PEARCE CREEK DREDGED MATERIAL CONTAINMENT FACILITY EXTERIOR MONITORING PROGRAM FALL 2018 POST-PLACEMENT RESULTS

The Pearce Creek Dredged Material Containment Facility (DMCF) is located on Maryland's Eastern Shore in the northern portion of the Chesapeake Bay, just east of the Elk River (Figure 1). The Pearce Creek DMCF was constructed in the mid-1930s for placement of dredged material from the southern approach channels to the Chesapeake and Delaware Canal. The DMCF is owned by the U.S. Army Corps of Engineers Philadelphia District and was operational until 1993.

Existing placement sites for dredged material from the Chesapeake Bay are limited, resulting in a need to study, select, and implement new options for accepting sediment removed annually from the shipping channels serving the Port of Baltimore. Using the Pearce Creek DMCF to accept dredged material is one component of the Maryland Department of Transportation Maryland Port Administration's (MDOT MPA) Dredged Material Management Plan (DMMP) for the Chesapeake Bay Federal Navigation Channels. Reactivation of the site was approved by the Maryland Department of the Environment (MDE), pending the completion of site improvements. Rehabilitation and repair of the existing Pearce Creek DMCF, including the installation of a geotextile liner, was completed in 2017 and dredged material placement occurred in the 2017/2018 dredging cycle.

MDOT MPA is conducting the Pearce Creek DMCF Exterior Monitoring Program to monitor environmental conditions around the DMCF to ensure that the environmental conditions surrounding the DMCF remain unaffected by water discharges from the facility. The Pearce Creek DMCF Exterior Monitoring Program consists of collecting sediment quality, surface water quality, benthic community, and benthic bioassay samples from the Pearce Creek Lake and the Elk River. Baseline information will be used to identify if there are any trends or changes in the aquatic environment in the vicinity of the Pearce Creek DMCF as a result of facility operations (i.e., "in-flow" or placement of dredged material and permitted discharge of excess surface water through the spillway). Water discharges from the DMCF are only conducted in accordance with the permit, known as a Water Quality Certification.

This data summary details the results of the fall 2018 post-placement monitoring event, which was conducted in October 2018 and included sediment quality, surface water quality, benthic community (animals that live in the bottom sediment, such as worms, clams, and insects), and sediment bioassay sample collection from seven monitoring locations and one reference

location in Pearce Creek Lake, and one monitoring location and one reference location in the Elk River (Figure 1).

Reference locations measure natural changes in background conditions and are located in areas that are outside of the influence of the DMCF operations. Results from the reference locations are compared to the results from the monitoring locations to evaluate if inputs from the surrounding watershed may be influencing conditions in Pearce Creek Lake or the Elk River.

This monitoring event is the second post-placement monitoring event since dredged material placement began in late 2017 at the Pearce Creek DMCF. The frequency of exterior monitoring events beyond those planned through the fall of 2019 will be determined through the adaptive management process.

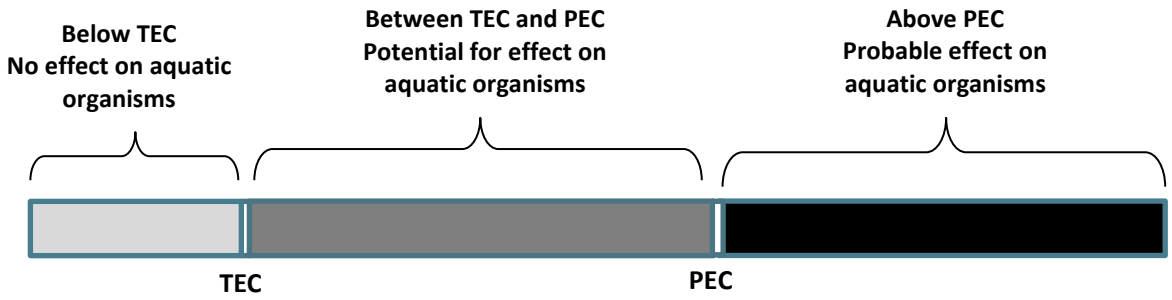
FIGURE 1. EXTERIOR MONITORING LOCATIONS

SEDIMENT QUALITY

The physical and chemical characteristics of ten sediment samples from the Pearce Creek DMCF exterior monitoring locations were assessed to determine the sediment quality. Sediments were sent to a certified laboratory and tested for grain size, metals, nitrogen, phosphorus, sulfur, ammonia, and organic carbon. This list was chosen because it represents the composition of soils that erode from the surrounding area, which are the source for the majority of the Pearce Creek Lake sediments.

