

PipeLine

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HOBAS in Poland

Pipes and manholes were assembled on-site even during frosty temperatures, which reached 5 degrees F in December.



Europe, like the USA, is struggling to upgrade its infrastructure. In Poland for example, over 1,000 wastewater treatment plants need to be constructed or upgraded in order to meet European standards which take effect in 2015. Warsaw, the capital and largest city in Poland, has many planned upgrades, including a recent two-year-long project which will provide added capacity and decrease overflows.

One of the driving forces for this new project was environmental, as it is estimated that 30 percent of effluents have been flowing directly into one of the longest and most important rivers in Poland. Warsaw's proximity to the Vistula River, the environmentally fragile Baltic Sea and the nearby Carpathian Mountains which are home to the largest European population of brown bears made the project a priority. The environmental aspects coupled with the growing population of the area meant the project should happen quickly.

The Czajka waste water treatment plant is currently being constructed on the right river bank of the Vistula River in Warsaw, Poland. After its completion, it will treat 80 percent of the Polish capital's effluents and make sure that no more untreated sewage will harm the flora and fauna along the Vistula.

As part of the development plan, a collector leading to the plant is also under

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construction. Due to this project's size, it was divided into three phases. The first phase is a 3.5 mile jack along the right side of the Vistula, the second a 4,600 foot jack along the left bank. These pipelines will meet in the third section, the river crossing.

The pipes for all three phases are being supplied by HOBAS, and are the largest centrifugally cast fiberglass reinforced polymer mortar (CCFRPM) pipes made to date. Phases one and three utilize 118-inch OD pipes. The river crossing consists of two parallel 63-inch diameter lines installed within a 15-foot diameter concrete tunnel.

The pipes are the largest CCFRPM pipes made to date with an OD of 118 inches.



The consortium of contractors, Hydrobudowa 9, PRG Metro and KWG (all belonging to the PBG Group) have now completed of the first pipeline section which includes nearly a mile of jacking utilizing two Herrenknecht microtunneling machines. Proximity to the river means the groundwater is high; the typical water table is just below the surface.

Low Loads & Quick Installation

The smooth and even outer surface of the centrifugally cast fiberglass pipes helped the contractor breeze through one of the project's challenges. Original plans called for a 2,800-foot section to be jacked from both ends and meet in the middle. However, when using CCFRPM pipes, the construction plan could be modified so that the section was jacked precisely with one single drive and from one side only.

Despite the anticipated low friction forces, the contractor followed the project plan and installed an intermediate jacking station (IJS) every 328 feet. These were insurance, but in practice, only one of these - the last was put into service. This longest single drive was conducted in two shifts working 24 hours per day and 7 days a week. After its completion, the intermediate stations were replaced by CCFRPM manholes and the IJS were reused for different sections of the project.

The tunneling progressed at an average of 9 feet per hour with the separator processing 76 tons of soil per hour. The cycle time between pipes (disassembly and reassembly of electric cables, slurry pipes and hydraulic hoses) takes

Jacking challenges, including the close proximity to a subway, were overcome with advance planning and precise remote controlled jacking.


40 to 60 minutes. At this rate, an average of 10 pipes could be installed per day. Due to the rapid production, it was possible to complete the first section of pipe installation weeks ahead of schedule. The contractors' expectations were certainly exceeded and allowed them to commence work on new sections.

Trenchless Option

Trenchless technology was chosen due to the river crossing but, also because the pipeline route runs beneath a 6-lane road (3 lanes in each direction). It is in this section that a single drive of nearly 3,000 feet broke the record of longest single drive for the project. Several impressive jacking runs were accomplished on this project, setting a global record for the longest fiberglass pipe jacking installation for 3000mm diameter pipes.

Jacking challenges, including the close proximity to a subway, were overcome with advance planning and precise remote controlled jacking. At one location the clearance between the jacked pipeline and the subway was only 2 feet.

