Esopus Creek Stream Restoration Demonstration Project

Project Summary and Status Report (12.19.03)

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Project Description

Esopus Creek in the Catskill Mountains is the main stream that flows into the Ashokan reservoir – a primary source of water for New York City. The Esopus Creek watershed delivers high quality water, yet during storm events clay can be eroded from streambanks and as a result the water becomes turbid. As part of the Filtration Avoidance Determination deliverables to USEPA, the DEP Stream Management Program, in conjunction with County Soil and Water Conservation Districts, has been developing stream management plans and constructing stream restoration projects that demonstrate the use of natural channel design practices. The primary purpose of the plans and restoration projects is to improve the water quality of the streams that feed the NYC water supply reservoirs. This report summarizes the development and completion of a demonstration project on Esopus Creek.

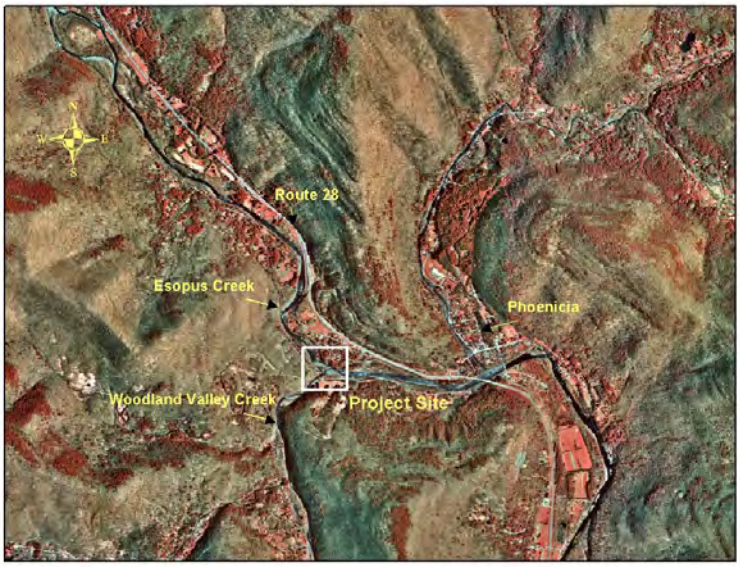

Figure 0. Project site location map

The project site is an approximately 1,000 ft section of Esopus Creek in the Town of Shandaken, Ulster County, NY (Figure 1). This section of Esopus Creek at the Woodland Valley creek confluence is approximately 10 miles upstream of the Ashokan reservoir and has a long history of channel instability (shifting and braided channels, eroding banks). Extreme floods during the 1980's and 1990's caused channel avulsion around the confluence with Woodland Valley creek resulting in an unstable braided channel partly bypassing the Woodland Valley creek (Figure 2). The new channel, a cutoff chute,

Figure 2. Aerial view of project reach (8.13.03)

became the main channel eroding into glacial lake clays and exposing a highly erodible bank of clay-rich glacial deposits. Since 1996 the eroding bank has extended to ~500 ft in length, migrated on average 3 ft/yr, and has reached a height of 20-25 feet (Figure 3).

Figure 3. Streambank failure along project reach (May, 2002)

In addition to the obvious significant problem for the adjacent landowners, the situation presented several other problems that needed to be resolved: (1) exposed clays are easily entrained into the stream resulting in a source of turbidity, (2) the drainage fields for the septic systems were susceptible to being excavated and draining directly to the stream, (3) the Esopus is a popular whitewater recreation stream and the failing bank was a hazard to tubers and paddlers. Demonstration projects that address multiple objectives help DEP build a constituency for water quality protection.

In 2002 NYCDEP commissioned an assessment of the reach and a proposed plan for stabilizing the stream reach. Dr. Craig Fischenich of FIScH Engineering proposed a restoration design which incorporated observations of the Esopus Creek in more stable locations as well as analytical calculations of sediment transport and flooding potential. The plan included restoring the stream to the previous channel, building rock structures to control erosion, filling the cut-off channel to floodplain elevation, and stabilizing the eroding bank with rip-rap and vegetation (Figure 4).

