A big STEP for a small community

Jerry A. May

The Village of Corrales, N.M., a picturesque rural community located immediately north of Albuquerque, N.M., and along the west side of the Rio Grande, had struggled with the issue of a wastewater system for years. An entire generation and countless mayors, councils, and engineers had unsuccessfully tried to address the need of replacing septic tanks with a wastewater system while retaining the rural appeal of the village. In 2010, the dream of a new wastewater treatment system finally became a reality.

Evaluating system needs

In 2000, the village decided to seek funding for a wastewater project, even though the project had not yet been identified specifically. In 2000–2001, the 106th U.S. Congress appropriated $958,200 for a village wastewater system as part of a U.S. Environmental Protection Agency funding bill.

After the village was unsatisfied with an earlier engineering report, it hired a new company in August 2007 to evaluate former planning documents and current villagewide wastewater system needs.

The new engineering report identified serving the village's business core as the No. 1 priority; it also identified seven neighborhoods located near Corrales Road, the community's primary transportation corridor, as being in "immediate need" of a wastewater system. Other areas were identified as short-term (greater than 5-year) or long-term (greater than 10-year) needs.

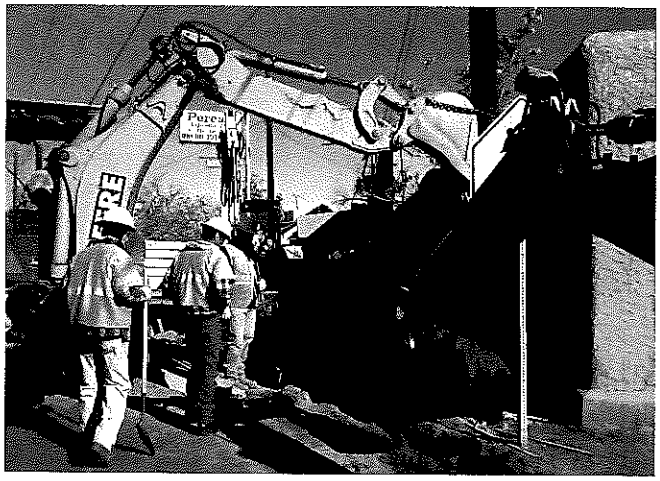
Conventional and nonconventional alternatives were considered. The report estimated the cost of installing a conventional gravity wastewater collection system to serve the entire village and to connect to an existing Albuquerque Bernalillo County Water Utility Authority lift station to be $83.4 million. The estimate to install a villagewide septic-tank effluent-pump (STEP) system and connect to the lift station was $64.1 million. STEP collection systems have been used in the United States since the 1970s but are not common in New Mexico, particularly in a large community setting. The estimate to install a STEP collection system for the village's business core and connect to the lift station in a single phase was $1.35 million. Only the last option was within the realm of the village's available funding.

The value of the existing septic tanks was taken into consideration, as well as the 20-year operation and maintenance costs of maintaining STEP pumps and pumping septic tanks on a 4-year cycle.

Planning challenges

At public meetings and council meetings during the planning phase, the engineers witnessed that support for the wastewater system was mixed. The Corrales Village Council was not 100% in support of the project. Many citizens doubted that the project was needed or that it could be provided technically or financially without significant effects on the village.

However, as a result of the report, meetings, and existing funding, the Village Council and mayor elected to move forward with a STEP wastewater collection system to serve the village business core. Existing septic tanks would be used and individual packaged pump systems installed at each property. The STEP system would connect to the



Working within a narrow right-of-way was a challenge for both design and construction when installing a septic-tank effluent-pump system in the Village of Corrales, N.M. Souder, Miller & Associates

Directional drilling was used to "surgically" install the septic-tank effluent-pump collection pipe between existing utilities in the narrow right-of-way. Souder, Miller & Associates

water utility authority lift station located just south of the village limits and be designed and constructed in two phases.

Project phasing was based on available funding. Phase 1 would be designed as a wastewater collection system and would extend the entire 2.4-km (8000-ft) length of the business core along the east side of Corrales Road. Phase 2 would be designed as a transmission system and would start from the southern end of the business core and travel 2.3 km (7500 ft) to the lift station. The design would use high-density polyethylene (HDPE) pipe and trenchless construction technology (directional drilling) to minimize the effect of construction on traffic and businesses within the village. The directional drilling also would provide a virtually joint-free piping system.

