



CITY OF DURHAM | NORTH CAROLINA

**Date:** July 8, 2013

**To:** Thomas J. Bonfield – City Manager

**Through:** W. Bowman Ferguson – Deputy City Manager

**From:** Marvin G. Williams – Director of Public Works

**Cc:** Paul Wiebke – Assistant Director of Public Works

**Subject:** Status of Durham/NC Ecosystem Enhancement Program Restoration Projects

### **Executive Summary**

Public Works, Parks and Recreation, Housing and Community Development, General Services, and Water Management have been working with the North Carolina Ecosystem Enhancement Program (NCEEP) to implement several stream restoration projects within the City of Durham. Stream restorations through NCEEP are and have been an excellent opportunity to accomplish urban stream restoration projects at minimal cost to the City. These projects help the City comply with the Falls and Jordan Lake Nutrient Management Rules as well as address creek impairment due to excess sediment (turbidity), low dissolved oxygen, poor aquatic community, copper, zinc, and bacteria. These impairments require the development of loading limits or a Total Maximum Daily Load (TMDL) as part of the federal Clean Water Act.

The collaborative stream restoration projects between the City and NCEEP have met the goals and objectives of both organizations. Where a project has not met those goals the NCEEP has developed a repair plan and implemented the plan at their cost. The stream restoration projects include Third Fork Creek in Forest Hills Park, Ellerbe Creek in Northgate Park, Ellerbe Creek at Hillandale Golf Course, Goose Creek in Long Meadow Park near Eastway Elementary School, and Sandy Creek stream and wetland restoration in Sandy Creek Park.

The NCEEP develops goals, objectives, and success criteria for a stream restoration based on existing site conditions prior to any project work. To develop project objectives NCEEP evaluates existing and future uses for a site, water quality concerns, as well as local government and resident input. Measurements are made to evaluate characteristics of the channel including stream shape, condition of the bed and bank, and to determine the potential for restoration. A reference reach of stream is selected from a nearby watershed with similar geographical characteristics. The reference reach is used to help design the restoration and to establish success criteria which incorporate current scientific literature, flood modeling, and state guidelines. This information is

captured in the Stream Restoration Plan and the Mitigation Plan which are produced for each project.

After construction, projects enter a monitoring phase which is a minimum of 5 years. Systematic measurements and observations are made annually during this time to ensure that project elements remain intact and are functioning as intended. The specific parameters monitored are listed in Table 1. If any part of the project fails to perform to expectations the state works to address deficiencies during the monitoring phase. The monitoring phase may be extended if significant repairs are performed to ensure that they are successful. Measurements of specific parameters such as nitrogen, phosphorous, dissolved oxygen, metals or turbidity are not monitored at project locations. These types of parameters are watershed based parameters and would not accurately represent individual project success.

Table 1. Success criteria and evaluation method for NCEEP stream restorations

<b>Success Criteria</b>	<b>Evaluation Method</b>
Channel Stability	Survey cross-sections – channel movement monitored
Stream Profile	Survey longitudinal profile – stream bed movement
Substrate	Conduct pebble counts – bed material changes or movement
Status of Engineered Structures	Visual assessments – movement or sediment accumulation
Stream Bank Stability	Visual assessments – movement or sediment accumulation
Bankfull Hydrology Data	Observations following high water conditions to assess stream and installed structure stability
Vegetative Performance	Live stem counts and assessment of invasive plants

When the monitoring phase for a stream restoration project is complete, NCEEP produces a Closeout Summary Report which documents site conditions from construction through the monitoring phase. Closeout Summary Reports for the Forest Hills Park Stream Restoration Project on Third Fork Creek and Hillandale Golf Course Stream Restoration Project on Ellerbe Creek have been completed. Both reports document that stream restoration activities have met the established objectives and have exceeded the success criteria. A summary of each closeout report is included in the project specific update below. Project details including closeout reports and annual monitoring reports for all restoration projects can be found at the interactive map link <http://portal.ncdenr.org/web/eep/interactive-mapping>.

