

AEP NIAGARA HYDRO ELECTRIC PLANT 78" & 66" STEEL PENSTOCKS

Snapshot

Owner:

American Electric Power (AEP)

Facility:

Niagara Hydroelectric Plant, Vinton VA
Original construction in mid-1950's

Project:

Penstock Restoration

Penstock Dimensions:

- 172.50 LF of 78" steel pipe with 45° slope
- 57.50 LF of 66" steel pipe with a 45° slope

Problem:

Failing penstock pipes with pre-existing failed polyurethane liner

Restoration Method:

- Utilized the Quadex Lining System®
- spray-applied Quadex GeoKrete®
 - 1" thickness for full structural rehab

Project Time Frame:

September 18-22, 2017

Installation Contractor:

Quadex Lining Systems®

FAILING PENSTOCKS, STEEP SLOPES MAKE FOR DIFFICULT PIPE REHABILITATION

SITUATION

The plant's two penstocks — which are the pipes that carry water down from the hydroelectric reservoir to the turbines inside the plant — were compromised with pin holes and weak spots. Each is fed by dual lines, combined into one just before the turbine. One was two (2) 78" in diameter lines totaling 115' long, while the other was one (1) 78" diameter line and one (1) 66" in diameter line, each 57.5' long. The lines had been treated in 1994 with a polyurethane liner... it had failed.

Faced with the decision of whether to replace or rehabilitate the penstocks, plant officials chose the latter. Replacing the penstocks would have been costly because it called for major excavation in a congested area between the plant's Lower Dam and Power House. In turn, the client chose to rehabilitate the penstocks. As part of the process, the deteriorated steel penstock pipes with the failed polyurethane liner would require a full structural restoration.



External view of 45° angled penstocks.



Penstock pipe after GeoKrete® application.



Compared to Baseline for
Trenchless Repair Systems for
Structural Rehabilitation of
Civil Infrastructure



SOLUTION OPTIONS

The CIPP process was considered but the combination of limited access and steep grades would have made it very expensive and too risky. The pipe entry was down an embankment that didn't allow vehicles, not to mention the site's access was extremely limited and would have required a helicopter to get CIPP liner into place.

The Quadex Lining System® (QLS) spin-cast process, on the other hand, requires a much smaller footprint and features a highly-portable, custom designed application sled. Due to the ability of the GeoKrete material to be pumped fairly long distances, in this case the balance of the equipment was securely positioned at the top of the slope where it could be safely operated.

What makes QLS truly unique is the GeoKrete® Geopolymer applied to the structures. Developed by Quadex LLC, it is a fully structural, corrosion resistant material that will not crack, peel or degrade over time.

THE QLS PROCESS

Although the job was unique in the pipe's extreme slope, the application of GeoKrete was not altered. Prior to lining, the failed polyurethane liner was removed and the pipe was prepped and patched where necessary. Ready for application, the QLS sled was able to precisely spin-cast the GeoKrete, at a 1" thickness, onto the inner wall of the penstocks. The application sled is winch-controlled to allow for consistent and uniform application throughout the entire length of the pipe.

As a value-added procedure the pipe's headwall, leading from the penstock, was also GeoKrete lined and shaped.

In closing, although AEP initially selected QLS for GeoKrete's performance properties, the QLS crew's strong safety score was also a factor. This installation proved to be a challenge due to the extreme slope grade. Safety, awareness and special attention to harnessing was paramount.



Urethane removal was tedious



Peering down the steep slope of penstock.



Remote access and narrow pathways.



GeoKrete Liner - Structural renewal & restored flow capacity.