CCFRPM was not the least expensive piping material for the project, but the higher material cost was outweighed by the savings. For example, a 30 percent reduction in soil extraction was possible due to the high strength thin walled product, which creates a smaller OD for the same ID. Construction equipment could be kept small and to a minimum, which was crucial in this tight space. Fast onsite assembly, long life expectancy and low maintenance all factored into the cost analysis.

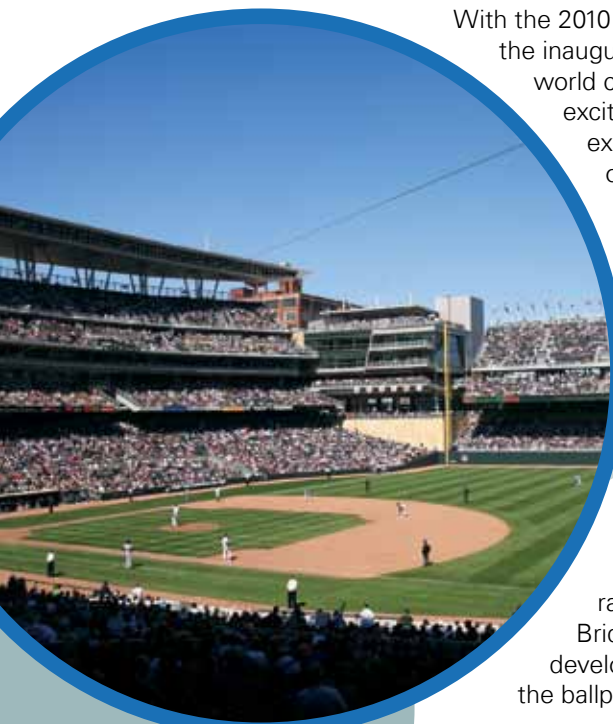
CCFRPM Pipes have experienced success globally in long jacking runs. In 1991, EE Cruz, the jacking contractor for the Oakwood Beach Interceptor in Staten Island, NY, regarding the 1,560-ft drive distance said, "The length appears to establish a world single drive record using a remote controlled microtunneling with slurry excavation technique." To make this even more impressive, the laser guidance system has brought all the bores home within 1 inch of both line and grade. Advances in tunneling continue and CCFRPM has been part of many of them. 

Years of Construction
2009 & 2010
Total length of pipe
23,000 feet
Diameter
118 inch O.D.
Stiffness class
46 psi
Installation method
Jacking
Application
Gravity sewer

Client
Waterworks Warsaw
Advantages
Ease of installation, corrosion resistant, lightweight



HOBAS at the Ballpark



Target Field is home to the Minnesota Twins.

With the 2010 baseball season winding down, the inaugural season at Target Field, the world class home of the Twins, proved exciting. Yet, few knew about the exhaustive effort by a consortium of designers, constructors and manufacturers that feverishly worked on below ground repairs, long before the above ground work could even begin.

Minneapolis in 2007 was set and eager for construction to begin on the long-awaited new Minnesota Twins ballpark. Also in the line-up of plans were adjacent transportation improvements to two commuter rail lines, the Fifth Street Bridge and various commercial development projects to help revitalize the ballpark vicinity.

Deep below the surface, however, lurked one of the oldest sanitary sewers serving the downtown area. Constructed from limestone and brick in 1889, long before city leaders envisioned skyscrapers, intermodal transportation hubs and modern sports stadiums, this aging infrastructure had city leaders expressing concern. What effect would construction vibrations and additional loads from new downtown growth have upon this antiquated interceptor line? It also served suburban municipalities never imagined when the original sewer line was constructed.

Once the ballpark and new developments to the north were built, access to the interceptor for repair or rehabilitation would be extremely limited and highly disruptive. The ballpark would be located directly to the south of the pipeline. Pile foundation piers and the west abutment for the Fifth Street Bridge were designed to straddle the interceptor. Other structures would be built directly atop the sewer line. It was a 'now or never' decision for the Metropolitan Council Environmental Services (MCES).

