

April 2018

Lockheed Martin Middle River Complex
2323 Eastern Boulevard
Middle River, Maryland

Sediment Cleanup In Dark Head Cove And Cow Pen Creek Is Done

The challenging task of removing contaminated sediment from Cow Pen Creek and Dark Head Cove is finished. In three major initiatives over the course of three construction seasons, Lockheed Martin and its contractors dredged or excavated approximately 55,500 cubic yards (3,285 truckloads) of sediments contaminated with polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and metals from nearly twelve acres of Dark Head Cove and Cow Pen Creek.

Dark Head Cove Near Outfall 005

The project started with an expedited effort to remove the highest PCB concentrations, which were in Dark Head Cove near Outfall 005. 1.3 acres (5,272 cubic yards, or 9,528 tons) of sediment were removed over three-plus months, and, an estimated 415 pounds of PCBs were removed from the bottom of Dark Head Cove next to the southern boundary

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Lockheed Martin participated at Hawthorne Elementary School's Science, Technology, Engineering, Arts, and Mathematics (STEAM) Night showing students how tender new plantings along Cow Pen Creek are, and encouraging everyone to help protect the creek and young plants.

Martin State Airport Groundwater Treatment Plant Begins Full Operation



The Groundwater Treatment Plant located at Martin State Airport began operation in December 2017.

Lockheed Martin's new groundwater treatment plant in the Dump Road Area of Martin State Airport began continuous operation in December 2017. A 21-day startup test included testing all the components of the groundwater treatment system, from drawing water from the 16 wells that intercept the Dump Road Area groundwater plume, to treating the water and, after confirming that the water was clean, releasing it to Frog Mortar Creek.



The treatment plant is located along Frog Mortar Creek on Lynbrook Road.

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Lighted buoys and a silt curtain were installed at the mouth of Cow Pen Creek to prevent boaters from entering and silt from leaving the work area.

of the Middle River Complex. The high concentrations were identified in the fall of 2013 when samples were taken in preparation for the overall sediment cleanup project. Work to remove these concentrations began in spring 2014 when a floating boom and silt curtains were installed in the Cove to keep boaters and swimmers away from the area and restrict sediment movement into greater Dark Head Cove.

During the summer and fall of 2014, Lockheed Martin gathered equipment, began preparing the sediment transfer site, and secured the permits necessary to work during the 2014-15 winter, when dredging could proceed with the least damage to spawning fish. By early March 2015, the dredging was finished, the contaminated material hauled to a licensed landfill, and in-water equipment removed.

Dark Head Cove and Lower Cow Pen Creek

In the fall of 2016, the larger dredging effort, in Dark Head Cove and the lower portion of Cow Pen Creek, was undertaken, and an additional 4.5 acres (35,851 cubic yards, or 41,287 tons, or 2017 truckloads) of sediment were removed from the waterway. The dredging of Dark Head



Excavators in the creek removed contaminated sediments to transfer by trucks for removal.

Cove and lower Cow Pen Creek was accomplished in the approximately five-month winter in-water work window from October 2016 to early March 2017, and included the time required to place a protective layer of sand over the dredged areas at the completion of the

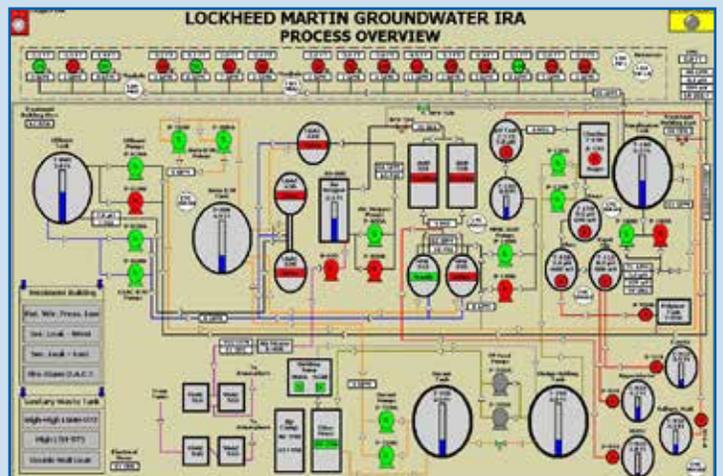


Martin State Airport groundwater treatment plant under construction.

