



Innovative Reuse Committee 2022: RFP Progress and Outcomes
Belden-Eco Products, LLC and Northgate Environmental Management, Inc.

Tuesday, June 7, 2022; 5:30 pm – 7:00 pm
Cox Creek Operations and Maintenance Building, 1000 Kembo Road, Baltimore, MD 21226

Meeting Objective: To learn about progress from two of the groups awarded support from the Request For Proposals.

Welcome and Introductions – *Sari Rothrock, RK&K*

Ms. Rothrock welcomed participants to the meeting, briefly introduced Robert Natarian, Senior Operations Manager at Cox Creek Dredged Material Containment Facility (DMCF) and requested that participants introduce themselves (**Appendix A**).

Results from Research & Development Projects– *Kristen Keene, MDOT MPA*

Kristen Keene provided an overview of the Request for Proposals process. The Maryland Port Administration (MPA) solicited proposals for research and development in response to private sector feedback that there were opportunities for dredged material to be used in new and innovative ways. There are currently six contracts that have been awarded and a seventh is pending.

Ms. Keene also introduced the speakers for the meeting, Bob Ittmann and Ryan Andre from Belden-Eco Products and Sam Merrill from Northgate Environmental Management.

Belden-Eco Products, LLC- *Bob Ittmann and Ryan Andre*

Belden Eco-Products has been working to combine dredged sediment with other materials to develop ceramic bricks and permeable pavers. They chose permeable pavers as a product because the product helps to manage stormwater runoff by creating opportunities for infiltration (unlike impervious surfaces like normal pavement). Belden Eco-Products is owned by The Belden Brick Company and Eco-Ash, LLC and its goal is to manufacture advanced “green” brick and paver products from nontraditional feedstocks. For the R&D contract, the company’s objectives were to evaluate the use of Cox Creek dredged material in isolation or in combination with shale, clay, and/or Maryland-sourced fly ash to produce ceramic paver products at commercial scale volumes; and to evaluate the ability to manufacture pavers that meet the criteria for Category 1 - Residential Unrestricted Use Soil and Fill Material and the American Society for Testing and Materials (ASTM) performance criteria. The project process had six steps:

1. Collect and process dredged material.
2. Mix dredged material with shale, clay, and fly ash for recipe blends.
3. Perform baseline analytical testing per Maryland Department of the Environment (MDE) guidance.
4. Material analysis and lab-scale firing at TCKI to select preferred blend(s).
5. Full-scale test firing in France to develop recommended firing process.
6. Post-firing testing against MDE guidance, leaching and ASTM standards.



The presenters showed pictures and a video describing each step of the process as well as the results. Ultimately, their final recipe 1 (100% dredged material) produced a product that fit into Category 1 – Residential Unrestricted Use Soil and Fill Material, and their final recipe 4 (70% dredged material and 30% fly ash) fit into Category 3 – Restricted Use Soil and Fill Material, Cap Required. The team presented results from the testing and concluded that the dredged material pavers have the potential to be a successful commercial product. The dredged material pavers could be sold at equal or less the cost of traditional clay/shale pavers.



The presenters brought bricks created from their dredged material recipes and placed them along the tables in the room so that participants could see and touch the product.

Question: Was the feedstock adequate or did you have to dry it?

Answer: It had to be dried.

Question: How did you remove the salt? Where is the salt from? Is there a structural integrity question if you didn't remove the salt?

Answer: We used a proprietary process to remove the salt. Prior to solving the salt issue, the bricks had effervescence. The salt is from the brackish water in the Harbor. We did not test the structural integrity of the bricks from which the salt was not removed, but most of the market would not want that brick due to the effervescence.

Question: The colors are great. Are those colors able to be replicated?

Answer: The team is constantly batch testing and can blend as necessary.

Question: How consistent is the dredged material?

Answer: The Cox Creek material is relatively homogenous in terms of chemical and physical nature. Once in the facility there is no segregation of material.

Question: Was the fly ash aged? Chemical reaction can change over time when exposed to water depending on the age of the fly ash.

Answer: The fly ash was aged.

Question: You mentioned scrubbers. Did you find a change in emissions from the process?

