Urban Creek Impacted Sediment Removal and Isolation Utilizing a Geosynthetic Clay Liner

Trevor Litwiller (tlitwiller@augustmack.com) and Joel Ruselink (JRuselink@envfield.com)
(August Mack Environmental Inc., Indianapolis, IN, USA)

Background/Objectives. Pleasant Run Creek (PRC) is an urban stream that bisects an 87-acre former manufactured gas plant (MGP) within Indianapolis, Indiana. PRC is considered an impaired waterway with a highly incised channel and more than 50 combined sewer overflow (CSO) discharge locations. Impacts associated with historic MGP plant operations were identified to exist up to 20 feet below the creek bottom. The impacts identified on site, including free product (coal tar and petroleum), were determined to present potential for ecological risk based upon sediment and pore water sampling. Hydrogeologic data evaluations were conducted by Purdue University to determine upland groundwater contribution to PRC. Results indicated that groundwater up-welling in the areas tested were minimal (~0.8 cm/day). Utilizing results from qualitative and quantitative sampling, a remedial approach was designed to mitigate the potential ecological risk. The remedial approach included sediment removal, sediment isolation, and free product capture from upland groundwater. Multiple capping technologies were reviewed for their ability to isolate the impacted sediment. A geosynthetic clay liner (GCL) was selected due to its isolation ability, constructability, uniform thickness upon application, and long-term viability. Data collection, remedial design, regulatory approval, and remedial construction were completed over a 24 month period.

Approach/Activities. An existing hydraulic control system was expanded to recover groundwater and free product. Sediment removal (>40,000 tons) was conducted to allow for GCL installation and restoration. PRC was diverted utilizing a pump-around system and temporary dam, allowing for excavation of sediment in “dry” conditions. GSE’s Bentoliner CNSL was selected as the GCL for uniform application of its granular sodium bentonite encapsulated between a woven and a nonwoven geotextile fabric. A polypropylene geofilm coating applied to the woven surface yielded a hydraulic conductivity of 5×10^{-10} cm/sec while providing increased internal shear strength in steep slope and lower load applications. Over 220,000 square feet of GCL was installed in shingled, overlapping sheets to achieve isolation between remaining impacted sediment and surface water. A natural restoration design was completed which included features such as pools, riffles, flood-prone benches, and boulder cross vanes to enhance biological function of the on-site reach of PRC and provide long-term stability based upon shear stresses estimated from HEC-RAS modeling. Bedding layers of structured backfill were installed above and below the GCL to protect against punctures while adding sufficient overburden pressure. 15-in. nominal size rip-rap was installed within the channel and bank flood elevations as a necessary overburden armor. Bank restoration was completed with topsoil graded to 3H:1V slopes and seeded with native, shallow rooted, vegetative species per agency (ACOE, IDEM, IDNR) approved restoration plans.

Results/Lessons Learned. The design-build process allowed for implementation challenges to be quickly addressed throughout the project. Use of the GCL resulted in a consistent application of the low permeability layer and a higher confidence in uniform hydraulic conductivity and transmissivity. Additional site preparation was required in the use of the GCL; however, overall material costs were lower than those estimated for other similar technologies. The ability to dewater the on-site stretch of PRC and work in “dry” conditions made utilizing a GCL viable. Efficiencies in production were recognized and the project was completed ahead of schedule and under budget. Ongoing visual inspections are required by the regulatory agency until completion of shallow site groundwater monitoring activities and plume stability analysis (5-10 years).