



Pearce Creek DMCF Baseline Exterior Monitoring Spring 2016 Results

Pearce Creek Implementation Committee
October 21, 2016

Project Overview

- Objective: Collect data from exterior monitoring locations to establish baseline conditions that will be used to monitor environmental conditions after dredged material placement starts
- First sampling event was conducted in Fall 2015; second event conducted in Spring 2016
- Testing program included:
 - Surface water quality
 - Sediment chemistry – testing of target chemicals
 - Sediment bioassays – 10-day tests that evaluate organism survival
 - Benthic community – Identification of bottom-dwelling organisms, including number of species (diversity) and number of organisms (abundance)

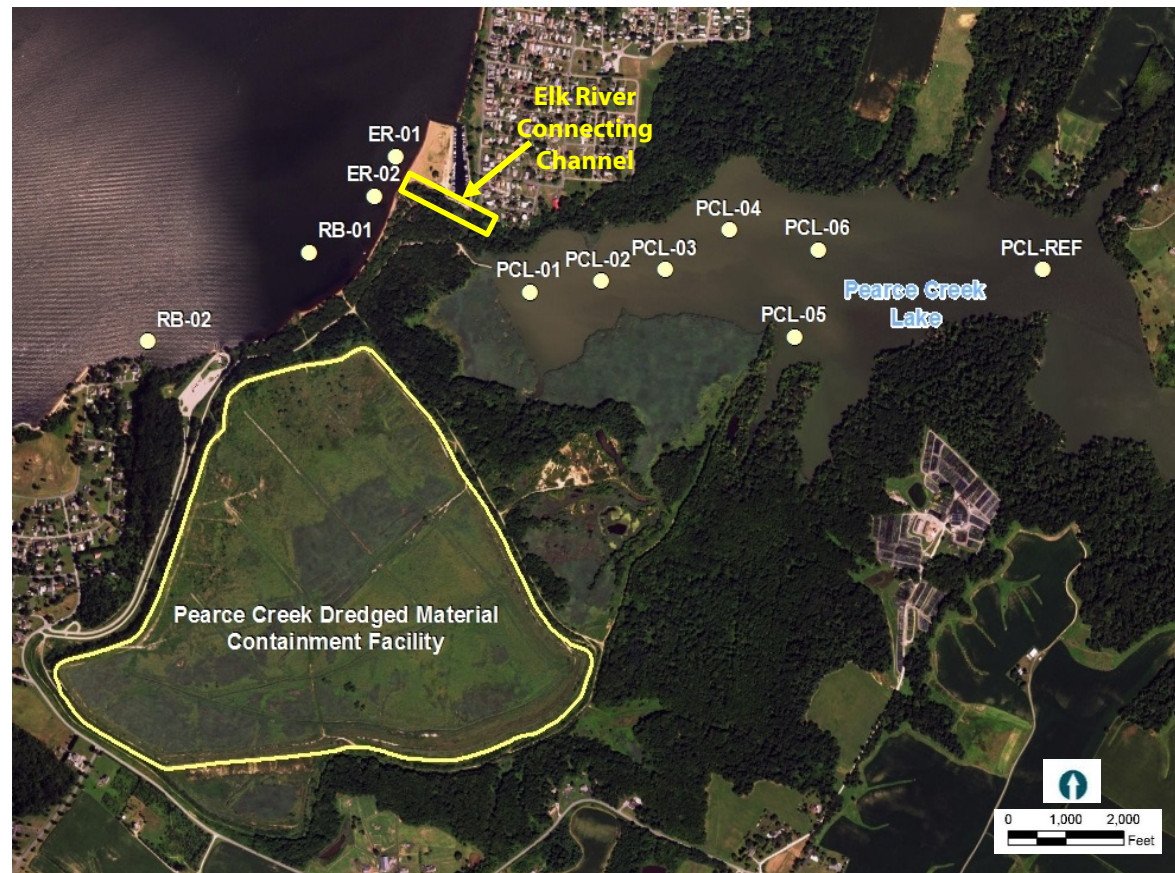
Monitoring Schedule

- Results presented today are from the second season of baseline monitoring
- Represent the initial characterization of existing conditions
- First dredged material placement at the Pearce Creek DMCF is anticipated in Fall 2017
- Sampling Schedule
 - Fall 2015, Spring 2016 → Year 1 baseline monitoring **(COMPLETE)**
 - Fall 2016, Spring 2017 → Year 2 baseline monitoring
 - Fall 2017, Spring 2018 → post-placement monitoring



