Frequently Asked Questions On Lockheed Martin's Middle River Sediment Removal Project

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This FAQ addresses several questions and concerns recently raised by community members in Middle River about our cleanup work. If you have questions about our sediment removal project, please contact Mékell Mikell, Communications Representative (Mekell.T.Mikell@lmco.com or 800-449-4486). This FAQ will also be updated as cleanup work continues.

Additional community project information is available at www.lockheedmartin.com/middleriver and includes a Season 1 Project Bulletin, a Photo Tour of the current work, and all technical documents related to the Middle River site.

Project Background

Lockheed Martin is working collaboratively with the Maryland Department of the Environment (MDE) to clean up legacy waste at the Middle River Complex (MRC), including dredging contaminated sediments in Dark Head Cove and Cow Pen Creek. Cleanup will also include excavation of Cow Pen Creek, restoration of the creek and banks, placement of a clean sand layer, and adding protective carbon over certain areas of the remaining sediment of Dark Head Cove. Every step of the cleanup process, from the original environmental investigation to the current MRC site work, is reviewed, approved, and routinely inspected by MDE. We also actively engage and seek feedback at every stage of the process from the community through public meetings, newsletters, regular updates to ***www.lockheedmartin.com/middleriver***, and a sediment working group.

Frequently Asked Questions (FAQs)

1) Why are you dredging in Middle River?

Over a number of years, Lockheed Martin has taken numerous samples to determine what contamination is in the sediments in Dark Head Cove and Cow Pen Creek. These samples revealed the presence of polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs), primarily in the cove, and metals, primarily in the Creek. Evaluations have shown that the contaminants are tightly bound to the sediments, so surface water is not considered a direct health-risk to humans or fish. The primary risk is to organisms living in the sediment and the waterway. PCBs, in particular, accumulate in tissue and travel further up the food chain when they are eaten by larger organisms. As a result, fish consumption advisories have been established throughout the Chesapeake Bay region by the Maryland Department of the Environment and include the Middle River area. Since PCBs are very stable, they will continue to be in the environment for many years if they are not removed. By reducing the contamination in sediments, a healthier food chain and fish habitat will result.

In 2012, Lockheed Martin presented its findings in community meetings, and a community working group was formed. Over 30 citizens from throughout the community volunteered to participate in multiple educational meetings to better understand the contaminants found in the creek and cove and explore cleanup options (combinations of removal, in-place treatment, and doing nothing). These citizens helped define the scope of the project, expressing a preference for the combination of approaches that became the project design.

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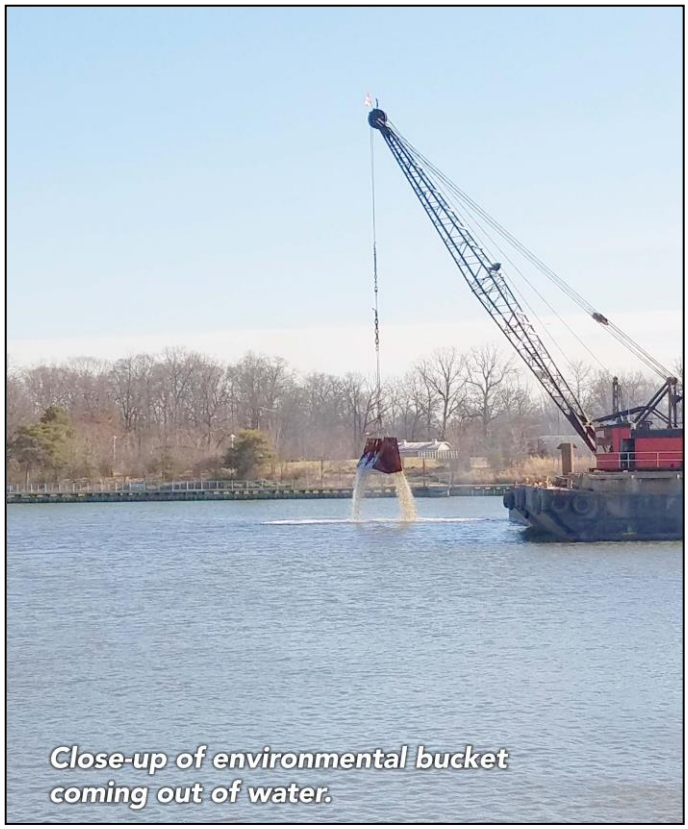
2) Who provides oversight of the Middle River sediment removal project?
Lockheed Martin's approved environmental remedy is a hybrid solution that minimizes dredging of sediment and maximizes in-place treatment (in-place treatment avoids additional dredging and disruption). All project design and planning were carefully reviewed and approved by the 12 responsible regulatory agencies before work began:

