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Gorge Dam Sediment Removal and Stabilization – Beneficial Use Treatability Study to Support Design

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Background/Objectives. Dam removals are of significant global interest due to aging infrastructure, flood safety issues, recreational demands, and changing priorities in watershed conservation management. Contaminated sediment accumulation behind dams is a particular challenge to dam removal and engineering design. The Gorge Dam is located on the Cuyahoga River, between the cities of Akron and Cuyahoga Falls, Ohio. Contaminated sediment from behind the Gorge Dam will be mechanically dredged to facilitate dam removal (anticipated 2023) for restoration of the Cuyahoga River, which is notorious for the 1960's fires that spurred the environmental movement in the United States. This project is being conducted under the auspices of the US Environmental Protection Agency Great Lakes National Program Office. A bench-scale laboratory treatability study was conducted to support engineering design analyses for the proposed beneficial use of amended Gorge Dam sediments at an upland placement site located approximately 7,000 feet from the Gorge Dam pool, adjacent to the Cuyahoga River. Phase I of the treatability program consisted of a proof-of-concept feasibility study in December 2019. Phase II of the treatability program was conducted from September 2020 to March 2021 to assess the geotechnical and material handling properties of amended Gorge Dam sediments, as would be produced by Stabilization/Solidification with a pozzolanic binder.

Approach/Activities. The Phase II laboratory treatability program included a range of binder addition rates and curing conditions to address the geotechnical requirements expected for the upland placement site. Amended sediment mixtures were prepared using a Portland cement slurry at seven (7) binder addition rates between 5% and 20% (by wet weight of sediment). Sample specimens were created according to standard (uncompacted) and modified Harvard Miniature compaction procedures to simulate the spectrum of material handling activities anticipated onsite – from bulk material placement to construction of thin, compacted lifts. A "mellowing" period (24 to 72 hours) was introduced between mixture creation and sample compaction to simulate an initial upland laydown period. Curing conditions varied from "closed" temperature- and humidity-controlled conditions to "open" air-drying. Samples were cured from 0 to 56 days prior to testing. Geotechnical tests performed on the stabilized sediment samples included unconfined compressive shear strength ("UCS"), moisture content, and consolidated-undrained ("CU") triaxial testing.

Results/Lessons Learned. Results show that both binder dosage and onsite material handling activities would considerably impact the strength performance of stabilized sediment at the upland placement site. Comparison of the UCS results highlight the tradeoff between mellowing/curing time and binder dosage and enable project decision-makers to optimize design parameters to suit project needs. A Phase III expanded sediment coring characterization effort will be conducted in Summer 2021 to further assess stabilization attributes and alternative binders. The structure of the Gorge Dam Sediment Stabilization Treatability Program has demonstrated the importance of early and ongoing treatability testing to support project design.