Underwood and Associates: Heather Johnson, Operations Manager; Received July 2, 2018

1. **What next steps do we think are important to use the data and information that we have gathered thus far to evaluate RSCs?**
   It would be very helpful to have a file sharing system that includes all the data that has been collected on RSCs so all interested parties can review and analyze all the available data and studies. For example, we can provide some monitoring data from the first five years post construction at Howards Branch that many of the partners likely haven't seen before. Additionally, it is imperative to carefully choose reference or control sites/conditions against which to evaluate stream restoration. Most stream restoration projects are installed specifically because the watershed/stream is severely degraded, and these projects can only restore so much. Lastly, in many cases the goal of an RSC project is not to restore just the stream but instead to restore the entire integrated stream and wetland complex to a condition that sets the evolution of the system on a path of regeneration towards the historical condition. In headwater systems, many believe the historical condition to be a large flowing wetland with conveyance frequently interrupted by deadfall and beaver impoundments.

2. **What organizations are critical to help define the path forward?**
   Organizations vital to the discussion include but are not limited to: DNR, Anne Arundel County Watershed Protection and Restoration Program, Chesapeake Bay Program, District Department of the Environment, Chesapeake Bay Trust, and our firm, Underwood & Associates, Inc.

3. **Are there any other research or data needs that we need to consider as we work collaboratively to use the data and apply it to our work?**
   There is a great deal of data that has been collected by various organizations. The thing that is most needed now is a way to bring together all of that data to allow all parties to truly collaborate based on shared knowledge.

4. **What role and/or resources do we need from the Chesapeake Bay Program partnership?**
   It would be beneficial to provide a venue for private sector practitioners to collaborate with Bay Program partners to develop policies. Firms like ours are involved in the design and construction of RSCs and have knowledge and experience that is unique and valuable.

5. **Do we need to create guides or tools for implementation efforts?**
   Guidelines that encourage innovation and take into account differing site conditions would be valuable. It should be noted that USFWS and AACO already have published guidelines for RSCs - these should be utilized rather than overlooked. Additionally,

converting those guidelines into strict regulatory practices would be counter-productive.

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RESPONSES TO GROUP DISCUSSION QUESTIONS FROM JUNE 19, 2018 USWG MEETING

1. What next steps do we think are important to use the data and information that we have gathered thus far to evaluate RSC'S?

   The data is a snapshot of relatively recent projects that appear to have been chosen in a somewhat haphazard way. Several of the projects were not even viable RSC's. This is problematic from a statistical and scientific viewpoint. Need to choose projects that truly represent RSC. Timeline is especially important with the iron floc issue, since we have observed that it tends to lessen considerably over time as the system stabilizes.

   Need to use the pre-restoration and post-restoration data that is available in many cases from Anne Arundel County and the watershed groups which sponsored the projects.

   Projects need to be followed over time. The project that has been installed the longest was not even included in the study (Howard's Branch).

   A successful RSC is an integrated complex of stream and wetland. Using the Stream IBI is therefore often not appropriate. Consider utilizing the wetland IBI for analysis.

   Measurement of DO in isolated locations may not be providing an accurate view of the project. For example, in the SERC data recently presented by Tom Jordon, he is finding rising DO in the recharged ground water at the site.

   The reference sites utilized do not appear to have been appropriately selected.

2. What organizations are critical to help define the path forward?

   Anne Arundel County Watershed Protection and Restoration Program (Department of Public Works)
   District Department of Energy and Environment (DOEE)
   Maryland Department of Natural Resources

3. Are there any other research or data needs that we need to consider as we work collaboratively to use the data and apply it to our work?

SERC is probably the most complete effort to date, and their long-term data will be helpful.

4. What role and/or resources do we need from the Chesapeake Bay Program partnership?

   We have real concerns regarding EPA Region III dictating appropriate design solutions to satisfy TMDL from the top down. It runs counter to Section 204 of Executive Order 13508 and is dismissive of the local jurisdictions and watershed group's abilities to develop appropriate responses. We rely on the CBP to mediate and advance the approaches developed at the state, county and watershed levels.

