PondPack, ...)

Response Count
### Do you use any of the following data sets?

<table>
<thead>
<tr>
<th>Data Set</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ohio Soil Survey</td>
<td>5</td>
</tr>
<tr>
<td>Land use / Land cover maps</td>
<td>4</td>
</tr>
<tr>
<td>NRCS Soil Data Mart</td>
<td>4</td>
</tr>
<tr>
<td>USGS Streamflow Data</td>
<td>3</td>
</tr>
<tr>
<td>Precipitation or climate data from Ohio-based stations (e.g., Cleveland Hopkins)</td>
<td>2</td>
</tr>
<tr>
<td>Huff and Angel Bulletin 71 Rainfall Frequency Atlas of the Midwest</td>
<td>2</td>
</tr>
<tr>
<td>International Stormwater BMP Performance Database</td>
<td>2</td>
</tr>
<tr>
<td>Data from Chagrin River Watershed Partners demonstration projects</td>
<td>1</td>
</tr>
<tr>
<td>USEPA National Risk Management Research Laboratory data</td>
<td>1</td>
</tr>
<tr>
<td>TP-40 Precipitation Frequency Atlas Map</td>
<td>1</td>
</tr>
<tr>
<td>NOAA Atlas 14 - Point Precipitation Frequency Estimates</td>
<td>1</td>
</tr>
<tr>
<td>Hydrologic performance data sets – University of New Hampshire</td>
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</tr>
</tbody>
</table>

**Others:**
- ODOT's Location and Design Manual Vol., II; Drainage Design
- Robert Pitt, Alex Maestre, and Renee Morquecho, National Stormwater Quality Database, ver 1.1, (Univ of Alabama, Feb 16, 2004)
Do you use any of the following resources?

- This is outside the scope of my professional role
- Other state stormwater BMP manuals
- Design guidance from the Center for Watershed Protection
- Design specifications from North Carolina State University
- Design specifications from the University of New Hampshire
- US EPA Stormwater Guidance - General
- Design criteria in Rainwater and Land Development

Others:
- ODOT’s L&D Manual Vol. II
- EPA Construction General Permit
- CRWP Model
What factors prevent or limit your access to needed models, data, or resources?

- Knowledge about available tools
- Staff time
- Funding
- Technical capacity
- Accessibility
What other models, data, or resources would you like to see developed? How can existing tools be enhanced?

• “There needs to be a standardized model used by the designer & reviewer. It needs to be simplified & intuitive so that someone who wears many hats doesn't need to invest a lot of time to relearn how to use it the model...to allow you to alter the key design inputs, such as dimensions, so that designers & developers have some flexibility to incorporate the controls and the reviewers have assurance that deviating from the standard design still meets the objective ...”
Modeling Goal

- Goal: Characterize BMP hydrology in a manner that allows us to properly credit services (volume reduction, peak discharge attenuation, etc.) provided by practices.
Modeling Objectives

1. Develop an accurate physical representation of the hydrologic function of each BMP. Ensure model reflects reality, is tested, and groundtruthed

2. Develop integrating models that allow us to account for peak discharge and volume reduction of common development scenarios with multiple BMPs

3. Develop design guidance and short-hand tools
P – Precipitation (Rainfall & Snowmelt)
ET – Evaporation & Transpiration
S1 – Temporary Surface Storage
S2 – Temporary Subsurface Storage

F1 – Infiltration
F2 – Exfiltration
Qin – Runon/Lateral Inflow
Qout - Runoff

BMP Model

Redistribution

Qin → F1 → S1
F1 → F2 → S2
S2 → ET → Qout- surface
S1 → ET → Qout- tile
BMPs We Will Model

1. Soil quality preservation/renovation
2. Grassed/vegetated filter strips
3. Impervious area disconnection
4. Swales (several variations)
5. Green roofs
6. Bioretention (including dry swales and tree boxes)
7. Infiltration (retention) basins and trenches
8. Underground retention/detention (with & w/out infiltration)
9. Pervious pavements
10. Dry detention (retention) basins
11. Wet ponds and wetland basins
12. Cisterns/rainwater harvesting
13. Subsurface gravel wetlands
Tools

- Bioretention Hydrologic Performance (HyPer) Tool
  - Spreadsheet design tool based on DRAINMOD
  - Menu-based design, twelve or so inputs that can be used both by designer and reviewer
North Carolina Long-Term Bioretention Hydrologic Performance Tool

