

The Course of the Corsica: A Report on Restoration



December 2020

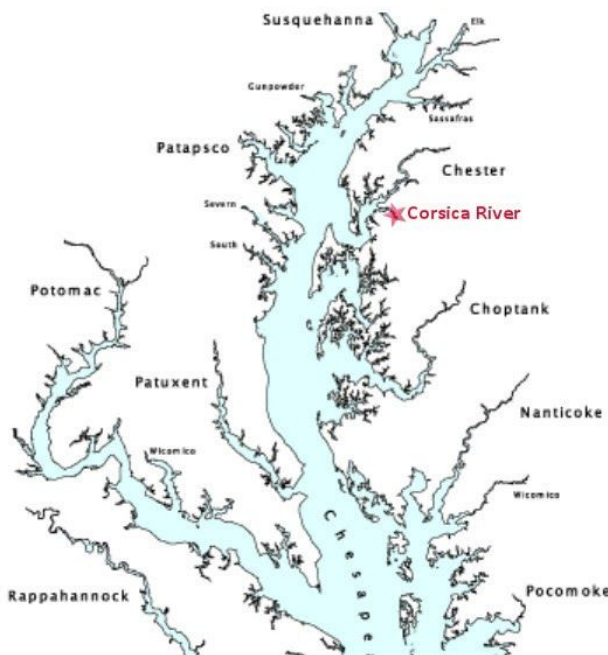


The Corsica River Conservancy (CRC) works to develop and maintain a constituency to restore and preserve the Corsica River and its surrounding lands through direct action, partnerships, and enhanced environmental awareness. This publication, developed by CRC, provides a history of a 15-year effort to restore and conserve the River and its watershed, the importance of doing so, and challenges we see going forward. Contributions to the pamphlet were also made by Maryland's Department of the Environment and Department of Natural Resources, Town of Centreville, ShoreRivers, Queen Anne's County, Washington College Center for Environment and Society, and Eastern Shore Land Conservancy.

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The Corsica River is a tidal estuary of the Chester River on the Eastern Shore of the Chesapeake Bay, across the bay from Washington DC and Baltimore, Maryland.

The Corsica is entirely located in Queen Anne's County, Maryland.

Map courtesy of:
Chesapeake Bay Program
<https://www.chesapeakebay.net/>

Executive Summary

The restoration of the Corsica is entering its fifteenth year. It continues to serve as a model of comprehensive and sustained effort with important lessons learned. Extensive improvements to nutrient management, pollution control, and stormwater management appear to have led to measurable improvement in water quality and habitat. Yet, in the main stem of the River, sustained water clarity, restored underwater grass habitat, and reduced algae are yet to be realized outcomes. Increased efforts to reduce sediment runoff would not only improve water quality but would save farmers' precious agricultural soil and save the County and State hundreds of thousands of dollars in periodic dredging costs.

Public awareness of and access to this incredibly valuable resource has significantly increased. Residents and visitors have a responsibility for how they use this resource and what they do to help preserve it—such as not throwing trash, boating with consideration of others, and managing stormwater on their property. Town and County governments have a responsibility to continue to financially support and implement best management practices to protect the river's economic and recreational value and to curtail violations of environmental regulations. Importantly, land use decisions that consider the negative impact of growing impervious surface must become the norm. As the County goes through its Comprehensive Plan update, it is an opportune time to reaffirm these goals and celebrate success.

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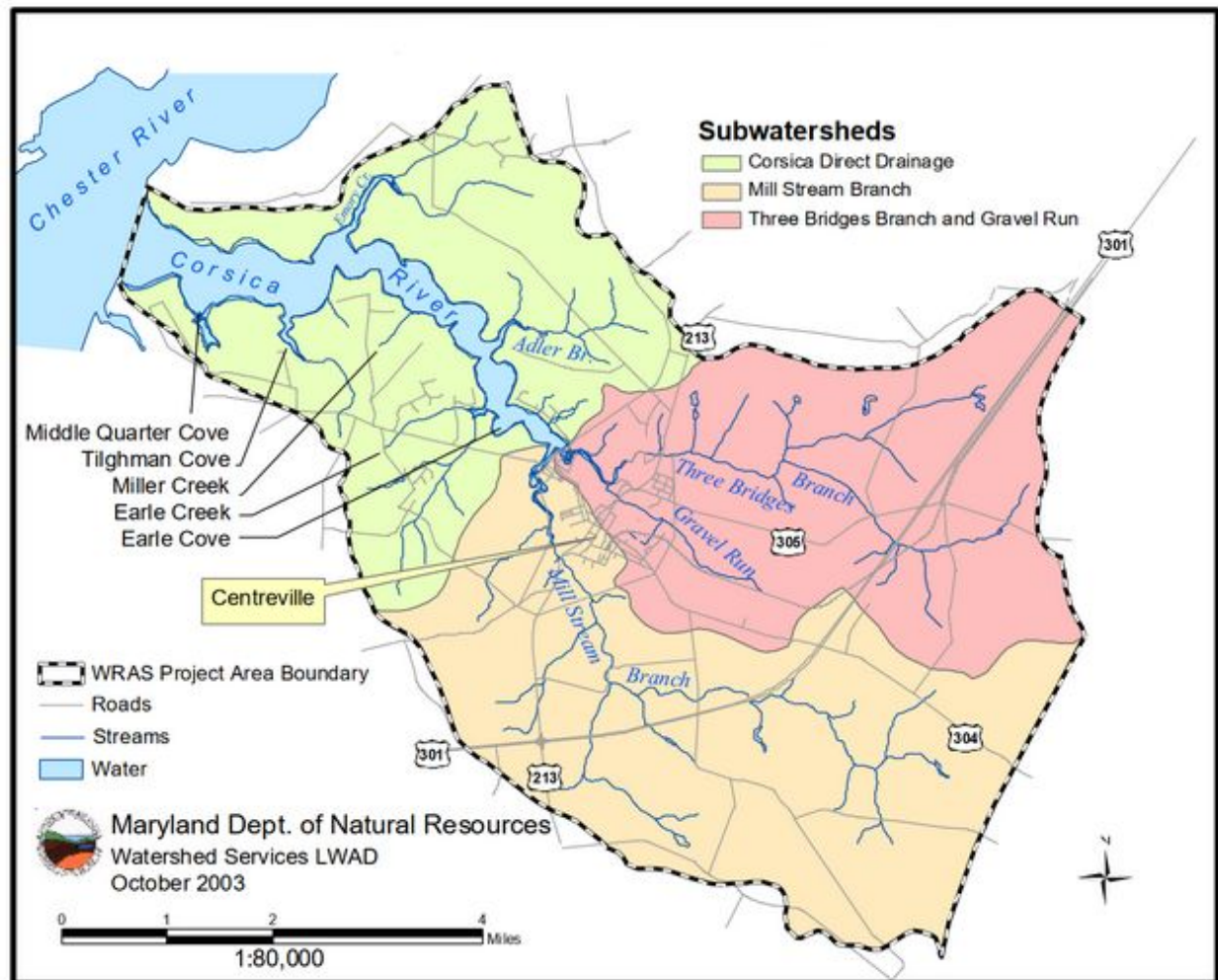
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Cover Photograph by Lew Gayner

Defining the Corsica Watershed

The Corsica River, on Maryland's Eastern Shore, is a tidal estuary flowing eventually into the Chesapeake Bay. It has both tidal and non-tidal portions. The land area that drains into it, known as a watershed, covers 25,000 acres. In addition, its 6.5 miles of open water comprise 1400 acres in total, including the tributaries of the three principal subwatersheds of Millstream, Gravel Run, and Three Bridges. The three tributaries comprise the non-tidal portion of the River system and extend through the eastern half of the watershed. The following map shows watershed boundaries (Maryland Department of Natural Resources [MDNR], 2003).

Project Area: The Corsica River Watershed



(Maryland Department of Natural Resources, 2003)

The Corsica's Diverse Early History

Several years ago, as engineers were conducting preliminary surveys for a breakwater construction project, they discovered artifacts in a clay bank on the Corsica River. Archeological examinations uncovered trade beads, pottery, and oyster shells and confirmed that native American settlements along the length of the river were numerous during the 16th and early 17th centuries (Seidel, 2009). Over time, the wide-spread tributaries of the River provided irrigation for the fertile fields of the watershed that produced fruits, vegetables, and grains and supported numerous dairy farms—many with their own “landings” for convenient loading. Crabs and fish were caught recreationally and commercially. Oysters were harvested from several large bars down the river.