Sampling Overview – Spring 2016

- 10 Sampling Locations:
 - 7 Pearce Creek Lake monitoring locations
 - 1 Pearce Creek Lake reference location
 - 1 Elk River monitoring location
 - 1 Elk River reference site
- Reference locations represent areas that are outside of the influence of the DMCF
- **NEW:** 2 Elk River beach locations



Sampling Overview

- At each location, surface water samples were collected first
- Water samples were pumped directly into the sample containers
- Surface sediments were collected using a grab sampler
 - 1 to 2 surface grabs collected at each location
 - Sediments from each grab at a location were mixed together and placed into sample jars
- Benthic organisms collected using a grab sampler



Surface Water Testing Program

- Laboratory and field data were collected to evaluate water quality
 - Field parameters measured during sample collection
 - Chemical analysis conducted by laboratory

Field Parameters

- Temperature
- Dissolved Oxygen
- Salinity
- Turbidity
- pH

Chemical Testing

- Phosphorus
- Nitrate+Nitrite (Inorganic Nitrogen)
- Total Kjeldahl Nitrogen (Organic Nitrogen)
- Aluminum
- Antimony
- Arsenic
- Beryllium
- Cadmium
- Chromium
- Copper
- Iron
- Lead
- Manganese
- Mercury
- Nickel
- Selenium
- Silver
- Thallium
- Zinc
- Suspended Solids

- Results of chemical testing were compared to water quality criteria
 - Criteria set by EPA and State of Maryland to be protective of aquatic life
 - Each chemical has two criteria → one that evaluates short term (acute) exposure and one that evaluates long term (chronic) exposure

Surface Water Results

- Salinity
 - Pearce Creek Lake and Elk River = freshwater
- Turbidity
 - Highly variable at Pearce Creek Lake locations because of natural factors (i.e., bank erosion, algae)
 - Elevated at Elk River reference because of runoff from rain storms
- Chemical Testing
 - No water criteria exceedances for Pearce Creek Lake or the Elk River
 - Generally consistent with Fall 2015 data
 - In Fall, zinc exceeded criteria at one location
 - None of the Elk River samples exceeded water quality criteria



Location PCL-01



Location PCL-05

Sediment Testing Program

- Sediment characterization included 3 components:
 - Physical characterization → sediment type
 - Chemical testing
 - Benthic bioassays – evaluate if the sediment supports benthic organism survival

Physical Characterization

- Sand
- Silt
- Clay
- Gravel
- Specific Gravity

Nutrients

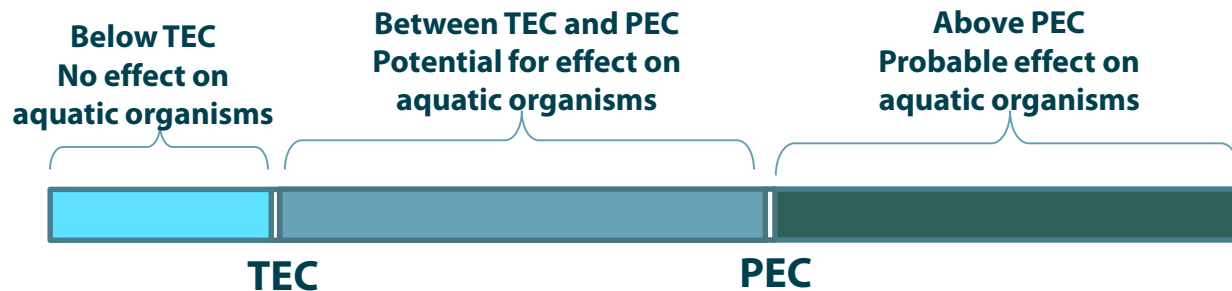
- Total Organic Carbon
- Nitrate+Nitrite (Inorganic Nitrogen)
- Total Kjeldahl Nitrogen (Organic Nitrogen)
- Ammonia
- Phosphorus
- Sulfur

