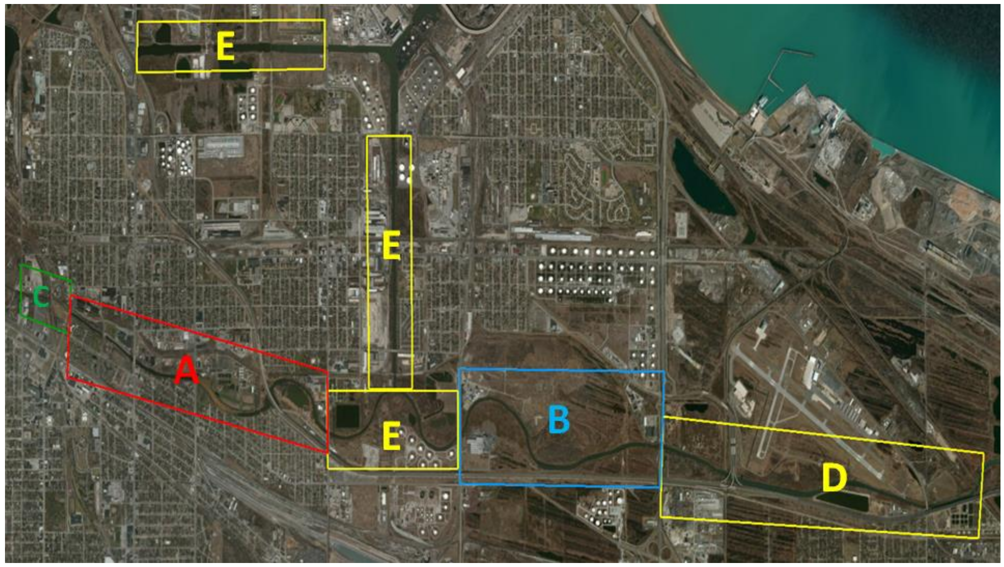
AquaBlok® Installation Profile

Site Location: *US EPA Region 5*

East Branch of the Grand Calumet River – East Chicago, IN

Project Status: Completed Winter 2014

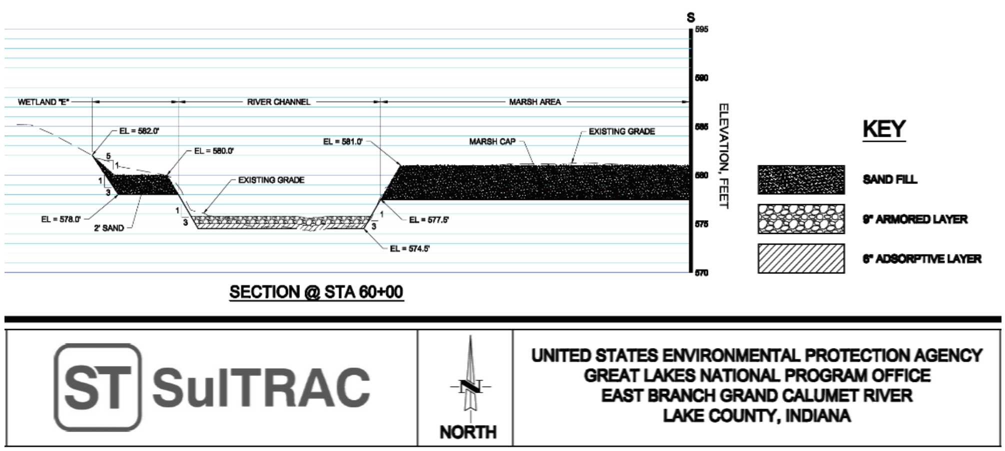
Setting / Purpose:



The East Branch of the Grand Calumet River (EBGCR) is located in East Chicago, Indiana. The area, identified as Zone B in the photo to the right, is a 1.8 mile stretch of the river from Indianapolis Boulevard to Holhman Avenue. This 1.8-mile stretch of the river contained 350,000 cubic yards of sediment slated to be removed. A cap consisting of AquaGate+Organoclay (AG+OC) and a bulking aggregate was placed over the surface of the dredged area. The purpose of the project was to remove PCB and SVOC contaminant mass, reduce the transport of contaminant further into the river, and to improve water quality in the EBGCR and the Grand Calumet River area of concern. The purpose of the AG+OC cap was to provide in-situ treatment of pore water impacted by residual contamination in underlying sediments.