Chuck Trione, Lockheed Martin’s project manager for remediation at Martin State Airport, reported that the the startup effectively optimized the system’s operation. “After the 21-day test finished, we reviewed all aspects of the test. Treated water was tested before release, and we achieved one hundred percent compliance with the discharge standards in our NPDES permit.”



The treatment plant includes a number of components that effectively treat groundwater, and releases cleaned water into Frog Mortar Creek, meeting permit requirements.



Onsite operators can review the effectiveness of all the treatment system’s components on a computer screen.

dredging process. The sand layer covers the dredged areas, preventing residual contaminants from entering the food chain.

Upper Cow Pen Creek

Sediment removal from upper Cow Pen Creek began in June 2017 with the sequential construction of dams that stopped the flow of water downstream and tidal water upstream. Multiple pumps removed the water from the three work areas, exposing the streambed for excavation. The sandbag dams were breached by storm waters during three heavy rains in July and August. As a testament to the challenge of the project, during the course of the July storm—the kind that comes only once every 25 years—24-hours' worth of rainwater came flooding down the stream in a single hour. In each case, Lockheed Martin's contractors cleared out the excess rainwater, pumping it through the treatment system.

One of the most interesting feats of the project was the use of a giant rubber bladder dam, 12-foot high, 25-foot wide and 200-feet across, as the lowest dam in the system. It took 470,000 gallons of water pumped from the cove to fill the bladder and give it structure. After successfully holding back the waters of Dark Head Cove from the Cow Pen Creek excavations, water eventually forced its way under the bladder dam and filled the excavation just days before the work would have been completed. Efforts to seal the

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The standards for National Pollutant Discharge Elimination System (NPDES) permit are set by the Maryland Department of the Environment (MDE), and are intended to avoid any detriment to water quality in the creek and harm to the ecosystem resulting from the discharge of treated water.

