Novel Shoreline Cap for Controlling Sheen and Dissolved-phase Constituent Discharge

Visible sheens of petroleum light nonaqueous phase liquid (LNAPL) are a common occurrence on surface water bodies adjacent to facilities with upland LNAPL impacts. These sheens may present a violation of the Clean Water Act and, because they are visible, can result in negative public perception. While technologies for mitigating upland impacts are well-established, they do not always fully eliminate petroleum LNAPL sheens on nearby water bodies, since they often do not directly or immediately contain or eliminate impacts within soil or sediment at the shore. This challenge was recently encountered at a 100-year-old fuel terminal adjacent to the Willamette River in Portland, Oregon. Release of LNAPL related to upland impacts caused occasional sheens on a portion of the river within the Portland Harbor Superfund Site. Installation of upland source control measures (a FRP sheetpile barrier wall and hydraulic containment wells) diminished the intensity and frequency of sheens, but did not fully eliminate them. While these ephemeral sheens were contained with adsorbent booms, design and construction of a sediment cap was identified to be a more robust, long-term strategy for sheen control. Prior to completion of cap design, the U.S. Environmental Protection Agency issued their record of decision (ROD) for the Portland Harbor Superfund Site identifying the terminal riverbank as remediation area and included riverbank cap requirements, such as the requirement to provide a sufficient chemical isolation layer to reliably contain underlying contamination. The cap therefore needed to meet the dual objectives of (1) eliminating sheen to the Willamette River and (2) reducing concentrations of dissolved-phase organic groundwater contaminants below the Portland Harbor ROD remedial action levels after discharge through the cap. In addition, permitting, design, and construction of the cap needed to consider the steep riverbank slope and in-water work requirements. No single capping technology was identified that would meet the cap objectives. Because of this, a novel, multilayered cap was designed and constructed, consisting of an oleophilic biobarrier (OBB) to mitigate sheen augmented with an activated carbon layer to capture dissolved-phased contaminants. The OBB is an emerging technology for shoreline sheen mitigation developed at Colorado State University (patent no. US 10,112,854 B2). The OBB adsorbs petroleum nonaqueous phase liquid (either light or dense) and promotes biodegradation. The cap was constructed in phases with the first portion constructed in October and November 2017 and the second portion constructed between September and November 2018; both during the low river stage Willamette River. Sheening was eliminated shortly after the first phase of cap installation and no sheens have been observed since completing the cap. The final cap met additional ROD requirements such as no net-fill or net-rise within the 100-year floodplain and preservation of beneficial habitat. The project area encompassed a steep riverbank slope which complicated the remedy as the remedial action needed to consider the overall stability of the bank, constructability of the remedy, access constraints during construction, and working within a tidally influenced area. Jacobs designed, permitted, managed, and oversaw construction of the cap on the steep slope and in-water work. Many valuable lessons were learned regarding application of OBB technology and construction of a riverbank cap on steep banks of the Willamette River within the Portland Harbor Superfund Site.