Contaminant(s) of Concern:

PCBs, PAHs, and heavy metals, in addition to high fecal coliform bacteria, BOD, suspended solids, and oil and grease in the water column.

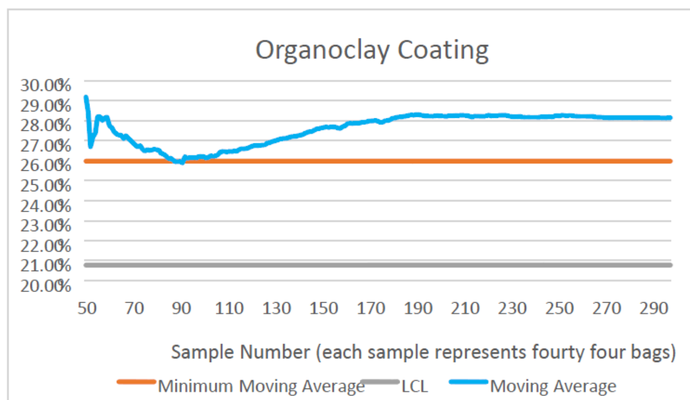


AquaBlok Cap Design / Site Area:

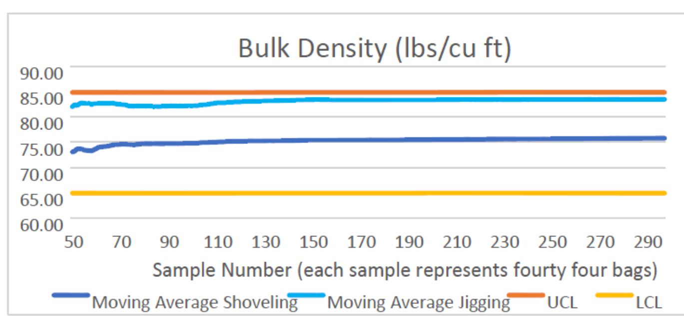
The cap specification called out for an adsorptive layer consisting of virgin organoclay bound to an aggregate material substrate. The organoclay was to have minimal swelling after placement and a minimum predicted long-term permeability of 10^{-3} centimeters per second (cm/s). The organoclay was also to have a documented partition coefficient (Kd) of at least 50,000 L/Kg for lightweight PAHs (Eg. Phenanthrene) and 350,000 L/Kg for mid to heavyweight PAHs (eg. Pyrene). It was also required that the organoclay would have a minimum quaternary amine loading of 25%. The capping area was split into two different sections for the application, an A-Cap and a B-Cap. The A-Cap consisted of a target 6-inch thickness of AG+OC. The project specifications called for a target loading for the A-Cap of 21.45 lbs/cu ft of pure organoclay content. The B-Cap required a 6-inch thick layer of bulking aggregate (sand-aggregate mixture) uniformly mixed and placed with AG+OC. As per the project specifications, the quantity of AG+OC included in the mix was determined to achieve a target loading of 7.0-7.2 lbs/cu ft of the pure organoclay component. This was achieved with an approximate mixture of 1/3 AG+OC with the balance being the bulking aggregate. In total, approximately 16,600 tons of AG+OC was placed.

Production / Shipping / Storage:
Production of the AG+OC was initiated in January 2014 and shipments totaling 16,600 tons were completed in November of 2014. The production took place in in Swanton, OH and the material was shipped to East Chicago, IN in 2500-lb bulk bags. Approximately 4-5 truckloads were shipped per day when in full production/shipping. Once on site, the bags were double stacked, stored, and protected for later placement. The photograph below shows the onsite stockpile of material prior to placement.

Quality Assurance / Quality Control:
The goal of the quality control reporting was to provide a degree of certainty that the data reported, when repeatedly calculated from a subset of the population, will equal or exceed data mean 90% of the time, with a precision level of ± 5% using a confidence interval test. Bulk density, moisture content, and coating content were all tracked and reported throughout the project. The graphs on the right depict the organoclay coating and bulk density over the life of the project.



Bulk Density



Post-placement active material testing and analysis was also performed. This was done over three steps. First, as-Produced AG+OC was put through a full quality control procedure designed to confirm that the proper amount of organoclay made it onto the finished product. Second, during the placement of the AG+OC, sample buckets were lowered into the river to collect as-placed product. These bucket samples were recovered from the river and the coating material was dried and removed from the AG+OC. This allowed a confirmation that the organoclay on the product made it through the water to the sediment surface as designed. Lastly, active coating material samples were prepared for lab testing. Powdered organoclay samples were collected from raw material bags prior to production, as-manufactured product, and as-placed product in the sample buckets. These samples were sent to the CETCO lab for DNAPL Adsorption Test and Dr. Danny Reible at Texas Tech University for Dissolved Phase PAH Adsorption Testing. The results from CETCO and Texas Tech are below.