**DESIGN INPUT PARAMETERS**
- Units: English
- Hydrologic Soil Group: C
- Soil Media Depth: 6 ft
- Depth to IWS: 13 ft
- Average Surface Ponding: 9 in
- Surface Storage Ratio: 100%
- Drainage Coefficient: 2 ft/day
- BRC Area : Drainage Area Ratio: 11.1%
- Factor of Safety: NONE

**WATER QUALITY CHARACTERIZATION**
- Runoff Avg TN Conc.: 1.63 mg/L
- Drainage Avg TN Conc.: 0.9 mg/L
- Runoff Avg TP Conc.: 0.19 mg/L
- Drainage Avg TP Conc.: 0.14 mg/L

**DESIGN OUTPUT PARAMETERS**
- Maximum Subgrade Ksat: 0.020 in/hr

**HYDROLOGY**
- Total (in/yr) & Percent of Total:
  - Runoff: 419 in/yr (47%)
  - ET: 40 in/yr (9%)
  - Overflow: 21 in/yr (5%)
  - Exfiltration: 161 in/yr (39%)
  - Drainage: 197 in/yr (47%)

**VOLUME REDUCTION TREATS 90% OF RUNOFF?**
- Yes

**WATER QUALITY**
- Total (lb/ac-yr) & Percent Reduction:
  - Influent Avg Total N: 17.2 lb/ac-yr (60%)
  - Effluent Avg Total N: 5.3 lb/ac-yr (60%)
  - Influent Avg Total P: 2.0 lb/ac-yr (60%)
  - Effluent Avg Total P: 0.8 lb/ac-yr (60%)

**Pie Chart**
- ET: 47%
- Overflow: 5%
- Exfiltration: 9%
- Drainage: 39%
Modeling Research Update

- Literature search
- Working on subcontract for two modelers
- Data set solicitation
  - North Carolina State University
  - University of New Hampshire
  - University of Wisconsin
  - USGS
- Researched models, tools, and approaches used to characterize BMP hydrology
- Developing SWMM, DRAINMOD, WinSLAMM input files and build models of BMPs
3. Discussion on Modeling Approach

- Is anything missing from our inventory of modeling and data sources?
- If this project produced or recommended tools like HyPer, would that be a good approach?
- Are there any other suggestions, ideas, things we should consider?

*We will be discussing how to translate models into tools that stormwater practitioners - not just modelers can understand.*

*Lunch and modeling workgroup discussion*
Modeling Workgroup

- CLG input is needed on modeling tasks
  - Feedback on approach/model selection
  - Review model inputs
  - Feedback on early results and tool interface
  - Test run tools and provide feedback

- Additional opportunity - proposed workgroup
  - Actively participate in modeling effort
  - Communicate frequently via e-mails, conference calls, in person meetings
  - Seeking 1 or 2 people with strong interest in modeling and translation to design tools from within CLG and elsewhere
  - Time commitment - 4-8 hours/month
  - CLG will receive updates on workgroup discussions and activities

Anyone interested in participating?
Collaborative Learning
Group Business

1. Staying in the loop
2. Schedule
3. Training
1. Staying in the loop

- Project update and survey
- Website
- Call/e-mail Amy or Heather any time
2. Meeting Schedule

- Quarterly in rotating locations

- July 17th  9:00am-1:00pm (Vermilion)

- October 18th 9:00am-1:00pm (Perkins Township?)

- Is 10:00am-2:00pm acceptable if needed for facility scheduling?
3. Collaboration Training

- “Working Together to Get Things Done”

Ritter Public Library Vermilion, OH

- July 17\textsuperscript{th} 12pm-4pm
  - Evening reception and canoe tour at Old Woman Creek NERR

- July 18\textsuperscript{th} 9am – 4pm
  - Free accommodations in rustic bunk house on Lake Erie
Project Contacts

- Amy Brennan – Project Lead
  - abrennan@crwp.org 440-975-3780
- Heather Elmer – Collaboration Lead
  - heather.elmer@dnr.state.oh.us 419-433-4601
- Jay Dorsey, P.E. / Ph.D. – Applied Science Investigator
  - jay.dorsey@dnr.state.oh.us 614-265-6647
- Breann Hohman and Crystal Dymond
  - bhohman or cdymond @eriecounty.oh.gov 419-626-5211
- Ona Ferguson
  - ferguson@cbuilding.org 617-844-1127