# Cherry Point Environmental Scientists Bring Stream Back to Life

## Restoration Project Flows Smoothly Past Initial Stage

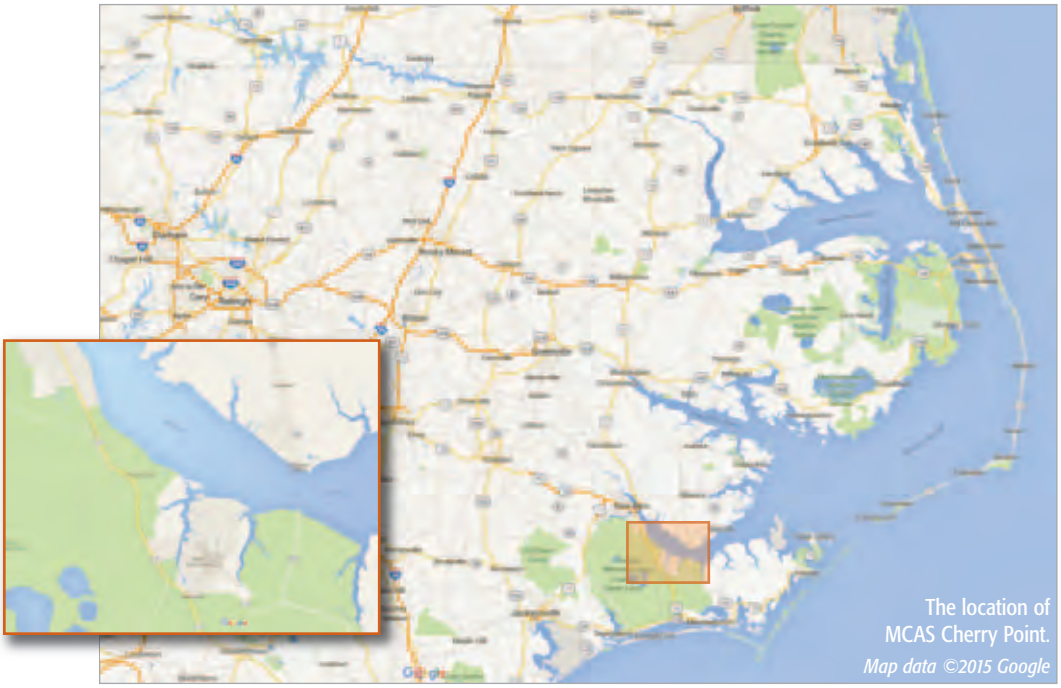
**PERSONNEL FROM THE** Environmental Affairs Department (EAD) at the Marine Corps Air Station (MCAS) Cherry Point, North Carolina have just recently completed the construction phase of a stream restoration project to replace an old, dysfunctional culvert system.

### The Setting

From a distance, it looks like just about any other tiny stream winding its way through a small hollow to the broad, murky river at its end. The water, only a trickle now in the early autumn heat, is crossed here and there with long early-morning shadows from the surrounding sweetgum and longleaf pine and the occasional oak that line the top edges of the shallow, grassy valley.

But what makes this tiny sliver of water in a back corner of Cherry Point's Grant's Landing housing area different, is what you don't see.

Only a few months ago, if you had found yourself crossing this idyllic patch of ground, the dominating feature was an ugly, unnaturally angular concrete culvert. Its purpose was to provide stormwater runoff from nearby residential streets to the Neuse River below. But it didn't work. It often filled with debris that backed water into filthy mosquito-breeding pools, or was lined with litter.



The location of MCAS Cherry Point.
*Map data ©2015 Google*

In nature, it seems, streams pretty much just make themselves. They rely on geology and gravity and weather and, especially, time. They are so good at it that their most basic aim has become a human philosophical idiom—"to take the path of least resistance." So, the smart human stream builder will simply ask, what would nature do?

That's where people like Jessica Guilianelli, a natural resources specialist, and others from EAD come in. Partially driven by a long-standing federal policy to ensure "no net loss" of wetlands due to economic development, it also happens to be the kind of project they live for; to take a piece of ugly human engineering and return it to a natural and logical state.