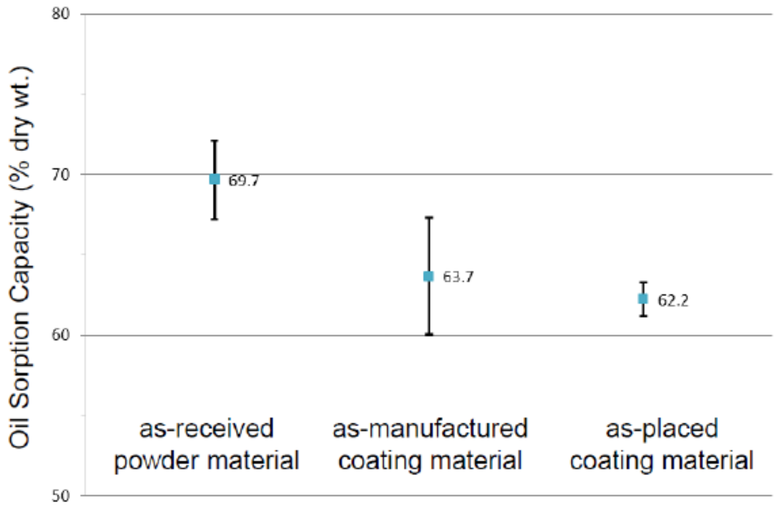


Figure 1. CETCO Lab oil sorption capacity (% dry wt.) for samples. Error bars represent the 95% confidence interval (CI) around respective mean values; n = 4 for each material type.

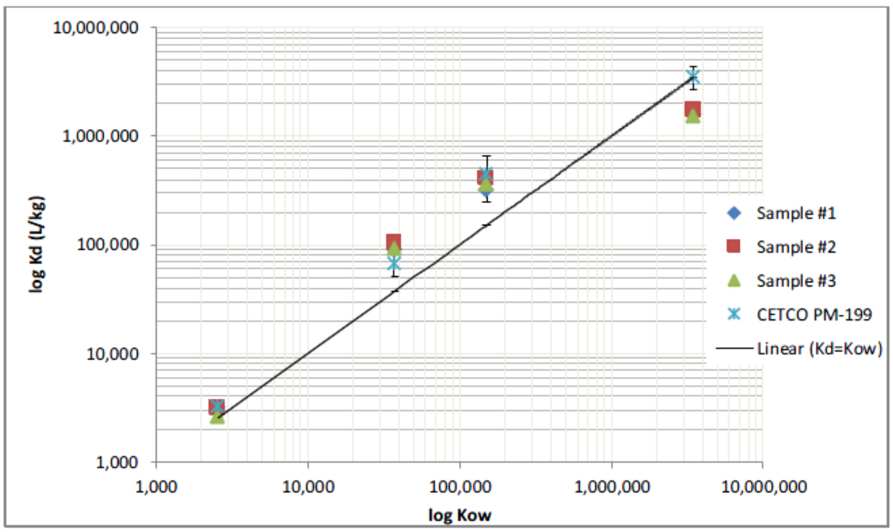


Figure 2. Texas Tech University Lab derived partition coefficients on samples. #1 – As Received, #2 – As Manufactured #3 – As Placed. Measured partition coefficients as a function of Kow.

This approach to quality control and placement gave the ability to confirm the quantity of high value amendment material (organoclay coating weight) being supplied and placed. It allowed for a confirmation of material properties such as bulk density, which determines layer thickness. The verification of uniform distribution of active treatment material is achieved through measuring the thickness of the capping layer. The protocol permitted the post-placement confirmation of active treatment by the testing of adsorption capacity (partition coefficient) that satisfied the specification. Modeling output was able to be confirmed through comparison of input and assumptions to post-placement physical and material property data. The results can support modeling assumptions and be used to reduce costs associated with excessive factors of safety due to lack of certainty of achievement of a design / specification as well as the ability to provide post-placement verification. This approach enabled full-scale verification of quantity and post-placement material properties relative to project material specifications, design standards, performance goals, and objectives.

One of the sample buckets, removed from the river post-placement, showing the as-placed AquaGate+Organoclay.