Developing Credits and Incentives for Innovative Stormwater Management
Collaborative Learning Group Meeting
October 18, 2012, 9:00 am-1:00 pm
Old Woman Creek National Estuarine Research Reserve
Huron, OH

Meeting Summary

Group Members Present: Dan Bogoevski (OEPA), Jane Cullen (City of Sandusky), Eric Dodrill (Perkins Township), Alex Etchill (John Hancock & Associates), Ken Fortney (Erie County), Lynette Hablitzel (OEPA), Clyde Hadden (CT Consultants), Frank Lopez (OWCNERR), Rachel Webb (NEORSD), Leonardo Sferra (GPD Group).

Project Team Members Present: Amy Brennan (CRWP), Jay Dorsey (ODNR), Crystal Dymond (ESWCD), Heather Elmer (OWCNERR), Ona Ferguson (CBI), Breann Hohman (ESWCD/OWCNERR).

Observers and Staff: Ryan Winston (NCSU), Kevin Grieser (Biohabitats), Peter Whiting (CWRU), Carlo DeMarchi (CWRU), Cheryl Wolfe-Cragin (OWCNERR).

Next Steps:

- All – Project team will notify the group of opportunities to provide feedback on BMP designs and installation of monitoring equipment.
- 2013 CLG meetings: April 24, July 17, and September 18. Locations TBD. Meetings will be slightly longer than 2012, running possibly until 3pm.

Site Visit: Plans for Porous Asphalt Parking Area and Tour of Old Woman Creek NERR

Frank Lopez, Manager of Old Woman Creek National Estuarine Research Reserve (OWCNERR) and CLG member, welcomed people to the Reserve and led the group on a tour of the Reserve pointing out rill erosion from parking lot runoff. Breann Hohman and Alex Etchill discussed plans for the parking lot retrofit project, noting that although the site assessment revealed extremely low infiltration rates (<.005 in/hr), the team will move forward with a porous asphalt installation to demonstrate how pervious pavement can provide storage to help meet peak discharge requirements and establish thresholds for infiltration on compacted tight soils. Alex Etchill reviewed the conceptual plan, which calls for a 27" sub-base per UNH Stormwater Center's 65% frost depth recommendation, Rainwater and Land Development, and manufacturer guidance. The underdrain is routed to a catch basin and then to an 8" pipe. The initial plan specifies outletting the pipe to a level spreader near the top of the slope but this is likely to be revised. Per infiltration test results, the 3" sump will take 1-2 days to draw down. Filter fabric will be installed to prevent the sub-base from sinking into the subsoil and (per NCSU recommendations) along the sides to minimize soil infiltration into the subgrade. A flush concrete section will delineate porous from conventional asphalt. A curb around the outside perimeter will prevent slumping. A minimum 3" drop over the outlet weir is needed for monitoring, 6" or more is preferred to reduce the frequency of tailwater conditions that invalidate flow readings. The system will treat the WQv and meet all applicable state and local design standards.

CLG members were interested in the sub-base depth and materials, how the BMP will be hydrologically isolated, and project goals given low infiltration rates. Bre noted that the goal is to effectively treat

stormwater, reduce impacts to the estuary and characterize the hydrologic performance of porous asphalt on tight compacted soils. Group members were also interested in why the grasspave failed. Jay indicated this was likely due to poor installation and compaction of the sub-base and underlying soil. For more information on this project contact bhohman@eriecounty.oh.gov.

Welcome and Project Web Resources

Heather Elmer and Amy Brennan welcomed everyone and Heather reviewed the meeting objectives. All meeting materials can be found at: http://www.nerrs.noaa.gov/NSCIndex.aspx?ID=690
Site Designs and photos: ftp://ftp.dnr.state.oh.us/Soil_&_Water_Conservation/public/NERR_SC/

Both sites are directly accessible through www.crwp.org or www.coastaltrainingohio.org

Swale Design Presentation and Discussion

Jay Dorsey gave a presentation about swale design and function as a follow-up to ongoing CLG discussions. He described a continuum of swale design and function, and talked about where the Perkins Township swale falls on this continuum. Depending on design, swales can provide a range of hydrologic or ecologic functions, including conveyance, reducing peak discharge, improving water quality and reducing runoff volume. Flow-through swales, even when designed for water quality treatment and volume reduction; differ from the dry enhanced and wet enhanced "swales" currently included in Table 2 of the Ohio EPA construction stormwater permit (CGP). Flow through swale designs do not meet the criteria to be used as a stand-alone practice to meet water quality volume (WQv) requirements.