Assessing Infrastructure

The engineering and consulting firm of Brown and Caldwell (BC) was hired in January 2007 to conduct an internal inspection, evaluate alternatives, recommend a solution, and prepare bid documents, all on a highly accelerated time schedule to allow rehabilitation to be completed before the end of that year.

Internal inspections of the sewer line were conducted in February and March of 2007. The assessment team, including engineers, a surveyor and support staff for lighting, hoist operations and safety, made their entrance into the cavernous interceptor after midnight to take advantage of the minimum daily flow that normally takes place before dawn. To further facilitate the inspection, the flow was held for as long as possible at two upstream pump stations.

Instrument use within the tunnel was restricted due to flowing wastewater and limited visibility, therefore the survey team employed a variety of basic, yet creative methods. Tunnel width was measured with a steel tape, and height was measured with a modified survey rod. Pipe length was measured using a cloth tape and a nail driven into the brick arch every 25 feet.

The inspections revealed a number of deformities: crown cracks, mineral deposits, two sagging areas, inward bulging in the vicinity of pilings supporting the Fifth Street Bridge, plus numerous groundwater leaks through masonry joints. Sediment was found in both the east and west reaches along with bricks and stonework that had dislodged from the tunnel invert and walls, according to Tom Noerenberg, P.E. with Brown and Caldwell.

West of the Bassett Creek crossing, two sags in the pipe created a minimum height measurement of 81 inches and a minimum width dimension of 86 inches. The reach of the pipe from Bassett Creek to the east was found to be in fairly good condition with few deformities. The minimum height here was measured at 88 inches and the minimum width at 79 inches. However, the eastern reach of the interceptor line threw a curve ball to the rehabilitation team – the pipe was constructed on a curve with a relatively short radius, posing another challenge for sliplining. MCES's recorded drawings showed the curve to have a 59-foot centerline radius with a centerline length of 40.5 feet.

Choosing A Rehabilitation Method

The 1-MN-320 interceptor had no parallel pipe to redirect flow. No route for temporary flow conveyance could be planned, shipped and constructed through this congested area and still support the project's aggressive schedule. In addition, acquisition of necessary temporary pumps would be almost impossible

and extremely expensive within the given time constraints. Therefore, the chosen repair method needed to be implemented "in the wet," with wastewater flowing in the pipe. That left only two possible repair methods:

- Crown Repair involving excavating the entire length of the pipe, removing the brick arch and reconstructing the crown using cast-in-place concrete or precast concrete sections.
- Sliplining pipe within the interceptor sewer.

The option of crown repair was discarded because of the public disruption that excavation of the entire length of the pipe would cause, along with the length of time that would be needed to manufacture coated or lined precast sections, excavation and installation. This was, after all, a time-sensitive project.

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Year of Construction
2007
Total length of pipe
1,300 feet
Diameter
72 to 84 inch
Stiffness class
51 and 59
Installation method
Slipline
Application
Sanitary sewer

Client
Metropolitan Council
Contractor
Lametti & Sons
Advantages
Quick installation, proven track record

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Sliplining the pipe would require opening up sections of the existing brick arch for installation of the slipline pipe in segments. During inspections, measurements had been taken with sliplining understood as the likely repair method. One of the main objectives of the inspection was to determine if deformities would limit the size of the sliplining pipe to be installed.

BC recommended sliplining the interceptor with fiberglass reinforced polymer mortar pipe that would resist corrosion, stabilize the interceptor during construction activities, and extend its service life another 50 years. The pipe would be lowered into the host pipe, moved into position, connected to the previously placed section, blocked against flotation, and finally, grouted into place.

The sliplining pipe would need to be corrosion resistant and fabricated quickly. Two prospective pipe manufacturers were contacted to provide prices on 72-inch and 78-inch diameter pipe. Meeting delivery deadlines was an important criterion in addition to price of the pipe and appurtenances.