1. U.S. Environmental Protection Agency
2. U.S. Army Corp of Engineers
3. National Oceanic and Atmospheric Administration
4. U.S. Fish and Wildlife Service
5. Maryland Department of the Environment
6. Maryland Department of Natural Resources
7. Maryland Board of Public Works
8. Maryland Aviation Administration
9. Maryland Air National Guard
10. Maryland Heritage Trust
11. Maryland Board of Public Works
12. Baltimore County

For example, the project erosion and sediment controls are very strict and were designed through a number of review cycles with the Baltimore County Soil Conservation District. Once the controls were in place, they were inspected by the County. These controls are regularly checked and maintained to prevent any sediment-laden water that might result from upland disturbance or accidental spills within the upland work area from getting into the cove.

3) What is the timeframe for the project?
The Middle River cleanup project work is scheduled specifically for limited times of year in order to protect fish and underwater plants (also known as subaquatic vegetation). Sediment cleanup began in October, and winter work in the waterway must be completed by February 14, 2017 so that fish spawning is not affected. Although the levels of contaminants being removed in 2016-17 are technically not considered to be hazardous waste under the nation's regulatory framework and have been in place for years, the regulators and community working group volunteers believe it is important that the contaminants be removed or treated in place to create a healthier ecosystem. Excavation of Cow Pen Creek will begin mid-June 2017.

4) How was the decision made to choose mechanical dredging instead of hydraulic (or suction) dredging?
Lockheed Martin and its contractors reviewed both dredging options, and in collaboration with the regulators, the MDE and the U.S. Environmental Protection Agency (EPA), selected the use of mechanical dredging rather than hydraulic dredging for this project. While both methods have advantages and neither is perfect, the United States Army Corps of Engineers (USACE) states that the two methods are considered equal in terms of the quantity of sediments stirred up in the waterway (USACE, 2008 - Technical Guidelines for Environmental Dredging of Contaminated Sediments).


Close-up of environmental bucket coming out of water.

5) Which dredging technique is better for the portion of the project going on during the winter of 2016-17?
The advantages of mechanical dredging are that it can be controlled more thoroughly and can facilitate the required removal of debris encountered in dredging. (Debris tends to clog a hydraulic dredge apparatus, while mechanical dredging more effectively removes such debris as logs and shopping carts.) Mechanical dredging does not generate the huge quantities of waste water that must be handled, treated and disposed when hydraulically dredging. Also, by using multiple mechanical dredging barges, the in-water winter work deadline of mid-February can be met. Use of an environmental dredge bucket allows water to be released, while minimizing release of contaminated sediments. Importantly, turbidity (a measure of the cloudiness of the

water) is closely monitored in order to meet the strict requirements set by regulators. (See Question 7 for more information.)

6) How will Lockheed Martin confirm that the sediment removal was successful?
By project design, dredging within specific areas will be complete when sediment has been removed to a specific depth. Additionally, samples will be taken at the conclusion of the planned dredging to confirm the contaminants have been removed. If established cleanup goals have not been met, then additional dredging will be performed. After dredging is completed, a layer of clean sand will be placed on top of dredged areas to ensure a clean surface is available to all aquatic organisms in the dredged areas of the cove and the lower creek.