In pre-industrial times, the River was essential to the commerce of the community. It was the major highway for goods in and out. Grain and produce were shipped out; fertilizer, fuel and goods were shipped in. It provided power for industry. The Wharf at Centreville Landing was a hub of commercial activity. The schooners of Captains C. H. Clash and Ozmon operated from there along with other large sailing vessels. The “Captains’ Houses” still standing in good shape just upstream, were crew quarters. The James Adams Floating Theatre regularly visited the landing. It is said to be the inspiration for the “Showboat” of Edna Ferber. The Valliant and Sons warehouse and fertilizer factory stood where the park and playground are now located. A dam on Gravel Run once allowed the Town of Centreville to operate its own power plant. It also provided for skating in the winter. Remnants of the mill races on Millstream can still be seen.



Photo Courtesy of Cathy Valliant Hill

Over time, the Corsica experienced pollution similar to many other water bodies across the country. As agriculture and the use of chemicals grew and development expanded, those changes were reflected in declining water quality and habitat. Increasing sediment from runoff decreased the River's depth, particularly in many creeks and the upper reaches of the river. Excess nutrients in runoff supported increased algae blooms which, along with suspended sediments, greatly reduced water clarity. Underwater vegetation, so important for habitat and a healthy ecosystem, declined, eventually disappearing completely.

The Clean Water Act, passed in 1972 and amended in 1977 and 1987, was designed to regulate the discharge of pollutants into the nation's surface waters, including lakes, rivers, streams, wetlands, and coastal areas. All streams and other water bodies in Maryland were assigned a "designated use" in the Code of Maryland Regulation (COMAR) 26.08.02.08, each of which is associated with a set of water quality criteria necessary to support that use.

The Corsica River watershed was assigned two uses under the Act—the first for "Water Contact Recreation, and Protection of Aquatic Life" and the second for "Shellfish Harvesting Waters." Waters that do not meet standards for the assigned uses are known as "impaired" and have tracking requirements which are contained in Section 303(d) of the federal Clean Water Act. For some pollutants, the Act also requires that total maximum daily loads (TMDLs) be set to constrain additional pollutants from flowing into waterways.

Today, Corsica River residents and visitors admire its beauty, fish and wildlife, and recreational opportunities. But the decline in water quality and habitat mean that not all parts of the river and stream can be used to the full extent envisioned by the designated uses. These waters continue to be designated "impaired." At times, water quality or habitat problems include an overabundance of nitrogen and phosphorus, fecal coliform bacteria, and sediment. Biological limitations have included poor or very poor fish or benthic organism populations and conditions. Toxins have also been present.

A Plan for Restoration Emerges

Recognizing the problems that had developed, the Town of Centreville successfully applied for a competitive Federal grant in 2002 to begin the development of a Watershed Restoration Action Strategy (WRAS). The process brought together the various recognized "stakeholders" of the watershed. In addition to the Town of Centreville, this included residents, regional environmental groups such as the Chester River Association (CRA) and the Eastern Shore Land Conservancy (ESLC), and the local Soil Conservation District, along with County and State representatives from the Departments of Environment (MDE) and Natural Resources (DNR).

The stakeholders realized an urgent need to comprehensively address the health of the Corsica when problems at the Centreville sewage treatment plant led to the release of up to a million gallons of untreated sewage in 2003.

Watershed Restoration Action Strategy (WRAS)

With the support of scientific data and analysis provided by DNR and MDE and many working sessions of the stakeholder group, a strategy was produced by the Fall of 2004. It was later judged by the Environmental Protection Agency (EPA) as one of the best such plans in the nation. This WRAS was documented and explicitly endorsed by the Town Council and the County Commissioners.

Key objectives included the promotion of an agricultural cover crop program with specific acreage goals, the expansion of shoreline buffers, water quality monitoring along the Corsica's main stem, farm and horse pasture nutrient management, residential pollution reduction, a low impact development ordinance, the creation of more non-agricultural wetlands, conversion of septic systems to "best available technology" (BAT), reduction of turbidity through restoration of oyster reefs, and re-establishment of underwater grasses (SAV). The strategy also included building community awareness and educating residents and businesses in how they could become better stewards of the watershed (Town, 2004).

The Town and Community Take Action

Even as the WRAS goals were being finalized, significant restoration efforts were getting underway. The Town sought funding for replacement of its outdated treatment plant, which it was then operating under a legally approved agreement with MDE and a moratorium on expansion. Residents along the waterfront of Corsica Landing Estates banded together to restore the shoreline buffers of 18 individual properties with native plants and grasses. This was accomplished through grants from the federal Wildlife Habitat Improvement Program (WHIP) and the help of the local soil conservation district. This community, the Town, and the County also came together to host the first of what would become an annual Watershed Awareness Day in the Fall of 2004. Through fourteen years this event has drawn as many as a thousand residents to learn about the watershed and its conservation through various exhibits in a family fun atmosphere.

In 2005, Centreville brought the new wastewater treatment plant into operation using state-of-the-art denitrifying technology. Additionally, it acquired acreage on which it began spray irrigation of treated effluent in lieu of in-stream discharge in non-winter months and when weather conditions permit.

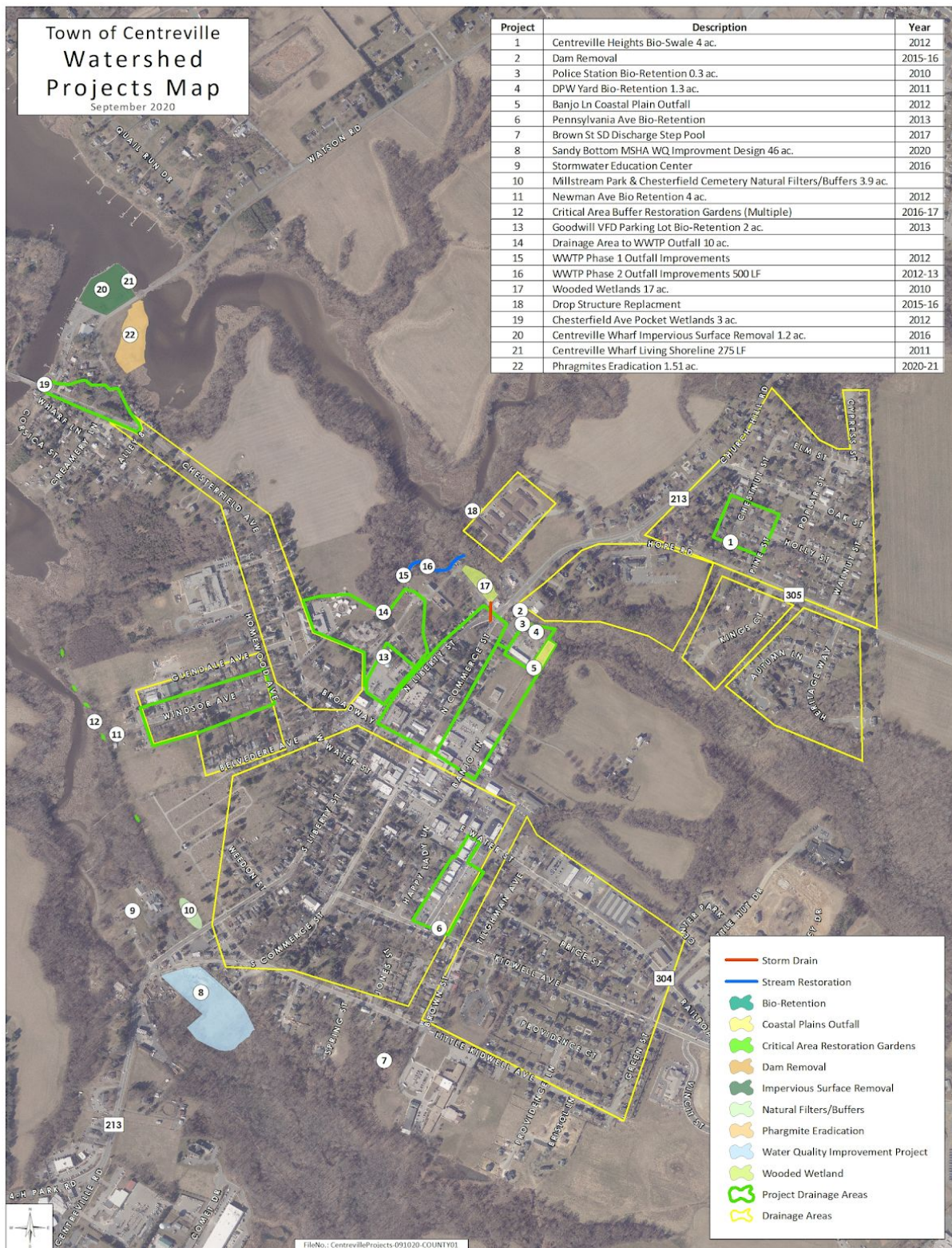
The community also began a volunteer program of monitoring the water quality of the Corsica main stem. MDE and community donors trained and equipped volunteers who began weekly monitoring at five points along the length of the river. By the beginning of 2006, these various resident efforts led to the formation of the non-profit Corsica River Conservancy (CRC) as a resource for the whole watershed and a key participant organization to help implement the WRAS.