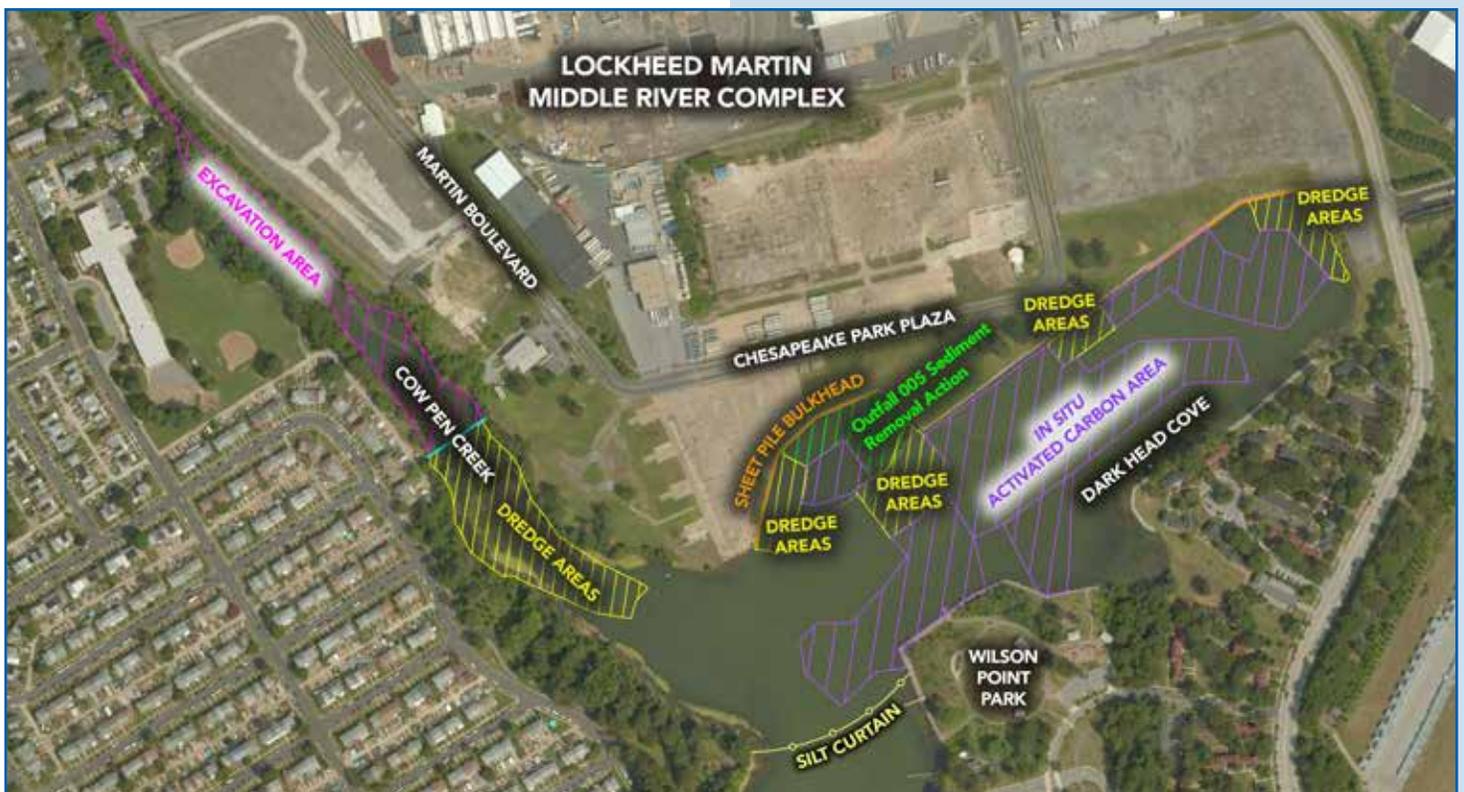
During the startup test the plant treated approximately 50,000 gallons of water per day. Since beginning full operation, the volume of contaminated water processed has been increased, and by April, seven and a half million gallons had been treated and released to Frog Mortar Creek.

Lockheed Martin has been testing the surface water in Frog Mortar Creek six times a year for the last five years. Lockheed Martin will continue to test the surface water in the creek six times a year. Our testing will include the volatile organic compounds that the groundwater collection and treatment plant is removing from groundwater before it discharges into the creek.

Chuck Trione said, "We will closely watch our results

A photo tour Groundwater Treatment System construction project is available at www.lockheedmartin.com/martinstateairport

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Locations of the three sediment removal actions.

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Dams built in Cow Pen Creek created dry excavation areas. A rubber water-filled bladder dam was constructed in the lowest excavation section where the creek was deepest and widest.

manner that resembles the original course of the stream before work began. Banks have been restored and replanted, and tree root wads have been placed in the stream bed to enhance fish spawning. To restore submerged aquatic vegetation, wild celery weed seeds were collected in the area in the fall of 2017 and are being planted this spring. The success of the submerged aquatic vegetation will be monitored and the vegetation supplemented as necessary.

Tom Blackman, Lockheed Martin's project manager for remediation of the Middle River Complex, summed up the sediment cleanup effort by saying, "I'm extremely proud of everyone who contributed to the success of this project—our consultants and contractor teams, the community that had to endure all this work in their back yards, and the regulators with whom we worked. This was not a simple project, and Mother Nature threw us a number of curves of her own. It wasn't easy. The challenges

leak below the dam with plastic sheeting and sand were ultimately successful, and the remediation work was completed.

Restoring Cow Pen Creek

The final and equally critical aspect of the project was the restoration of Cow Pen Creek. The upper section of the creek bed was restored with a streambed mix that included sand and gravel and an organic mixture capable of supporting vegetation. The channel now meanders in a



Following sediment excavation, the creek was restored to resemble the stream course before work began by rebuilding meandering curves and planting native vegetation.

were enormous. At times the sheer work involved was daunting and exhausting. But in the end, everything worked out according to our plans and I'm extremely grateful for everyone's effort."

