First Street Tunnel

Washington, D.C.

DC Water and Sewer Authority's $2.6 billion Clean Rivers Project aims to nearly eliminate combined sewer overflows to the Anacostia and Potomac Rivers and Rock Creek, also improving the health of the Chesapeake Bay.

The project

The First Street Tunnel project is part of the overall DC Water Clean Rivers Project and is intended to relieve persistent flooding of streets and sidewalks in the city's northwest residential community. The First Street Tunnel work consisted of TBM mining of a 2,700-ft long tunnel, the sinking of four large diameter shafts, and the construction of three adits, four diversion chambers, and other structures. With sufficient space available, the main shaft had been excavated within slurry walls. Keller had installed the deep well system for depressurization to allow shaft excavation in the dry. The three remaining shafts and adits were situated in considerably more congested areas, requiring an alternative approach to dewatering and excavation support.

The challenge

The impact of noise and construction operations on the area's residential community was deemed a critical consideration.

The solution

Ground freezing was selected as the best option since it would provide both groundwater control and excavation support in a single operation and could be accomplished with minimal community impact.

Accordingly, Keller's refrigeration plants were located adjacent to the main shaft. From here, HDPE supply and return brine pipes were run to the other sites via shallow utility trenches over distances from 300 ft up to 2,600 ft. The key to the ground freezing was integrating all instrumentation in a central mobile office from where operating parameters such as supply temperatures, brine levels, pressure, and flow were communicated.

The three shafts were each 23-ft ID and extended to a depth of 90 ft. The ground freezing design called for an average of 28 freeze pipes installed around the perimeter of each shaft, extending into the rock at a depth of 160 ft for complete water cut-off. The adits ranged from 80 to 100 ft deep. The objective of the shaft freezing operation was to install a 6.5-ft thick collar around each shaft, while the adits were encapsulated within a solid block of frozen soil. Freeze pipes were strategically located and angled where necessary to avoid major utilities and not impede access to adjacent residences. Freeze headers were insulated to prevent freezing the utility trenches.

A total of 331 freeze pipes, equating to 42,500 LF, were installed for the project. Keller's streamlined and fully automated and computerized instrumentation readily handled the magnitude of the work.

Project facts

Owner(s)
DC Water

Keller business unit(s)
Keller

Main contractor(s)
SKJD (Skanska Jay-Dee) Joint Venture

Solutions
Support of excavation
Groundwater control and dewatering

Markets
Infrastructure
Water, sewage and waste disposal

Techniques
Ground freezing

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