Centreville hired a full time watershed coordinator. The position was funded through the state managed EPA Clean Water Act funds (Section 319). With this position, the Town was able to make headway with a series of projects to control and treat stormwater runoff and to take advantage of available grants.

The annotated map on page 6 locates 22 projects, collectively known as best management practices or BMPs, designed to improve stormwater management, that have been accomplished by the Town of Centreville since that time. Results have been impressive. The Town removed 2,950 tons of concrete from the Wharf in 2016 consisting mostly of floor slabs and footings that had been covered with topsoil. The old dam at Gravel Run was removed through a project with DNR. The sewage plant outfall that had failed was replaced in 2017 with a step pool and rip-rap. The Town and local businesses constructed a stormwater demonstration kiosk in Millstream Park.

Centreville also removed two dump sites off Little Hut Road and replaced 8,100 linear feet of leaking terracotta sanitary sewer. This was particularly impactful for the segment under Millstream, which was in the worst condition.

The Town established tree canopy and impervious cover baseline maps and established a tree canopy program. They acquired a street sweeper, which removes 50 tons of debris annually that would otherwise flow into the Corsica. The Town and CRC recruited volunteers for an annual spring Stream Clean event that regularly collected truck loads of trash. This event continues with support also from the Alliance for the Chesapeake Bay. In 2015, Centreville was certified under the Sustainable Maryland program.



(Whitehill, 2020)

Corsica Becomes a Targeted Maryland Watershed

In late 2005, Maryland chose the Corsica to be the first watershed selected under its newly created Targeted Watershed program. The Corsica was selected in part due to its size and agriculture-urban mix, but also because of the WRAS, its established stakeholder group, and the community involvement and support that had been demonstrated. The idea behind this program was to take an “ecosystem-wide” approach to restoration dealing with all significant aspects and areas of the watershed. It would address these with a multi-million dollar program of state funding, Federal and non-Federal grants, and staff resources. A business plan was developed that was largely based on the WRAS, with a five year timeframe kicked off in 2006.

Many watershed improvements were accomplished under this program. Nearly 400 rain gardens were installed under a National Fish and Wildlife Foundation (NFWF) grant administered by CRC. Septic systems were replaced with advanced denitrifying systems and participation in the cover crop program expanded to almost 7000 acres in the watershed. Additionally, wetlands were created, trees planted, grasslands established, and Delmarva bays were restored on hundreds of acres of County-owned land. Several barges placed spat-seeded oyster shell on historic oyster bars in the River. These were later supplemented by oysters grown at residents’ piers through CRC’s early adoption of the Maryland Grows Oysters (MGO) program. The River was made an oyster sanctuary.

Queen Anne’s County (QAC) Department of Public Works passed an ordinance for low impact environmental site design and stormwater management at the County level. A Maryland state regulation later incorporated many of the local provisions. A stormwater utility ordinance was developed and approved by the Town. A large demonstration rain garden was installed at the Centreville Branch County Library as a result of QAC Master Gardeners teaming up with County Public Works. The success of this project in treating stormwater led to numerous others, including a large rain garden at the Department of Education Building. The County also began using pervious pavers, including extensive use for parking at White Marsh Park. The various stakeholders and DNR coordinated to directly implement the WRAS and business plan goals. This new Implementers group met monthly as a project team and continue to meet and plan the work regularly to this day.

DNR Offers Continuous Support

Since 2006, staff from the Chesapeake and Coastal Program (formally Watershed Services) has worked as a key partner for planning, coordinating, and financing habitat restoration and water quality projects in and around the Corsica River. From 2014-2020, staff from this program office has provided continuous leadership and coordination for the

restoration project Implementers group. DNR, through the State's Chesapeake and Atlantic Trust Fund, partnered and provided funding for many restoration and protection projects, including a living shoreline project at the Gunston School, down river from Centreville, and a follow-up stormwater/stream project there to improve the quality of water entering the Corsica River. Students assisted with Trust Funded projects at Centreville's elementary, middle, and high schools. These included tree and meadow plantings and a stormwater wetland treatment system. The wetland created at White Marsh Park was also a DNR-funded effort, and new Trust Fund money will be creating more riparian buffers there. DNR also assisted property owners in the construction of living shorelines.

DNR also funded several wetland enhancements projects at Conquest Preserve at the river's mouth, including 12 acres of meadow creation and 15-plus acres of riparian tree plantings. In the Town of Centreville, the Trust Fund grant provided approximately \$500,000 for four different stormwater projects to improve sediment and nutrients from entering the waterways. DNR staff has also been key to working with State Highway Administration staff to coordinate land acquisition and the design of a large wetland restoration effort.

Assessing Water Quality Outcomes

In September 2005 when then Governor Ehrlich announced that the Corsica would be the State's first Targeted Watershed, he called the project a "grand experiment" that would spend \$20 million over five years to hopefully remove the river from EPA's "impaired waters" list. That goal proved exceedingly ambitious. But the project has succeeded in many respects in that significant improvements in water quality have been obtained, and the project continues to serve as a model for conducting community-based, ecosystem-wide restoration. The following sections describe results of analyses of water quality, habitat, and progress that has been made in improving the river and its watershed.

Water Quality Has Measurably Improved

Improvement in water quality was and remains a bottom line in assessing progress. But it was clear from early studies of ground water transport time in the watershed that some of the most impactful practices such as use of cover crops would take many years to show impact in the water column. That time period was estimated to be 10 years or more on a watershed basis. Some more limited analysis such as the study of new septic system nutrient reduction by MDE showed more immediate and significant results in specific and limited areas closer to shorelines.