Answer: No. They practically overlapped.



Northgate Environmental Management, Inc. – Sam Merrill

Northgate Environmental Management has been working with partners to develop concrete traffic barriers and modular shoreline protection structures using dredged sediments. The goal of their R&D work was to determine if dredged material could be used to create coastal stabilization structures that are durable and safe for shoreline deployment, as well as to determine whether dredged material could be a viable substitute for the sand fraction of concrete mixes for transportation purposes.

For both processes, the team worked to collect, dry, and process the sediment (including texting mix ingredients and creating/testing mixes). For the coastal stabilization product, they used the mixes to 3D print cubes (two for each mix design), cored the cubes to conduct strength tests, and then conducted leachability tests. Then they evaluated the results with MDE and MPA and selected optimal mix designs before collecting additional sediment, 3D printing additional structures, and then conducting drop tests. The purpose of the drop test was to evaluate the structural integrity of the structures based on heights the units could experience during transport and installation. No structures cracked or fractured when dropped from six inches. The structures also passed the strength and leachability tests. The modular 3D-printed shoreline protection structures could be considered for deployment in field conditions to address coastal stabilization concerns including erosion from sea level rise and storm surge.

For the concrete barrier product, they used the mixes to construct concrete cylinders, conducted strength tests on the cylinders, and conducted leachability tests before evaluating the results with MDE and MPA and selecting optimal mix designs. The structures did not pass the strength test, but they did pass the leachability test. Two of the mix designs have the potential to be used for alternative products with lower strength requirements like sidewalks, curbs, gutters, medians, electrical conduits, and drainage structures.

The presenter brought 3D printed structures made from their dredged material recipes and placed them outside the meeting space for attendees to see.



Question: Did you try dropping them on each other?

Answer: No. They were placed next to each other for a linear structure rather than stacking.



Question: Have you tried printing tetrapods?

Answer: No, but we could print any shape.

Question: Any chemical residuals from capillary agents?

Answer: Nothing was left behind.

Question: Capillary action typically action of pore size?

Answer: Printing process was more or less complete.

Question: Do you think the concrete barriers didn't pass because of organics and salt? What about ice?

Answer: Yes, to organics, but not sure about salt. SPLP encompasses ice conditions and is anticipated to stand up.

Question: What was the cure time of the structures?

Answer: Can be ready in eight hours but gave them thirty days.

Question: How much dredged material did you use?

Answer: We used one cubic yard of dredged material per block.

7:00 **Adjourn**



Appendix A Participant List

Innovative Reuse Committee Members:

Anne Arundel County Department of Public Works: Chris Phipps
Baltimore County Department of Environmental Protection & Sustainability: David Riter
Baltimore Port Alliance: Rupert Denney
Cox Creek Citizens Oversight Committee: Gary Gakenheimer
Maryland Department of Environment: Matt Rowe
Maryland Department of Natural Resources: Paul Petzrick
MDOT, The Secretary's Office (TSO): John Denniston
Northeast Maryland Waste Disposal Authority: Andrew Kays
Stancills, Inc.: Chris Siciliano
Tradeport Atlantic: Pete Haid

IRC Support Staff and Observers:

Facilitator: Sari Rothrock (RK&K)
Anchor QEA: Walter Dinicola
Bioenergy Devco: Nelson Widell
Blue Water Baltimore: Cody Mattheson
Direxa Engineering LLC: Yann Rouquie
EA Engineering, Science, and Technology, Inc.: Chris Overcash
EcoLogix Group: Steve Pattison
Full Circle Mushroom Compost: Lisa Van Houten
GEI Consultants, Inc.: Nancy Straub
Kent Conservation, Inc.: Doug West
MDOT Maryland Port Administration (MDOT MPA): Kristen Fidler, Kristen Keene, Joseph Ross
Maryland Environmental Service (MES): Dallas Henson, Robert Natarian
My Transaction Co: Anita Kestel
RK&K: Kim Troiani

Invited Speakers

Belden-Eco Products, LLC: Bob Ittmann, Ryan Andre
Northgate Environmental Management, Inc.: Sam Merrill