The 2014 Chesapeake Bay Watershed Agreement (www.chesapeakebay.net/documents/21752/final_ches_bay_watershed_agreement.pdf), which guides the work of the Chesapeake Bay Program, calls for state and federal partners to “restore native oyster habitat and populations in 10 Bay tributaries by 2025, and ensure their protection.”

To coordinate planning efforts to achieve this outcome, in Virginia, the Chesapeake Bay Program’s Sustainable Fisheries Goal Implementation Team convened three oyster restoration workgroups—one each for the Lafayette, Piankatank, and Lynnhaven rivers. These workgroups plan and coordinate large-scale oyster restoration in each tributary. Each is working to develop an oyster restoration plan to describe how the tributaries will be restored and monitored, consistent with standards described in the Chesapeake Bay Oyster Metrics report (www.chesapeakebay.noaa.gov/images/stories/fisheries/keyFishSpecies/oystermetricsreportfinal.pdf).

On behalf of each workgroup, NOAA maintains GIS geodatabases with relevant data on each tributary, available at www.habitat.noaa.gov/chesapeakebay/gis/Oyster_Restoration_Geodatabases/.

In addition to the Lafayette, Piankatank, and Lynnhaven rivers, two other tributaries (Great Wicomico and lower York rivers) have been preliminarily selected for large-scale restoration in Virginia.

An overview of Bay-wide progress toward the Chesapeake Bay Watershed Agreement oyster outcome is available at www.chesapeakeprogress.com/abundant-life/sustainable-fisheries/oysters.

An overview of Maryland progress toward the Chesapeake Bay Watershed Agreement oyster outcome is available via chesapeakebay.noaa.gov/oysters/oyster-restoration.
Lafayette River

Lafayette River Workgroup Members

NOAA (chair), Chesapeake Bay Foundation (CBF), Christopher Newport University, City of Norfolk, Elizabeth River Project (ERP), U.S. Army Corps of Engineers’ Norfolk District (USACE), Virginia Commonwealth University, Virginia Institute of Marine Science (VIMS), Virginia Marine Resources Commission (VMRC)

Update

- The Lafayette Workgroup convened in early 2014.
- Prior to 2014 VMRC, USACE, ERP, and CBF constructed a number of reefs in the Lafayette River.
- The workgroup has developed a GIS geodatabase of Lafayette spatial information relevant to oyster restoration. The geodatabase is maintained by NOAA, and is used to help the workgroup set restoration goals and track progress.
- Using the GIS geodatabase and NOAA GIS analysis, the workgroup determined that there are 146 acres of currently restorable river bottom. This was a key step, as Chesapeake Bay Oyster Metrics has a two-pronged test for success—fully restoring a tributary:
  - First, 50 to 100 percent of a tributary’s ‘currently restorable bottom’ needs to be covered with functioning oyster reefs. (Hence, in the Lafayette River, between 73 and 146 acres must be restored). The Lafayette Workgroup determined that 80 acres was an appropriate restoration goal within that range.
  - Second, the restoration target (in this case, 80 acres) must amount to at least 16 percent of the historic acreage of oyster reefs in the river. In the Lafayette, 16 percent of historic reef acreage is estimated at 16.2 acres, so meeting the 80-acre target for the first prong will also meet the second prong.
- In late 2014, with funding from NOAA and USACE, scientists from Christopher Newport University and VIMS surveyed oyster populations on existing reefs (deemed ‘relict reefs’). Together with NOAA GIS analysis, they determined that 48 acres of these relict reefs had sufficient oyster populations to be considered restored per the Oyster Metrics success criteria. These reefs have presumably existed historically, or have ‘self-restored’ since the river was closed to oyster harvest in the 1970s.
- The workgroup also compiled data on existing restoration projects in the river, and has determined that 22.5 acres have already been restored by USACE, ERP, and CBF.
- A total of 70.5 acres of reefs are either high-density relict reefs (48 acres) or restored reefs (22.5 acres). This leaves 9.5 acres remaining to meet the 80-acre restoration target (see table).
- The workgroup, assisted particularly by ERP, developed an initial cost estimate of $1.35 million to complete the remaining 9.5 acres on the Lafayette River. This estimate may be reduced significantly by placing strips of reef-building substrate across a site (rather than covering the full site with substrate). This new design has been successfully used for oyster restoration in Texas. See Outlook section below.
- The workgroup also determined which river areas are most suitable for oyster restoration (deemed ‘prime restorable bottom’; see map).

### Progress toward the Lafayette River Oyster Restoration Goal as of end of 2016

<table>
<thead>
<tr>
<th>Restoration Goal</th>
<th>Already Restored</th>
<th>Remaining to Be Restored</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 acres</td>
<td>70.5 acres (48 acres “relict reefs” and 22.5 acres of restoration projects)</td>
<td>9.5 acres</td>
</tr>
</tbody>
</table>

Photos: ERP/CBF
The workgroup has also served in an advisory capacity for related Lafayette issues:
- In 2015, VMRC consulted the workgroup as it developed regulations to protect Lafayette relict reefs and restoration projects from leasing.
- In 2016, the workgroup was consulted on a Lafayette dredging project; workgroup input allowed for a resolution that avoided dredging through high-oyster-density relict reefs.