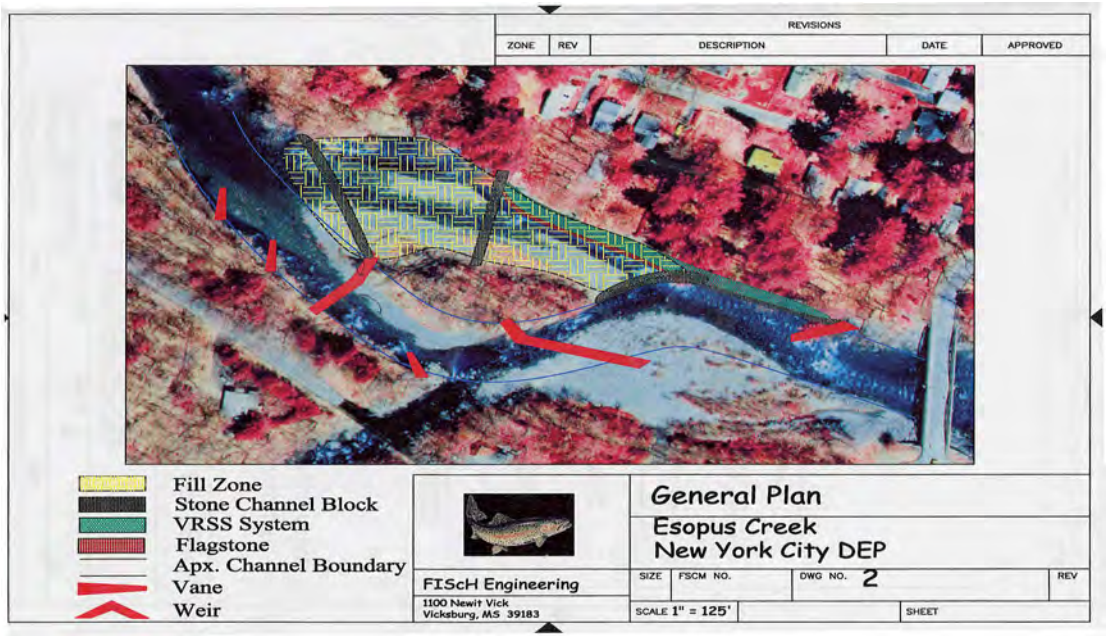

Figure 4. Original conceptual design. Final design is slightly different with changes in weir location and orientation and one rock vane moved just downstream of Woodland Valley.

Project Funding

NYCDEP sponsored the project as the demonstration project for the upcoming Esopus Creek stream management plan. NYCDEP contracted with the Ulster County Soil and Water Conservation District to administrate construction and help maintain the project over a 3-year period. The contract budget is $945,000 to apply to project administration, construction, construction inspection, and project monitoring for the next several years. NYCDEP also contracted with the US Army Corp to receive reimbursement funds for project construction. The Water Resources Development Act (WRDA) of 1996 provides federal funding to the Army Corp for the design and construction of resource protection and development projects in the New York City Watershed. The NYSDEC works with the US Army Corp to review and select applicable projects. NYSDEC and the Army Corp supported the use of $500,000 of WRDA funds for the project as long as the project was constructed in 2003.

Project Construction

In July, 2003 a contracting firm from Margaretville, NY (Hubbell, Inc) was the successful bidder at ~$475,000. The project channel construction occurred during the 7-week period of August 18 - September 30. During that time, the Catskills experienced one of the wettest summers on record. According to a local weather monitoring station, locations within the Catskills received 39 inches of rain since June - a year ' s worth of rain in four months. The stream flow during the construction period was well above average every day. In fact, the daily maximum stream flow record for the Esopus Creek just upstream of the site was set on 14 of the days during the construction period (Figure 5). In the last week of construction an overnight rainstorm dumped 3"-7" of rain upstream of the project on an already saturated watershed. The resulting flood flows were estimated to be around a 10-year recurrence interval. Fortunately, though the reconstructed floodplain was not completed, the newly constructed channel and rock structures performed successfully and the channel and floodplain construction were completed on time. Figures 6-12 depict various stages of channel construction.