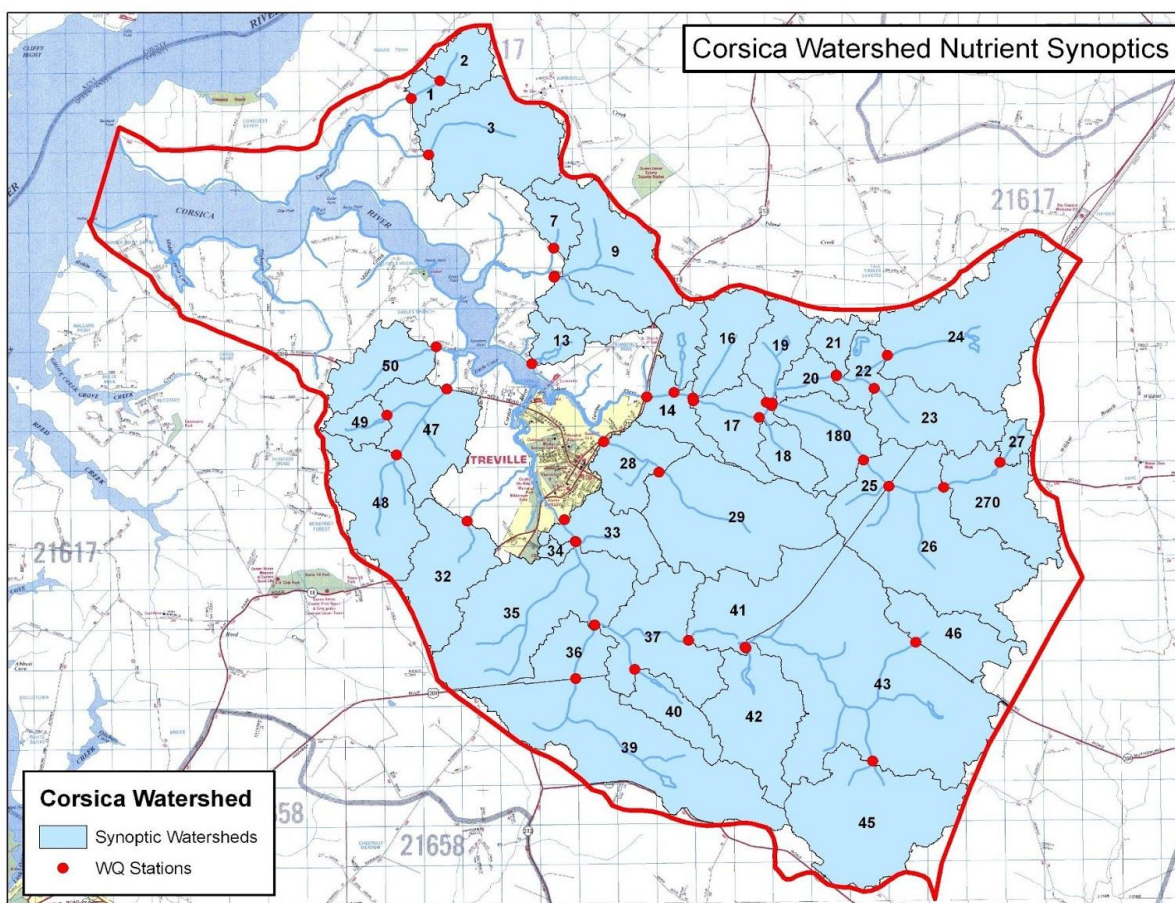
Several studies and analyses have been conducted to determine the dynamics of changes in the Corsica's water quality over time. Research done by Walter Boynton and others from the University of Maryland Center for Environmental Science (UMCES) in 2009 showed that in the Corsica the relationship between nutrient load reduction and water clarity is not linear. For example, they found that a 50 percent reduction in nutrients could result in a 70 percent increase in clarity due to reduced plankton blooms. This would greatly expand benthic photosynthesis from light that plants at the bottom of the river receive. Furthermore, they determined that the Corsica was near this nutrient load "tipping point" (Boynton et al., 2010).

In 2012, MDE had a quantitative analysis of water quality data conducted covering the period of 2005-2011. It found a small but statistically significant improvement in health in the Corsica tributaries (Spooner et al., 2014). Nutrient levels were lower in Three Bridges Branch and in Gravel Run while remaining level in Millstream Branch. The full report is available at https://dnr.maryland.gov/ccs/Publication/Corsica_report.pdf.

In 2019, MDE issued a follow up report, conducted by staff of the Interstate Commission on the Potomac River Basin, which had even better news, showing significant and improving nutrient reductions in all three tributaries of the Corsica River. The statistical trend analysis of the nutrient levels in the non-tidal portion of the Corsica River watershed between 2006 and 2018 was performed to determine if the 12 years of comprehensive work within the watershed were resulting in improved water quality. All trend analyses employed a method to adjust for normal seasonal differences in the parameters. Trend analyses were done on data that were not adjusted for flow (grab samples), as well as data that were flow-adjusted (composite samples).

Comparisons of the flow-adjusted and unadjusted analyses can typically identify the influence of extreme or unusual flow events on trend results. Both the long term (2006-2017) and short term (2012-2018) trends in total nitrogen are significant and downwards for all three. Long term trends in total phosphorus concentrations are significant and downwards for all three as well. However, only the Gravel Run tributary showed a significant short term difference in phosphorus (Wallace, 2019). Testing and analyses were quick and relatively inexpensive for the knowledge gathered and provided a potential tool to target efficient and effective best management practices.

If water quality improvements in the tributaries continue, they should extend into the main stem in the future. However, we need to continue to monitor impacts from stormwater runoff and from other sources that flow directly into the main stem of the River.



(Wallace, 2019)

From 2005 to 2014 CRC volunteers sampled at the five points along the Corsica main stem. CRC transitioned main stem testing to ShoreRivers starting in 2015 in order to have a more coherent and comparable grading system. ShoreRivers and its predecessor have been testing the Corsica non-tidal tributaries for 20 years and currently publish an annual report card for the Corsica and other Eastern Shore rivers.

The ShoreRivers 2018 and 2019 report cards gave the Corsica a C. The overall grade represents a number of measures over time: dissolved oxygen levels, which scored a B; total nitrogen a C; total phosphorus a D; chlorophyll a C; and water clarity a C. The full 2019 report card is available here: <https://www.shorerivers.org/report-card>. Volunteers and ShoreRivers staff regularly measure at three points along the main tidal stem of the Corsica. These readings are then combined to create the grade assigned. In addition, ShoreRivers also measures bacteria levels at the Centreville Wharf, Conquest Beach, and the Corsica River Sailing Center. For most of 2020, those areas passed with 95 percent or more of samples passing water quality standards set by the EPA. However, a significant bacteria

spike occurred in the fall. Initial investigations and lab analysis by ShoreRivers indicate human waste caused the spike. Potential sources of human waste are wastewater treatment plant discharges and failing septic systems, though it should be noted that the Town of Centreville reported no illicit discharges or issues with the wastewater treatment plant during the timeframe of the spike. ShoreRivers, the Corsica River Conservancy, and other partners have developed a testing strategy to more fully investigate the source should another spike occur.

With that exception, ShoreRivers Chester Riverkeeper reports that the Corsica water quality has remained stable despite a particularly large Mahogany algal bloom in May, 2020. Submerged aquatic vegetation has been slowly returning to other Chester River tributaries, but it does not seem to be returning to the Corsica River and may be the focus of some future study and intervention. The 2020 data will be significantly impacted by the disruption in water testing due to coronavirus restrictions. Bacteria and water quality sampling by ShoreRivers staff on the Corsica resumed in May, and the Chester Tester volunteers were on hold from March until August. A score for 2020 will be available in Spring 2021.

Nutrient Management

There is too much nitrogen and phosphorus in the Corsica. As the aforementioned MDE studies point out, nutrient levels are being reduced in the tributaries, a trend that should be increasingly reflected in the main stem of the River. But the overall level is still too high to sustain a healthy ecosystem with water clarity sufficient to permit significant increase in underwater grasses and benthic habitat.

Boynton (2009) and his associates found that “nutrients from agriculture (so-called diffuse sources) make up the lion's share of the load entering the Corsica system—some 84 percent of the nitrogen and 74 percent of the phosphorus. The watershed is dominated by agricultural land uses (60 percent)—mostly corn and soybean farms that feed the Eastern Shore's poultry operations.” Furthermore, much of the nutrients from agriculture in the watershed, especially away from the River, flow through ground water, so reductions from improved agricultural practices can take a very long time to show up in the water column.

Sedimentation

Sedimentation is a very important factor affecting water quality. Sediment from stormwater runoff, particularly from the extensive agricultural lands of the watershed during spring cultivation and corresponding with intensive rain events, is a continuing problem that requires attention. Phosphorus binds with sediment and can be retained for

years before runoff. Spring runoff of sediment is a particular problem in that the timing kick starts algae growth for the summer season. Stormwater accounts for 25 percent of the total phosphorus load. Some improvements in reducing sediment in the Corsica have been scientifically observed and associated with improved conservation practices. A study by C. M. Palinkas (2013) found that, “Averaged over the study period, sediment deposition rates decreased and sediment grain sizes increased, especially since 2010, which was about 5 years after restoration began. These trends are consistent with sediment reductions within the watershed.”

The photo below, from 2020, shows the impact that sediment runoff has on the river.



Photo courtesy of The Corsica River Conservancy

Dredging of the upper end of the main stem has occurred many times in the past due to continued sedimentation. It is costly, time consuming, and difficult to get permitted. Aside from nutrient reduction, reduction of sedimentation would reduce the need for dredging and save a recurring cost of hundreds of thousands of dollars.

The County’s Parks and Recreation Department awarded a contract for the latest dredging project, which began in November 2020. The dredging will be to a depth of five feet in the channel and will include dredging at the wharf. The Conservancy anticipates that this step will improve the tidal flush in the upper, shallow end of the River. It also may reduce the resuspension of sediment that occurs from boat travel in the shallow water. The project has been years in the making. The Conservancy is also working with DNR to improve channel markers in this area to help keep boaters in the channel and to reduce erosion from wakes.