   At this point this is one-sided top down science that frankly appears to be a conclusion looking for a study to attach itself to. Functional and biological uplift is complicated. Anne Arundel County moved forward with their RSC/SPSC approach in order to create biological uplift and ecological services that are not necessarily achieved when using more conventional BMP and stream restoration approaches. The local jurisdiction in Anne Arundel County has developed a very professional and thorough approach and to be blindsided and scolded by EPA Region III is counter productive to achieving Bay health AND improved ecology.

   We need better integration of the private construction contractors who are working in the field.

5. Do we need to create guides or tools for implementation efforts?

   Not at this time. What we really need is more flexibility in the field for interpretation of the regulations for compliance with projects that are providing ecological uplift. These projects should not turn into checklists. Rather, regulators should employ interpretative guidelines that allow freedom to explore innovation and to capture unforeseen ecological opportunities. Unlike the armored and structured BMP, these projects are actually intended to change over time as they mature.

6. Can these research findings be addressed along with the action items identified at the June 4 Joint USWG/Stream Health Workgroup meeting?

Not sure what these are, although we participated and are a member.

ACTAEON
expert execution of environmental projects

Actaeon: Responses to Group Discussion Questions from June 19, 2018 USWG Meeting

Q1. What next steps do we think are important to use the data and information that we have gathered thus far to evaluate RSCs?

a. Ensure that we have done due diligence in gathering and analyzing a wide range of studies that have been conducted in the past decade.
b. Consider comparing RSC macroinvertebrate data to Wetland IBI as well since properly designed and constructed RSCs should have a more intricate mosaic of habitat types with a preponderance of wetlands.
c. Regarding low DO, properly constructed RSCs that fully reconnect the stream to its floodplain is often a "stream" of wetland complexes. It often has robust subsurface flow that is rarely measured or fully understood. It increases time of concentration by storing water on the landscape and, therefore, has low DO in these segments but will seep and feed downstream segments during dry periods, enabling downstream segments to flow and have higher DO. This poses a challenge when assessing RSCs since DO is a parameter in federal WQ standards for streams. However, as restoration practitioners, should we not look at the system as a whole in an effort to maintain and restore the integrity of our complex natural resources rather than dissecting it to check off boxes? Perhaps we should be monitoring WQ parameters downstream of RSCs to measures its effects downstream, not only inside the project footprint.

Q2. What organizations are critical to help define the path forward?

a. The following organizations have funded and implemented the most RSCs in the region and, therefore, are critical to defining the path forward:
    1. Anne Arundel County DPW
    2. Maryland Department of Natural Resources
    3. District Department of Energy and Environment and
    4. Chesapeake Bay Trust.

Q3. Are there any other research or data needs that we need to consider as we work collaboratively to use the data and apply it to our work?

a. It is important to study the groundwater/surface water interaction that is often robustly restored post RSC and to monitor, long-term, the hydrological and geochemical processes in groundwater pre and post restoration.
b. Funding current monitoring efforts at RSC sites, e.g., SERC, to enable long-term monitoring is critical to assess the full effects of RSC, which may take longer to detect biological uplift but ultimately reach a higher functioning state if the full hydrologic and hydraulic functions have been properly restored.

Q4. What role and/or resources do we need from the Chesapeake Bay Program partnership?

a. The restoration community depends on the CBP to be a fair arbiter in advancing sound science and policy.
b. CBP's support in providing a forum for advancing the science and practice of stream restoration is critical to the restoration of the Bay.

Q5. Do we need to create guides or tools for implementation efforts?

a. Assessing new techniques for effectiveness is sound practice. However, based on the June 19th meeting, there still seems to be a question within the CBP restoration community whether to maintain RSC as a tool for restoration. CBP's lead in taking RSC topic to STAC, as discussed at the meeting, would be the most effective use of CBP's valuable time and resources at this time and can be instrumental in generating collaborative attempts to move forward in finding effective solutions to successfully implementing the RSC tool, which is currently lacking.

Q6. Can these research findings be addressed along with the action items identified at the June 4 Joint USWG/Stream Health Workgroup meeting?

a. Was not at the meeting and, therefore, cannot respond knowledgeably.

Robert Goo, EPA: Responses on RSC Guiding Questions (Received 7/10/18)

1. What next steps do we think are important to use the data and information that we have gathered thus far to evaluate RSCs?