**Outlook**
- The Workgroup plans to draft a Lafayette River Oyster Restoration Tributary Plan in 2017, describing how the acreage goals and cost estimate were developed and indicating where the best areas are to target oyster restoration in the river.
- The City of Norfolk will construct approximately 1.4 acres of reefs in 2017 with funding via National Fish and Wildlife Foundation’s (NFWF) Hurricane Sandy Coastal Resiliency Program. These acres were already accounted for in the 70.5 acres of existing oyster projects on the Lafayette, as funding and plans have been in place.
- ERP plans to construct four acres of reefs in 2017, with funding from NOAA. These will incorporate ‘strips’ of substrate across each reef site, and new design to provide structural complexity while maximizing substrate and minimizing cost. CBF, with funding from NOAA via NFWF, plans to place reef balls in between the substrate strips on these four acres.
- ERP and CBF are seeking approximately $550,000 to construct and seed the final 5.5 acres of oyster reefs needed to restore the river (including funds to monitor Chesapeake Bay oyster metrics success criteria, such as oyster density and biomass). The Lafayette Workgroup is providing guidance on the reef designs, which will also likely include the use of substrate ‘strips.’ If completed, this would make the Lafayette River Virginia’s first restored tributary under the Chesapeake Bay Watershed Agreement oyster outcome.
Piankatank River

Piankatank Workgroup Members
NOAA (chair), U.S. Army Corps of Engineers’ Norfolk District (USACE), The Nature Conservancy, Chesapeake Bay Foundation, Christopher Newport University, Virginia Institute of Marine Science, Virginia Marine Resources Commission (VMRC)

Update
- The Piankatank Workgroup convened in early 2014.
- The workgroup has developed a GIS geodatabase of Piankatank spatial information relevant to oyster restoration. The geodatabase is maintained by NOAA, and is used to help the workgroup set restoration goals and track progress.
- Using the GIS geodatabase and NOAA GIS analysis, the workgroup determined that there are potentially just over 1,000 acres of currently restorable river bottom. Per Oyster Metrics success criteria, 50 to 100 percent of this river bottom (500 to 1000 acres in the Piankatank) should be covered with reefs for the tributary to be considered restored. The team is working to set a specific restoration goal somewhere in this range.
- The Nature Conservancy (TNC) constructed a 21.5 acre reef in 2014 (made of 4- to 6-inch crushed concrete) and a similar 3.5 acre reef in 2015 (made from 90% crushed concrete and 10% stone), for a total of 25 acres. The combined cost of these reefs was $500,000, or about $20,000 per acre. Funding was from a grant to TNC from a private donation, and TNC has also raised an additional $250,000 toward the Piankatank Chesapeake Bay Oyster Recovery Project in partnership with VMRC.
- There are approximately 55 acres of additional sanctuary reefs designated in the river. Determining these reef’s achievement of Oyster Metrics is the next step for the tributary.
  - In addition, there are 118 acres VMRC-designated seed reefs in the river, from which oyster seed can be harvested by hand scrape and placed onto private leases for grow out and harvest.

Outlook
- USACE is slated to construct a 25-acre stone substrate reef in spring 2017. The innovative design seeks to maximize spatial ecological benefits per unit cost by deploying reef-building substrate in 30-foot-wide rows, 12 to 18 inches high, in a striated pattern across the 25-acre reef area. Rows will be 45 feet apart. This may improve water flow and reduce sedimentation on the reef, and allows space for future adaptive management. This design concept is new to the Chesapeake, and is well suited for the Pianktank River where the natural spat set is very high each year.
  - The next steps for restoration planning are to review existing VMRC oyster population data and conduct new oyster population surveys elsewhere in the river as needed. These surveys are necessary to determine whether these areas meet the Oyster Metrics success criteria.

Progress toward the Piankatank River Oyster Restoration Goal as of end of 2016

<table>
<thead>
<tr>
<th>Restoration Goal</th>
<th>Constructed Since 2014</th>
<th>To Be Constructed in 2017</th>
<th>Remaining to Be Restored</th>
</tr>
</thead>
<tbody>
<tr>
<td>500-1,000 acres (target within this range TBD)</td>
<td>25 acres</td>
<td>25 acres</td>
<td>TBD</td>
</tr>
</tbody>
</table>

Reef-building substrate prior to deployment on TNC’s 21.5-acre reef site in 2014 (top). Similar substrate retrieved from the nearby Iron Point reef in 2015, covered with naturally set oysters (bottom). Photos: TNC/VMRC
Lynnhaven River

Lynnhaven Workgroup Members

NOAA and U.S. Army Corps of Engineers’ Norfolk District (USACE) (cochairs), Chesapeake Bay Foundation, Christopher Newport University, City of Virginia Beach, Lynnhaven River NOW (LRN), Virginia Institute of Marine Science, Virginia Marine Resources Commission (VMRC)