Sediment Cleanup Timeline

- Fall 2013—Relatively high concentrations of polychlorinated biphenyls identified near Outfall 005 in Dark Head Cove.
- May 2014—Floating boom placed in Dark Head Cove to isolate Outfall 005 area from boaters and swimmers.
- December 10, 2014 to February 14, 2015—Outfall 005 area of Dark Head Cove dredged.
- October 26, 2016 to March 8, 2017—Season One, the extended "Winter In-Water Work Window." Dark Head Cove and lower Cow Pen Creek dredged.
- February 18 to March 3, 2017—Layer of sand placed over dredged area to control any residual contaminants.
- March 3-8, 2017—In-water work completed.
- March 13, 2017—Turbidity and boat-traffic control curtain and buoys removed.
- July 12, 2017—Season Two, began construction of first sandbag dam.
- July 28-29, 2017—25-year storm breaches sandbag dams.
- August 24, 2017—Rubber bladder dam placed between lower and upper Cow Pen Creek. Excavation in Cow Pen Creek continues.
- October 27, 2017—Portion of Dark Head Cove bulkhead improved with deeper piles.
- November 9-10, 2017—Bladder dam undermined, requiring repair; excavation area filled with creek water, intruding water treated.
- November 16, 2017—Uppermost Cow Pen Creek excavated (BGE section).
- October 2017-December 2017—*In situ* (in place) treatment by placing activated carbon granules atop those portions of Dark Head Cove where levels of polychlorinated biphenyls (PCBs) are so low that dredging is not warranted. Activated carbon binds with PCBs to prevent them from entering the aquatic food chain.

- December 2017—On-shore work areas restored; sediment-handling materials hauled to landfill; erosion and sediment control fencing removed; stream banks regraded and native plantings installed.
- December 26, 2017—Rubber-bladder dam removed.
- Ongoing for the next four-to-six years:
 - Monitor effectiveness of activated carbon *in situ* treatment.
 - Monitor health of submerged aquatic vegetation plantings.
 - Monitor Cow Pen Creek wetland vegetation.
 - Monitor Cow Pen Creek bank stabilization and floodplain reconstruction.

Facts and Figures

4.5 acres of Dark Head Cove and 3.5 acres of lower Cow Pen Creek dredged, and 3.6 acres of Cow Pen Creek excavated.

~55,500 cubic yards (~75,000 tons) of sediment transported to out-of-state, licensed landfills in 3,285 truckloads.

160,000 gallons of sediment drainwater treated and discharged to the sanitary sewer in Season One. During Season Two, 12.2 million gallons of water treated and returned to the lower portion of the creek, in accordance with a National Pollutant Discharge Elimination System (NPDES) permit.

2,500 tons of activated carbon placed on the 13.7 acres of Dark Head Cove's floor where concentrations of PCBs are so low that dredging was not warranted.

10,263 tons of sand placed over the dredged and excavated areas of Dark Head Cove and Cow Pen Creek, including the bladder-dam repair area; also 450 tons, or about 21 truckloads of streambed organic mix with sand/gravel mix, placed upstream in Cow Pen Creek.

Annual Groundwater and Surface Water Monitoring Begins This Spring

Annual comprehensive groundwater monitoring across the Middle River Complex began in March and runs through April. Groundwater samples are collected once a year. The objective of this activity is to determine if concentrations of contaminants in groundwater plumes are trending up or down over time.

Surface water samples are collected three times each year, in April, June and September. The objective of this monitoring is to determine any effects on surface water from groundwater plumes.

In 2016, Lockheed Martin groundwater sampling revealed areas of groundwater with elevated concentrations of trichloroethene (TCE, formerly used as a solvent) under Tax Blocks E and F. As a precautionary measure, additional samples were taken of the surface water in Dark Head Cove in the vicinity of the groundwater samples, where the groundwater may flow into surface water. These surface water samples showed that concentrations of TCE in Dark Head Cove were well below the Maryland Department of the Environment's (MDE) surface water quality guidance. The samples were also below the concentrations that would cause risk to swimmers, so the state has not posted an advisory regarding swimming in the cove. As noted, samples of surface water in Dark Head Cove and Cow Pen Creek are now taken three times a year.