   Determine whether there is enough data to draw consensus conclusions about RCS site, design and performance factors that can inform both funding, site selection, design and operation of maintenance of RCS. If there is sufficient agreement about what conclusions can be drawn from the current research, determine whether guidance can be developed on this topic. If insufficient agreement occurs, determine what additional research is needed and seek research funding or develop a research agenda that can be pursued if funding becomes available.

2. What organizations are critical to help define the path forward?

   EPA (Regions, HQ Office of Water, Office of Research and Development), Ches. Bay States and other interested states, USFWS, USACE, NGOs, Counties (Anne Arundel et al), DC, FHWA/DOTs

3. Are there any other research or data needs that we need to consider as we work collaboratively to use the data and apply it to our work?

   Are RCS instream treatment systems or restoration projects? Should they be allowed inline (instream)? Where are they most appropriate based on successes and other concerns, e.g., low gradient systems, first order streams, ephemeral streams. Are there secondary effects from tree canopy removal? Is the addition of iron stone detrimental to downstream DO and biotic diversity? What are the trade-offs and how do we evaluate them? Is the high cost of RCS commensurate with the benefits? Should we be exploring other options that achieve the most positive results of RCS that may be implemented at lower cost, e.g., outlet modifications? Would outlet modifications achieve similar results over time in terms of achievement of channel stability and flood plain restoration? Are RCS primarily being used to take WIP credits for pollutant removal reductions or restoration purposes? If they are being used for pollutant removal credit purposes, should they be allowed inline?

4. What role and/or resources do we need from the Chesapeake Bay Program partnership?

5. Do we need to create guides or tools for implementation efforts?
   Yes. Guides and tools are needed for siting, design, performance evaluations and monitoring and operation and maintenance.

6. Can these research findings be addressed along with the action items identified at the June 4 joint USWG/Stream Health Workgroup meeting?

7. Next Steps/Action items

Jeff White, MDE: Responses to RSC Guiding Questions (Received July 12, 2018)

- Initial research indicates that habitat scores (mainly woody debris and riffle quality) improve at RSCs (compared to control sites); therefore, it is not likely that habitat is a limiting factor for benthic recolonization.

- Initial research indicates that DO is a likely limiting factor, preventing benthic recolonization at some RSCs; however, what hasn't been studied is the recolonization potential of a given site, in the form of a) the proximity to good benthic sites, or b) the benthic organisms that were present prior to restoration, and whether or not DO is the primary limiting factor in comparison to recolonization potential. Further study on DO as a limiting factor and new studies related to recolonization potential appear to be needed.

- Are there any effects of RSCs on fish passage? Could be a potential research project.

- Most RSCs on perennial streams that have been constructed are located in the coastal plain physiographic province. Generally speaking, coastal plain streams present a greater degree of difficulty in determining biotic metrics and identifying stressors/stressor thresholds to biotic communities. These streams are often more like wetland complexes. They can naturally have high DOC and low pH (blackwater), and they often have naturally low diversity and IBI scores. MD DNR has not developed a specific blackwater IBI, but they do acknowledge that when the DOC is high (> 8.0 mg/L) IBIs can be low for natural reasons. Therefore, we may want to question whether or not we need further research on what constitutes a reference condition on the coastal plain and what stressors affect biotic communities in this province, before making recommendations and/or assessments as they relate to RSCs?

Steve Saari, Cecilia Lane, Josh Burch, Stephen Reiling, DOEE

Date: August 1, 2018

To: Norm Goulet, Chair, Urban Stormwater Workgroup
Tom Schueler, Coordinator, Urban Stormwater Workgroup

From: Steve Saari, DOEE; Cecilia Lane, DOEE; Josh Burch, DOEE; Stephen Reiling, DOEE

Re: DOEE Comments on the Urban Stormwater Workgroup (USWG) Stream Restoration Research Special Session

On Tuesday, June 19, the Urban Stormwater Workgroup (USWG) held a special session on stream restoration research with a particular emphasis on the regenerative stormwater/stream conveyance (RSC) practice.

The following reflects DOEE's response to the information that was presented.

General Comments:

DOEE Specific Needs for RSCs

As the only solely urban state in the Chesapeake Bay Watershed, DOEE has found RSC to be an effective restoration technique. Most of the District's streams are severely impacted by high velocity flows coming from stormwater outfalls, and RSCs have been the most effective restoration technique in these areas, especially given the spatial constraints the District has as an urban jurisdiction.