In the portions of the creek that are being excavated, the upper creek areas will be restored to their current depths, with a comparable meandering channel. Additionally, native species will be planted on banks, wetlands, and upland areas, resulting in an improved wildlife habitat. The middle portion of the creek will be restored to its new, deeper depth, and it will be topped with clean sand and in some places gravel, and other structures, such as root wads, to create a healthy habitat. Subaquatic vegetation (SAV) will also be planted. The SAV will be carefully monitored to ensure a successful recovery and replanted if necessary. Because more creek acreage will be created that will support SAV growth (by deepening the creek), fish spawning habitat will also be improved.

In the *in situ* (in-place) planned treatment areas, activated carbon, similar to that found in activated carbon-based water filters, will be placed over the remaining portion of the cove where very low levels of PCBs were found. Those PCBs will be trapped by the activated carbon, permanently preventing them from uptake by aquatic organisms. Furthermore, the EPA will require confirmation of the treatment's success. Worms living in sediment will be tested before and after the project to confirm the treatment's effectiveness. This is considered more reliable than testing fish, since fish move and feed from one area to another.

7) How effective is the silt curtain at keeping suspended sediment from moving outside the work area, and how does Lockheed Martin know what is being released?
Use of a silt curtain, which is recommended by the U.S. Army Corps of Engineers (USACE), is one of the best management practices for reducing the short-term impact of dredging on the environment.[1] Another best management practice is scheduling construction during the winter to avoid adversely impacting fish spawning. Other best management practices include, but are not limited to, the choice of the environmental dredge bucket used, operational controls, constant monitoring of water quality, and use of erosion and sedimentation controls around the upland operations.

The silt curtain is being used according to U.S. Army Corps of Engineers' design guidelines, including the recommendation that the curtain not go completely to the mudline within a tidal or non-static flow environment, since that would cause further sediment disturbance (USACE, 2008). The silt curtain is made of PVC-coated plastic and panels are 100-feet wide and 8-feet deep. It is securely fastened at each end near the shore at the side of the cove. Small gaps are maintained on the sides to allow flow of tidal water and prevent disturbance of the bottom at the shoreline. On some days, the curtain moves substantially with the current created by the wind and the tide moving in and out of the cove. The curtain also moves up and down with the tide, and on days of very low tide may contact the cove bottom. The silt curtain flotation system allows it to move with the tide; it is not a stationary wall, but rather a flexible engineering control designed to impede the movement of solids moving through the water column.

The project team monitors water quality by assessing turbidity (note: turbidity is a measurement of how much sediment is stirred up in water) during the in-water work, both within the cove and outside the silt curtain. Since these contaminants attach to sediment particles, the regulators require us to monitor turbidity. Strict turbidity limits have been established by the regulators for this project (a small difference of only five NTUs – turbidity measurement units – are allowed between compliance monitoring and background locations), and Lockheed Martin meets these criteria. Measurements are collected throughout the work day, and the results are communicated weekly to regulators. If

[1] U.S. Army Corp of Engineers (2008). "4Rs of Environmental Dredging: Resuspension, Release, Residual, and Risk." https://quicksilver.epa.gov/work/02/145555.pdf

required turbidity limits are exceeded more than twice within 60 minutes, work is stopped and steps are taken to lower the turbidity levels before work proceeds. If turbidity limits are exceeded, regulators are notified immediately and the likely cause is identified. For example, the propellers of the boats used to push barges could potentially increase turbidity on a temporary basis. A second curtain is available on site to install if necessary, but so far has not been needed.

