CLAYTON COUNTY WATER AUTHORITY'S GATEWAY STREAM RESTORATION PROJECT

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Abstract. Clayton County Water Authority (CCWA) has embarked on an innovative stream restoration program to restore streams in Clayton County, Georgia, located south of Atlanta. The first stream restoration project, the Gateway Project, is located in the Jesters Creek Watershed, within the Flint River Basin, one of the county's most urban areas.

Natural fluvial geomorphic channel design methods were used to create approximately 2,150 feet of stable stream channel in East Jesters Creek. The restored and reshaped stable channel, with meander, is located within the floodplain and replaced the channelized and straightened reach that had been historically relocated along the base of a ridgeline. The project restored the stream segment based on the existing and anticipated future hydrologic conditions and included riffle and pool habitats for aquatic species and other wildlife. In the Rosgen classification system, this project is considered a Priority I restoration.

INTRODUCTION

In 2001, CCWA conducted a Watershed Assessment (WA) as required by the Georgia Environmental Protection Division (EPD) for new or expanding wastewater treatment or drinking water facilities. The WA identified degraded conditions in county streams, including poor habitat, reduced water quality, severe sedimentation, and potential threats to human health (CH2M HILL, 2001). Based on these findings, CCWA prepared a Watershed Management Plan (WMP) that addressed the current and future decline of stream integrity. To address stream degradation, CCWA initiated a Stream Restoration Plan designed to evaluate the conditions of the streams, document problem areas, recommend corrective measures, prepare conceptual improvement plans, and implement the corrective measures.

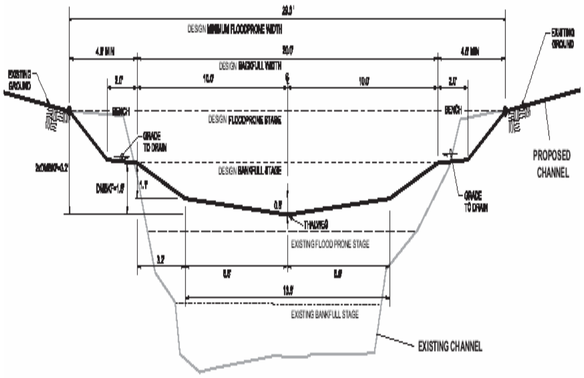
CCWA's first stream restoration project involved 2,230 feet of degraded channel to create approximately 2,400 feet of stable stream channel in East Jesters Creek. This section of East Jesters Creek, referred to as the "Gateway Stream Restoration Project," is located along the 165-acre Gateway Village. This channelized section of East Jesters Creek was deeply incised, with exposed 8- to 10-foot-high banks (Figure 1). The streambed was relatively wide, ranging from 15 to 20 feet, and the unconsolidated sandy substrates continually shift and are transported to downstream water supply reservoirs. Historically, the stream was dredged and relocated, probably for agricultural purposes. Prior to restoration, the creek was a channelized and straightened (i.e., a Rosgen "F5") stream (Rosgen, 1994).

CHANNEL DESIGN

Fluvial geomorphic techniques and natural channel design methodology developed by Rosgen (1994, 1996, and 1997) were used to restore the "F5" channel to a Rosgen "B5c" type channel with meander and instream habitat. The dimension, pattern, and profile of the stream restoration were developed using dimensionless ratios derived from the measurements taken from the Rosgen "B4c" channel at Coffey Creek, a stable reference reach in the Piedmont province. Iterative calculations, using the reference reach measurements, were used to develop the appropriate stable cross-sections, profile, and plan form dimensions (Figure 2).

Figure 1. Typical erosion in Jesters Creek.

Figure 2. Typical existing and design cross-sections.



During each iteration, the resulting channel shape was compared to reference reach conditions. The final average cross-sectional shape and area of the natural channel included the restored "B" channel with a floodprone shelf and flatter (<2:1 slope) banks compared to the existing channel; however, the cross-sectional area at bankfull did not change. The floodprone shelf reduces the erosive forces during flooding by allowing the water to spread out over a large, vegetated flat surface area.

The straightened channel was realigned through the floodplain with an increased sinuosity from 1.1 to 1.22 based on the reference reach. The increased sinuosity provides diverse habitat for fauna and dissipates the stream energy associated with high storm surges. Energy absorption in the bends protects the stream from excessive erosion and flooding and provides refuge for benthic invertebrates and fish during storm events.

The profile bedform of the channel was altered from the flat, unstable, uniform sandy substrate with little diversity to one with stable rock riffles and pools. The stream restoration included the construction of a step (riffle)/pool stream bed with riffle space ranging from 67 to 81 feet apart. The step/pool spacing, like the other design features, was based on the reference reach to provide a stable bottom and provide habitat for aquatic species.

Cross-vanes were used to control the grade, create the step/pool bedform, create instream habitat, and increase sediment transport capacity. The structures were constructed to direct the stream flow over the structure, into the center of the channel, and away from the stream banks, thus reducing shear stress on the banks (Figure 3).

Revegetation of the bank, riparian zone, and upland buffer was an essential component of the overall stream restoration. Vegetation not only provides habitat for terrestrial and aquatic species but also provides bank stability. The revegetation included soil bioengineering techniques to stabilize the channel below the bankfull bench and through the riparian zone.

CCWA identified several opportunities throughout the project to pilot unique infrastructure upgrades. For example, at several locations, sanitary sewer lines crossed under the new channel alignment. In an effort to protect the sewer line and create habitat, the top of the concrete-encased sewer line was layered with rock to create an additional riffle feature.

SEDIMENT TRANSPORT

Sediment loads from upstream sources were estimated and compared to the sediment transport capacity of the restored channel cross-section. The upstream sediment load and the channel transport capacity were within 10 percent of each other to prevent aggradation or degradation.

The total upstream sediment load was the sum of sediment originating in the watershed and sediment eroded from the stream banks. The annual watershed sediment load was estimated with PLOAD, a land use based pollutant load model, using the upstream drainage area and land use categories. The annual sediment load from stream bank erosion was estimated using a combination of the bank erosion hazard index (BEHI) and near-bank stress (NBS) methods.

CONCLUSIONS

CCWA identified stream degradation as a primary aquatic integrity issue affecting the drinking water supplies, degrading habitat for fish and wildlife, causing some streams not to meet their designated use, and threatening human health. The restoration project at the Gateway site resulted in a dynamically stable stream system that withstood three hurricanes during 2004, showing minimal impact. In the future, stream restoration work will be instrumental in helping CCWA

Figure 3. Typical cross-vane structure.

manage its responses to regulatory drivers, such as the new Total Maximum Daily Load (TMDL) and stormwater provisions of the federal Clean Water Act. The work will also be useful in helping CCWA provide clean water supplies under provisions of the federal Safe Drinking Water Act.

CCWA plans to implement additional stream improvement projects to assure the safety of future drinking water resources (surface waters) and to improve the overall aquatic integrity of the County streams. Recently, CCWA completed construction of an additional 2,000 linear feet of stream restoration on East Jesters Creek immediately downstream of the Gateway Stream Restoration Project.

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