Tree Loss

Presentations that note "tree loss" as a result of RSCs being constructed should consider the following:

1. If Natural Channel Design or Legacy Sediment Removal techniques are used at these sites, more trees would likely die from the large amount of excavation needed on site (RSCs require little, if any, excavation);
2. RSCs raise the water table, creating historic hydrologic conditions that favor native trees over the existing upland or nonnative trees; and
3. In the District the National Park Service has preferred the standing dead trees caused through inundation to outright tree removal. They have looked at the standing wood as providing habitat for wildlife. DOEE concurs with this approach when there are no other safety concerns.

Macroinvertebrates/Other Stream Health Indicators

It must be acknowledged that, in an urban environment, there is a limit to the degree of healthy water quality conditions. RSCs and other types of restoration can improve conditions but will likely not return stream health to the conditions prior to urbanization. If RSCs or other techniques reduce bank erosion and its associated nitrogen, phosphorus, and total suspended solid (i.e., sediment) loads, that is considered a success. When assessing water quality impacts, further studies are needed for dissolved oxygen and temperature. The studies should be done at a minimum of five years after restoration as plants are established at restored sites.

Comparison of Other Stream Restoration Techniques

DOEE maintains that in order to get a fair assessment of the RSC practice, it is important to evaluate other stream restoration techniques in terms of pre- and post-restoration conditions and compare those to the RSC pre- and post-restoration conditions.

Quality of Data Presentation

DOEE is concerned about the prevalence of data-limited presentations being given throughout the Chesapeake Bay Watershed. Open discussions similar to the June

19 USWG meeting, which include presentations with conclusions supported with limited data, do little to facilitate knowledge transfer. It is essential that enough data is being collected and presented for decision makers to draw accurate conclusions.

Group Discussion Comments

The following discussion points were identified by the presenters of the special session. DOEE's comments on each question are listed below.

1. What next steps do we think are important to use the data and information that we have gathered thus far to evaluate RSCs?
    - Gather all research including NC State studies, District of Columbia, and Maryland data to have a fuller picture.

2. What organizations are critical to help define the path forward?
    - District of Columbia
    - Biohabitats, Inc.
    - NC State University
    - MD DNR
    - EPA
    - USFWS
    - UMD
    - USACE

3. Are there any other research or data needs that we need to consider as we work collaboratively to use the data and apply it to our work?
    - Significantly more data collection is necessary in order to accurately assess the efficacy of these practices.
    - Pre- as well as post-restoration data should be considered in evaluating these systems.
    - Longer time periods for evaluation of the practices after restoration is necessary.
    - Survey of all installed RSCs looking at agreed upon attributes such as age, slope, stability, presence of floc, native soils, construction materials, etc.

4. What role and/or resources do we need from the Chesapeake Bay Program partnership?
    - Facilitation services – need to bring key players together with regulators to understand what the real issues and roadblocks are for both sides, try and find compromise/consensus, come up with steps to move the debate forward, etc.

5. Do we need to create guides or tools for implementation efforts?
    - The functional pyramid guide should work for RSCs as well, perhaps some consensus guidance on under what conditions the RSC

approach is favored and when natural channel design is preferred, and when a combination is the best approach.

6. Can these research findings be addressed along with the action items identified at the June 4 joint USWG/Stream Health Workgroup meeting?
    - N/A – this meeting has already passed.

Offer to Collaborate

DOEE is willing to collaborate with the U.S. Environmental Protection Agency (EPA) Region III to identify RSCs installed throughout the District for further study. Additionally, DOEE can provide pre- and post-restoration monitoring data to be considered as a part of this evaluation process.

Over the course of eight years, the District has installed 10 RSCs at various sites with differing conditions. DOEE will work with EPA Region III to catalogue the sites, visit the sites post-restoration, share pre-restoration monitoring data (scientific and anecdotal), and provide additional support as EPA Region III evaluates the efficacy and suitability of RSCs.

Please do not hesitate to contact us about opportunities for collaboration.

Steve Saari
Associate Director
Watershed Protection Division
Department of Energy and Environment
Government of the District of Columbia