Metals

- Antimony
- Arsenic
- Beryllium
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Silver
- Thallium
- Zinc

Sediment Data Analysis

- Results of chemical testing were compared to freshwater sediment guidelines
 - Values derived by scientific community based on real world sediment concentrations
 - Each chemical has two values:
 - A threshold effect concentration (TEC)
 - A probable effect concentration (PEC)



- An “effect” means that an organism’s behavior is impacted, such as a slow down of organism growth rate
- “Effects” do not indicate mortality

Sediment Results

- Sediment Type
 - Pearce Creek Lake sediments were mostly silts and clays
 - Elk River monitoring location was silts and clays, and Elk River reference location was silty with a lot of shell material
- Nutrients and Metals
 - Nutrient concentrations naturally variable at all locations
 - Overall, concentrations of nutrients and metals were lower in the Elk River reference sediments → had higher percent of sand and contained substantial shell material



Elk River Connecting Channel – Elk River Outlet at High Tide

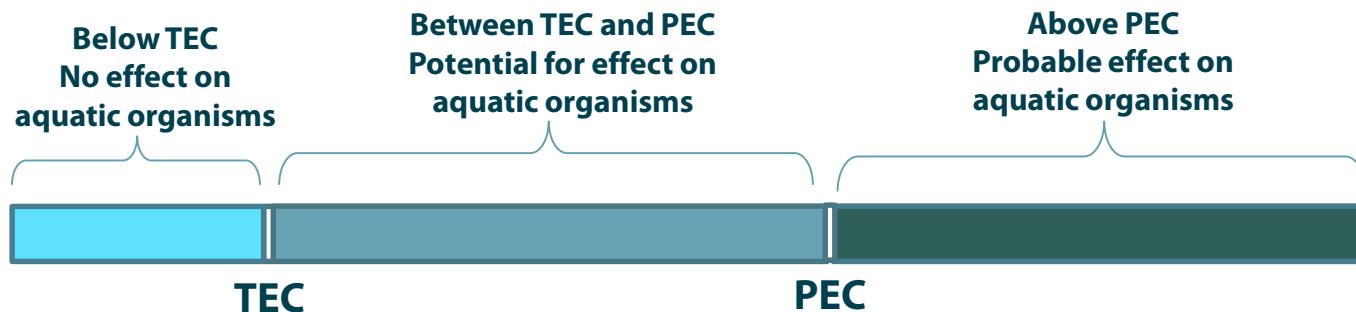


Elk River Connecting Channel – Elk River Outlet at Low Tide

Sediment Chemical Screening

- Results are generally consistent with the Fall 2015 data
 - For Pearce Creek Lake monitoring locations, 5 metals were between the TEC and PEC, and nickel exceeded the PEC
 - For the Pearce Creek Lake reference location, 4 metals were between the TEC and the PEC, and nickel exceeded the PEC
 - For Elk River monitoring location, 1 metal was between the TEC and PEC, none of the metals exceeded the PEC
 - For Elk River reference location, 2 metals were between the TEC and PEC, none of the metals exceeded the PEC

Nickel concentrations are generally consistent with sediment in the upper reaches of the Chesapeake Bay



Benthic Bioassays

- 10-day whole sediment toxicity testing using *Hyalloa azteca* : freshwater amphipod (laboratory cultured)
- Standard testing procedure commonly used to evaluate sediment conditions
- Amphipods are added to sediment collected from each sampling location
- 8 replicates tested for each location x 10 organisms per replicate = 80 organisms
- Measure survival and organism growth