This particular project began when housing residents complained of the poor drainage and its related consequences, which led the EAD team to investigate the site and to seek possible solutions. It may sound like a reasonably simple task—just remove the culvert, introduce plants to help check the resulting erosion and voilà—you've got a natural creek. But it just isn't that simple.

## The Complexity of Stream Restoration

Geologists have been wrestling with the science of stream restoration for decades and have learned it is an extremely complex process. A stream, they have discovered, is not just a sliver of water cutting through the landscape, but a complex ecosystem that includes the plants and sometimes even animals that surround it and live in it. The stream's riparian zone—or the interface between the land and the stream—is a symbiotic partner that supports, and is supported by, the stream itself.

Guilianelli and her team waded through a river of past research. One of their key influences was renowned hydrologist David L. Rosgen, a pioneer in the science and art of stream restoration. Rosgen developed processes to help determine the necessary characteristics of various kinds of streams, which he classified based on the wide range of those characteristics.

- Would the streambed need to be steep or nearly level, deep or shallow, built on bedrock or gravel or silt or sand?
- Would it need to be straight or sinuous?
- What kind of plants should grow in its vicinity?
- What would be its source?

These and many other questions must be answered during the planning for a new stream. In the end, it would have to be something that had a chance to work under local conditions.

There were other goals too. "This project gave us the opportunity to be good neighbors by improving water quality in the Neuse River," said Guilianelli. The idea is that this new stream, unlike its solid, manmade predecessor, will allow for the appropriate filtration and distribution of upstream nutrients as they travel along its meandering course. Much of the material that finds its way into this creek from the streets above will be better deposited in the surrounding earth rather than flowing directly into the river below.

**Jessica Guilianelli examines water samples two weeks after the initial construction stage of a stream restoration project at MCAS Cherry Point. Guilianelli, a Cherry Point natural resources specialist, is primarily seeking early signs of biological progress in the new stream's ecosystem, evidence that the stream restoration project is moving in the right direction.**

***Mike Barton***

"We finally narrowed it down to a set of characteristics that are common to this region and this specific ecosystem," said Guilianelli, who worked with McAdams Company, the Durham, North Carolina, engineering design firm that created the new stream's design; and River Works Inc., a subcontracted river restoration construction company based in Raleigh. "Obviously, the more it works like other natural streams here, the more successful we feel the project will be."

## The Construction Process

According to Phillip Todd, River Works vice president, stream restoration is very complex. "If you don't have a good understanding of the critical design principles, your project can easily go awry," he said.

With 1,300 feet of channel work, the Cherry Point project was small compared to some that the company has tackled, but not without its challenges. "The site was very wet, mucky," said Tony Carmillo, the River Works Cherry Point project manager. "We also had to deal with the river's wind-driven tide that backed water and sand into the site, sometimes damming the outflow into the river."

Further complexity was added as River Works crews worked in the shadow of the residential neighborhood that wrapped around three sides of the construction site. "It was a high-profile project," said Todd. "It was congested with lots of people watching. Being a good neighbor was a priority—like parking and stockpiling supplies and equipment on the site instead of blocking streets, restricting our work hours, and working within the tight access to remove soil and debris."


**Members of a construction crew make final adjustments near the end of the initial construction stage of a stream restoration project at MCAS Cherry Point. Only weeks before, this piece of ground was the site of a dysfunctional concrete culvert that did a very poor job of routing stormwater runoff from an air station housing area to the Neuse River.**
***Jessica Guilianelli***

During the main construction phase, the crew disposed of tons of old concrete and removed 1,500 cubic yards of earth to subtly reform the little valley. Clay was trucked in to help plug the weak areas in the valley floor left by the former culvert as the new stream began to take on its new curvy path. Balanced against the heavy lifting (typical of any sizable construction project) was the fine-tuning required to meet the contract's very specific design goals. These included building special instream features ranging from hard structures such as logs, to strategically shaped and measured curves, to a very critical angle of grading—less than one percent down—to help control the stream water's flow.