Stream restorations reduce sediment load by stabilizing banks. This also reduces phosphorous as it is attached to sediment and reduces bacteria by enhancing light penetration of the water column. Restorations reconnect disconnected floodplains and

provide flood control as well as nitrogen, phosphorous and other pollutant removal by filtering storm runoff through vegetated riparian buffers and floodplains. Restorations also improve dissolved oxygen by reestablishing riffle pool sequences by use of in-stream structures and modifying stream geometry.

The City granted conservation easements to the state of North Carolina on behalf of the NCEEP to allow for the construction and protection of these projects. The NCEEP provided all monetary funds necessary for design, construction, equipment, and labor. NCEEP monitors and maintains the projects for at least 5 years after completion. A project remains under state maintenance until the project goals are achieved. This is documented through annual monitoring reports and the final project closeout report. If necessary, additional work is contracted and performed by the state to achieve the restoration project goals. The Northgate Park project will undergo restoration repairs in the winter of 2013/2014.

The City has taken over maintenance of the Third Fork Creek stream restoration in Forest Hills Park and the Ellerbe Creek stream restoration at the Hillandale Golf Course. As a condition of the conservation easements, the City will preserve the riparian and wetland resources in the easement areas and maintain their natural condition. In February 2013 the City contracted (\$25k/yr) to address invasive and nuisance vegetation in the conservation easement areas at Forest Hills Park and Hillandale Golf Course. It is anticipated that the City will begin maintenance of the remaining three projects in the next two to four years. This work is needed in order to preserve the riparian area and to ensure that the water quality aspects of the stream restoration function properly. Proliferation of these types of plants can degrade the quality of the wetland and riparian resources in the easement areas.

### **Forest Hills Park Stream Restoration Project on Third Fork Creek:**

**Background:** In January 2005, a stream restoration project was completed on 2,900 linear feet of Third Fork Creek in Forest Hills Park. The goals of the stream restoration were to restore a stable channel, reduce sediment related water quality impacts, improve aquatic habitat and restore vegetative riparian buffers. Prior to this project the stream buffer was mowed to the water's edge and lacked riparian vegetation which resulted in an unstable and eroding channel with high levels of sediment. As part of the project over 5,000 native trees and shrubs were planted. This created riparian buffers which naturally slow down, clean, and infiltrate stormwater before it enters the creek as well as reduce erosion and sediment. The tree canopy also helps to keep the water cool enough to support aquatic life. The City granted a conservation easement and the North Carolina Ecosystem Enhancement Program (NCEEP) funded the design and construction of the project which included 2 new pedestrian bridges. The project was considered successful and was maintained by NCEEP until January 2012. In January 2012, the project, as required by the conservation easement, was transferred from the state maintenance phase into the stewardship phase where it is now the City's responsibility for maintenance and protection of the project.

**Project Closeout Summary:** The restoration project has resulted in a stable channel and robust riparian buffer. Although some vertical down cutting of the stream channel occurred after construction this activity stabilized over time. Grade control structures rated at or above 95% stable in Monitoring Year 5 indicating overall project stability. As the site and riparian vegetation have matured the system has stabilized and the problems declined. Similarly, lateral movement of the channel declined as stream bank vegetation became more established. At closeout, less than 5% of the total bank length was identified as erosional. Overall, the site maintained acceptable riffle-pool morphology and most in-stream structures were stable. This helped create a variety of aquatic habitats along the stream. Sediment loading from upstream sources is apparent, but the project reaches have generally been effective at transporting input material. Planted vegetation density at the site was excellent and a native riparian buffer was well-established.