Lockheed Martin is preparing a feasibility study of how to most efficiently reduce the area of TCE contamination under Block F. "We're looking at ways to decrease the risk of this area of contaminated groundwater moving into Dark Head Cove," Lynnette Drake, project manager, said. "The results of the feasibility study will be presented to the public later this year and will form the basis of an addendum, or modification, to the existing Groundwater Response Action Plan that is guiding groundwater cleanup at the site."

Meanwhile, the groundwater cleanup process using bioremediation continues in other portions of the Middle River Complex. The bioremediation process feeds nutrients (sugars) to the naturally occurring bacteria in the soil, causing the bacteria to break down contaminants into safe byproducts. When helpful, similar bacteria are added to increase the effectiveness of bioremediation. Past monitoring has shown that the Block G plume has been significantly reduced through this process, and additional nutrients were injected into the plume in Block I in 2017. The groundwater cleanup results in both of these areas will be checked during the annual sampling. "2017 marked two years since we reached the desired groundwater cleanup

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Photo tours and project bulletin of the Sediment project are available at www.lockheedmartin.com/middleriver

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from sampling throughout the year, with the expectation that we'll see improved water quality in Frog Mortar Creek."

Meet Chuck Trione

Chuck Trione is the new manager of the Martin State Airport remediation project. The 55-year old hydrogeologist hails from northern New Jersey and has spent his entire 33-year career working on groundwater-related environmental issues, the last ten of which have been for Lockheed Martin.

Chuck graduated from Rider University with a BS degree in geology, a subject in which he has had a lifelong interest. He later earned an MBA in Management from Ramapo College in Mahwah, New Jersey. Throughout his career Chuck has worked on projects related to cleaning up sites with contaminated wastes. As he describes it, "I've spent my share of time presenting plans to government agencies and community groups, plus going into private homes to talk about technical issues and learn about people's concerns."



Chuck Trione participated at the Hawthorne "Bein' Green" creek cleanup.

Chuck handles a number of projects for Lockheed Martin, working out of the same office in Rockville, Maryland as Tom Blackman and Lynnette Drake. He has been transitioning onto the Martin State Airport project since last summer, and sees two primary challenges for the site.

First and foremost, Chuck says, "We need to show that the newly constructed groundwater treatment plant and the extraction-well network operate as designed. Though the system has only been operational for about four months, thus far we have met our monthly discharge water quality reporting requirements and our initial biotoxicity tests were also successful. We will continue reporting our discharge water quality results to MDE on a monthly basis and will perform additional biotoxicity test as required in our permit."

Chuck's second major goal is the completion of the Dump Road Area remediation project. "As important as it is, our groundwater treatment system is only part of the remedy for cleanup of the Dump Road Area. As we move forward with planning the remaining portions of the remediation project, we need to work effectively with all stakeholders in the Dump Road Area—first and foremost, the State of Maryland as land owner, represented by the Maryland Aviation Administration—and the various parts of the community that have an interest in what happens here."

Frog Mortar Creek Water Sampling and Contact Advisory Update

Lockheed Martin's water sampling program for Frog Mortar Creek continued in 2017. Results are available at www.lockheedmartin.com/martinstate.

Surface water sampling in Frog Mortar Creek began in 2004. In July 2010 sampling results unexpectedly showed higher contaminant levels than had been previously detected. Following Lockheed Martin and the Maryland Department of the Environment (MDE) evaluations of the data, the MDE issued a water contact advisory for a 2,000-foot long stretch of shoreline along Martin State Airport. The advisory recommends that swimming within 200 feet of the shoreline be limited to no more than 4 hours per day and a total of approximately 70 days per year. That advisory is still in effect. The advisory area is identified by signs posted along the shoreline, and is also marked on the 2017 poster located at the Parkside Marina and is included on the project website.

The creek water is tested for volatile organic compounds and metals. The 2017 results are consistent with 2016 and are at similarly low levels. However, vinyl chloride, a volatile organic compound, has been coming in slightly higher over the past two years; the average summer-month concentration of 1.4 parts per billion (ppb) is above the Maryland Department of the Environment screening level of 0.7 ppb.

