Lake Lure, North Carolina, Finds a Solution to I/I

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Aging manholes located along the shoreline of a large man-made lake were a source of inflow and infiltration (I/I) that was placing an excessive burden on the Lake Lure, North Carolina's small treatment plant during summer months when the town's population would grow from its year-round number of 1,200 to in excess of 12,000.

Trenchless methods using spray-applied polyurethane linings has now provided a sustainable fix and extended the life of these critical collection system structures.

A Novel Idea

Lake Lure's sewer system runs on the floor of a lake that was constructed by two business tycoons approximately one hundred years ago who came to the area and decided to build a dam and create a man-made recreational waterbody. The tycoons went bankrupt but before they did, they put the city sewer system fully in place. Manholes for the system are located along the shoreline with property laterals running down to the manholes and from there into mainlines on the lakebed bottom which are held by cribbing. Sewage is conveyed by gravity feed to the town's wastewater treatment plant.

The town's wastewater treatment plant was designed to manage 125,000 gallons of intake per day but even during the off-season it's been receiving an average of 200,000 gallons. It was decided that the manholes needed rehabilitation on the inside, as well as the outside in order to reduce the amount of infiltration coming in.

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Picture-perfect Setting

Lake Lure and its historic Lake Lure Inn and Spa have been featured in such popular films as Dirty Dancing and The Last of the Mohicans. It is a popular tourist destination for mountain hiking and various water recreation activities.

Work on the 65 manholes would need to be completed during the winter off-season. CTR Coatings, a woman-owned business based in Knoxville, Tennessee, was contracted to perform the rehabilitation of the structures. The project required a good degree of planning and forethought due to access location. Sixty manholes were situated along the shoreline, halfway submerged and the only way to reach them would need to be by watercraft from the lake, the remaining five were land-based.

Luckily, the town had recently purchased a maintenance barge to perform tasks around the lake. The CTR Coatings' crews would be able to utilize this craft along with a Jon boat to access each of the shoreline manholes. But before that could begin, Lake Lure first needed to drain the lake and reduce the water level by at least 12 ft. The use of the lakes dam structure allowed for this to happen in a relatively brief period of time and CTR Coatings was able to deploy and commence the project in December 2021.

CTR Coatings applied OBIC 1200, by OBIC Products, a semi-structural material designed for culverts and wastewater applications due to its high impact resistance. "This lining material was perfect for this type of application because of the structures being in a lake with logs and debris and impact from boats," shares CTR Coatings project manager Mike Weichold. "We also needed something with a high abrasion protection for when the lake would be brought back up to full level."

Due to weight and logistics, it was decided that the OBIC plural component lining materials that they would be using would be brought onboard in smaller quantities — enough to complete each week's work — that could be easily hand-carried and transferred into larger drums on the barge. CTR Coatings acquired new equipment for the project that included a Graco power station, polyurea pump and transfer sticks. Confined space entry equipment, heaters, drying torches and ancillary accessories were also put onboard and a small structure on the barge was constructed to house the equipment to protect it from the elements.

Unique Characteristics

Although most of the structures to be rehabilitated were in a similar condition, many of them had odd positions along the shoreline, as well as lateral tie-ins that were quite unusual. Being that the manholes were constructed more than 100 years ago, as the town grew and houses began to pop up on the shoreline, lateral connections to the manholes were not performed by the sewer department and done by independent contractors.

Because of this, some structures could have five pipes coming into them, but not all located at the bottom near the bench. Some connections were nearly at the top of the manholes and in many cases, holes were simply busted into the side of the manhole structures for lateral to

be connected and then concrete was applied to seal up the joint. Time and the elements had taken its toll on the porous concrete substrate, deteriorating it, and leaving visible holes around some of the connected pipes.

Some of the manholes were also equipped with basket catches, a large metal ring that was located approximately 6 in. down into the manhole that resembled a large iron donut. Underneath this “donut” or circle was attached a metal basket to catch all of the solids and debris that might flow into the manhole. The City would come to clean out the debris on a routine basis so that it wouldn’t get into the main collection system and clog the mainlines or cause problems at the treatment plant. Removal of these rings in the structures equipped with them became part of the pre-lining prep portion of the project.

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For each of the manholes, thorough cleaning and filling with hydraulic cement to remedy any holes or gaps was first performed. After a smooth profile was achieved, the structure was fully dried by indirect heat wagons for the interior and propane torches for the exterior. This prepared all surfaces for the spray-applied lining of the material both on its interior and exterior to manufacturer’s specs. The lining was applied to the exterior from top to bottom and as close to the ground level as possible. The average depth of the manholes was 7 to 8 ft depending on its location and the terrain. Most were 3 ft in diameter at the top expanding to 4 ft in diameter at the base.

Each week, CTR Coatings would deploy its crew of three beginning on Monday. Preparation steps were performed first on all the structures slated for week and this was followed by the spray-applied lining application. On average the crews were able to complete six to eight manholes a week. Access to each of the structures was done completely through the use of the barge.

The barge was driven up to the structure and stakes were put into the lake bottom at the shoreline to function as anchors so that it would not drift or shift away. The spray crews would perform their work using a long safe walk plank to access and standard confined space entry procedures for the interior applications. Exterior application was completed by walk around. The OBIC 1200 lining was applied at 150 mils thick on both the interior and exterior surfaces.

Home Away from Home

Because of the nature of the project, it was necessary for CTR Coatings's three-person crews to set up residence in the town each week. They were housed in beach cottages that were part of the historic Lake Lure Inn and Spa. "During off-season there is little open except for one small store. The staff at the hotel were gracious and accommodating, seeing to it that they had refrigerators and microwaves and as close to all the comforts of home as possible.

"This made doing our job so much easier and allowed our crews to be comfortable at the end of long workdays away from home." says Weichold. "In addition, the crews felt a complete community buy-in and cooperation for what they were doing to help the town."

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Case in point, while performing rehabilitation near one residence, the homeowner approached the crews commenting that this particular manhole structure had always emitted terrible odor. Weichold explained that this was due to hydrogen sulfide (H2S) buildup and debris inside of it and the way it was constructed. They communicated that it was impossible to get rid of the H2S which was causing the smell, but they would try to alleviate it by cutting some of the lateral connections back and pressure washing the structure. As soon as it was

pressure washed and cleaned it, the smell was gone cased by the debris getting stagnant over the years sitting there. The lining applied creates a smooth surface which would make it harder for bacteria to attach to and grow on and odors to reappear.

“Although we couldn’t guarantee that what we did would eliminate the smell permanently, she was still appreciative and expressed her gratitude that there was some relief,” says Weichold.

Quality Assurance

Although not required, Weichold and his crew opted to utilize holiday testing after completing each lining to assure the quality of the application and verify the non-existence of any unacceptable discontinuities in the lining such as fisheyes, craters or weaknesses which are not easily visible.

“This has probably been one of the best projects I’ve ever been part of because of its unique dynamics and also the appreciation that we have received from the community,” shares Weichold.

By the time this article is published, CTR Coatings will have completed the project and are excited to find out what the benefits of rehabilitating these critical structures deliver to Lake Lure and alleviating the burden at its treatment plant through the elimination of I/I.