In September 2015, River Works crews returned to the site to plant more than 9,000 herbaceous plugs (non-woody grasses) within the stream's riparian zone.

## Lessons Learned

Todd's advice to future stream restorers is to engage as early as possible in the planning process with your contractor to take advantage of any expertise they may have. "Stream restoration is so different from other horizontal or vertical construction projects," said Todd. "You must ensure you are working with a company that has the appropriate training and certifications for this kind of work."

He encouraged planners to share ways of doing things more efficiently and offered the following additional advice:

- Conduct a constructability review with the builder to identify construction practices that might improve the design or be more cost effective.
- Consult with a botanist familiar with regional plant species. Factors such as how wet the site is, and global sourcing of materials like select species of plants or special types and sizes of boulders can all affect the construction timetable and associated costs.
- Plan for the seasonal factors that can influence anything from the human element created by nearby work or living space, to the construction element that is affected by wet and dry climate periods. Build "down days" into your schedule to offset delays caused by weather and other hiccups.

To avoid changes in work orders and price changes, River Works planned for the additional challenges of working on a military installation, most specifically, base access for construction personnel. For this particular project, the company used a local contractor whose personnel were already vetted and cleared to haul dirt from the installation, which kept the project moving smoothly.

## What's Ahead

If the duration of the project is measured from the time the old culvert was first removed to the shaping, filling of the land and planting of the first thin grasses lining its muddy banks, it lasted only a couple of months. If the time it took to plan, finance, schedule and complete the work was factored in, the period would be closer to three years.

Standing at the place where the young stream meets the quietly flowing river, you can look upstream and begin to see the reward for all of this effort. But the project is far from complete.

By the end of November 2015, larger trees and shrubs were introduced to the 50-foot riparian buffer to provide fauna-friendly shade to the stream, and enhance the natural transition toward civilization. "Nature itself," says Guilianelli, "will fill in the remaining space between the stream zone and the housing area above."

Ultimately, the EAD team's goal is to have a broad range of plant species growing along this serpentine watercourse much like you would find in a completely natural setting. They want this to be a place where neighborhood families can explore or just relax on a pretty day—a little pocket of nature near their own backyards.

"We're definitely not done here," says Guilianelli, standing atop the short bluff near the head of the newly designed stream. "We will have to monitor its condition and continue to introduce other plant species as the stream matures."

Guilianelli has been involved in nearly 20 stream restoration projects prior to this, but this is her first at Cherry Point, and it brought with it some unique challenges, such as the unpredictable effects of the Neuse River's natural and wind-driven tides. "I look forward to learning how the backflow of river water will affect the stream, how the influx of tidal water will change its appearance over time," she said.

Guilianelli takes in the full view of the waterway as it snakes its way to the river below—its canvas still has plenty of room for the paints she plans to apply over the coming months and years. "It's a dynamic system, it's always changing, and we'll need to make sure we are allowing it to do its thing, allowing it to stabilize and still maintain that connection to the Neuse," she continued.

Members of a construction crew lay stabilizing mesh along the serpentine sides of a newly dug streambed during the initial construction stage of a stream restoration project at MCAS Cherry Point. The mesh will help control erosion of the stream's banks until appropriate plant life is introduced to the stream's riparian zone in later stages of the project.
*Jessica Guilianelli*

Stormwater runoff finds its way into the Neuse River after traveling through a brand new streambed, the result of a stream restoration project at MCAS Cherry Point. The project, with only its first construction stage now complete, was initiated by EAD personnel to clean up a previously inefficient drainage system and to improve water quality in the Neuse.
*Mike Barton*

That is, of course, the biggest question of all. Will it hold up to the test of time? For now, the improvement is staggering. Even to Guilianelli, who watched as it slowly transformed from a nearly useless concrete-clad scar on the natural environment to its present, infinitely more pleasing state, it's more than just an "E5" (a highly sinuous stream with a sand bottom on the Rosgen scale)—it is a beautiful attempt to admit nature had it right the first time. ⚓

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