Mobile monitoring of turbidity confirms that the great majority of solids associated with dredging settle out prior to reaching the silt curtain. However, the curtain will capture solids upon contact, and they will settle to the bottom during the slack tide. Data collected throughout each work day confirms that very little sediment or silt is arriving at the curtain. The curtain is designed to keep more than 90% of disturbed sediment within the work area. Turbidity monitoring has been well documented, including during the earlier project in Dark Head Cove during the winter of 2014-15 when the highest concentrations of PCBs were removed. Monitoring data collected to date confirms that only minute levels of stirred-up sediment could have escaped from the work zone. These tiny levels are barely discernable to the naked eye and require optical monitors for detection. Even at 100 turbidity measurement units, the quantities of particles are so small that they do not create a detectable quantity at the bottom of the curtain that could be swept away by the tide. Instead, the particles hit the curtain and fall to the bottom of the cove when the tide is slack, where they sit unless disturbed, such as by a boat propeller.

Any turbidity caused during dredging is temporary, very localized to the dredge area, and the sediment resettles quickly. The mobile monitoring of water quality performed by the Water Quality Monitoring Technicians has confirmed what was determined during bench scale testing of the sediments during the design phase of the project: contaminants are tightly bound to sediments, so they are not released into the water. The layer of clean sand that will be placed on top of the dredged areas of the creek and cove following dredging, plus the layer of activated carbon that will be placed in areas of the cove where levels of residual contamination are too low to warrant dredging will isolate the waterway and aquatic organisms from the very low levels of remaining sediment contamination.


Silt curtain photo, taken from one bank and monitoring locations.


Silt curtain with monitoring locations.

8) How does the work in Cow Pen Creek differ from the dredging project in Dark Head Cove?

The deepest portion of Cow Pen Creek, which is nearest Dark Head Cove, is being dredged at the same time as the cove during the winter 2016-17. The shallower portions of the creek (the upper and middle, which are closer to Eastern Avenue) will be excavated in sections instead of by dredging. Each work area will be temporarily isolated by constructing berms, also known as coffer dams, to wall water out. The area will be pumped dry and any fish remaining in the drained area will be removed by hand and placed in the creek. The creek water will be piped around excavation work areas. Berms will be moved to new sections until the planned excavation is complete.

Sediments will be dug out in the dry areas and trucked directly onto the Lockheed Martin property. These sediments will be handled similarly to the earlier dredged sediments and mixed with Calciment® (a product used to dewater and solidify sediments). The Calciment-sediment mixture will be trucked to a licensed landfill. During this part of the project, a silt curtain will be in place at the bottom of the creek primarily as a safety measure to restrict access to the work area. Water quality monitoring will continue at the compliance and background monitoring locations. Because the creek water will be diverted around the work areas in the upper creek area, there will be no turbidity concerns from the excavation activities.

The project will begin in mid-June, after fish spawning season ends and during the subaquatic vegetation (SAV) protection season. Since SAV will be removed when digging up the creek bed, it was considered important to complete the entire creek project within one construction season (between June 15, 2017 and February 14, 2018) so that the subaquatic vegetation can be restored as soon as possible.

9) What is being done to maintain submerged aquatic vegetation?
Submerged aquatic vegetation (SAV) restoration is an important component of the dredging project, especially because SAV is critically important for fish spawning habitat. Before beginning work, Lockheed Martin studied where the SAV is located, how much existed, and what species were growing. Working with permitting and advising agencies, plans were created to reestablish SAV growth following work completion. SAV most commonly grows at water depths ranging between 2.5 and 5.5 feet below mean low water level in Cow Pen Creek and Dark Head Cove. While the creek will be dug deeper, the project will increase the creek acreage at these ideal SAV-growing depths. Adding a top layer of sand and in certain locations gravel will help facilitate SAV growth and provide for fish-friendly bottom substrate and structure. While SAV would grow by itself over time, restoration plans have been developed, reviewed and approved by the agencies which include planting a desirable native species (for example, wild native water celery), monitoring the return of SAV over five years, and replanting if necessary. The upper portion of the creek, which is above the area where SAV grows, will be restored to its original depth and to an improved environment, planting native species in both wetlands and on the creek banks.

