Lead contamination cleanup at Bunker Hill Superfund site

Applying morphological modelling to guide remedial actions in a lead contaminated river with connected lakes and floodplain

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Identification of the most cost-effective remediation strategy among potential solutions

Better understanding of the morphology of Coeur D'Alene River lower basin

Easy-to-use tool for planning additional remedial actions until objectives are met

Challenge

The lead contamination in the lower basin of Coeur D'Alene River is a challenge for mitigation and cleanup. The reach is around 60 km long. While the river is only 80 m wide, the floodplain and lakes expand up to 1 km away from the river path with a complex flow network connecting them. The river flows into Lake Coeur D'Alene. The lead contamination, originating from mine tailings, is found over as much as 5 m of substrate in the riverbed (recreation area), in the lakes (where black swans and other migratory birds feed) and in the floodplain (where people live). The Coeur D'Alene River lower basin is classified as one of the Superfund sites – polluted locations in the United States where long-term response is needed to clean up hazardous material contamination. The United States Environmental Protection Agency (EPA), responsible for managing the site, needed to test different remediation strategies.

Solution

Using MIKE 21C to test solutions before implementation
Testing remedial actions in the MIKE 21C morphological model is cheap compared to the implementation cost. Solutions could involve capping of the riverbed, construction of sills along the river to induce sedimentation of clean sediment coming from the upstream catchments, hydraulic and source control.

The hydro-morphological problem is extremely complex with eddies forming over large scour holes, small tie channels flowing to and from lakes, and floodplain flow. The problem also has large time and spatial scale variations, requiring an efficient numerical model. The sedimentation is modelled as a graded problem with 14 sediment fractions consisting of four cohesive and three sand fractions mirrored by contaminated counterparts, with the bed substrate described by five layers. The hydro-morphological models are required to run several years when testing solutions.

'The Coeur D'Alene River lower basin required a hydro-morphological model capable of handling the inherent complexities, including hydrodynamics with flow separation, secondary flow, small tie channels connecting the river and adjacent lakes, as well as floodplain. MIKE 21C was deemed the best tool for the model due to its ability to handle the complexities and the run speed of the model allowed handling the long timescales that are necessary to simulate for morphological problems.'

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