**Current Status:** In February 2013, Public Works contracted to address the maintenance of invasive and nuisance vegetation in the conservation easement areas at Forest Hills Park. The contract includes treatment of target species for six treatment periods over three years. This work is needed in order to preserve the riparian area and to ensure that the water quality aspects of the stream restoration function properly. Proliferation of these types of plants can degrade the quality of the wetland and riparian resources in the easement areas, alter their natural condition, and interfere with the ecological functions of the easement areas. Initial treatments for this year at the site began May 2013. Public Works (Stormwater and GIS Services) and General Services (Urban Forestry) are collaborating on execution and oversight of the contract. Urban Forestry has conducted a workshop with the neighborhood association to address riparian vegetation management and pruning efforts. We continue to work with NCEEP cooperatively to develop future restoration projects in the City as was agreed to in our March 10, 2010 letter of intent.

The state has identified that Third Fork Creek is impaired due to sediment, low dissolved oxygen, and metals. This stream restoration project reduces downstream sediment load and transport by stabilizing the stream. Recent evaluations on improving low dissolved oxygen suggest that stream restorations can help to improve dissolved oxygen levels. Under a federal clean-up plan for Jordan Lake, the City is required to reduce nutrients (nitrogen and phosphorus) from existing developed land. Nitrogen and phosphorous credit calculations for stream restoration are being developed for North Carolina Department of Environment and Natural Resources (NCDENR.) By the end of the year, we expect to be able to calculate nutrient credits for this project.

### **Northgate Park Stream Restoration Project on Ellerbe Creek**

**Background:** In December 2008, a stream restoration project was completed on 2,273 linear feet of Ellerbe Creek in Northgate Park. Also, 2 pocket wetland stormwater control devices were installed as part of this project to treat incoming stormwater to the site.

The goals of the stream restoration were to improve water quality, enhance flood attenuation, and restore aquatic and riparian habitat. This stretch of Ellerbe Creek exhibited typical urban stream problems associated with past channelization efforts by the US Army Corps of Engineers dating back to the mid-20<sup>th</sup> century, such as increased stormwater runoff, high levels of erosion, and loss of riparian buffer vegetation. The degraded stream with unstable banks and poor water quality more resembled a manmade drainage canal than a natural stream. Ellerbe Creek is also an EPA 303d-listed stream due to its overall degraded water quality and is classified as a Nutrient Sensitive Water by the NC Division of Water Quality (NCDWQ). The City granted a conservation easement and North Carolina Ecosystem Enhancement Program (NCEEP) funded all design and construction for the project including a new pedestrian bridge.

**Current Status:** The project is still under NCEEP maintenance with repair work to be performed on a section of the stream restoration (paid for by the State) in Winter 2013/2014. The project is expected to remain under state-controlled maintenance until late 2017.

### **Hillandale Golf Course Stream Restoration Project on Ellerbe Creek**

**Background:** In December 2004, a stream restoration project was completed on 6,279 linear feet of Ellerbe Creek located on the Hillandale Golf Course. The goals of the stream restoration were to improve water quality, enhance flood attenuation, and restore aquatic and riparian habitat. This stretch of Ellerbe Creek exhibited typical urban stream problems associated with past channelization efforts by the US Army Corps of Engineers dating back to the mid-20<sup>th</sup> century, such as increased stormwater runoff, high levels of erosion, and loss of riparian vegetation. The surrounding land use also contributed to instability of the stream as the golf course had intensively managed the existing vegetation adjacent to the stream such that only a grass buffer remained in most areas. Ellerbe Creek is also an EPA 303d-listed stream due to its overall degraded water quality and is classified as a Nutrient Sensitive Water by NCDWQ.

The City granted a conservation easement and the North Carolina Ecosystem Enhancement Program (NCEEP) funded all design, construction and monitoring for the project. The design of the stream restoration project was modified as a result of the golf course bisecting the site. Accommodations were made to protect existing golf fairways and cart bridges. This included altering the channel design and the standard riparian buffer planting plan to provide 'playover zones'. Plant height was intentionally limited by specifying low-growing varieties in areas where the fairway crossed the stream. The project was considered successful and was maintained by NCEEP until January 2012. In January 2012, the project, as required by the conservation easement, was transferred from the state maintenance phase into the stewardship phase where it is now the City's responsibility for maintenance and protection of the project.