To meet water quality and runoff reduction goals, the swale design is modified to maximize hydrologic *inefficiency*, which can be counterintuitive for engineers used to designing practices that convey water away quickly. Ohio's current technical guidance (Rainwater and Land Development manual) for swales focuses on channels for conveyance and avoiding channel erosion. ODNR is expanding guidance for stormwater management swales to include design specification to achieve water quality and volume reduction. Key features of this swale include reduced channel slopes, a flatter cross-sectional shape for more wetted perimeter, and higher roughness to maximize residence time, amended soils to enhance infiltration, and shallow flow depth to contain the WQv event within turfgrass. The swale could have multiple uses from alternative pretreatment for a dry basin to a treatment train practice that helps meet runoff reduction requirements. The Perkins swale was designed to get real data on the volume reduction of such systems and lay the groundwork for expanding swale design guidance in Rainwater and Land Development. Such designs could be an important practice for meeting runoff reduction requirements that could be included in future watershed-specific or statewide CGPs.

CLG members discussed the pros and cons of wetland swales. NCSU research has shown lower effluent total nitrogen concentrations from wetland swales than standard dry grass swales, but did not show a similar water quality benefit for phosphorus and sediment. Jay commented that a wetland swale with larger plants such as willows would provide more roughness for larger events but have lower roughness for smaller events, reducing residence time and compromising runoff reduction and WQv treatment. Another tradeoff is that wetland systems that remove nitrogen can become phosphorus sinks depending on soil conditions and iron concentrations.

Participants asked for guidance on how to describe the Perkins Township swale. Terminology is an ongoing discussion within this group, but in the meantime Jay suggested the term "Water Quality Infiltration Detention Swale" per the site plans was an appropriate way to describe the intended functions of this design. In Wisconsin, swales receiving WQv credit are classified as vegetated infiltration swales. Jay suggested that Ohio could go to similar terminology that makes BMP function explicit.

Stormwater Monitoring Lessons Learned

Ryan Winston, NCSU, will manage the monitoring component of this project. He will be responsible for designing monitoring systems for sites and analyzing the results. He'll be working with Biohabitats staff including Paul Kovalcik and Kevin Grieser, who will be responsible for on-site management of equipment and data acquisition. Ryan provided an overview of stormwater monitoring systems and how they work and then discussed initial plans for the Perkins Township administration building.

NCSU utilizes as a range of equipment that can be divided into two categories. *Primary devices* such as weirs, flumes, or orifice plates allow measurement of flow rate in an open conveyance. Flow determination is based on measurement of upstream head acting on the structure. *Secondary devices* are used to measure the depth of flow over a weir or other structure and include pressure transducers, bubblers, area velocity meters, and rain gauges. Considerations for equipment selection include design and construction of inlet and outlet structures, accuracy, accessibility, cost, monitoring goals (hydrology or water quality), and anticipated flow rates. Ryan discussed pros and cons associated with use of manual and automatic tipping bucket gauges. Hydrologic monitoring data can be analyzed by importing flow rate as a function of time into Excel to create a hydrograph. Excel automatically integrates the area under the hydrograph curve, which equals volume. Inflow and outflow hydrographs can be plotted together to determine lag time and differences in peak flow rate. Ryan recommends monitoring for at least a year to understand performance as a function of rainfall variability.

After discussing stormwater monitoring generally, Ryan described the monitoring plan for Perkins Township. For the pervious concrete, since there is no defined inlet and no run on from pervious surfaces, inflow will be calculated based on rainfall data using the curve number method (CN98). Outflow will be monitored using a weir box in catch basin #16, which contains an outflow pipe from a set of connected underdrains. A second pipe that flows into the same catch basin from downspout drains could be a confounding factor due to tailwater but NCSU thinks this is unlikely because of anticipated low flows. For future projects, Ryan recommends designing one pipe in and out of each catch basin. Downspouts that flow into the pervious pavement subgrade will be included in the inflow. He noted that with a pitched rooftop, there will be almost no initial abstraction so 100% runoff is expected. A small area on the back of the building drains to the pervious pavement but it is 95% impervious so CN 98 will be used to model it. Catch basin #16 is located in the road, which can present maintenance and safety concerns but is workable here because with an underdrain it is unlikely that grass clippings or other debris will clog the weir. For the swale, an inlet weir will be located either within the catch basin or at the downslope end of the pipe at the inlet to the swale, depending on where there is enough drop. The swale outlet has a very long underdrain and two orifices so high flows will be measured separately from low flows.