Update

• The Lynnhaven Workgroup convened in early 2016.
• The workgroup has developed a GIS geodatabase of Lynnhaven spatial information relevant to oyster restoration. The geodatabase is maintained by NOAA, and is used to help the workgroup set restoration goals and track progress.
• Using information in the GIS geodatabase and NOAA GIS analysis, the workgroup is developing an analysis to determine how much currently restorable river bottom exists. This is a key step, as Oyster Metrics criteria require 50 to 100 percent of currently restorable river bottom to be covered with reefs for the tributary to be considered restored. Once the amount of restorable river bottom is determined, the workgroup plans to set a specific restoration goal somewhere in the 50 to 100 percent range. (Note: Oyster Metrics also requires that the restoration goal be at least equivalent to 16 percent of the historic reef acreage in the river. Per USACE’s Chesapeake Bay Native Oyster Restoration Master Plan, 16 percent of the Lynnhaven’s historic oyster reefs is estimated at 90 acres).
• USACE, LRN, and VMRC have already completed the restoration of 63 acres of oyster reefs in the river.
• The restored oyster reefs in the Lynnhaven River harbor nearly 20 million oysters and have been self-sustaining since 2008, as indicated by surveys through 2016.

Lynnhaven River oyster reef. Photo: USACE
Outlook

- USACE and the City of Virginia Beach are planning a multiphase project in the Lynnhaven River, which will eventually restore 31 acres of reef habitat. The first phase will restore nine acres.
- NOAA will conduct additional survey work in early 2017 in high-priority potential restoration areas in the eastern and western branches of the river.

Great Wicomico and York Rivers
(Preliminarily Selected Tributaries)

- The Great Wicomico and lower York rivers have been preliminarily selected for large-scale restoration.
- Both are ‘Tier 1’ tributaries under the U.S. Army Corps of Engineers’ Chesapeake Bay Native Oyster Restoration Master Plan, [www.nao.usace.army.mil/About/Projects/Oyster-Restoration/](http://www.nao.usace.army.mil/About/Projects/Oyster-Restoration/), meaning they have been identified as the most suitable in Chesapeake Bay for oyster restoration. In addition, the Virginia Oyster Interagency Team (an advisory group to USACE composed of restoration partners) preliminarily selected these two tributaries for large-scale oyster restoration in late 2016.
- NOAA is currently using available data to analyze baseline conditions in each of these two tributaries before a final decision is made on selection.
- In the Great Wicomico River, USACE used shell to construct 85 acres of sanctuary reefs in 2003 and 2004. Approximately 61 of these acres currently meet the Oyster Metrics success criteria. On 13 of the original 85 acres, USACE used reef-building substrate (shell) to raise the height of low-relief, degraded, and poached reefs as an adaptive management effort in 2015.
- The restored oyster reefs in the Great Wicomico River support a population of nearly 200 million oysters and have been self-sustaining since 2004, as indicated by multiple surveys through 2016. The only reefs that have not persisted over this period are those that have been poached and some that were constructed either at low relief or on suboptimal bottom.
- Minimal oyster restoration work has occurred in the lower York River.

Barge contracted by USACE places shell substrate to rehabilitate oyster reefs in the Great Wicomico River in 2015.
Photo: USACE
Factors Influencing Successful Completion of the Chesapeake Bay Watershed Agreement Oyster Outcome

- Many factors may influence the successful completion of the Chesapeake Bay Watershed Agreement oyster outcome. These include water quality, oyster disease, fluctuations in natural oyster recruitment, funding, and availability of suitable reef-building substrate.
- That oyster restoration can succeed in the Chesapeake Bay has been validated by successful oyster restoration efforts in the Great Wicomico and Lynnhaven rivers, and by the discovery of a relict, self-sustaining oyster population in the Lafayette River. These serve as evidence that oyster populations can prosper and be self-sustaining in Chesapeake Bay, either naturally or due to restoration in sanctuaries.
- 2015 Virginia fisheries landings (not including the ocean system) had an approximate dockside value of $111,382,475. Of that, $31,333,604 was the dockside value of oysters alone (source: VMRC). Oyster reefs can contribute to overall fisheries productivity by providing habitat for commercially and recreationally valuable species and forage fish. In addition, oyster reefs can provide water filtration and supply broodstock for repopulating nearby harvest reefs.

The 2016 Virginia Update was compiled by the Lafayette, Lynnhaven, and Piankatank Oyster Workgroups of the Chesapeake Bay Program’s Sustainable Fisheries Goal Implementation Team:

Chesapeake Bay Foundation
Christopher Newport University
City of Norfolk
City of Virginia Beach
Elizabeth River Project
Lynnhaven River NOW
National Oceanic and Atmospheric Administration (NOAA)
The Nature Conservancy
Pleasure House Oysters/Ludford Brothers Oyster Company
U.S. Army Corps of Engineers’ Norfolk District
Virginia Commonwealth University
Virginia Institute of Marine Science
Virginia Marine Resources Commission