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BRICKHAVEN WATER MANAGEMENT CASE STUDY

INTRODUCTION

Stormwater management can present challenging conditions on any construction project that includes clay soils; however, when the project site is a 267-acre exposed former clay mine under reclamation, the challenges become significantly more complex. Charah Solutions began mine reclamation at a former clay mine in central North Carolina in 2015 and assumed responsibility of all National Pollutant Discharge Elimination System (NPDES) discharge requirements for stormwater and wastewater for the site.

Brickhaven Mine Tract No. 2 was a former mine site which developed raw clay material used in brick manufacturing for a local manufacturer. Of the approximately 300 acres of area that encompassed the property, approximately 180 acres were denuded, providing a significant source for sediment transport.

Stormwater at the site collected into an existing 20-acre lake that by regulation required treatment prior to discharge to meet NPDES permit requirements for Total Suspended Solids (TSS). Charah Solutions' site operations were limited to stormwater benchmark values of 0.1 ml/L settleable solids, 100 mg/L TSS, and 50 NTU of Turbidity. Wastewater discharges were limited to a monthly daily average of 25 mg/L and a daily maximum value of 45 mg/L of TSS, and 0.1 ml/l of settleable solids. Initial water samples were tested to have TSS values in the range from 500 to more than 1,500 mg/L.



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CHALLENGING SITE CONDITIONS

As part of the mine reclamation project, Charah Solutions was required to install perimeter stormwater controls to collect and control all stormwater generated at the site during reclamation activities. To meet state and federal regulations, all stormwater Best Management Practices (BMPs) were sized to contain and/or convey a minimum of a 25-year, 24-hour storm event. Stormwater BMPs were designed and installed to meet permit requirements including vegetated stormwater conveyance ditches, temporary sediment basins, and convertible sediment basins to stormwater ponds with discharge controls (Fairchild Skimmers and Riser Structure).

During construction, the predominance of fine-grained clay soil at the site required significant resources to comply with NPDES discharge requirements. The native clay soil sought after for brick manufacturing was determined to be unsuitable for most uses including growing vegetation. Several of Charah Solutions' project team members that visited the site remarked how it looked like the surface of a distant planet, barren of vegetation of any kind. The clay soils were found to vary in type and color due to the parent rock they formed from and were so fine-grained that when entrained in storm or mine water, sediment would remain in suspension seemingly indefinitely. An inability to support vegetation as well as the sediment remaining in suspension even after allowing significant time for settling posed two significant challenges to the site team in how to manage the stormwater and erosion and sediment control.

BEST MANAGEMENT PRACTICES

Charah Solutions focused on a trial and error approach to learn about and develop a plan to work with the site soils at Brickhaven. The team also investigated the chemistry of the stormwater and lake water to improve water quality and stabilize the ground surface to reduce erosion at the site. Charah Solutions contacted a Professional Agronomist to evaluate the clay soils for supporting vegetation. After physical and chemical testing, the Agronomist stated that the site soils were the worst they have encountered in their many years of practice. After extensive testing, however, they were able to recommend amendments, seed mixture, and an application plan for establishing temporary and long-term vegetative growth at the site.

Charah Solutions worked with internal and external resources to understand the water chemistry of stormwater runoff and the mine lake water to develop a comprehensive water management plan to reduce TSS prior to off-site discharge. The team developed a hold and treat approach to stormwater management to ensure no non-compliant stormwater left the site. Daily and post-storm event monitoring of TSS and pH levels in the perimeter sediment basins were completed using field equipment to check for high TSS levels. A dosing regime was developed through bench testing using a combination of an aluminum sulfate based flocculent and a polymer-based coagulant to treat suspended clay particles from different clay chemistries effectively within a 24 to 36-hour period prior to discharge from the site. Stormwater continued to be monitored until it met minimum thresholds for TSS prior to discharge to maintain compliance with NPDES permit requirements.



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BRICKHAVEN MINE LAKE

To complete mine reclamation, Charah Solutions was required to remove more than 300,000,000 gallons of water contained in the mine lake.



DRYING BED FLOW DISTRIBUTION MANIFOLD

Because treating significant volumes of fine-grained solids from the mine lake waters would require a dedicated water treatment system to meet the NPDES discharge permit requirement as part of final reclamation, a drying bed was designed by Charah Solutions to allow for an efficient method of treating suspended soil contained in the mine lake prior to off-site discharge at less than 45 mg/L of TSS. Additionally, employing a temporary water treatment system was determined to be cost prohibitive for the time period it would need to operate at the site to maintain project schedule and budget constraints. Turbid mine lake water was conveyed to the drying bed location approximately 300 feet away from the mine lake using a diesel pump and piping. Charah Solutions devised and installed an inline dosing system to inject flocculent into the raw mine lake water to allow it to mix during conveyance. Once the raw mine lake water reached the drying bed, to allow for settling, a perforated HDPE pipe header was used to distribute the flow of mine lake water across the drying bed to reduce velocity and maximize residence time.



FINAL DRYING BED FILTER BERM

Rock filter berms were used to provide additional filtration and flow reduction within the drying bed, reducing TSS and improving water quality in each bed cell. A geomembrane wrapped rock filter berm was used as the last BMP prior to water collection and conveyance to the NPDES discharge outfall.



TREATED MINE LAKE WATER PRIOR TO OFF-SITE DISCHARGE

The drying bed allowed for an efficient method to continuously treat TSS without utilizing expensive water treatment filtration systems and required minimal supervision to operate. Charah Solutions was able to treat all mine lake water and discharge from the site without exceeding NPDES permit limits for TSS.





CONCLUSION

Sustainability is central to everything we do at Charah Solutions and the Brickhaven mine reclamation project is a great example of our proven ability to develop innovative sustainable solutions to complex environmental issues for the betterment of the planet and the communities in which we operate. Despite challenging site and soil conditions at this former clay mine, the Charah Solutions team was able to develop a solution to maintain all NPDES discharge requirements and compliance for stormwater and wastewater for the site with minimal impact to overall project productivity.

About Charah Solutions, Inc.

With 30 years of experience, Charah Solutions, Inc. is a leading provider of environmental services and byproduct sales to the power generation industry. Based in Louisville, Kentucky, Charah Solutions assists utilities and independent power producers with all aspects to sustainably manage and recycle ash byproducts generated from the combustion of coal in the production of electricity. Charah Solutions also designs and implements solutions for ash pond management and closure, landfill construction, fly ash sales, and structural fill projects. Charah Solutions is the partner of choice for solving customers' most complex environmental challenges, and as an industry leader in quality, safety, and compliance, Charah Solutions is committed to reducing greenhouse gas emissions for a cleaner energy future. **For more information, please visit www.charah.com or download our 2020 Environmental, Social and Governance (ESG) Report at charah.com/sustainability**



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