**Project Closeout Summary:** The restoration project has resulted in a stable stream channel that has floodplain access and a thriving native riparian buffer. The riffle-pool

structure remained intact and improved the quality and distribution of in-stream habitat, and erosion and sedimentation on the site has been significantly decreased. Specifically, less than 2% of the total bank length was identified as erosional in Monitoring Year 5. The report indicates that the planted buffer vegetation was successful and that continued growth will further improve stream bank stability.

**Current Status:** As with Forest Hills Park, Public Works contracted to address the maintenance of invasive and nuisance vegetation in the conservation easement areas at Hillandale Golf Course in February 2013. The contract includes treatment of target species for six treatment periods over three years. This work is needed in order to preserve the riparian area and to ensure that the water quality aspects of the stream restoration function properly. Proliferation of these types of plants can degrade the quality of the wetland and riparian resources in the easement areas, alter their natural condition, and interfere with the ecological functions of the easement areas. Initial treatments at this site began in April 2013. Public Works (Stormwater and GIS Services) and General Services (Urban Forestry) are collaborating on execution and oversight of the contract.

Urban Forestry and Stormwater and GIS Services are continuing to work with golf course management and staff to address concerns over riparian vegetation issues. Since the summer of 2012 both divisions have conducted multiple field visits to coordinate meetings with state officials to ensure that signage is properly demarking the playover zones and plant types are correctly identified prior to removal of vegetation. City staff is actively coordinating with the City contractor and golf course management to avoid scheduling conflicts. Also, with the assistance of Keep Durham Beautiful, a volunteer effort was assembled to provide vegetation management in a constructed wetland located at the golf course parking lot that had been installed in 2002 by researchers with NC State University in collaboration with the City.

### **Long Meadow Park and Eastway Elementary School Stream Restorations on Goose Creek**

#### **Background:**

In September 2008, a stream restoration project was completed on 1,465 linear feet of Goose Creek in Long Meadow Park and near Eastway Elementary School. The goals of the stream restoration were to improve water quality, enhance flood attenuation, and restore aquatic and riparian habitat. Upstream of the project, approximately 1,180 feet of stream is contained in culverts. In the project area, the stream banks had been hardened by concrete and vertical masonry walls. The degraded condition of the channel, extensive bank armoring, onset of neighborhood revitalization efforts, and community support made this an excellent location for a restoration project. Goose Creek is included on the EPA 303d-listed stream due to its overall degraded water quality and is classified as a Nutrient Sensitive Water by NCDWQ. The City granted a conservation easement and North Carolina Ecosystem Enhancement Program (NCEEP) funded all design, construction and monitoring for the project.

**Current Status:**

On March 25, 2011 NCEEP conducted supplemental planting of 185 large (5 and 10 gallon) containerized trees and in Spring 2012 additional container plantings and 'live-stakes' were added. The project is currently meeting project goals for vegetation and stream attributes. The project is expected to remain under NCEEP maintenance until Late 2014.

**Sandy Creek Park Stream and Wetland Restoration Project****Background:**

In summer 2003, a stream restoration project was completed on 2,461 linear feet of Sandy Creek in Sandy Creek Park. Also, a wetland restoration project on 3.1 acres was conducted as part of this project. The goals of the stream restoration were to improve water quality, enhance flood attenuation, and restore aquatic and riparian habitat. The project site was the abandoned City of Durham New Hope Creek Waste Water Treatment Facility. This site was selected to mitigate impacts to jurisdictional areas associated with the extension of the Martin Luther King, Jr. Parkway between Cook Road and Hope Valley Road in Durham. The City granted a conservation easement and North Carolina Ecosystem Enhancement Program (NCEEP) funded all design, construction and monitoring for the project.

In 2004, the site was partially replanted due to low plant survivorship. The wetland restoration area was again re-graded between December 2009 and February 2010 to correct final grade elevations to establish proper wetland hydrology. Topsoil was added to improve soil fertility for plant growth and the graded areas were replanted with native plant species.

**Current Status:**

The project is expected to remain under NCEEP maintenance until Late 2016.