Group members asked about monitoring equipment costs. Ryan's estimates included $100 for a metal v-notch weir plate constructed in house and $500 for a pressure transducers with built in data logger. Telemetry costs include a modem ($1,000) and a cell phone plan ($60-$80/monthly). The project team will track and establish benchmark costs for monitoring.

Group members talked about the potential of design standards based on annual runoff reduction capability. Jay noted that infiltration rates are so low in comparison to rainfall intensity that engineers must design a specific storage volume into the BMP to achieve significant volume reductions.

Three group members indicated that they would like to see winter monitoring of BMPs to address mild weather, rain over snow and frozen ground, winter flooding events, infiltration of snow melt, and generally to provide a more robust assessment of system function applicable to current and future climate conditions. Amy said the team will explore possibilities for winter monitoring with NCSU.

Design Assistance Updates

This project is providing funding to assist with BMP design at five potential monitoring sites. CLG members will have additional opportunities to provide input regarding these projects including feedback on draft designs through participation in optional meetings, webinars, and site visits over the winter. Project Team members gave an update on the status of each of these sites as follows.

Perkins Township Administration Building - 2/3 of the pervious concrete has been installed and the final section is expected to be installed within the week. The sub-base consists of #57 and #8 stone. Installation was completed quickly to prevent drying, used sprayers and a roller until done working the surface, covered with plastic immediately while it cured for a minimum of seven days. Cloudy and humid conditions were perfect as they reduce the risk of drying. This project surmounted financial, educational, political, site design and space barriers and was already in the planning stages when the CRWP-NERRS Science Collaborative project got underway. The project used a certified installer and batch plant (per Ohio Concrete Association). The swale has been excavated but amended soils have not yet been added and it has not yet been stabilized. Plans are underway for educational signage and it is already being used for training.

Old Woman Creek NERR – Contracts are complete and kickoff and initial design meetings have been held. There is currently no certification for porous asphalt manufacture or installation. Leo Sferra noted that the installation process is less labor intensive than pervious concrete and offered to provide contacts for installers in Cleveland. Rachel Webb suggested contacting those involved with a Kentucky porous asphalt installation. People discussed the temperature limits of porous asphalt binders. If asphalt temperature exceeds 64°C, the typical binder PG64-22 (rated -22°C to 64°C) will melt and consolidate and the system's infiltrative function will be lost. A new binder PG76-22 is rated from -22°C to 76°C. Bre suggested that the team consider how climate change impacts other than changing precipitation patterns could affect BMP performance e.g. temperature affecting pavement mix or plant selection. Sealcoating is also a risk with porous asphalt. The Reserve will provide educational and maintenance signage and communicate with ODOT about the project.

Willoughby Hills Community Center (Lake County- site of 2nd CLG meeting): Plans for this installation are in flux. The original plan called for pervious pavers in handicap parking areas and a bioretention cell downstream. A second iteration included maintaining pervious pavers in their location, capturing

downspout drainage, and moving the bioretention cell closer to parking area because of potential catch basin interconnections. The plan has again been revised, per the Mayor's request, to incorporate pervious pavers in an area adjacent to a planned amphitheater. During a recent site visit, the project team discovered flow around a pipe in a catch basin of interest and identified potential safety and accessibility concerns with another catch basin, which is 8 ½ feet deep. Next steps include conceptual plan updates, surveys and infiltration tests.

Orange Village Service Facility: This project is still in the early planning stages and contracts are in process. The village purchased on old church that will be renovated into the service department. Proposed design includes pervious pavers (on a commercial scale) and a series of bioretention cells that would infiltrate roof drainage from existing buildings. The project team will evaluate monitorability concerns if underdrains are connected to the paver system. This project may be applicable for residential downspout disconnection and rain gardens.

