NC NUTRIENT SCIENTIFIC ADVISORY BOARD MEETING SUMMARY

MAY 7, 2021 / 9:30 AM – 12:00 PM
REMOTE WEB MEETING

ATTENDEES

Members / Advisors
Charles Brown – Cary
Alisha Goldstein – Chapel Hill
Sally Hoyt – UNC
Bill Hunt - NCSU
Josh Johnson – AWCK
Eric Kulz - Cary
J.V. Loperfido – Durham
Andy McDaniel - DOT
David Phlegar – Greensboro
Haywood Phthisic – LNBA
Allison Schwarz Weakley - Chapel Hill
Forrest Westall – UNRBA
Sandra Wilbur – Durham

TJCOG Staff
Maya Cough-Schulze

Guests
Teresa Andrews – Guilford County
Anne Coan - NC Farm Bureau Federation
Kathryn Cooper, Raleigh
Jacob Dorman - Stormwater Solutions
Amy Farinelli – Raleigh
Alix Matos - Brown and Caldwell
Dan McLawhorn - Raleigh
Sushama Pradhan - NCDHHS
David Shouse – Carolina Wetland Association
Rahn Sutton

DEQ Staff
Corey Anen - DEMLR
Patrick Beggs - DWR
Trish D'Arconte - DWR
Nora Deamer - DWR
Rich Gannon – DWR
Joey Hester - DWR
John Huisman - DWR
Kelsey Rowland - DWR

AGENDA TOPICS

1. Approve March 5, 2021 Meeting Summary
2. Latest stormwater research from NCSU Bio and Ag Engineering

Meeting Materials and the NSAB Charter are available online: www.deq.nc.gov/nps

MEETING SUMMARY

Patrick Beggs (DWR) opened the meeting with introductions and a review of the agenda.

The March 5, 2021 meeting summary was approved.

Stormwater Research supported by the NC Policy Collaboratory and Others

Presenter: Bill Hunt – NCSU Biological and Agricultural Engineering
Slides can be found online.

How can we improve stormwater control measures over time rather than assume they will get better? Models assume SCMs work the same over a 30-year window, bu model input is from the beginning of SCMs lifetime.

Bioretention:

- Collaboratory wanted to look at the performance of a bioretention in University Mall that Bill Hunt built/studied 15 years ago. Performance was BETTER 15 years later! Why?
- Suspect that the amount of biological activity increased 15 years later. More carbon in the media. Bioretention is an ecosystem!
- SCM was also well-maintained.
- Phosphorous storage was not near storage capacity.
- Implications for crediting: consider role of maturation by practice?
- Studied a range of ages of bioretention cells rather than doing a longitudinal study of one bioretention.
- C:N ratio significantly decreases with age of bioretention. Not a great thing for performance. Worth adding some C? Wood chips, sawdust?
- Majority had Phosphorous indices that were not saturated, several were close to saturated, one was leaching P.
- What design elements matter for C:N ratio and P-index? Forebay, Age, Media depth important for both.
- Forebay stores Carbon and preserves Phosphorous.
- Forebay will not make sense if bioretention is receiving sheet flow. But if bioretention has a few inlets, put them in!
- Forebays need to be maintained of course. (should be easy to maintain, at edge of parking lot.)
- Vegetation type did not appear to make a difference.

Q&A - bioretention
Sandi: What do you attribute the bioretention in Chapel Hill improvement to? Was there less loading over time?

Bill: Probably more loading, as we saw higher pollutant concentrations entering at the later date. Despite higher influent concentrations, lower effluent concentrations.

Sandi: Do we know for sure that maintaining vegetation makes a difference, or that there just needs to be vegetation?

Bill: We know that having any healthy vegetation is good. But, if you have turfgrass, it seems to work as well. We do not know the role of maintenance, because all the practices we studied were well-maintained.

Rich Gannon: Is there concern that biomass accrual might affect mechanisms of nutrient removal? Is biomass removal part of maintenance requirements?

Bill: Yes, maintenance is needed for biomass accumulation, but based on work colleague Alan Davis at UMD has done, the amount of biomass accumulation typical for bioretention does not appear to cause issues with eventual N or P leaching.
Biomass accumulation needs to be managed more because it starts taking up storage volume, and reduces your storage depth. Design does not accommodate extensive biomass removal.

Grady McCallie: Looks like there is a "sweet spot" of bioretention age where performance improved significantly. Why?

Bill: We do not know the history of these bioretention cells. It is likely that the newer cells are just getting designed better over time.
MD has amended cells with questionable P removal with water (not wastewater) treatment residuals to good effect.

Alisha Goldstein: Besides age, do you have a sense of loading rates for the 18-year-old bioretention site and how the loading rates may have affected bioretention performance?

Bill: Loading rates didn't end up being a significant factor in decision tree analysis. Would seem that higher influent loads would tax the cells. Expects that influent loading was in a tolerable range.
Practices that are undersized for their watershed can perform VERY poorly. These ones were all well designed, implemented, and maintained.

Sand filters

- Current research on treatment effectiveness is not in ecosystems anything like NC.
- Research on ones in Fayetteville and Greensboro. Perform well for sediment, ok for P (because of particulate P being strained out). Nitrogen removal varies.
- Look like dry or wet ponds depending when you visit, but with a cleanout pipe
- Seeing grass on your sand filter is not a great sign. Sand filters require fast flow.
- Internal water storage – missed implications
- Sand filter studies will be completed in December 2021.