Aquatic Habitat Shows Promising Signs

Maryland's Department of Natural Resources Fish Habitat and Ecosystem Program has, since 2003, focused on how converting farms, forests, and wetlands to suburbs and urban areas affects fish habitat and fisheries. In 2018 and 2019, the Program sampled the estuarine or brackish and tidal portions of the Corsica and other water bodies to support Queen Anne's County update to its 2010 Comprehensive Plan. These water bodies had been sampled several times in the past. The following updated findings were provided by Jim Uphoff of DNR.

The habitat studies use Maryland Department of Planning property tax map based counts of structures (buildings) in a watershed, standardized to hectares (1 hectare is about 2.5 acres), as an indicator of development. These estimates extend back to 1950, allowing analysis of changes over time. Structures per hectare relate well to the amount of impervious surface (surfaces that do not allow water to drain through, such as roads, rooftops, parking lots, compacted soils, etc.). Impervious surface is a scientifically recognized indicator of multiple problems (nutrients, contaminants, altered flow and physical habitat, increased water temperature, disrupted food chain, etc.) that come with development. Structures per hectare can be converted to percent impervious surface.

The Fish Habitat Program uses 5 percent impervious surface (or 0.37 structures per hectare) as an upper boundary for a target level of development that supports productive fish habitat and 10 percent impervious surface (0.86 structures per hectare) as a lower boundary or tipping point beyond which increasingly serious fish habitat problems can be expected. The Habitat Program estimated that the Corsica River's watershed had 0.27 structures per hectare in 2018, the highest of those they studied in Queen Anne's County, but just below the target level. (Another analysis using satellite imaging obtained by the County in 2016 determined impervious surface in the Corsica Watershed to be 4.56 percent.) It is important to keep the impervious surface in the watershed below the 5 percent critical target level if we are to continue to have a healthy river habitat.

A survey of anadromous fish spawning based on sampling with fine mesh nets was conducted in two Corsica River streams, Mill Stream Branch and Three Bridges Branch, as part of a larger survey of the Chester River drainage during 2018-2019. Spawning was indicated by whether eggs and/or larvae were present in samples. Anadromous fish come from the ocean or brackish regions of the Bay into freshwater to spawn in spring. Some of these species support important fisheries and others are the focus of intensive efforts to restore their populations.

Yellow perch, white perch, and three species of herring (alewife, blueback herring, and hickory shad) are anadromous fish that use small streams like Mill Stream Branch and Three Bridges Branch tributaries for spawning. Spawning habitat of these fish is sensitive to the level of land development. (Yellow Perch Photo, Maryland DNR)



These streams had been surveyed by DNR in 1977 and by citizen scientists in 2006-2007. White and yellow perch were spawning in these two streams during 1977 and 2006-2007. Yellow perch larvae were frequently detected in surveys in the tidal portion of the Corsica River during 2006-2007. These species were present in Mill Stream Branch and Three Bridges Branch stream samples during 2019. Herring spawning was detected in 2019. DNR determined that Mill Stream Branch and Three Bridges Branch are still viable anadromous fish spawning areas.

During July-September of 2018 and 2019, DNR sampled fish communities in the Corsica River. They measured basic water quality at multiple sites at the surface, mid-depth, and bottom, including water temperature, dissolved oxygen (DO), pH (a measure of acidity), salinity, and clarity.

The Corsica River was seen to have a noticeable improvement in bottom dissolved oxygen during 2018-2019 compared to earlier samples taken during 2003 through 2012. Low oxygen levels, driven by excessive nutrients, were more common in past surveys. They concluded that the increase may reflect the State's 2005 designation of the Corsica River as a targeted restoration watershed and its associated conservation and restoration programs. In comparison, similar testing at one station in the Wye River found substantially lower bottom DO readings than previous years, and Langford Creek, located opposite of the Corsica River on the north shore of the Chester River, did not exhibit changes from when it was last sampled. The lack of similar dissolved oxygen trends in the Wye River and Langford Creek support the idea that conservation activities in the Corsica River watershed led to improvement.

Upper ranges of water clarity increased from previous years in all three tributaries (i.e., water was clearer on occasion, but not that often). Fish communities in the three Queen Anne's County sub-estuaries were somewhat altered in 2018-2019, and catches were low. Comparisons of fish community and water quality data have to be tempered by the possible impact of extremely high rainfall during the summers of 2018-2019. Periods of high rainfall in 2004-2005 and 2018-2019 resulted in substantial expansion of the native dark false mussel population in the Corsica main stem. The dramatic increase in the number of these filter feeders produced extraordinary water clarity up to 4 feet or more and an almost

immediate dense growth of bay grasses along the north shore of the river. These events help illustrate the incredible effect that filter feeders can have in improving water clarity and giving life at the bottom a chance to regenerate.

In a comparative study of the Corsica, Magothy, and Rhode rivers (Leight, 2014), the Corsica was found to support somewhat better species diversity and abundance, while also showing greater stress and disease. The Corsica reflected good dissolved oxygen levels and no hypoxia but slightly lower overall water quality. The Magothy demonstrated the expected negative effects of higher levels of impervious surface on habitat in that highly developed watershed.

Current Initiatives Target Land-based Practices

Over time, agricultural and forested land in the Corsica Watershed has been replaced by developments and impervious surfaces. Forests and protected lands have the ability to self regulate. Agricultural and developed land each require different strategies to mitigate negative impacts on water quality and habitat. The County and Town have comprehensive planning processes to set long-range land use goals, and planning departments have the responsibility to see that those long-range goals are carried out in individual zoning and permitting decisions.