Pepper Pike City Hall: The city is re-grading and adding pervious pavers to existing parking lot and installing a rock lined 'snowmelt swale' which will serve as pretreatment for a turfgrass bioretention cell. Only the pavers are under consideration for monitoring. The city is interested in this bioretention design because some local homeowners have replaced perennials in roadside bioretention with turfgrass.

Other Project Updates

Infiltration Test Results – All projects being monitored need a site characterization. If owners or contractors provide a backhoe and coordination, ODNR will perform infiltration tests and soil investigation. Tests have been completed for Perkins Township (.05in/hr) and Old Woman Creek NERR (<.005in/hr) and for the City of Sandusky Warren Street project – a brownfield redevelopment that was proposing a 42" deep bioretention cell. Bedrock was discovered at 24," so the group is now investigating a shallower swale. ODNR performed an infiltration test in a fill layer on top of bedrock.

Modeling – A contractor developed continuous and design event data sets based on the historic record including analysis of typical, dry, and wet years for Sandusky and Chardon, Ohio. These data sets illustrated highly variable rainfall patterns across the study area which means it is not possible to base modeling on data from one central station. The contractor also compared Atlas 14, Bulletin 71 and TP 40 data for project focus areas and researched availability of evapotranspiration data. The project team is currently building baseline unit area models of BMPs. Once models are built, soil and shape parameters can be adjusted to predict volume reduction. Monitoring data will be used to calibrate or validate models. The project team is also inventorying data available from others including UNH Stormwater Center, NCSU, and Wisconsin. One CLG member noted that local monitoring data is needed to inform engineering practice and decisions in Ohio.

Monitorability Fact Sheet - Jay presented the "Making Stormwater BMPs Monitoring Capable" factsheet, which was developed with CLG input. This fact sheet has been made available to Ohio EPA to share with SWIF grant recipients and to projects receiving stormwater design assistance through this grant.

Communications and Outreach - Heather discussed outreach to the stormwater management community to increase awareness of the project. Amy and Crystal gave updates on training and technical assistance provided by ESWCD and CRWP.

Stormwater Management Threshold - The City of Lakewood has an 8000 square foot trigger at which redevelopment projects must meet local and state standards. This threshold was selected because it does not apply to most residential projects. CRWP shared this information with the Cities of Mayfield Heights and Solon for consideration of a less than one acre threshold for development sites to manage stormwater. To date, neither of these communities have adopted a stricter standard. Amy asked that anyone aware of other communities adopting lower thresholds please contact her. CRWP is assisting the City of Mentor and Orange Village with updates to stormwater and parking codes, including revisions to allow porous pavement and bioretention, provisions for shared parking, land banking, or shared uses. CRWP is also working with partners to develop inspection and maintenance checklists and manuals and recently led a better site design tour focused on riparian setbacks, conservation development, and parking standards.

Erie County Update - ESWCD coordinates quarterly meetings with regulated communities to provide compliance updates, discuss innovative techniques and providing implementation tools and resources. The district recently partnered with OWCNERR to offer training workshops on local codes and BMPs, is working with communities to improve illicit discharge detection and elimination, and will coordinate development of a local stormwater management plan. ESWCD is working with the Ohio Balanced Growth Program to provide technical assistance with adoption of local stormwater codes. The City of Vermilion revised driveway paving requirements to allow pervious options and City of Sandusky commissioners recently contacted the district about pervious pavement for a museum parking lot.

CLG Engagement - Heather asked the group to contact her or Amy with training or technical assistance needs that could be met through this project or related work of the partners involved. She thanked CLG members who responded to the bi-annual online feedback survey and distributed a results summary. CLG members are also encouraged to contact Amy or Heather directly with any suggestions. Amy reviewed the work plan for the next several months, which include completing designs for four projects, providing opportunities for CLG input, developing monitoring plans, equipment measurement for two sites, building models, and ongoing scoping for tools and data sources for climate scenario modeling. Heather distributed certificates that note 2012 project participation to all CLG members.

CLG Meetings in 2012 - CLG meeting dates for 2013 are April 24, July 17, and September 18. Meetings will include site visits and be slightly longer than 2012, possibly until 3pm. Locations will be determined based on design and construction schedules. Project updates will be provided before the next meeting along with additional opportunities to provide feedback on site designs.