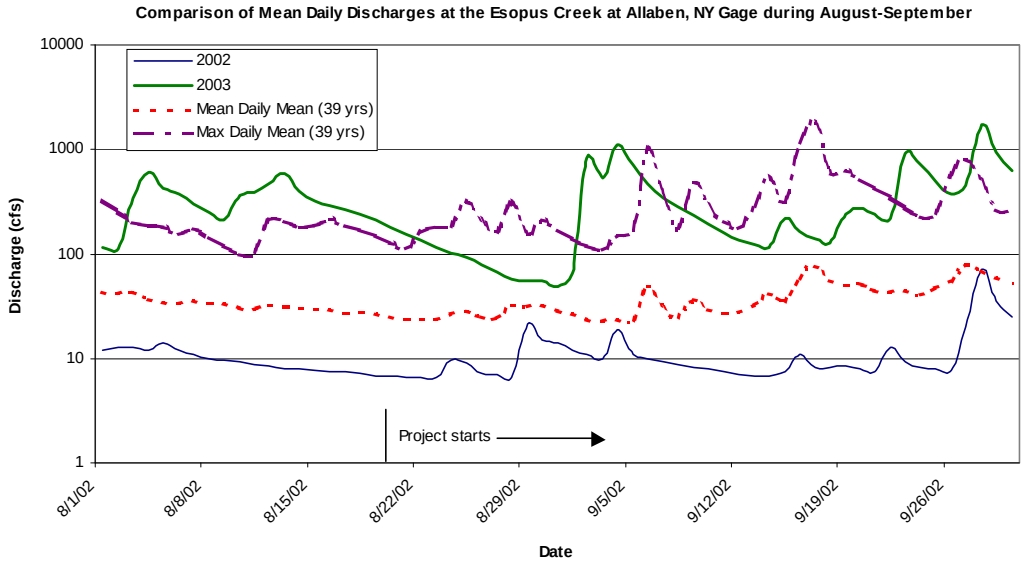

Figure 5. Esopus Creek hydrograph during construction period

The final stage of the project construction was the bioengineering, completed by 12/15/03. The bioengineering includes placement of 1,000 containerized trees, 400 feet of willow fascines, and 900 live willow stakes (Figures 16 and 17). An additional 21,000 willow whips and 6,500 bare root cuttings will be used in conjunction with geotextile-wrapped terraced soil lifts to stabilize the badly eroded stream bank as part of a vegetation reinforced slope system (Figures 18-21).

Project Monitoring

Following project construction, NYCDEP and the Ulster County Soil and Water Conservation District will monitor the project performance and provide maintenance as needed.

Project Construction Photos

Figure 6. Constructing rock vane and weir below Woodland Valley confluence (8.20.03)

Figure 7. Excavating new channel and constructing rock vane (9.x.03)

Figure 8. Completed south channel with upstream weir (9.09.03)

Figure 9. Streamflow in new south channel (9.19.03)

Figure 9. Aerial view of project construction (9.11.03)

Figure 10. Filling in cutoff channel (9.17.03)

Figure 11. Constructing downstream channel block (9.18.03)

Figure 12. Rip rap revetment along failing bank (9.24.03)

Figure 14. Post-flood flows at project reach (9.23.03)

Figure 15. Aerial view of project reach after channel restoration (10.16.03)

Figure 16. Tree plantings along the new channel margin (11.19.03)

Figure 17. Willow fascine placement along cobble bar (11.19.03)

Figure 18. Constructing VRSS with batter boards (11.11.03).

Figure 19. VRSS on top of rip rap at downstream channel block (11.24.03)

Figure 20. VRSS - geotextile encapsulated soil lifts with layered willow whips (12.05.03)

Figure 21. Completed Project (12.12.03)