Benthic Bioassay Results

- Compared results for each location to reference site
 - Pearce Creek Lake monitoring locations (PCL-01 to PCL-07) compared to Pearce Creek Lake reference (PCL-REF)
 - Elk River monitoring location (ER-01) compared to Elk River reference (ER-REF)
- Results
 - Survival high for the Pearce Creek Lake and Elk River sediments
 - Sediments are not toxic, and support benthic organisms



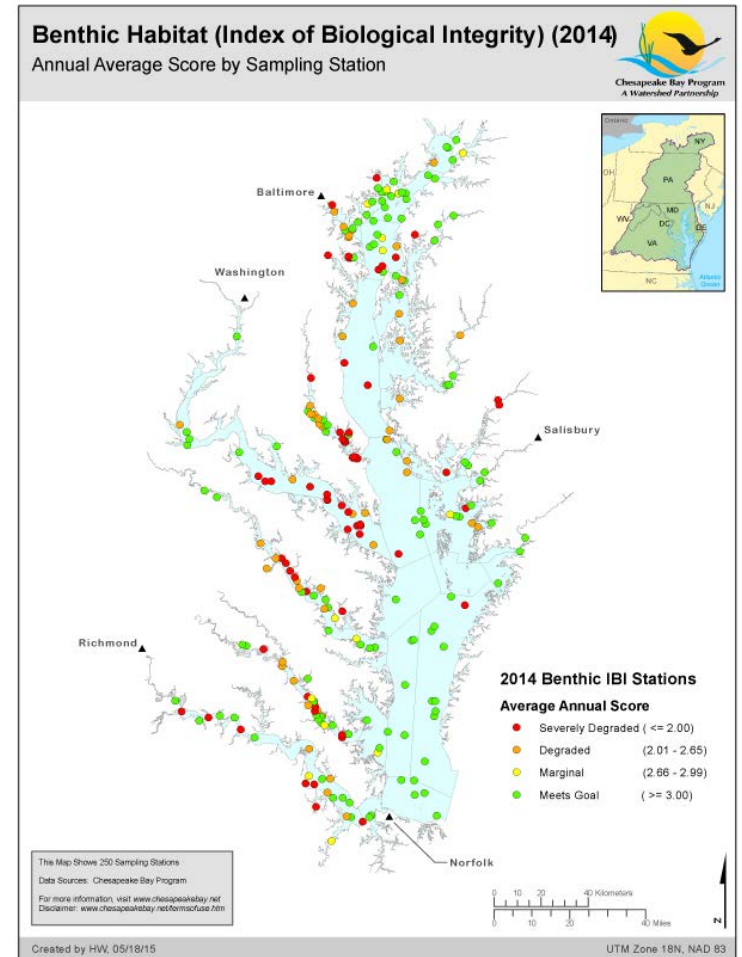
Benthic (Bottom Dwelling) Community

- Biological characterization of sediments included benthic community sampling
 - Benthics are bottom-dwelling organisms, such as worms, insects, amphipods, and clams
 - Are an important part of the diet for fish and birds
 - Commonly used as indicators of environmental stressors because they live in the sediment and can't move away
- Extensively used throughout the Chesapeake Bay
 - Bay Program has developed a standard set of measurements, or metrics, used to determine if benthic community is healthy
 - 12 different metrics are calculated for each location



Benthic (Bottom Dwelling) Community

- Several of the metrics are combined into a value called the Chesapeake Bay Benthic Index of Biotic Integrity (B-IBI)
 - Takes into account salinity and sand or silt
 - Allows for direct comparison between sites throughout the Bay
- Can be influenced by natural conditions (i.e. low dissolved oxygen, low total organic carbon) or a response to poor sediment quality
- B-IBI only applies to samples collected between July and September → not calculated for Spring samples



Benthic (Bottom Dwelling) Community

- Benthic organisms collected using a grab sampler
- Three replicate grabs were collected from each location and sieved on the boat
- Organisms were transferred to cloth bags and preserved immediately after collection
- At the laboratory, microscope analysis is used to identify all the species for each replicate
 - Often hundreds of organisms per replicate
- For each location, the result is a sum of all the species identified in each replicate