Sediment quality guidelines are used to identify potential chemicals of concern in aquatic ecosystems. The threshold effect concentrations (TEC) are chemical concentrations below which adverse effects on organisms are unlikely. Probable effect concentrations (PEC) represent concentrations above which adverse effects on organisms are possible. Concentrations that are between the TEC and PEC represent the concentrations at which adverse effects on organisms may occur, as shown in Figure 2:

FIGURE 2. DATA EVALUATION USING SEDIMENT QUALITY GUIDELINES



Comparisons of chemical concentrations in sediment from the Pearce Creek Lake monitoring locations to the TECs and PECs indicated that five metals were detected at concentrations between the TEC and PEC, and only nickel was detected at a concentration that exceeded the PEC value. Nickel exceeded the PEC for most of the Pearce Creek Lake monitoring locations and the reference site. However, the nickel concentrations are within the range of concentrations observed during the baseline sampling, so environmental conditions have not changed compared to the pre-placement condition. Nickel is typically detected at concentrations that are slightly above the PEC throughout the Chesapeake Bay region due to the underlying geology in the area.

Comparisons of chemical concentrations in sediment from the Elk River monitoring location to the TECs and PECs indicated that all of the metals had concentrations below the TEC values.

For sediment samples, results from the fall 2018 post-placement monitoring event indicated that concentrations of detected metals in sediment samples were generally comparable to and within the range of concentrations from the baseline monitoring events.

WATER QUALITY

The physical and chemical characteristics of ten water samples from the Pearce Creek DMCF exterior monitoring locations were assessed to determine post-placement surface water quality. Chemicals detected in the surface water were compared to water quality standards and criteria developed by the U.S. Environmental Protection Agency and the State of Maryland for freshwater environments. Each chemical has two criteria—one that evaluates short term, or acute, effects and one that evaluates long term, or chronic, effects.

Eight surface water samples were collected from Pearce Creek Lake, and two surface water samples were collected from the Elk River (Figure 1). In addition to measuring the surface water conditions when the samples were collected—such as water temperature, oxygen content, and water clarity (turbidity)—the surface water samples were also sent to a certified laboratory. Laboratory tests for the water samples included metals, phosphorus, nitrogen, ammonia, and suspended solids. This list was chosen to represent the composition of surface water runoff and soil erosion, which provide the majority of the surface water that flows into Pearce Creek Lake from the surrounding area.

For the Pearce Creek Lake samples, 10 of the 16 tested metals were detected in the surface water samples. Concentrations for the metals were generally low and consistent with metal concentrations at the upstream reference site. The aluminum concentration at one monitoring location exceeded the chronic freshwater criteria for aquatic life. None of the metals analyzed in the Pearce Creek Lake surface water samples, including both the monitoring locations and the reference location, exceeded the acute freshwater criteria for aquatic life.

For the Elk River samples, 9 of the 16 tested metals were detected in the surface water samples. Concentrations for the metals were generally low and consistent with metal concentrations at the offshore reference site. None of the metals analyzed in the Elk River surface water samples, exceeded the either the acute or chronic freshwater criteria for aquatic life.

For surface water, results from the fall 2018 post-placement monitoring event indicated that concentrations of detected metals were comparable or within the range of concentrations from the baseline monitoring events.

BENTHIC COMMUNITY

Benthic organisms (animals that live in the bottom sediment such as worms, clams, and insects) are important indicators of environmental stress in aquatic systems because they do not move very far during the course of their lifetime. Therefore, benthic organisms act as a record of the environmental conditions in a specific area over a long period of time. Benthic invertebrates are also important food for many species, and in healthy ecosystems a robust and diverse benthic community provides food to many other animals.

To characterize the benthic communities in Pearce Creek Lake and the Elk River, several components of the community were calculated, including the total number of species, abundance (total number of organisms), and diversity (how many different species are present). The Pearce Creek Lake reference site fell within the range of the results of the Pearce Creek Lake monitoring locations for each of the measured metrics, indicating that there is not a difference between the benthic communities at these locations. The results of the benthic community metrics at the Elk River monitoring location and Elk River reference site were also similar.

For the benthic community samples, results from the fall 2018 post-placement monitoring event indicated that although there was variability for some metrics at individual locations, the benthic community results indicate that the overall benthic community condition in Pearce Creek Lake and the Elk River monitoring locations has not substantially changed compared to the baseline monitoring results.

BENTHIC BIOASSAYS

Benthic bioassays are standard laboratory tests designed to tell if the sediment from each sampling location is acutely toxic to benthic organisms by measuring the survival of organisms in the sediment after a set amount of time. For the Pearce Creek DMCF bioassays, a species of freshwater amphipod (a small crustacean that is typically found in sediments throughout the Chesapeake Bay) was used in the bioassays, and survival was measured after the amphipods had lived in the sediment for 10 days. After the tests were completed, statistical analyses were performed to determine if the Pearce Creek Lake and Elk River sediment samples were statistically different from reference site samples.

Survival of the amphipods at the Pearce Creek Lake monitoring locations and the Elk River monitoring location was high. Therefore, the fall 2018 sediments collected from Pearce Creek Lake and the Elk River were not were statistically different from reference site samples, and the sediments are unlikely to cause adverse effects to benthic organisms.

For the fall 2018 post-placement monitoring, the benthic bioassay results were consistent with the results of the baseline monitoring events.