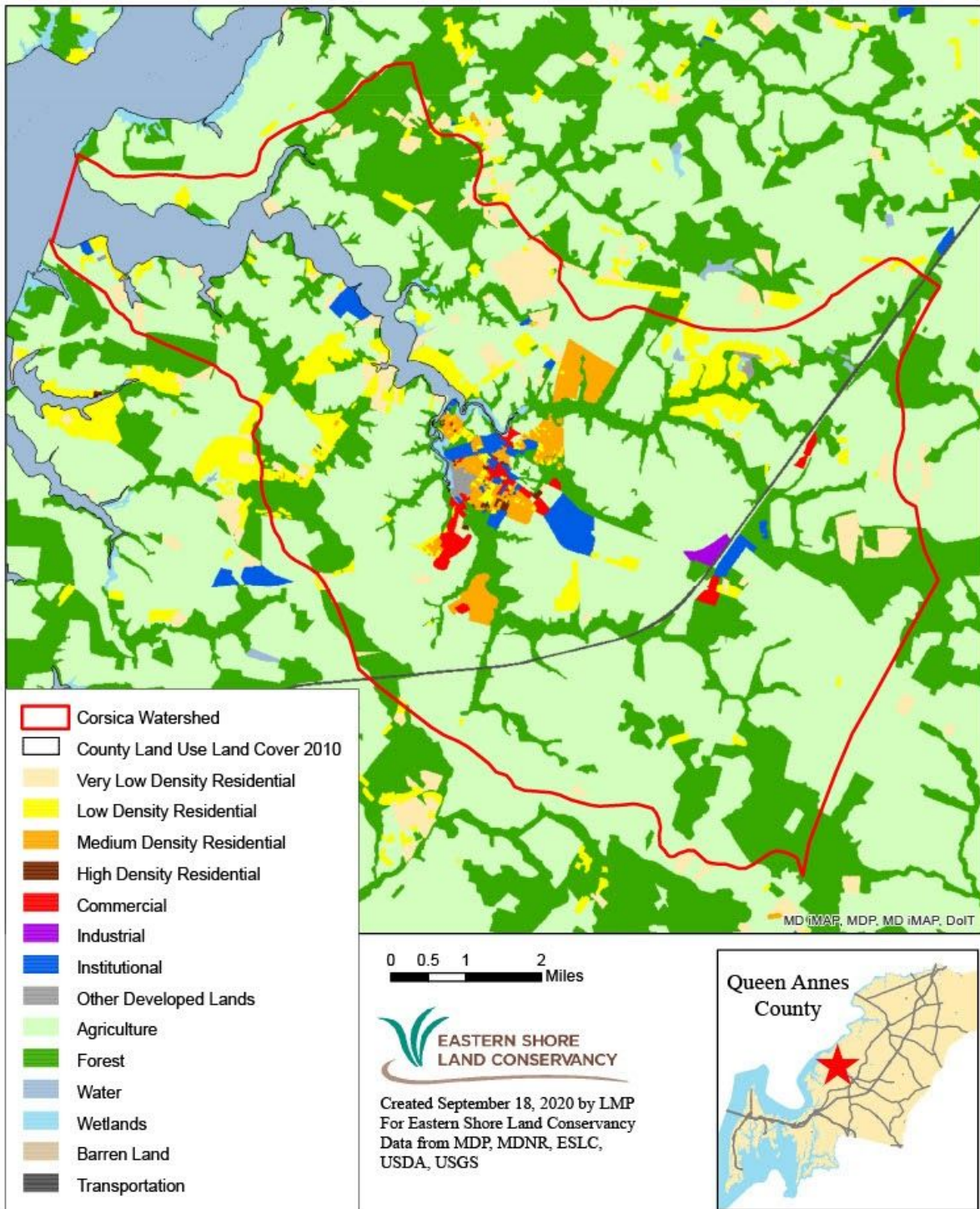
Land Use Has Changed Over Time

By one measure, land use in 2000 in the Corsica Watershed was 64 percent agricultural, 28 percent forested, and 7.2 percent developed. Estimates of the percentage of the watershed devoted to agriculture vary depending on the measurements and methodology used. Various studies since 2000 have cited agricultural land use to be as low as 60 percent. The most recent figures available from the state are from 2000—20 years old—and range from 60 to 64 percent. At the time of this report, updated land use data was not available from the State. The map on page 16, Land Use/Cover Data Within the Corsica Watershed, gives a visual presentation based on various sources compiled by the Eastern Shore Land Conservancy (ESLC).

Current analysis provided by the Eastern Shore Land Conservancy indicates that approximately 55 percent of the acreage in the watershed is protected through easements, trusts, and other categories (refer to the map Protected Lands Within the Corsica Watershed, page 17). This compares well with Queen Anne's County as a whole, which had protected 33 percent as of 2010. The County's Rural Legacy Program and the other land conservation programs listed on the map will hopefully continue to expand the percentage of lands that are protected.



Land Use/Cover Data Within the Corsica Watershed

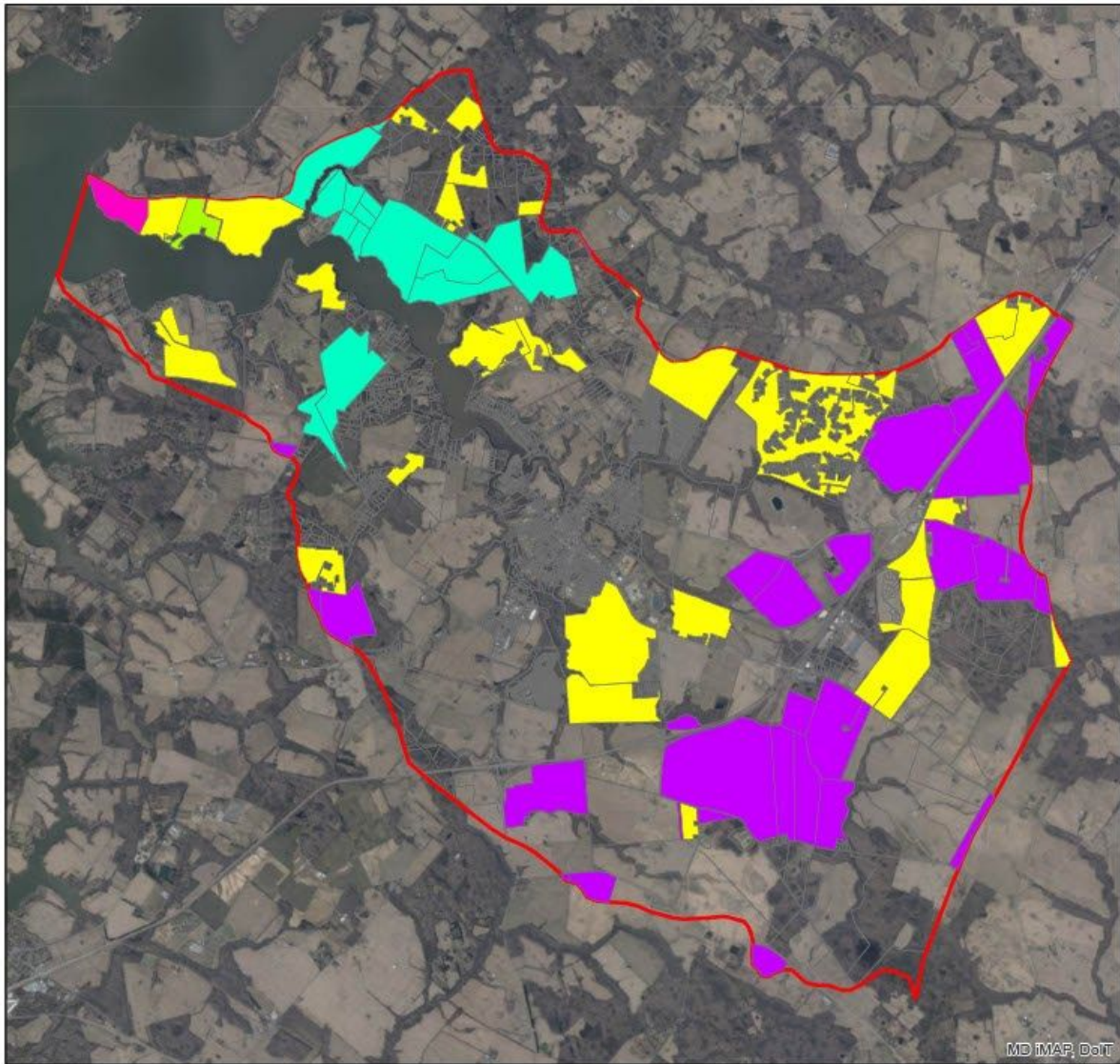


(Eastern Shore Land Conservancy, 2020)



Protected Lands Within the Corsica Watershed

12,612.26 / 23,047.62 Acres Protected (54.72%)

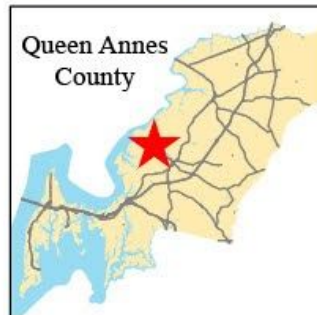


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Created September 18, 2020 by LMP
For Eastern Shore Land Conservancy
Data from MDP, MDNR, ESLC,
USDA, USGS

- Local Protected Lands (Open Space)
- MD Agricultural Land Preservation Foundation
- MD Environmental Trust/ESLC Easements
- Rural Legacy/ESLC Easement
- DNR Conservation Easement
- Corsica Watershed
- Parcel Boundaries



(Eastern Shore Land Conservancy, 2020)

Planning and Permitting Processes Are Critical

Queen Anne's County is in the process of updating its state-mandated, ten-year Comprehensive Plan. (The 2010 Comprehensive Plan is available at <https://www.qac.org/486/2010-Comprehensive-Plan>.) The update and the associated Town of Centreville's plan are important management tools for guiding future land use in the watershed. They and subsequent zoning and permitting approvals are particularly important in how future decisions about growth will integrate the built environment with the County's important natural resources.

CRC has been an active participant in the comprehensive planning process, advocating for the protection of water quality and illuminating the damage done by too much impervious surface, or areas from which polluted water runs off into streams and rivers. As described previously in the Habitat section of this report, numerous studies over the last several decades have shown the link between impervious surface and water quality and habitat. These studies have established impervious surface thresholds beyond which lasting harm is typically observed in watersheds. When this threshold is breached the fish habitat is expected to be compromised (Uphoff, McGinty, 2012). CRC believes that better oversight and management to limit the growth of impervious surfaces is needed and should be reflected in the QAC comprehensive plan update.

Gathering County residents' input is one of the critical underlying tenets of the planning process. Upcoming meetings and ways to get involved will be posted on the Conservancy's website www.corsicariverconservancy.org, and action alerts will be sent to the Conservancy's membership as events dictate.

Although the Comprehensive Planning process is important for setting a long term vision of what the County is striving to attain, it is the subsequent zoning and permitting decisions that determine whether the plan's goals are realized. Development in the critical area, that is, all land within 1,000 feet of tidal waters and tidal wetlands, is governed by the State's Critical Area laws as interpreted and managed by the county planning process.