10) How are fish affected by the sediment project work?
During the first season of work, when dredging occurs in Dark Head Cove and Cow Pen Creek, impacts to fish are expected to be minimal. They will be free to swim away from equipment and even through gaps beneath and around the silt curtain. The dredging crane uses an environmental bucket to trap sediment at the mudline, at which point the bucket is closed. When the bucket is lifted, excess water is released through vents. Sediments are generally collected in a very small area at any one time, so the opportunities to capture fish are very few.

During season two, fish stranded within the excavation areas during the dewatering process will be moved downstream. Any fish stranded within the excavation areas will also be counted and identified before being transferred and released downstream.

11) Some community members are concerned that the 2015 fish die-off was affected by the earlier dredging project. What is the scientific evidence about the cause of the fish kill and could the current dredging project cause a fish kill?
An investigation by the Maryland Department of the Environment (MDE) concluded that the 2015 Middle River fish die-off was the result of a toxic algae bloom.[2] Significant scientific evidence supports MDE's conclusion, and water samples revealed the presence of the harmful culprit: dinoflagellate algae *Karlodinium veneficum*. Warm fall weather and higher salinity levels likely help the algae survive past the summer and into November. A sudden drop in temperature likely killed the algae and released a toxin that kills fish by inhibiting oxygen uptake through their gills. Furthermore, the rapid, simultaneous fish die-off encompassing an expansive 16 miles of shoreline in a tidal-controlled estuarine environment strongly supports algae as the cause rather than a single point source.

[2] Maryland Department of the Environment. 2015. "Algae-produced toxin found to be cause of Middle River fish kill." http://news.maryland.gov/mde/2015/12/07/algae-produced-toxin-found-to-be-cause-of-middle-river-fish-kill/.

Algae growth and blooms occur throughout the Chesapeake Bay and the world and have become a significant problem. Studies show the growth of algae in bodies of water is linked to excessive nutrients, especially nitrogen and phosphorus, which come from various sources, including fertilizers and air emissions. However, the contaminants removed in the first Lockheed Martin dredging project are not chemically similar to either nitrogen or phosphorus compounds. MDE found no known relationship between algae growth and polychlorinated biphenyls (PCBs) dredged in a small area within Dark Head Cove during the winter of 2014-15, nor do PCBs have immediate, severe, or acute effects on fish. As with the 2014-15 dredging project, the ongoing sediment removal and in-place treatment is not anticipated to negatively affect fish populations, and over time should help improve the health and abundance of local fish.

12) What measures are being taken to prevent community exposure to sediment?
Steps are being taken throughout the cleanup process to prevent sediments from escaping into the environment. Measures are taken to reduce blowing dust, such as watering down any dust generating surfaces. Capture areas have been constructed to keep sediments from spilling back into the waterways when transferring from barge to truck and from truck to mixing bins. Sediments are transported onsite using temporary construction-haul-roads, so that they never leave the work area until they are ready to be transported to the landfill. The transporting trucks' tires are regularly cleaned to limit tracking any contamination onto public roadways.

Lockheed Martin is always focused on the health and safety of its workers and neighbors affected by our work. The corporation strives to be open and transparent with our stakeholders and be responsive to their questions and concerns.

To date, two incidents have occurred, resulting in sediments being spilled on the roadways. The first incident occurred November 8, 2016 when a spill of between 15-20 hand shovelfuls of nonhazardous sediment fell along Martin State Boulevard as a result of a loose tailgate on one truck. The second event occurred December 14, 2016 when a truck hauling sediments on Eastern Boulevard was involved in a three-vehicle accident, and the truck’s sudden braking caused about 500 pounds of sediment to fall onto the road. The responses to both accidents were organized and swift, and the sediments were quickly and safely cleaned up. Lockheed Martin takes action to understand such occurrences and takes steps to prevent any reoccurrences.

13) When will the next community meeting occur?
A community information session is anticipated between the two sediment work seasons in spring 2017. Details will be provided in an upcoming newsletter and at the Lockheed Martin website www.lockheedmartin.com/middleriver. If you wish to be added to the mailing list, please provide an email or mailing address to Mekell.T.Mikell@lmco.com or call 800-449-4486.