Design Criteria Outlined

Hobas Pipe USA was selected to supply centrifugally cast, fiber reinforced, polymer-mortar pipe (CCFRPMP) to slipline 1,300 lineal feet of the existing 84-inch pipe. It was determined that 72-inch pipe could be sliplined in the reach east of Bassett Creek, and 78-inch in the reach to the west.

Per requirements, HOBAS pipe proved the best choice to resist corrosion, stabilize the interceptor, and be delivered on time. The pipe was manufactured in Houston, Texas and included a combination of 20-foot, 10-foot and 8-foot long pipe sections to fit into the existing line. Several custom pieces were fabricated as well including elbows, risers and T-base manholes.

The design flow for 1-MN-320 was projected to reach a peak of approximately 150 MGD through the year 2050. When hydraulically modeled, the 72-inch fiberglass pipe showed

a capacity of approximately 126 MGD (million gallons per day), indicating surcharging of the pipe during peak flows. However, the draw-down due to the drop would minimize or eliminate the surcharging; bringing it in line with the capacity computed using Manning's Equation of 166 MGD. The 78-inch fiberglass liner pipe created a capacity of 185 MGD, exceeding the 150 MGD design flow.

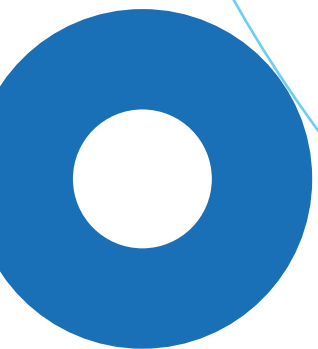
BC worked with HOBAS to design the segments for the short radius curve east of Bassett Creek. The challenge was to fabricate sections that could be constructed and grouted into a pipe that could not be precisely surveyed. At the center of the curve, an access structure was constructed that included two outside drops for sanitary sewage from the new stadium, the Minikahda Storage building, and future development to the north.

Construction Challenges

Lametti and Sons, Inc. was the low bidder and could commit to meeting the aggressive deadlines required to keep the ground-level projects on schedule. Rehabilitation began in April 2007.

Because scheduling between this sewer rehabilitation and two other concurrent projects was essential, timing and access to the interceptor were critical considerations as were material delivery and construction activities. With numerous projects going on in this area of downtown Minneapolis, pedestrian and traffic changes had to be closely sequenced and scheduled.

The contractor performed moderate cleaning below the water surface for the lining operation and removed mineral deposits on the walls. Several service connections protruding into the interceptor line were trimmed and reconnected. "In some locations we needed to remove some of the internal brick lining to accommodate the





Chuck Lewis and Tom Noerenberg of Brown and Caldwell conducted an inspection on an accelerated schedule.

new pipe and to maintain the proposed grade," added Fred Chase, P.E., Vice President of Construction, Lametti and Sons.

Brown and Caldwell, in conference with Lametti and HOBAS, determining that at least six access pits would be necessary, including two rectangular pits over the sagged sections, plus a large pit at the bend in the pipe near the east end of the project.


The depth from the surface to the crown of the interceptor ranged from 18 feet to 50 feet below grade. The access pits consisted of a trench box for the shallowest pit and others consisted of either a 25-foot to 30-foot diameter circular ring beam and lagged pits or rectangular drilled soldier pile and lagged pits, modified to accommodate bends in the interceptor and inclusion of new structures.

In order to maintain grade and work with the close tolerance between ID of the interceptor and OD of the new pipe, each pipe was placed individually. This level of detail required man entry into the interceptor and working at low flow times of the day. The new pipe was blocked into place and grouted in two lifts with cellular concrete.