Q&A – sand filters

Josh Johnson: If they are built on basis of high velocity flow - how does IWS impact that from a long term maintenance perspective?

Bill: I don't know, but I don't think so.

Josh: Current MDC allows a lot of storage on top of sand - would this be impacted by IWS or impact the study?

Bill: The more 'driving edge' you have the better to push water off your sand layer. Might allow you to shrink your footprint. The IWS zone would be impacted most by having a smaller volume/footprint.

IWS preserves a volume of water to stay until the next storm comes. That water that gets pushed out is cleaner. Smaller footprint minimizes this potential benefit.

Sally: How will IWS be different in SF's contained in concrete versus those graded into soil?

Bill: The concrete box ones have higher likelihood of denitrification but eliminate chances for infiltration.

JV Loperfido: Do you think removal rates monitored in the above ground sand filters translate to underground sand filters?

Bill: Yes, if appropriately maintained. Underground sand filters often seem to be less reliably maintained. When we shrink the footprint of the media, it receives more water and pollutants, so there is more likely to be a sealing at the surface, which is not good.

JV: UMN research on SFs: They added iron – are you considering this?
Bill: We have looked at this but they are expensive.

Sand filters completely hinge on good infiltration. And there is no built-in mechanism besides maintenance to complete infiltration. If you don't, they're a bad practice.

Tree planter systems

- Silva Cells originally created to allow urban trees to be healthier – allow their roots to take up needed space under suspended pavement
- Bill began researching their use for stormwater. Treated 80% of all the water during 1-year monitoring period. Excellent pollutant removal rates (see slides.)
- Unexpected results – Fayetteville Silva Cell inlet was clogged because it was via unmaintained, clogged permeable pavement.
- Experimented with undersized Durham Silva Cell to test overtaxing. 94% of water bypassed. Inlet was not big enough.
- Clearly need to work on getting the water into the media – it provides good treatment if it gets there, current designs aren't effective for inflow though.

Q&A – Tree planter systems

Grady McCallie: One of the arguments that urban forest advocates use for street trees is that they intercept a certain amount of rain even before it hits the ground - that's in addition to flow reduction from in to out, right? Of course, the area caught by the tree foliage is probably just a fraction of the area of the cell catchment?

Bill: Yes, interception is a fraction of overland flow inflow.

Sally: How was tree health in these systems with high bypass?

Bill: Tree that received more of the flow was very healthy. In Fayetteville where there was high bypass, a lot of trees died. Durham's silva cells have piped inflow – does not depend on whim of the curb line – so Bill does not worry about Durham's!

Sally: The site I mentioned has an existing hydrodynamic separator treating the flow before it enters the Silva Cell

Have Bill or Sarah talked with Katie Rose Levin about using Silva Cells for stormwater management? What has her experience has been re: long-term tree health?

Charles Brown: Would a storage box be helpful to catch sediment and have a notch for flow into silva cell and a bypass?

Bill: Sarah Waickowski is starting to study this – a catch basin as pretreatment for a silva cell. We also have data from Goldsboro with something similar to this – which had less bypass.

Another idea: Put Silva Cell in the saddle of a roadway, so the water doesn't have anywhere else to go.

Maintenance access is still important. Curb Inlet is an easy way to do this.

Subsurface gravel wetlands

- Eliminate hazards of mosquitoes and drowning relative to stormwater wetland.
- Not very well studied, current design guidance based on one study in NH
- Highly impervious watershed, compacted clay on site. Design and depth shrunk for cost needs – 50% undersized. Design is similar to bioretention with IWS. Wetland forebay is always wet.
- Became clogged during within a year due to impermeable layer forming on top. Maintained by using a garden rake everywhere besides where plants were (were not taking well.)
- Gravel wetland is now well-vegetated (grass growing on top.)
- Subsurface gravel wetlands should not have more than 3 days of ponding and this one definitely exceeded that.
- Has very good P removal.

Q&A - Subsurface gravel wetlands

Sally: Could these be installed in a linear way - like a bioswale?
Bill: I think so.

Andy McDaniel: Would you expect this type of formation on the surface of a subsurface gravel wetland in other types of development?
Bill: No. Greensboro watershed draining to this practice was bigger and dirtier than pretty much anywhere you could site it.

Andy: The finer gravel under sand – could you get away with an entire full depth of expanded slate instead of different types of material?

Bill: Expanded slate would still need to be amended with something that supports plant growth. But you could probably just add 6 inches of sand or something similar to a column of expanded slate.

JV: Looked like the slime layer formed in colder months too - am I remembering the graph correctly?
Bill: It started late summer/early fall, and continued/sealed shut in November

Rich: Is the gravel wetland lined to ensure the right hydroperiod for the media? - Yes.
Were the percentage removals load reduction percentages? - Yes
What kind of plants survived?
Bill: Would have to check with student!

Floating Treatment Wetlands

- No data yet. Could be $20 - $100 per sq ft? Need to check with student. Not cost effective if so. Could we optimize placement to reduce footprint?
- Retrofitting 3 across central/eastern NC with B-Mat floating islands that touch and water has to flow through them to get to the outlet structure. One on NCSU campus, one in Wilson, one in Wilmington.
- Expect this study to be done in a year – will report back on results then!

The NSAB will meet Sept 3, 2021.