Forty-four water samples are collected six times a year, with monthly samples taken during the summer swimming months (June to September). Sampling results often vary according to such factors as rainfall and water flow in the creek.

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concentrations in Block G,” Drake added. “If the spring groundwater sampling results confirm that cleanup goals have been maintained, then we will request a ‘no further action’ letter from the Maryland Department of the Environment for that portion of the site, reaching an important milestone in cleanup of the facility.”

Abandoned Drainage Pipes To Be Removed This Summer

This summer a number of abandoned drainage pipes will be removed from the Lockheed Martin-side of Cow Pen Creek. Six outfalls were identified over the last few years during remediation work. After researching existing records and conducting field investigation, Lockheed Martin determined that none of these pipes provide any useful purpose and that they should be effectively decommissioned.

The outfalls are associated with historical buildings that were demolished long ago and are not part of the storm water drainage system included in the National Pollutant Discharge Elimination System (NPDES) permit for the Middle River Complex. After identifying the outfalls, Lockheed Martin remediation experts examined each one to determine if they were related to active drainage, and searched records to determine their original purpose. For example, one pipe dates back to World War Two when it drained the area around a long-ago demolished Navy barracks in Block F.

The removal work will likely take only a few days. The ends of the pipes will be removed and pits will be dug some distance back from the creek-side end of the pipes, where they will be cut in two and permanently sealed.



Mitigation Planting Areas

Samples taken in December 2017, three weeks following the start of operation of the groundwater treatment facility in the Dump Road Area, contained virtually no volatile organic compounds. Vinyl chloride was found in only one of the 44 samples and no trichloroethene was detected in any sample. Sampling over six events in 2018, starting in March, will help evaluate how successfully the groundwater treatment system meets its goal of improving the water quality of Frog Mortar Creek.

Lockheed Martin to plant hundreds of trees in Baltimore County

To compensate for the loss of forest habitat due to construction of the Dump Road Area groundwater treatment plant at Martin State Airport, Lockheed Martin will plant a similar acreage of trees at the Middle River Complex and on other land in Baltimore County. The groundwater treatment plant is within the limits of the Chesapeake Bay Critical Area and the requirement for the replacement of the trees is a condition for the Maryland Critical Area Commission’s approval of the treatment plant.

Lockheed Martin removed trees from nearly an acre of property within the 100-foot tidal buffer of the Critical Area, and nearly three acres of trees just outside the buffer. Under normal circumstances, to meet the conditions of the Critical Area Commission, new trees would be planted near the area where they were removed. However, because replacement trees at the Martin State Airport might create wildlife hazards for aviation, Lockheed Martin will plant trees on the Middle River Complex Tax Blocks G and F,

adjacent to Cow Pen Creek, and on another property in Baltimore County.

Speaking of the proposed reforestation plan, Chuck Trione, Lockheed Martin’s manager for the Martin State Airport remediation project said, “This is a really creative response to the

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For More Information

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All documents are available at the Essex Library,
410-887-0295, or on Lockheed Martin's Web site
at www.lockheedmartin.com/middleriver or
www.lockheedmartin.com/martinstateairport

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Hours: Sunday, 1 p.m. to 5 p.m.
Monday through Thursday, 9 a.m. to 9 p.m.
Friday and Saturday, 9 a.m. to 5:30 p.m.

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mitigation requirements of the Critical Area Commission. The addition of a substantial number of new trees to the sediment remediation project on Cow Pen Creek will further enhance the work that's already been completed at the Middle River Complex.”

Lockheed Martin plans to plant a variety of trees typical of a Chesapeake Bay mixed hardwood forest: canopy trees such as sweetgum, tulip poplar and red maple, and understory trees such as American holly, musclewood and mountain laurel. Switchgrass, joe-pye weed and spotted joe-pye weed will be planted to minimize erosion and provide a more diverse and native herbaceous cover.

Eddyville, Ky 42038

455 Hillside Trail

Lockheed Martin Corp