Aggressive Schedule

Shortly after the bid was awarded, the Northstar Commuter Rail authority requested that the project be accelerated in the area of the Fifth Street Bridge west abutment, which was on the critical path for the new rail line. This change necessitated Lametti adding another pit to provide for the segment under the abutment to be installed first, and working under the bridge as it was being partially demolished. The Northstar Commuter Rail was installed directly above the pipe, on schedule, after Lametti had sliplined and grouted that segment.

The interceptor rehabilitation work was a home run – completed on schedule in December 2007 for just under \$4 million. Target Field was also completed in time for the Minnesota Twins to play their opening game in 2010.

Success of this project has led to further use of fiberglass pipes for MCES. The same team which successfully completed the 1-MN-320 interceptor (MCES, Brown and Caldwell, HOBAS and Lametti) is currently working to complete the Victoria Interceptor Sewer. For this sewer, over a mile of 72-inch diameter pipe is being installed in a tunnel. "HOBAS pipe has been very well received in the Twin City area, with installations including, direct bury, sliplining and tunneling methods," stated Vince Paparozzi, Area Manager of the North Central Region for HOBAS. 

HOBAS in Marysville, Ohio

The City of Marysville, Ohio maintains and operates a wastewater system that serves a population of 19,000. Included in their service area are several industrial contributors including Scotts Miracle-Gro Company, Nestle Corporation, Goodyear Tire and Rubber Co. and Honda of America Manufacturing.

To serve the existing population and meet the future wastewater requirements, the City identified the need for a new Water Reclamation Facility. In addition, a new wastewater conveyance system was planned in order to eliminate lift stations throughout the existing collection system and lessen the number of future pump stations. In turn, the City of Marysville would reduce their maintenance cost and increase future reliability of their conveyance system.

The City accomplished this through the execution of five contracts. One of the contracts was the Trunk Interceptor Project with a cost of \$35 million. The Trunk Interceptor Sewer discharges into Crosses Run Pump Station, which conveys flow to the Water Reclamation Facility.

The consulting engineering firm of DLZ of Columbus, OH designed the Trunk Interceptor Project. Debarati Bardhan, public works project manager with DLZ stated, "The design considerations for the project were based on the Marysville Wastewater Master Plan and included assumptions based on the existing residential and commercial / industrial demographics and predicted future growth. We had a good distribution of residential and commercial contributors within the various sheds."

Trenchless Necessity

The presence of industrial sites also posed design challenges. Within the project alignment, the potential for contaminated soils and water existed. "This was one of the reasons we chose to specify trenchless installation techniques for the majority of the project," Bardhan explained. "Other reasons included depth, issues related to easement acquisition and subsurface utility interferences. Even in areas where we were in a wide open field, the depth dictated that the most economic method of construction would be trenchless."

A variety of easements were necessary for construction of the new line. These easements were both permanent and temporary (construction easements). In some situations, open surface easements were possible, while in others, only subsurface easements were allowed. "In Marysville, we had some situations where subterranean easements were utilized," stated Bardhan. "These types of easements allow the owner to have access confined to a specific length around the installed utility/sewer. The easement rights do not extend all the way to the surface. As in the case of the temporary easement, if additional work is required in future, the utility owner has to negotiate with the property owner for a new temporary work easement."

By choosing trenchless installation and placing the shaft locations outside the possible contamination zones, the difficulties associated with managing the contamination, if it was encountered, were significantly reduced.

Construction Challenges

Super Excavators, Inc. of Menomonee Falls installed 20,500 linear feet of 60-inch diameter pipe with 14,000 linear feet installed by microtunneling methods. The jacking pipe with an allowable capacity of 540 tons was supplied by HOBAS Pipe USA. The contractor requested shorter, 10-foot jacking pipe lengths, which decreased the size of the installation shaft as compared to the standard 20-foot pipe section. The remaining 6,500 linear feet of 60-inch, 72 psi line was constructed by open-cut methods.



Depth, easement acquisition and possible contamination were the main reasons for the trenchless installation.

The 14,000 feet of jacking pipe was installed in 18 drives; the longest drive equaling 1,056 feet. Super Excavators averaged less than 100-tons of jacking load during installation of the 60-inch, 540-ton jacking pipe.