The Planning Commission meets on a monthly basis to hear requests for commercial and residential development. The meetings are open to the public. More information can be found at <https://www.qac.org/611/Planning-Commission>. Requests for variances from zoning requirements are also important in determining actual land use and whether it is in line with the Comprehensive Plan and zoning requirements. The Zoning Appeals Board was established in 1961 to hold public hearings on requests for variances, conditional uses, and appeals relating to Queen Anne's County Code. Information on its membership and meetings can be found here: <https://qac.org/548/Board-of-Appeals-Zoning>.

Effective Stormwater Management Is Key to Improving Water Quality

Water pollution comes from specific locations, such as sewage treatment plants, or from nonpoint sources, such as runoff from agricultural fields and livestock operations or hard surfaces and pavement. When it rains, stormwater washes excess nutrients, chemicals, and dirt from impervious surfaces, such as buildings, roads, and parking lots, into local waters and the Chesapeake Bay. Excess stormwater runoff can also flood local communities, scour sediment from waterways, and degrade the health of stream systems and habitat.

As described earlier, advances have been made in limiting the impact of development on the environment through low impact development (LID) and stormwater management techniques. Green infrastructure, which includes practices such as rain gardens and bioswales, keeps stormwater where it falls. Its co-benefits include flood minimization, increased bird and pollinator habitat, increased property values, and enhanced community livability.

Under the federal Clean Water Act, the Maryland Department of the Environment (MDE) issues 5-year permits that require local jurisdictions to prevent pollution and meet standards that set total maximum daily load (TMDL) for sediment and certain nutrients. These permits seek to advance Chesapeake Bay restoration while reducing flooding and making communities more resilient to the effects of climate change.

Queen Anne's County is subject to such a permit, known as MS4 (municipal separate storm sewer system). The MS4 permits require local jurisdictions to restore impervious surface areas that have little or no stormwater treatment with green infrastructure and other techniques at a pace and scale that they can achieve through continued commitment, collaboration, and innovation.

MDE provides financial and technical support to localities to help support this work and is working to streamline and improve the agency's permitting process for local stream and wetland restoration projects. It is also charged with addressing violations, which are common.

State Highway Administration (SHA) Mitigation Site

At the urging of the Town of Centreville, CRC, and the restoration implementation team, Maryland's SHA purchased the property at the south end of Commerce Street (opposite Citgo), called Sandy Bottom, as partial mitigation for the Routes 304/301 overpass construction. Plans were developed to convert it into a wetland area. However, that process

was put on hold for several years as SHA needed to use it as a staging area for replacement of the Millstream bridge and road refinishing.

Since SHA has completed the bridge replacement, the parcel is now available for the purpose of mitigation. This roughly 8 acre property is ideally located to serve as a wetland and to better manage and treat some of the stormwater from the south end of Town. The CRC, the Town, DNR, and the other restoration partners have been pressing for this next step for several years because the proposed wetland would treat 41 acres that currently shed unfiltered stormwater into Millstream. It would also improve habitat and make a beautiful addition to the Town. Unfortunately, SHA recently informed the Town and restoration team that budget restrictions will not allow them to proceed with the planned environmental site design at this time. The project team and the Town will continue to work on alternatives to advance this very important initiative.

Improved Agricultural Practices Receive Attention and Resources

As the major use of land in the Corsica watershed, agricultural practices play a critical role in improving water quality. According to a 2015 report, the Chesapeake Bay's Eastern Shore receives nearly twice as much nitrogen and phosphorus per square mile of land area as other parts of the Bay watershed. The disproportionately large amounts of nutrients are primarily the result of agricultural production of crops and livestock. The fertilizer and manure applied to agricultural lands in past decades exceed the amount used by crops. Excess nitrogen accumulates in groundwater and excess phosphorus accumulates in soils. Once in the groundwater and soils, the nitrogen and phosphorus move very slowly from upland areas to streams where they eventually contribute to water-quality problems. Both the excess nutrients and their slow movement are delaying the full benefits of practices to improve water quality (Ator, 2015).

By law and regulation, Maryland farmers are required to closely manage application of nutrients in order to reverse decades of damage to water quality. All farms that gross \$2,500 a year or more or manage at least 8,000 pounds of live animal weight are required, by law, to operate their farms in accordance with a nutrient management plan approved by the Maryland Department of Agriculture. These plans specify how much fertilizer, manure, or other nutrients may be safely applied to crops to achieve yields and prevent excess nutrients from impacting waterways. Farmers are also required to submit Annual Implementation Reports summarizing their nutrient applications for the previous calendar year.

In an effort to provide farmers a means to avoid excess use of phosphorus, the Maryland Department of Agriculture (MDA) introduced a Phosphorus Management Tool (PMT)

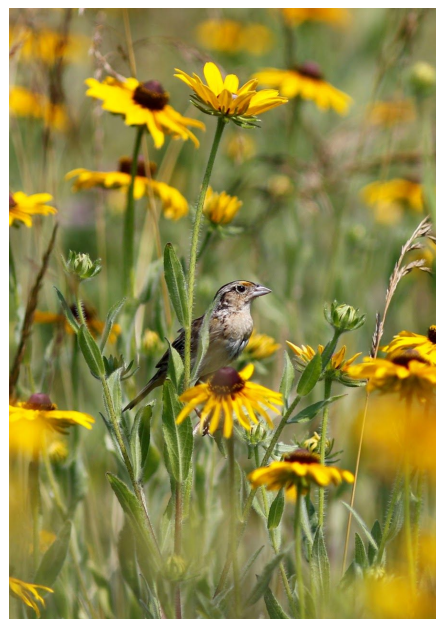
regulation that would ban adding phosphorus to fields that soil test data showed was unnecessary. Full implementation has been scheduled for 2022.

Farmers are given significant help to meet these goals. The federal Natural Resources Conservation Service (NRCS) and the local Soil Conservation Districts together provide funding and technical assistance to help farmers install best management practices that decrease excess nutrients. Cover crops are the most widely used practice in the watershed. Assistance to create buffers through tree plantings, a practice with more permanent impact, is also available through DNR programs, as well as grass swales.

Restoring the Land at Conquest Preserve and Other Areas

From 1998 to 2003, Queen Anne's County took possession of the 758-acre area known as Conquest Preserve, bounded by the Corsica and Chester Rivers. Managed by the County's Department of Parks and Recreation and home to the Corsica River Sailing Center, this site also has been the location of the Conservancy's Corsica River Day. In 2015, Washington College's Center for Environment and Society and ShoreRivers launched the Natural Lands Project. The goal was to improve water quality within the Chesapeake Bay watershed while providing much needed early successional habitat for the declining wildlife that depend on this vital resource. The following section is largely a description of that project as provided by its manager Dan Small of the College.

In 2019, Washington College teamed up with Queen Anne's County to convert approximately 200 acres of the previously cropped land on Conquest Preserve into a mix of habitat types including meadows, hedgerows, forests, and wetlands. The meadows were designed specifically to provide habitat to a host of grassland dependent wildlife including the Northern Bobwhite quail and Monarch butterflies, both well-known charismatic species, but hundreds of other species will also benefit from the approximately 150 acres of expansive diverse meadows. Areas dedicated to planting trees were specifically chosen to complement existing forested blocks, thereby increasing forest interiors specifically targeting wildlife requiring large contiguous forested areas. An additional seven acres of native fruit and nut producing trees and shrubs were planted as a native edible garden. Once mature, park visitors will be able to forage and collect the native edible



produce, which is part of the larger education effort of the project to promote the benefit of native plants. (Photo courtesy of Dan Small.)

In the fall of 2020, wetland restoration and construction began. Soil surveys across the property were conducted to find areas that were historically wetlands. Five areas totaling 35 acres were identified; these areas consisted of hydric soils—soils with high water holding capacity—and were deemed appropriate for wetland restoration. Shallow water wetlands will be restored to benefit area waterfowl, amphibians and reptiles, as well as important wetland plants. More information on birdlife provided by the Maryland Ornithological Society can be found at <https://birdersguidemddc.org/site/conquest-preserve/>.

While this project was designed with the idea of creating much needed wildlife habitat and water quality improvements, park visitors are very much a part of the overall plan as well. Trails throughout the newly created habitat have been included, and once the habitat work has been completed, trail maps and other educational signage will be developed.