The design had to avoid many existing utilities within the narrow Corrales Road (State Highway 448) right-of-way, as well as avoid potential construction damage to historical structures. The engineer considered it a "surgical installation" of a collection system.

Additional challenges

Phase 1 design began in June 2008. Geotechnical borings were performed to identify depth to groundwater and soil types for directional drilling. A subsurface utility investigation also was performed to meet New Mexico Department of Transportation (NMDOT) requirements for utility projects constructed within the right-of-way.

An existing 150-mm (6-in.) natural gas main skirted the eastern edge of Corrales Road for the entire length of the project. The gas company required a minimum 1-m (3-ft) setback from the natural gas main when using directional drilling. The available existing right-of-way was very narrow, and the gas company requirement reduced the available width to 1.5 m (5 ft) or less.

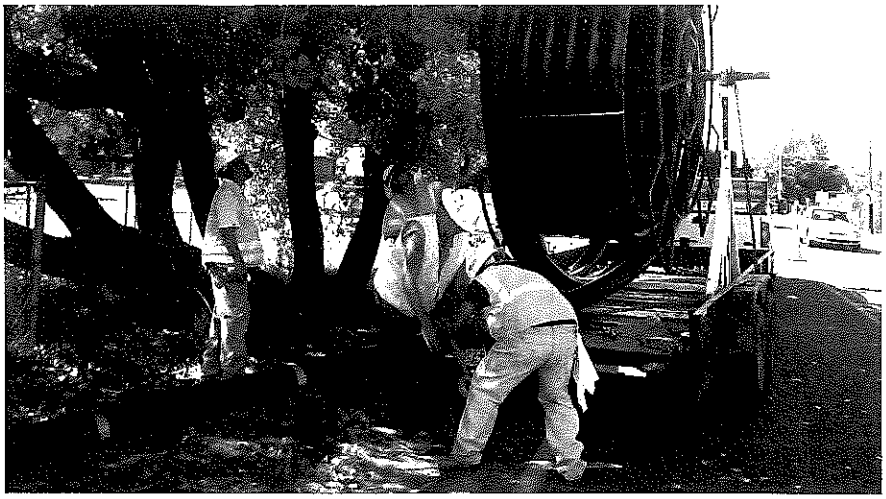
Another wrinkle was that the STEP pipe had to be kept from beneath the road pavement, because NMDOT requires steel casing for any pipe placed under the road. The cost of any significant amount of steel casing, other than service connections crossing the road, was not in the project budget.

Shortly after the start of Phase 1 design, the Village Council directed the engineer to include in the design the seven neighborhoods located adjacent to the business core. These neighborhoods previously had been determined to be of "immediate need." The addition increased the design flow of 189 m^3/d (50,000 gal/d) to a new design flow of 727 m^3/d (192,000 gal/d).

However, the initially targeted lift station was not capable of receiving the new volume, and the connection point had to be moved approximately 0.5 km (1600 ft) farther south – through a major city intersection – to a 600-mm (24-in.) gravity-sewer manhole. This change added an additional phase of design. The engineer checked Phase 1 calculations and confirmed that the initially selected 150-mm (6-in.) HDPE STEP collection pipe was adequate for the business core; however, he determined, a 200-mm (8-in.) HDPE STEP transmission pipe would be required for phases 2 and 3.

Design solutions

The STEP system was designed such that each individual pump located within properties would be able to overcome the total head loss of the system. The design considered all pumps on at the same time as the system peak flow demand. This conservative peak flow



To minimize the number of fusion joints and speed up construction, 150-m (500-ft) rolls of high-density polyethylene pipe were specified for the project. Souder, Miller & Associates

demand met the worst-case scenario, as well as provided room for system expansion once actual flows were measured over time.