Benthic Community Results

- Pearce Creek Lake
 - Abundance was lower compared to Fall 2016 at each location except PCL-07
 - Observed an expected seasonal shift in the species
- Elk River
 - Abundance was lower compared to Fall 2016 at each location
 - Observed an expected seasonal shift in the species



Exterior Monitoring Schedule

- This completes the initial round of baseline exterior monitoring in Pearce Creek Lake and the Elk River
- Baseline monitoring will continue in Fall 2016 and Spring 2017
- Establish the “existing” condition for water, sediment, and benthic community
- Once dredged material placement starts, monitoring will continue and results will be compared to the baseline data



Elk River - Beach Sampling

Sampling Overview – Spring 2016

- Samples collected in nearshore areas close to beach areas in the Elk River
- Added at the request of the citizens
- Evaluated independently from the baseline exterior monitoring data
- Included same testing program
 - Sediment
 - Water quality
 - Benthic community
 - Toxicity (one location only)



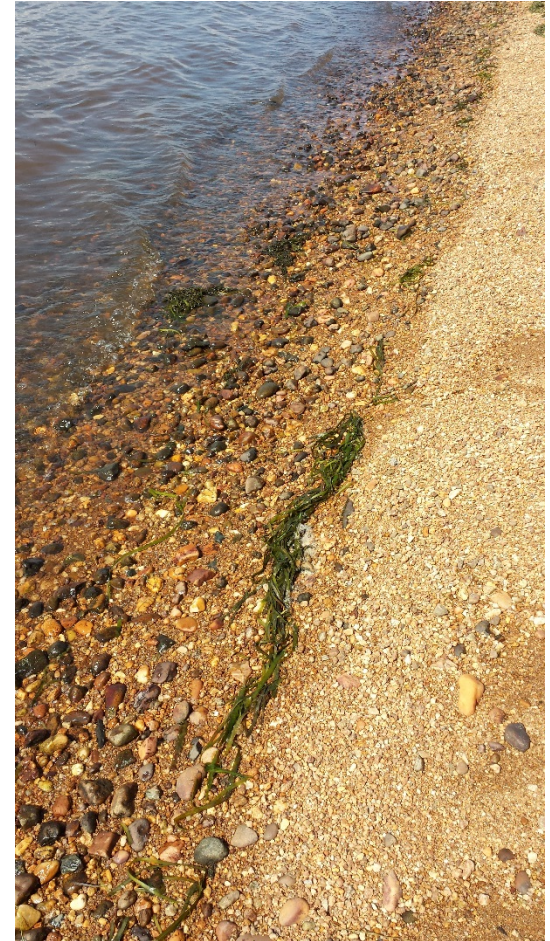
Surface Water Results

- Salinity was freshwater
- Turbidity was low
- Chemical Testing
 - Concentrations are generally very low
 - No water criteria exceedances; well below water quality criteria



Sediment Results

- Sediment Type
 - Location 1 was mostly silts and clays with shell fragments
 - Location 2 was primarily sand
- Nutrients and Metals
 - Nutrient concentrations naturally variable
 - Metal concentrations generally low
 - Nickel was between the TEC and PEC at Location 1 → essentially same as concentration at Elk River locations
 - Overall, concentrations of nutrients and metals were lower in Location 2 sediments → had much higher percent of sand



Benthic Community and Toxicity Results

- Benthic Community
 - Lower diversity and lower abundance than other Elk River locations
 - Grain size effect (shell hash and sand)
 - Lots of clams observed at Location 1
- Benthic Toxicity
 - Location 2 was 91 percent sand, so no toxicity sample collected
 - Sample from Location 1 had high survival, therefore the sediment is not toxic



Elk River - Beach Sampling Schedule

- This is the initial round of sampling
- Sampling will continue in Fall 2016 and Spring 2017
- Establish the “existing” condition for water, sediment, and benthic community
- Evaluate if there are any changes to the environmental conditions over time



Questions/Discussion