The unparalleled sweeping views across the meadows at Conquest are critical for wildlife that require large areas of contiguous habitat, but they are also extremely important for improving local water quality. The Preserve has approximately 3.2 miles of waterfront within the Corsica and Chester watersheds. This project will contribute to reduction of 1,094 lbs of nitrogen, 73 lbs of phosphorus, and 42,900 lbs of sediment from entering the Corsica and Chester Rivers combined annually.

Corsica River Watershed	Acres	N (lbs)	P (lbs)	Sediment (lbs)
Meadow	74.93	417.39	29.32	14,134.01
Wetlands	24.84	66.65	7.91	873.26
Shrubs	1.0	7.97	0.39	188.63

The Town and County have also been engaged in other plantings. At White Marsh Park, 30 acres of trees are being planted under a grant to create a forested buffer along the perimeter trail closest to the Delmarva Bay wetland area, as well as other areas in the park. The plantings are designed to address water quality, filter/slow erosion, and create habitat. There is also a new “Edible Garden” of native trees and shrubs that has been planted by DNR’s Forest Service. The Conservancy also provided funding for these plantings.

In 2019, the Town planted trees at Centreville Wharf Park under a grant from the Chesapeake Bay Trust. In conjunction with the current dredging project, phragmites eradication will take place near the Wharf on the east and west sides of Watson Road. Once completed, a major wetland restoration project will begin in the area.

You and the Corsica: Recreation and Stewardship

Boating on the River

Boating on the Corsica is popular and expanding. Access to the water is important for the public and a key to building awareness and appreciation. The Town has 8,300 feet of tidal waterfront in parkland under its stewardship—both an opportunity and a responsibility for a small town.

The Centreville wharf area includes a busy County boat landing. The Town has installed an excellent kayak launch facility there. Kayaks and paddle boards can be rented on site with advance notice. The dredging project currently underway should improve public access to the tidewaters. There is also a launch area for kayaks at Millstream Park.

Several years ago, CRC worked with the County, Town, and DNR to formally establish a Corsica Water Trail among Maryland's other water trails. Hard copy descriptive maps can be obtained through QAC Parks and Recreation or at CRC events. They can also be accessed online from DNR at <https://dnr.maryland.gov/boating/Documents/CorsicaRiverWT.pdf>

The Corsica River Sailing Center, managed by the Corsica River Yacht Club and located at Ship's Point, offers annual memberships for sailors, kayakers, and canoe enthusiasts as well as sailing classes. (For more information, see <http://www.cryc.org>). The Club is also the site of the annual Corsica River Day, co-sponsored by the Conservancy and the County Parks Department.

Sharing the river requires courtesy and constant awareness. Power boating accidents have shown the need to improve safety on the river. The Conservancy is working to have additional markers installed to keep boaters in the channel and reduce shoreline erosion.

Visiting the Parks

Queen Anne's County supports several parks in the Corsica watershed (see <https://www.qac.org/229/Parks-Recreation>). Visitors are welcome at Conquest Preserve, and once habitat work is completed, trail maps and signage will be developed. The edible trail at White Marsh Park is another County initiative designed to educate. It provides a model for native plantings that can provide food and offer an alternative to crop farmers. The Town of Centreville maintains parks at Millstream and Route 213 and at the Wharf area. A walking trail connects the two parks.

How To Be a Good Steward

The Conservancy website has detailed information on how to be a good steward of our land and water (<http://www.corsicariverconservancy.org>). In short, there are many things you can do on your own, as a resident or visitor. Your individual contribution, especially when combined with others, has an impact.

Become an Advocate

- Connect with Corsica River Conservancy. <http://www.corsicariverconservancy.org>
- Volunteer to collect trash by yourself, with your family, or with a group.
- Learn best practices and teach the next generation.
- Support local ordinances that encourage resilience.
- Attend Planning Commission and County Commissioner Meetings.

Adopt Sustainable Practices

- Don't over fertilize your lawn.
- Mulch leaves in the fall to help the soil and reduce yard waste.
- Put in a rain garden.
- Stop or significantly reduce using single-use plastics.
- If you have a farm, sign up to participate in the Cover Crop program.
- If you live on the River, participate in Marylanders Grow Oysters.



Photo courtesy of Corsica River Conservancy

CRC Has Learned Important Lessons About Restoring a Watershed

Restoration of a watershed is a multi-generational undertaking. It takes many years of experimentation to determine which are the best means to reduce excess nutrients through soil, groundwater, streams, and developed surfaces. Scientific knowledge is evolving and more is known all the time. But, in addition to determining which practices are most effective and efficient in which locations, a successful approach to defining the problem and implementing solutions is common across all efforts. As a key player in the Corsica restoration process, CRC has learned important lessons that can be passed on.

- Identify principals at Federal, State, County, and Municipal levels along with key Nongovernmental Organizations (NGO) and citizens. Enlist their active participation along with their key representative officials.
- Conduct a comprehensive assessment to establish a baseline before developing a strategy. Studies that documented earlier conditions in the Corsica are still an important tool for measuring progress over a decade later.
- Develop a watershed wide strategy and action plan. The Watershed Restoration Action Strategy was developed collaboratively and was critical in establishing priorities and responsibilities for individual agency activities.

- Establish a defined goal with interim measures and milestones, and identify who is responsible for monitoring and making adjustments as needed.
- Use an ecosystem wide approach to restoration and to conservation going forward, but put emphasis where it will do the most good. In the Corsica watershed, where agriculture is a major source of pollution, sector-wide strategies are efficient. More recently, increasing impervious surface due to development has appropriately put a spotlight on the need for zoning and permitting decisions to take impervious surface into account.
- Develop an active and broad public education and outreach program. Get people to care.
- Identify all stakeholders, get their commitments, and keep them to their commitments.
- Establish a stakeholder association to represent residents as initiatives are introduced. The Conservancy actively participates in regular meetings with those responsible for implementing the restoration strategy.
- Continue working the plan and keep checking progress toward milestones. Agree on roadblocks and make adjustments.

Meeting Future Challenges Depends on You

The momentum of the Corsica Restoration has been largely sustained for fifteen years. Significant progress has been made and appears to be occurring at an increasing rate, but we have yet to see the desired dramatic improvements to water quality in the main stem of the River. Furthermore, restoration efforts are not up against a static challenge.

Development continues just about everywhere in the Bay watershed, including the Corsica. Population growth increases the intensity of resource utilization, including the demands on agriculture to feed us all. Trash proliferation in the watershed seems to continue unabated despite many admirable volunteer efforts to clean up. Perhaps the greatest challenge comes from the unpredictable but inevitable big weather events like major storms and hurricanes. The year 2020 has seen the largest number of named weather events on record. Recent estimates are that climate change alone is increasing the cost of restoration by 10 percent (Blankenship, 2020).

In order to meet these threats and challenges, improvement in the watershed must reach a level of resilience to compensate or bounce back in reasonable time. Hopefully the Corsica restoration project will be able to continue its work to get more BMPs in place to address current and future pollution hotspots. But the health of the watershed is also a quality of life issue for residents and visitors. It is a result of the decisions we all make, or do not make, about how we live, what we spend our time on, and how we use our civil voice.

This report has endeavored to explain what impacts the health of the watershed. It is hoped that this knowledge leaves the reader better prepared to take the actions necessary as individuals, as parents, as homeowners, as constituents and voters, as volunteers, and as donors, and while enjoying the wonderful blessings of living in or near a beautiful watershed and river.



Photo courtesy of Corsica River Conservancy

Abbreviations

BAT	Best Available Technology
BMP	Best Management Practice
COMAR	Code of Maryland Regulations
CRA	Chester River Association, now part of ShoreRivers
CRC	Corsica River Conservancy
DNR	Department of Natural Resources
EPA	Environmental Protection Agency
ESLC	Eastern Shore Land Conservancy
LID	Low Impact Development
MDE	Maryland Department of the Environment
MGO	Maryland Grows Oysters
MS4	Municipal Separate Storm Sewer Systems
NFWF	National Fish and Wildlife Foundation
QAC	Queen Anne's County
SAV	Submerged Aquatic Vegetation
TMDL	Total Maximum Daily Load
WHIP	Wildlife Habitat Improvement Program
WRAS	Watershed Restoration Action Program



Centreville Fishing Derby

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In addition to the reports and studies cited, some information contained in this publication was created specifically for a scheduled April 2020 CRC-sponsored community meeting that was cancelled due to COVID-19. It is previously unpublished.

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Photograph courtesy of Becky Richardson. Corsica River Day



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