For the longer jacking runs, intermediate jacking stations were installed to complement the main jacks at the installation pit. These intermediate jacking stations were used to distribute the thrusting force along the pipe string by dividing the string into independent reaches. The jacks were installed inside a steel casing fabricated to the same outside diameter as the pipe.

A Microtunneling Boring Machine (MTBM) was the equipment utilized on the tunnel portion of the Trunk Interceptor project. It operated as a remote controlled, earth pressure balance machine. This project consisted of varying and difficult ground conditions such as cobbles, boulders, gravels and sticky clays. The MTBM performed well and was equipped with disk cutters to handle the large quantity of rocks.

"Initially there were originally no intermediate jack stations used and we did not plan on using any," said Jake Keegan, Project Manager with Super Excavators. "On the second tunnel run we had to excavate a recovery shaft because the machine was stuck, due to ground conditions. Therefore... intermediate jack stations had to be installed on three of the longer runs over 800. However, they proved unnecessary; we did not need to extend the jacks on any of the runs, as no surge in jacking pressure occurred."

Installation Savings

There were two pipe materials specified for this project: centrifugally cast, fiberglass reinforced, polymer mortar (CCFRPM) and reinforced concrete pipe with internal PVC lining. CCFRPM was utilized for the majority of this project instead of RCP due to the cost savings. The utilization of CCFRPM fittings for some of the manholes also contributed to cost savings.




Year of Construction
2009
Total length of pipe
20,500 feet
Diameter
60 inch
Stiffness class
72 psi

Installation method
Jacking and direct bury
Application
Sanitary sewer
Client
City of Marysville, Ohio
Contractor
Super Excavators
Advantages
Chemical resistant, leak free

"The initial material cost increase of the CCFRPM over the concrete was offset by the decreased labor cost we expected to see with the HOBAS fittings," stated Keegan. This was due in part to the easy connections with the supplied couplings which reduced the amount of labor needed to install the manholes.

Once the line was installed, a series of tests were conducted to ensure proper installation and performance of the installed line. The installed line was checked for ovality and leakage per the project specifications.

"A proof stick with a length equal to 97 percent of the internal diameter of the installed pipe was utilized by the CMT (Construction Management Team) to check for deflection. DLZ Inspectors walked through the installed HOBAS pipe with the stick to ensure that minimum acceptable internal diameter and shape were maintained throughout the length of the project and deflection was within the limits allowed in the Contract Documents and the pipe manufacturer," explained Bardhan.

In addition, the installed pipe was tested for pipe joint leakage. "All tests were conducted in accordance with the latest specifications and results were found to be acceptable and within the limits specified in the Contract Documents," stated Bardhan. "Actually, in the jacking installation we didn't find a single joint leak," Keegan said. "When the job was completed, all parties were pleased with the project success." 

HOBAS Pipe Preferred For Environmental Safeguards

Various types of industrial accidents have been making headlines in the past months, but many companies are taking measures to prevent negative environmental impacts. One such electric utility that serves more than 3 million customers across the Southeast turned to products made by Hobas Pipe for a solution at two of their 500-kilovolt (kV) substations.

Electrical Distribution

When power leaves any generation plant, it travels to massive substations that begin the distribution process. Arriving at 500,000 volts at these substations, electricity must be stepped down to a lower voltage for its secondary distribution to successive substations in the power grid, where it eventually splits off to various neighborhoods and commercial zones.

These substations are all constructed with drainage systems to collect rainwater to be channeled away from the electrical transformer and discharged into a nearby creek or tributary to a river. Because these initial distribution transformers deal with massive amounts of voltage, they are encased in several thousand gallons of oil for cooling.