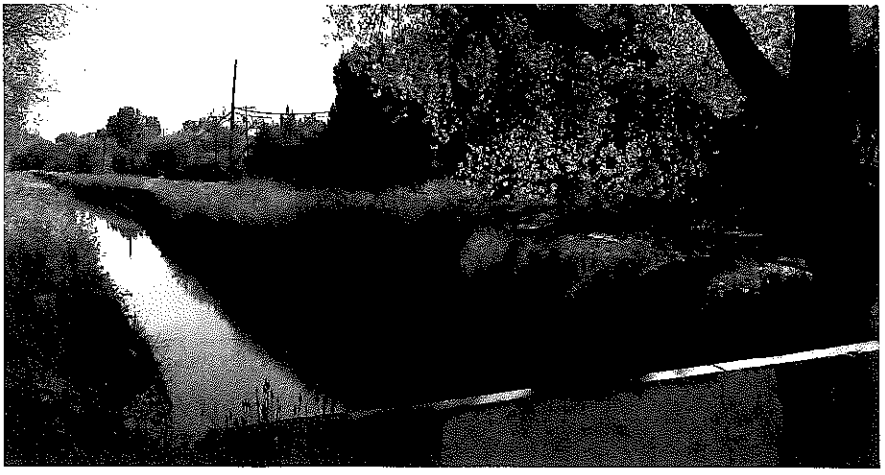
During the Phase 1 design, the engineer requested that the village contact property owners in the business core to determine where they would prefer their wastewater connection and to advise the engineer of any future large-scale development plans for their properties. Locating wastewater connections at adjoining property corners led to the most cost-effective method, as property connections could share a single-connection pipe to the main. The discharge connection for a STEP pump capable of serving a residence or small business was 30 mm (1.25 in.) in diameter.

As public feedback was sparse, the engineer designed a larger, 50-mm (2-in.) wastewater connection as the minimum size for most of the properties. Larger properties and the elementary school were provided with 75-mm-diameter (3-in.-diameter) connections, or – in cases where significant Corrales Road frontage existed – multiple 50-mm (2-in.) connections.

The final design included a total of 80 service connections in the business core plus seven laterals for future connection of the adjacent immediate-need neighborhoods. The design also included isolation valves, air valves, and cleanouts for the STEP collection main. Since the air valves would be located within an area of high public use, they were equipped with odor-control units.

Beginning of a new era

The Phase 1 design and bid documents were completed in May 2009. The engineers estimated the Phase 1 cost at $788,000. Project bidding in July 2009 led to a $744,000 contract and 6-month schedule



The Village of Corrales, N.M., located on the west side of the Rio Grande and bisected with multiple irrigation channels, has shallow groundwater that was affected by septic tank discharges. Souder, Miller & Associates

for the project. Construction began in September 2009.

Utility potholing was conducted during directional drilling. The head of the directional drilling rod was traced with a hand-held detector to ensure the horizontal and vertical position within centimeters.

To minimize the number of fusion joints and the time required for construction, the 150-mm (6-in.) HDPE pipe used for the STEP collection pipe was specified by the engineer to be provided in 150-m (500-ft) rolls. This length also guided the daily production target of 150 m (500 ft) per day. As a result, directional drilling was completed in 5 weeks, with little effect on traffic and businesses.

Another requirement of the project was for the contractor to lay out all wastewater service connections before construction so that locations could be confirmed by the engineer. Some changes were made, but in the end, the total number was the same, and no additional cost was incurred.

In November 2009, the contractor began installing the business-core service connections. More than half of the 80 connections were made across Corrales Road. As the contractor was required to maintain one traffic lane open at all times, a service connection was open-trenched halfway across Corrales Road and piped, capped, backfilled, compacted, and paved to meet existing conditions. The contractor followed this method down the east side of Corrales Road, then returned and started at the beginning on the west side of the road to complete the services.

In December 2009, the contractor started to run behind schedule, and cold weather and the inability to place new asphalt and meet NMDOT temperature conditions – 10°C (50°F) and rising – delayed completion. The contractor requested a delay in schedule, and the village granted the request, setting a new substantial completion date of June 30, 2010.

Construction recommenced in April 2010. The service connections were completed, the entire system was successfully pressure-tested to 1034 kPa (150 lb/in.^{2}), and substantial completion was obtained in early June 2010. The alternative design and construction techniques proved to be an effective and low-impact method of construction.

Success!

The special needs and desires of the village, including a layman's understanding of wastewater systems, the village's hydrogeology, and effects from septic tanks, were incorporated as part of the project. The project was designed and constructed to give the greatest overall value to the community. Nonconventional thinking and methods were utilized to meet the special requirements of the project. It was performed in a cost-effective manner and resulted in overall positive approval from the community, from which evolved the momentum to design, fund, and make ready to construct the final phases 2 and 3 in the coming year. These are expected to be completed by this July.

The village still has some other major tasks to complete – a rate schedule, hiring a wastewater operator, and initiating hookup requirements – but the biggest STEP will soon be completed.

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