Preventing Oil Spills

In order to devise the most efficient containment system possible to protect against a transformer leak, the utility provided research funds to several engineering firms to design an interceptor and underground oil containment system for two existing 500-kV substations. These computer-controlled substations are unmanned, and therefore the challenge of designing the system lay in its automation to sense an oil spill on its own. The electric utility also wanted a pipe material that would be impervious to most of the chemicals with which it would come in contact, particularly oil, and they wanted a joining system that would not leak.

They chose a unique design submitted by civil engineers at Davis-Martin-Powell & Associates (DMP) of High Point, NC. Ben Palmer, P.E., the DMP engineer in charge of the project, worked with Don Joyce of Pomona Pipe Products, who suggested using HOBAS Pipe for the project.

Year of Construction
2009

Total length of pipe
500 feet

Diameter
72 inch

Stiffness class
72 psi

Installation method
Direct bury

Application
Fluid containment for electrical substation

Contractor
Quartermaster Environmental & Willis Construction Co.

Advantages
Leak free, corrosion resistant



"I know of no other product that has a better joint or better chemical resistance than Hobas pipe," said Joyce. "Palmer agreed because he had also had some experience with it [HOBAS pipe]."

Palmer's plan to intercept the drainage system involved installing an oil stop valve that would be sensitive to the specific gravity of the liquid in it. Water inside this chamber would cause the valve

to float, allowing the water to continue outward to public drainage. If oil were sensed inside this chamber, the valve would not open because oil is less dense and lacks the buoyancy to lift the valve.

"The bank of transformers is situated atop a rock field sump," Palmer explained. "The sump areas are connected to a storm drain pipe that conveys the storm water runoff off-site and drains these sumps during a rainfall event."

This oil stop valve was installed in-line on the storm drain pipe leaving the site. Inside of the oil stop valve structure, a precast structure houses the oil stop valve along with a diversion pipe leading into the containment system.

In the event that the valve sensed oil and remained closed, the oil-contaminated water would be funneled into an underground containment reservoir constructed of 6-foot diameter HOBAS pipe, where it would temporarily remain until it could be pumped out manually and disposed properly.

"The design capacities for the two sites was based upon containment of a single piece of equipment and the rainfall from a 25-year, 24-hour storm event," according to Palmer. "The concept was very similar to an underground stormwater detention facility, just a different application."

The containment vessels are made up of custom-made HOBAS elbows and tees to create manifolds and 90- to 104-foot long straight runs, according to Matt Swenson of Power Consulting, LLC, the on-site inspector for the utility. The straight sections used were 20 feet long and weighed about 7,000 lbs.

One substation's containment vessel covers a footprint of 26 feet by 104 feet and is composed of 328 lineal feet of 72-inch Hobas FRP in three straight runs for a capacity of 60,750 gallons. The other 500-kV substation's vessel covers a footprint of 36 feet by 90.25 feet with 383 lineal feet of 72-inch HOBAS FRP in four straight runs for a capacity of 81,560 gallons.

"The owner had pre-ordered the Hobas pipe for the project due to some of the custom manufacturing involved," said Joyce. "It saved time and the pipe was on site when the contractors arrived."

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The installation was performed by different contractors at the two different sites, neither of whom had prior experience with Hobas pipe. Quartermaster Environmental installed one system and Willis Construction Co. installed the other.

Each 72-inch Hobas pipe containment reservoir was installed in a 12-foot deep excavation atop a one-foot base of washed stone and topped with 5 to 6 feet of cover.

There was a learning curve in handling and placing the sections, with correct placement being critical in order to make the straight runs and manifold join properly at opposite ends

approximately 100 feet apart, Swenson explained. "As the contractor set each piece, they backfilled a portion to hold the pipe in place so that there would be no need for manipulation when tying into the manifold at the end of the run."

"With just a few instructions on how to handle Hobas pipe, the installation went well," Joyce added.

Swenson, who was also pleased with the installation said, "I feel both projects were a success and I understand that both are operating correctly now a year later, namely that they are dry." 



HOBAS pipe was used for fluid containment for an electrical substation